Ministry of Railways

Ministry of Railways
Government of India

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THE INFRASTRUCTURE PEOPLE
A Government of India Enterprise

National Rail Plan (NRP)-India

Draft Final Report

Volume 1: Report
December 2020

AECOM

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EXECUTIVE SUMMARY

0.1. Background

Indian Railways is the 4th largest railway network in the world by size with 121,407 kilometres (75,439 mi) of total track over a 67,368 Km route. In the year ending March 2018, IR carried 8.26 billion passengers and transported 1.16 billion tonnes of freight. In the fiscal year 2017–18, IR is projected to have revenue of 1.874 trillion (US$26 billion), consisting of 1.175 trillion (US$16 billion) in freight revenue and 501.25 billion (US$7.0 billion) in passenger revenue, with an operating ratio of 96.0 %.

Now moving forward and with a vision to develop Indian Railways as a world class system which shall be able to cater to the demand by keeping pace with growth and compliment the economic development, Ministry of Railways has envisioned the preparation of National Rail Plan (NRP) for India keeping the year 2050 as the horizon. For this purpose, Ministry of Railways has mandated Rail India Techno Economic Services (RITES) to provide advisory services by further appointing a Consultant. In pursuance of the above and to enable preparation of National Rail Plan, the RITES have assigned the study to M/s AECOM India Private Limited.

AECOM commenced the study in January 2019. As per the Terms of reference of the Study, various deliverables have been submitted.

This deliverable concludes the National Rail Plan and is being submitted as Draft Final Report for circulation to various Stakeholder's for obtaining their observations so that National Rail Plan can be formalised in its true form.

Present report being the Draft Final Report, not only summarises all the previously submitted deliverables but also concludes the National Rail Plan and details out the infrastructure requirements along with their funding and financing strategies. Various components covered as part of Draft Final Report are explained in subsequent sections.

0.2. AS-IS Rail Network Mapping

One of the objectives of NRP was to map the entire Indian Railway Network on GIS Platform along with their respective attributes and line features. This massive exercise was carried out as part of the study and entire network was mapped on GIS platform.

Preparation of Base Map

For preparation of Base map for the Indian Rail Network, an authentic reference in form of raster data was required. Based on this reference data, rail network has been digitized on Arc map.

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All the collected maps have been converted into digital from paper format through scanning process. This process is reading from paper grid and conversion of this grid into computer compatible digital format.

Geo Referencing of the System Maps

Geo referencing means to associate something with locations in physical space. Geo referencing can be applied to any kind of object or structure that can be related to a geographical location, such as roads, places, bridges, or buildings.

System map for all zones were scanned, and geo-referenced on ArcMap. Thus, these geo-referenced maps formed the base for digitization of the railway network.

Mosaic of Geo-referenced Digital Maps

The geo-referenced scanned maps have been set side-to-side for proper study the actual project area. This has done through standard Remote sensing software (ERDAS Imagine). Edge matching also conducted during mosaicking of the images.

Vectorization of Geo-referenced Digital Maps

The geo-referenced maps have been vectorised in different layers for required themes in point, line or polygon features depending upon the nature of layer. Following features has been created during vectorisation of the maps.

Digitisation of Railway Lines

In ArcMap, entire rail network has been digitised in various shapefiles. There are 23 types of rail lines which have been digitised and later grouped for better understanding. The grouping of lines has been done based on their existence and construction status.

The complete railway link network including the category of all the railway lines as per gauge is shown in Figures below.

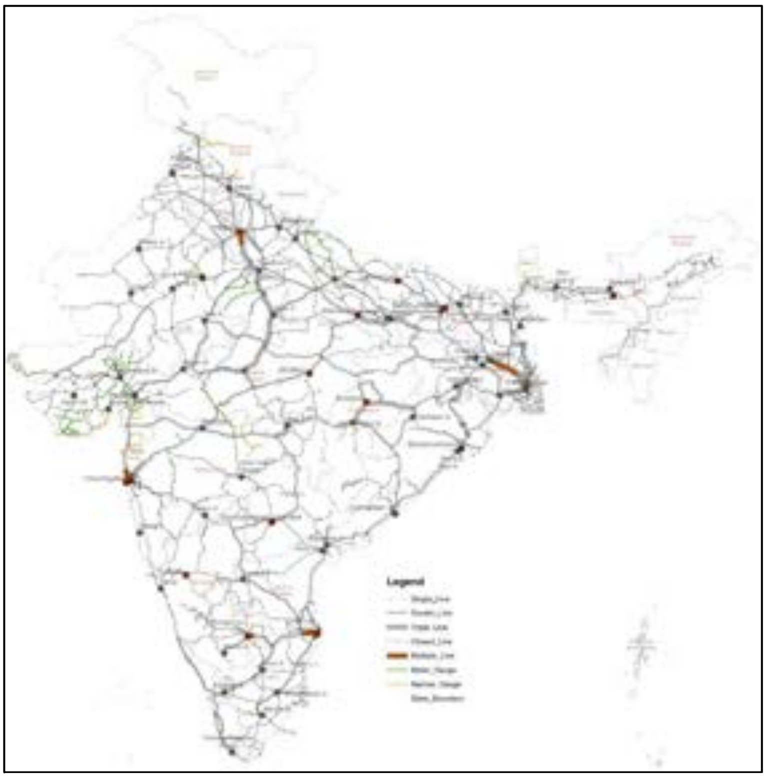


Figure 0-1: Types of railway lines in Indian Rail Network

Digitization of Railway Stations

In GIS map, besides digitization of railway lines, digitization of railway stations has also been undertaken on basis of type of railway station. Stations and Junctions identified for the upcoming Dedicated Freight Corridor (DFC) are also digitised based on the location provided in the proposed alignment and digitised under following head:

- DFC Station,
- DFC Junction

Figure 0-2: Zonal & Divisional HQ of Indian Rail Network

External Attribute Data Attachment to ***Vectorized Data***

Each Rail link has following information:

Section Name: This contains the name of the start and end point of section e.g. Sanewal-Ludhiana section

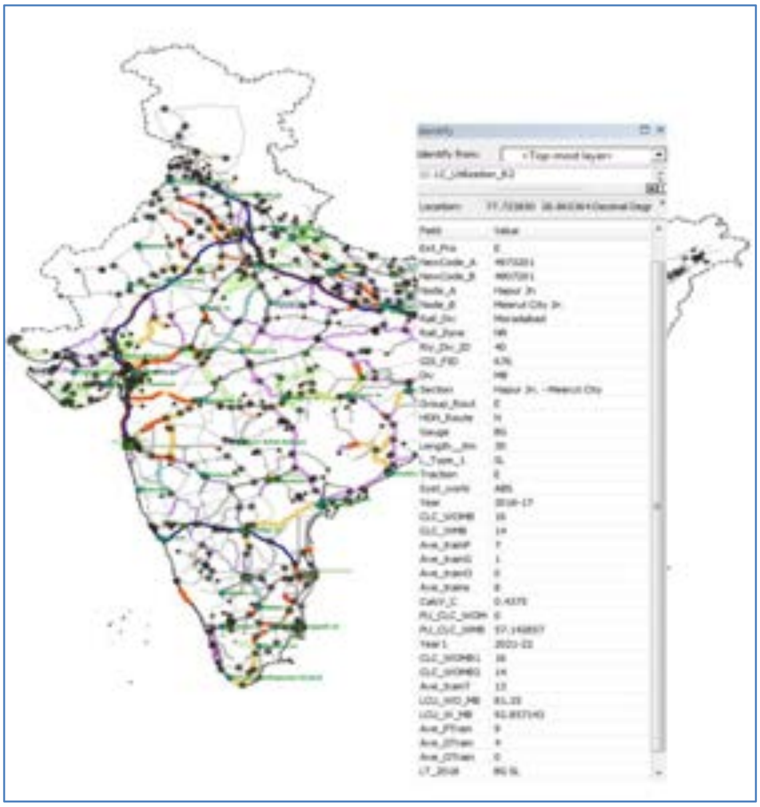


Figure 0-3: Data Heads Attached for all the Rail Links

Group Route: A/B

HDN Route: Under this head the information about the high-density network has been provided.

Gauge: This head contains the gauge information i.e. broad gauge, narrow gauge and meter gauge.

Length (Kms.): This head contains the information about the length of section.

SL/TSL/DL/TL/ QL/QSL: This head explains the type of the section discussed i.e. whether the section is single, triple, double line etc.

Traction: It can define as the railway vehicle that provides the necessary traction power to move the train is referred as the traction or locomotive. This traction power can be diesel, steam or electric power

System of working: ABS/Manual

Average Nos. of train services each way i.e. Passengers, Goods, others and Total

0.3. Demand Forecast

As discussed, the report aims at listing out future rail network requirements based on demand forecast. For the purpose of setting the context, the present chapter briefly details out the passenger and freight demand forecast for horizon and cardinal years.

Secondary Data Collection

AECOM collected extensive secondary data from various sources. These include Ministry of Railways and other Ministries. List of data collected from Ministry of Railways and various other sources are listed below:

Passenger ticketing Systems:

- Passenger Reservation System (PRS): This is the system which allows a passenger anywhere to book train tickets from any station to any station.
- Unreserved Ticketing System (UTS): The unreserved ticketing from dedicated counters, replacing manual printed-card tickets with centralized online sales is done via this system.

Freight Ticketing Systems:

The Freight Operation and Information System (FOIS): This system is responsible for optimized asset utilisation, management and control of freight movement and the generation of invoices. An electronic payment gateway is interfaced with the FOIS, and many of the large freight customers use this gateway for the payments.

Primary Data Collection

As part of scope a number traffic and transportation surveys are required to be carried out in order to establish the base line data for future transport demand. Following traffic surveys will be carried out as part of the study:

- ✓ Classified Traffic Volume Counts
- ✓ Passenger and Goods Origin-Destination Survey
- ✓ Freight Stakeholders' Consultations

A total of 100 locations were selected for carrying out 24-hour CTVC and OD surveys on all 7 days of the week for this study. These survey locations have been identified using the following key parameters:

- Million Plus Cities, State Capitals and Union Territories
- Mine producing places
- NTPC, Major Refineries of India & Logistic Hubs
- Major Cement Production and Attraction Centres
- FCI>10K
- Heavy Machinery production centres, Industrial Towns, FMCG;
- District Headquarters
- ICDs/ Dry Ports, Major Ports of India
- Coal Fields, Major Fertilizer Plants, Textile Hubs
- Religious Centres and Tourism Hubs
- Agricultural districts

Figure 0-4: Classified Traffic Volume Count & OD Survey Locations

Passenger Demand Forecast

The passenger data analysed from 2010-11 to 2017-18 for all passenger categories of Indian Railways shows that railway passengers have grown at a CAGR of 2% per annum. Maximum growth has been witnessed in AC category out of which 3rd AC passengers have increased at CAGR of 10.33%, 2nd AC at 6%, 1st AC at 6.74% and AC Chair Car and Executive class at 9% & 12% per annum respectively. In Non-AC category, Sleeper Class has grown at a rate of 4.4%, 2nd class sitting at 8.76% and unreserved at 0.89% per annum respectively.

Suburban passenger traffic has grown by 2.3% from 2008-09 to 2017-18. The share of suburban passengers to non-suburban passengers has also remained consistent from 55% in 2008-09 to 56% in 2017-18.

Table 0-1: Annual Growth of Passenger Traffic (Millions)

S. No	Class	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	CAGR
1	Sleeper Class	232.82	248.12	265.19	316.97	311.22	297.52	315.57	323.84	329.91	342.49	4.38%
2	3rd AC	38.61	45.03	53.25	60.35	70.08	68.60	78.27	84.48	89.08	93.54	10.33%
3	2nd Sitting	73.14	95.85	113.96	107.04	126.80	140.65	142.81	157.07	149.58	155.74	8.76%
4	Chair Car	13.54	14.56	16.69	19.44	22.13	24.46	25.89	26.52	27.42	29.28	8.94%
5	2nd AC	16.21	17.37	19.56	21.68	22.56	23.00	25.15	25.92	25.27	27.39	6.01%
6	1st AC	1.53	1.66	1.92	2.34	2.39	2.50	2.50	2.54	2.68	2.74	6.74%
7	Exe Chair Car	0.39	0.64	0.70	0.87	0.92	1.01	1.01	0.96	1.00	1.08	11.93%
8	1st Class	1.34	1.84	1.68	1.32	1.10	0.95	0.68	0.46	0.39	0.37	-13.28%
9	Unreserved	2,740.62	2,945.28	3,117.18	3,316.91	3,386.90	3,286.19	3,127.22	3,026.70	2,924.33	2,967.79	0.89%
	Total	**3,118.20**	**3,370.37**	**3,590.14**	**3,846.94**	**3,944.10**	**3,844.88**	**3,719.08**	**3,648.47**	**3,549.67**	**3,620.44**	**1.67%**
10	Suburban	**3,802.17**	**3,875.44**	**4,060.95**	**4,377.44**	**4,476.56**	**4,552.18**	**4,505.03**	**4,458.86**	**4,566.43**	**4,665.34**	**2.30%**
Grand Total		**6,920.37**	**7,245.80**	**7,651.09**	**8,224.38**	**8,420.66**	**8,397.06**	**8,224.12**	**8,107.33**	**8,116.10**	**8,285.77**	**2.02%**
Suburban Share (%)		**54.94**	**53.49**	**53.08**	**53.23**	**53.16**	**54.21**	**54.78**	**55.00**	**56.26**	**56.31**	**0.27**

In order to further analyse the growth trends, the above-mentioned classes were further clubbed into 3 broad categories namely; LDAC, LDNA and Suburban.

Table 0-2 -Growth Trends in Passenger Traffic in mentioned Categories (Millions)

S. No.	Class	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	CAGR
1	LDAC	70.27	79.27	92.12	104.69	118.08	119.57	132.81	140.41	145.46	154.03	9.11%
2	LDNA	3,047.92	3,291.10	3,498.01	3,742.25	3,826.02	3,725.30	3,586.27	3,508.07	3,404.21	3,466.40	1.44%
Total		**3,118.20**	**3,370.37**	**3,590.14**	**3,846.94**	**3,944.10**	**3,844.88**	**3,719.08**	**3,648.47**	**3,549.67**	**3,620.44**	**1.67%**
3	Sub	**3,802.17**	**3,875.44**	**4,060.95**	**4,377.44**	**4,476.56**	**4,552.18**	**4,505.03**	**4,458.86**	**4,566.43**	**4,665.34**	**2.30%**
Grand Total		**6,920.37**	**7,245.80**	**7,651.09**	**8,224.38**	**8,420.66**	**8,397.06**	**8,224.12**	**8,107.33**	**8,116.10**	**8,285.77**	**2.02%**

Methodology for Passenger Demand Forecast

Passenger demand forecast stages are listed below:

- ✓ Stage 1 – Estimation of Horizon Year Production and Attraction Trips Ends: Sum of all the horizontal rows of a Passenger Matrix is referred as Production Trip End and sum of all the columns of a Matrix is referred as Attraction Trip Ends.
- ✓ Stage 2 – Trip Distribution: The horizon year production and attraction trip ends have been distributed in rows and columns to obtain horizon year passengers matrices for LDAC, LDNA and Sub-urban Passengers for the years 2021, 2031, 2041 and 2051.

Passenger Trip Generation

Growth rate of production trip ends was analysed with total population and growth rate of attraction trip ends was analysed with the total workers' quantum for each TAZ, for the purpose of estimating the elasticity of production and attraction.

Once the elasticity is estimated for production and attraction of Intercity AC (LDAC) Trips, Intercity Non-AC (LDNA) Trips and Sub-urban passengers, same has been applied on the forecasted population and workers quantum for estimating future passenger quantum produced or attracted by each of TAZ (Trip Ends) for the cardinal years of 2026, 2031, 2041 and 2051.

Forecast of Planning Variables

As described above, Population and Work Force Quantum have been used as planning variables for estimating production and attraction trip ends. Therefore, these planning variables have been forecasted for the purpose of estimating horizon year production and attraction.

Suburban Passenger Growth

Consultants collected the data related to suburban system expansion plans from respective suburban rail corporations. All the cities where suburban system is operating such as Mumbai, Chennai, Kolkata and Hyderabad, have recently got prepared Comprehensive Mobility Plans (CMP) in which the daily suburban ridership has been forecasted. These estimates have been adopted as it is and are allocated in the respective zones of the matrix.

Future passenger growth rates were then estimated using the ratio mentioned in table above, which was then applied on the horizon year population growth rates for the years 2021, 2031, 2041 and 2051.

Table 0-3: Adopted Railway Passenger Growth Rates

Years	Projected Population CAGR (%)	Projected CAGR (%) LDAC	Projected CAGR (%) LDNA	Projected CAGR (%) Suburban	Grand Total
2019-21	1.11%	7.87%	9.33%	1.52%	5.35%
2021-26	0.79%	8.50%	3.44%	1.17%	2.50%
2026-31	0.80%	9.02%	3.48%	1.07%	2.62%
2031-41	0.44%	6.47%	3.00%	0.85%	2.34%
2041-51	0.45%	5.43%	2.81%	0.64%	2.28%

Using the above-mentioned growth rates, the passenger forecast has been made and same is described in table below:

Table 0-4: Rail Passenger Forecast (Millions)

Categories	2018	2021	2031	2041	2051
LDAC	154.05	252.24	584.08	1,093.20	1,854.68
LDNA	3,466.19	4,529.87	6,364.03	8,555.34	11,289.18
Total	3,620.24	4,782.11	6,948.11	9,648.55	13,143.86
Sub-Urban	4,459.38	4,665.84	5,215.54	5,676.21	6,050.13
Grand Total	8,079.62	9,447.95	12,163.65	15,324.76	19,194.00

*Note: * Excludes Ridership Data of Kolkata Metro for the year 2017-18 which is otherwise included in Suburban Category*

Freight Demand Forecast

Freight Forecast Methodology

The potential overall requirements for transportation of commodities/ commodity groups were analysed & projected using the following framework.

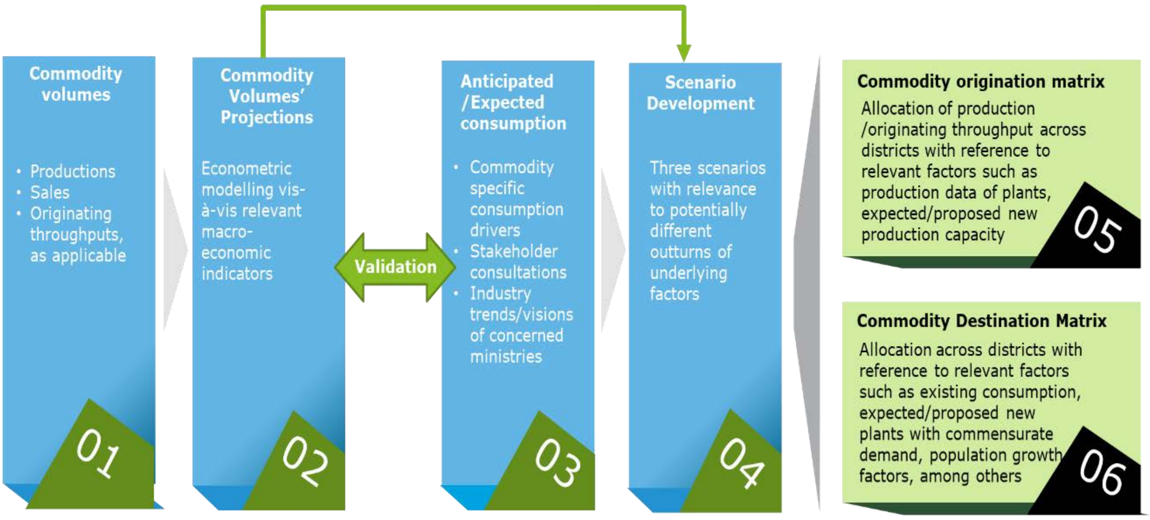
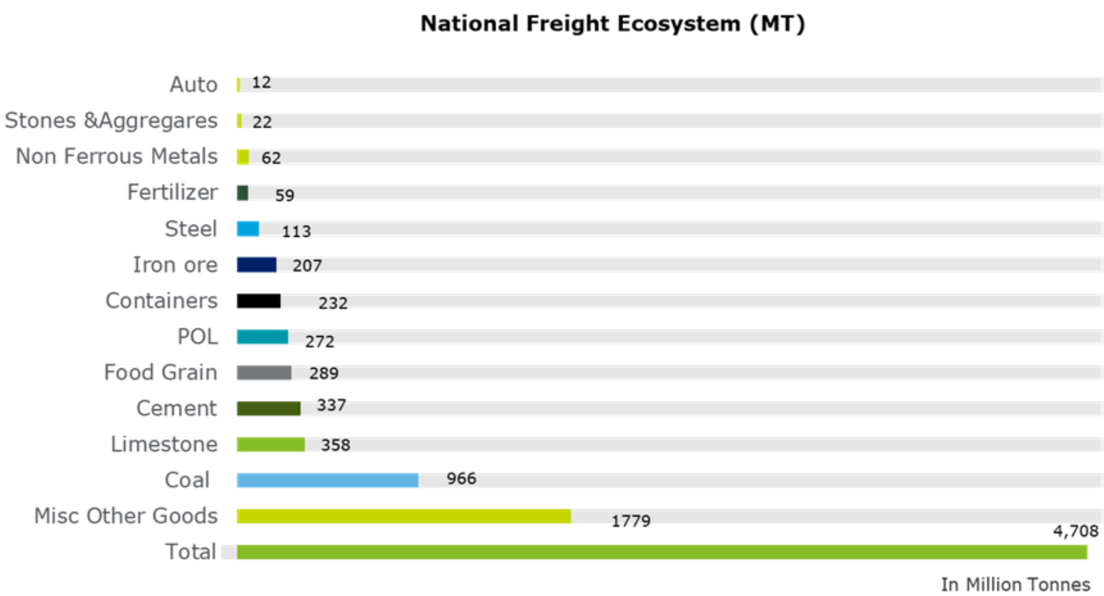


Figure 0-5: – Methodology for Freight Volume & Transportation Requirement Projections

Consolidated Projections

Total commodity volumes in the national freight ecosystem in FY 18-19 were projected at 4,708 MT as illustrated in figure below:



Source: Deloitte Analysis, Primary Surveys, FOIS Data, Various Statistics and Stakeholder Consultations
Note: The commodity wise numbers represent total freight transported and may vary with total cargo generated (production + imports)

Figure 0-6: – National Freight Ecosystem

Production and consumptions will grow in future. For projection of Future demand of different commodities, different time frames are considered such as 2019-2021, 2021-2026, 2026-2031, 2031-2041 & 2041-2051. The Cumulative Annual Growth rate of different commodities are given in Table below.

Table 0-5: Phase wise CAGR of Commodities

Commodity wise CAGR	2019-2021	2021-2026	2026-2031	2031-2041	2041-2051
BOG	4%	7%	6%	3%	3%
Cement	14%	9%	6%	5%	5%
Coal	12%	3%	4%	3%	0%
Container	20%	5%	6%	5%	4%
Fertilizer	14%	6%	5%	4%	4%
Food grains	5%	3%	3%	3%	3%
Iron Ore	2%	6%	5%	4%	3%
Pig Iron	22%	6%	6%	4%	3%
POL	17%	8%	5%	4%	4%
Steel RM	6%	6%	5%	4%	3%
Total	9%	6%	5%	4%	3%

Total freight demand forecast by commodity are listed in table below.

Table 0-6: Projected Commodity Demand in Million Tons

Commodity (Demand)	2019	2021	2026	2031	2041	2051
BOG	2,172	1,922	2,638	3,499	4,774	6,309
Cement	339	399	601	813	1,355	2,114
Coal	965	1,052	1,237	1,502	2,081	2,136
Container	231	316	411	546	870	1,264
Fertilizer	61	74	100	128	196	284
Food grains	287	315	362	416	541	701
Iron Ore	207	221	295	377	569	798
Pig Iron	113	121	164	215	322	452
POL	273	329	484	629	930	1,323
Steel RM	61	56	74	95	143	200
Total	**4,709**	**4,805**	**6,366**	**8,220**	**11,780**	**15,583**

0.4. Estimation of Rail Freight Share

Total freight forecast by commodity has been presented in the previous section. Subsequent to that, share of rail in carrying the commodities considering the future, production, demand and railway infrastructure improvement proposal has been estimated. For this purpose, mode split modal using Binary Logit has been prepared for the base year. The modal split model shall estimate the probability of share carried by railways based on certain parameters.

Railway Freight Growth Trends

Freight movement by rail has grown at CAGR of 3.74%.

Table 0-7: Railway Freight Growth Trends

Commodity	FY 9	FY 10	FY 11	FY 12	FY 13	FY 14	FY 15	FY 16	FY 17	FY 18	CAGR
Coal	369.63	396.1	420.37	455.81	496.42	508.6	545.81	551.83	532.83	555.2	4.62%
RM for Steel	10.85	11.6	13.3	14.51	15.6	17.33	18.28	20.29	22.75	23.7	9.07%
Pig Iron & Finished Steel	28.58	31.85	32.82	35.15	35.31	38.95	42.84	44.79	52.41	54.36	7.40%

Iron Ore	130.58	132.74	118.46	104.7	111.4	124.27	112.77	116.94	137.55	139.8	0.76%
Cement	86.24	93.15	99.08	107.66	105.87	109.8	109.8	105.35	103.29	112.96	3.04%
Food grains	35.51	38.69	43.45	46.4	49.03	55.1	55.47	45.73	44.86	43.79	2.36%
Fertilizers	41.35	43.68	48.22	52.7	46.21	44.7	47.41	52.23	48.34	48.53	1.79%
POL	38.08	38.88	39.29	39.77	40.61	41.16	41.1	43.24	42.42	43.11	1.39%
Containers-Exim	23.29	25.32	26.58	28.54	31.69	32.61	37.88	36.79	37.01	42.82	7.00%
Containers-Domestic	7.05	9.63	11.01	9.48	9.35	10.93	10.5	9.04	10.34	11.12	5.19%
BOG	62.23	66.1	69.15	74.33	66.6	68.75	73.4	75.28	74.35	84.09	3.40%
Total	**833.39**	**887.74**	**921.73**	**969.05**	**1,008.09**	**1,052.2**	**1,095.26**	**1,101.51**	**1,106.15**	**1,159.48**	**3.74%**

Existing Scenario

A total freight movement of 4,464 Million Tonnes occurred across the country. Of which 1,162 million tonnes were moved by rail i.e. 3,157,802.5 tons per day. on the overall railways registered a market share of 26% in the total freight movement.

Table 0-8: Share of Railways in Total Freight Movement (2017-18)

Mode	Tonnes (Millions)	Share (%)	NTKM (Billions)	NTKMS
Rail	1162.72	26%	616.38	29%
Road	2911.76	65%	1521.04	71%
Coastal Shipping	234	5%	N.A.	
IWT	72	2%	N.A.	
Pipeline	84	2%	N.A.	
TOTAL	**4464.48**	**100%**	**2137.42**	**100%**

Mode Choice Model

In order to estimate the rail share, binary logit model has been used. This model was first applied on the base year freight demand for the purpose of calibration so that the estimated modal parameters (coefficients) provide results similar to what has been observed. These parameters will then be used to estimate future rail share.

Mode choice model has been developed based on the most evident factors of any goods transfer i.e. Travel Time and Travel Cost and the Probability of any Commodity to be transferred by any mode has been estimated by the Binary Logit Model. Utility equation is developed by the Difference of Travel time and Difference of Travel cost of the same Origin-Destination pairs of two different Modes (Road and Rail).

Scenario Building

Total 4 scenarios have been considered and these are explained below.

1. Scenario 1: Business as Usual (BAU): Rail Infrastructure Remain same but includes sanctioned projects such as Eastern and Western DFC, Mumbai Ahmedabad HSR and projects as per Pink Book. Whereas in case of Roads, Project Bharat Mala is considered implemented.
2. Scenario 2: Enhancement of Average Rail Speed of Freight Trains from 25 Kmph to 50 Kmph.

3. Scenario 3: Enhancement of Speed from 25 Kmph to 50 Kmph with 30% Reduced Tariff:
    A. Implementation of Railway projects corresponds to average speed to 50 Kmph & reducing tariffs by **30%** by 2026.
    B. Implementation of Railway projects corresponds to average speed to 50 Kmph & reducing tariffs on 4 items by 30% by 2026
    C. Implementation of Railway projects corresponds to average speed to 50 Kmph gradually & reducing tariff on 4 items by 30%
        - Year 2021 - 25 Kmph
        - Year 2026 – 30 Kmph
        - Year 2031 – 35 Kmph
        - Year 2041 – 40 Kmph
        - Year 2051 – 50 Kmph
4. Scenario 4: Business as Usual (BAU) with reduction in Cost by 30%: Rail Infrastructure Remain same whereas, the cost being charged is reduced by 30%.

The Speed of Road and Rail and the Cost of Commodities considered are mentioned in table below.

Table 0-9: Comparison of Scenarios

Components	Existing Scenario	Scenario 1: BAU	Scenario 2: Enhancement Average Speed to 50 Kmph	Scenario 3A: Enhancement Average Speed to 50 Kmph with 30% Reduced Tariff	Scenario 3B: Enhancement of Average Speed to 50 KMPH with 30% less Tariff on selected items*	Scenario 3C: Enhancement of Average Speed to 50 Kmph gradually with 30% less Tariff on selected Commodities	Scenario 4: BAU with Tariff Reduction by 30%
Operating Speed (kmph)	25	25	50	50	50	25-50	25
Railway Tariff		BAU	BAU	30% lesser than BAU	30% lesser than BAU on selected items	30% lesser than BAU on selected items	30% lesser than BAU
Daily Run in Road	350	450	450	450	450	450	450
Cost on Road	BAU	BAU	BAU	BAU	BAU	BAU	BAU
Rail Commodity Share (%)	**28%**	**24%**	**40%**	**45%**	**44%**	**30%-44%**	**31%**

For the purpose of estimation of Rail Share and working out the future network requirements, Scenario 3C has been recommended.

Scenario 3C: Enhancement of Speed from 25 Kmph to 50 Kmph Gradually with 30% Reduced Tariff on Selected Commodities

In this scenario, the enhancement of speed from existing 25 Kmph has been considered as gradual rather instant. Speeds for freight trains considered for modelling purpose for various cardinal years are listed below:

- Year 2021 - 25 Kmph
- Year 2026 – 30 Kmph
- Year 2031 – 35 Kmph
- Year 2041 – 40 Kmph
- Year 2051 – 50 Kmph

Further to adoption of above-mentioned speeds, reduction of 30% in tariff has been applied in selected commodities including BOG, Cement, Containers, Food Grains, Iron Ore and Raw Material for Steel similar to Scenario 3B.

Table 0-10: Rail share for Scenario 3C

Commodity	**2051**	**2041**	**2031**	**2026**	**2021**	**2019**	**Existing**
BOG	22%	20%	16%	9%	7%	7%	4%
Cement	51%	51%	50%	48%	46%	47%	37%
Coal*	74%	72%	70%	65%	61%	62%	65%
Container	48%	47%	43%	32%	29%	32%	24%
Fertilizer*	90%	90%	89%	87%	85%	85%	87%
Food grains	32%	32%	31%	28%	28%	26%	16%
Iron Ore*	82%	81%	77%	68%	60%	60%	65%
Pig Iron	70%	69%	69%	66%	64%	63%	49%
POL	48%	40%	28%	17%	15%	15%	18%
Steel RM*	60%	59%	58%	56%	55%	55%	56%
Total Percentage	**44%**	**43%**	**39%**	**33%**	**31%**	**30%**	**28%**
Point Percent Change	**+16%**	**+15%**	**+11%**	**+5%**	**+3%**	**+2%**	
Tonnes/ day, Scenario 3C	18,863,731	13,857,702	8,676,969	5,742,684	4,108,379	3,357,614	
Million Tonnes/ Year	**6,885**	**5,058**	**3,167**	**2,096**	**1,500**	**1,226**	**1,162**
Tonnes/ day in Existing Situation	11,550,543	9,082,809	6,200,981	4,908,080	3,847,409	3,116,458	
Commodity Diversion (Tonnes/ Day)	**+7,313,187**	**+4,774,893**	**+2,475,988**	**+834,604**	**+260,971**	**+241,156**	

Comparison of Scenarios

Present modal share in Rail is 28% but if there is no augmentation in Rail and after Bharatmala Project, the Share will come down to 24%.

Table 0-11: Rail Commodity Forecast by Scenario in 2051 (Million Tonnes)

Commodity in million tonnes per year by Rail (2051)	**Present**	**Scenario 1**	**Scenario 2**	**Scenario 3A**	**Scenario 3B**	**Scenario 3C**	**Scenario 4**
Containerizable BOG	23	28	342	429	429	429	137
Non-Containerizable BOG	54	64	789	990	990	990	315
Total BOG	**77**	**92**	**1,131**	**1,419**	**1,419**	**1,419**	**452**

Commodity in million tonnes per year by Rail (2051)	Present	Scenario 1	Scenario 2	Scenario 3A	Scenario 3B	Scenario 3C	Scenario 4
Cement	114	809	893	1,079	1,079	1,079	1,019
Coal	575	1,307	1,577	1,622	1,577	1,577	1,426
Container	54	202	560	610	610	610	370
Fertilizer	49	242	256	259	256	256	250
Food grain	45	117	151	225	225	225	200
Iron Ore	137	475	652	670	652	652	558
Pig Iron	40	222	259	318	318	318	296
POL	43	124	583	630	630	630	185
Steel RM	28	110	120	123	120	120	115
Grand Total	**1,162**	**3,701**	**6,182**	**6,955**	**6,885**	**6,885**	**4,872**

Forecast Rail Share

It is evident that the maximum enhancement of rail share shall be in both Scenario 3B and 3C. Forecast Rail Share by commodities under Scenario 3C is presented in Table below:

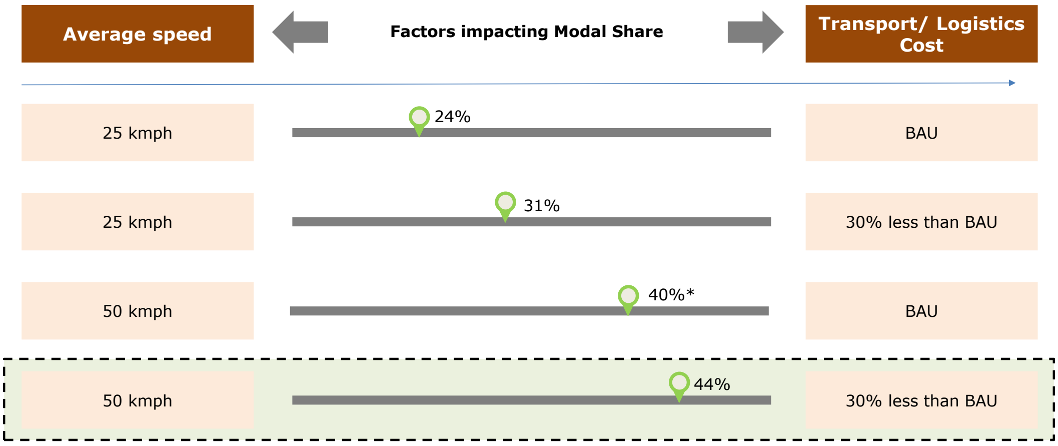
Table 0-12: Rail Commodity Forecast for Scenario 3C (Million Tonnes)

Commodity	Existing	2021	2026	2031	2041	2051
Containerizable BOG	23	42	73	171	292	429
Non-Containerizable BOG	54	96	169	395	674	990
Total BOG	**77**	**138**	**242**	**567**	**966**	**1,419**
Cement	114	185	288	405	686	1,079
Coal	575	646	810	1,050	1,455	1,577
Container	54	90	132	234	374	610
Fertilizer	49	64	87	113	174	256
Food grain	45	88	103	127	165	225
Iron Ore	137	132	202	289	435	652
Pig Iron	40	77	108	147	221	318
POL	43	50	84	179	264	630
Steel RM	28	31	42	55	83	120
Total	**1,162**	**1,500**	**2,096**	**3,167**	**4,823**	**6,885**

0.5. Freight Flow and Modal Share Estimation

As discussed in this report, a Binary Logit Model was developed to analyse potential freight movement over rail with reference to the two major parameters of overall logistics time and cost. As can be seen from the figure below, with a combination of higher than extant average speed of freight movement (at 50 km per hour) and reduction in the transport/ logistics cost by 30% from extant levels, the model estimates that based on relative cost-economics of various modes (including inter-modal transfers), railways could potentially cater to about 44% of the total freight movement.

Figure 0-7. Rail modal share under different scenario runs of Logit Model



**This may not be feasible given improvement in logistics performance of other modes such as IWT, coastal shipping, etc.*

These changes in the two parameters of overall logistics time and cost could be affected as a function of a number of interventions targeted at improving provision, as well as transit speeds (and reliability).

Presently, the modal share of railways (at ~30%) in the national transport system is mainly attributable to transport of traditional bulk commodities (fertilizers, coal, iron ore and food grains) which constitute about 60% of Indian Railways' freight business.

Going forward, projections for potential freight transport demand in the national system suggest that commodity groups like Containers and Balance Other Goods would contribute a very significant proportion of the total demand (~48% in 2030).

As can also be seen from the figure below (illustrating the existing rail usage/ share for various commodity groups), for enhancing its modal share, Indian Railways will need to cater to freight transport demand of other commodities (non-conventional as well as conventional high-value) which presently don't have a high rail co-efficient/ usage through appropriate interventions, strategies and product offerings.

0.6. Rail Network Demand Corridors

Railway Classification of High Demand Corridors

As per the Indian Railways a total of 7 High-Density Network (HDN) routes and 11 Highly Utilised Network (HUN) routes have been classified. HDN Comprise of 16% (11,000 Km) of total Indian Railway Network and transports 41% of total traffic of the entire network. HUN comprise of 35% (24,230 Km) of the total railway network and transports 40% of the total traffic moving on Indian Railway network. Combined HDN+HUN account for almost 50% (34,214 Km) of the total network.

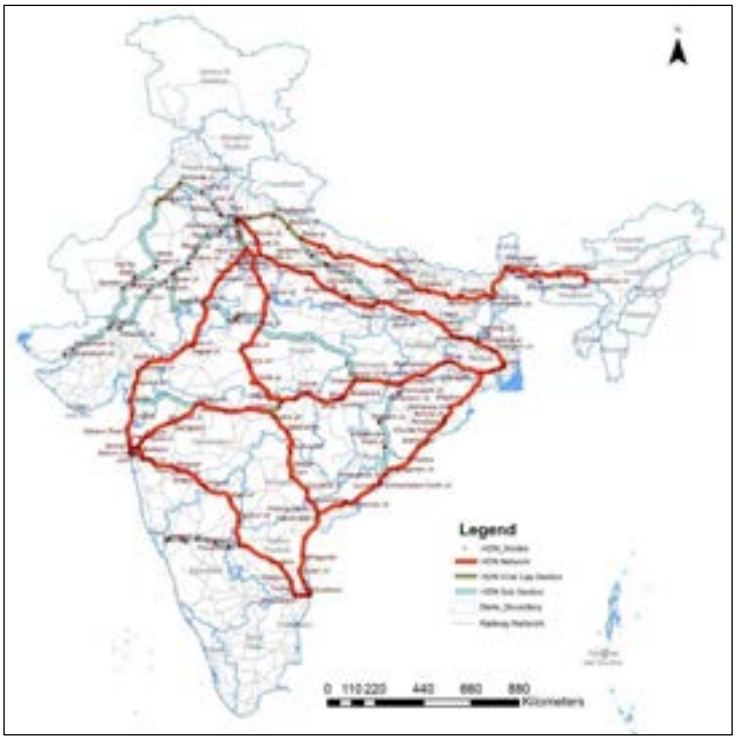


Figure 0-8: HDN Routes

Passenger Demand Corridors

Based on this analysis, top 10 passenger corridors were identified. Majority of the passenger demand is in between the OD Pairs which are located on all 7 HDNs and 3 HUNS namely HUN 1, HUN 9 and HUN 10.

Both AC and Non-AC passenger demand has been summed up and assigned on the rail network in order to identify total passenger demand corridors. Overall passenger demand corridors are described in table below:

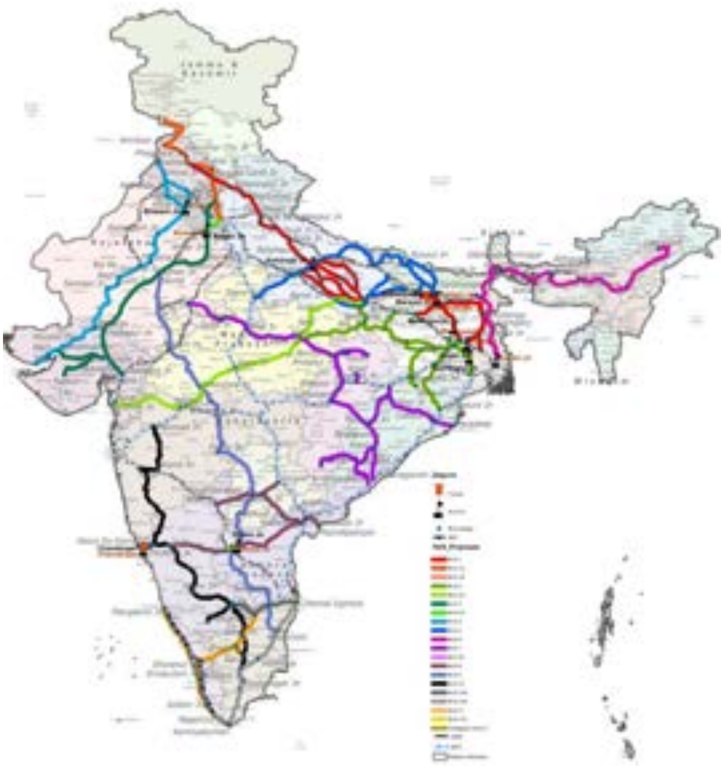


Figure 0-9: HUN Routes

Table 0-13: Overall Rail Passenger Demand Corridors

Route	Total 2018		Total 2026		Total 2031		Total 2041		Total 2051	
	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)
Mumbai - Howrah via Nagpur - Jharsuguda	258.68	6.00	868.76	10.30	1,045.83	9.70	1,547.68	8.90	2,117.24	8.30
Delhi - Chennai via Jhansi - Bhopal	242.32	5.60	605.26	7.20	802.91	7.50	1,256.75	7.20	1,776.61	7.00
Kharagpur - Udhna via Bhusawal	256	5.90	550.15	6.50	675.49	6.30	1,144.05	6.60	1,767.96	6.90
Delhi - Mumbai via Kota - Ratlam	284.15	6.60	582.56	6.90	688.31	6.40	971.67	5.60	1,418.06	5.60
Vizianagram/Paradeep - Kota	160.83	3.70	438.34	5.20	569.35	5.30	964.78	5.60	1,460.96	5.70
Amritsar - Andal via Mughalsarai - Patna	257.72	6.00	346.44	4.10	448.59	4.20	721.79	4.20	1,131.89	4.40
Delhi - Howrah via Kanpur - Gaya	227.72	5.30	312.2	3.70	444.37	4.10	654.95	3.80	1,054.77	4.10
Kolkata - Vijayawada via Jharsuguda - Sambalpur	109.14	2.50	286.14	3.40	355.79	3.30	646.68	3.70	949.14	3.70
Manmad - Kanyakumari via Hubli - Birur	189.52	4.40	344.55	4.10	453.14	4.20	701.8	4.00	878.27	3.40
Mumbai - Chennai via Guntakal - Hospet	135.81	3.20	307.44	3.70	398.71	3.70	642.36	3.70	818.37	3.20
Delhi - Guwahati via Moradabad - Chhapra - Katihar	124.63	2.90	230.82	2.70	305.97	2.80	553.83	3.20	886.83	3.50
Vasco - Machlipatnam via Dharwad - Vijaywada	101.79	2.40	213.62	2.50	262.89	2.40	456.38	2.60	620.15	2.40
Chandigarh - Rajkot Via Panipat - Rewari	109.86	2.50	200.53	2.40	284.21	2.60	397.14	2.30	626.66	2.50
Ajmer - Dindigul via Nanded	109.65	2.50	188.48	2.20	262.99	2.40	379.35	2.20	546.43	2.10
Bandel - Dibrugarh via Azimganj - Barsoi	48.21	1.10	95.01	1.10	145.61	1.40	299.34	1.70	504.78	2.00
Jhansi - Muzaffarpur - Katni	94.36	2.20	146.37	1.70	192.56	1.80	281.16	1.60	464.28	1.80
Firozpur - Mundra Port via Bhatinda-Jakhal	61.41	1.40	144.74	1.70	217.31	2.00	260.87	1.50	391.25	1.50
Mangalore - Kanyakumari via Shoranu	78.02	1.80	126.79	1.50	164.6	1.50	305.29	1.80	414.57	1.60
Total	2849.82	66	5988.2	71	7718.63	72	12185.87	70	17828.22	70
All HDN	**1,382.460**	**32**	**3,193.180**	**38**	**4,041.880**	**38**	**6,273.930**	**36**	**9,021.020**	**35**
All HUN	**1,485.470**	**35**	**2,819.830**	**34**	**3,711.900**	**34**	**5,975.630**	**35**	**8,903.960**	**35**
HDN+HUN	**2,755.490**	**64**	**5,797.350**	**69**	**7,452.820**	**69**	**11,758.420**	**68**	**17,185.560**	**67**
Entire Network	**4,310.230**	**100**	**8,407.980**	**100**	**10,776.250**	**100**	**17,341.100**	**100**	**25,544.630**	**100**

Share of High Passenger Demand Corridors

The identified corridors shall continue to cater to higher share of passenger traffic the respective share of these corridors shall be 64-67% till 2051.

Table 0-14: Passenger Share on Demand Corridors

	Passenger Category	2018	2026	2031	2041	2051
Total Passenger Km (Million)	LDAC	409.88	984.79	1,501.60	2,748.64	4,733.47
	LDNAC	3,900.35	7,423.19	9,274.66	14,592.46	20,811.17
	Total	**4,310.23**	**8,407.98**	**10,776.25**	**17,341.10**	**25,544.63**

	Passenger Category	2018	2026	2031	2041	2051
Passenger Km on High Demand Corridors	LDAC	266.61	667.07	1,016.21	1,853.39	3,183.24
	LDNAC	2,488.88	5,130.28	6,436.61	9,905.03	14,002.32
	Total	**2,755.49**	**5,797.35**	**7,452.82**	**11,758.42**	**17,185.56**
Share of High Demand Corridors	LDAC	65.0%	67.7%	67.7%	67.4%	67.2%
	LDNAC	63.8%	69.1%	69.4%	67.9%	67.3%
	Total	**63.9%**	**69.0%**	**69.2%**	**67.8%**	**67.3%**

Freight Demand Corridors

The major freight corridors where share of freight traffic > 50% have been further considered for development of Dedicated Freight Corridors (DFCs). These are listed below:

Figure 0-10: Freight Demand (Trains) Corridors - 2051

- Kharagpur- Vishakapatnam- Vijayawada- Guntakal
- Delhi- Agra- Bhopal- Nagpur- Vijayawada- Chennai
- Agra- Mughalsarai- Gaya- Dhanbad- Kolkata
- Mumbai- Nashik- Nagpur- Raipur- Bilaspur- Jharsuguda- Jamshedpur- Kharagpur
- Mumbai- Pune- Guntakal- Chennai
- Delhi- Kota- Surat- Mumbai
- Delhi- Ajmer- Ahmedabad

Table 0-15: Major Freight Corridors

Route	Rake Km 2018	Rake Km 2026	Rake Km 2031	Rake Km 2041	Rake Km 2051
Delhi - Mumbai via Kota - Ratlam	142,646	128,116	128,065	253,709	607,395
Mumbai - Howrah via Nagpur - Jharsuguda	153,322	191,886	284,575	302,143	556,427
Delhi - Chennai via Jhansi - Bhopal	115,208	194,157	191,792	329,236	514,105
Amritsar - Andal via Mughalsarai - Patna	88,587	118,788	185,734	237,116	436,096
Kharagpur - Udhna via Bhusawal	127,437	109,995	189,481	345,518	411,105
Vasco - Machlipatnam via Dharwad - Vijaywada	39,373	37,102	52,356	131,095	397,948
Vizianagram/Paradeep - Kota	144,061	201,973	278,433	371,369	380,241
Delhi - Guwahati via Moradabad - Chhapra - Katihar	64,102	213,776	260,253	377,942	342,465
Delhi - Howrah via Kanpur - Gaya	125,474	72,888	174,326	204,722	341,716
Kolkata - Vijayawada via Jharsuguda - Sambalpur	65,425	143,314	201,958	265,061	298,949
Bandel - Dibrugarh via Azimganj - Barsoi	32,330	77,377	88,269	144,652	274,620

Route	Rake Km 2018	Rake Km 2026	Rake Km 2031	Rake Km 2041	Rake Km 2051
Ajmer - Dindigul via Nanded	27,163	21,154	37,437	128,934	268,808
Chandigarh - Rajkot Via Panipat - Rewari	74,797	71,354	144,795	178,936	225,608
Jhansi - Muzaffarpur - Katni	43,542	72,708	112,270	190,810	215,763
Manmad - Kanyakumari via Hubli - Birur	37,650	42,495	67,090	113,590	187,530
Mumbai - Chennai via Guntakal - Hospet	39,624	32,510	47,117	107,025	174,203
Firozpur - Mundra Port via Bhatinda-Jakhal	53,199	50,325	93,634	113,955	170,565
Mangalore - Kanyakumari via Shoranu	17,076	17,111	27,900	40,100	58,892

0.7. Capacity Utilization and Identification of Bottlenecked Sections

After mapping the existing pan India rail network, the capacity of the rail network was provided as per the LC Data shared by Indian Railway.

Table 0-16: Existing Capacity Utilization

Existing	<70%	70%-100%	100%-150%	>150%
Entire Network	45%	29%	25%	1%
HDN	2%	18%	58%	22%
HUN	24%	28%	35%	13%
HDN+HUN	20%	36%	41%	3%
Others	69%	22%	9%	0%

Existing capacity utilization was calculated as per the LC data. Existing Passenger trains, Existing Goods Trains and Utilization and mapped accordin

- 74% of the overall entire netv utilization, 25% of entire netw capacity utilization and 1% of n its capacity.
- HDN network has the highest u is operating below 100% capac below 70% utilization.
- 58% of HDN network is ope utilization and 22% of networ higher than 150%.
- 52% of HUN network is operat of HUN network is operating ir and 13% is operating 1.5 times c

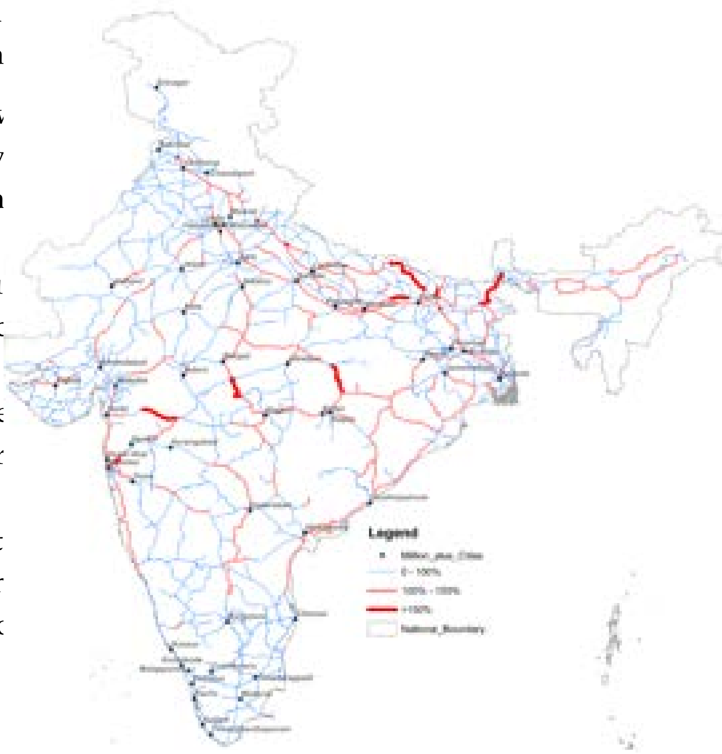


Figure 0-11: Existing Capacity Utilisation

Future Capacity Utilization and Bottlenecked Sections

Future capacity utilizations were calculated for each cardinal year 2026, 2031, 2041 and horizon year 2051.

It has been estimated that by 2051, 33% of the entire network will be operating below 100% capacity and 24% below 70% of utilisation. Whereas 11% of the network will be operating between 100%-150% of capacity utilization and 57% of network will exceed 1.5 times of its capacity.

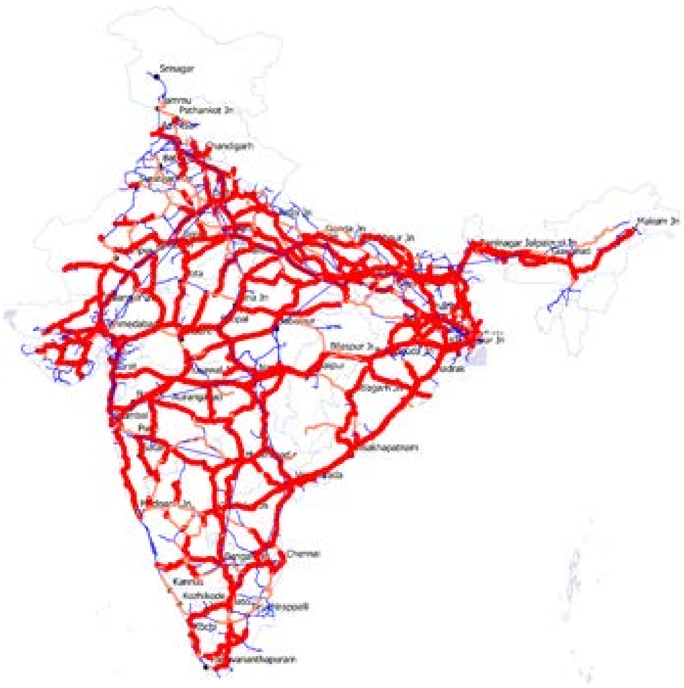


Figure 0-16: Capacity Utilisation - 2051

In case of HDN by 2051, none of the sections will be operating with capacity utilisation of less than 100% and 92% network shall be operating on capacity utilisation higher than 150%.

In case of HUN, 8% of the network will be operating below 100% capacity, whereas 14% network is operating in between 100%-150% capacity and 82% of network will exceed 1.5 times of its capacity by 2051.

Table 0-17: Rail Network Future Capacity Utilization

Network Type	<70%	70%-100%	100%-150%	>150%
2026				
Entire Network	55%	16%	17%	12%
HDN	5%	27%	45%	24%
HUN	41%	23%	19%	17%
HDN+HUN	30%	24%	28%	18%
Others	75%	10%	9%	6%
2031				
Entire Network	44%	15%	18%	24%
HDN	2%	9%	39%	50%
HUN	22%	19%	27%	32%
HDN+HUN	16%	17%	30%	37%
Others	66%	13%	7%	13%
2041				
Entire Network	30%	9%	14%	48%
HDN	0%	1%	10%	89%
HUN	6%	11%	20%	63%
HDN+HUN	4%	8%	17%	71%
Others	51%	10%	11%	28%
2051				

Network Type	<70%	70%-100%	100%-150%	>150%
Entire Network	24%	9%	11%	57%
HDN	0%	0%	7%	92%
HUN	3%	5%	14%	78%
HDN+HUN	2%	3%	12%	82%
Others	42%	13%	10%	35%

0.8. Methodology for Identifying Network Improvements

The methodology and optioneering is required to be accompanied with certain assumptions or underlying parameters that will help in concluding the projects. in this endeavour. Section details out various options for enhancing capacity and methodology for sequencing the same along with assumptions that have been adopted for framing projects for HSR, DFC, HDN, HUN, etc.

Overall Methodology

The process of identification for interventions in carried out as peer following steps.

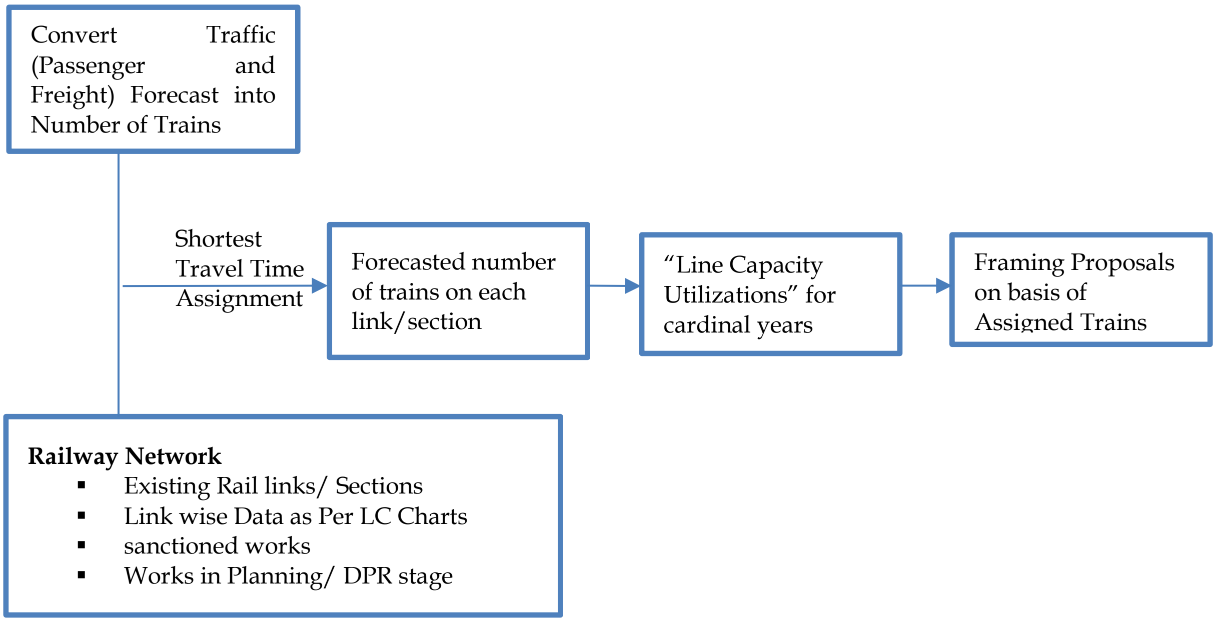


Figure 0-17: – Overall Methodology for Network Requirements

0.9. Dedicated Freight Corridors (DFCs)

The eastern and western DFC are already under construction. The other 3 identified DFCs are also concurrent with the proposals identified under National Infrastructure Pipeline (NIP). These are discussed in the following sections.

The East-West DFC

East West DFC connects Palghar to Dankuni.

Proposed Route

- East-West DFC starts from Palghar (on Western DFC, near Vangaon station on IR), as direct connectivity with Mumbai is not feasible.

- On the Eastern end, one route ends at Andal (on Eastern DFC station) and the other route at Kamarkundu (new station on Eastern DFC, near Dankuni), as direct connectivity with Howrah/Dankuni is not feasible.
- Total route length of East-West Dedicated Freight Corridor between Howrah (Andal/Kamarkundu near Dankuni) and Mumbai (near Palghar) is 2,328 km.
- Total of 37 Junction Stations (31 on Palghar - Andal Line and 6 on Rajkharswan – Kamarkundu Line) and 29 Crossing Stations are proposed on this corridor.

The North- South DFC

Proposed route:

- North-South DFC starts from Pirthala (on Western DFC, near Palwal station on IR), as direct connectivity with Delhi is not feasible at the Northern-end.
- At the Southern-end, the proposed Arakkonam station is connected with Chennai-Bangalore line.
- One connection is proposed towards Chennai at IR station Trubalangadu and another connection is proposed with Melapakkam towards Bangalore side.
- Total route length between Pirthala (near Delhi) and Arakkonam (near Chennai) is 2,327.6 km.
- A total of 21 Junction Stations and 43 crossing stations have been proposed along the North-South DFC.

The East Coast DFC

Proposed Route

- East-Coast DFC starts from Hijli (near Kharagpur), as direct connectivity with Kharagpur is not feasible.
- At the Southern-end, the proposed Vijayawada DFC terminal is connected with Vijayawada IR station and North-South DFC line.
- Total route length from Kharagpur to Vijayawada is 1,114.7 km.
- This route has 31 stations between Kharagpur and Vijayawada, out of which 15 are junction stations and 16 are crossing stations.

Figure 0-18: –Proposed DFC Master Plan and Phasing

Table 0-18: Proposed Phasing of DFC Network

Phasing	2026	2031	2041	2051
Length (Km)	**2,807**	**3,278**	**1,206**	**751**
New DFC Corridors	**Eastern DFC**, 1,324 Km (Under Construction till Sonnagar)	**East Coast DFC**, 1,265 Km (Kharagpur to Vijayawada)	**North South DFC**, 1,206 Km (Itarsi to Chennai via Nagpur and Vijayawada)	**North South DFC**, 751 Km (Palwal to Itarsi)

Phasing	2026	2031	2041	2051
	Western DFC 1,483 Km (Under Construction)	**East West DFC**, 2,013 Km (Palghar to Dankuni and EDFC Connectors)		
		Eastern DFC, 515 Km (Sonnagar to Dankuni)		

0.10. High Speed Rail (HSR) Corridors

HSR Corridors as proposed as part of National Infrastructure Pipeline (NIP) have been reviewed with an objective of enhancing the outreach of HSR network and increasing the connectivity to cities of importance.

Given the long lead time and inherent risk in high-speed rail investments, it is essential that suitable corridors are selected where the conditions exist to support strong passenger demand for high-speed services. In other words, it is critical to identify the corridors across the country with the maximum potential to support high-speed rail in order to minimize this investment risk.

To do so, a ranking system based on an index of five criteria was developed to judge the extent of demand for high-speed rail between any two city pairs. Each city pair consists of two cities, each with a population of at least 10,00,000 that are separated by a distance of 300 to 700 Km.

The criteria are listed below:

1. City Population (> 1 million)
2. Distance between city pairs, confined to distances between 300-700 Km
3. City GDP
4. High levels of congestion
5. Passenger flow between city pairs- AC rail and air trips
6. Corridors having AC passenger share of more than 50% were identified.

Recommended High Speed Rail (HSR) Corridors as per National Rail Plan (NRP)

With an aim to meet the growing passenger demand and to optimise the high-speed rail connectivity between major cities/ commercial/economic centres, the following high-density passenger routes were identified for developing High Speed Railway (HSR) corridors.

The corridors are more or less same as proposed as part of NIP. In addition, certain extensions/ new corridors have been proposed for enhancing HSR outreach and providing connectivity to other towns:

1. Delhi- Chandigarh- Ludhiana - Jalandhar- Amritsar HSR Corridor is recommended to be extended to Jammu via Pathankot for enhancing regional connectivity and for giving economic boost to the Jammu and Pathankot Region. It will cater to the religious tourism potential of Vaishno Devi Shrine and other places.
2. Delhi- Agra- Kanpur- Lucknow- Varanasi- HSR corridor is recommended to route via Ajodhya due to Religious Tourism Potential.

3. Delhi- Agra- Kanpur- Lucknow- Varanasi- HSR corridor is also recommended to be extended to connect Patna and Kolkata.
4. Additional HSR Line from Patna to Guwahati via Katihar and New Jalpaiguri thereby connecting Guwahati with Delhi Varanasi Kolkata HSR Corridor.
5. Additional HSR Line between Hyderabad and Bengaluru by extending Mumbai Hyderabad HSR Line. This shall connect Mumbai with Chennai and also will bring North India from Jammu – Amritsar – Delhi – Jaipur – Ahmedabad – Mumbai – Hyderabad – Bengaluru – Chennai on HSR corridor and all the major towns of North, West and South India shall be connected with 1 HSR Corridor. This will help in boosting the regional economy.

Figure 0-19: – Proposed HSR Corridors and Phasing

6. Additional HSR line is proposed between Nagpur and Varanasi by extending the Mumbai – Nashik – Nagpur HSR Corridor. This shall connect Mumbai with Varanasi which will further connect with Delhi – Varanasi – Patna – Guwahati HSR corridor.

Table 0-19: Proposed HSR Phasing

Phasing	2026	2031	2041	2051
New HSR Corridors	Mumbai Ahmedabad, 508 Km (As per NIP also)	Delhi Varanasi via Ajodhya, 855 Km (As per NIP also, Ajodhya included)	Hyderabad Bangalore, 618 Km (New)	Mumbai Nagpur, 789 Km *(As per NIP)*
		Varanasi to Patna, 250 kms (New)	Nagpur Varanasi, 855 Km (New)	Mumbai Hyderabad, 709 Km *(As per NIP)*
		Patna to Kolkata, 530 Km (New)		Patna Guwahati 850 Km (New)
		Delhi Udaipur Ahmedabad 886 Km *(As per NIP also)*		Delhi Chandigarh Amritsar, 485 Km *(As per NIP)*
				Amritsar - Pathankot - Jammu, 190 Km (New)
				Chennai to Mysuru via Bangalore, 462 Km *(As per NIP)*
Length (Km)	508	2,521	1473	3485

0.11. Network Improvement Proposals for Highly Dense Network (HDN)

Majority of the HDN Network is congested. Capacity utilisation of entire HDN is presented in table below.

Table 0-20: Existing Capacity Utilization of HDN

Capacity Utilization	Network KM	Share
0%-70%	189	2%
70%-100%	2,003	18%
100%-150%	6,326	58%
>150%	2,450	22%
Total	**10,969**	**100%**

HDN 1 – Delhi Howrah Main Route via Prayagraj, Mughalsarai and Gaya

Majority of the sections of HDN 1 are operating beyond their capacity in terms of number of trains/ days which is causing congestion, delay in passenger operations and enormous delay in freight operations.

Table 0-21: Existing Capacity Utilization of HDN 1

Capacity Utilization	Network KM	Share
0%-70%	0	0%
70%-100%	262	18%
100%-150%	1187	81%
>150%	15	1%
Total	**1463**	**100%**

HDN 1 has been recommended to be upgraded to triple line for the entire length.

Table 0-22: HDN 1 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line KM
Double to Triple Line	191	191
Quadruple Line to 6 Lines	9	18
Total	200	209

Figure 0-20: Network Upgradation Proposals - HDN 1

HDN 2 – Mumbai to Howrah via Jalgaon, Nagpur, Bilaspur, Jharsuguda and Tata Nagar

HDN 2 is a part of Golden Diagonal, from Kolkata (Howrah) to Mumbai via Jalgaon, Nagpur, Bilaspur and Jharsuguda.

Table 0-23: Existing Capacity Utilization of HDN 2

Capacity Utilization	Network KM	Share
0%-70%	17	1%
70%-100%	130	7%
100%-150%	1509	80%
>150%	233	12%
Total	**1,889**	**100%**

HDN 2 has been recommended to be upgraded to triple or quadruple line for the entire length.

Table 0-24: HDN 2 – Additional Line Requirements (2051)

Configuration Conversion	Network (Km)	Line (Km)
Triple to Quadruple Line	64	64
Triple Line to 6 Lines	11	33
Quadruple Line to 6 Lines	32	64
6 Lines to 8 Lines	17	34
Total	124	195

Figure 0-21: Consolidated Network Upgradation Proposals - HDN 2

HDN 3 – Delhi to Mumbai via Kota, Bharatpur, Ratlam, Ahmedabad and Vadodara

HDN 3 is a part of Golden Quadrilateral, running from Delhi to Mumbai via Kota, Bharatapur and Ratlam.

Table 0-25: Existing Capacity Utilization of HDN 3

Capacity Utilization	Network KM	Share
0%-70%	0	0%
70%-100%	170	12%
100%-150%	1148	83%
>150%	70	5%
Total	**1,889**	**100%**

HDN 3 has been recommended to be upgraded to triple or quadruple line.

Table 0-26: HDN 3 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line KM
Double to Triple Line	562	562
Triple to Quadruple Line	338	338
Quadruple Line to 6 Lines	7	14
6 Lines to 8 Lines	2	4
Total	**909**	**919**

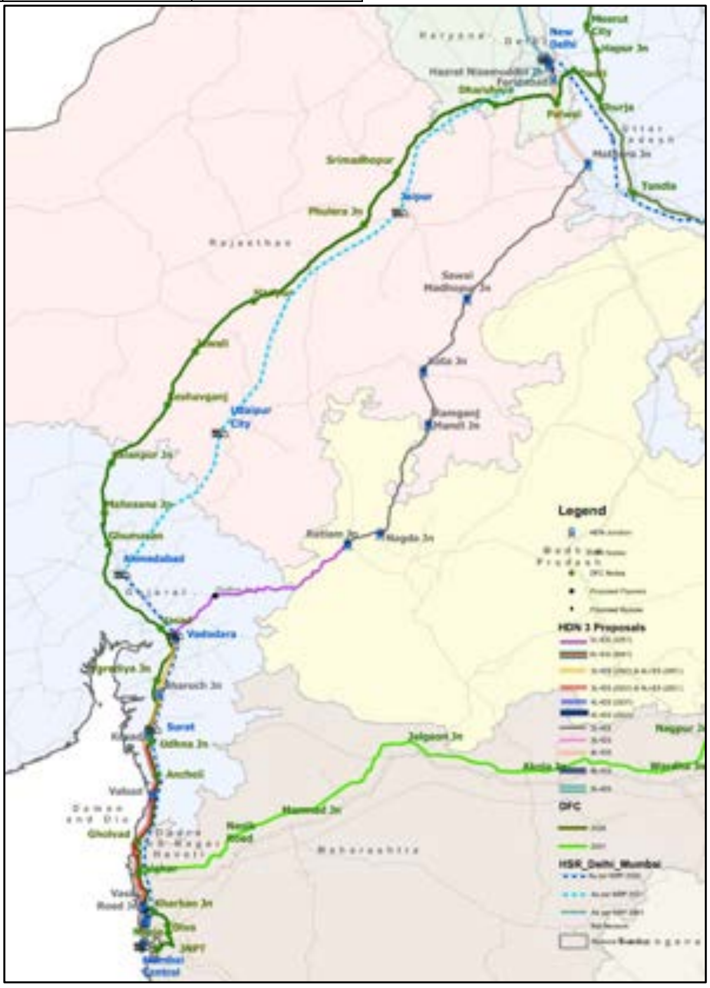


Figure 0-22: –Consolidated Network Upgradation Proposals – HDN 3

Western DFC is proposed from and Khurja to JNPT (before year 2026) along the HDN 3 to handle the freight demand and leave the HDN 3 as a passenger only operation for a higher efficient operation and maintaining higher speed.

High Speed Rail Corridor is proposed from Mumbai to Delhi via Surat, Ahmedabad.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HDN 3 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

HDN 4 – Delhi to Guwahati via Rosa and Gorakhpur

HDN runs from Delhi to Guwahati via Rosa and Gorakhpur. It is the shortest route between cities of Delhi and Guwahati having a length of 1,845 Km. As the route is connects the North-Eastern India with National Capital via 3 more metropolitan cities, the passenger demand as well as the freight demand is very high.

At present most of the HDN 4 is operating over 100% of capacity Utilization. Only 27% below 100% and nothing below 70%. This is one of the most highly congested networks and requires infrastructure Upgradation.

Table 0-27: Existing Capacity Utilization of HDN 4

Capacity Utilization	Network KM	Share
0%-70%	0	0%
70%-100%	498	27%
100%-150%	840	46%
>150%	507	27%
Total	**1,845**	**100%**

HDN 4 has been recommended to be upgraded to triple line for the entire length.

Table 0-28: HDN 4 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line KM
Double to Triple Line	637	637
Double to Quadruple Line	456	912
Triple to Quadruple Line	978	978
Total	2070	2,526

Figure 0-23: –Consolidated Network Upgradation Proposals – HDN 4

HDN 5 – Delhi to Chennai via Bhopal, Nagpur, Vijayawada

HDN 5 is a part of Golden Diagonal, running North South, it connects Delhi with Chennai via Bhopal, Nagpur, Vijayawada and Gudur. Having a length of 2,048 Km. the corridor provides connectivity of North India with South India and therefore caters to huge passenger and freight demand.

At present most (83%) of the HDN 5 is operating over 100% of capacity Utilization. Only 2% is below 100% and 6% below 70%. This is one of the highly congested networks and requires infrastructure Upgradation.

Figure 0-24: –Consolidated Network Upgradation Proposals – HDN 5

Table 0-29: Existing Capacity Utilization of HDN 5

Capacity Utilization	Network KM	Share
0%-70%	121	6%
70%-100%	33	2%
100%-150%	1693	83%
>150%	201	10%
Total	**2,048**	**100%**

HDN 6 – Kolkata to Vijayawada via Kharagpur and Vijayanagaram

HDN 6 is a part of Golden Quadrilateral, starting from Kolkata (Howrah) to Vijayawada via Kharagpur and Vijayanagaram and is also connected to HDN 5.

Table 0-30: Existing Capacity Utilization of HDN 6

Capacity Utilization	Network KM	Share
0%-70%	0	0%
70%-100%	62	6%
100%-150%	978	88%
>150%	72	6%

Total	**1,113**	**100%**

At present most (94%) of the HDN 6 is operating over 100% of capacity Utilization. Only 6% is below 100% and none is below 70%. This is one of the highly congested networks and requires infrastructure Upgradation.

HDN 6 has been recommended to be upgraded to triple line or quadruple for the entire length.

Table 0-31: HDN 6 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line Km
Triple to Quadruple Line	158	158
Total	158	158

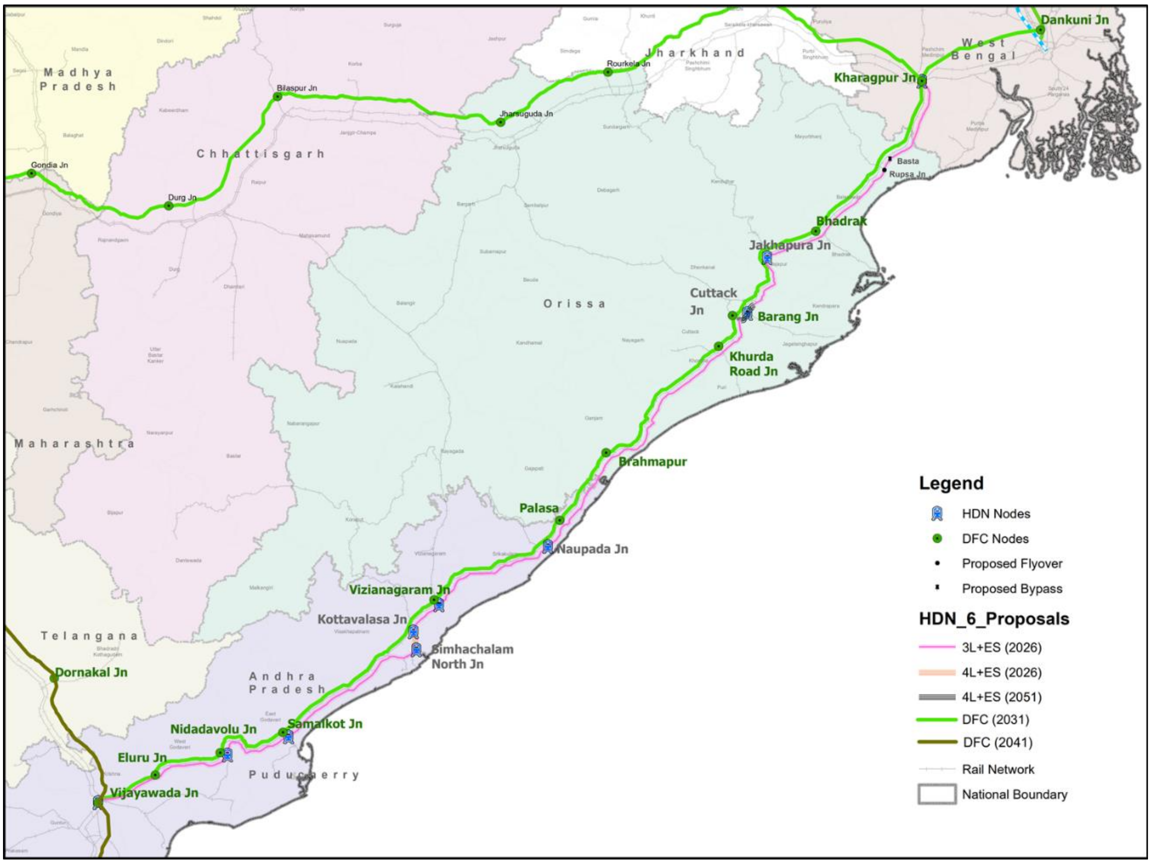


Figure 0-25: –Consolidated Network Upgradation Proposals – HDN 6

HDN 7 – Mumbai to Chennai via Pune

HDN 7 is a part of Golden Quadrilateral, starting from Mumbai to Chennai passing through Pune, Wadi, Nandalur. It is the shortest route between Mumbai and Chennai having a total length of 1,224 km.

Table 0-32: Existing Capacity Utilization of HDN 7

Capacity Utilization	Network KM	Share
0%-70%	58	5%
70%-100%	466	38%
100%-150%	675	55%
>150%	25	2%
Total	**1,224**	**100%**

HDN 7 has been recommended to be upgraded to triple line or quadruple for the entire length.

Table 0-33: HDN 7 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line Km
Double to Triple	379	379
Quadruple to 6 Lines	38	76
Total	**417**	**455**

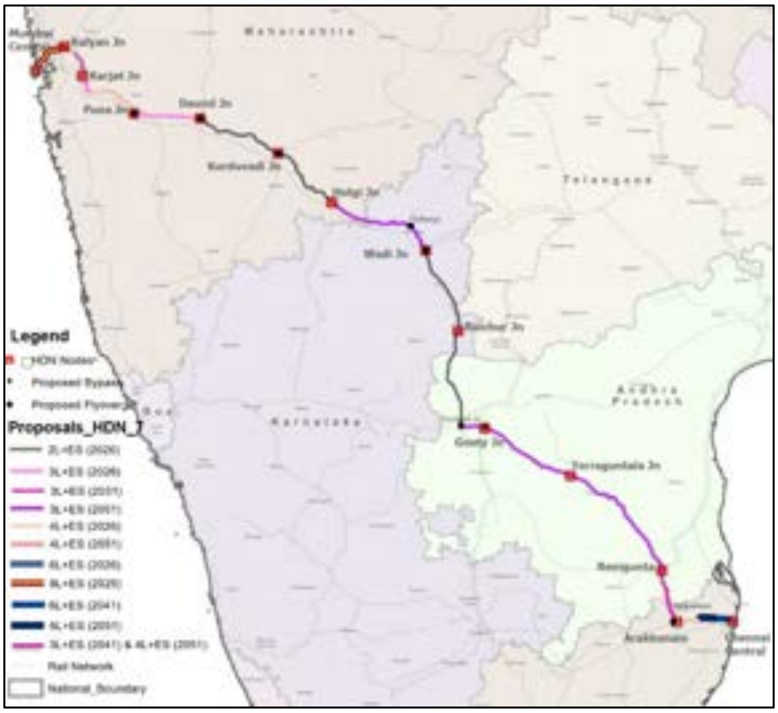


Figure 0-26: –Consolidated Network Upgradation Proposals – HDN 7

0.12. Network Improvement proposals for Highly Utilized Network (HUN)

Similar to HDN, the Indian Railways have classified the next hierarchy of network catering to predominantly high traffic demand as Highly Utilised Network.

A total of 11 routes have been identified as Highly Utilized Network (HUN), having a total length of 23,347 km.

The entire HUN Network is very much congested. More than 46% of HDN network is operating beyond 100% of its capacity. Only 24% of network is having less than 70% capacity Utilization.

Table 0-34: Existing Capacity Utilization of HUN

Capacity Utilization	Network KM	Share
0%-70%	5,896	24%
70%-100%	6,887	28%
100%-150%	8,361	34%
>150%	3,121	12%
Total	**23,347**	**100%**

Entire HUN is recommended to be upgraded for Automatic Signalling with TCAS

Table 0-35: HUN – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	2026	2031	2041	2051	Total	2026	2031	2041	2051	Total
HUN 1										
Single Line to Double Line	49	14	205	120	388	49	14	205	120	388
Double Line to Triple Line	98	102	298	133	631	98	102	298	133	631
Double Line to Quadruple Line	46	103	41	394	584	92	206	82	789	1168
Triple Line to Quadruple Line	43	19	193	183	437	43	19	193	183	437
Quadruple Line to 6 Lines	0	0	0	40	40	0	0	0	80	80
Total	235	238	737	871	2,081	281	340	778	1,305	2,705
HUN 2										
Single Line to Double Line	76	106	0	4	186	76	106	0	4	186
Single Line to Triple Line	0	0	0	6	6	0	0	0	12	12
Single Line to Quadruple Line	0	0	21	0	21	0	0	62	0	62
Double Line to Triple Line	0	184	500	267	951	0	184	500	267	951
Double Line to Quadruple Line	0	0	206	0	206	0	0	412	0	412
Triple Line to Quadruple Line	0	0	16	0	16	0	0	16	0	16
Total	76	290	742	277	1,386	76	290	990	284	1639
HUN 3										
Single Line to Double Line	113	0	0	0	113	113	0	0	0	113
Double Line to Triple Line	0	159	292	259	709	0	159	292	259	709
Double Line to Quadruple Line	0	0	0	6	6	0	0	0	13	13
Triple Line to Quadruple Line	0	0	94	51	145	0	0	94	51	145
Total	113	159	386	316	974	113	159	386	323	981
Single Line to Double Line	555	0	100	43	698	555	0	100	43	698
Double Line to Triple Line	0	53	300	0	353	0	53	300	0	353
Triple Line to Quadruple Line	0	0	53	203	255	0	0	53	203	255
Total	555	53	453	246	1306	555	53	453	246	1306
HUN 5										
Single Line to Double Line	83	0	0	227	310	83	0	0	227	310
Double Line to Triple Line	53	9	100	37	198	53	9	100	37	198
Double Line to Quadruple Line	17	0	0	0	17	34	0	0	0	34
Triple Line to Quadruple Line	0	124	0	44	168	0	124	0	44	168
Quadruple Line to 6 Lines	0	0	0	18	18	0	0	0	37	37
Total	153	133	100	326	711	170	133	100	344	747
HUN 6										
Single Line to Double Line	174	204	177	35	590	174	204	177	35	590
Double Line to Triple Line	0	0	180	0	180	0	0	360	0	360
Double Line to Quadruple Line	0	223	43	143	410	0	223	43	143	410
Triple Line to Quadruple Line	0	118	182	0	300	0	236	363	0	600
Quadruple Line to 6 Lines	0	0	223	0	223	0	0	223	0	223
Total	174	546	805	179	1704	174	664	1167	179	2183
Single Line to Double Line	0	0	385	0	385	0	0	385	0	385
Double Line to Triple Line	100	0	0	508	607	100	0	0	508	607
Double Line to Quadruple Line	0	0	45	12	58	0	0	91	24	115
Triple Line to Quadruple Line	0	136	397	0	533	0	136	397	0	533
Total	100	136	827	520	1,583	100	136	873	532	1,640
HUN 8										
Single Line to Double Line	41	0	239	0	280	41	0	239	0	28
Double Line to Triple Line	0	0	138	139	278	0	0	138	139	278
Double Line to Quadruple Line	0	0	138	0	138	0	0	276	0	276
Triple Line to Quadruple Line	0	0	0	64	64	0	0	0	64	64
Quadruple Line to 6 Lines	0	0	0	38	38	0	0	0	77	77

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Total	41	0	515	242	**798**	41	0	653	281	974
HUN 9										
Single to Double Line	875	207	39	387	**1508**	875	207	39	387	**1508**
Double to Triple Line	0	0	2	13	**15**	0	0	2	13	**15**
Double to quadruple Line	0	0	7	0	**7**	0	0	13	0	**13**
Total	875	207	48	400	**1530**	875	207	55	400	**1536**
HUN 10										
Single to Double Line	147	0	117	74	**338**	147	**0**	117	74	**338**
Double to Triple Line	177	0	122	343	**642**	177	0	122	343	**642**
Double to Quadruple Line	3	0	0	0	**3**	5	0	0	0	**5**
Triple to Quadruple Line	0	177	0	0	**177**	0	177	0	0	**177**
Quadruple to 6 Lines	0	0	0	38	**38**	0	0	0	76	**76**
Total	**327**	**177**	**239**	**455**	**1,199**	**330**	**177**	**239**	**493**	**1,239**
HUN 11										
Single to Double Line	11	65	0	0	**76**	11	65	0	0	**76**
Double to Triple Line	0	184	83	346	**613**	0	184	83	346	**613**
Double to Quadruple Line	0	0	184	185	**369**	0	0	184	185	**369**
Total	**11**	**249**	**267**	**531**	**1059**	**11**	**249**	**267**	**531**	**1059**

0.13. Network Improvement proposals for Port Connectivity

A total of 2,722 network Km has been selected for Port Connectivity. This includes part of HUNs and HDNs also. For port Connectivity, the undermentioned sections are selected as per nearest port to Nearest HDN or DFC.

Table 0-36: Port Connectivity Doubling Proposals

Section	Port Name	Configuration after completion of Works as per Pink Book	Proposed Configuration			
			2026	2031	2041	2051
Attipattu - Gummidipundi	Chennai/ Ennore Port	2L	2L+ ABTS	-	-	-
Chennai Beach - Chennai Egmore		4L	-	4L+TC	-	-
Chennai Beach - Royapuram		4L	4L+ TC	-	-	-
Chennai Egmore - Tambaram		4L	4L+ TC	-	-	-
Ennore - Attipattu		4L	4L+ ABTS	-	-	-
Gummidipundi - Sullurupeta		2L	2L+ ABTS	-	-	-
Korukkupet Jn. - Tiruvottiyur		3L	3L+ ABTS	-	-	-
Royapuram - Washermanpet.		4L	-	-	4L+TC	-
Sullurupeta - Gudur		2L	2L+ ABTS	-	-	-
Tiruvottiyur - Ennore		4L	4L+ ABTS	-	-	-
Gandhidham - Adipur	Kandla Port	2L	-	-	-	2L+TC
Jhund - Maliya Miyana		2L	-	-	2L+TC	3L+TC
Maliya Miyana - Samakhiyali		2L	-	-	2L+TC	-
Samakhiyali - Gandhidham		2L	2L+TC	3L+TC	4L+TC	-

Section	Port Name	Configuration after completion of Works as per Pink Book	Proposed Configuration			
			2026	2031	2041	2051
Shoranur Jn. - Kozhikode	Kozhikode Port	2L	-	2L+TC	-	3L+TC
ANDUL - ULUBERIA	Kolkata/Haldia Port	3L	3L+ ABTS	-	-	-
MECHEDA - PANSKURA		3L	3L+ ABTS	-	-	-
PANSKURA - HALDIA		2L	-	-	-	2L+TC
PANSKURA - KHARAGPUR		3L	3L+ ABTS	-	-	-
SANTRAGACHI - ANDUL		3L	3L+ ABTS	-	-	-
ULUBERIA - MECHEDA		3L	3L+ ABTS	-	-	-
Kulem - Vasco - Da - Gama	Madgaon Port	2L	-	-	2L+TC	-
ROHA - Madgaon	Mangalore Port	1L	2L	-	3L+TC	-
Kannur - Netravati		2L	-	-	2L+TC	3L+TC
Kozhikode - Kannur		2L	-	2L+TC	-	3L+TC
Mangaluru Jn. - Thokur		1L	2L	-	-	2L+TC
Netravati - Mangaluru Jn.		2L	-	-	-	2L+TC
Chhatrapati Shivaji Terminus, MUMBAI - Dadar	Mumbai port	4L	4L+ ABTS	-	-	-
Dadar - Kurka		4L	4L+ ABTS	6L+ ABTS	8L+ ABTS	-
Dadar - Mahim Jn		6L	6L+ ABTS	-	-	8L+ ABTS
Bhildi - Samakhiyali		1L	2L	2L+TC	3L+TC	4L+TC
Budhapank - Rajathgarh	Paradeep	4L	-	-	-	4L+TC
Cuttack - Barang		3L	3L+ ABTS	-	-	-
Cuttack - Paradeep		2L	-	-	-	3L+TC
Haridaspur- Paradeep		1L	2L+TC	-	-	4L+TC
Nergundi - Cuttack		3L	3L+ ABTS	-	-	-
Talcher - Budhapank		1L	4L+TC	-	-	-
Gopalpatnam - Duvvada	Vishakhapttanam	3L	3L+ ABTS	-	-	-
Gopalpatnam - Visakhapatnam		3L	3L+TC	4L+TC	-	-
Kottavalasa - Simhachalam North		4L	4L+ ABTS	-	-	-
Simhachalam North - Duvvada (By - Pass)		2L	2L+TC	-	-	-
Simhachalam North - Jaggayyapalem		3L	-	-	-	-

Table 0-37: Port Connectivity Doubling Proposals

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single to Double Line	218	137	81	215	**650**	218	137	81	215	**650**
Single to Quadruple Line	141	0	0	0	**141**	424	0	0	0	**424**
Double to Triple Line	0	53	160	475	**687**	0	53	160	475	**687**
Double to Quadruple Line	0	0	0	76	**76**	0	0	0	151	**151**
Triple to Quadruple Line	0	6	53	92	**151**	0	6	53	92	**151**
Quadruple to 6 Lines	0	6	0	0	**6**	0	12	0	0	**12**
6 Lines to 8 Lines	0	0	6	2	**8**	0	0	12	5	**17**
Total	**359**	**202**	**299**	**859**	**1720**	**642**	**208**	**305**	**937**	**2092**

0.14. Trans Asian Rail Connectivity

0.15. Rail Connectivity with Industrial Corridors

National Industrial Corridor Development Programme is India's most ambitious infrastructure programme aiming to develop new industrial cities as "Smart Cities" and converging next generation technologies across infrastructure sectors.

Govt. of India is developing various Industrial Corridor Projects as part of National Industrial Corridor programme which is aimed at development of futuristic industrial cities in India which can compete with the best manufacturing and investment destinations in the world. The same will create employment opportunities and economic growth leading to overall socio-economic development.

11 Industrial Corridors Projects are being taken up for development with 30 Projects to be developed in 04 phases up to 2024-25:

1. Delhi Mumbai Industrial Corridor (DMIC);
2. Chennai Bengaluru Industrial Corridor (CBIC);
3. Amritsar Kolkata Industrial Corridor (AKIC);
4. East Coast Industrial Corridor (ECIC) with Vizag Chennai Industrial Corridor (VCIC) as Phase 1;
5. Bengaluru Mumbai Industrial Corridor (BMIC);
6. Extension of CBIC to Kochi via Coimbatore;
7. Hyderabad Nagpur Industrial Corridor (HNIC);
8. Hyderabad Warangal Industrial Corridor (HWIC);
9. Hyderabad Bengaluru Industrial Corridor (HBIC);
10. Odisha Economic Corridor (OEC);
11. Delhi Nagpur Industrial Corridor (DNIC).

Table 0-38: Rail Connectivity Proposals for NICDC Projects

S. No	National Industrial Corridor	State	Phase	District Name	Existing	Proposed	DFC	HSR
1	Dholera Special Investment Region (22.5 sq. kms)	Gujarat	Phase 1	Ahmedabad	2L	4L+TC	DFC (2026)	HSR
2	Shendra Bidkin Industrial Area (18.55 sq. kms)	Maharashtra	Phase 1	Aurangabad	3L	4L+TC	DFC (2026)	-
3	Integrated Industrial Township – Vikram Udyogpuri (1,100 acres)	Madhya Pradesh	Phase 1	Ujjain	2L	3L+ABTS	-	-
4	Integrated Industrial Township –	Uttar Pradesh	Phase 1	Gautam Buddh Nagar	4L	4L+ABTS	DFC (2026)	-

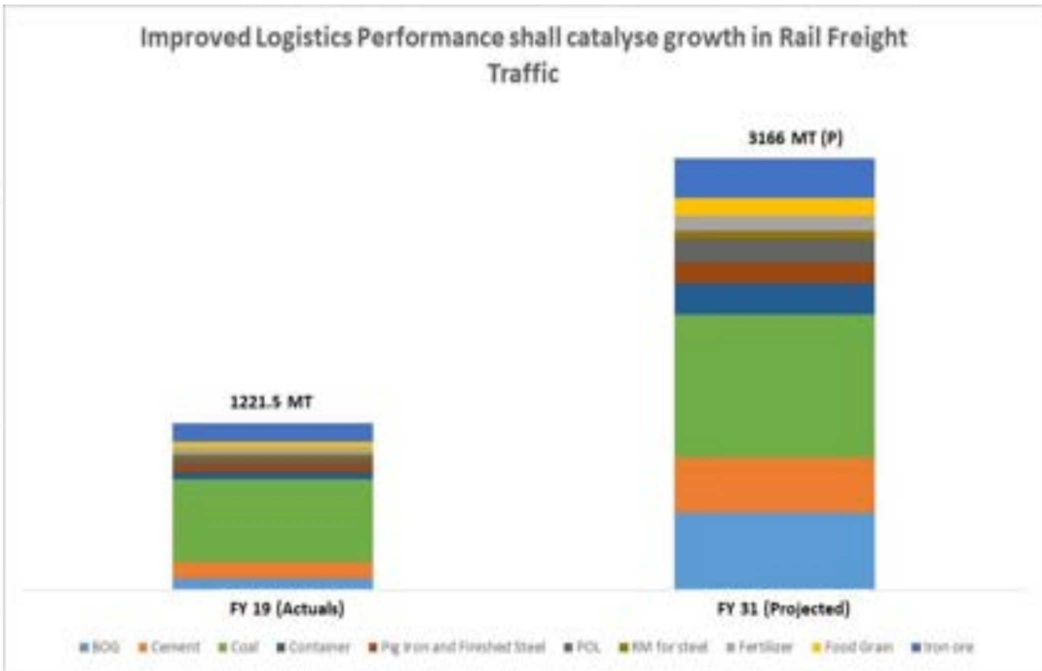
S. No	National Industrial Corridor	State	Phase	District Name	Existing	Proposed	DFC	HSR
	Greater Noida (747.5 acres)							
5	Integrated Multi-Modal Logistics Hub – Nangal Chaudhary (886 acres)	Haryana	Phase 1	Mahendragarh	2L	2L	DFC (2026)	-
6	Krishnapatnam Industrial Area (2,500 acres)	Andhra Pradesh	Phase 2	Nellore	4L	4L+ABTS	DFC (2031)	-
7	Tumakuru Industrial Area (1,736 acres)	Karnataka	Phase 2	Tumkur	1L	2L+TC	-	-
4	Multi Modal Logistics Hub & Multi Modal Transport Hub (MMLH & MMTH) (1,208 acres)	Uttar Pradesh	Phase 2	Ghaziabad	4L	4L+ABTS	DFC (2026)	-
8	Multi Modal Logistics Park, Sanand (500 acres)	Gujarat	Phase 2	Ahmedabad	2L	4L+TC	DFC (2026)	HSR
9	Dighi Port Industrial Area (7,413 acres)	Maharashtra	Phase 2	Pune	4L	4L+ABTS	-	HSR
10	Zaheerabad Phase 1 (3,500 acres)	Telangana	Phase 2	Sangareddy	2L	4L+TC	-	-
11	Hyderabad Pharma City Phase 1 (8,000 acres)	Telangana	Phase 2	Hyderabad	2L	4L+TC	-	-
12	Raghunathpur Industrial Park (2,483 acres)	West Bengal	Phase 2	Purulia	3L	3L	-	-
13	Ponneri Industrial Area (4,000 acres)	Tamil Nadu	Phase 3	Tiruvallur	4L	6L+ABTS	DFC (2031)	-
14	Salem (1,773 acres)	Tamil Nadu	Phase 3	Salem	2L	4L+TC	-	-
15	Palakkad Industrial Area (1,878 acres)	Kerala	Phase 3	Palakkad	3L	4L+TC	-	-
16	Koparthy Industrial Area (4,085 acres)	Andhra Pradesh	Phase 3	Srikakulam	3L	3L+ABTS	DFC (2031)	-
17	Chitoor Industrial Area (2,346 acres)	Andhra Pradesh	Phase 3	Chittoor	2L	3L+ABTS	DFC (2031)	-
18	Vishakhapatnam Industrial Area (1,100 acres)	Andhra Pradesh	Phase 3	Visakhapatnam	4L	4L+ABTS	DFC (2031)	-
19	Hisar Integrated Manufacturing Cluster (4,000 acres)	Haryana	Phase 3	Hisar	2L	3L+TC	-	-
20	Prag Khurpia Integrated Manufacturing	Uttarakhand	Phase 3	Udham Singh Nagar	1L	2L	-	-

S. No	National Industrial Corridor	State	Phase	District Name	Existing	Proposed	DFC	HSR
	Cluster (2,935 acres)							
21	Rajpura Patiala	Punjab	Phase 4	Patiala	2L	2L+TC	DFC (2026)	-
22	Kanpur	Uttar Pradesh	Phase 4	Kanpur Nagar	4L	6L+ABTS	DFC (2026)	HSR
23	Ghamariya	Bihar	Phase 4	Gaya	3L	3L+ABTS	DFC (2031)	-
24	Bahri	Jharkhand	Phase 4	Hazaribagh	1L	2L+TC	-	-
25	Sangli / Satara / Solapur	Maharashtra	Phase 4	Sangli	2L	2L+TC	-	-
			Phase 4	Satara	2L	2L+TC	-	-
			Phase 4	Solapur	2L	2L+ABTS	-	-
26	Dharwad	Karnataka	Phase 4	Dharwad	2L	3L+TC	-	-
27	Hyderabad Bengaluru Industrial Corridor	Orvakal/Anantapur/Hindupur	Phase 4	Kurnool	2L	2L+ABTS	-	HSR
				Anantapuramu	2L	4L+TC	-	-
28	Odisha Economic Corridor	Khurda-Cuttack-Jagatsinghpur/Jajpur-Kendrapara-Bhadrak	Phase 4	Khordha	3L	3L+ABTS	DFC (2031)	-
				Cuttack	4L	4L+TC	DFC (2031)	-
				Jagatsinghpur	2L	4L+TC	-	-
				Jajpur	3L	4L+ABTS	DFC (2031)	-
				Kendrapara	1L	4L+TC	-	-
				Bhadrak	3L	3L+ABTS	DFC (2031)	-
29	Delhi Nagpur Industrial Corridor		Phase 4	Nagpur	4L	4L+ABTS	DFC (2031)	HSR
			Phase 4	Delhi	3L	4L+TC	DFC (2041/ 2051)	HSR

0.16. Multimodal Freight Terminal

Rail transportation inherently involves handling of cargo at terminals as part of the chain. Any rail-based cargo transportation chain therefore invariably involves both, terminal handling as well as first and last mile operations, as additional activities in comparison with road-based transportation, which in turn potentially adds to cost as well as time spent in the transit process, when compared to road-based movement of cargo alone.

The projected potential growth of freight traffic on rail, as discussed in the demand forecast report, indicates that rail traffic has a potential for almost 2.5x growth over the next decade subject to improved 'logistics performance' on rail. This additional demand will clearly throw up an inherent need for corresponding additional capacity for MMLPs/Freight Terminals to service the same.



Note: FY 19 Rail Traffic sourced from Indian Railways. FY 31 Rail Traffic Projections sourced from AECOM Logit Model

During the course of consultations with multiple Industry stakeholders, various issues were raised, ranging from lack of adequate terminal infrastructure capacity at desired locations, non-availability of facilities/mechanisms aligned with specific needs of different commodities, primitive nature of loading/unloading operations at existing terminals/good sheds, inefficiencies at terminals, etc

0.17. Multi Modal Passenger Terminals

On the basis of the existing travel demand pattern which has been derived from the ticket sales data, total number of passengers from each of the railway terminal has been estimated for the base year (2018). There are around 24 (no.) terminals (station clusters) that handle more than 2,00,000 passengers per day.

The passenger demand in terms of the footfall at the various Railway Stations has been forecasted using the results of the travel demand forecast model. This demand has been forecasted for all the cardinal years using the Passenger OD Matrices where the total number top 24 clusters (identified earlier which have a demand of more than 2,00,000 Passengers per day).

These 24 terminal/ station clusters are proposed to be taken up for upgradation immediately. The upgradation plan / interventions for each these clusters will have to be drawn up depending on the proposed footfall. As a first preference, the major station of these clusters will be taken up for upgradation so that the demand can be met. However, in case, there are physical, land or any other constraints to expand any station to meet the demand, directional terminals for the main station may be considered in the same district.

It is forecasted that with time more terminals /stations clusters will be added to this list which will handle more than 2,00,000 passengers/ day.

Figure 0-28: –Passenger Terminal Phasing

Additional stations have been identified for upgradation where a multimodal integration is required with other Rail modes such as High-Speed Rail, RRTS, etc.

There are 13 (no.) stations that overlap with the proposed HSR corridors but do not appear in the list of stations to be upgraded. Similarly, three (no.) stations i.e. Bharuch, Vadodara, Jodhpur and Dhanbad stations which appear in the original list, but their upgradation has been preponed so that it is in line with the proposed corridor development.

The list of stations to be upgraded has been revised to include the stations that will multi-modal integration. This revised is given at Table below.

Table 0-39: Updated List of Stations for Upgradation

S. No	New Stations to be taken up for upgradation in the year			
	2026	2031	2041	2051
1	Jaipur	Gaya	Allahabad	Gwalior
2	Rohtas	Saran	~~Dhanbad~~	Gonda
3	Munger	~~Vadodara~~	Bhagalpur	Saharanpur
4	Palghar	Chittoor	Purnia	Nashik
5	Kanpur Nagar	Bhopal	Bareilly	Ratlam
6	Ernakulam	Bilaspur	Raipur	Kheda
7	Guntur	Kollam	~~Jodhpur~~	Amritsar
8	Valsad	Muzaffarpur	Moradabad	Mysore
9	Darbhanga	Nagpur	Mathura	Sri Potti Sriramulu Nellore

10	Hazaribagh	Ranchi	Jalgaon	~~Bharuch~~
11	Gorakhpur	~~Ghaziabad~~	Vellore	Karnal
12	Krishna	Agra	Visakhapatnam	Birbhum
13	Gurgaon	Ajodhya	Murshidabad	Dharwad
14	Kathgodam	Ajmer	Palakkad	Solapur
15	Vapi	Jodhpur	Khordha	Puruliya (Purulia)
16	Vadodara	Dhanbad	Thanjavur	~~Rohtak~~
17	Bharuch	Thiruvananthpuram	Kota	East Godavari
18	Ghaziabad	Kannur	East Singhbhum	Ludhiana
19	Meerut	Hapur	Ambala	Gulbarga
20	Rohtak	Khurja	~~Kannur~~	Begusarai
21		Aligarh	Jhansi	Katihar
22		Faridabad	Jabalpur	New Jalpaiguri
23			~~Meerut~~	New Bongaigaon
24			Kozhikode	Pathankot
25			Coimbatore	Jammu
26			Sri Ganganagar	
27			Durg	
28			Kurnool	
29			Katni	
30			Satna	
No. of Stations	**20**	**20**	**27**	**23**

A total of 90 stations qualify for upgradation. This list may undergo slight modifications after the DPRs for the HSR and RRTS corridors are carried out and the location of new stations are finalised.

0.18. Rolling Stock Requirement

The projections for the rolling stock have been made to meet the forecasted demand for passenger and freight in the travel demand model that has been made for the study. This chapter covers the following rolling stock components:

- Electric Locomotives
    a. Freight
    b. Passenger
- Freight Wagons
    a. Open Wagons
    b. Closed Wagons
    c. Container Wagons
    d. Flat Wagons
    e. Tank Wagons
    f. Other special purpose wagons for the Automobiles
- Passenger Coaches
    a. Air Conditioned (AC) Coaches
    b. Non-AC Coaches
- Mainline Electric Multiple Units (MEMUs)
- Train Sets

The projections made in the plan for different components of the Rolling stocks are based on the characteristics of the existing operations, Emerging trends in Freight and passenger movement, Plans of Indian Railway and results of the travel demand model

0.18.1. Demand for Locomotives

Demand for locomotives has been assessed in four steps:

1. Assessment of total demand for locomotives for passenger operations
2. Assessment of total demand for locomotives for freight traffic operations
3. Condemnation Plan of Existing fleet based on the age profile
4. Procurement plan to meet total demand and supply

The demand for total locomotives required are summarised in table given below

Item	2026	2031	2041	2051
Total Coaching Locomotives Required	3,494	4,782	8,687	13,498
Total Freight Locomotives Required	13,305	15,957	22,894	32,519
Total Locomotives Required	**16,799**	**20,739**	**31,581**	**46,017**

0.18.2. Demand for Wagons

Total Number of wagons required for all categories including the Special Purpose Wagons that are required to meet the freight demand in the cardinal years is given at the table below:

Type of Wagon	2018	2026	2031	2041	2051
BCN	84,128	1,57,456	2,12,727	2,79,539	3,54,684
BOXN	1,31,573	1,47,738	1,71,242	2,22,115	2,59,050
BCACBM	-	6,523	10,221	14,293	19,754
BLC	30,073	48,162	73,525	1,15,135	1,65,333
BRN	20,622	29,671	35,243	47,895	68,413
BCFC	290	4,158	7,979	21,074	57,413
BTPN	13,189	14,062	34,288	79,020	1,43,483
Total	2,79,876	4,07,769	5,45,225	7,79,071	10,68,130

0.18.3. Demand for Coaches

Total Number of AC and Non-AC Coached that are required to meet the passenger demand in the cardinal years is given at the table below:

Type of coach	2018	2026	2031	2041	2051
AC	4,074	8,311	11,546	19,067	30,685
Non-AC	39,343	52,430	60,569	87,360	1,21,824
Total	43,417	60,741	72,115	1,06,427	1,52,509

0.18.4. Demand for Mainline Electric Multiple Units (MEMUs)

It is proposed that the MEMUs operations will carry around 50% of the total Non-AC passenger demand on the entire network. Considering that MEMUs shall have a provision only for the seating, it is further proposed that the Passenger demand for non-AC on these corridors with the Average Trip Length less than 200 Km shall be carried through MEMUs. Accordingly, total Number of MEMUs that are required to meet the demand in the cardinal years is given at the table below:

Year	2018	2026	2031	2041	2051
Total EMUs Required	653	1284	1487	1767	2045

0.18.5. Demand for Mainline Electric Multiple Units (MEMUs)

It is proposed that Golden Quadrilateral and Golden Diagonal shall be developed with an infrastructure which will allow the train sets to operate at speed of 160 KMPH. Thus, it is proposed that the Train Sets will run on these corridors. Considering that Train Set shall have a provision for car chairs, it is further proposed that the Passenger demand for AC on these corridors with the Average Trip Length between 200 to 700 Km shall be carried through Trains Sets. Accordingly, total Number of Train Sets that are required to meet the demand in the cardinal years is given at the table below:

Year	2018	2021	2026	2031	2041	2051
Trains Required	42	70	100	144	214	306

The details to work out the overall requirements are given in the main report. It also gives the details of the procurement plans for each of these rolling stock components which have been worked out by considering the existing fleet size and their age profile.

0.19. Costing and Phasing

Indian Railways must invest on the capacity augmentation of the railways carrying capacity to serve the huge upcoming demand on its network. Passengers will increase and the freight will be increased as well. To serve the multi-fold demand, a lot of projects to be taken up and finished as per the timeline suggested in the National Rail Plan. This includes the dedicated freight service in terms of DFC, Dedicated world class Passenger service as High Speed Rail, Semi-Highspeed Rail. Doubling works of the existing network, Improvement of the existing signalling system, flyovers and bypasses for the decongestion of the bottlenecks, Passenger terminals, Freight Terminals. In addition to that procurement of Rolling stock coaches, MEMU, Train Sets for passengers and Wagons for Freight and Locomotives to run the trains.

0.19.1. Comprehensive NRP Cost

Table 0-40: Comprehensive Cost Table

Head		2021-26	2026-31	2031-41	2041-51	Grand Total
DFC						
DFC Corridors	1		East Cost DFC Kharagpur to Vijayawada	North South DFC Itarsi to Chennai via Nagpur and Vijayawada	North South DFC Palwal to Itarsi	
			1265 km	1206 km	751 km	
			50,600	48,240	30,040	
	2		East West DFC Palghar to Dankuni and EDFC Connectors			
			2013 km			
			80,520			
	3		Eastern DFC Sonnagar to Dankuni			
			515 km			
			20,600			
	DFC Corridor Total					
	Length in KM		**3793 km**	**1206 km**	**751 km**	**5750 km**
	Cost in Crore Rupees		**151,720**	**48,240**	**30,040**	**230,000**
HSR						
HSR Corridor	1		Delhi Varanasi via Ajodhya	Hyderabad to Bangalore	Mumbai to Nagpur	
			855 km	618 km	789 km	
			171,000	123,600	157,800	
	2		Varanasi to Patna	Nagpur to Varanasi	Mumbai to Hyderabad	
			250 km	855 km	709 km	
			50,000	171,000	141,800	
	3		Patna to Kolkata		Patna to Guwahati	
			530 km		850 km	
			106,000		170,000	
	4		Delhi Udaipur Ahmedabad		Delhi to Amritsar via Chandigarh	
			886 km		485 km	
			177,200		97,000	
	5				Amritsar - Pathankot - Jammu	
					190 km	
					38,000	
	6				Chennai to Mysuru via Bangalore	
					462 km	
					92,400	
	HSR Corridor Total					
	Length in KM		**2521 km**	**1473 km**	**3485 km**	**7479 km**
	Cost in Crore Rupees		**504,200**	**294,600**	**697,000**	**1,495,800**
IR Network						
HDNs	HDN 1	2,698	0	349	2,852	5,898
	HDN 2	4,014	2,540	188	257	6,999
	HDN 3	2,373	3,325	2,069	8,663	16,429
	HDN 4	1,729	19,000	12,394	7,141	40,265
	HDN 5	4,257	0	0	0	4,257
	HDN 6	2,119	0	0	2,418	4,537

Head		2021-26	2026-31	2031-41	2041-51	Grand Total
	HDN 7	2,054	980	3,488	2,493	9,015
	All HDN	**19,244**	**25,846**	**18,487**	**23,825**	**87,402**
HUNs	HUN 1	5,155	5,467	12,273	20,156	43,051
	HUN 2	2,278	4,684	15,233	4,514	26,708
	HUN 3	1,935	2,522	6,350	5,268	16,075
	HUN 4	9,102	960	6,922	4,086	21,071
	HUN 5	3,000	2,046	1,631	5,401	12,078
	HUN 6	3,242	10,026	17,957	2,927	34,152
	HUN 7	2,297	2,175	13,839	8,643	26,953
	HUN 8	636	123	10,267	4,490	15,516
	HUN 9	12,717	3,143	923	6,660	23,443
	HUN 10	5,607	2,687	4,078	7,833	20,204
	HUN 11	383	4,078	4,185	8,052	16,697
	All HUN	**43,717**	**37,797**	**87,583**	**76,703**	**245,800**
Others	**Other than HDN/HUN Network**	**65,813**	**17,254**	**117,960**	**82,647**	**283,673**
Ports	**Port Connectivity**	**11,858**	**1,978**	**4,923**	**14,351**	**33,110**
Total Network	**Overall**	**126,914**	**71,358**	**221,456**	**181,967**	**601,696**
Flyovers and By-Passes						
Flyovers	178 No.	71,200				71,200
By-passes	58 No.	8,700				8,700
	Total	**79,900**	**0**	**0**	**0**	**79,900**
Terminal						
Terminal Development Cost	Passenger Terminal Development Cost	54,316	16,175	9,325	4,041	83,857
	Freight Terminal Development Cost	6,241	4,161			10,402
	Terminal Total	**60,557**	**20,336**	**9,325**	**4,041**	**94,259**
Rolling Stock						
Rolling Stock	**Locomotives**					
	Electric Locomotives	**154,336**	**65,044**	**189,140**	**235,718**	**644,238**
	Wagons					
	- BOXN	3,749	11,992	20,795	25,513	62,049
	- BCN	17,820	11,120	19,253	26,330	74,523
	- BTPN	1,290	8,677	19,094	27,881	56,943
	- BLC	5,603	8,751	14,000	20,169	48,523
	- BRN	5,595	2,671	6,505	10,697	25,468
	- BCACBM	3,339	1,893	2,084	2,795	10,111
	- BCFC	1,442	1,325	4,543	12,605	19,916
	Wagon Total	**38,838**	**46,430**	**86,274**	**125,990**	**297,532**
	Coaches					
	- NAC	75,582	33,442	48,222	62,035	219,283
	- AC	15,545	9,279	16,170	24,979	65,973
	MEMU	5,150	2,718	3,615	3,844	15,335
	Train Sets	25,000	11,000	17,500	23,000	76,500
	Coach Total	**121,276**	**56,439**	**85,508**	**113,858**	**377,091**
	Broad Cost Estimates	**314,450**	**167,913**	**360,922**	**475,566**	**1,318,861**
Grand Total		**581,821**	**915,527**	**934,543**	**1,388,614**	**3,820,516**

0.20. Funding Requirements Identified Under NRP And Potential Financing Strategies

The scope for this module of the study on National Rail Plan was enunciated as follows:

- *Assess funding requirement for above capacity enhancement plans*
- *Conduct Sensitivity Analysis under critical assumptions and by identifying key risks*
- *Evolve a detailed financing strategy plan including budgetary support, PPPs, enabling financing environment*

This section presents analyses of these scope elements based on inputs from earlier sections of the report on identified capacity augmentation works and required projects/ investments.

0.20.1. Estimated funding requirements for capacity enhancement plans under NRP (2022-2051)

With IR's focus on augmenting railway infrastructure to facilitate movement of freight and passengers, as discussed earlier under this study, investments will be needed over 2022 to 2051 to address capacity constraints and make multi-modal transportation more efficient for users – dovetailing with existing and planned transport infrastructure in the country.

Such investments/ capital expenditure requirements have been estimated under earlier modules of NRP for three major asset categories viz. tracks, terminals and rolling stock, and are presented in the following exhibits.

As can be observed, till 2031, capital expenditure requirements in track infrastructure (including investments in DFC, HSR and Core Track Infrastructure i.e. doubling and signalling works across HDN, HUN and other networks) along with construction of flyovers and bypasses) account for a majority of the total capital expenditure requirements i.e. ~66% - with a year-on-year increase in investment requirements for DFC as well as HSR. Capital expenditure requirements for rolling stock (wagons, coaches and locomotives) account for ~29% of the total capital expenditure requirements with the balance ~5% of the total capital expenditure requirements pertaining to development of terminal infrastructure (including both passenger and freight terminals).

This trend continues in the future. Of the total capital expenditure requirements estimated beyond 2031 under this study - i.e. till 2051, capital expenditure requirements in track infrastructure are estimated to constitute ~60% of the total capital expenditure requirements, that for rolling stock are estimated to constitute ~39% of the total capital expenditure requirements with the balance pertaining to development of terminal infrastructure

0.20.2. Potential sources of funding for Core Track Infrastructure

As mentioned above, India follows a state-owned monopoly model for Railway track infrastructure where both the segments ("Above the rail" and "Below the rail") are provided by a single entity, i.e. Indian Railways. Since it is difficult in such a scenario to segregate revenue from individual projects or even to asses returns for such projects which are part of a larger network, the ideal option for cost recovery of track development and maintenance is through internal accruals generated from the passenger and freight services. However, with the high operating ratio being experienced by IR, it would be challenging to fund such track infrastructure projects through internal accruals.

Chapter 1 THE STUDY CONTEXT

1.1. Background

Indian Railways operate more than 13,000 passenger trains carrying 23 million passengers and more than 9,000 freight trains carrying 3 million tons of freight everyday over a network that extends over 67,368 route kilometres.

Indian Railways is the 4th largest railway network in the world by size with 121,407 kilometres (75,439 mi) of total track over a 67,368 Km route. In the year ending March 2018, IR carried 8.26 billion passengers and transported 1.16 billion tonnes of freight. In the fiscal year 2017–18, IR is projected to have revenue of 1.874 trillion (US$26 billion), consisting of 1.175 trillion (US$16 billion) in freight revenue and 501.25 billion (US$7.0 billion) in passenger revenue, with an operating ratio of 96.0 %.

Now moving forward and with a vision to develop Indian Railways as a world class system which shall be able to cater to the demand by keeping pace with growth and compliment the economic development, Ministry of Railways has envisioned the preparation of National Rail Plan for India keeping the year 2050 as the horizon. For this purpose, Ministry of Railways has mandated Rail India Techno Economic Services (RITES) to provide advisory services by further appointing a Consultant. In pursuance of the above and to enable preparation of National Rail Plan, the RITES have assigned the study to M/s AECOM India Private Limited.

AECOM commenced the study in January 2019 and submitted the Inception Report, Interim Reports, Demand Forecast Report, AS-IS Mapping Report, Future Network Requirement Report and Options Identification Report as 1st, 2nd, 3rd , 4th, 5th and 6th Deliverables. As part of Interim Report, extensive data was collected and analysed. The collected data included, rail passenger quantum and their respective origin and destinations along with other characteristics, freight quantum its origin and destination, road survey data for both passengers and freight, etc. this data was analysed, and various conclusions were drawn.

Demand Forecast Report contained estimation of overall travel demand forecast comprising of Passengers and Freight for the Horizon Year of 2051 and intermediate Cardinal Years. The reports also detailed out the future share of Railways for both passenger and freight segments and in freight rail share for each commodity till 2051 and far the intermediate cardinal years.

Future Network Requirements report established the capacity creation requirements based upon the forecast demand between respective origin and destinations which was assigned on the rail network for obtaining capacity requirements. A detailed capacity deficiency analysis was carried out considering the forecast rail demand. Based on this comprehensive Future Rail Network Requirements were worked out.

Options Identification for Capacity Creation, Prioritisation of Projects for Implementation, Capacity Creation Phasing till 2050 along with Rolling Stock Requirements and their procurement prioritisation. This report is being submitted as 5th Deliverable of National Rail Plan - 2050.

Subsequent to above Present report being the Draft Final Report, not only summarises all the previously submitted deliverables but also concludes the National Rail Plan and details out the infrastructure requirements along with their funding and financing strategies.

1.2. Study Objective

The objective of the study is to prepare a compressive strategy and master plan for the Rail Sector in the form of National Rail Plan for India for creation of adequate capacity ahead of demand. The study objectives listed below:

- assess the level of utilization, potential and deficiencies in the present system of Indian Railways;
- determine the strengthening requirement of existing corridors and requirement of new rail corridors between different cities/ ports/ region;
- study the existing road and rail network characteristics for passenger and goods traffic;
- study the existing rail infrastructure deficiencies in various parts of the country and suggest the ways to overcome the same;
- Estimate the existing and forecast travel demand for both passengers and freight that can be shifted to Indian Railways network by.
- Develop and use a country level transport planning model appropriate to the conditions and planning needs and develop alternative transport strategies;
- Prepare a multimodal, integrated and prioritized master plan for entire rail network comprising of recommendations and proposals for upgradation of rail infrastructure and providing connectivity to ports/ cities and other locations of strategic importance;
- select the appropriate strategy and recommend short, medium- and long-term comprehensive Railway Development strategy up to the year 2050;
- identify various projects and provide pan India prioritized rail investment plan and implementation timelines;

1.3. Base & Horizon Year

Base year for this study shall be 2019 and horizon year shall be the year 2050.

1.4. Deliverables

As per the Terms of Reference (ToR), following deliverables shall be submitted as part of the Study:

Inception Report including work plan, methodology, schedule, working arrangement etc;

Interim Report documenting existing situation, base data collection, base data analysis as specified in Section 5 of ToR;

Demand Forecast Report comprising of travel demand forecast for both passenger and rail including the share that will be carried by Railways in future;

AS-IS Network Mapping comprise of mapping the whole network of Indian Railways as per the existing situation including their respective attributes such as line type, speeds, etc;

Future Network Requirement Report shall include the Railway Network Improvement proposals based upon Demand Forecasts of Passengers and Freight;

Option Identification and Evaluation Report for Capacity Creation shall include various Railway Infrastructure development Options, their phasing and evaluation in terms of implementation and timelines;

Draft Final Report comprising of all the base data analysis, demand forecast, network and infrastructure development proposals, phasing timelines, broad cost estimation and financial analysis;

Final Report Incorporating Comments on Draft Final Report;

1.5. Report Structure

This Report is 3rd Deliverable of Study being submitted after incorporating comments and observations. Report is structured as per following Chapters:

- ✓ Chapter 1 The Study Context
- ✓ Chapter 2 As Is Rail Mapping Preparation
- ✓ Chapter 3 Demand Forecast
- ✓ Chapter 4 Estimation Of Rail Freight Share
- ✓ Chapter 5 Freight Flow Assessment And Modal Share Of Railways
- ✓ Chapter 6 Rail Network Corridor Demand
- ✓ Chapter 7 Capacity Utilisation And Identification Of Bottlenecked Sections
- ✓ Chapter 8 Options Identification, Evaluation & Priortisation – Methodology
- ✓ Chapter 9 Dedicated Freight Corridors (DFC)
- ✓ Chapter 10 High Speed Rail (HSR) Corridors
- ✓ Chapter 11 Highly Dense Network (HDN)
- ✓ Chapter 12 Highly Utilised Network (HUN)
- ✓ Chapter 13 Port Connectivity
- ✓ Chapter 14 Trans Asian Network Connectivity
- ✓ Chapter 15 Connectivity With The Backward Area And Industrial Corridors
- ✓ Chapter 16 Multimodal Freight Terminals
- ✓ Chapter 17 Multimodal Passenger Terminals
- ✓ Chapter 18 Other Projects
- ✓ Chapter 19 Rolling Stock Requirements
- ✓ Chapter 20 Costing And Phasing
- ✓ Chapter 21 Funding Requirements Identified Under Nrp And Potential Financing Strategies
- ✓ Chapter 22 Way Forward

Chapter 2 AS IS RAIL MAPPING PREPARATION

2.1. Introduction

Indian Railways (IR) is the 4th largest railway network in the world by size, with 121,407 kilometres of total track covering over a 67,368 kilometre route. 49% of the routes are electrified with 25 KV AC electric traction while 33% of them are double or multi-tracked.

IR runs more than 13,000 passenger trains daily, on both long-distance and suburban routes, from 7,349 stations across India. The trains have a 5-digit numbering system. Mail or express trains, the most common types, run at an average speed of 50.6 kmph. In the freight segment, IR runs more than 9,200 trains daily. The average speed of freight trains is around 24 kmph.

IR employs a workforce of 1.36 million. In addition to IR being significant formal employment provider, it also provides large scale informal employment, making itself an enabler of large-scale employment generation in India. Overall transport sector contributes about 7% of India's GDP, with IR contributing about 1% of India's GDP.

The chapter briefly highlights the salient features of Indian Railways network and process undertaken for mapping As Is network of Indian Railways.

2.2. Indian Railways – Growth History

In April 2018, Indian Railways celebrated 165 years since its first passenger trains went into service in the country. This section presents a brief look at the long and complex history of one of the world's largest rail employers, from the British Raj to the modern rail operations.

2.2.1. 1853-1869: Launching passenger rail services

Although rail services in India were initially proposed in the 1830s, historians cite 16 April 1853 as the kick-starter for India's passenger rail revolution. On this date, the country's first passenger train set off on a 34 km journey between Bombay's Bori Bunder station and Thane. It consisted of 14 cars being hauled by three steam locomotives and carried 400 passengers.

The line was built through an alliance between the Great Indian Peninsular Railway (GIPR) – incorporated in 1849 – and the East India Company, which at that point ruled large swathes in India. Its success spurred subsequent launches of railways in Eastern India and South India to create a 4,000-mile network spanning the width of India.

2.2.2. 1869-1900: Famine and economic growth

From 1869-1881, British took control of railway construction from external contractors and increased expansion to help areas struck by famine after intense droughts in the country. The length of the network reached 9,000 miles by 1880, with lines snaking inward from the three major port cities of Bombay, Madras and Calcutta.

2.2.3. 1901-1925: Moves towards centralisation

After years of construction and financial investment the railways finally began to make a profit in 1901. The government purchased all major lines and began leasing them back to private operators. The Railway Board was established in 1901. In 1905, its powers were formalised by the government.

World War - I took it's toll on Indian rail development, with production diverted to meet British requirements outside of India. By the end of the war, the network was in a state of disrepair, with many services restricted or downgraded. Railway finances were separated from the general budget in 1924, with the railway receiving its first individual dividend in 1925.

2.2.4. 1925-1946: Electrification and hard times

The first electric train ran between Bombay and Kurla on February 3, 1925, setting a precedent for further electrification in the coming years. By 1929, the railway network had grown to an overall length of 66,000km and carried approximately 620 million passengers and 90 million tonnes of goods annually.

2.2.5. 1947-1980: Partition and zonal creation

In 1947, the independence causes the nation to split in two, causing a ripple effect across the railways as more than 40% of the network was lost to the newly created Pakistan. Two major lines, the Bengal Assam and North Western Railway, were divvied up and isolated from the Indian rail system. In the post-partition furore, violent mobs damaged railway infrastructure and attacked trains carrying refugees.

A few years later, Indian Railways set about manifesting its own destiny, acquiring the majority of control over railway franchises in 1949-1950. In 1951-1952, it began reorganising the network into zones. The first train between India and Pakistan, the Samjhauta Express, began running between Amritsar and Lahore in 1976.

Moving into the latter half of the 20th Century, the railways increasingly made steps towards modernisation. Colonial-era locomotives were replaced with state-of-the art trains, while moves to adopt 25kv AC traction in the 1950s drove set off a new drive towards electrification.

2.2.6. 1980-2000: Technology and phasing out steam

The 1980's saw a complete phase-out of steam locomotives, as electrification was spurred on by energy crises in the 1970s. Around 4,500km of track was electrified between 1980 and 1990. Meanwhile, India's first metro system opened in Calcutta in 1984.

Though economic stagnation and political upheaval blocked growth of the network in the 80's, the 90's saw the opening of the Konkan Railway; a 738kms behemoth connecting the western coast of India with the rest of the country.

However, the major revolution of the period came from the world of computing. In particular, the Indian Railways online passenger reservation system was launched in 1985 and gradually introduced at Delhi, Madras, Bombay and Calcutta. This was designed to allow passengers to reserve and cancel accommodation on any train from any terminal – a vital boon for passengers – and was extended with the introduction of the country-wide network of computerised enhanced reservation and ticketing (CONCERT) in 1995.

2.2.7. 2000-2017: Moving online

Since 2000, metro stations have continued to come up in major cities, including Delhi (2002), Bangalore (2011), Gurgaon (2013) and Mumbai (2014). the greatest step forward for IR was the launch of online train reservations and ticketing through its IRCTC system in 2002.

2.2.8. 2018: The future of Indian Railways

Today, Indian Railways manages the fourth-largest rail network in the world, with tracks spanning more than 120,000km of the country. The other details are mentioned in the subsequent sections.

2.3. Salient Features of Indian Railways

The salient feature of Indian Railway in terms of its operational characteristics, type of Gauge, Signalling, Electrification and Telecommunication etc are discussed in the following sections

2.3.1. Zones and Division

Indian Railways is headed by Railway Board whose chairman reports to the Ministry of Railways. Railway Board also acts as the Ministry of Railways. IR is divided into 17 zones, headed by general managers who report to the Railway Board. These zones are further sub-divided into 70 divisions, each having a divisional headquarters and headed by Divisional Railway Managers (DRMs).

Table 2-1: Details of Indian Railway Zones and Railway Divisions

Sl. No	Name of Railway zone	Abbr.	Route length (Km)	Zone HQ	Railway Divisions
1.	Northern Railway	NR	6968	Delhi	Delhi, Ambala, Firozpur,Lucknow Moradabad
2.	North Eastern Railway	NER	3667	Gorakhpur	Izzatnagar, Lucknow, Varanasi
3.	Northeast Frontier Railway	NFR	3907	Guwahati	Alipurduar, Katihar, Rangiya, Lu mding, Tinsukia
4.	Eastern Railway	ER	2414	Kolkata	Howrah, Sealdah, Asansol, Malda
5.	South Eastern Railway	SER	2631	Kolkata	Adra, Chakradharpur, Kharagpur, Ranchi
6.	South Central Railway	SCR	5803	Secunderabad	Secunderabad, Hyderabad, Vijayawada, Guntakal, Guntur, Nanded
7.	Southern Railway	SR	5098	Chennai	Chennai, Tiruchirappalli,

Sl. No	Name of Railway zone	Abbr.	Route length (Km)	Zone HQ	Railway Divisions
					Madurai, Palakkad, Salem, Thiruvananthapuram
8.	Central Railway	CR	3905	Mumbai	Mumbai, Bhusawal, Pune, Solapur, Nagpur
9.	Western Railway	WR	6182	Mumbai	Mumbai, Ratlam, Ahmedabad, Rajkot, , Bhavnagar, Vadodara
10.	South Western Railway	SWR	3177	Hubballi	Hubballi, Bengaluru, Mysuru
11.	North Western Railway	NWR	5459	Jaipur	Jaipur, Ajmer, Bikaner, Jodhpur
12.	West Central Railway	WCR	2965	Jabalpur	Jabalpur, Bhopal, Kota
13.	North Central Railway	NCR	3151	Allahabad	Allahabad, Agra, Jhansi
14.	South East Central Railway	SECR	2447	Bilaspur	Bilaspur, Raipur, Nagpur
15.	East Coast Railway	ECoR	2572	Bhubaneswar	Khurda Road, Sambalpur, Waltair
16.	East Central Railway	ECR	3628	Hajipur	Danapur, Dhanbad, Mughalsarai, Samastipur, Sonpur
17.	Konkan Railway	KR	741	CBD Belapur, Navi Mumbai	Karwar, Ratnagiri

2.3.2. Hierarchy of Rail Network Lines

Indian Railways operates on three gauges: Broad gauge, Meter gauge and Narrow gauge. All major routes are served by broad gauge (61,680 route km as on 2016-17). The width of each railway gauge is described in **Figure 1-1**. and route distribution under each gauge is shown in **Table 1-1**. The details of the route length under each gauge are as below:

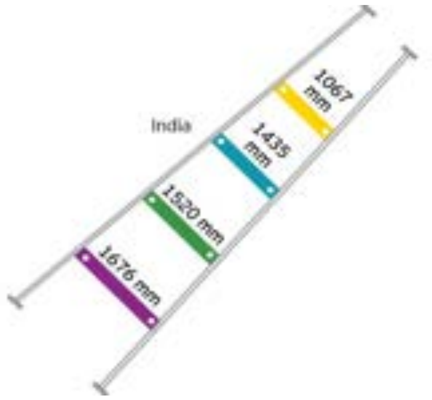


Figure 2-1: Gauges of Indian Rail

Table 2-2: Size of the Network - Gauge-wise as on 31st March, 2017

Gauge	Route Kms	Running Track Kms	Total Track Kms
Broad Gauge (1676 mm)	61,680	87,962	1,14,912
Metre Gauge (1000 mm)	3,479	3,731	4,099
Narrow Gauge (762 mm and 610 mm)	2,209	2,209	2,396
Total	**67,368**	**93,902**	**1,21,40**
			(Source: - Indian Railway Year Book, 2016-17)

2.3.3. Railway Electrification

With a view to reduce the Nation's dependence on imported petroleum-based energy and to enhance energy security to the Country, as well as to make the

Railway System more eco- friendly and to modernize the system, Indian Railways have been progressively electrifying its rail routes.

In pre-independence period, electrification remained confined to 388 Route Kilometres (RKMs) and it is only in the post-independence period that further electrification was taken up. While, 4556 RKM were electrified during XI Five Year Plan (2007-12). The progress increased to 7785 RKMs in the XII Five Year Plan, 2012-17(against the target of 6500 RKMs).

Further, Indian Railways have prepared an Action Plan for electrification of 90% of BG network of Indian Railways by 2020-21. Accordingly, it has been planned to electrify 24,400 RKM in five years (2016-17 to 2020-21). Up to March 2017, 25,367 Route kilometres which is 37.65% of the total Railway network has been electrified. On this electrified route 65.10%. of freight traffic & 54.30% of Passenger traffic is hauled with fuel cost on electric traction being merely 36.14% of the total traction fuel cost on Indian Railways. **Figure 1-2** shows the progress of electrification of Indian railway annually.

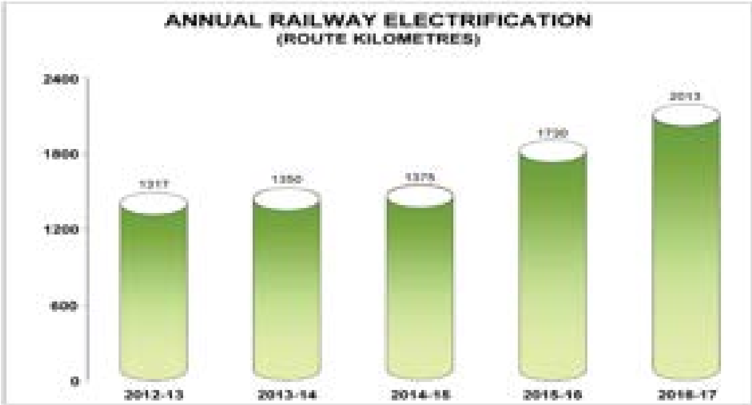


Figure 2-2: Annual Railway Electrification (Route Kilometers) as on 31st March 2017

2.3.4. Signalling

Indian Railways has inherited its "Route Signalling" from British Rail. During Pre-Independence India, as the advancement in Railway Signalling & Telecommunication systems took place on British Railways, they were brought and introduced on Railways in India.

After Independence, to increase efficiency and enhance safety, a great thrust was given for advancement of Signalling on Indian Railways. Imported Route Relay Interlocking e.g. at Churchgate, Howrah, Kharagpur were installed, Centralized Traffic Control (CTC) from GRS Rochester USA was commissioned at Gorakhpur–Chapra and Bongaigaon–Changsari sections. Indigenization of Electrical Signalling equipment under RDSO guidance, TOT from OEM abroad and under Indian Railways & Private sector's own initiatives were undertaken. As a result, by the end of 20th Century Indian Railways had over 3000 Route Relay /Panel Interlocking installation with Multiple Aspect Colour Light Signalling, replacing the Semaphore mechanical signalling of yester years.

In 1985 British Railways has successfully introduced the new technology of Solid-State Interlocking (SSI) at Lemington Spa. The 1st trial installation of this technology was made at Shreerangapatnam on Southern Railways and several Pilot projects were introduced on South Central Railway. With experienced thus gained and Validation of indigenous SSI at Barar Square, RDSO prepared IR Specification for SSI and the 1st installation with this new specification was made in the year 2000 on SE Rly. Thus, began the era of microprocessor-based Signalling on Indian Railways.

To enhance Safety, several new technologies i.e. Block Proving by Axle Counter (BPAC) for automatic verification of complete arrival of train at a station, Track detection by Axle Counter and to mitigate safety risk of accidents/collisions due to loco pilot's error of Signal Passing at Danger (SPAD), Train Protection and Warning System (TPWS) were introduced. Besides these, SMPS based Integrated Power supply (IPS) was developed and LED Signals were introduced. To increase Line Capacity, Intermediate Block Signalling (IBS) and Automatic Block Signalling were progressed. Train Management System (TMS) was provided on Mumbai suburban section of Western and Central Railway. Initially this microprocessor-based Signalling equipment were imported but progressive indigenization of these systems is taking place.

These developments have led to Indian Railways have the following Signalling systems on its network by the end of March 2017.

Table 2-3: Modern Signalling Systems on Indian Railways by March 2017

Items	**Nos**
Panel Interlocking (Stations)	4,155
Route Relay Interlocking (Stations)	281
Electronic Interlocking (Stations)	1,148
PI/RRI/EI (Stations)	5,584
MACLS (Stations)	6,000
Track Circuiting (Locations)	33,054
Block Proving Axle Counter (Block sections)	4,976
TPWS (Rkm)	342
(Source: - Indian Railway Year Book, 2016-17)	

2.3.5. Telecommunication

Telecommunication plays an important role in train control, operation and safety on Indian Railways. Till 1970s most of the important telecommunication circuits of Indian Railways were dependent on Overhead lines running by the side of the railway track and were subjected to miscreant activities and theft. Over a period of time, Optical Fibre Communication has completely replaced this conventional landline communication system.

Rail Tel, formed in September 2000, has installed (as on March 2017), over 51,000 Rkms of Optical Fibre Cable (OFC) that is carrying Gigabits of traffic. In line with Digital India initiative of Govt of India, RailTel in association with Google, has provided Wi-Fi internet facility at 405 stations and is planning to provide Broadband connectivity to Panchayats through its OFC network. It has set up a State-of the-Art MPLS network that is used for providing Internet and L3-VPN services. The Enterprise WAN of Railway-Railnet Works as an L3-VPN on this MPLS network. Rail Tel is involved in major Govt projects like National

Knowledge Network (NKN) & National OFC Network (NOFN), thereby contributing to the growth of the nation.

GSM - Railways based Mobile Train Radio Communication has been provided on 2,461 Route Km on Indian Railways. It has planned to provide Video Surveillance System at 983 A1, A, B & C category stations. Indian Railways has its own satellite hub that is being utilized for connecting remote locations for Freight Operation Information System (FOIS), Unreserved Ticketing System (UTS), and Disaster Management System as well as for other critical communication needs.

Table 2-4: Indian Railways Important Telecom Assets as on 31st March 2017

S No.	Installation	Units	Quantum
1	Optical Fiber Cable	R km	51,247
2	Quad Cable	R km	60,458
3	Railway Telephone Subscribers Lines	No.	3,95,816
4	Mobile Train Radio Communication System (Route km.) – GSM R based	R Km	2461
5	Public Address System	No. of STNs	4,893
6	Train Display Boards	No. of STNs	1,090
7	Railnet Connections	No.	1,30,185
8	UTS/PRS Circuits	No.	10,839
9	FOIS Circuits	No.	2,219
10	NGN & Exchange Circuits	No.	2,536
(Source: - Indian Railway Year Book, 2016-17)			

2.4. AS IS RAIL Network on GIS Platform

For the preparation of the NRP, a base map of the network on GIS Platform has been prepared. This base map will be used for further analysing and modelling of the data on different software's. The AS IS map has been digitized through Arc GIS to represent the secondary data provided by IR (Indian Railway) on GIS ArcMap through schematic Maps.

The Study Area for the NRP AS IS rail network mapping work covers the entire territory of India with an area of 3.287 million sq. km.

For the preparation of Base Map following methodology has been following:

2.5. Preparation of Base Map

For preparation of Base map for the Indian Rail Network, an authentic reference in form of raster data was required. Based on this reference data, rail network has been digitized on Arc map.

Ministry of Railway provided Zonal System Map for the year of 2018. These system maps contain the entire rail network including the location and category of railway line and stations lying in concerned zone.

All the collected maps have been converted into digital from paper format through scanning process. This process is reading from paper grid and conversion of this grid into computer compatible digital format.

The generated digital files through the process of scanning have been indexed and quality checked for legibility, continuity, correctness, texture etc. for use in this project.

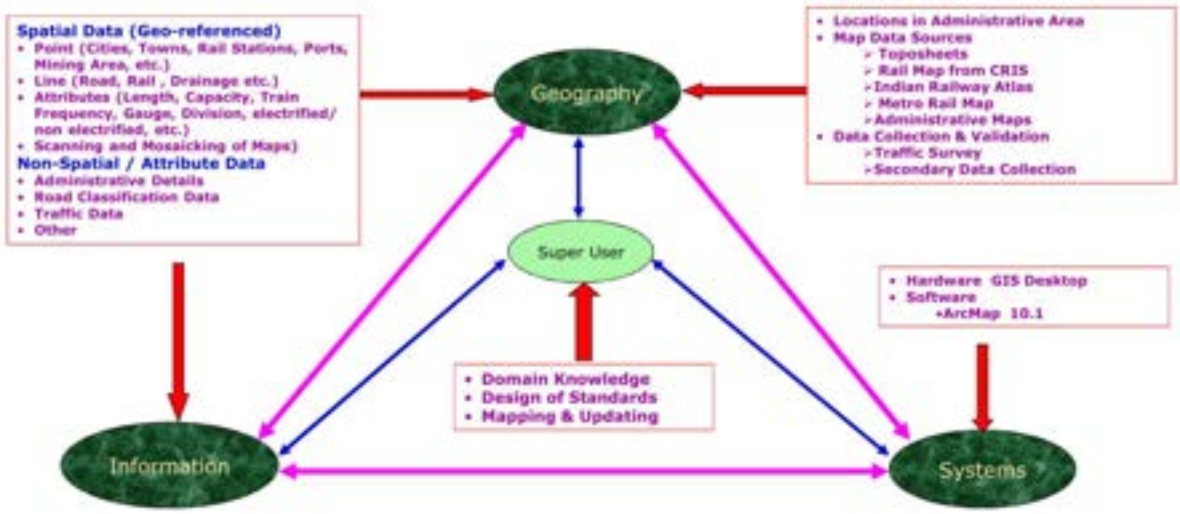


Figure 2-3: Methodology for Developing AS-IS Rail Map on GIS Platform

2.5.1. Geo Referencing of the System Maps

Geo referencing means to associate something with locations in physical space. Geo referencing can be applied to any kind of object or structure that can be related to a geographical location, such as roads, places, bridges, or buildings.

Geographic locations are most commonly represented using a coordinate reference system, which in turn can be related to a geodetic reference system such as WGS-84.

To geo reference an image, one first needs to establish control points, input the known geographic coordinates of these control points & choose the coordinate system.

Following the above method of geo-referencing, system map for all zones were scanned, and geo-referenced on ArcMap. Thus, these geo-referenced maps formed the base for digitization of the railway network.

2.5.2. Mosaic of Geo-referenced Digital Maps

The geo-referenced scanned maps have been set side-to-side for proper study the actual project area. This has done through standard Remote sensing software (ERDAS Imagine). Edge matching also conducted during mosaicking of the images.

The mosaic of geo-referenced digital files then properly quality checked and indexed for future use. The continuity of the data has been checked based on the continuity and matching of line and polygon features of the maps.

2.5.3. Vectorization of Geo-referenced Digital Maps

The geo-referenced maps have been vectorised in different layers for required themes in point, line or polygon features depending upon the nature of layer. Following features has been created during vectorisation of the maps.

2.6. Digitisation of Railway Lines

After geo-referencing of the source data, the process of digitization was conducted. Digitization in GIS is the process of converting geographic data either from a hardcopy or a scanned image into vector data by tracing the features. During the digitizing process, features from the traced map or image are traced in either point, line, or polygon format.

In the case of National Rail Plan, the vector data is prepared from the Scanned and referenced Zonal System maps, provided by Railway department which are in form of images.

In ArcMap, entire rail network has been digitised in various shapefiles. All links of railway networks have been digitized and a different shapefile for various type of rail link/line has been created. For example, single rail line on rail network has been digitised in one shapefile and double line has been digitised in another shapefile. There are 23 types of rail lines which have been digitised and later grouped for better understanding. The grouping of lines has been done based on their existence and construction status.

The existing rail lines have been digitised in separate shape files having following names:

Broad Gauge Multiple line; more than 3 lines are running parallel in this section
Triple line,
Double Line Electrified,
Metre Gauge Single line,
Single Line Electrified,
Narrow Gauge Single line,
Closed line,
Sidings

There are lines where upgradation of the existing line is under process have been digitised in separate shape files having following names:

- Broad Gauge 3rd and 4th Line Under Construction
- Broad Gauge – only 4th line Under Construction
- Broad Gauge Tripling,
- Broad Gauge Doubling Electrified

The rail lines for which survey is ongoing are listed below:

- Survey for New line,

Under construction rail lines are digitised under following heads:

- Broad Gauge New Single Line Under Construction
- Gauge Conversion

The complete railway link network including the category of all the railway lines as per gauge is shown in **Figure 2-1 and Figure 2-2**

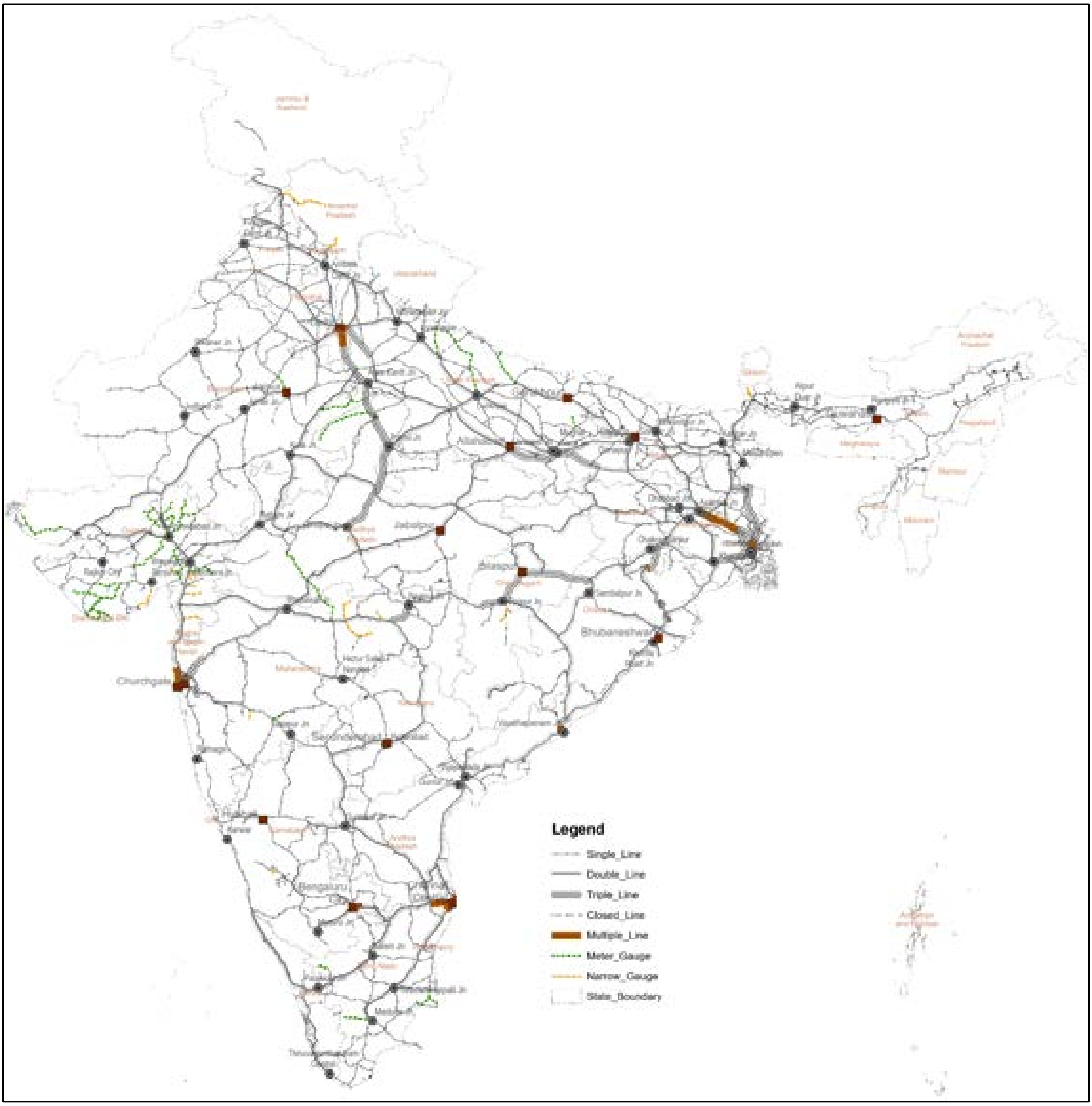


Figure 2-4: Types of railway lines in Indian Rail Network

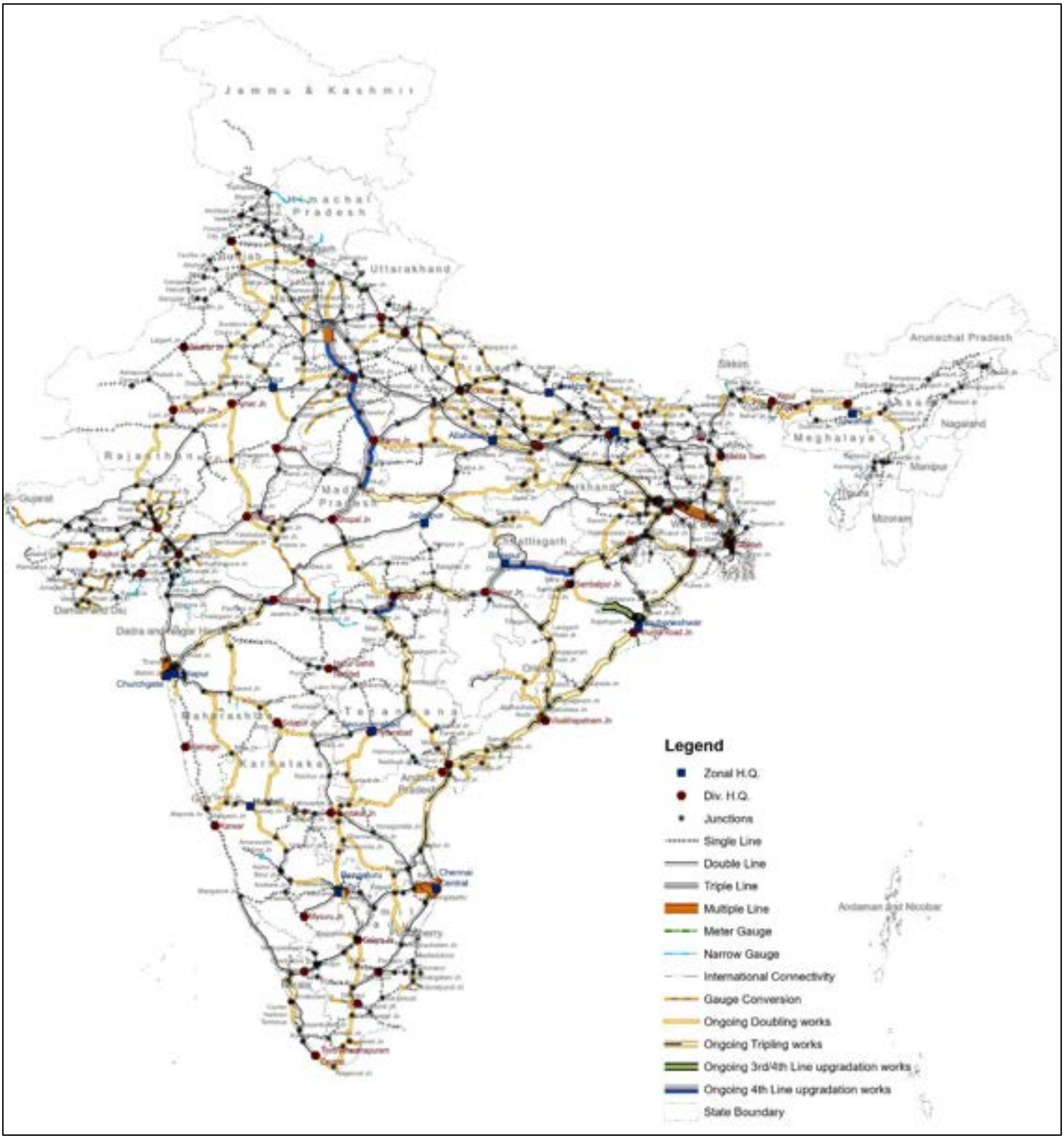


Figure 2-5 – Indian Railways Network under upgradation

The maps shown in **Figure 2-1 and Figure 2-2 for existing network and upgradation work going on** are given in **A0 scale** at the end of the report.

2.7. Digitization of Railway Stations

In GIS map, besides digitization of railway lines, digitization of railway stations has also been undertaken on basis of type of railway station. Total stations on the Indian Railways network has been categorised in 12 station types including Zonal and Divisional Headquarter to Closed Stations and Siding. All the station categories along with their number digitised on the map are shown in **Table 2-1**

Stations and Junctions identified for the upcoming Dedicated Freight Corridor (DFC) are also digitised based on the location provided in the proposed alignment and digitised under following head:

- DFC Station,
- DFC Junction

The detail of stations along with the hierarchy of the station is shown in **Table 2-1**

Table 2-5: Stations Type and their Numbers

Sr. No	Station Type	Number of Station
1	Divisional HQ	53
2	Zonal HQ	16
3	Important Station (like important places, district headquarter, tourist places etc.)	469
4	Junction Stations	461
5	Terminal Stations	226
6	Remaining Station	6124
	Sub Total	**7349**
7	Cabin	*85*
8	Passenger Halts/Huts	*279*
9	Siding	*659*
10	Closed Stations	*1010*
	Sub Total	***2033***
11	DFC Junctions	*31*
12	DFC Stations	*85*
	Sub Total	***116***
	Grand Total	**9498**

Spatial location of all the stations on Indian railway network has been shown on rail network of India in the **Figure 2-3 and Figure 2-4**

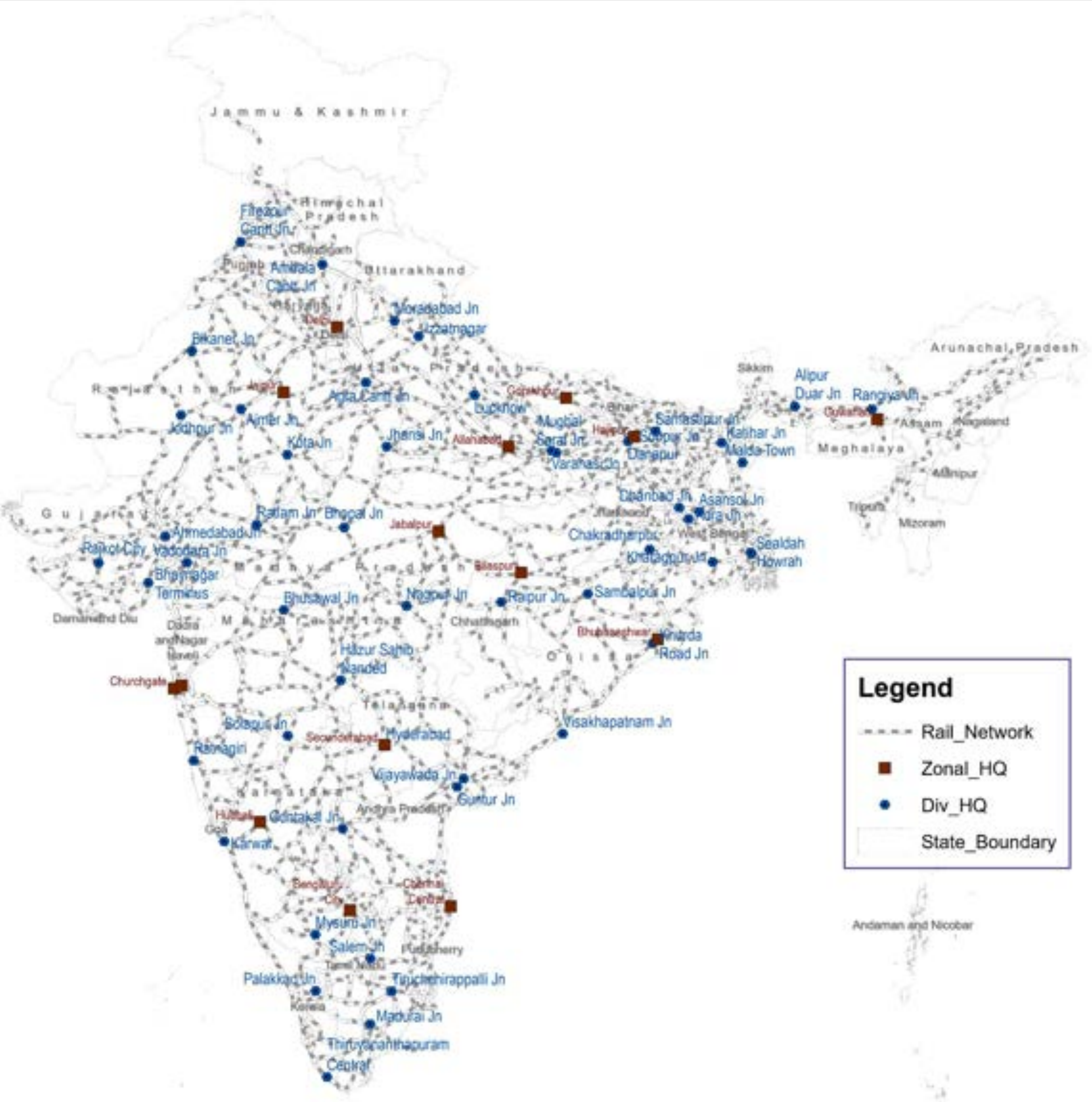


Figure 2-6: Spatial Distribution of Zonal HQ and Divisional HQ of Indian Rail Network

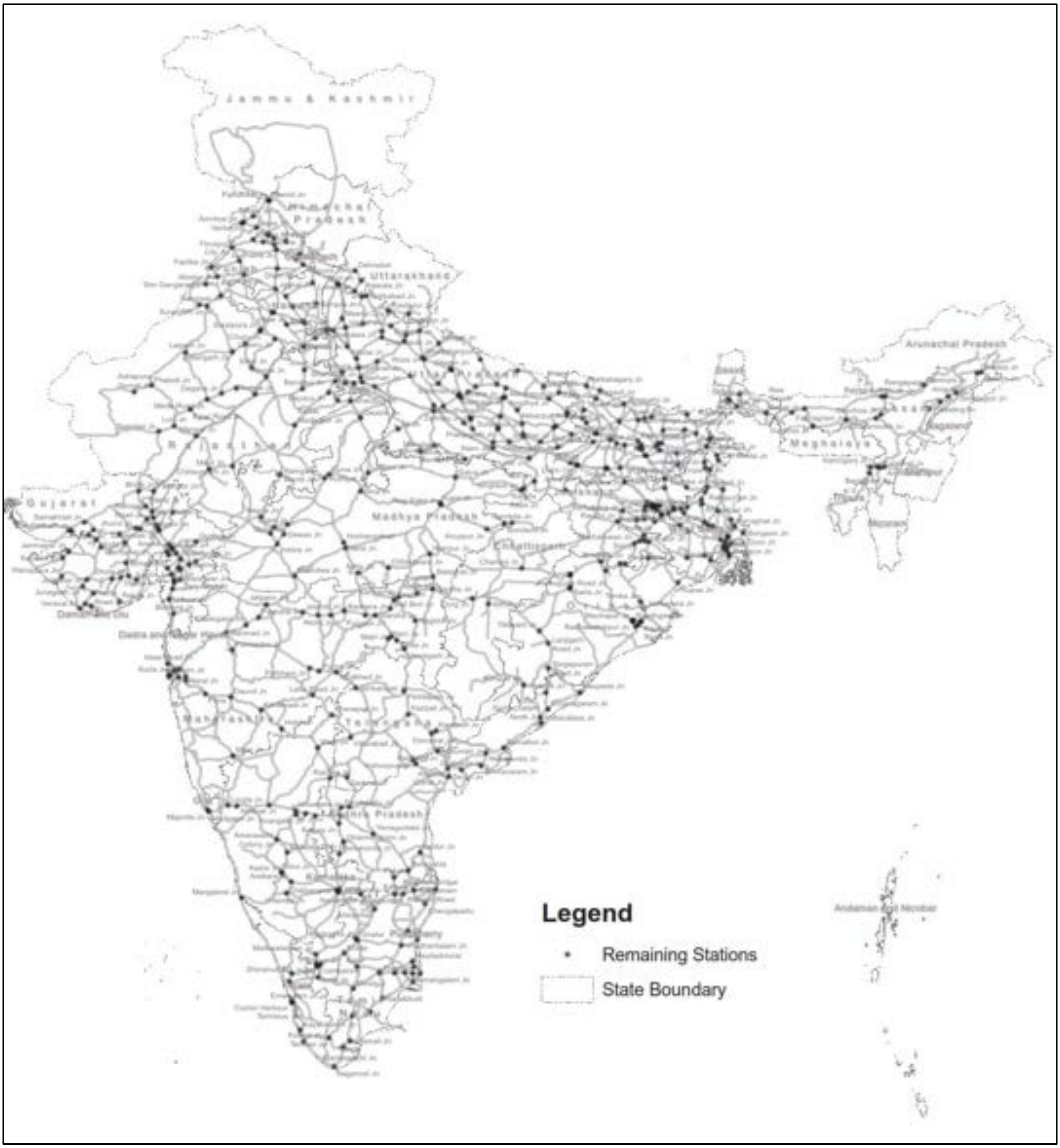


Figure 2-7: Spatial Distribution of Remaining Stations of Indian Rail Network

2.8. Digitization of Zones and Divisions

As mentioned earlier, IR divide its operations into zones, which are further sub-divided into divisions, each having a divisional headquarters. A total of 16 operational Zones but there are no set boundaries of these zones. The boundaries are based on the stations and rail lines lying in that zone not based on any administrative boundaries. The zones are mentioned in the **Figure 2-5** and shown in **Figure 2-6**

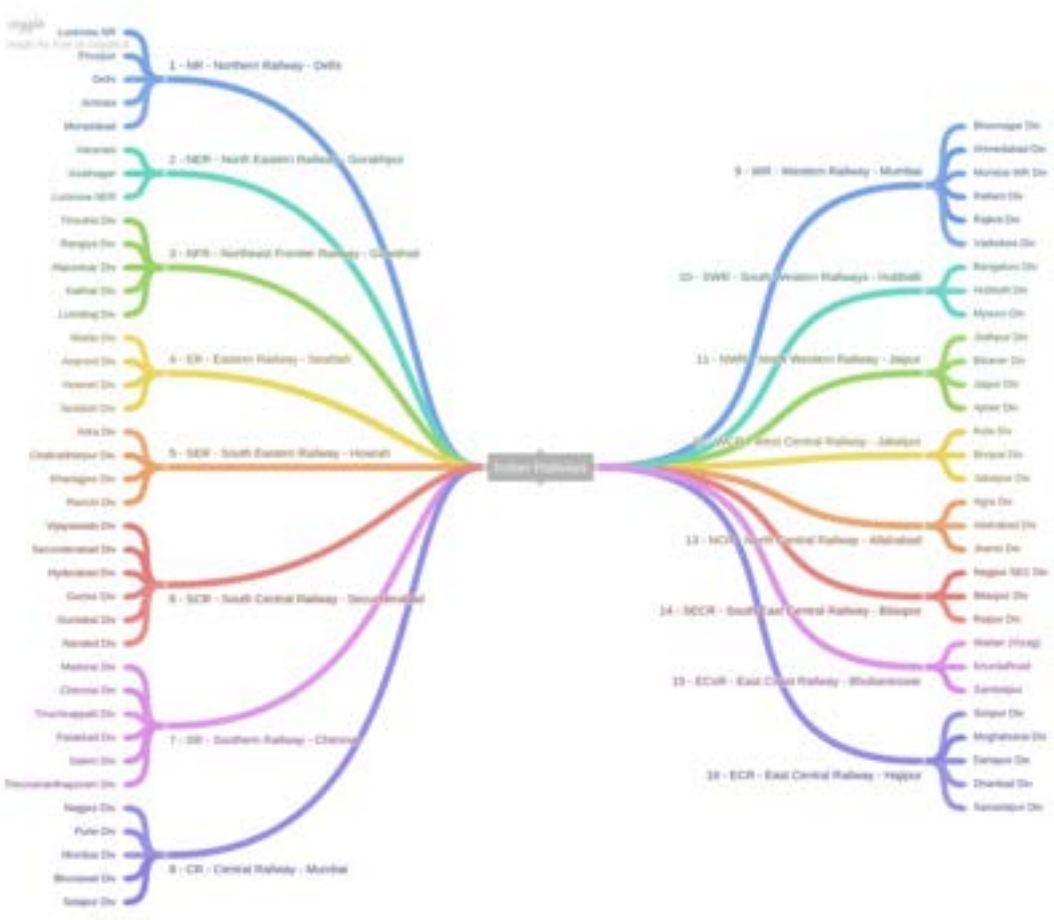


Figure 2-8: Zones of Indian Railways

Figure 2-9: Zones of Indian Railway Network

2.9. External Attribute Data Attachment to Vectorized Data

Base map prepared in GIS shows only length of the rail line and type of both rail network and station unless any other information is attached in form of attributes. For additional information for respective rail network, information provided by the Indian Railway was used. Each link has following information:

Section Name: This contains the name of the start and end point of section e.g. Sanewal-Ludhiana section

Group Route: A/B

HDN Route: Under this head the information about the high-density network has been provided.

Gauge: This head contains the gauge information i.e. broad gauge, narrow gauge and meter gauge.

Length (Kms.): This head contains the information about the length of section.

SL/TSL/DL/TL/ QL/QSL: This head explains the type of the section discussed i.e. whether the section is single, triple, double line etc.

Traction: It can define as the railway vehicle that provides the necessary traction power to move the train is referred as the traction or locomotive. This traction power can be diesel, steam or electric power

System of working: ABS/Manual

Average Nos. of train services each way i.e. Passengers, Goods, others and Total

The above-mentioned data has been attached with the rail link in GIS base map in form of attributes in each line type. As GIS map has format to insert in software, the above head has been changed and shown is T**able 2-2**

Table 2-6: Attribute type adopted for Railway Network

Sr. No	Information Head (IR)	Information Head (GIS)
1	Section of the Link	Section
2	Group Route	Group_Rout
3	HDN Route	HDN_Route
4	Gauge	Gauge
5	Length (Kms.)	Length__Km
6	SL/TSL/DL/TL/ QL/QSL	L_Type
7	Traction	Traction
8	System of working	Syst_worki
9	Charted Line Capacity each way	
i	*with MB*	*CLC_WMB,*
ii	*without MB*	*CLC_WOMB*
10	Average Nos. of train services each way	
i	*Pass*	*Ave_trainP*
ii	*Goods*	*Ave_trainG*
iii	*Other*	*Ave_trainO*
iv	***Total***	***Ave_trainsT***

Sr. No	Information Head (IR)	Information Head (GIS)
11	%age utilisation of Charted Line Capacity	LCU_WMB, LVU_WOMB

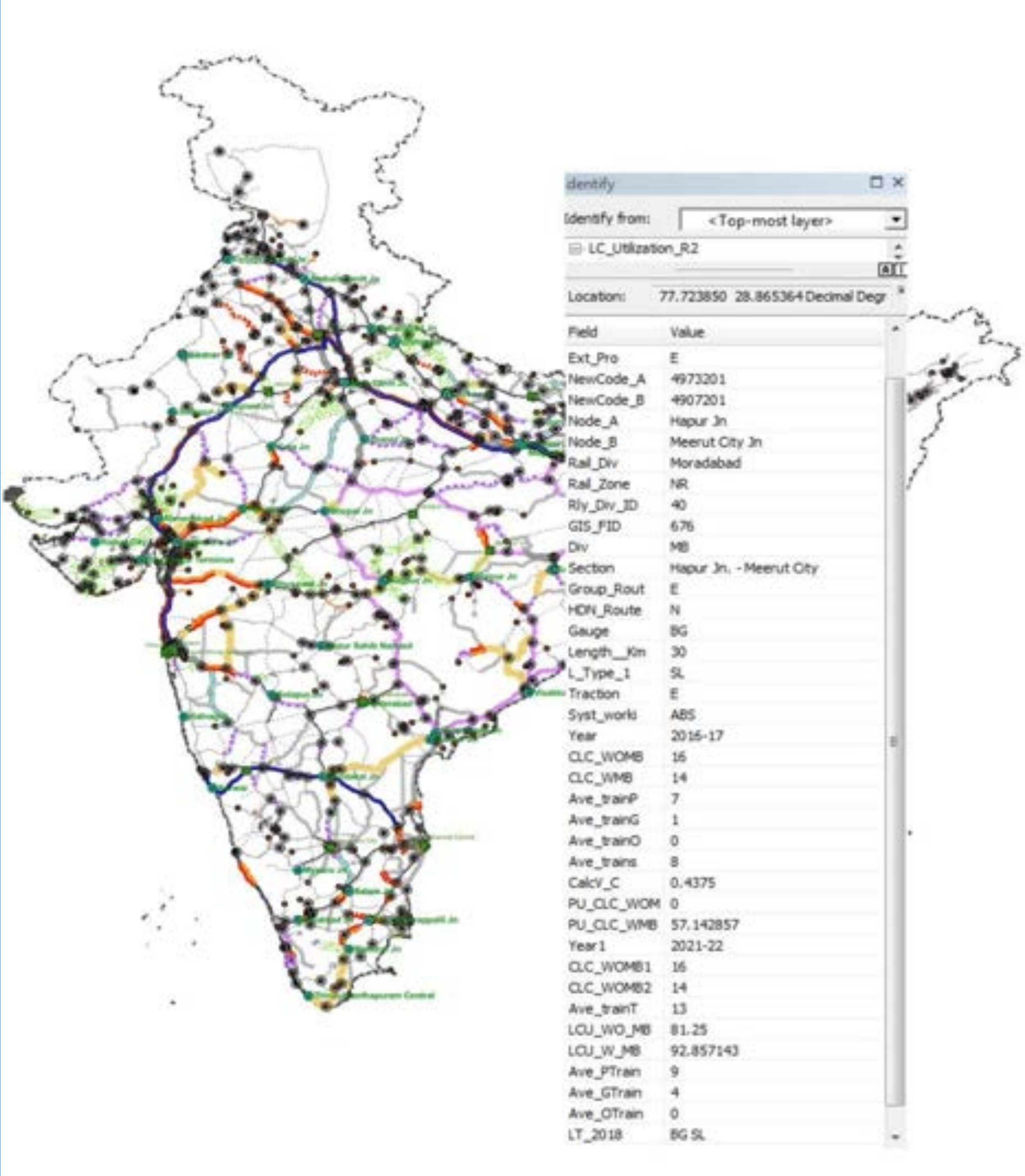


Figure 2-10: Data Heads Attached for all the Rail Links

2.10. Connectivity with Major Cities

After developing the complete rail network including stations at GIS platform, analysis regarding rail connectivity to major cities i.e. class I and class II was carried out. Cities were classified based on the population criteria mentioned in the Census of India to earmark towns hierarchy. The classification considered is mentioned in **Table 3-1**

Table 2-7 - Classification of Indian Cities based on Population

Class	Population
Class I	100,000 and above
Class II	50,000 to 99,999
Class III	20,000 to 49,999
Class IV	10,000 to 19,999
Class V	5,000 to 9,999
Class VI	less than 5000

Existing railway network connects more than 9,000 cities and towns of different hierarchy. National Rail Plan envisages connectivity to all important cities and town to boast economic and social balance in the country. It is difficult to understand which town or cities needs rail connections as all the cities contribute to the development of that region. To understand the missing rail connectivity, Class I and Class II towns were considered. Total number of Class I and Class II cities as per Census of India 2011 and number of cities connected with direct rail connection are given **Table 3-2**

Table 2-8: Class I & II cities, total number and number of cities with rail connection

Sr. No.	City Hierarchy	Total Cities	Direct rail Connectivity	Cities with no rail connectivity
1	Metropolitan	53	52	1
2	I	415	402	13
3	II	474	395	79

During the analysis, it was observed that some cities during their development path were being developed away from their mother city like Panchkula, NOIDA etc. These cities don't have any rail station in the city, but these cities are being served with the rail head in mother city or nearby city.

So, a buffer of 05-10 kms radius has been drawn around the cities which are not getting connected with direct rail connection. The radius was considered based on the operational characteristics of Intermediate Public Transport (IPT) modes like Auto Rickshaws, cycle rickshaws etc. These modes operate easily in this radius and can help the residents of these cities to use the rail services. A buffer of 10 kms radius shows most of the cities in the Class I & II hierarchy being connected with rail network. provided the list of cities which are having a railway station within a radius of 10 kms. Following **Table 3-3** shows the cities getting connected with rail network considering the radius of 10 kms.

Table 2-9: Cities getting connected with 10kms Radius

Sr. No.	City Hierarchy	Total number	Cities with direct rail	Cities with no rail connection	Cities getting Connected with rail	Cities with no rail connectivity

		of Cities	connection Connected		network within 10 kms Radius	
1	Metropolitan	53	52	1 (Malappuram)	0	0
2	I	415	402	13	5	8
3	II	474	395	79	21	58

Still there are around 05 Class I cities and 58 Class II cities having no rail connectivity. As part of this plan, these cities should be considered for providing rail connection as these cities are contributing in the country's economic growth.

Before considering these town of linkage to these town as missing link, it is important to study the railways proposals in terms of new rail links surrounding these cities. All the railway proposal were studies and analysis were made to understand the missing links after the development of new rail connections are given in **Table 3-4**

Table 2-10 – Cities getting connected with Rail Network through Proposed Rail Connections

Sr. No.	City Hierarchy	Total number of Cities	Cities with direct rail connection Connected	Cities with no rail connection	Cities getting connected with new rail links	Cities still with no rail connection or missing links
1	Metropolitan	53	52	0	1	0
2	I	415	402	8	6	2
3	II	474	395	58	15	43

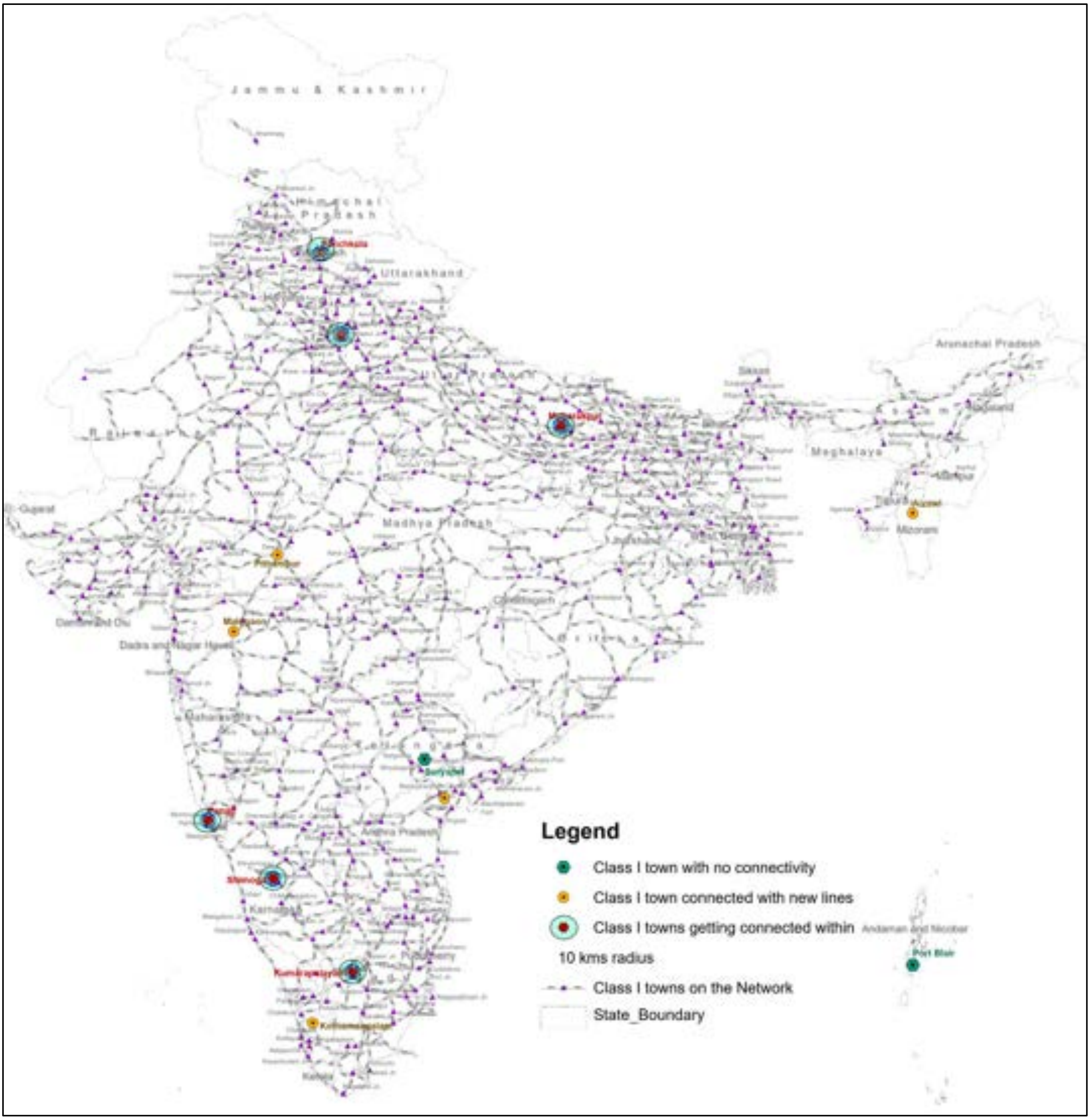
The details of the town still with no rail connections and their distance from the nearest railway station is mentioned in the **Table 3-5.** Port Blair being an island is not relevant for direct rail connection so it will be excluded while considering the missing links.

Table 2-11: Cities with no Rail Connectivity and distance from nearest Railway Station

Sr. No.	Status of City	Cities Not Connected	Pop_2011	Nearest Station	Distance (km)
1	Class I	Port Blair	108058	Paradip	1164
2		Suryapet	106805	Miryalaguda	32
1	Class I	Auraiya	99674	Phaphund	21
2		Yemmiganur	95149	Adoni	27
3		Sangareddy	83858	Shankarpalli	20
4		Mawana	81443	Sakhoti Tanda	23
5		Tura	74858	Dhubri	61
6		Chopda	72783	Dharangaon	28
7		Valparai	70859	Anaimalai Road	37
8		Badvel	70626	Cuddapah	40
9		Basavakalyan	69717	Humnabad	23
10		Uran Islampur	67391	Takri	13

Sr. No.	Status of City	Cities Not Connected	Pop_2011	Nearest Station	Distance (km)
11		Sahaswan	66204	Kachhia Bridge	18
12		Sangamner	65804	Sainagar Shirdi	38
13		Pulivendla	65706	Kadiri	35
14		Sinnar	65299	Devlali	18
15		Kodad	64234	Bona Kalu	30
16		Laharpur	61990	Biswan	26
17		Shahade	61376	Dondaicha	27
18		Chhibramau	60986	Kamalganj	20
19		Ilkal	60242	Guledagudda Rd	46
20		Jahangirabad	59858	Maman	25
21		Bheemunipatnam	59595	Vishakapatnam	25
22		Itanagar	59490	Gohpur	21
23		Gangoh	59279	Sona Arjunpur	20
24		Sillod	58230	Badnapur	48
25		Mulbagal	57276	Kanginhal	15
26		Lunglei	57011	Monu	142
27		Kandi	55632	Salar	25
28		Yanam	55626	Kakinada Town	26
29		Barwani	55504	Dondaicha	85
30		Edappadi	54823	Sankaridurg	16
31		Punganur	54746	Madanapalle Rd	32
32		Deglur	54493	Bodhan	35
33		Budhana	53722	Shamli	24
34		Ashta	53184	Jabri	36
35		Siruguppa	52492	Kupgal	36
36		Sironj	52460	Bareth	38
37		Mandvi	51376	Okha	50
38		Pernampattu	51271	Ambur	17
39		Sarni	86141	Ghoradongri	17
40		Palmaner	54035	Gudiyattam	34
41		Ozar	51297	Niphad	16
42		Kandukur	57246	Singarayakonda	13

The criteria mentioned above to analyse the connectivity of Class I cities and cities like Noida, Panchkula, Kumarapa, Panaji, Mubarkpur, Shimoga getting connected with rail link considering a radius of 10 kms and the cities like Malegaon, Aizwal, Pithampura, Kothamangalam, Chilaki connected through proposed rail network and cities still with no rail connection like Suryapet and Port Blair are shown in **Figure 3-**



1

Figure 2-11 – Class I - Connected and Missing Towns

Similarly, for Class II cities, 79 cities were not getting connected with the existing rail network. Out of these 79 cities, 21 cities were connected considering a radius of 10 kms as explained earlier and 15 cities getting connected after the completion of the proposed network. The details of the towns are given in **Table 3-6 & Table 3-7** and shown in **Figure 3-2**

Table 2-12: Class II Cities Connected with Rail Network considering 10 kms radius and new lines

S. No.	Connectivity through 10 kms Buffer	S. No.	Connectivity through proposed line
1	Kairana	1	Silvassa
2	Nirmal	2	Karauli
3	Saunda	3	Gobichettipalayam
4	Palwancha	4	Chikhli
5	Rabkavi-Banhatti	5	Kollegal
6	Sindhnur	6	Jalaun
7	Narsimhapur	7	Sidhi
8	Puliankudi	8	Amalapuram
9	Wadgaon Kolhati	9	Thodupuzha
10	Sherkot	10	Gumla
11	Raghogarh-Vijaypur	11	Hunsur
12	Sardhana	12	Jaspur
13	Mandapeta	13	Sindhnur
14	Manglaur	14	Samana
15	Baduria		
16	Zirakpur		
17	Tiruchengodu		
18	Sunabeda		
19	Shahabad U.A.		
20	Rajsamand		
21	Masaurhi		

Thus, there are still 43 cities not connected with the rail network (**Refer Table 3-5).** All these cities are shown in **Figure 3-3.**

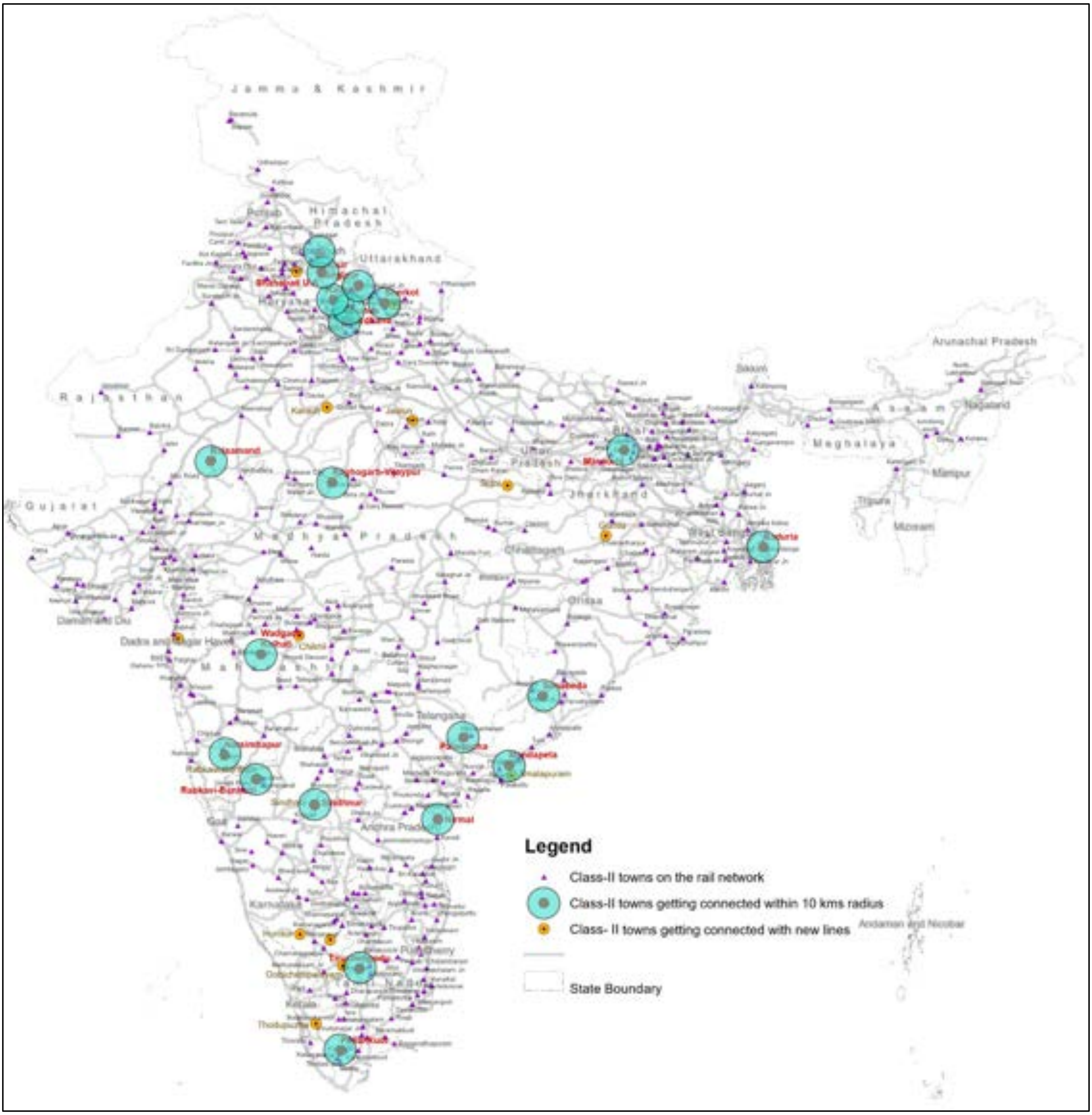


Figure 2-12 – Class II towns with Direct Rail Connection and getting connected within 10 kms Radius and proposed New Lines

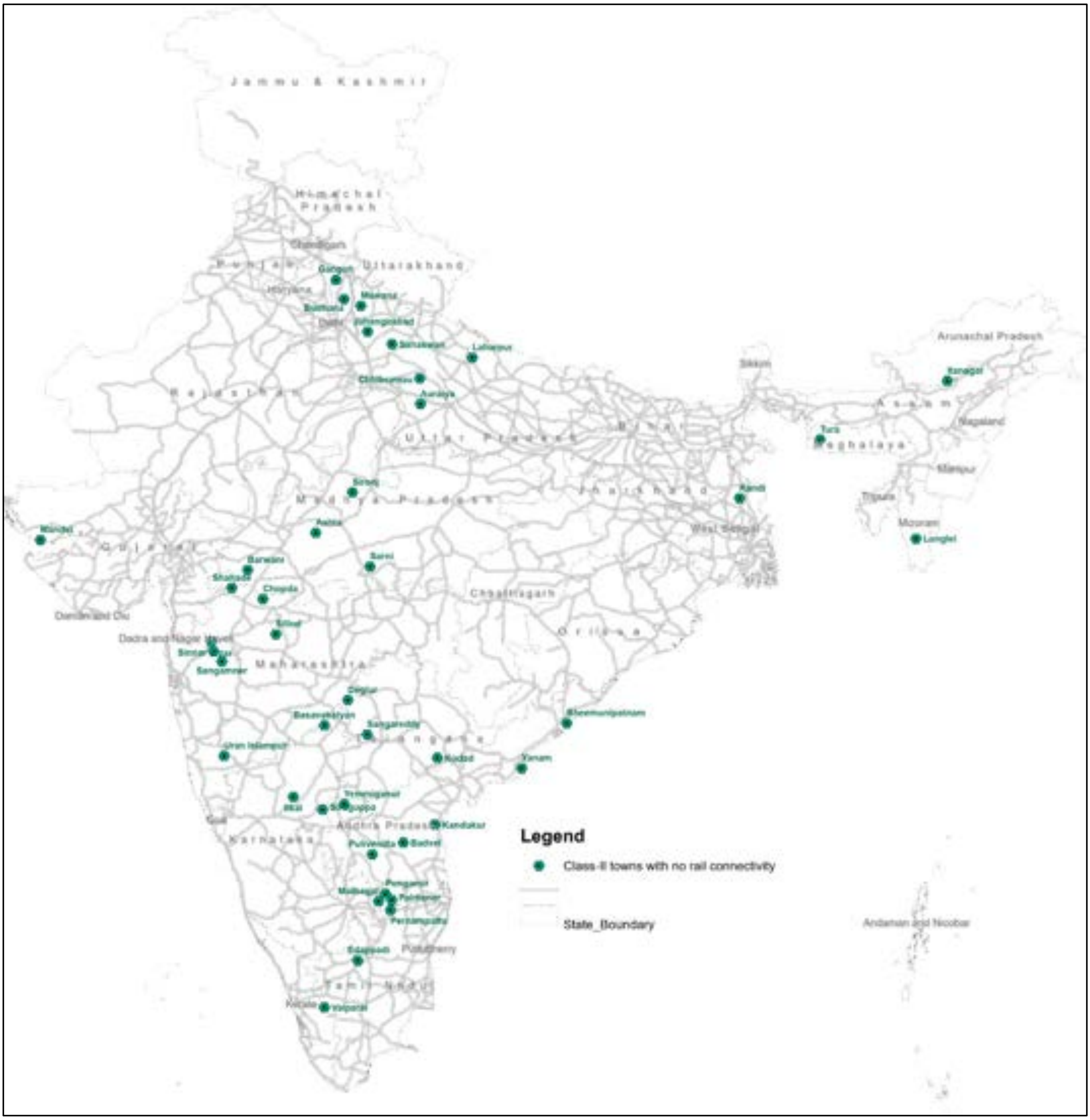


Figure 2-13: Class II Cities with no Rail Connectivity

NRP plan will address the infrastructure demand for rail network till 2050, so it is important to consider these missing cities while suggesting the infrastructure improvement proposal for the rail network.

Other than the existing Class I and II towns (as per Census of India 2011) rail connectivity it is prudent to consider those towns whose hierarchy will change to class I or II from existing status of Class II or III. There are a total 1373 Class III cities (as per Census of India, 2011) and out of these 287 cities will be change their hierarchy to Class II by 2030. Thus, connectivity of these future Class II cities with railway network will also be checked. The details are given in **Table 3-7**

Table 2-13: Rail Connectivity Status for Class III Turning Class II in 2030

Total Town in Class III	Towns with Change Hierarchy	Already Connected with Rail Network	Not Connected with rail network	Cities getting connected Proposed Rail Lines	Cities with No Rail Connectivity
1373	287	256	31	3	28

The details of 28 cities not getting connected with rail network is mentioned in the **Table 3-8**. These towns will also be considered while preparing the infrastructure plan for rail network improvement

Table 2-14: Class III Cities not connected with Railway Network

S. No.	Class III Cities with No Rail Connectivity	Population (2011)	Population (2031)	Terrain	Nearest Railway Station	Distance (km)
1	Chakan	41,113	54,555	Mountainous	Chinchvad	15.62
2	Almora	40,679	53,979	Hilly	Kathgodam	38.62
3	Bali Hongal	49,182	65,262	Hilly	Pachhapur	37.08
4	Bhupalpally	42,387	56,245	Hilly	Bisugir Sharif	40.89
5	Cheeka	38,952	51,687	Plain	Patiala	33.35
6	Chinnamanur	42,305	56,137	Hilly	Rajapalayam	47.57
7	Daman	44,282	58,760	Plain	Vapi	12
8	Gudalur (Nilgiris)	49,535	65,731	Hilly	Nilambur road	35.79
9	Jintur	44,291	58,772	Plain	Parbani	43
10	Kotputli	49,202	65,289	Plain	Narnaul	38.6
11	Manjlegaon	49,453	65,622	Plain	Manwath Road	41.46
12	Mehkar	45,248	60,042	Plain	Washim	59.64
13	Nainital	42,775	56,760	Hilly	Kathgodam	15.03
14	Nelliyalam	44,590	59,169	Hilly	Nilambur Road	30
15	Noorpur	38,806	51,494	Plain	Chand Saini	13
16	Nowgong	40,580	53,848	Plain	Bela Tal	25.3
17	Paithan	41,536	55,116	Plain	Aurangabad	42.59
18	Palladam	42,225	56,030	Plain	Tiruppur	14.35

S. No.	Class III Cities with No Rail Connectivity	Population (2011)	Population (2031)	Terrain	Nearest Railway Station	Distance (km)
19	Periyakulam	42,976	57,027	Hilly	Kodai Kanal road	40
20	Raisen	44,162	58,601	Plain	Sanchi	18
21	Rawatbhata	37,699	50,025	Plain	Dakaniya Talav	36.54
22	Saundatti-Yellamma	41,215	54,690	Flat topped barren hills	Dharwar	37
23	Siana	44,415	58,937	Granite hills	Garmuktesar	17
24	Simdega	42,944	56,985	Hilly	Bano	41.23
25	Thoubal	45,947	60,969	Hilly	Daotuhaja	110
26	Umarkhed	47,458	62,974	Hilly	Himayatnagar	27
27	Vita	48,289	64,077	Plain	Kirloskarvadi	24.43
28	Gudalur (Theni)	41,915	55,619	Plain	Nilambur Road	36

2.11. Connectivity to Major Tourist Places in India

Other than Class I and II cities, tourist areas play a pivot role in the economy of a country. Rail is always considered as preferred, safe, convenient, reliable and economical mode to travel to tourist destinations in India by domestic as well as international tourists. As a part of the study, the accessibility to important tourist destinations by rail was also evaluated.

Around 298 tourist destinations in India were identified based on the following criteria:

- UNESCO World Heritage Sites
- Cities covered under HRIDAY (Heritage City Development and Augmentation Yojana) and PRASAD (Pilgrimage Rejuvenation and Spirituality Augmentation Drive)
- Archaeological Survey of India (ASI) protected and ticketed monuments
- ASI denoted Adarsh Smaraks
- Religious Places- Char Dham, Jyotirlings, Kumbh Melas, Shakti Peeths, Pancha Bootha Sthalams etc.
- Popular hill stations, National Parks/ Wildlife Sanctuaries, Lakes etc.

These 243 tourist places are shown in **Figure 3-4** and shown in **Appendix 3-1**

Out of these 243 selected tourist places, 111 places are already connected with the existing rail network and out of remaining 132, 30 tourist places are within the distance of 10 kms from the nearest railway station and 30 are within distance of 15 kms from the nearest railway station. The remaining 72 locations (**Refer Table 3-9**) which are not getting connected with the railway network are primarily the wild life sanctuaries, beaches and areas located in hilly and mountainous terrain where providing rail connectivity is either not advisable or difficult.

Table 2-15: Tourist Places not connected to the Rail Network

S. No.	Name of Tourist Attraction	Type	Additional Significance	Nearest City	State	Nearest Railway station	Distance (km)	Terrain
1	Shravasti	Historical Place		Shravasti	Uttar Pradesh	Bairampur	17	Undulating
2	Rann of Kutch	Desert		Kutch	Gujarat	Bhuj	70	Desert
3	Gir National Park	National Park/ Wildlife Sanctuary		Talala Gir	Gujarat	Veraval	72	Forest
4	Bandhavgarh National Park	National Park/ Wildlife Sanctuary		Umaria	Madhya Pradesh	Umaria	35	Forest
5	Kanha National Park	National Park/ Wildlife Sanctuary		Mandla	Madhya Pradesh	Gondia	145	Forest
6	Mandu	Historical Place	Adarsh Smarak	Mandu	Madhya Pradesh	Indore	64	Rocky
7	Chilika Lake-Satapada	Beach/ Lake		Satapada	Orissa	Balugaon	50	Lake
8	Simlipal National Park	National Park/ Wildlife Sanctuary		Baripada	Orissa	Balasore	76	Forest
9	Chitrakoot Waterfalls	Waterfall		Jagdalpur	Chhattisgarh	Jagdalpur	38	Hilly
10	Bhuteshwar Shivaling	Religious Place		Gariaband	Chhattisgarh	Raipur Jn	103	Hilly
11	Mallikarjuna Jyotirlinga Temple	Religious Place	Jyotirling	Srisailam	Andhra Pradesh	Markapur	85	Mountaineous
12	Amravati	Historical Place	HRIDAY, PRASAD	Amaravathi	Andhra Pradesh	New Amravati		Hilly
13	Nagarjunasagar Dam	Waterfall		Vijayapuri North	Telangana	Macherla	24	Hilly
14	Kodaikanal	Hill Station		Kodaikanal	Tamil Nadu	Kodai road	80	Hilly
15	Mahabalipuram Cave Temples	Historical Place	UNESCO World Heritage Site, Adarsh Smarak	Mahabalipuram	Tamil Nadu	chengalpattu Jn	24	Hilly
16	Brihadisvara Temple Gangaikondacholapuram	Religious Place	UNESCO World Heritage Site	Gangaikondacholapuram	Tamil Nadu	Thanjavur	24	Plain
17	Mudumalai National Park	National Park/ Wildlife Sanctuary	UNESCO World Heritage Site	Gudalur	Tamil Nadu	Coimbator	120	Forest
18	Thekkady Periyar Wildlife Sanctuary	National Park/ Wildlife Sanctuary	UNESCO World Heritage Site	Thekkady	Kerala	Kottayam	110	Forest
19	Wayanad	Hill Station		Wayanad	Kerala	Kozhikode	110	Hilly
20	Calangute Beach	Beach/ Lake		North Goa	Goa	Thivim	40	Plain
21	Anjuna Beach	Beach/ Lake		North Goa	Goa	Karmali	11	Rocky
22	Baga Beach	Beach/ Lake		North Goa	Goa	Thivim	37	Plain

S. No.	Name of Tourist Attraction	Type	Additional Significance	Nearest City	State	Nearest Railway station	Distance (km)	Terrain
23	Bandipur National Park	National Park/ Wildlife Sanctuary		Bandipur	Karnataka	Mysore	80	Forest
24	Shivanasamudra Falls	Waterfall		Shivanasa mudra	Karnataka	Mandya	39	Plain
25	Kollur Mookambika Temple	Religious Place		Kollur	Karnataka	Byndoor	28	Mountai neous
26	Leh Ladakh	Hill Station	Adarsh Smarak	Leh	Jammu & Kashmir	Jammu Tawi	712	Desert
27	Pahalgam	Hill Station		Pahalgam	Jammu & Kashmir	Jammu Tawi	255	Forest
28	Sonamarg	Hill Station		Sonamarg	Jammu & Kashmir	Jammu Tawi	182	Mountai neous
29	Gulmarg	Hill Station		Gulmarg	Jammu & Kashmir	Jammu Tawi	157	Hilly
30	Manali	Hill Station		Manali	Himachal Pradesh	Jogindern agar	50	Hilly
31	Kasol	Hill Station		Kasol	Himachal Pradesh	Jogindern agar	145	Hilly
32	Dalhousie	Hill Station		Dalhousie	Himachal Pradesh	Pathanko t	80	Hilly
33	Khajjiar	Hill Station		Khajjiar	Himachal Pradesh	Pathanko t	118	Hilly
34	Mcleodganj	Hill Station		Mcleodga nj	Himachal Pradesh	Pathanko t	90	Hilly
35	Lahaul Spiti	Hill Station		Keylong	Himachal Pradesh	Shimla	157	Hilly
36	Great Himalayan National Park	Hill Station	UNESCO World Heritage Site	Bhuntar	Himachal Pradesh	Jogindern agar	143	Forest
37	Manikaran Sahib	Religious Place		Manikaran	Himachal Pradesh	Pathanko t	300	Hilly
38	Jwala Devi Temple	Religious Place		Jawalamu khi	Himachal Pradesh	Kangra	30	Hilly
39	Badrinath Temple	Religious Place	Char Dham	Badrinath	Uttarakhand	Rishikesh	294	Hilly
40	Yamunotri Temple	Religious Place	Chhota Char Dham	Yamunotri	Uttarakhand	Dehradu n	175	Mountai neous
41	Gangotri Temple	Religious Place	Chhota Char Dham	Gangotri	Uttarakhand	Rishikesh	234	Mountai neous
42	Kedarnath Temple	Religious Place	Jyotirling, PRASAD	Kedarnath	Uttarakhand	Rishikesh	216	Hilly
43	Mussoorie	Hill Station		Mussoorie	Uttarakhand	Dehradu n	34	Hilly
44	Jim Corbett National Park	National Park/ Wildlife Sanctuary		Ramnagar	Uttarakhand	Kotdwar a	44	Forest
45	Nanda Devi and Valley of Flowers	Hill Station	UNESCO World Heritage Site	Joshimath	Uttarakhand	Rishikesh	276	Mountai n ranges
46	Bhimashankar Jyotirlinga Temple	Religious Place	Jyotirling	Bhimasha nkar	Maharashtra	Pune	111	Ghat
47	Trimbakeshwar Temple	Religious Place	Jyotirling, Kumbh Mela	Trimbak	Maharashtra	Nasik Road	32	Hilly

S. No.	Name of Tourist Attraction	Type	Additional Significance	Nearest City	State	Nearest Railway station	Distance (km)	Terrain
48	Mahabaleshwar	Hill Station		Mahabaleshwar	Maharashtra	Wathar	60	Hilly
49	Kumbhalgadh Fort	Historical Place	UNESCO World Heritage Site, Adarsh Smarak	Kumbhalgarh	Rajasthan	Falna	80	Hilly
50	Ranakpur Jain Temple	Religious Place		Ranakpur	Rajasthan	Falna	27	Valley
51	Kaziranga National Park	National Park/ Wildlife Sanctuary	UNESCO World Heritage Site	Bokakhat	Assam	Furkating	75	Forest
52	Manas Wildlife Park	National Park/ Wildlife Sanctuary	UNESCO World Heritage Site	Barpeta Road	Assam	Barpeta	44	Forest
53	Majuli Island	Beach/ Lake		Jorhat	Assam	Mariani Jn	19	Plain
54	World Peace Pagoda	Religious Place		Rajgir	Bihar	Rajgir		Hilly
55	Netarhat	Hill Station		Netarhat	Jharkhand	Ranchi	155	Hilly
56	Sundarbans National Park	National Park/ Wildlife Sanctuary	UNESCO World Heritage Site	Canning	West Bengal	Canning Railway	29	Forest
57	Lachung	Hill Station		Lachung	Sikkim	New Jalpaigiri	190	Hilly
58	Tsomgo Lake	Beach/ Lake		Gangtok	Sikkim	New Jalpaigiri	150	Mountaineous
59	Nathula Pass	Hill Station		Gangtok	Sikkim	New Jalpaigiri	176	Hilly
60	Gurudongmar Lake	Beach/ Lake		Lachen	Sikkim	Darjeeling	171	Lake
61	Pelling	Hill Station		Pelling	Sikkim	Jalpaigiri	170	Hilly
62	Kanchenjunga Biosphere Reserve	National Park/ Wildlife Sanctuary	UNESCO World Heritage Site	Chungthang	Sikkim	New Jalpaigiri	221	Mountaineous
63	Laitlum Canyon	Hill Station		Shillong	Meghalaya	Guwahati	135	Hilly
64	Mawlynnong village	Hill Station		Dawki	Meghalaya	Guwahati	182	Hilly
65	Lunglei	Hill Station		Lunglei	Mizoram	Manu	143	Mountaineous
66	Vantawng Falls	Waterfall		Thenzawl	Mizoram	Bairabi	208	Stoney
67	Loktak Lake	Beach/ Lake		Bishnupur	Manipur	Jiribam	240	Undulating
68	Mokokchung Town	Hill Station		Mokokchung	Nagaland	titabar	44	Hilly
69	Touphema Tourist Complex	Hill Station		Kohima	Nagaland	Dimapur	81	Plain
70	Ziro	Hill Station		Ziro	Arunachal Pradesh	Naharalagun	100	Hilly
71	Bomdila	Hill Station		Bomdila	Arunachal Pradesh	Rangapara north	145	Hilly
72	Dudhni Lake	Beach/ Lake		Silvassa	Dadra & Nagar Haveli	Vapi	54	

Figure 2-14: Tourist Attractions Areas

Chapter 3 DEMAND FORECAST

3.1. Introduction

As discussed in the previous chapter, the report aims at listing out future rail network requirements based on demand forecast. For the purpose of setting the context, the present chapter briefly details out the passenger and freight demand forecast for horizon and cardinal years.

3.2. Secondary Data Collection

AECOM collected extensive secondary data from various sources. These include Ministry of Railways and other Ministries. List of data collected from Ministry of Railways and various other sources are listed below:

3.2.1. Passenger ticketing Systems:

- Passenger Reservation System (PRS): This is the system which allows a passenger anywhere to book train tickets from any station to any station.
- Unreserved Ticketing System (UTS): The unreserved ticketing from dedicated counters, replacing manual printed-card tickets with centralized online sales is done via this system.

The data was received from the PRS (year 2015-18) and UTS systems (year 2016-18) with information under the following heads:

Table 3-1: Passenger Data Formats received from PRS and UTS Systems

Passenger Data from PRS system	Passenger Data from UTS system
• Month • Frequency • Train number • Train source • Train destination • Train distance • Class • Boarding & Alighting station • Boarding & Alighting Zone • Boarding & Alighting Division • Number of passengers • Concession in Rupee • Train source & destination railway zone • Train source & destination railway division	• Railway Zone Code (for both Origin and Destination) • Railway Division Code (for both Origin and Destination) • Station Code (for both Origin and Destination) • Station Name (for both Origin and Destination) • Distance • Class Code • Passengers

Source: CRIS, Ministry of Railways

In the Unreserved ticketing system (UTS) data, the information of the origin and destination and the number of passengers travelled is provided, however the train number is not provided as an unreserved ticket is not assigned for a specific train.

3.2.2. Freight ticketing systems:

The Freight Operation and Information System (FOIS): This system is responsible for optimized asset utilisation, management and control of freight movement and the generation of invoices. An electronic payment gateway is interfaced with the FOIS, and many of the large freight customers use this gateway for the payments. The data received from Other secondary data collected is listed below:

Table 3-2: Secondary Data Collected from Ministry of Railways

S.No.	Head	Details	Duration
1	Line Capacity Charts	Section-wise details of %age utilisation, number of passengers, express, goods trains passing through the section	2016 -2017
2	IR System Maps	Railway Zone and Division wise maps of the network	As on March 31,2016
3	Permanent Speed Restrictions	Section-wise details of the speed restriction	
4	Train Master (Mail Trains)	Train-wise details of start station, end station, division name, speed of the train, rake details, frequency	September 2016
5	Station name list	Details of the station name against the codes mentioned of different station	As of now
6	Coaching Terminals	Avg. daily originating-terminating trains, total rakes, PFTR	

3.3. Primary Data Collection

As part of scope a number traffic and transportation surveys are required to be carried out in order to establish the base line data for future transport demand. Following traffic surveys will be carried out as part of the study:

- ✓ Classified Traffic Volume Counts
- ✓ Passenger and Goods Origin-Destination Survey
- ✓ Freight Stakeholders' Consultations

These primary surveys were carried out with the objective of preparing an appropriate data base for traffic model development. This section describes the purpose of the various surveys and its analysis thereof. Data collected will help in traffic model creation process, which comprises of three basic components;

- ✓ development of base year trip matrices
- ✓ development of base year road network
- ✓ assignment of base year traffic and validation of the traffic model

3.3.1. Identification of Survey Locations

A total of 100 locations were selected for carrying out 24-hour CTVC and OD surveys on all 7 days of the week for this study. These survey locations have been identified using the following key parameters:

- Million Plus Cities, State Capitals and Union Territories
- Mine producing places
- NTPC, Major Refineries of India & Logistic Hubs
- Major Cement Production and Attraction Centres

- FCI>10K
- Heavy Machinery production centres, Industrial Towns, FMCG;
- District Headquarters
- ICDs/ Dry Ports, Major Ports of India
- Coal Fields, Major Fertilizer Plants, Textile Hubs
- Religious Centres and Tourism Hubs
- Agricultural districts

The survey locations are presented in the figure below.

The field data collection activities were taken up during the period of July- August 2019. Subsequent sections discuss the methodology, locations selected, nature and extent of data collected while conducting the above-mentioned surveys.

Figure 3-1: NRP Classified Traffic Volume Count & OD Survey Locations

3.3.2. Classified Traffic Volume Count Survey

The survey was carried out using Videography technology.

A total of 104 locations were identified for conducting this survey. This survey was conducted for 7 days for duration of 24 hours on these locations. Detailed list of survey locations and duration is given in the following table.

Table 3-3: Survey Schedule for OD and CTVC (24 hours X 7 days)

Section	NH No.	Chainage	Survey Location	Location No.	Start date	End Date
Howrah-Kalighat	NH 16	Km 35.250 (NH 6)	Jaladhulagori (Dhulagarh)	4	20-Jul-19	26-Jul-19

Section	NH No.	Chainage	Survey Location	Location No.	Start date	End Date
Guwahati-Shillong	NH 6	Km 13.550 (NH 40)	Pahammawlein	42	20-Jul-19	26-Jul-19
Siliguri- Dalkola	NH 27	Km 547.350 (NH 31)	Paschim Madati	44	20-Jul-19	26-Jul-19
Haldia- Kolaghat	NH 116	Km 11.600 (NH 41)	Sonapetya	50	28-Jul-19	3-Aug-19
Bongaigaon-Alipurduar	NH 27	Km 243.00 (NH 31C)	Guabari	54	28-Jul-19	3-Aug-19
Ayodhya-Gorakhpur	NH 28	Km 163	Chaukadi	74	6-Aug-19	12-Aug-19
Gorakhpur - Kushinagar	NH 28	NH 28 Km 313	Muziana Hetim Toll Plaza	75	6-Aug-19	12-Aug-19
Kolkata-Bardhaman	NH 19	Km 646.005	Dankuni	103	28-Jul-19	3-Aug-19
Aurangabad - Asansol	NH 2	Km 438	Beliyad Toll Plaza	104	26-Jul-19	1-Aug-19
Fatehpur-Prayagraj	NH 19	Km 161.850	Allahbad Bypass (Kokhraj Toll)	41	6-Aug-19	12-Aug-19
Paradeep-Talcher	NH 53	Km 3.588 (NH 5A)	Srirampur	49	26-Jul-19	1-Aug-19
Jajpur Road-Baleshwar	NH 16	Km 97.960	Sergrarh	55	4-Aug-19	10-Aug-19
Jajpur Road-Cuttack	NH 16	Km 34.624	Manguli	56	26-Jul-19	1-Aug-19
Bokaro- Ranchi	NH 320	Km 16.770 (NH 23)	Tand Balidih	59	3-Aug-19	9-Aug-19
Bhilai- Raipur	NH 53	Km 285.400 (NH 6)	Kharun (MoRTH) (Kumhari Toll)	60	26-Jul-19	1-Aug-19
Rajnandgaon-Bhilai	NH 53	Km 331.865 (NH 6)	Thakurtola (End of Durg Bypass)	61	1-Aug-19	7-Aug-19
Raigarh-Jharsuguda	NH 49		Raigarh	62	26-Jul-19	1-Aug-19
Ranchi Hazaribagh Section	NH 33	Km 98.93	Pundag Toll Plaza	76	3-Aug-19	9-Aug-19
Raipur-Sambalpur	NH 53	Km 41.00	Baragarh (Barhaguda)	83	3-Aug-19	9-Aug-19
Varanasi-Aurangabad	NH 19	Km 860.000	Mohania	87	8-Aug-19	14-Aug-19
Raipur- Bilaspur	NH 130	Km 65.800	Nandghat	94	24-Jul-19	30-Jul-19
Vindhyanagar-Robertsganj	SH		Malo Ghat	95	24-Jul-19	30-Jul-19
Ranchi- Keonjhar	NH 20	Km 134.380	Banajodi	97	8-Aug-19	14-Aug-19

Section	NH No.	Chainage	Survey Location	Location No.	Start date	End Date
Chennai-Tindivanam	NH 32	km 52.820 (NH 45)	Paranur (Chengalpet)	1	10-Jul-19	16-Jul-19
Chennai-Kanchipuram	NH 48	Km 37.800	Nemili (Sriperumbudur)	2	12-Jul-19	18-Jul-19
Chennai-Tirupati	NH 716	Km 38.100 (NH 205)	Pattaraiperumbudur	3	11-Jul-19	17-Jul-19
Bangalore-Hosur	NH 44	Km 32.700 (NH 7)	Attibele	11	16-Jul-19	22-Jul-19
Bangalore-Tumakuru	NH 48	km 23.150	Bangalore-Neelamangla (navayuga)	12	19-Jul-19	25-Jul-19
Kochi- Palakkad-Coimbatore	NH 544	Km 278.000	Paliyekkara	28	24-Jul-19	30-Jul-19
Vellore-Kanchipuram	NH 4	Km 104.900	Chennasamudram	35	12-Jul-19	18-Jul-19
Puducherry-Tindivanam	NH 32	Km 6.572 (NH 66)	Morattandi	36	11-Jul-19	17-Jul-19
Vishakapatnam Port Road	NH 16	Km 728.055	Aganampudi	38	11-Jul-19	17-Jul-19
Mangalore-Udupi	NH 66	Km 358.042	Surathkal	46	24-Jul-19	30-Jul-19
Tiruchirapali-Tirunelveli	NH 138	Km 17.000	Pudukottai (Vagaikulam)	47	20-Jul-19	26-Jul-19
Thoothukudi-Madurai	NH 38	Km 254.940 (NH 45B)	Pudurpandiyapuram	48	21-Jul-19	27-Jul-19
Mangalore-Shivamogga	NH 169		Moodbidri	51	24-Jul-19	30-Jul-19
Visakhapatnam-Vijayawada	NH 16	Km 795.498	Vempadu	53	12-Jul-19	18-Jul-19
Salem- Bhavani	NH 544	Km 27.697	Vaiguntham	57	16-Jul-19	22-Jul-19
Salem- Madurai	NH 44	Km 259.500	Rasampalayan	58	17-Jul-19	23-Jul-19
Tada Nellore (Chennai-Nellore)	NH 5	Km 86	Sullurpet Toll Plaza	77	21-Jul-19	27-Jul-19
Near Ennore Port		Jawaharlal Nehru Salai	Ennore Port (Mathur Toll)	78	28-Jul-19	3-Aug-19
Chitradurga-Bangalore	NH 48	Km 172.770	Guilalu	79	10-Jul-19	16-Jul-19
Chittoor- Kolar	NH 206	Km 217/450	Gaddurur	80	20-Jul-19	26-Jul-19
Vijayawada-Jagdalpur	NH 30	Km 35.800	Badava	82	16-Jul-19	22-Jul-19
Madurai- Kollam	NH 744	Km 18.652	Kappalur	99	19-Jul-19	25-Jul-19
Ahmedabad-Dhrangadhra	NH 947	SH	Sanand	17	29-Jul-19	5-Aug-19

Section	NH No.	Chainage	Survey Location	Location No.	Start date	End Date
Ahmedabad-Vadodara	NE 1	Km 2.600	Ahmedabad	18	21-Jul-19	28-Jul-19
Jaipur- Tonk	NH 52	Km 30.500	Barkheda (Chandlai)	20	12-Jul-19	19-Jul-19
Jaipur-Kishangadh	NH 48	Km 286.700	Thikariya (Jaipur)	21	12-Jul-19	19-Jul-19
Indore- Nagpur	NH 47	Km 14.700 (NH 69)	Milanpur	27	22-Jul-19	29-Jul-19
Indore - Gwalior	NH 46	Km 113.278	Pagara	34	22-Jul-19	29-Jul-19
Gandhidham-Deesa	NH 41	Km 308.600	Samakhiyali	45	21-Jul-19	28-Jul-19
Vadodara-Anand	NH 64	Km 92.000 (NH 8)	Vasad	52	21-Jul-19	28-Jul-19
Rewa Bypass	NH 7	Km 650	Koshta	73	12-Jul-19	19-Jul-19
Rewa- Singrauli	NH 39	Km 58.800	Sonvarsaa	88	12-Jul-19	19-Jul-19
Sagar- Nagpur	NH 44	Km 295.000	Titarpani	93	21-Jul-19	28-Jul-19
Surat- Mumbai	NH 48	Km 470.000 (NH-8)	Khaniwade	6	18-Jul-19	24-Jul-19
Mumbai- Pune	Mumbai Pune Expressway		Talegaon Toll Plaza	7	12-Jul-19	18-Jul-19
Hyderabad-Anantapur-Bangalore	NH 44	Km 54.290	Raikal	13	22-Jul-19	28-Jul-19
Hyderabad-Suryapet	NH 65	Km 60.650	Panthangi	14	22-Jul-19	28-Jul-19
Hyderabad-Warangal	NH 163	Km 38.100	Gudur	15	22-Jul-19	28-Jul-19
Hyderabad-Humnabad-Solapur	NH 65	Km 515.200	Patancheru	16	25-Jul-19	31-Jul-19
Pune- Nashik	NH 60	Km 41.800	Chandloi/ Rajgurunagar	19	9-Jul-19	15-Jul-19
Panaji- Mumbai	NH 66		State Border Checkpost/ Banda	37	9-Jul-19	15-Jul-19
Mumbai- Nashik	NH 3	Km 532	Arjunali	71	12-Jul-19	18-Jul-19
Nagpur-Hyderabad	NH 44	Km 92.500	Daroda	81	23-Jul-19	29-Jul-19
Dhule- Nagpur	NH 53	Km 415.800	Nashirabad	89	27-Jul-19	2-Aug-19
Kolhapur-Belgaum	NH 48	Km 537.770	Hattargi	90	13-Jul-19	19-Jul-19
Hubbali- Bellary	NH 67	Km 288.000 (NH 13)	Hitnal	92	10-Jul-19	16-Jul-19

Section	NH No.	Chainage	Survey Location	Location No.	Start date	End Date
Delhi- Shamli	NH 709B		Baghpat	8	7-Aug-19	13-Aug-19
Delhi- Hapur	NH 9	Km 29.300	Dasna	9		
Delhi- Bulandshahr	NH 34	Km 47.500 (NH 91)	Luharali	10	21-Jul-19	27-Jul-19
Panipat- Thanesar	NH 44	Km 94.800	Panipat Elevated	40	30-Jul-19	5-Aug-19
Bawal Rewari Roahtak	NH 71	Km 430	Gangyacha Jatt	69	21-Jul-19	27-Jul-19
Sirsa- Hisar	NH 10	Km 241.920	Bhavdeen	70	28-Jul-19	3-Aug-19
Moradabad- Sitapur	NH 24	Km 172.698	Niyamatpur Ikrotiya Toll Plaza	72	7-Aug-19	13-Aug-19
Delhi- Rohtak	NH 9	Km 52.460 (NH 10)	Rohad	84	23-Jul-19	29-Jul-19
Meerut- Muzzafarnagar	NH 58	Km 75.990	Siwaya	85	8-Aug-19	14-Aug-19
Faridabad- Mathura	NH 19	Km 74.00	Srinagar	86	14-Aug-19	20-Aug-19
Rupnagar- Ambala	NH 205/205A	Km 35.000	Kurali (Behrampur)	29	14-Aug-19	20-Aug-19
Zirakpur- Shimla	NH 5	Km 51.400	Chandimandir	31	2-Aug-19	8-Aug-19
Jammu- Pathankot	NH 44	Km 16.4	Lakhanpur/ Rajbagh	63	2-Aug-19	8-Aug-19
Jalandhar- Amritsar	NH 1	Km 410.181	Dhilwan	64	2-Aug-19	8-Aug-19
Jallandhar- Pathankot	NH 1A	Km 84.5	Harsa Mansar	65	2-Aug-19	8-Aug-19
Pathankot- Amritsar	NH 54	Km 16	Ladpalwan	66	2-Aug-19	8-Aug-19
Ambala- Ludhiana	NH 44	Km 211.8	Sambhu	67	1-Aug-19	8-Aug-19
Patiala- Sangrur- Barnala- Bathinda	NH 7 (old 64)	Km 139.7,	Badbar	68	5-Aug-19	11-Aug-19
Ganganagar - Bikaner	Old NH 15	Km 229.100	Ganganagar	98	14-Jul-19	20-Jul-19
Hoshiarpur- Mubarikpur	NH 70		State Border Checkpost	100	3-Aug-19	9-Aug-19
Etawah- Kanpur	NH 19	Km 438.000	Barajore (Bara)	22	30-Jul-19	5-Aug-19
Kanpur- Mahoba	NH 34	Km 43.500 (NH 86)	Aliyapur	23	30-Jul-19	5-Aug-19
Kanpur- Fatehpur	NH 19	Km 527.275 (NH 2)	Badauri	24	31-Jul-19	6-Aug-19
Lucknow- Sitapur	NH 30	Km 467.00	Itunja (Barabhari)	26	12-Aug-19	18-Aug-19

Section	NH No.	Chainage	Survey Location	Location No.	Start date	End Date
Agra- Delhi	Yamuna Expressway		Agra Toll Plaza	33	12-Aug-19	18-Aug-19

Source: AECOM Primary Survey, 2019

Seasonal Correction Factor (SCF)

The data collected from the traffic count stations need to be adjusted to derive Annual Average Daily Traffic (AADT) considering the variation of traffic intensity over various months in a year. For this purpose, seasonal traffic variations on the expressways and national highways in project area were analysed. Monthly data on toll able vehicles for the last 3 years was collected from various toll plazas being operated on National Highways by NHAI for determining monthly variation in traffic data.

The consolidated Seasonal Correction Factors applied for major modes are given in table below.

Table 3-4: Adopted Seasonal Correction Factor

S. No.	Mode	Adopted SCF
1	Car	0.92
2	Bus	0.88
3	LCV	1.02
4	2 and 3 axle trucks	1.07
5	Multi Axle Trucks	1.01

3.3.3. Passengers & Goods Origin Destination Survey

The Origin-Destination survey was conducted along with the Classified Traffic Volume Count Surveys at all locations. Output from this survey are described below:

- Travel pattern of vehicles (passenger & freight)
- Lead distribution
- Load distribution
- Commodity movement pattern
- Occupancy and Trip purpose

3.4. Traffic Analysis Zoning System

For better understanding of travel pattern in the study area and its interaction with regions external to Study Area, it has been delineated into number of Traffic Analysis Zones (TAZs). The traffic zoning system has been developed considering the district boundaries as of Year 2011.

Figure 3-2: NRP Traffic Analysis Zones

A total of 701 Traffic Analysis Zones (TAZs) have been identified considering the district boundaries. Traffic Zoning has been done in 2 categories; these include internal and external zones. Internal zones include the 677 district zones and 14 port zones. Total 10 external zones have been considered which include the international regions.

3.5. Passenger Demand Forecast

3.5.1. Rail Passengers Characteristics

The passenger data analysed from 2010-11 to 2017-18 for all passenger categories of Indian Railways shows that railway passengers have grown at a CAGR of 2% per annum. Maximum growth has been witnessed in AC category out of which 3rd AC passengers have increased at CAGR of 10.33%, 2nd AC at 6%, 1st AC at 6.74% and AC Chair Car and Executive class at 9% & 12% per annum respectively. In Non-AC category, Sleeper Class has grown at a rate of 4.4%, 2nd class sitting at 8.76% and unreserved at 0.89% per annum respectively.

Suburban passenger traffic has grown by 2.3% from 2008-09 to 2017-18. The share of suburban passengers to non-suburban passengers has also remained consistent from 55% in 2008-09 to 56% in 2017-18.

Reason for stagnation in the growth of unreserved/ non-AC category may be due to stagnation in supply. Since the seats in the unreserved category are limited so a meagre growth witnessed in this category.

Table 3-5: Annual Growth of Passenger Traffic (Millions)

S. No	Class	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	CAGR
1	Sleeper Class	232.82	248.12	265.19	316.97	311.22	297.52	315.57	323.84	329.91	342.49	4.38%
2	3rd AC	38.61	45.03	53.25	60.35	70.08	68.60	78.27	84.48	89.08	93.54	10.33%
3	2nd Sitting	73.14	95.85	113.96	107.04	126.80	140.65	142.81	157.07	149.58	155.74	8.76%
4	Chair Car	13.54	14.56	16.69	19.44	22.13	24.46	25.89	26.52	27.42	29.28	8.94%
5	2nd AC	16.21	17.37	19.56	21.68	22.56	23.00	25.15	25.92	25.27	27.39	6.01%
6	1st AC	1.53	1.66	1.92	2.34	2.39	2.50	2.50	2.54	2.68	2.74	6.74%
7	Exe Chair Car	0.39	0.64	0.70	0.87	0.92	1.01	1.01	0.96	1.00	1.08	11.93%
8	1st Class	1.34	1.84	1.68	1.32	1.10	0.95	0.68	0.46	0.39	0.37	-13.28%
9	Unreserved	2,740.62	2,945.28	3,117.18	3,316.91	3,386.90	3,286.19	3,127.22	3,026.70	2,924.33	2,967.79	0.89%
	Total	**3,118.20**	**3,370.37**	**3,590.14**	**3,846.94**	**3,944.10**	**3,844.88**	**3,719.08**	**3,648.47**	**3,549.67**	**3,620.44**	**1.67%**
10	Suburban	**3,802.17**	**3,875.44**	**4,060.95**	**4,377.44**	**4,476.56**	**4,552.18**	**4,505.03**	**4,458.86**	**4,566.43**	**4,665.34**	**2.30%**
Grand Total		**6,920.37**	**7,245.80**	**7,651.09**	**8,224.38**	**8,420.66**	**8,397.06**	**8,224.12**	**8,107.33**	**8,116.10**	**8,285.77**	**2.02%**
Suburban Share (%)		**54.94**	**53.49**	**53.08**	**53.23**	**53.16**	**54.21**	**54.78**	**55.00**	**56.26**	**56.31**	**0.27**

In order to further analyse the growth trends, the above-mentioned classes were further clubbed into 3 broad categories namely; LDAC, LDNA and Suburban.

Table 3-6 -Growth Trends in Passenger Traffic in mentioned Categories (Millions)

S. No.	Class	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	CAGR
1	LDAC	70.27	79.27	92.12	104.69	118.08	119.57	132.81	140.41	145.46	154.03	9.11%
2	LDNA	3,047.92	3,291.10	3,498.01	3,742.25	3,826.02	3,725.30	3,586.27	3,508.07	3,404.21	3,466.40	1.44%
Total		**3,118.20**	**3,370.37**	**3,590.14**	**3,846.94**	**3,944.10**	**3,844.88**	**3,719.08**	**3,648.47**	**3,549.67**	**3,620.44**	**1.67%**
3	Sub	**3,802.17**	**3,875.44**	**4,060.95**	**4,377.44**	**4,476.56**	**4,552.18**	**4,505.03**	**4,458.86**	**4,566.43**	**4,665.34**	**2.30%**
Grand Total		**6,920.37**	**7,245.80**	**7,651.09**	**8,224.38**	**8,420.66**	**8,397.06**	**8,224.12**	**8,107.33**	**8,116.10**	**8,285.77**	**2.02%**

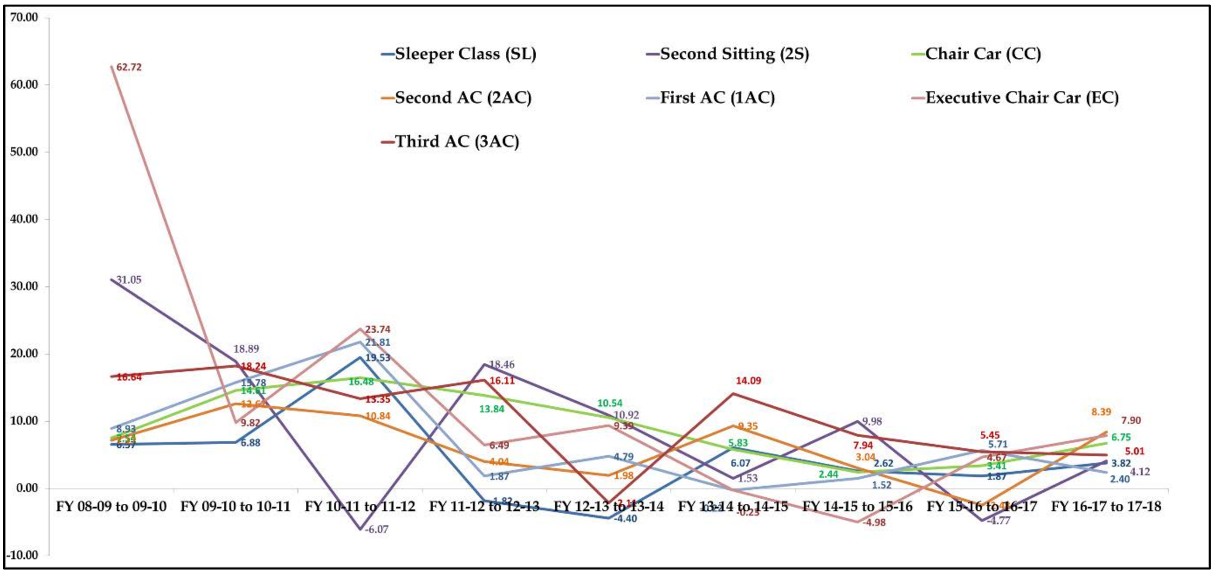


Figure 3-3: – Rail Passengers Growth Trends -Class wise

The reclassification of passenger's data shows that long distance AC category passengers have grown at an average annual growth rate of 9% in the last 10 years. Whereas, long-distance non-AC category passengers shows a growth of 1.44% and Suburban passengers traffic growth observed is 2.30%.

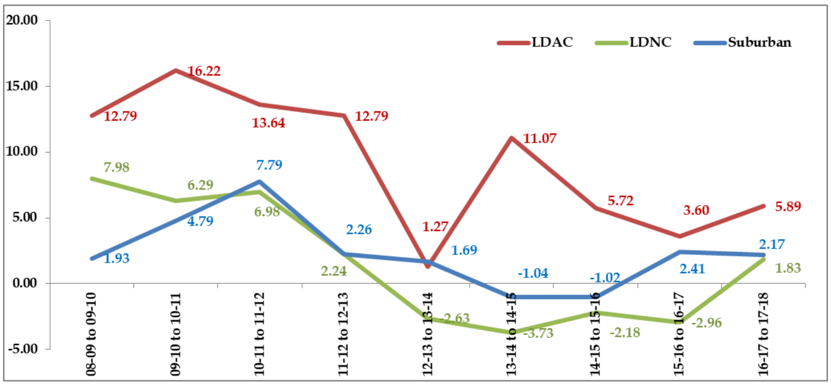


Figure 3-4: – Rail Passengers Growth Trends

Overall, long distance passengers show a growth of 1.67% and overall passengers growth observed is 2% in the last 10 years.

3.5.1.1. Composition of Passenger Traffic on IR

Following Figure provides the composition of passenger traffic across different classes in 2017-18. It is observed that Unreserved Class accounts for the majority share (93%) in the total rail passenger traffic. Sleeper Class and AC Class constitute 4% and 2% of the rail passenger share respectively.

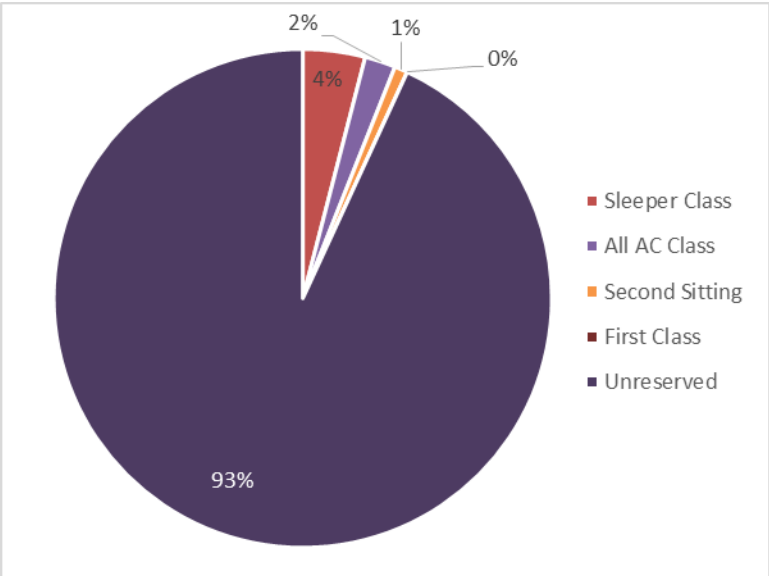


Figure 3-5: Class Wise Composition of Passenger Traffic (2017-18)

3.5.1.2. Travel Pattern of Passenger Traffic on IR

The travel pattern of the rail passengers was studied for the year 2017-18 to determine the routes having maximum traffic in reserved and unreserved segments. The findings of the analysis are discussed in the subsequent sections.

3.5.1.3. Travel Pattern for Reserved Passenger Segment

It is observed that Bengaluru- Chennai and Chennai-Bengaluru are the busiest routes accounting for around 12,000 reserved passengers daily. This is followed by the Chennai-Coimbatore and Coimbatore-Chennai routes, carrying around 8,700 reserved passengers daily. The origin-destinations of the reserved passenger trips are concentrated around the four metro cities in India, along-with Hyderabad, Bengaluru, Ahmedabad and others. Southern India has a higher concentration of busy routes. The share of the top 10 districts in the reserved passenger traffic is given in figure below.

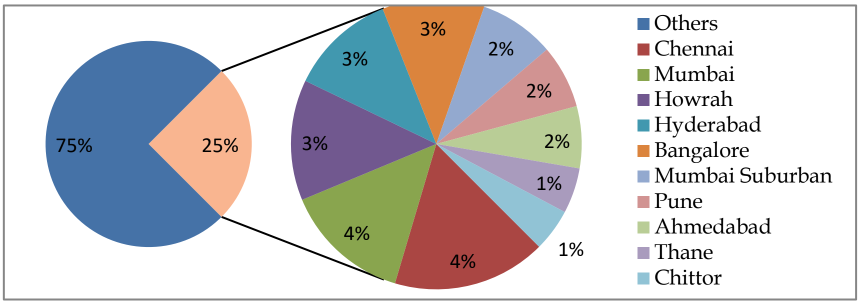


Figure 3-6: District-wise Composition of Reserved Passenger Traffic

It can be observed that southern districts together account for 11% of the reserved passenger traffic, with Chennai leading at 4.3%. Mumbai along-with Mumbai suburban district also accounts for 6% of the daily reserved passenger traffic.

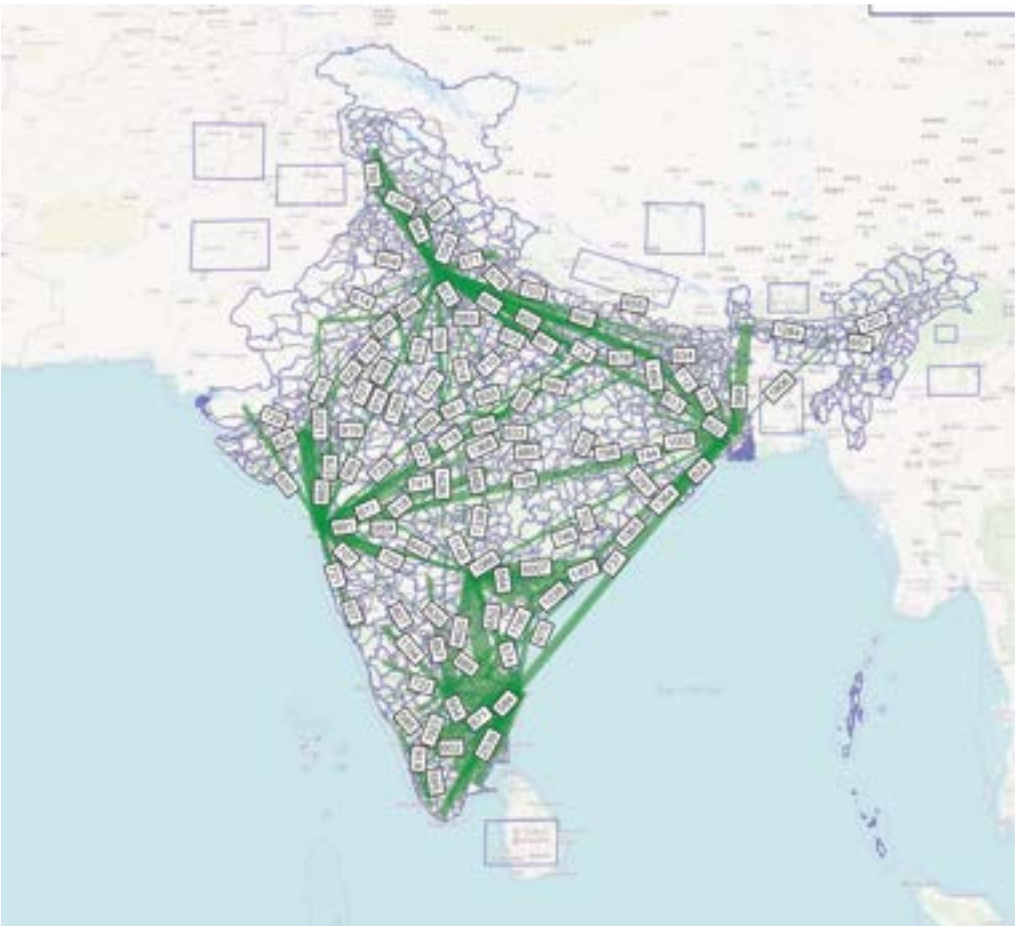


Figure 3-7: Desire Line Diagram for Average Daily Reserved Passenger Category

From the above figure, it is evident, that the maximum passenger movement over a long distance is happening on Amritsar – Delhi – Kanpur – Prayagraj Lukhnow – Varanasi – Kolkata route. The movement is in sync with the existing population density in this part of the country. The other substantial movement long distance is observed between Mumbai and Kolkata followed by Kolkata and Chennai. Other corridors contributing to substantial passenger movement are Ahmedabad – Mumbai followed by Bengaluru – Hyderabad.

3.5.1.4. Travel Pattern for Unreserved Passenger Segment

From the analysis of unreserved category of passengers, it has been observed that the Mumbai suburban railway network spanning the districts of Mumbai, Mumbai Suburban, Palghar and Thane has the busiest routes accounting for around 71 lakhs unreserved passengers every day. This is followed by the Chennai suburban railway network connecting Chennai, Tiruvallur and Kanchipuram, carrying around 11 lakh unreserved passengers daily. Heavy concentration of daily unreserved commuters is also observed on the IR network connecting North 24 Parganas-Hooghly-Kolkata-Howrah districts, totalling 18

Significant flows of long-distance unreserved passenger trips are observed from Mumbai and surrounding areas to Uttar Pradesh and Bihar, as well as from Punjab to Chhattisgarh and Jharkhand.

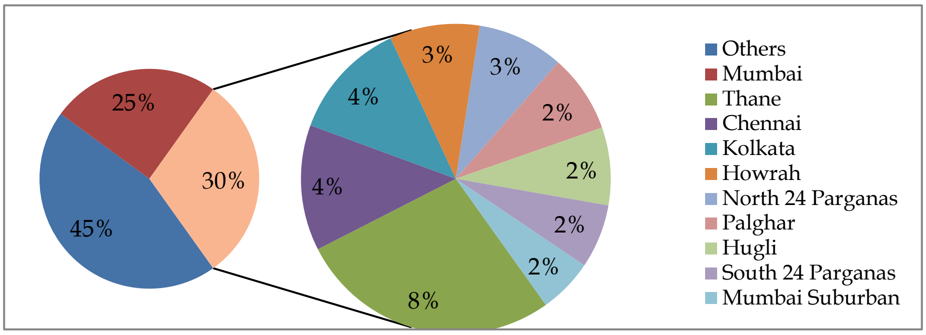


Figure 3-8: District-wise Share of Unreserved Passenger Traffic

It can be observed that Mumbai district accounts for 25% of the daily unreserved passengers on IR, followed by Thane at 8%. Majority of the trips from these districts are short commuter trips, served by the Mumbai suburban railway network. Chennai and Kolkata, each account for 4% of the daily unreserved passengers on IR.

Figure 3-9: Desire Line Diagram of Unreserved Passenger Category

As evident from the figure above, Mumbai – Lucknow route carries maximum passengers of unreserved category followed by Amritsar – Delhi – Lucknow.

3.5.1.5. Reserved Passengers Traffic Characteristics based on City Size

An analysis based of quantum of passengers being generated based on city type has also been made in order to understand the contribution of city size on rail passenger demand.

Table 3-7: Share of Passengers based on City Type on Various Classes

City Type	1A	2A	2S	3A	CC	EC	FC	SL	3E	Total
Metropolitan	0.25%	2.88%	6.13%	9.22%	3.23%	0.14%	0.01%	26.67%	0.05%	48.57%
Tier I	0.11%	1.65%	4.23%	5.46%	1.49%	0.03%	0.04%	22.35%	0.00%	35.36%
Tier II	0.01%	0.14%	0.45%	0.50%	0.14%	0.00%	0.00%	2.01%	0.00%	3.24%
Tier III	0.02%	0.22%	0.64%	0.78%	0.30%	0.01%	0.00%	2.41%	0.00%	4.38%
Other	0.04%	0.49%	0.75%	2.00%	0.31%	0.01%	0.01%	4.85%	0.00%	8.45%
Total	0.42%	5.39%	12.20%	17.95%	5.47%	0.19%	0.05%	58.28%	0.05%	100.00%

Source: Analysis of CRIS Data, 2017-18

It is evident from the above table that of the total passengers travelling by rail under reserve category, metropolitan cities constitute to 49% share. Of these, 27% travel by sleeper class, 9% by 3rd AC, 6 % by 2nd Sitting, 3% each by Chair Car and 2ns AC and 0.25% by 1st AC.

Tier 1 cities constitute to 35% of total reserved passengers traveling by rail. Of these, 22% travel by sleeper class, 5% by 3rd AC, 4% by 2nd Sitting and 1.65% by 2nd AC.

Tier II and Tier III cities contribute to 12% share of total passengers.

Non-urban areas contrite to 9% of total rail passengers.

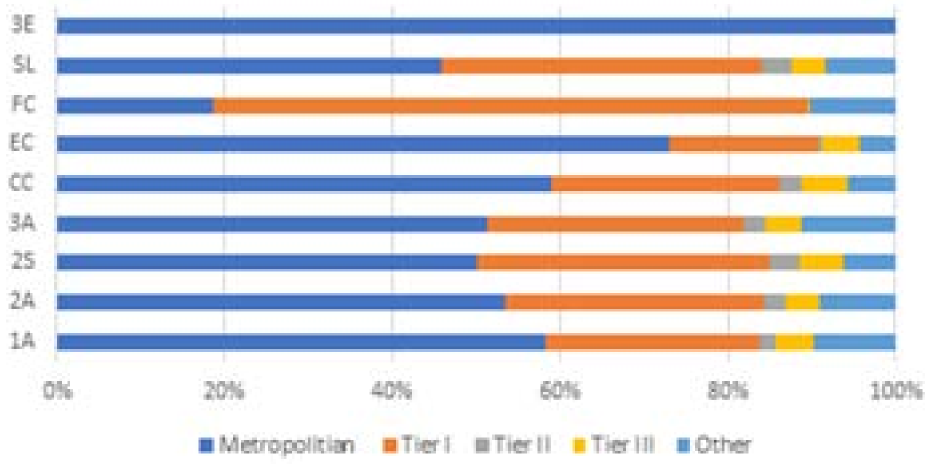


Figure 3-10: Share of Various City Types in Passenger Traffic

3.5.2. Road Passenger Travel Characteristics

As the travel characteristics of the rail passenger have been discussed earlier, similarly the road passenger characteristics are also significant for the study, to estimate their travel pattern, trip length, trip purpose and the districts having major share in the trip generation and attraction In order to analyse the travel pattern and estimated quantum of passenger trips, their movement was captured at 104 locations by conducting Road Side Interview (RSI) for Origin and Destination survey. The O-D surveys were conducted at the same location as the Classified Traffic Volume Count surveys, simultaneously, for 24 hours a day X 7 days. The following sections discuss the travel characteristics of road passengers presently using major roads networks in the study area.

3.5.2.1. Travel Pattern

A total of 9,89,444 vehicular trips have been performed daily on road network using various modes. The share of the top 10 districts with respect to the movement of passengers on the overall road network is shown in the figure below.

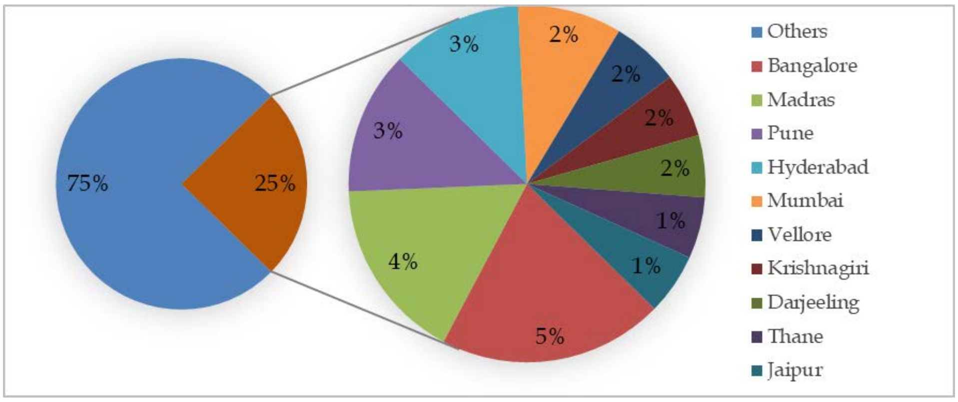


Figure 3-11: District-wise share in passenger movement by Road, FY 20

It can be observed that the top metropolitan cities viz. Bangalore, Chennai, Pune, Hyderabad and Mumbai constitute 17% of the total regional passenger movements. Bangalore leads with 5% share, followed by Chennai with 4% share.

For the ease of presentation, top 20 OD pairs has been shown in table below and the remaining OD pairs are mentioned under the category "others". The desire line diagram of the passenger movement by road in FY 19-20 has been shown in figure below.

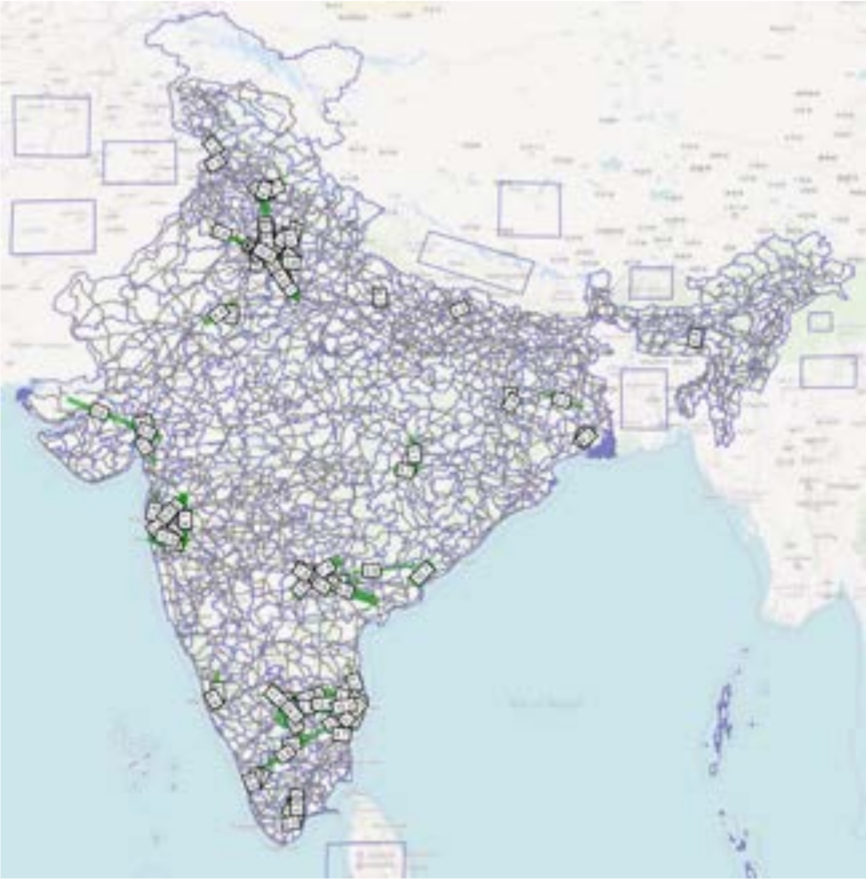


Figure 3-12: Desire Line Diagram for Daily Passenger Movements by Road (Figures in 000)

Most of the passenger trips are within distances of less than 400 km, and are highly concentrated around major cities like Bengaluru, Chennai, Mumbai, Hyderabad, Delhi and Ahmedabad.

Travel pattern for the major passenger movements by road in FY 20 has been shown in the table shown below. Maximum passenger movement is seen on the Tumkur- Bangalore route (~12000 daily passengers) followed by Mumbai- Pune, Krishnagiri- Bangalore and Chennai- Vellore each at 11,000 daily passengers.

3.5.2.2. Trip Purpose

The distribution of trips by purpose was analysed, and the composition is shown in figure below.

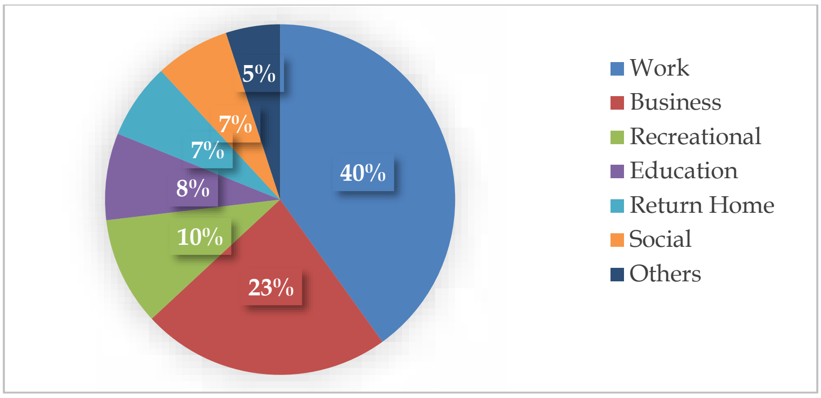


Figure 3-13: Trip Distribution by Purpose

It is observed that work and business trips account for almost two-thirds of all passenger trips. Recreational trips account for 10% share, whereas educational trips account for 8% share.

3.5.2.3. Trip Length Frequency

The cumulative trip length frequency for all passenger trips were analysed and presented in figure below.

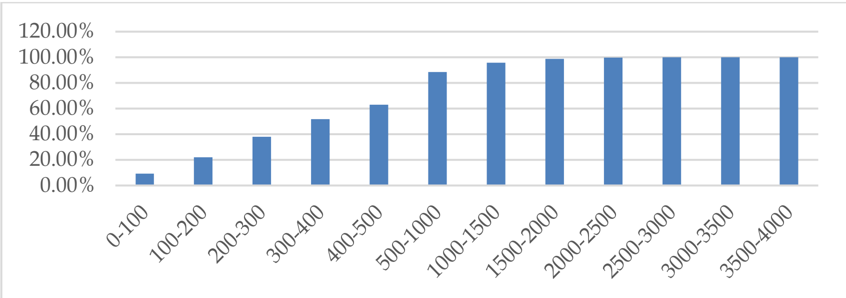


Figure 3-14: Trip Length Frequency for Passenger Trips

It can be observed that more than 50% of the passenger trips were less than 400 km. 95% of the passenger trips were less than 1500 km.

3.5.3. Air Passenger Traffic Characteristics

Air Passenger Traffic in India, both domestic and international witnessed a positive growth in the year 2017-18 compared to the previous year.

Table 3-8: Growth of Air Passenger Traffic (Millions)

Passenger Traffic	Unit	2013-14	2014-15	2015-16	2016-17	2017-18
Domestic	Departing	60.67	70.08	85.20	103.75	123.32
Domestic Airline Demand	Revenue Passenger Km (RPK)*	59,140	67,020	80,970	98,640	117,040
Domestic Airline Capacity	Available Seat Km (ASK)**	80,720	84,810	97,730	116,940	134,540
International	Departing and Arriving	43.08	45.74	49.78	54.68	60.58
Total Passengers (Domestic & International)		103.75	115.82	134.98	158.43	183.90

Source: DGCA, Ministry Of Civil Aviation

* **ASK** is calculated as the sum of products obtained by multiplying the total number of seats that are available in each flight stage by the corresponding stage distance.

** **RPK** is calculated as the sum of the product obtained by multiplying the number of revenue passengers carried on each flight stage by the corresponding stage distance.

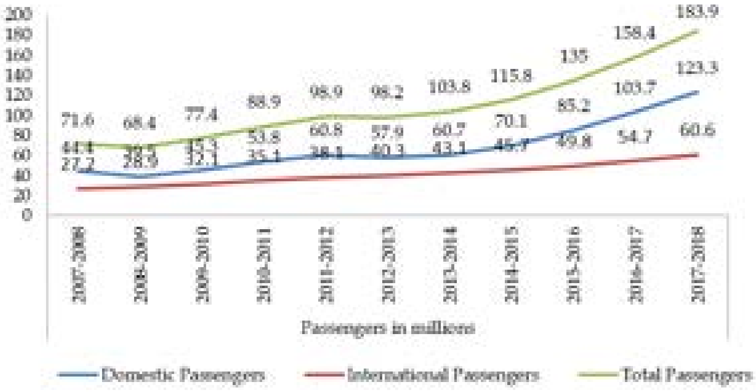


Figure 3-15: Passenger Traffic Growth

The domestic passenger traffic registered a CAGR of 10.76% during the period 2007-08 to 2017-18 while the international passenger traffic grew at 8.32% CAGR during the same period. During the years from 2007-08 to 2017-18, the capacity (ASK) in the domestic market grew at a rate of 8.30% (CAGR) while the demand (RPK) grew at 10.87% (CAGR) during the same period.

3.5.3.1. Busiest Airports and Routes

Indian Aviation sector has been growing at the rate of 20% for last 4 years. Domestic air traffic passengers have doubled during the last five years. In December 2018, Indian aviation completed 52 consecutive months of double-digit growth. Most airports (joint venture and AAI-operated) have either reached saturation levels or expected to reach optimal capacity within a decade. India plans to increase the number of airports to 250 by 2030 to cater to growing leisure and business travel. Capacity will also increase with new terminals coming up in Delhi, Mumbai, Bengaluru, Chennai and Guwahati. Indian carriers are expected to double their fleet capacity to around 1,100 aircrafts by 2027.

3.5.3.2. Passengers

IGI Airport at Delhi accounts for highest share (56 MPA) of passengers handled by any airport in the country followed by Mumbai (38 MPA). Bengaluru is placed at 3rd position, whereas Hyderabad and Kolkata Airports are placed at 4th and 5th position in terms of handling quantum of passengers in the year 2018-19.

3.5.3.3. Busiest Air Passenger Routes

The top 3 busiest air passenger's routes include Delhi – Mumbai, Delhi – Bengaluru and Bengaluru – Mumbai followed by Delhi – Kolkata and Delhi – Hyderabad. Passenger growth on Delhi Mumbai route is stable with annual CAGR of 2% whereas on Delhi – Bengaluru route has witnessed growth at a rate of 6%.

Table 3-9: Passenger Quantum (MPA) & Growth on Top 20 Busiest Air Routes

S. No.	Route	FY 16-17	FY 17-18	FY 18-19	CAGR
1	Mumbai-Delhi	3.34	3.55	3.53	3%
2	Delhi-Mumbai	3.39	3.56	3.52	2%
3	Bengaluru-Delhi	2.02	2.15	2.25	6%

S. No.	Route	FY 16-17	FY 17-18	FY 18-19	CAGR
4	Delhi-Bengaluru	2.01	2.16	2.24	6%
5	Mumbai-Bengaluru	1.69	1.78	1.89	6%
6	Bengaluru-Mumbai	1.69	1.77	1.87	5%
7	Delhi-Kolkata	1.46	1.57	1.69	7%
8	Kolkata-Delhi	1.38	1.49	1.62	9%
9	Hyderabad-Delhi	1.13	1.32	1.46	14%
10	Delhi-Hyderabad	1.14	1.33	1.44	12%
11	Delhi-Pune	1.14	1.33	1.38	10%
12	Pune-Delhi	1.15	1.33	1.37	9%
13	Chennai-Delhi	1.18	1.26	1.34	7%
14	Delhi-Chennai	1.16	1.25	1.33	7%
15	Ahmedabad-Delhi	0.91	1.09	1.20	15%
16	Hyderabad-Bengaluru	0.77	1.04	1.20	25%
17	Delhi-Ahmedabad	0.92	1.10	1.18	13%
18	Bengaluru-Hyderabad	0.78	1.04	1.17	22%
19	Mumbai-Chennai	1.10	1.20	1.13	1%
20	Chennai-Mumbai	1.10	1.19	1.11	0%

Source: Analysis of DGCA Data

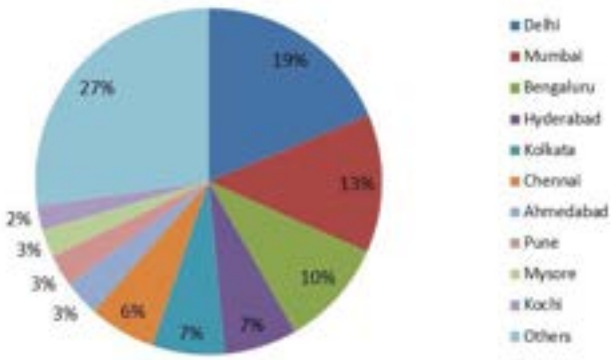


Figure 3-17: Airport Share in Total Air Passenger Demand

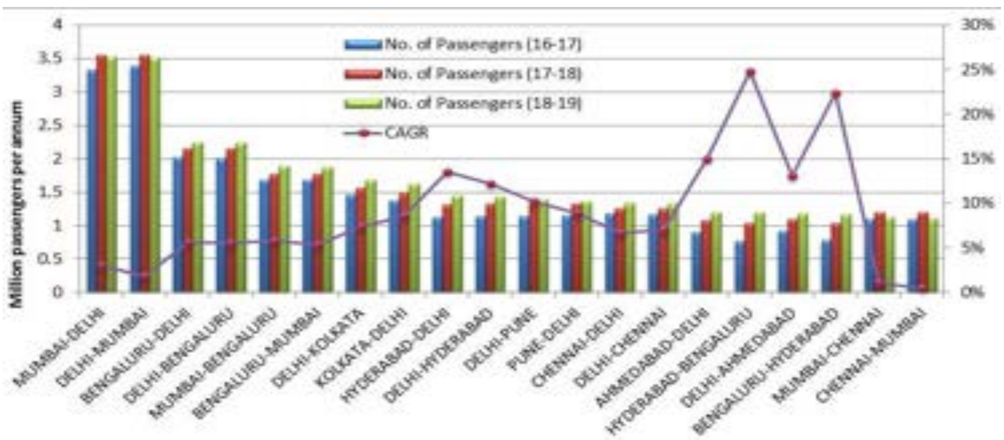


Figure 3-16: Passenger Quantum on Busiest Air Routes

Table 3-10: Air Passenger Growth at Top 20 Busiest Airports (Millions)

S. No.	Airports	FY 16-17			FY 17-18			FY 18-19			CAGR		
		Domestic	International	Total	Domestic	International	Total	Domestic	International	Total	Domestic	International	Total
1	Delhi	42.66	3.33	45.99	48.78	3.78	52.56	51.49	4.10	55.59	10%	11%	10%
2	Mumbai	32.54	2.96	35.50	34.74	3.24	37.98	34.85	3.40	38.25	3%	7%	4%
3	Bengaluru	19.26	0.84	20.09	22.98	0.91	23.89	28.73	1.04	29.77	22%	12%	22%
4	Hyderabad	12.51	0.75	13.26	15.96	0.81	16.77	19.34	0.88	20.22	24%	8%	23%
5	Kolkata	13.68	0.53	14.21	17.40	0.61	18.01	19.37	0.66	20.02	19%	11%	19%
6	Chennai	13.16	1.23	14.39	14.90	1.27	16.17	17.02	1.44	18.46	14%	8%	13%
7	Ahmedabad	6.25	0.28	6.53	7.93	0.27	8.20	9.77	0.29	10.06	25%	2%	24%
8	Pune	6.49	0.06	6.55	7.90	0.07	7.97	8.77	0.08	8.85	16%	13%	16%
9	Goa	N.A.	0.09	0.09	N.A.	0.11	0.11	7.67	0.10	7.77	NA	4%	N.A.
10	Kochi	4.13	1.17	5.30	5.17	1.21	6.38	5.54	1.23	6.77	16%	2%	13%
11	Lucknow	3.29	0.17	3.46	4.12	0.18	4.31	4.84	0.21	5.05	21%	12%	21%
12	Jaipur	3.32	0.10	3.42	4.23	0.13	4.37	4.85	0.12	4.97	21%	11%	21%
13	Bhubaneswar	2.28	0.00	2.28	3.21	0.01	3.22	4.13	0.03	4.16	35%	NA	35%
14	Coimbatore	1.98	0.03	2.01	2.24	0.05	2.28	2.76	0.06	2.82	18%	37%	18%
15	Visakhapatnam	2.28	0.02	2.31	2.39	0.03	2.43	2.74	0.04	2.78	10%	33%	10%
16	Nagpur	1.79	0.03	1.82	2.08	0.03	2.10	2.75	0.03	2.77	24%	-5%	23%
17	Trivandrum	1.60	0.57	2.17	2.01	0.61	2.61	2.00	0.63	2.63	12%	5%	10%
18	Varanasi	1.79	0.02	1.81	1.92	0.03	1.95	2.58	0.05	2.62	20%	60%	20%
19	Chandigarh	1.79	0.00	1.79	1.99	0.04	2.03	1.94	0.03	1.98	4%	244%	5%
20	Amritsar	1.06	0.12	1.19	1.67	0.15	1.82	1.71	0.18	1.89	27%	19%	26%

Source: DGCA, Ministry of Civil Aviation

3.5.4. Methodology for Passenger Demand Forecast

The base year passenger travel demand data was collated using the ticket sales data for each station provided by CRIS. This data was classified into 3 categories these are:

- ✓ Intercity AC (LDAC)
- ✓ Intercity Non-AC (LDNAC)
- ✓ Sub Urban (Sub)

The ticket sales data by each station was classified as per the above-mentioned categories. The data was further classified into various Traffic Analysis Zones (TAZs) based on the location of stations. This data was then converted into Origin-Destination matrices for Long Distance AC, Long Distance Non-AC and suburban passengers for the years 2016-17 and for 2017-18.

Passenger demand forecast stages are listed below:

- ✓ Stage 1 – Estimation of Horizon Year Production and Attraction Trips Ends: Sum total of all the horizontal rows of a Passenger Matrix is referred as Production Trip End and sum total of all the columns of a Matrix is referred as Attraction Trip Ends.
- ✓ Stage 2 – Trip Distribution: The horizon year production and attraction trip ends have been distributed in rows and columns to obtain horizon year passengers matrices for LDAC, LDNA and Sub-urban Passengers for the years 2021, 2031, 2041 and 2051.

Passenger Trip Generation

Using the passenger matrices, the total growth occurred between the years 2016-17 and 2017-18 was estimated for production and attraction trips ends respectively. Growth rate of production trip ends was analysed with total population and growth rate of attraction trip ends was analysed with the total workers' quantum for each TAZ, for the purpose of estimating the elasticity of production and attraction.

Once the elasticity is estimated for production and attraction of Intercity AC (LDAC) Trips, Intercity Non-AC (LDNA) Trips and Sub-urban passengers, same has been applied on the forecasted population and workers quantum for estimating future passenger quantum produced or attracted by each of TAZ (Trip Ends) for the cardinal years of 2026, 2031, 2041 and 2051.

Passenger Trip Distribution

After obtaining the horizon years production and trip ends as per the above-mentioned methodology same have been distributed for the purpose of obtaining passenger demand matrices. Globally accepted mathematical model namely 'Fratar Trip distribution model' has been used to distribute the forecasted trips.

Trip distribution refers to modelling the choice of destination zone for a particular trip originating from a particular zone. Various parameters define this choice; prominent of them is the travel distance and travel time. It is assumed that the quantum of trips being performed between 2 zones choice of destination is inversely proportion to the distances between them.

Forecast of Planning Variables

As described above, Population and Work Force Quantum have been used as planning variables for estimating production and attraction trip ends. Therefore, these planning variables have been forecasted for the purpose of estimating horizon year production and attraction. For this purpose, 2011 Census of India data has been used as baseline data and population is projected up to 2051. These projections are undertaken both at the national level, states, districts and Union Territories (UTs).

3.5.5. Passenger Forecast

Suburban Passenger Growth

Although separate growth rates have been estimated for all suburban systems in the country as described above. However, in order to be more realistic consultants collected the data related to suburban system expansion plans from respective suburban rail corporations. A detailed meeting in this regard was also held in Mumbai with MRVC. All the cities where suburban system is operating such as Mumbai, Chennai, Kolkata and Hyderabad, have recently got prepared Comprehensive Mobility Plans (CMP) in which the daily suburban ridership has been forecasted. These estimates have been adopted as it is and are allocated in the respective zones of the matrix.

Non - Suburban Passenger Growth Rates

For estimating passenger growth rates, the ratio of population growth rate and passenger growth rate for the base years has been estimated. The ratio was estimated using the passenger CAGR for last 10 years for all 3 categories and the population growth rate since 2011. Table below describes the estimated ratio between the population growth rate and passenger growth.

Table 3-11: Ratio between Population CAGR and Observed Passenger Growth Rates

	Passenger CAGR (%, 2008-2018)	Population CAGR (%)	Ratio
LDAC	9.1	1.11	0.12
LDNA	1.44	1.11	0.77

Future passenger growth rates were then estimated using the ratio mentioned in table above, which was then applied on the horizon year population growth rates for the years 2021, 2031, 2041 and 2051.

Table 3-12: Adopted Railway Passenger Growth Rates

Years	Projected Population CAGR (%)	Projected CAGR (%) LDAC	Projected CAGR (%) LDNA	Projected CAGR (%) Suburban	Grand Total
2019-21	1.11%	7.87%	9.33%	1.52%	5.35%
2021-26	0.79%	8.50%	3.44%	1.17%	2.50%

2026-31	0.80%	9.02%	3.48%	1.07%	2.62%
2031-41	0.44%	6.47%	3.00%	0.85%	2.34%
2041-51	0.45%	5.43%	2.81%	0.64%	2.28%

Using the above-mentioned growth rates, the passenger forecast has been made and same is described in table below:

Table 3-13: Rail Passenger Forecast (Millions)

Categories	2018	2021	2031	2041	2051
LDAC	154.03	252.23	586.42	1106.3	1887.78
LDNA	3,466.40	4538.54	6411.58	8687.69	11530.71
Total	3,620.43	4,790.77	6,998.00	9,793.99	13,418.49
Sub-Urban*	4,459.38	4,665.84	5,215.54	5,676.21	6,050.13
Grand Total	8,079.81	9,456.61	12,213.54	15,470.20	19,468.62

*Note: * Excludes Ridership Data of Kolkata Metro for the year 2017-18 which is otherwise included in Suburban Category*

Therefore, based on Fratar model distribution, the resultant values of annual passengers under all 3 categories have undergone minor adjustment. The adjusted horizon year passenger quantum which has been used in CUBE Voyager Fratar Module is listed in table below:

Table 3-14: Rail Passenger Forecast after Fratar Distribution (Millions)

Categories	2018	2021	2031	2041	2051
LDAC	154.05	252.24	584.08	1,093.20	1,854.68
LDNA	3,466.19	4,529.87	6,364.03	8,555.34	11,289.18
Total	3,620.24	4,782.11	6,948.11	9,648.55	13,143.86
Sub-Urban	4,459.38	4,665.84	5,215.54	5,676.21	6,050.13
Grand Total	8,079.62	9,447.95	12,163.65	15,324.76	19,194.00

*Note: * Excludes Ridership Data of Kolkata Metro for the year 2017-18 which is otherwise included in Suburban Category*

The above-mentioned annual passenger forecast was then converted into daily passenger volume for the purpose of assignment and obtaining section loads.

Table 3-15: Projected Daily Passengers (,000s)

Daily	2018	2021	2031	2041	2051
LDAC	422.00	691.04	1,606.63	3,030.96	5,172.00
LDNA	9,496.99	12,434.36	17,565.97	23,801.89	31,590.99
Total	9,918.99	13,125.40	19,172.60	26,832.85	36,762.99
Sub-Urban	12,217.49	12,783.12	14,289.16	15,551.27	16,575.71
Grand Total	22,136.47	25,908.51	33,461.77	42,384.12	53,338.70

3.6. Freight Demand Forecast

Freight movement by all possible modes such as Rail, Road, Air, IWT, etc has been captured and analysed for each commodity. Following sections detail out freight movement characteristics for each mode type

3.6.1. Freight Commodities/ Commodity Groups

This section presents the approach taken for identifying all relevant commodities/ commodity groups in the national freight ecosystem for further study with respect to future volume projection as well as potential strategies for enhancement in rail share.

Indian Railways identifies 346 freight commodities that can be classified under certain segments. Further, any freight commodity that has any movement by rail gets identified/ finds mention in the freight movement data of the Indian Railways. Based on stakeholder consultations with respect to relevance of considering distinct commodities[1]/ commodity groups for such a study, a benchmark of two (02) million-tonnes annual throughput on the rail system was considered and Freight Operations Information System (FOIS) database was accordingly analysed to identify such commodities.

Figure 3-18: – Freight Commodity Groups

To ensure that the set of freight commodities/ commodity groups identified is representative of all major commodities within the national freight eco-system, broader reference was also made to industrial output and commodities that underpin/ drive the same. The following sources were referenced in this regard:

- National Account Statistics, Government of India: Provides goods classification based on Gross Value Added.
- Annual Survey of Industry: Provides classification based on value of total output.
- Index of Industrial Production: Provides comparative changes in volume of production of a basket of industrial products for given period with respect to a preferred base period.

Such identified commodities were compared against the list of commodities considered by Indian Railways. It was found that IR's classification was comprehensive.

[1] Non-Commercial or internal traffic like Ballast, though above benchmark, were not included

The commodities were grouped as illustrated below and further study/ projections undertaken for the identified commodities/ commodity groups. This provided the basis for use of Indian Railways' FOIS data representing rail freight flows, as well as road surveys for mapping commodity flows in the rest of the national freight ecosystem.

3.6.2. Rail Freight Characteristics

Freight movement data for the year 2017-18 was collected from Ministry of Railways and same has been analysed in order to understand the characteristics. Following sections detail out salient feature of freight movement. Also, the movement pattern by each commodity has been analysed and explained in sections below.

Railway Freight Growth Trends

Freight movement by rail has grown at CAGR of 3.74%. Maximum growth rate (9%) was witnessed in case of Steel, followed by Pig Iron. Finished Steel and Exim Containers both witnessing a CAGR of 7%. Domestic containers and coal both have grown at CAGR 5% and 4.62% respectively.

Table 3-16: Railway Freight Growth Trends

Commodity	FY 9	FY 10	FY 11	FY 12	FY 13	FY 14	FY 15	FY 16	FY 17	FY 18	CAGR
Coal	369.63	396.1	420.37	455.81	496.42	508.6	545.81	551.83	532.83	555.2	4.62%
RM for Steel	10.85	11.6	13.3	14.51	15.6	17.33	18.28	20.29	22.75	23.7	9.07%
Pig Iron & Finished Steel	28.58	31.85	32.82	35.15	35.31	38.95	42.84	44.79	52.41	54.36	7.40%
Iron Ore	130.58	132.74	118.46	104.7	111.4	124.27	112.77	116.94	137.55	139.8	0.76%
Cement	86.24	93.15	99.08	107.66	105.87	109.8	109.8	105.35	103.29	112.96	3.04%
Food grains	35.51	38.69	43.45	46.4	49.03	55.1	55.47	45.73	44.86	43.79	2.36%
Fertilizers	41.35	43.68	48.22	52.7	46.21	44.7	47.41	52.23	48.34	48.53	1.79%
POL	38.08	38.88	39.29	39.77	40.61	41.16	41.1	43.24	42.42	43.11	1.39%
Containers-Exim	23.29	25.32	26.58	28.54	31.69	32.61	37.88	36.79	37.01	42.82	7.00%
Containers-Domestic	7.05	9.63	11.01	9.48	9.35	10.93	10.5	9.04	10.34	11.12	5.19%
BOG	62.23	66.1	69.15	74.33	66.6	68.75	73.4	75.28	74.35	84.09	3.40%
Total	**833.39**	**887.74**	**921.73**	**969.05**	**1,008.09**	**1,052.2**	**1,095.26**	**1,101.51**	**1,106.15**	**1,159.48**	**3.74%**

Growth in Ton- Kilometres on IR

Railways registered 0.65 Billion freight ton kilometres in the year 2017-18. Of these coal and coke account for 41% of total freight ton Km followed food grains and cement having 9% each.

Table 3-17: Freight Ton Km 2017-18 (Millions)

Commodity	Ton-Km	Share
Coal and coke	267,613	40.7%
Food grain	61,914	9.4%
Cement	60,288	9.2%
Containers	49,094	7.5%

Commodity	Ton-Km	Share
Balance Other Goods	47,562	7.2%
Pig Iron and Finished Steel	45,293	6.9%
Iron Ore	41,928	6.4%
Fertilizers	41,316	6.3%
POL	27,489	4.2%
RM for Steel	15,336	2.3%
Total	657,833	100.0%

Source: Analysis of CRIS Data, 2017-18

Composition of Freight Traffic on IR

From the analysis of the freight data for the year 2017-18, it is observed that a total of 1163 million tonnes of freight was carried by Indian Railways. Of this, Coal and Coke was the dominant commodity, accounting for 48% share, followed by Iron ore (12%), Cement (10%).

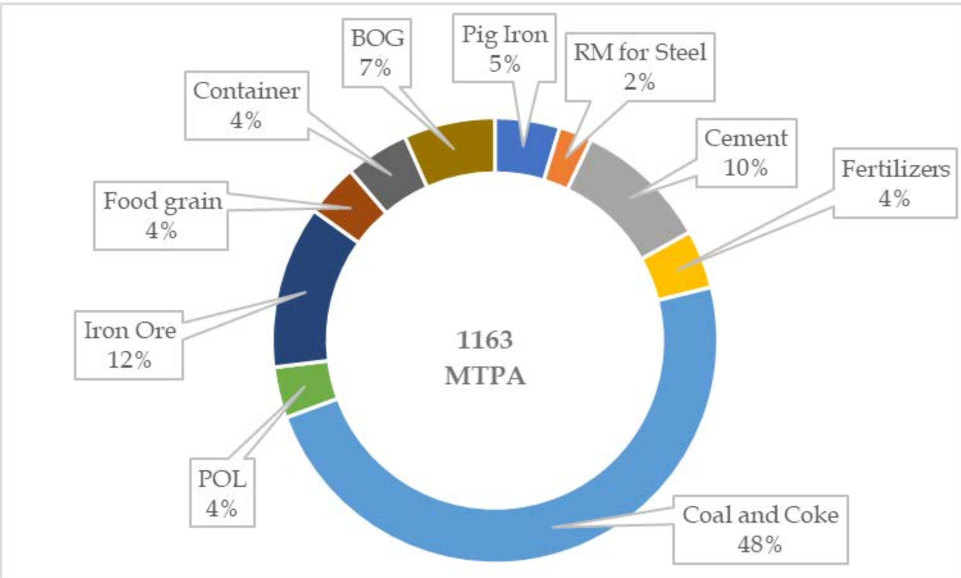


Figure 3-19: Commodity Composition of Rail Freight Fy18

3.6.3. Freight Forecast Methodology

The potential overall requirements for transportation of commodities/ commodity groups were analysed & projected using the following framework.

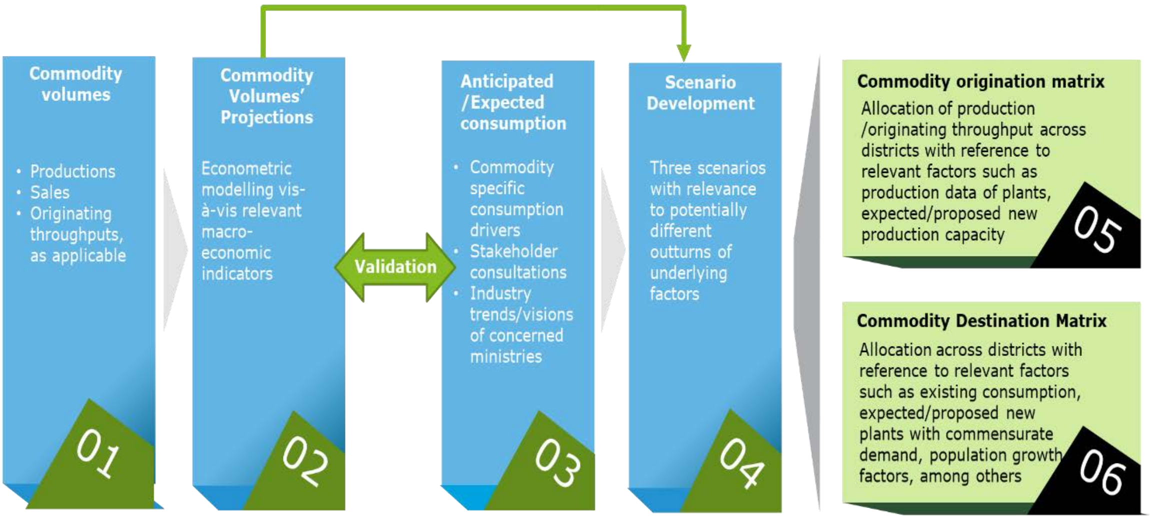


Figure 3-20: – Methodology for Freight Volume & Transportation Requirement Projections

1. Commodity Volumes: Depending on the commodity/ group, production/ sales or originating throughput volumes were taken as the base for projecting overall commodity volumes in the future – over various Projections period.

2. Commodity Volume Projections: Econometric modelling was undertaken to project growth in commodity volumes in future by identifying appropriate macroeconomic indicators vis-à-vis nature of the commodity and through evaluation of potential relationships.

   The base year for Projections was taken as FY 17-18 (April 2017-March 2018) on account of data availability considerations - given the delay in release of FY 18-19 data/ statistics for several commodities by various stakeholders[2].

   Some of the macro-economic indicators evaluated included economic growth (represented by GDP), industrialization (represented by IIP), production and consumption patterns, pace of urbanization, per capita Income, and per capita GDP. Other components of such modelling included:

   ✓ Selection of relevant causal factors (independent variables) based on possible correlations combined with expert judgement;
   ✓ Unique nature of commodities/ groups and corresponding market dynamics, as well as data availability informed the approach/ modelling;
   ✓ Collection of historical data (long time series) to allow coverage of business cycles, lending robustness to the modelling;
   ✓ Statistically estimating and testing relationships between independent variable(s) and commodity volumes - inspecting historical data and fitment of various functional forms (Log-Log, Log-linear, VAR model etc);

[2] This also provided an opportunity to validate the forecast against actual FY19 numbers, where available.

- ✓ For identifying potential modelling errors, goodness of fit was checked by studying the pattern of variation of projected values from actual data for past years.

3. Validation of Commodity Volume Projections with Anticipated/ Expected Consumption Trends: The Projections were validated by comparing them against anticipated/ expected consumption trends. This was important so that any factors at variance from past trends could be accounted for and considered.
4. The anticipated/ expected consumption trends were constructed based on extrapolation of commodity specific trends and expected consumption drivers in future, stakeholder consultations on expected growth of underpinning industry segments, growth plans of key consumers (especially institutional) as well as targets prescribed/ adopted by concerned agencies/ ministries.
5. Scenario Development: Three scenarios were considered for commodity volume Projections – with an intent to span/ account for potentially higher as well as lower outturns vis-à-vis the base Projections. For the same, scenarios of the identified independent variables were in turn considered. For example, varying level of GDP Projections were considered for the Projections horizon period.
6. Commodity Origination Matrix: The production/ sales or originating throughput volumes (depending on the commodity/ group) projected over various Projections period were allocated across various districts (the smallest unit taken for such allocation) of the country with reference to relevant factors like production data of plants, expected/ proposed new project capacity, etc. The resultant was the Origin Data-Matrix for the commodity.
7. Commodity Destination Matrix: To model the potential evolution of transportation requirements in future, an independent assessment was also made of how the commodities would be consumed (requiring transportation to such points) across various districts of the country. This allocation had reference to relevant factors like existing consumption pattern, expected/ projected new consumption centres (with commensurate demand), population growth factors, etc.

3.6.4. Assumptions and Limitations

The Projections exercise had reference past trends as well as relationships evaluation vis-à-vis independent variables and had certain constraints/ limitations as under:

- ✓ Future events that cause a disruptive change to the underlying relationships between independent variables and commodity volumes can essentially not be ruled out/ accounted for;
- ✓ Volumes for various commodities/ groups in future could combine across different Projections scenarios across such commodities/ groups – resulting in a broader range of overall freight volume scenarios;

3.6.5. Consolidated Projections

Total commodity volumes in the national freight ecosystem in FY 18-19 were projected at 4,708 MT as illustrated in figure below:

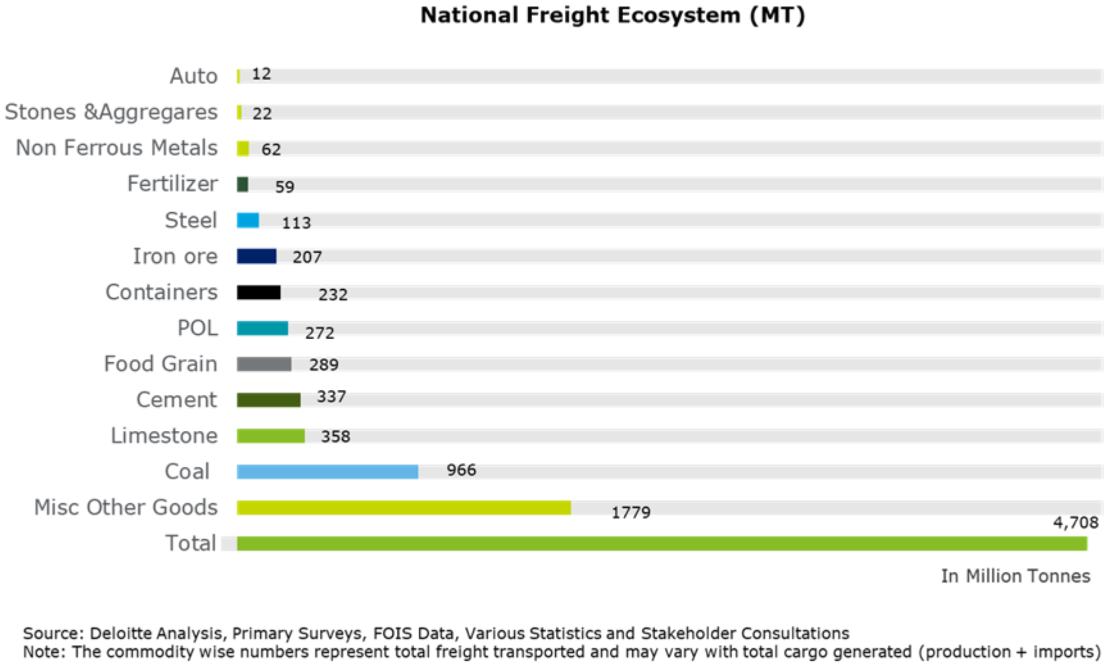


Figure 3-21: – National Freight Ecosystem

Production and consumptions will grow in future. For projection of Future demand of different commodities, different time frames are considered such as 2019-2021, 2021-2026, 2026-2031, 2031-2041 & 2041-2051. Detail projections of each commodity have already been explained in **Demand Forecast Report.** The Cumulative Annual Growth rate of different commodities are given in Table below.

Table 3-18: Phase wise CAGR of Commodities

Commodity wise CAGR	2019-2021	2021-2026	2026-2031	2031-2041	2041-2051
BOG	4%	7%	6%	3%	3%
Cement	14%	9%	6%	5%	5%
Coal	12%	3%	4%	3%	0%
Container	20%	5%	6%	5%	4%
Fertilizer	14%	6%	5%	4%	4%
Food grains	5%	3%	3%	3%	3%
Iron Ore	2%	6%	5%	4%	3%
Pig Iron	22%	6%	6%	4%	3%
POL	17%	8%	5%	4%	4%
Steel RM	6%	6%	5%	4%	3%
Total	9%	6%	5%	4%	3%

Total freight demand forecast by commodity are listed in table below.

Table 3-19: Projected Commodity Demand in Million Tons

Commodity (Demand)	2019	2021	2026	2031	2041	2051
BOG	2,172	1,922	2,638	3,499	4,774	6,309
Cement	339	399	601	813	1,355	2,114
Coal	965	1,052	1,237	1,502	2,081	2,136
Container	231	316	411	546	870	1,264
Fertilizer	61	74	100	128	196	284
Food grains	287	315	362	416	541	701
Iron Ore	207	221	295	377	569	798
Pig Iron	113	121	164	215	322	452
POL	273	329	484	629	930	1,323
Steel RM	61	56	74	95	143	200
Total	**4,709**	**4,805**	**6,366**	**8,220**	**11,780**	**15,583**

A summary snapshot of the consolidated Projections is presented in figure below.

S.No.	Commodity	Sub-commodity	Cases	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040	2045	2050
1	Cement (MT)		Optimistic			377	420	465	512	562	614	670	729	792	858	928	1337	1850	2480	3240
			Realistic	298	337	361	373	423	487	539	568	582	601	637	688	743	959	1242	1582	1986
			Pessimistic			359	371	386	410	444	478	508	533	558	587	620	797	1007	1256	1555
2	Steel (MT)	Iron Ore	Optimistic			210	225	242	260	279	299	321	345	370	398	427	594	796	1038	1321
			Realistic	201	207	209	219	237	247	263	276	292	308	325	340	356	444	541	647	762
			Pessimistic			206	215	230	238	250	261	274	286	300	311	323	385	447	510	573
		Finished Steel	Optimistic			121	130	140	150	161	173	185	199	214	229	246	342	459	598	761
			Realistic	105	113	120	126	137	143	151	159	169	177	187	196	205	256	312	373	439
			Pessimistic			118	124	133	137	144	150	158	165	173	179	186	222	258	294	330
3	Limestone (MT)		Optimistic			423	471	521	574	629	689	751	818	888	962	1041	1499	2074	2780	3632
			Realistic	339	358	403	430	457	485	513	542	571	602	633	666	699	878	1077	1298	1538
			Pessimistic			396	418	439	461	483	505	527	550	572	595	618	736	855	974	1093
4	Fertilizers (MT)	Fertilizer Products (Urea, DAP, MOP, Complex fertilizer, SSP)	Optimistic			66	72	79	85	92	99	106	114	122	130	138	189	250	325	416
			Realistic	57	59	64	69	73	78	83	88	93	99	104	110	116	145	179	217	260
			Pessimistic			61	65	69	73	77	81	86	90	94	99	104	118	147	180	216
5	Foodgrains (MT)		Optimistic			302	313	325	338	350	364	377	392	406	422	438	533	648	789	960
			Realistic	285	289	298	307	316	325	334	344	353	363	374	384	395	450	513	585	666
			Pessimistic			293	301	308	315	323	331	339	347	355	364	373	413	470	533	604
6	POL (MT)		Optimistic			292	312	334	357	382	409	438	468	501	536	574	805	1129	1583	2220
			Realistic	254	272	291	310	330	350	370	391	412	434	457	480	504	669	821	989	1173
			Pessimistic			285	301	317	333	348	364	380	396	413	429	446	561	652	743	833
7	Coal (MT)		Optimistic			1021	1047	1058	1115	1173	1232	1293	1355	1418	1484	1547	1907	2267	2611	2921
			Realistic	885	966	1003	1020	1022	1069	1115	1162	1209	1256	1305	1354	1400	1656	1888	2085	2237
			Pessimistic			984	991	983	1018	1052	1086	1119	1152	1185	1218	1248	1410	1536	1622	1664
8	Automobiles (in Million Tonnes)	Passenger Vehicles, Commercial Vehicles, Three Wheelers, Two Wheelers	Optimistic			12	13	14	15	17	18	19	21	22	24	26	37	53	72	97
			Realistic	10	12	11	12	12	13	13	14	14	15	16	16	17	21	25	30	36
			Pessimistic			11	11	11	11	11	12	12	13	13	14	14	17	20	23	26
9	Metals & Ores (MMT)	Aluminium, Bauxite Ore, Copper, Copper Ore, Lead and Zinc, Lead and Zinc Ore	Optimistic			71	77	83	90	97	105	113	122	132	142	153	216	293	386	497
			Realistic	44	62	68	74	80	86	92	99	105	112	119	126	133	173	217	266	319
			Pessimistic			66	71	76	81	85	90	95	100	105	110	115	140	166	193	218
10	Stones & aggregates	Marble, Laterite	Optimistic			25	27	29	32	34	37	39	42	45	48	51	67	87	110	136
			Realistic	21	22	24	26	28	30	33	35	37	39	42	44	46	60	75	91	109
			Pessimistic			24	25	27	29	30	32	34	35	37	39	40	49	58	67	76
11	Containers (MMT)		Optimistic			254	275	297	320	346	374	404	436	471	509	549	785	1080	1440	1871
			Realistic	218	232	253	274	295	317	339	362	385	409	434	459	485	625	781	953	1140
			Pessimistic			247	265	282	300	317	335	352	370	388	406	424	517	614	710	804
12	Miscellaneous Other Goods		Optimistic			1800	1926	2061	2206	2360	2525	2702	2891	3093	3310	3542	4213	5011	5960	7090
			Realistic		1779	1792	1908	2033	2165	2305	2455	2615	2785	2966	3159	3364	3857	4422	5070	5814
			Pessimistic			1771	1864	1962	2065	2173	2287	2407	2534	2667	2807	2954	3264	3607	3985	4403
13	**Total National freight throughput (MT)**		Optimistic			**4974**	**5308**	**5647**	**6053**	**6482**	**6938**	**7419**	**7932**	**8474**	**9052**	**9660**	**12524**	**15998**	**20173**	**25162**
			Realistic		**4709**	**4898**	**5150**	**5443**	**5794**	**6151**	**6493**	**6837**	**7200**	**7597**	**8021**	**8464**	**10193**	**12094**	**14186**	**16479**
			Pessimistic			**4821**	**5022**	**5223**	**5471**	**5739**	**6012**	**6292**	**6571**	**6859**	**7157**	**7465**	**8631**	**9837**	**11090**	**12396**

Figure 3-22: – National Freight Ecosystem Detail Breakup

Chapter 4 ESTIMATION OF RAIL FREIGHT SHARE

4.1. Background

One of the objectives of the National Rail Plan is to ascertain the share of Rail in transporting freight for each of the commodity type and to provide strategies for enhancing the rail share. In continuation of the same, total freight forecast by commodity has been estimated in the previous chapter. Therefore, the next step is to estimate the share of rail in carrying the commodities considering the future, production, demand and railway infrastructure improvement proposal. The chapter discusses in detail the share of rail in the base year and what shall be the future rail share with respect to various ongoing and proposed railway projects.

4.2. Base Year Railway Share in Freight Movement

A total freight movement of 4,464 Million Tonnes occurred across the country. Of which 1,162 million tonnes were moved by rail whereas 2,911 million tonnes were moved by road. on the overall railways registered a market share of 26% in the total freight movement. Refer Table below.

Table 4-1: Share of Railways in Total Freight Movement (2017-18)

Mode	Tonnes (Millions)	Share (%)	NTKM (Billions)	NTKMS
Rail	1162.72	26%	616.38	29%
Road	2911.76	65%	1521.04	71%
Coastal Shipping	234	5%	N.A.	
IWT	72	2%	N.A.	
Pipeline	84	2%	N.A.	
TOTAL	**4464.48**	**100%**	**2137.42**	**100%**

4.2.1. Total Freight Distribution

Analysis related to total freight generation and the modal share has been analysed in historical perspective by comparing the data collected as part of present study with that of the data collected as part of Total Transport Study Report. Total freight movement carried by Road and Rail has almost doubled since 2007-08 from 2,327 MT to 4,074 MT in 2018-19. Total traffic carried by rail has increased from 768 MT in 2007-08 to 1162 MT in 2018-19. Total traffic carried by Road has increased from 1,559 MT in 2007-08 to 2,911 MT.

Total freight movement having leads up to 300 Km have increased from 840 MT in 2007-08 to 1829.16 in 2018-19. Total freight movement having leads beyond 300 Km has increased from 1486 MT in 2007-08 to 2245 MT in 2018-19. It is pertinent to note that share of Rail in freight movement having leads beyond 300 Km has fallen from 51.5% (765 MT) in 2007-08 to 32.4% (727 MT) in 2018-19. However, quantum of freight movement has remained same, but share has fallen due to overall increase in the freight generation clearly stating the issue related to stagnation of supply of railway freight wagons.

Table 4-2: Total Freight Distribution (Million Tonnes)

Total Traffic	**2017-18**	**2007-08#**
a) Traffic carried by Road Transport	2911.76	1558.87
b) Traffic Carried by Rail	1162.72	768.72
c) Traffic Rail & Road (a+b)	4074.48	2327.59
d) Traffic Road Leads up to 300 km	1393.14	837.89
e) Traffic Rail leads up to 300 km	436.03	2.90
f) Total Traffic leads up to 300 km (d+e)	1829.16	840.79
g) Total Potential Traffic Moving Beyond 300 km		
- Rail	726.69	765.82
- Road	1518.62	720.98
Total	**2245.31**	**1486.80**
Rail Share in Potential Traffic*	**32.4%**	**51.5%**
* % of Rail traffic (726.7MT) to total (2245.3MT)		

Source: # Total Transport Study Report, RITES

4.2.2. Lead and Load Distribution (Road and Rail)

Analysis related lead and load analysis has been made for both Road and Rail. In case of rail, 38% (436 MT) of total freight carried is in the lead range of 300 Km and 70% (786 MT) of total freight carried by rail is in the lead range of 600 Km.

In case of road, 48% (1393 MT) of total freight carried by road is in the range of 300 Km and 70% (339 MT).

Table below provides the detailed analysis of lead and load for both Road and Rail.

Table 4-3: Lead and Load Analysis, Road and Rail (2017-18)

Distance Slab (km)	**Tonne (Million)**			**Tonne Km (Million)**			**Average Lead (Km)**		
	Rail	**Road**	**Total**	**Rail**	Road	**Total**	**Rail**	**Road**	**Total**
up to 100	175.32	428.15	603.47	3,163.07	20,163.78	23,326.85	18.04	47.09	38.65
100-200	151.86	624.22	776.09	24,090.00	92,827.46	1,16,917.46	158.63	148.71	150.65
200-300	108.84	340.76	449.60	26,727.25	84,614.06	1,11,341.31	245.56	248.31	247.64
300-400	144.35	304.86	449.21	50,054.92	1,07,496.40	1,57,551.32	346.76	352.61	350.73
400-500	101.34	179.57	280.91	45,579.41	80,422.56	1,26,001.97	449.75	447.87	448.55
500-600	104.56	156.40	260.96	57,373.36	86,200.13	1,43,573.49	548.70	551.15	550.17
600-1200	250.06	492.85	742.91	2,11,741.35	4,19,788.68	6,31,530.03	846.76	851.76	850.08
1200 - 1800	102.03	279.08	381.10	1,45,264.04	4,03,697.50	5,48,961.54	1423.78	1446.55	1440.45
1800 - 2400	19.10	89.32	108.42	38,716.06	1,81,424.25	2,20,140.31	2027.21	2031.11	2030.42
2400 - 3000	4.95	14.93	19.88	12,730.09	39,227.55	51,957.64	2572.34	2627.36	2613.66
Above 3000	0.30	1.61	1.92	936.02	5,178.89	6,114.91	3097.17	3206.89	3189.59
Total	**1,162.72**	**2,911.76**	**4,074.48**	**6,16,375.57**	**15,21,041.26**	**21,37,416.83**	**530.11**	**522.38**	**524.59**

4.2.3. Share of Railways in Various Commodity Movement

An analysis has been carried out in order to understand, share of each of the top 9 commodities in both road and rail as modes.

As described above, the total freight moved by both road and rail combined in the year 2018-19 is 4,074.5 Million Tonnes, of which 1162 MT (29%) was carried by Rail and 2911 MT (71%) were carried by road. Of the all main commodities, maximum quantum is of Coal both in Road and Rail. A total of 860 MT of coal was carried in total, of which 560 MT (65%) was carried by Rail and 298.5 MT (35%) was carried by road.

Balanced other Goods (BOG) comprise of various commodities carried either by containers or by bulk. A total of 1767 MT of BOG has been transported, of which 1690 MT (96%) were transported by Road and only 77 MT (4%) were transported by Rail.

Of the other main commodities, barring Coal, Cement, Food Grains and POL has maximum share in total quantum of freight generation which is 305 MT, 284 MT and 241 MT respectively. In case of Cement, 37% has been transported by Rail and remaining 63% was transported by Road, in case of Food Grains, 16% was transported by Rail and 84% was transported by Road and in case of POL 18% was transported by Rail and 82% was transported by Road.

Of all the 9 commodities, maximum share of Rail is in case of Fertilisers (87%) followed by Pig Iron (68%), Coal (65%), Iron Ore (65%) and RM for Steel (56%).

In case of Road, maximum share is of BOG (96%) followed by Food Grains (84%), POL (82%), Container (76%) and Cement (63%). Table below presents the share of various commodities carried by both road and rail.

Share of each commodity in the total freight transported by Rail and Road along with their respective NTKMs is presented in the table below.

As per the analysis, of the all commodities carried by Rail Coal has maximum (48%) share followed by Iron Ore (12%). Of the all commodities carried by road BOG has maximum share (58%) followed by Coal (10%).

Table 4-4: Commodities Distribution for Rail and Road (2017-18)

S. No	Commodity	Rail				Road				Total	
		Million Tonnes	Share (%)	NTKMs (Millions)	Share (%)	Million Tonnes	Share (%)	NTKMs (Millions)	Share (%)	Million Tonnes	NTKMs (Millions)
1	Pig iron	54.78	5%	44,068.5	7%	26.22	1%	15,983.6	1%	81.00	60,052.1
2	RM for Steel	27.90	2%	14,754.0	2%	21.90	1%	12,009.9	1%	49.80	26,763.8
3	Cement	114.05	10%	57,442.4	9%	191.16	7%	92,485.5	6%	305.21	1,49,927.9
4	Fertilizer	49.18	4%	38,189.0	6%	7.65	0%	5,842.8	0%	56.84	44,031.7
5	Coal	560.75	48%	2,48,602.0	40%	298.52	10%	1,89,463.4	12%	859.26	4,38,065.4
6	POL	43.11	4%	26,914.0	4%	198.13	7%	1,67,231.3	11%	241.24	1,94,145.4
7	Iron Ore	137.46	12%	33,922.3	6%	73.38	3%	35,001.3	2%	210.84	68,923.6
8	Food grain	44.84	4%	59,016.2	10%	239.16	8%	1,02,284.8	7%	284.00	1,61,301.0
9	Container	53.63	5%	47,460.4	8%	165.37	6%	89,234.1	6%	219.00	1,36,694.5
10	BOG	77.03	7%	46,006.8	7%	1,690.26	58%	8,11,504.6	53%	1,767.29	8,57,511.4
	Total	**1,162.72**	**100%**	**6,16,375.57**	**100%**	**2,911.76**	**100%**	**15,21,041.26**	**100%**	**4,074.48**	**21,37,416.83**

4.2.4. Average Trip Length by Commodity Type (Rail and Road)

Analysis related to average trip length by each commodity by both road and rail has been made for the purpose of analysing the lead of each commodity. The maximum average lead in case of Rail is for Food Grains (1316 Km), followed by Containers (885 Km), Pig Iron (804 Km) and Fertilisers (776 Km). in case of Road, the maximum average lead is for POL (844 Km), followed by Fertilisers (763 Km) and Coal (634 Km). on the overall, the average leads for Rail is 530 Km and for Road is 522 Km.

Table 4-5: Mode wise Average Leads by Commodity Type (2017-18)

S. No	Commodity	Rail	Road	All Modes (Km)
1	Pig Iron	804.5	609.7	741.4
2	RM for Steel	528.8	548.4	537.4
3	Cement	503.7	483.8	491.2
4	Fertilizer	776.4	763.3	774.7
5	Coal	443.3	634.7	509.8
6	POL	624.3	844.0	804.8
7	Iron Ore	246.8	477.0	326.9
8	Food grain	1316.2	427.7	568.0
9	Container	885.0	539.6	624.2
10	BOG	597.3	480.1	485.2
Overall		**530.1**	**522.4**	**524.6**

4.3. Estimation of Railway Mode Share

Previous sections have explained in detail the scenario of freight movement in the country and share of Railways for each commodity. Going forward, the demand for both passengers and freight is required to be estimated and also the share that can be carried by Railways. For this purpose, mode split modal using Binary Logit has been prepared for the base year. The modal split model shall estimate the probability of share carried by railways based on certain parameters. Following section explains the model development, its calibration and estimation of future rail share for each of the commodities.

4.3.1. Existing Scenario

As of 2017-18 31,57,803 metric tons of commodities are moved daily in India. Cumulatively 4,059 million tons per year. Out of 4,059 million tons of commodities, transferred cumulatively by Road and rail, 28.40% commodities by weight is carried by the Indian Railway. 1,162.6 Million tons of commodities are handled by the Rail every year i.e. 3,157,802.5 tons per day. Which is a huge quantity of commodity to move every day. Major commodities which are transferred every day are Cement, Coal, Container, Fertilizer, Food grains, Iron Ore, Pig Iron & Finished Steel, Petroleum Oil and Lubricants, Raw Materials for Steel etc.

Table 4-6: Present Condition of Commodity Movement (2017-18)

Commodity	Total Commodities in Million Tonnes/ year (Rail)	Total Commodities in Million Tonnes/ year (Road)	Total Commodities in Million Tonnes/ year (Road and rail)	Tonnes/ Day by Rail	Tonnes/ Day by Road	Total Freight Movement (Tonnes/ Day)
BOG	77	1,690	1,767	211,040	46,30,849	4,841,889
Cement	114	191	305	312,465	5,23,726	836,191
Coal	561	299	859	1,508,561	8,17,863	2,326,424
Container	54	165	219	146,927	4,53,068	599,995
Fertilizer	49	8	57	134,751	20,959	155,710
Food grains	45	239	284	122,843	6,55,233	778,076
Iron Ore	137	73	211	376,593	2,01,041	577,634
Pig Iron	55	26	81	108,733	71,836	180,569
POL	43	198	241	118,111	5,42,822	660,933
Steel RM	28	22	50	76,434	60,000	136,434
Total	1,163	2,912	4,074	3,116,458	79,77,397	11,093,855

4.3.2. Future Freight Projections

Production and consumptions will grow in future. For projection of Future demand of different commodities, different time frames are considered such as 2019-2021, 2021-2026, 2026-2031, 2031-2041 & 2041-2051. Detail projections of each commodity have already been explained in **Chapter 3.** The Cumulative Annual Growth rate of different commodities are given in Table below.

Table 4-7: Phase wise CAGR of Commodities

Commodity wise CAGR	2019-2021	2021-2026	2026-2031	2031-2041	2041-2051
BOG	4%	7%	6%	3%	3%
Cement	14%	9%	6%	5%	5%
Coal	12%	3%	4%	3%	0%
Container	20%	5%	6%	5%	4%
Fertilizer	14%	6%	5%	4%	4%
Food grains	5%	3%	3%	3%	3%
Iron Ore	2%	6%	5%	4%	3%
Pig Iron	22%	6%	6%	4%	3%
POL	17%	8%	5%	4%	4%
Steel RM	6%	6%	5%	4%	3%
Total	9%	6%	5%	4%	3%

Total freight demand forecast by commodity are listed in table below.

Table 4-8: Projected Commodity Demand in Million Tonnes

Commodity (Demand)	2019	2021	2026	2031	2041	2051
BOG	2,172	1,922	2,638	3,499	4,774	6,309
Cement	339	399	601	813	1,355	2,114
Coal	965	1,052	1,237	1,502	2,081	2,136
Container	231	316	411	546	870	1,264
Fertilizer	61	74	100	128	196	284
Food grains	287	315	362	416	541	701
Iron Ore	207	221	295	377	569	798

Commodity (Demand)	2019	2021	2026	2031	2041	2051
Pig Iron	113	121	164	215	322	452
POL	273	329	484	629	930	1,323
Steel RM	61	56	74	95	143	200
Total	**4,709**	**4,805**	**6,366**	**8,220**	**11,780**	**15,583**

4.3.3. Mode Choice Model

In order to estimate the rail share, binary logit model has been used. This model was first applied on the base year freight demand for the purpose of calibration so that the estimated modal parameters (coefficients) provide results similar to what has been observed. These parameters will then be used to estimate future rail share.

Choice of Mode to be used is dependent on various factors. Two of the most important factors are Travel Time and travel cost. Other factors are availability of modes, predominant bias towards any mode, transferability and last mile haulage of that commodity and reliability etc. Mode choice model has been developed based on the most evident factors of any goods transfer i.e. Travel Time and Travel Cost and the Probability of any Commodity to be transferred by any mode has been estimated by the Binary Logit Model. Utility equation is developed by the Difference of Travel time and Difference of Travel cost of the same Origin-Destination pairs of two different Modes (Road and Rail).

Utility Equation is derived in the form of, $y = \alpha + \beta \times \delta TT + \gamma \times \delta TC$

Where,

α = Constant

β = Coefficient of Difference of Travel Time

γ = Coefficient of Difference of Travel Cost

δTT = of Difference of Travel Time

δTC = of Difference of Travel Cost

and the probability equation for Binary Logit of using rail as a mode to transfer a commodity is derived as, $P(Rail) = \frac{e^{\lambda y}}{1+e^{\lambda y}}$

Where,

y = Utility Equation.

λ = Calibration factor

The coefficient and Constants as estimated from the base year modal calibration are described in the Table below:

Table 4-9: factors of Logit Model (Freight)

Commodities	α	β	γ	ʎ
BOG	-6.4888000	-0.0802750	-0.0041350	0.9733726
Cement	-1.6912554	-0.0074710	-0.0020270	0.5904951
Coal	2.7096500	-0.0371550	-0.0006130	0.3785395
Container	-2.1570188	-0.1100354	-0.0002078	0.8819811
Fertilizer	1.7919700	-0.0080090	-0.0003010	1.0818453

Commodities	α	β	γ	ʎ
Food grains	-2.2142800	-0.0057490	-0.0016370	1.5583742
Iron Ore	2.4188600	-0.0678320	-0.0012270	0.6576445
Pig Iron	-0.1540670	-0.0408710	-0.0073230	0.1429972
POL	-1.4237100	-0.0892460	-0.0006100	0.4563849
Steel RM	1.5171170	-0.0254710	-0.0009290	0.1942935

4.3.4. Distribution of Future Origin-Destination Matrix

The total freight demand forecast by commodities has been done as total quantum that shall be produced by each zone and total quantum that shall be attracted by each zone. This kind of forecast is normally referred to as trip ends. These Trip Ends are required to be distributed in the form of Origin-Destination Matrix. This distributed Origin-Destination Matrix shall be required for each of the cardinal year. On this distributed matrix the Modal Split (Binary Logit) Model shall be applied for obtaining future Rail Origin Destination Matrices. Therefore, for preparing the future freight matrices, Fratar Distribution model has been adopted.

The Fratar Method is used for future trip distribution. Fratar Method is a growth factor trip distribution method there the cell values of the matrix are multiplied by a factor. The advantage of this method is the no iteration is required to generate the future matrix. This method is used to overcome some of the disadvantages of the constant factor and average factor methods. According to this method, the total trips for each zone are distributed to the interzonal movements, as a first approximation, according to relative attractiveness of each movement. Thus, the future trips estimated for any zone would be distributed to the movements involving that zone in proportion to the existing trips between it and each other zone and in proportion to the expected growth of each other zone. This may be expressed as

$$T_{i-j} = t_{i-j} \times \frac{P_i}{p_i} \times \frac{A_j}{a_j} \times \frac{\sum_1^k t_{i-k}}{\sum_1^k \left[\frac{A_k}{a_k}\right] t_{i-k}}$$

Where,

Ti-j	=	Future trips from zone i to zone j
ti-j	=	Present trips from zone i to zone j
Pi	=	Future trips produced at zone i
pi	=	Present trips attracted at zone i
Ai	=	Future trips attracted to zone j
aj	=	Present trips attracted to zone j
k	=	Total numbers of zones

When the future traffic into and out of all zones is similarly distributed, each interzonal trip has been assigned two tentative values – one the result of the distribution for one of the zones involved and the other, the result of the distribution for the other zone involved. As a first approximation those pairs of tentative values are averaged. A new 'growth factor' for each zone is then calculated and the distribution process is repeated.

The procedure is laborious except for simple problems but can be conventionally tackled by a computer. It has the same drawbacks as other growth factor models and is unable to forecast trips for those areas which were predominantly under-developed during the base year. It does not consider the effects of changes in accessibility for various portions of the study area.

4.3.5. Scenario Building

As described the sections above, the Logit Model is based on 2 major parameters which are Time and Cost. Any change in these parameters may impact the probability of moving Freight by Rail. In short, the rail share may either increase or decrease if these parameters are altered. Therefore, various scenarios have been considered in order to estimate the future rail share. These scenarios use values of Time and Cost based on various projects of both Road and Rail that shall be implemented in due course.

Scenarios were built to project the rail share and to estimate the shift to Rail as a better mode to transfer of commodity. Total 4 scenarios have been considered and these are explained below.

1. Scenario 1: Business as Usual (BAU): Rail Infrastructure Remain same but includes sanctioned projects such as Eastern and Western DFC, Mumbai Ahmedabad HSR and projects as per Pink Book. Whereas in case of Roads, Project Bharat Mala is considered implemented.
2. Scenario 2: Enhancement of Average Rail Speed of Freight Trains from 25 Kmph to 50 Kmph.
3. Scenario 3: Enhancement of Speed from 25 Kmph to 50 Kmph with 30% Reduced Tariff:
    D. Implementation of Railway projects corresponds to average speed to 50 Kmph & reducing tariffs by **30%** by 2026.
    E. Implementation of Railway projects corresponds to average speed to 50 Kmph & reducing tariffs on 4 items by 30% by 2026
    F. Implementation of Railway projects corresponds to average speed to 50 Kmph gradually & reducing tariff on 4 items by 30%
        - Year 2021 - 25 Kmph
        - Year 2026 – 30 Kmph
        - Year 2031 – 35 Kmph
        - Year 2041 – 40 Kmph
        - Year 2051 – 50 Kmph
4. Scenario 4: Business as Usual (BAU) with reduction in Cost by 30%: Rail Infrastructure Remain same whereas, the cost being charged is reduced by 30%.

In the Scenarios 2&3, the improvement in the speed has been considered since majority of the network shall be tripled or quadrupled by the addition of 3rd and 4th line. This will help in bringing the network at par with DFC which offer improved speeds. The data regarding improvement of rail speed with implementation of DFC has been sourced from Table 51, Page 133 of *'Draft Final Report, Development of marketing and commercial strategies for the DFC and its catchment areas '.*

Data related to Cost that will be charged by commodity type has also been sourced from Table 86, Page 190 *'Draft Final Report, Development of marketing and commercial strategies for the DFC and its catchment areas '.*

The Speed of Road and Rail and the Cost of Commodities considered are mentioned in table below.

Table 4-10: Comparison of Scenarios

Components	Existing Scenario	Scenario 1: BAU	Scenario 2: Enhancement Average Speed to 50 Kmph	Scenario 3A: Enhancement Average Speed to 50 Kmph with 30% Reduced Tariff	Scenario 3B: Enhancement of Average Speed to 50 KMPH with 30% less Tariff on selected items*	Scenario 3C: Enhancement of Average Speed to 50 Kmph gradually with 30% less Tariff on selected Commodities	Scenario 4: BAU with Tariff Reduction by 30%
Operating Speed (kmph)	25	25	50	50	50	25-50	25
Railway Tariff		BAU	BAU	30% lesser than BAU	30% lesser than BAU on selected items	30% lesser than BAU on selected items	30% lesser than BAU
Daily Run in Road	350	450	450	450	450	450	450
Cost on Road	BAU	BAU	BAU	BAU	BAU	BAU	BAU
Rail Commodity Share (%)	**28%**	**24%**	**40%**	**45%**	**44%**	**30%-44%**	**31%**

4.3.6. Estimation of Rail Share by Scenario

Modal share of both Road to Rail for each of the scenario has been estimated using Binary Logit Model. The modal share probability is calculated phase wise i.e. for the year of 2021, 2026, 2031, 2041 and 2051 based on the assumptions and are explained in the following sections.

4.3.6.1. Scenario 1: Business as Usual (BAU) with Bharat Mala Incorporated

In Scenario 1, Rail speed has been considered as 10.4 kmph and Road speed is considered as higher than present considering completion of Bharatmala Project. As the speed of road transport will increase from 16.6 kmph to 23 kmph and cost of Transportation remaining same. The estimated Rail shares for Scenario 1 are described in Table below.

Table 4-11: Estimated Rail share of Commodities for Scenario 1

Commodity	2051	2041	2031	2026	2021	2019	Existing
BOG	1%	1%	1%	1%	1%	1%	4%
Cement	38%	38%	38%	38%	37%	37%	37%
Coal	62%	62%	62%	62%	62%	62%	65%
Container	16%	16%	16%	16%	16%	18%	24%
Fertilizer	85%	85%	85%	85%	85%	85%	87%
Food grains	17%	17%	17%	16%	16%	15%	16%
Iron Ore	60%	60%	60%	60%	60%	60%	65%
Pig Iron	49%	49%	49%	49%	48%	48%	49%
POL	9%	10%	10%	11%	11%	11%	18%
Steel RM	55%	55%	55%	55%	55%	55%	56%
Total Percentage	26%	25%	23%	24%	25%	25%	28%
Point Percent Change	-2%	-3%	-5%	-4%	-3%	-3%	
Tonnes/ day, Scenario1	11,616,293	7,999,604	5,138,283	4,056,158	3,139,703	2,762,661	
Tonnes/ day in Existing Situation	13,066,358	9,036,474	5,834,786	4,596,847	3,556,573	3,116,458	
Commodity Diversion (Tonnes/ Day)	-1,450,065	-1,036,870	-696,504	-540,689	-416,870	-353,797	

As evident from table above, in case no improvement is made in Rail infrastructure and Bharatmala Pariyojna is implemented in Road Sector, there may be an estimated diversion of freight traffic from existing rail share by a quantum of 0.3 Million Tonnes/ Day.

4.3.6.2. Scenario 2: Enhancement of Average Rail Speed of Freight Trains from 25 Kmph to 50 Kmph by Year 2026

As described in sections above, in Scenario 2, Rail Speed has been considered as 50 Kmph due to implementation of Dedicated Freight sub-network with heavier and longer trains. Enhancement in Road speed has also been considered due to implementation of Bharatmala Project. As a result, the speed of road transport will increase from 16.67 kmph to 23 kmph.

Therefore, in this scenario, Average Speed of Freight Trains has been considered as 50 Kmph from the year 2026 onwards. The scenario aims estimating rail freight share in case the speed of freight increases to 50 Kmph right from 2026 itself. Cost of Transportation for both road and rail remain same. Based on the enhanced speeds, the estimated Rail share in Scenario 2 is presented in Table below.

Table 4-12: Rail share for Scenario 2

Commodity	2051	2041	2031	2026	2021	2019	Existing
BOG	18%	18%	18%	18%	18%	18%	4%
Cement	42%	42%	42%	42%	41%	41%	37%
Coal	74%	74%	74%	74%	74%	74%	65%
Container	44%	44%	44%	44%	43%	47%	24%
Fertilizer	90%	90%	90%	90%	90%	90%	87%
Food grains	21%	21%	21%	21%	21%	19%	16%
Iron Ore	82%	82%	82%	82%	82%	82%	65%
Pig Iron	57%	57%	57%	57%	56%	55%	49%
POL	44%	44%	43%	43%	43%	42%	18%
Steel RM	60%	60%	60%	60%	60%	60%	56%

Commodity	2051	2041	2031	2026	2021	2019	Existing
Total Percentage	41%	41%	39%	39%	40%	40%	28%
Point Percent Change	+13%	+12%	+11%	+11%	+12%	+12%	
Tonnes/ day, Scenario 2	18,636,839	13,043,998	8,584,999	6,677,108	5,080,368	4,442,019	
Tonnes/ day in Existing Situation	13,066,358	9,036,474	5,834,786	4,596,847	3,556,573	3,116,458	
Commodity Diversion (Tonnes/ Day)	+5,570,481	+4,007,524	+2,750,213	+2,080,261	+1,523,795	+1,325,561	

As evident from table above, in this scenario due to substantial increase in Rail speed there will be considerable time savings which will help in diversion of time sensitive commodities. In the base case, this kind of improvement shall help an estimated diversion of freight traffic from existing road share by a quantum of 1.3 Million Tonnes/ Day.

4.3.6.3. Scenario 3: Enhancement of Speed from 25 Kmph to 50 Kmph with 30% Reduced Tariff

This scenario has 4 sub-scenarios that correspond to both increase in speed of freight trains and also reduction in tariff/ charges.

4.3.6.3.1. *Scenario 3A: Enhancement of Speed from 25 Kmph to 50 Kmph with 30% Reduced Tariff by Year 2026*

This scenario is similar to that of Scenario 2, only difference is that a cost reduction of 30% has been considered in charges for transporting the freight across all commodities.

Therefore, in this scenario, Average Speed of Freight Trains has been considered as 50 Kmph from the year 2026 onwards along with tariff reduction by 30% across all commodities.

Based on the enhanced speeds and reduced cost, the estimated Rail share in Scenario 3A is presented in Table below.

Table 4-13: Rail share for Scenario 3A

Commodity	2051	2041	2031	2026	2021	2019	Existing
BOG	22%	22%	22%	22%	22%	22%	4%
Cement	51%	51%	51%	50%	49%	49%	37%
Coal	76%	76%	76%	76%	76%	76%	65%
Container	48%	48%	48%	48%	47%	52%	24%
Fertilizer	91%	91%	91%	91%	91%	91%	87%
Food grains	32%	32%	32%	31%	31%	30%	16%
Iron Ore	84%	84%	84%	84%	84%	84%	65%
Pig Iron	70%	70%	71%	70%	68%	67%	49%
POL	48%	47%	47%	46%	46%	46%	18%
Steel RM	61%	61%	61%	61%	61%	61%	56%
Total Percentage	46%	45%	44%	44%	45%	45%	28%
Point Percent Change	+18%	+17%	+16%	+16%	+17%	+16%	
Tonnes/ day, Scenario 3	20,795,572	14,582,103	9,636,505	7,480,675	5,672,624	4,949,795	
Tonnes/ day in Existing Situation	13,066,358	9,036,474	5,834,786	4,596,847	3,556,573	3,116,458	
Commodity Diversion (Tonnes/ Day)	+7,729,214	+5,545,629	+3,801,719	+2,883,828	+2,116,051	+1,833,337	

As evident from table above, in this scenario due to substantial increase in Rail speed and also reduced cost of transportation, there will be further diversion of commodities. In the base case, this kind of improvement shall help an estimated diversion of freight traffic from existing road share by a quantum of 1.8 Million Tonnes/ Day in case of Scenario 3A.

4.3.6.3.2. *Scenario 3B: Enhancement of Speed from 25 Kmph to 50 Kmph by Year 2026 (Instantly) with 30% Reduced Tariff on Selected Commodities*

This scenario is similar to that of Scenario 3A, only difference is that a cost reduction of 30% has been considered in charges for transporting the freight across all commodities.

Therefore, in this scenario, Average Speed of Freight Trains has been considered as 50 Kmph from the year 2026 onwards. Tariff reduction of 30% has been considered only on selected commodities including BOG, Cement, Containers, Food Grains, Iron Ore and Raw Material for Steel.

Based on the instantly enhanced speeds and reduced cost on selected commodities, the estimated Rail share in Scenario 3B is presented in Table below.

Table 4-14: Rail share for Scenario 3B

Commodity	2051	2041	2031	2026	2021	2019	Existing
BOG	22%	22%	22%	22%	22%	22%	4%
Cement	51%	51%	51%	50%	49%	49%	37%
Coal*	74%	74%	74%	74%	74%	74%	65%
Container	48%	48%	48%	48%	47%	52%	24%
Fertilizer*	90%	90%	90%	90%	90%	90%	87%
Food grains	32%	32%	32%	31%	31%	30%	16%
Iron Ore*	82%	82%	82%	82%	82%	82%	65%
Pig Iron	70%	70%	71%	70%	68%	67%	49%
POL	48%	47%	47%	46%	46%	46%	18%
Steel RM*	60%	60%	60%	60%	60%	60%	56%
Total Percentage	**44%**	**45%**	**44%**	**44%**	**45%**	**44%**	**28%**
Point Percent Change	**+16%**	**+17%**	**+16%**	**+16%**	**+17%**	**+16%**	
Tonnes/ day, Scenario 3B	18,863,731	14,483,765	9,954,132	7,755,016	5,938,721	4,886,395	
Million Tonnes/ Year	**6,885**	**5,287**	**3,633**	**2,831**	**2,168**	**1,784**	**1,162**
Tonnes/ day in Existing Situation	11,550,543	9,082,809	6,200,981	4,908,080	3,847,409	3,116,458	
Commodity Diversion (Tonnes/ Day)	**+7,313,187**	**+5,400,956**	**+3,753,151**	**+2,846,936**	**+2,091,313**	**+1,769,937**	

4.3.6.3.3. *Scenario 3C: Enhancement of Speed from 25 Kmph to 50 Kmph Gradually with 30% Reduced Tariff on Selected Commodities*

In this scenario, the enhancement of speed from existing 25 Kmph has been considered as gradual rather instant. Speeds for freight trains considered for modelling purpose for various cardinal years are listed below:

- Year 2021 - 25 Kmph
- Year 2026 – 30 Kmph

- Year 2031 – 35 Kmph
- Year 2041 – 40 Kmph
- Year 2051 – 50 Kmph

Further to adoption of above-mentioned speeds, reduction of 30% in tariff has been applied in selected commodities including BOG, Cement, Containers, Food Grains, Iron Ore and Raw Material for Steel similar to Scenario 3B.

Based on the gradually enhanced speeds and reduced cost on selected commodities, the estimated Rail share in Scenario 3C is presented in Table below.

Table 4-15: Rail share for Scenario 3C

Commodity	2051	2041	2031	2026	2021	2019	Existing
BOG	22%	20%	16%	9%	7%	7%	4%
Cement	51%	51%	50%	48%	46%	47%	37%
Coal*	74%	72%	70%	65%	61%	62%	65%
Container	48%	47%	43%	32%	29%	32%	24%
Fertilizer*	90%	90%	89%	87%	85%	85%	87%
Food grains	32%	32%	31%	28%	28%	26%	16%
Iron Ore*	82%	81%	77%	68%	60%	60%	65%
Pig Iron	70%	69%	69%	66%	64%	63%	49%
POL	48%	40%	28%	17%	15%	15%	18%
Steel RM*	60%	59%	58%	56%	55%	55%	56%
Total Percentage	**44%**	**43%**	**39%**	**33%**	**31%**	**30%**	**28%**
Point Percent Change	**+16%**	**+15%**	**+11%**	**+5%**	**+3%**	**+2%**	
Tonnes/ day, Scenario 3C	18,863,731	13,857,702	8,676,969	5,742,684	4,108,379	3,357,614	
Million Tonnes/ Year	**6,885**	**5,058**	**3,167**	**2,096**	**1,500**	**1,226**	**1,162**
Tonnes/ day in Existing Situation	11,550,543	9,082,809	6,200,981	4,908,080	3,847,409	3,116,458	
Commodity Diversion (Tonnes/ Day)	**+7,313,187**	**+4,774,893**	**+2,475,988**	**+834,604**	**+260,971**	**+241,156**	

4.3.6.4. Scenario 4: BAU Speed along with Cost Reduction of 30%

This scenario is similar to that of Scenario 1, however cost reduction of 30% has also been considered. It means that Indian Railways continue to operate in same manner without any enhancement in speed but shall charge 30% lesser than their current charges. Based on the reduced cost, the estimated Rail share in Scenario 4 is presented in Table below.

Table 4-16: Rail share for Scenario 4

Commodity	2051	2041	2031	2026	2021	2019	Existing
BOG	7%	7%	7%	7%	7%	7%	4%
Cement	48%	48%	48%	48%	46%	47%	37%
Coal	67%	67%	67%	67%	67%	67%	65%
Container	29%	29%	29%	29%	29%	32%	25%

Fertilizer	88%	88%	88%	88%	88%	88%	87%
Food grains	29%	29%	29%	28%	28%	26%	16%
Iron Ore	70%	70%	70%	70%	70%	70%	65%
Pig Iron	65%	65%	66%	65%	64%	63%	49%
POL	14%	14%	15%	15%	15%	15%	18%
Steel RM	58%	58%	58%	58%	58%	58%	56%
Total Percentage	**33%**	**32%**	**31%**	**31%**	**32%**	**32%**	**28%**
Point Percent Change	+5%	+4%	+3%	+3%	+4%	+4%	
Tonnes/ day, Scenario 4	14,929,875	10,352,515	6,729,614	5,276,591	4,048,242	3,547,142	
Tonnes/ day in Existing Situation	13,066,358	9,036,474	5,834,786	4,596,847	3,556,573	3,116,458	
Commodity Diversion (Tonnes/ Day)	+1,863,517	+1,316,041	+894,828	+679,744	+491,670	+430,684	

As evident from table above, in this scenario due to reduced cost of transportation, there will be an estimated diversion of freight traffic from existing road share by a quantum of 0.6 Million Tonnes/ Day in case of Scenario 4.

4.3.6.5. Comparison of Scenarios

Present modal share in Rail is 28% but if there is no augmentation in Rail and after Bharatmala Project, the Share will come down to 24%. In case the rail speed is enhanced to 50 Kmph instantly without changing the tariff, the share increases to 40% (Scenario 2). The share further enhances to 45% in case tariff reduction along with instant speed enhancement to 50 Kmph by 2026 is considered (Scenario 3A). in case the tariff is reduced only on selected commodities which are price sensitive and speed is enhanced instantly to 50 Kmph by 2026, the estimated rail is 44% (Scenario 3B). Further in case the speed is enhanced gradually with rail speed considered as 25 Kmph in 2021, 30 Kmph in 2026, 35 Kmph in 2031, 40 Kmph in 2041 and 50 Kmph in 2051, the rail share increases gradually and reaches 44% by the year 2051 while in cardinal years it is estimated to be 33%, 39%, 43% and 44%. (Scenario 3C).

Table 4-17: Rail Commodity Forecast by Scenario in 2051 (Million Tonnes)

Commodity in million tonnes per year by Rail (2051)	Present	Scenario 1	Scenario 2	Scenario 3A	Scenario 3B	Scenario 3C	Scenario 4
Containerizable BOG	23	28	342	429	429	429	137
Non-Containerizable BOG	54	64	789	990	990	990	315
Total BOG	**77**	**92**	**1,131**	**1,419**	**1,419**	**1,419**	**452**
Cement	114	809	893	1,079	1,079	1,079	1,019
Coal	575	1,307	1,577	1,622	1,577	1,577	1,426
Container	54	202	560	610	610	610	370
Fertilizer	49	242	256	259	256	256	250
Food grain	45	117	151	225	225	225	200
Iron Ore	137	475	652	670	652	652	558
Pig Iron	40	222	259	318	318	318	296
POL	43	124	583	630	630	630	185
Steel RM	28	110	120	123	120	120	115
Grand Total	**1,162**	**3,701**	**6,182**	**6,955**	**6,885**	**6,885**	**4,872**

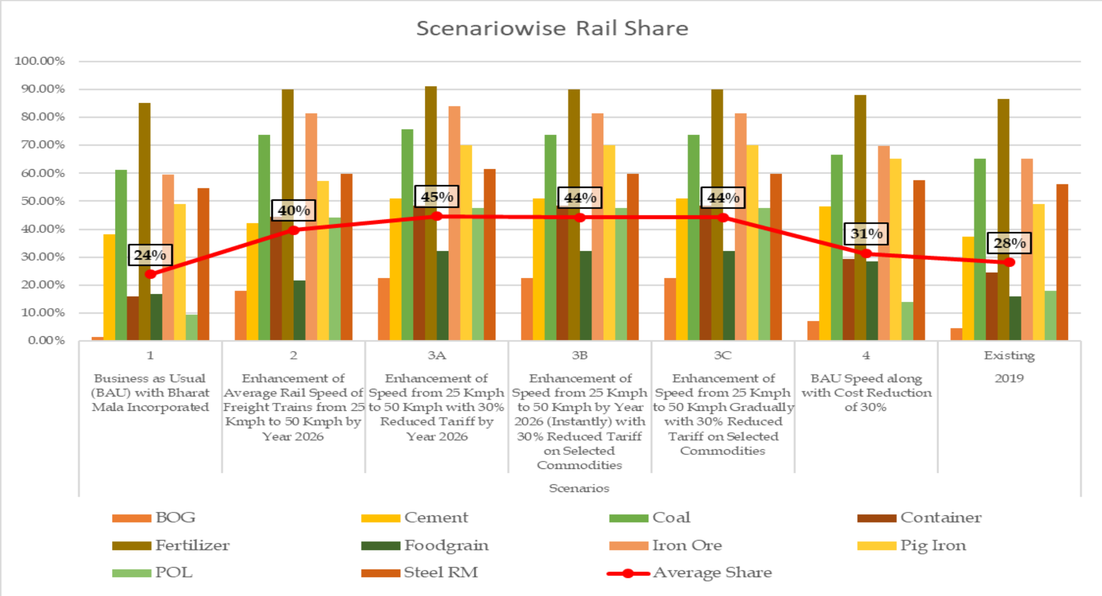


Figure 4-1: Impact on Rail share by Scenario

In case there is no improvement made in Rail Infra and only cost reduction is done, the rail share is estimated to increase to 31% (Scenario 4).

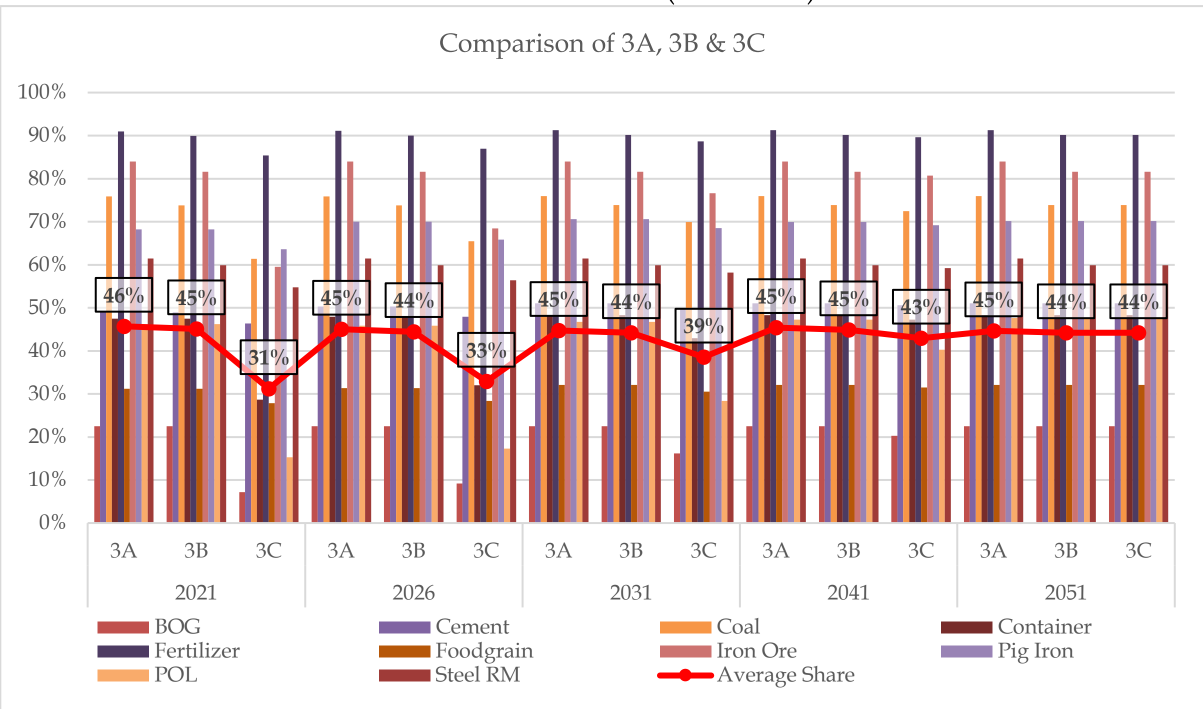


Figure 4-2: Comparison of Rail Share 3A, 3B & 3C

At present, Rail handles 3.12 Million tons of commodity daily. Whereas in Horizon year, 2051 the estimated share in Scenario 1 will be 10.13 Million tons/day, Scenario 2 will be 16.93 Million tons/day, Scenario 3A will be 19.05 Million tons/day, Scenario 3B & 3C each will be 18.86 Million Tons/ Day and Scenario 4 will be 13.34 Million tons/day.

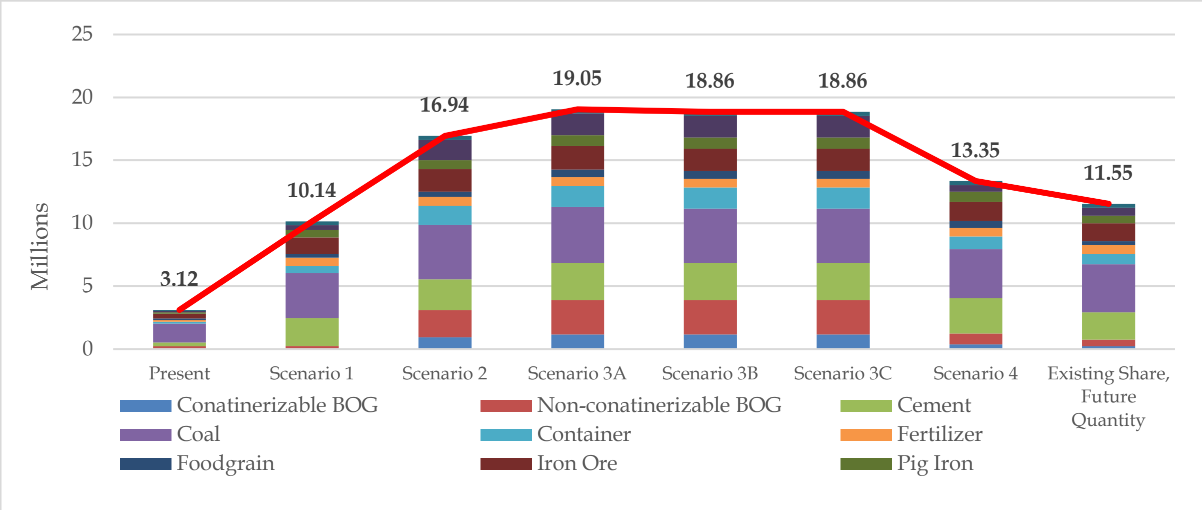


Figure 4-3: Forecast Freight Movement by Rail (2051), By Scenarios (Million Tonnes/ day)

Table below presents the quantum of freight (Million Tonnes/ Day) that is estimated to be carried by Rail under each Scenario.

Table 4-18 Commodities Carried by Rail (Tonnes/ Day)

Commodity tonnes per day by Rail (2051)	Present	Scenario 1	Scenario 2	Scenario 3A	Scenario 3B	Scenario 3C	Scenario 4
Containerizable BOG	63,811	76,094	936,950	1,175,325	1,175,325	1,175,325	374,276
Non-Containerizable BOG	147,229	175,569	2,161,788	2,711,781	2,711,781	2,711,781	863,553
Total BOG	**211,040**	**251,664**	**3,098,739**	**3,887,106**	**3,887,106**	**3,887,106**	**1,237,829**
Cement	312,465	2,217,271	2,446,502	2,955,650	2,955,650	2,955,650	2,792,427
Coal	1,508,561	3,582,126	4,321,580	4,443,623	4,321,580	4,321,580	3,907,989
Container	146,927	552,567	1,534,264	1,672,403	1,672,403	1,672,403	1,012,826
Fertilizer	134,751	663,400	701,425	709,856	701,425	701,425	684,596
Food grain	122,843	319,518	412,620	616,105	616,105	616,105	547,721
Iron Ore	376,593	1,301,873	1,785,217	1,836,282	1,785,217	1,785,217	1,529,445
Pig Iron	108,733	608,708	708,713	869,903	869,903	869,903	810,512
POL	118,111	341,072	1,598,349	1,725,467	1,725,467	1,725,467	507,927
Steel RM	76,434	300,717	328,874	337,368	328,874	328,874	315,838
Grand Total	**3,116,458**	**10,138,914**	**16,936,283**	**19,053,762**	**18,863,731**	**18,863,731**	**13,347,111**

Table 4-19: Rail Commodity Forecast for Scenario 3A, 3B & 3C (Million Tonnes)

Commodity	2019	2021			2026			2031			2041			2051		
	Existing	3A	3B	3C	3A	3B	3C	3A	3B	3C	3A	3B	3C	3A	3B	3C
Containerizable BOG	23	131	131	42	179	179	73	179	179	171	325	325	292	429	429	429
Non-Containerizable BOG	54	301	301	96	414	414	169	414	414	395	749	749	674	990	990	990
Total BOG	**77**	**432**	**432**	**138**	**593**	**593**	**242**	**593**	**593**	**567**	**1,074**	**1,074**	**966**	**1,419**	**1,419**	**1,419**
Cement	114	195	195	185	302	302	288	415	415	405	692	692	686	1,079	1,079	1,079
Coal	575	798	776	646	939	913	810	1,140	1,109	1,050	1,537	1,537	1,455	1,622	1,577	1,577
Container	54	150	150	90	197	197	132	264	264	234	420	420	374	610	610	610
Fertilizer	49	68	67	64	91	90	87	117	115	113	176	176	174	259	256	256
Food grain	45	98	98	88	114	114	103	133	133	127	173	173	165	225	225	225
Iron Ore	137	186	181	132	247	240	202	317	308	289	464	464	435	670	652	652
Pig Iron	40	83	83	77	115	115	108	152	152	147	227	227	221	318	318	318
POL	43	152	152	50	222	222	84	294	294	179	434	434	264	630	630	630
Steel RM	28	34	33	31	46	45	42	58	57	55	85	85	83	123	120	120
Total	**1,162**	**2,196**	**2,168**	**1,500**	**2,865**	**2,831**	**2,096**	**3,676**	**3,633**	**3,167**	**5,283**	**5,283**	**4,823**	**6,955**	**6,885**	**6,885**

Forecast Rail Share

Scenario 3 in general is based on rail infrastructure improvements along with reduction in tariffs. Within Scenario 3, 3A refers to instant increase in rail speed by year 2026 along with tariff reduction in all commodities, 3B refers to instant increase in rail speed by year 2026 along with tariff reduction in selected commodities and 3C refers to more gradual increase in rail speed by year 2026 along with tariff reduction in all commodities. However, in all these 3 scenarios, the estimated rail share in the year 2051 is more or less similar.

In both Scenario 3B and Scenario 3C there will a shift of +16% from road to rail in the year 2051. However, in case of Scenario 3B the speed enhancement is considered right from the year 2026 and therefore, the rail share of 44% shall be achieved in the year 2026 itself. But, in case of Scenario 3C, enhancement of rail share is gradual (33% in 2026, 39% in 2031, 43% in 2041 and 44% in 2051). This is due to the fact that enhancement of rail speed is gradual in Scenario 3C.

It is evident that the maximum enhancement of rail share shall be in both Scenario 3B and 3C. However, in order to achieve the rail share of 44% in the year 2026 itself, shall require implementation of large quantum of rail infrastructure projects for making dedicated freight sub-network which may not be feasible. Therefore, considering the pace of development of rail infrastructure and maximum shift towards rail, Scenario 3C has been adopted. Forecast Rail Share by commodities under Scenario 3C is presented in Table below:

Table 4-20: Rail Commodity Forecast for Scenario 3C (Million Tonnes)

Commodity	Existing	2021	2026	2031	2041	2051
Containerizable BOG	23	42	73	171	292	429
Non-Containerizable BOG	54	96	169	395	674	990
Total BOG	**77**	**138**	**242**	**567**	**966**	**1,419**
Ceme nt	114	185	288	405	686	1,079
Coal	575	646	810	1,050	1,455	1,577
Container	54	90	132	234	374	610
Fertilizer	49	64	87	113	174	256
Food grain	45	88	103	127	165	225
Iron Ore	137	132	202	289	435	652
Pig Iron	40	77	108	147	221	318
POL	43	50	84	179	264	630
Steel RM	28	31	42	55	83	120
Total	**1,162**	**1,500**	**2,096**	**3,167**	**4,823**	**6,885**

Above mentioned rail freight demand forecast was converted into future Freight Origin and Destination matrices. these matrices were then assigned on rail network for estimation of capacity requirements, based rail infrastructure has been worked and explained in subsequent chapters, Detail Passenger and Freight Forecast is explained in Deliverable 3-Demand Forecast Report.

4.3.6.6. Change in Pattern of Rail Commodity Mix

As described above, of all the scenarios developed for estimating future rail freight share, Scenario 3 in general is based on rail infrastructure improvements along with reduction in tariffs. Within Scenario 3, 3A refers to instant increase in rail speed by year 2026 along with tariff reduction in all commodities, 3B refers to instant increase in rail speed by year 2026 along with tariff reduction in selected commodities and 3C refers to more gradual increase in rail speed by year 2026 along with tariff reduction in all commodities. However, in all these 3 scenarios, the estimated rail share in the year 2051 is more or less similar.

It is to be noted that although there is increase in rail freight share and also in the total commodity basket by the year 2051, the commodity mix shall have drastic change. The commodity mix that rail carries today will change significantly. A comparison in this regard has been carried out and is presented in figures below.

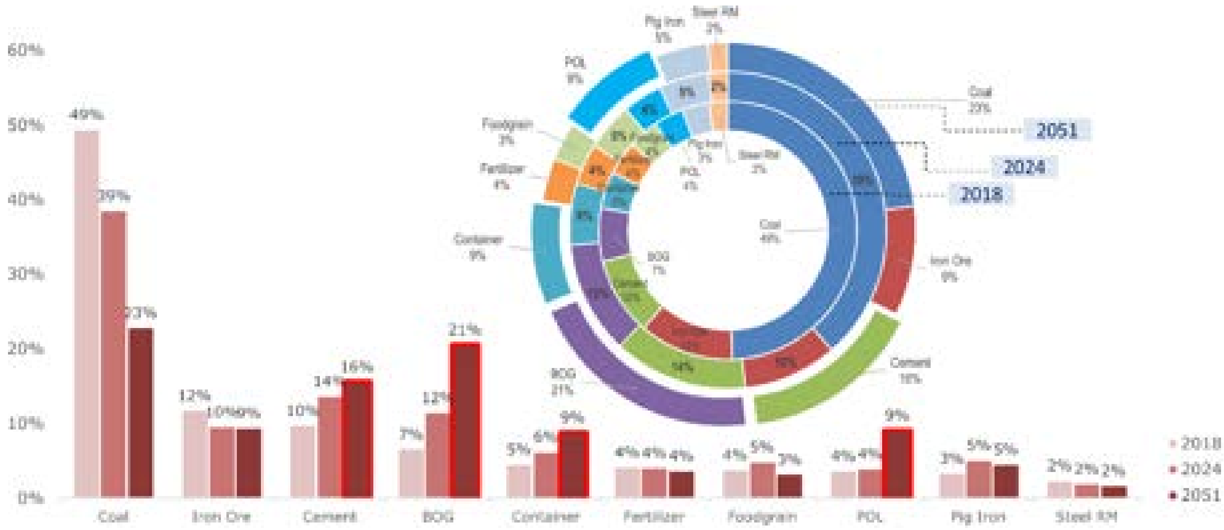


Figure 4-4: Comparison of Change in Commodity Share carried by Rail by 2051

As evident from the figure above, significant change is estimated in the rail commodity mix by 2051. Share of coal transported by rail is estimated to reduce from present 49% to 23%, share of BOG is estimated to increase from present 7% to 21% and share of Exim Containers is estimated to increase from present 5% to 9%. In case Scenario 3C, since the rail freight share is increasing gradually, the commodity mix is also estimated to be different in each cardinal year.

Chapter 5 FREIGHT FLOW ASSESSMENT AND MODAL SHARE OF RAILWAYS

5.1. Chapter Outline

As part of this study for preparation of the National Rail Plan, various aspects have been studied with reference to existing and projected potential movement of passengers as well as freight in the national transport system.

This section on freight flows assessment presents the following:

A. Classification and identification of commodity groups to facilitate further assessment and perusal of outcomes – having reference to their contribution/ share in extant movement on the railway system;

B. Approach adopted for 'as-is' assessment of freight flows for the key commodity groups in the national transport system;

C. Methodology adopted for projecting (as well as validating/ corroborating) potential demand for transport of commodity groups in the national transport system;

D. Consideration of shares of various transport modes in freight flows;

E. Enablers/ approaches for enhancement in modal share of railways;

F. Commodity group specific sections covering as-is assessment of flows, projection of potential transport demand in the national transport system, modal share, and modal shift strategies specific to the commodity group (where rail share has potential for enhancement) commodities.

5.2. Commodity classification

Identification of commodity groups commenced with listing of commodities being transported over the national transport ecosystem – covering all commodities produced and consumed in India. For the same, reference was made to the following national databases:

National Account Statistics (2018), Government of India: Provides classification of commodities based on Gross Value Added;

Annual Survey of Industry (2017-18): Provides classification of commodities based on value of total output; and

Index of Industrial Production (2017-18): Provides comparative changes in production volumes of a basket of industrial products for a given period with respect to a preferred base period.

Based on these national databases, a total of 27 commodities (refer **4**) that are transported across different production and consumption centres in the country were identified.

As a next step, commodities that have been part of IR's freight traffic (based on past and current trends) were examined[3]. 346 such commodities classified under 25 segments - further categorised into ten groups (refer **ANNEXURE 5.2:**). The commodities on this list largely corresponded to the long-list of commodities being transported over the national transport system – indicating that such listing would be comprehensive and appropriate for further reference/ use under this study. Accordingly, the broad list of ten commodity groups were finalised for further analyses.

While eight of these commodity groups such as coal, iron ore, steel, cement among others could be considered as distinct sets, a disjointed array of multiple commodities constituted the tenth group of 'Balance Other Goods'. Given the extremely fragmented nature of this tenth commodity group and limitations on data availability, the group was further restructured into following sub-groups:

- Automobile

- Stones and aggregates

- Non-ferrous metals and

- Miscellaneous Other Goods

These ten commodity groups (presented in Figure below), comprising over 100% of the total rail freight movement in the country, were used for further analyses.

[3] Indian Railways, 2012, General Classification of Goods, Letter No. 2012/TC (CR)/505/4, March 2012, Indian Railways, New Delhi

Figure 5-1. Commodity groups for rail freight analysis

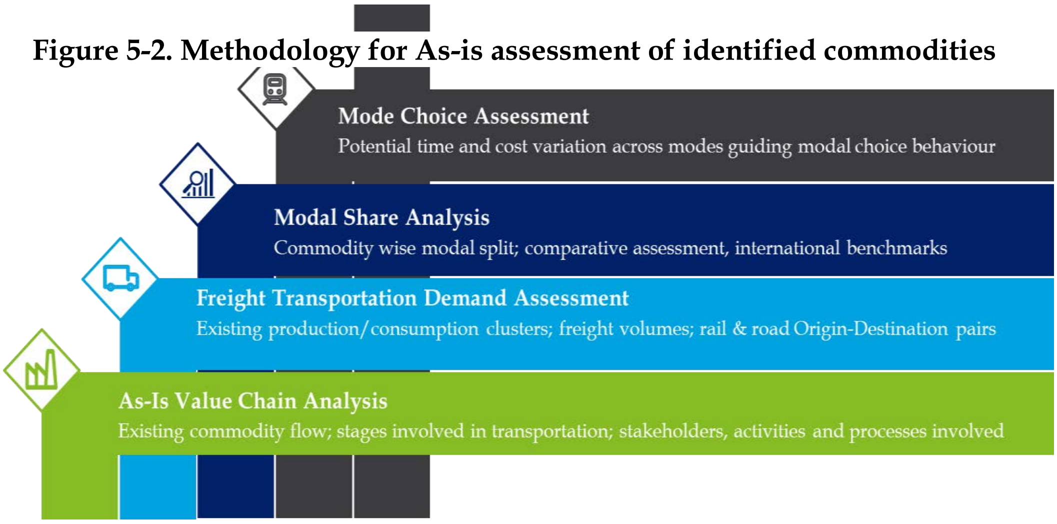
According to Indian Railway data[4], conventional bulk commodities including coal, iron ore, fertilizers, and food grains comprise majority of rail freight traffic on account of their inherent transportation characteristics including large volumes, long leads, cargo weight and cost preference for rail among others. Rail remains the preferred mode of transportation for these commodities.

On the other hand, road emerges as the preferred mode of transport for the remaining two categories, i.e. conventional high value commodities such as steel, cement and non-conventional commodities such as unitized cargo including automobiles, containers and balance other goods. This is mainly on account of various factors such as better transits, service reliability, movement of smaller parcel sizes, shorter leads and cost preference for road among others. POL moves to a larger extent on the pipeline network, given its distinct logistics requirements.

5.3. As-is assessment of freight flows for key commodity groups

A study of the key commodity groups was undertaken to identify the existing transportation patterns across modes (modal shares) and to identify the factors driving choice of transport modes. This was done using a four-step approach, which is presented in the following figure.

Figure 5-2. Methodology for As-is assessment of identified commodities



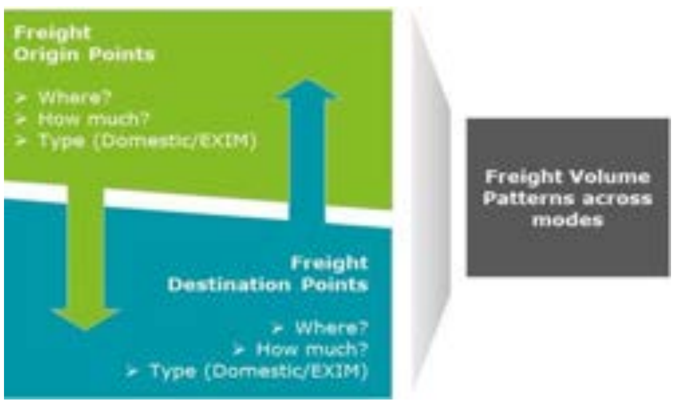
[4] Centre for Rail Information Systems, FOIS Data, 2017-2018, Indian Railways, New Delhi

As-is value chain analysis: For each of the identified commodity groups, existing transport and logistics chains were mapped through stakeholder consultations – starting with origin of raw materials, progressing through production/value addition stages, and tracing the movement covering transport modes, interaction of stakeholders and processes involved.

Figure 5-3. Illustrative As-Is logistics value chain mapping for steel as a commodity

Freight transport demand assessment: The key production and consumption centers were identified for each commodity group, along with associated freight volumes – including exports and imports. The total freight transport demand in the national ecosystem was examined with reference to the existing FOIS data of IR and results of the primary road surveys undertaken earlier in the study.

Figure 5-4: Identification of freight movement patterns across different modes



Modal share analysis: Along with the above analyses, based on production data for the key commodity groups, data available on freight movement by various modes was considered to ascertain freight movement patterns on rail and road respectively.

Subsequently, a comparative assessment was also undertaken to examine rail modal share for each of these commodity groups across different country contexts, subject to data availability in the public domain.

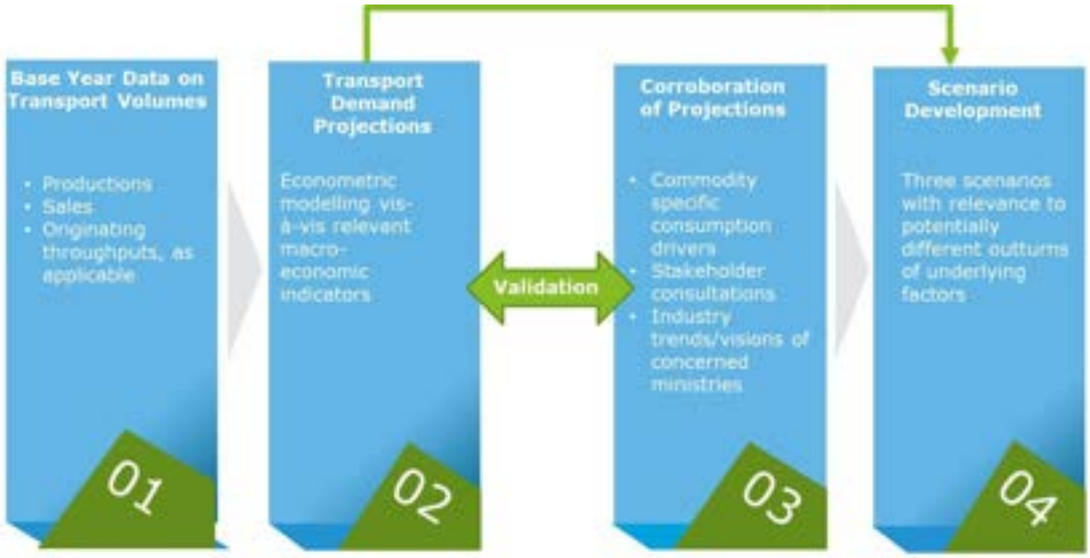
Mode choice assessment: Finally, based on primary stakeholder consultations[5], modal choice drivers in terms of time/cost (based on data availability) were studied for the identified key commodity groups to assess advantages/benefits offered by other competing modes, service gaps in rail among others.

[5] Pan-India primary consultations were undertaken with traders/shippers, industry associations, logistics service providers, terminal operators and transport operators.

5.4. Potential demand for transport of key commodity groups

To assess the potential freight transport demand for identified key commodity groups, the following framework was adopted.

Figure 5-5: Methodology for projecting potential demand for transport of key commodity groups in the national transport system



1. Base year data on transport volumes: For each of the identified key commodity groups, production/ sales or originating throughput volumes for FY 2017-18 (April 2017-March 2018) were taken as the base, given the delay in release of statistics for FY 2018-19 for several commodities by various stakeholders[6]. Based on consultations with stakeholders, this was taken as a proxy for total volumes transported across the national eco-system through various modes.

2. Transport demand projections: Using the base transport volumes for commodity groups, econometric modelling was undertaken to project the potential growth in future. Appropriate macroeconomic indicators were identified for each of the commodity groups and potential relationships were evaluated for estimating annual transport demand projections up to 2030, followed by ten-yearly projections up to 2050.

Some of the macro-economic indicators evaluated included economic growth (represented by GDP), industrialization (represented by IIP), production and consumption patterns, pace of urbanization, per capita income, and per capita GDP. Other components of such modelling included:

Selection of relevant causal factors (independent variables) based on possible correlations combined with expert judgement;
Unique nature of commodities and corresponding market dynamics, as well as data availability informing the modelling;

[6] This study was commissioned in Dec 2018 and work on this module was undertaken accordingly and completed by Aug 2019.

Collection of historical data (long time series) to allow coverage of business cycles, lending robustness to the modelling;

Statistically estimating and testing relationships between independent variable(s) and commodity volumes - inspecting historical data and fitment of various functional forms (Log-Log, Log-linear, VAR model etc);

For identifying potential modelling errors, goodness of fit was checked by studying the pattern of variation of projected values from actual data for past years.

1. Corroboration of projections: The projections were corroborated by comparing them against anticipated/expected consumption trends for key commodity groups. This was important so that any relevant factors at variance from past trends could be identified and considered.

The **anticipated**/expected consumption trends were constructed based on extrapolation of commodity specific trends and expected consumption drivers in future, growth plans of key consumers (especially institutional) as well as targets prescribed/ adopted by concerned agencies/ ministries, and finally validated by industry stakeholders' outlook on expected growth of their respective industry segments.

2. Scenario Development: To account for possible variations in the projections on account of higher or lower outturns of independent variables considered for base projections (such as GDP, per capita income among others as applicable), projection scenarios were additionally considered.

Going forward, it is expected that these projections as well as attendant analyses/ outputs would be refreshed and updated periodically - capturing any new/ relevant information, to account for any changes which can in turn inform any required investments/ interventions at such stage. A number of similar limitations of projections are presented in section below. Further, it is advisable to track and plan investments and other interventions vis-à-vis their linkages to volumes over the medium term i.e. 2019-2030 and longer term i.e. 2030-2050 to be able to prioritize and proceed with varying levels of scrutiny/validation as relevant.

5.4.1. Limitations of projections

Projections had reference to past trends as well as evaluation of relationships vis-à-vis independent variables and are characterised by certain constraints/ limitations, as listed below:

Future events that cause a disruptive change to the underlying relationships between independent variables and commodity transport volumes can essentially not be ruled out/accounted for;

Transport volumes for commodities in future could combine across different scenarios of projections across such commodities– resulting in a broader range of overall freight volume scenarios.

The potential overall transport volumes for commodity groups for the period beyond 2030 were projected using the model developed and established for the period 2019-2030. Some additional limitations specific to the projections for this long-term period are presented below:

Uncertainty in future outturns of independent macroeconomic variables over such long periods considered as part of the modelling - Any variances on this account could cumulatively lead to more amplified variances in projections of commodity volumes over such long horizons. This is mainly because the projected growth trends for such independent macroeconomic variables like Real GDP as issued by agencies like OECD, are generally relevant for a shorter horizon and have an inherent limitation in capturing any potential structural shifts in the economy, advent of new technologies, policy reforms, catalytic events and other unanticipated market trends over such longer periods.

The strength of relationships between growth in commodity transport volumes and underlying macro-economic variables itself may change over such long horizon (including on account of the factors mentioned in the above point) and new correlation patterns may emerge which cannot be envisaged at this stage.

The allocation of such volumes across origin-destination points is also not possible for such a long horizon given unforeseeable variations in spread of production facilities, consumption centers, etc.

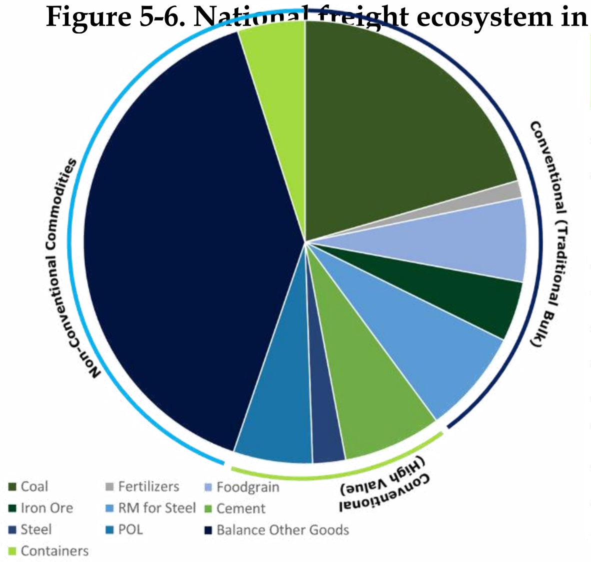
Further, no corroboration/ validation benchmarks or industry estimates for components of the model or its results are available for this period.

ANNEXURE 5.3: discusses relevance of the projections in view of the disruption caused on account of the COVID-19 pandemic in FY20-21.

5.4.2. Analysis

The total volume of production/ consumption, or total transport volumes over the national transport system, of key commodity groups was 4,709 MT (MT) in FY 2019. A commodity group-wise break-up is presented below.

Figure 5-6. National freight ecosystem in FY 2019 (Volume in MT)



Commodities	Total Volume (in Mill. Tonnes)	Rail volume (in Mill. Tonnes)	Volume by Road and other modes (in mill. Tonnes)
Coal	966	606	360
Fertilizers	59	52	7
Foodgrain	289	39	250
Iron Ore	207	137	70
RM for Steel*	358	26	332
Cement	337	117	220
Steel	113	54	59
POL	272	43	229
Balance Other Goods	1863	87	1776
Containers	232	60	172
Sum	**~4700**	**1221**	**3475**

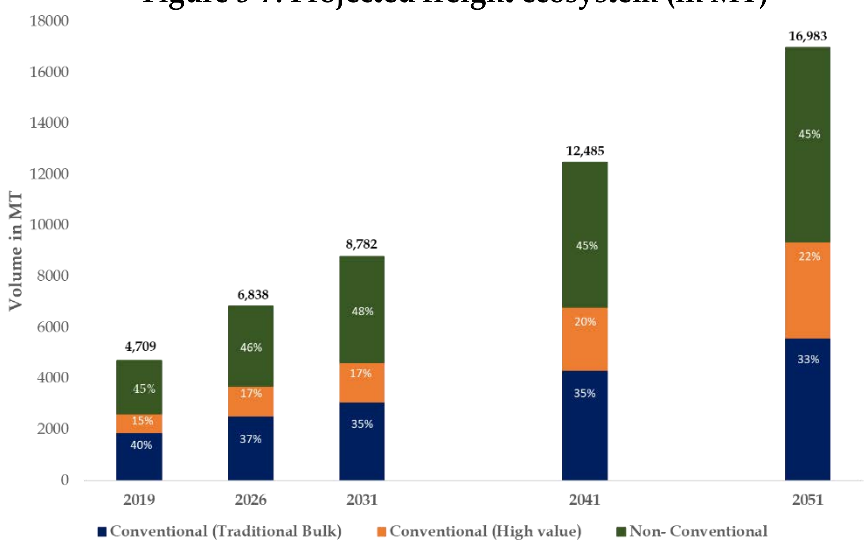
Source: Consultant Analysis, AECOM surveys

While conventional high-value and non-conventional commodities constituted over 60% of this total, they constituted about 30% of the total rail freight volumes in FY19.

The transport requirements are projected to grow at a CAGR of approximately 5% till 2031. Over the next decade, it is projected that the commodities that presently represent about 80% of Indian Railway's freight volumes will only account for about one-third of the total freight transport demand in the national system.

Therefore, conventional high-value and non-conventional commodities will become important for IR to focus on vis-à-vis provision of suitable product and services for rail transport of such commodities.

Figure 5-7. Projected freight ecosystem (in MT)



Source: Consultant Analysis

5.5. Share of railways in freight flows

Over the last three decades, the modal share of railways has reduced to ~30% from ~50% earlier. The contraction in modal share has been on account of roadways catering to increasing freight movements over this period on account of factors like:

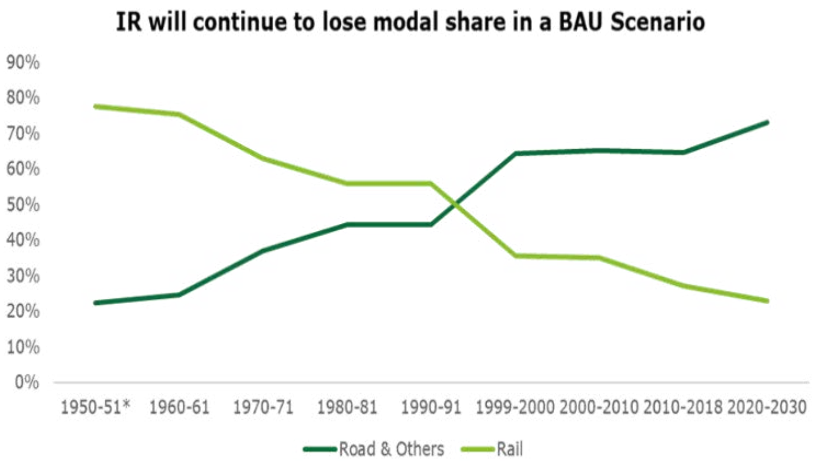
Evolution in the industrial and consumption landscape changing the dynamics for freight transport towards need for faster transit, service reliability, smaller parcel sizes, etc.;

Enhanced road infrastructure and initiatives like GST, electronic toll collection, increasing axle loads of commercial vehicles[7], etc. leading to a change in the relative competitiveness of road transport as a mode vis-à-vis rail.

Stakeholder consultations, undertaken earlier in this study, also brought out the need for Indian Railways to look at an overall logistics proposition for customers - across the key dimensions of logistics cost, time and quality vis-à-vis other modes.

In a 'business as usual' scenario, rail's modal share could continue declining as illustrated below.

Figure 5-8. Modal split: Rail vs road



Note: Assumes Historical Volume to NTKM ratio of 0.9:1; Source: Erstwhile Planning Commission Data, IR Annual Reports, AECOM surveys and Consultant Analysis

As part of the objective on preparation of the National Rail Plan, with respect to freight transport, it was envisaged that movement of freight should be facilitated with reliable services to secure an environmentally efficient and long-term sustainable transport system – with creation of rail infrastructure in conjunction with other modes of transport. To achieve the same, rail transport needs to be considered such that its comparative advantages and characteristics are optimally used.

[7] Annual Reports for 2016-17, 2017-18, 2018-19, various dates, issued by Ministry of Road Transport and Highways (MoRTH), New delhi

5.5.1. Modal share of railways in future – Policy Guidance

Focus on low carbon transport system

In view of the issue of Climate Change, India has communicated its Intended Nationally Determined Contribution (INDC) in response to COP decisions 1/CP.19 and 1/CP.20 for the period 2021 to 2030[8] – including reduction in emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.

As part of on-going mitigation strategies, actions and interventions, India identified 'reduction of emissions from transportation sector' as one of the priority areas.

India articulated its focus on low carbon infrastructure and transport systems like the Dedicated Freight Corridors and energy efficient railways to reduce environmental impact. In this context, it has also been articulated that we will endeavour to increase the share of railways in total land transportation to 45%.

Role of railways in India's long-term transport policy

A National Transport Development Policy Committee (NTDPC) was constituted by the Government of India in 2010 to formulate a long-term transport policy. The Committee submitted the "India Transport Report: Moving India to 2032" in January 2014[9]. The Working Group on Railways (for NTDPC) recommended a market share of 50% for Indian Railways in view of economics, customer convenience and international examples. The report had reference to capacity constraints and outlined potential modal shares that railways should achieve over the years to target the above mentioned 50% market share by 2032.

Box 1. Potential rail modal share identified by NTDPC

Year	NTKM basis	Volumes basis[10]
2012-17	35%	29-31%
2017-22	39%	33-35%
2022-27	45%	36-38%
2027-32	50%	43-45%

For achieving growth in freight transport volumes by railways, implied in the above projections, the report discussed the need for focus on major sectors like coal, steel and cement in addition to capturing significant share of Containerizable cargo, and better addressing a segment like automobiles transport. The report

[8] Various authors, 2015, "India' Intended Nationally Determined Contribution: Working Towards Climate Justice", United Nations Framework Convention on Climate Change , Bonn at https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Indiapercent20First/INDIApercent20INDCpercent20TOpercent20UNFCCC.pdf ,

[9] National Transport Development Policy Committee, 2012 , "India Transport Report: Moving India to 2032"; Niti Aayog, new Delhi at https://niti.gov.in/planningcommission.gov.in/docs/sectors/index.php?sectors=Nationalpercent20Transportpercent20Developmentpercent20Policypercent20Committeepercent20(NTDPC)

[10] Assumes historical volumes to NTKM ratio of 0.9:1

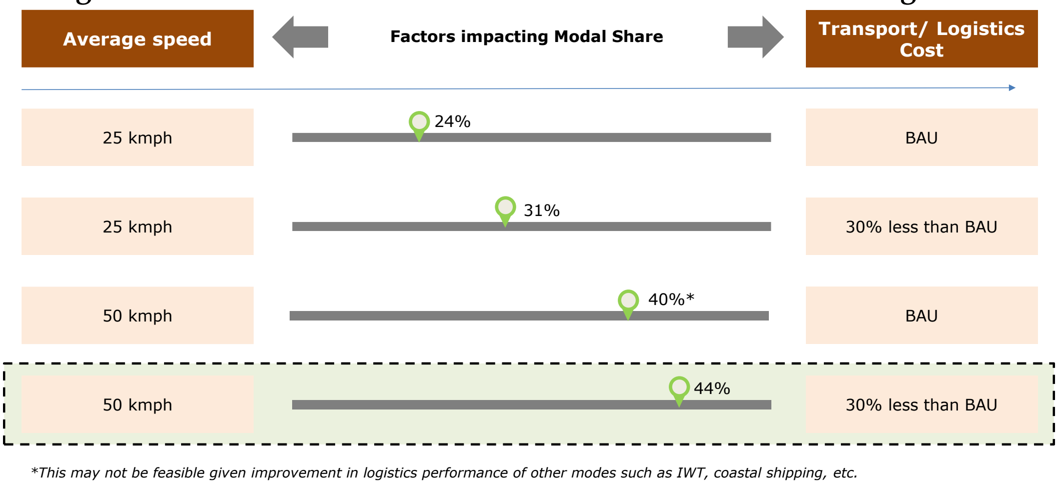
advocated the need for providing services to meet customer's requirements and expectations – focused on improving transit and cost-efficiencies in freight.

Indian Railway: Visions & Plans (2017-19)[11] identified a target modal share of 37% in 10 years through a number of interventions including policy interventions, new service offerings, and infrastructure creation.

5.5.2. Rail modal share – Corroboration through modelling

As discussed in this report, a Binary Logit Model was developed to analyse potential freight movement over rail with reference to the two major parameters of overall logistics time and cost. As can be seen from the figure below, with a combination of higher than extant average speed of freight movement (at 50 km per hour) and reduction in the transport/ logistics cost by 30% from extant levels, the model estimates that based on relative cost-economics of various modes (including inter-modal transfers), railways could potentially cater to about 44% of the total freight movement.

Figure 5-9. Rail modal share under different scenario runs of Logit Model



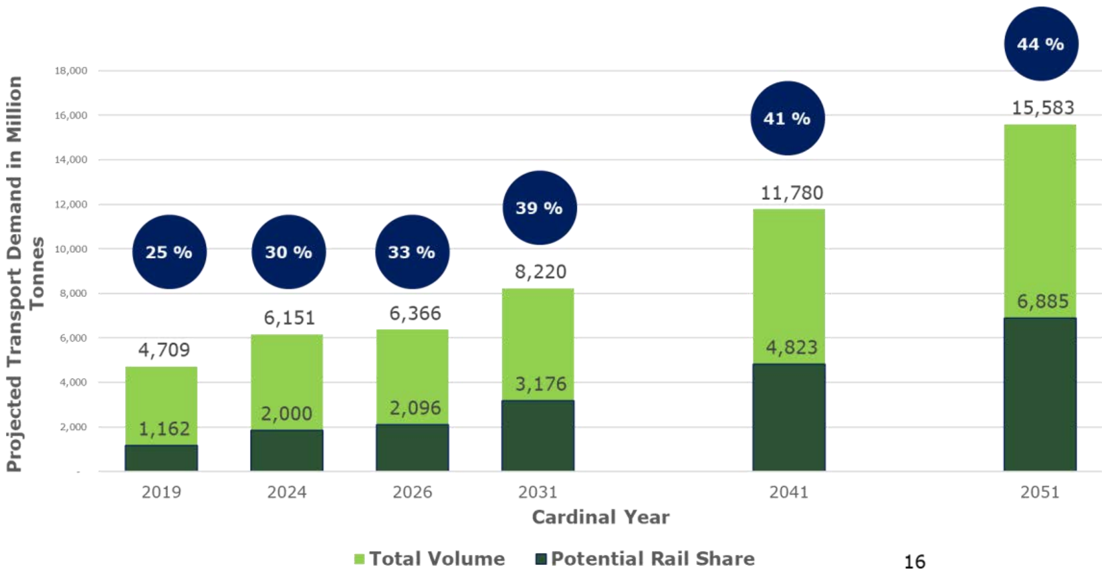
These changes in the two parameters of overall logistics time and cost could be affected as a function of a number of interventions targeted at improving provision, as well as transit speeds (and reliability).

> Due to the COVID-19 pandemic, when operations of passenger trains were curtailed, and speed of freight trains was higher at ~45 Kmph, it is understood that the railway system catered to a higher share of freight traffic within the national eco-system
> It must be noted that during this period, road transportation of freight was also impacted on account of certain challenges like unavailability of drivers, etc.

[11] Various Authors, January 2017, "Indian Railways Vision & Plans 2017-2019", Indian Railways, New Delhi at https://indianrailways.gov.in/Railwayspercent20Presentation.pdf

The figure below shows potential freight transport demand for railways under certain scenarios of changes in logistics time and cost. Arguably, fast-tracking of certain interventions could enable earlier achievement of higher rail modal share.

Figure 5-10. Potential freight transport demand for railways



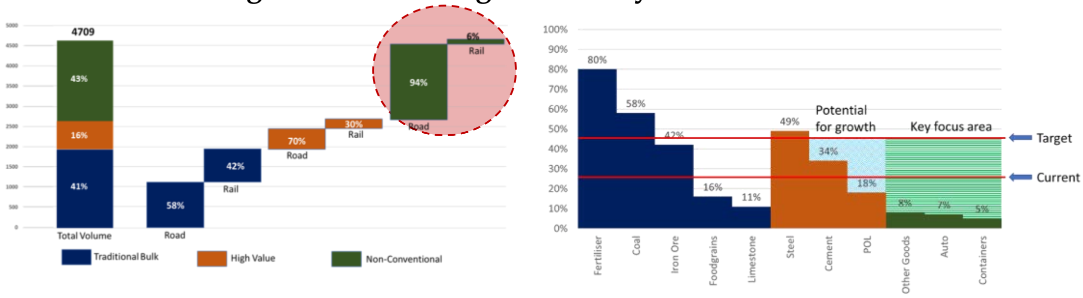
5.6. Deconstructing possible increase in rail modal share

Presently, the modal share of railways (at ~30%) in the national transport system is mainly attributable to transport of traditional bulk commodities (fertilizers, coal, iron ore and food grains) which constitute about 60% of Indian Railways' freight business.

Going forward, projections for potential freight transport demand in the national system suggest that commodity groups like Containers and Balance Other Goods would contribute a very significant proportion of the total demand (~48% in 2030).

As can also be seen from the figure below (illustrating the existing rail usage/ share for various commodity groups), for enhancing its modal share, Indian Railways will need to cater to freight transport demand of other commodities (non-conventional as well as conventional high-value) which presently don't have a high rail co-efficient/ usage through appropriate interventions, strategies and product offerings.

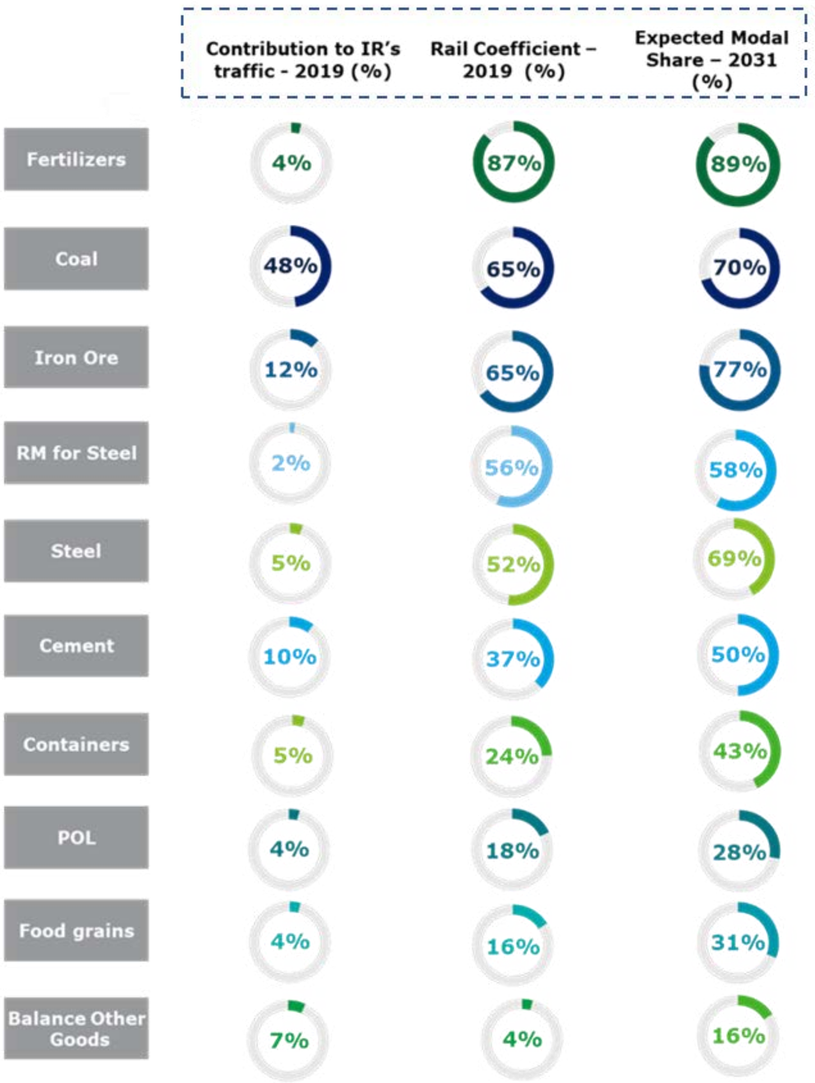
Figure 5-11. Existing commodity-wise rail shares



Source: AECOM Surveys, Data from CRIS and Consultant Analyses

The figure below presents analyses for the key commodity groups in terms of existing rail share/ usage, future growth potential for transport demand of such commodity groups, potential rail share/ usage and identification of key focus commodities for enhancement of overall rail freight share in the national transport system.

Figure 5-12. Key commodity gropus, existing rail share and identification of focus commodities for IR



To summarise the key take-aways from the above analyses:

Commodities which already move substantially over the railway system may not contribute significantly to enhancement in rail freight share within the national transport system. In some cases, for instance coal and iron ore, introduction of slurry pipelines, pit-head power plant locations, increase in share of renewable energy sources in the electricity generation mix, etc. may start limiting further increase in movement of such commodities over the rail system.

For certain commodities like POL and food grains, while the rail modal share is low, increase in transport demand of such commodities over the rail system may also remain limited due to inherent characteristics of such commodities, other developments and competitive position of other modes of transport – for instance, pipelines for movement of POL, and road transport for movement of foodgrains (shorter leads/ parcel sizes).

Non-conventional commodities like containers and 'balance other goods' and conventional high-value commodities like steel and cement with need to be focused on for enhancing rail share in their transport over the national system. For containers and 'balance other goods', the overall rail share is low and these would be natural market segments of focus of railways given the projected growth in transport demand for such commodity groups. With substantial potential for increased containerisation of 'balance other goods', railways can enhance its competitive positioning for movement of such goods. For steel, while rail share even presently is sizable, there is further potential for transport of this commodity group vis-à-vis the MSME sector (almost 45% of the total throughput of the steel sector) which currently predominantly contributes to road transport. For cement, the potential cost advantage from converting bagged to bulk movements, could present a significant opportunity for increased transport by rail.

5.7. Enablers/ approaches for enhancement in rail modal share

As mentioned earlier, for enhancing its modal share, Indian Railways will need to progressively cater to additional transport of non-conventional as well as conventional high-value commodities through appropriate interventions, strategies and product offerings.

5.7.1. International Examples

Review of studies on international railway systems[12] indicates that many international railway systems have ambitious modal share targets with reference to considerations like environmental impact and overall cost to the economy.

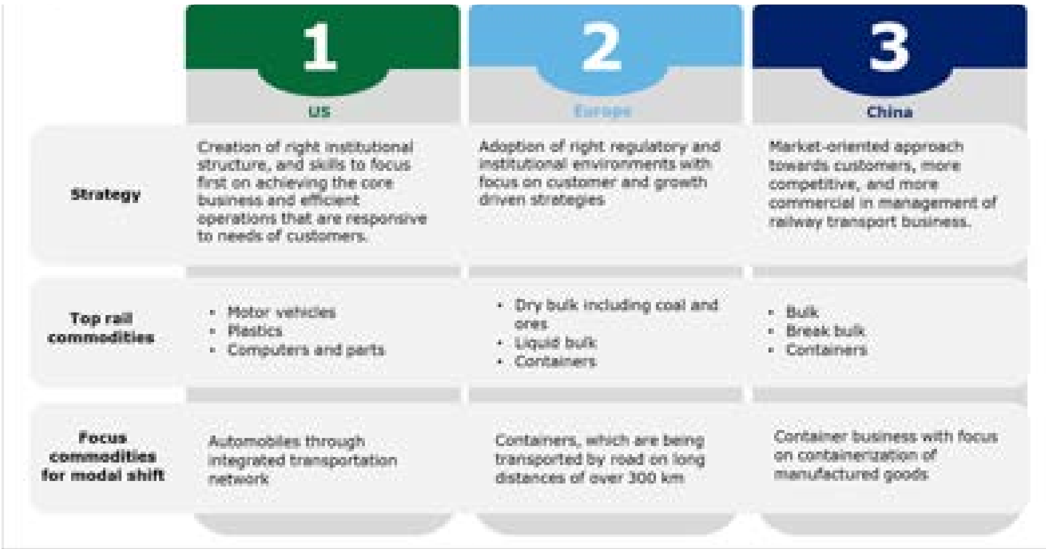
This system adopted market-oriented strategies and changed their business practices to enable the same through user-friendly interfaces, price flexibility, provision of integrated logistics solutions, increased deployment of multimodal solutions, and adoption of technology among others.

This system also reportedly identified focus commodities for improving their modal shares of freight transport. While The Association of American Railroads (AAR) Factsheet highlighted the potential increase in modal share through attracting more number automobile units on rail in the US, studies including European Rail Freight Vision 2030 and Transport for the Future for China's Railway Industry highlight the growing importance of container business towards

[12] Aritua, Bernard. 2019. The Rail Freight Challenge for Emerging Economies: How to Regain Modal Share. International Development in Focus. Washington, DC: World Bank. doi:10.1596/978-1-4648-1381-8 License: Creative Commons Attribution CC BY 3.0 IGO; Various Authors, 2018, European Rail Freight Vision, Rail Frwight Forward Coalition, Various Locations, at https://www.railfreightforward.eu/sites/default/files/usercontent/white_paper-30by2030-150dpi6.pdf; Various Authors, 2009, Tracks from the Past, Transport for the Future: China's Railway Industry 1990-2008 and Its Future Plans and Possibilities,The World bank, Washington DC **; Various Authors, Various dates,** The Association of American Railraods (AAR) Factsheets, various dates, at https://www.aar.org/fact-sheets/

increasing modal share for these systems, as against traditional bulk and break-bulk commodities.

Figure 5-13. Market oriented strategies and commodities for enhancing modal share



	1 US	2 Europe	3 China
Strategy	Creation of right institutional structure, and skills to focus first on achieving the core business and efficient operations that are responsive to needs of customers.	Adoption of right regulatory and institutional environments with focus on customer and growth driven strategies	Market-oriented approach towards customers, more competitive, and more commercial in management of railway transport business.
Top rail commodities	• Motor vehicles • Plastics • Computers and parts	• Dry bulk including coal and ores • Liquid bulk • Containers	• Bulk • Break bulk • Containers
Focus commodities for modal shift	Automobiles through integrated transportation network	Containers, which are being transported by road on long distances of over 300 km	Container business with focus on containerization of manufactured goods

Box 2. Overview of revival of rail freight transport in North America

Within five years of deregulation (post 1980), rail freight volumes in North America started increasing. There was a remarkable shift to a focus on providing services to customers through rate and service-level flexibility rather than just service availability. Some of the aspects which were deregulated/ focussed on include:

- **Significant investment of upto $510 bn in infrastructure** between 1981 and 2009 resulting in Infrastructure inprovment and reduction in maintance backlog
- **Increasing openness to intermodal opportunities** through:
  - **Partnerships with third party service providers** like trucking companies to leverage latter's client base and enable rail based end to end solutions
  - **Developing in house logistics capabilities** to provide logistics services ranging from transloading to transportation to supply chain consulting.
- **Investing in logistics technology and intermodal digital platforms like** double stacking of containers for various freight types, piggybacking of trailers to provide flexibility for intermodal services, etc.
- **Restrictions** impeding transportation of international freight in one direction and domestic in the other were relaxed.

Source: Aritua, Bernard. 2019. The Rail Freight Challenge for Emerging Economies: How to Regain Modal Share. International Development in Focus. Washington, DC: World Bank. doi:10.1596/978-1-4648-1381-8 License: Creative Commons Attribution CC BY 3.0 IGO

Box 3. European Rail Freight Vision 2030: Targeting 30% modal share

In Europe, a coalition of Rail Companies, Rail Freight Forward, commits to increase rail freight share to 30% by 2030 (on tonne km basis). To achieve this target, several strategies focusing on customers' requirements/ benefits have been identified, including:.

a) Providing Better visibility to customer including track and trace and real time estimate for cargo arrival throughout the transit
b) Working across various National Railways to drive standardization in IT innovation and embrace latest concepts (to increase operational efficiency) including intelligent wagon and digital train which provides real time condition and position of cargo
c) Improving Infrastructure capacity, availability, access and reliability
d) Establishing a stable regulatory framework and level playing field for all railways including reduction in Track access charges and administrative costs, sharing of safety costs by transport authorities etc.

Source: European Rail Freight Vision, 2018, Rail Freight Forward at https://www.railfreightforward.eu/sites/default/files/usercontent/white_paper-30by2030-150dpi6.pdf accessed in May 2020

5.7.2. Framework for considering enablers for rail modal share in India

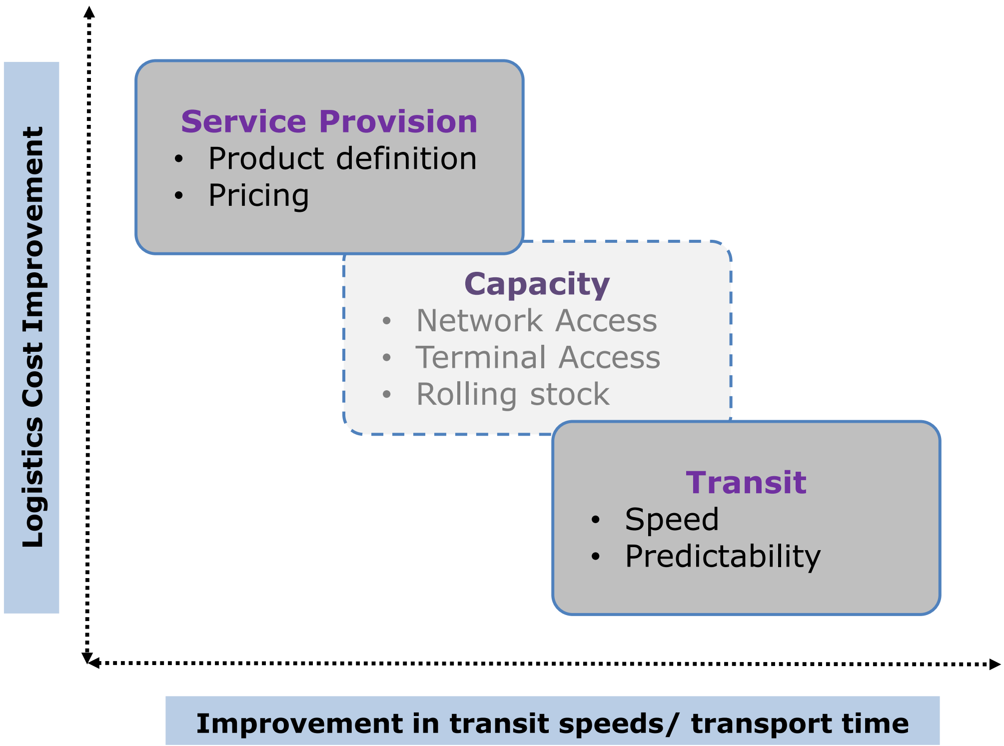
As discussed in this section, from the perspective of users, their choice of modes for transport of goods tends to be governed by the overall transport & logistics time and cost, as well as quality of service offered to them.

These outcomes across transporters/ modes in turn tend to get determined by various strategies and actions transport providers take and offerings they create and provide to meet customer requirements.

Key enablers for consideration of Indian Railways for enhancing their modal share of freight transport have accordingly been considered with reference to the following framework. While the possible initiatives/ enablers categorized broadly under 'service provision' can be seen to be more material to users from the perspective of improvement in the overall logistics cost, initiatives/ enablers categorized broadly under 'transit' could be more material to users from the perspective of improvement in the overall logistics time.

Creation of adequate capacity in the network – in terms of track infrastructure, terminals as well as appropriate and adequate rolling stock – would also contribute to improvement of logistics time and cost experienced by users. While proposals for creation of track infrastructure as well as numbers and type of rolling stock have been discussed in other sections of this report, the requirement of freight terminals has been discussed as part of this section – including with reference to commodity types.

Figure 5-14. Framework for considering enablers for rail modal share enhancement



5.8. Service Provision

5.8.1. Marketing and Business Development

The Indian Railways' traditional role has been that of a supplier of 'terminal to terminal' rail transportation services. In the last 3 to 4 decades, this has further evolved in terms of movement of single commodity full train load or "rake" volumes. The attention of the Railways on carrying goods for which there is excess demand or a capacity shortage, has potentially contributed to the modal shift that has seen even some traditional customers move away from an organization that has been unable to respond to their emerging service needs.

As some of the recommendations from this study support the Railways in a demand-led capacity expansion of infrastructure – tracks, terminals and rolling stock, focus would also be required on finding means to attract customers back on the rail system through improved service provision and attention to evolving customer needs.

In the present market construct, a single window, end-to-end solution has increasingly become the norm for logistics services required. At the same time, quality aspects related to the overall service experience also make a difference. Timebound service delivery, transparency and currency in information provision, solutions especially designed to suit customer needs etc. can positively influence customers' modal choice decision.

On the basis of stakeholder interactions, discussions with market experts, and an evaluation of the existing policy framework for marketing and business development in the IR today, the following strategic initiatives merit consideration.

1. Setting up business development units that address the need for direct customer engagement.
2. A large part of the potential customer network – that which needs less than train load solutions, that which needs hub-spoke operations, that for which pure terminal to terminal transport alone is not enough to meet its logistics needs – is largely unaddressed by the Indian Railways currently. A mechanism to engage with such customers, primarily through third party logistics service providers (LSPs) needs to be developed and strengthened.
3. IR could further leverage the availability of data within existing operating systems and harness the capacity of big-data analytics to provide more data driven solutions and provide much greater transparency in information availability to its customers.
4. Existing policy formulations are sometimes repetitive, at other times in conflict with each other, and mostly transactional rather than strategic in nature. There is also a tendency at times for such policy formulations to be restrictive/ conservative for investor returns, as a result of which they do not attract the extent of participation required or anticipated. There is therefore a need to re-vamp policy and make it more customer and investment friendly in order for Indian Railways to become relevant in its chosen markets.

1. *Business Development Units*

The Indian Railways has already embarked on an initiative by setting up business development units and encouraging greater engagement of its front-end personnel with potential rail customers. Understanding customer needs and requirements is the first step in creating a viable solution, and this has already been initiated. Through such engagement, many of the problems initially raised by direct customers or customer groups will likely be of a very specific/ tactical nature – seeking to address certain transactional pain points. While these would be important to address, it would also be critical to evaluate the nature of problem areas, understand root causes, and find potential solutions for the longer term as well.

As an instance, the following table provides reference to some specific suggestions of customer groups that have been recently provided to the Indian Railway as part of a series of interactions with the Rail Minister.[13] IR has already addressed some of the suggestions/ problem areas and is looking to find policy frameworks to address others.

Figure 5-15. Certain suggestions from customer groups provided to IR

[13] Exerpts from Minutes of meetings held by Railway Board (in the presence of MR) with Stakeholders of key commodities like Steel, Cement, Automobiles, Containers etc.

Commodity	Stakeholder Suggestions
Cement	- Assured Rake Availability - Improvement in Rail Connectivity to be developed by IR - Reclassification of Clinker as a Raw material - Development of special purpose wagons for Clinker - Infrastructure modernisation and innovation
Steel	- Piecemeal loading to be promoted - Easing of GPWIS policy to encourage investment in wagons - PCC of Coking coal to be revised downward - Waiver of Demurrage charges due to slump in market - Short lead discounts below 100 km - Long lead discounts for Iron Ore beyond 1400 kms - Proliferation of 25 T axle load routes - Reduction in frequent loading restrictions - Rebate in engine hire charges during lockdown period - Liberalise sanctions for imported coal - Mini Rakes for Steel - Interplan Iron pellet transfers to be allowed
Automobiles	- Need to cast a wider net by targeting SUVs, 2 Wheelers and LCVs by modification of wagon design for BCABM - BCACBM is designed for 110 kmph in empty and 105 kmph in loaded condition, but currently only 90 kmph maximum speed is permitted - Increase wagon height from 4305 to 4877 mm (equivalent to dwarf container envelope) to allow double decker movement of bigger cars - New wagon design for 2-Wheeler movement - Notify design modifications so that cost of maintenance is not recovered from the AFTOs.
Containers	- Container Sector is most operationally ready to help increase modal share of rail - Three Key areas to be addressed for modal share increase – Transit, Terminals, Pricing

Commodity	Stakeholder Suggestions
	- Request for policy on transit commitments instead of time-tabled trains - Rationalise CRT access – create a common user access platform and reduce costs - Simplify pricing – reduce cost of empties, remove CC and FAK segregation in container pricing, remove charging of container weight along with cargo, long term haulage commitments - Single rake-based pricing mechanism - Base universalisation for maintenance – moves toward private maintenance of wagons

Source: Experts from Minutes of meetings held by Railway Board (in the presence of MR) with Stakeholders of key commodities like Steel, Cement, Automobiles, Containers etc.

2. *Enablement of LSPs and provision of end to end services*

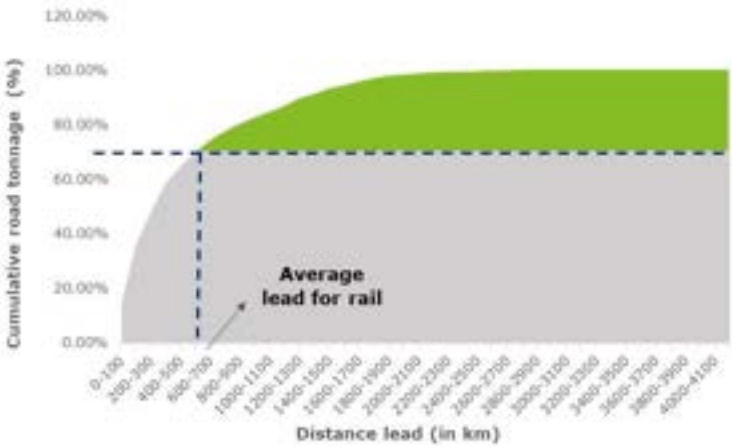
While rail transport is conventionally considered cheaper than road on a per/tonne-km basis for longer leads, the cost of first & last mile connectivity and additional handling cost at modal change terminals can often neutralize this cost advantage and even make the total cost for rail transport higher than that for end-to-end road transport.

Figure 5-16. Transportation cost for different commodities: road vs rail

Source: Stakeholder Consultations, Consultant Analysis

A further assessment of road transport across different leads indicates that considerable volumes of cargo are still getting transported on road even on higher leads where typically rail should become viable/ attractive. During FY 2019, a total of 869 MT of road freight traffic (~30% of total freight movement on road) was moved over longer leads than the weighted average rail transportation lead of 565 km for the IR system.

Figure 5-17. Road Traffic distribution across different leads, FY 2019



Source: AECOM Primary surveys, Consultant analysis

A further analysis reveals that, presently Indian Railway has limited penetration in a significant portion of the freight market where logistics service providers play a key role. This segment constitutes around 43% of total freight market, and includes:

Table 5-1. Commodity wise freight volumes and rail share

#	Commodity	Total freight, FY 2019 (MT)	Rail share (MT, %age)
1	Steel	113	53.99, 48%
2	Exim Containers	232	48.26, 21%
3	Domestic other goods	1876	86.88, 4.6%

Source: Indian Railways Annual Reports, AECOM Surveys and Consultant Analysis

The key benefits that involvement of LSPs can provide with respect to addressing the specific service needs and attracting cargo from these segments include:

a) Providing flexible parcel sizes by running consolidation services
b) Providing on demand end to end logistics solutions
c) Providing transit assurance at market/ competitive pricing

However, IR's current service or operational construct does not resonate fully with these needs. For instance, while the IR does offer a mini-rake of 20 wagons as a product in some commodities, the product is not available in the container space, where the parcel size issue is most critical. The mini-rake product also does not work well with consolidation needs, or the hub-spoke principle.

Another constraint towards attracting certain goods which are mostly serviced through LSPs is the practice of charging dead-weight on the IR. Road movements follow the practice of charging only for cargo weight. However, in the case of rail, dead weight charging – by specifying minimum charge conditions on wagons, and including the weight of containers in chargeable freight, create an automatic disadvantage for rail. The practice of overloading of trucks further exacerbates this disadvantage.

In order to attract and transport freight from this segment, IR needs to reach out to end shippers in a more efficient manner and establish an institutional mechanism wherein IR can partner with LSPs to leverage their superior market access and create end-to-end logistics products for prospective customers. LSPs can consolidate freight and provide single point of coordination as well as add on services to such customers. LSPs can also issue suitable documentation (negotiable instruments) and requisition rakes for mixed cargo needs, apart from providing first/last mile services through other service providers.

Box 4. Select examples of Global Railways providing end-to-end Solutions

While IR's rail network provides considerable geographical reach, the lack of ability to provide terminal handling services and first and last mile connectivity prevents the Railways from being recognised as an integrated service provider. Creating a separate policy and institutional mechanism within the railways that focuses on developing or enabling these capabilities will allow the IR to leverage its long lead transport capability with value additions that can convert it to a formidable end to end logistics solutions provider. The aim of such a mechanism, would be to enable partnership across various transport actors in the supply chain – including road hauliers, third party logistics providers, shippers/consignees and rail operators.

The following box presents areas which a possible policy instrument can address to recognize the role of LSPs and enable their functioning.

Key Components of an LSP Policy:

1. **Eligibility Conditions –** Widest possible eligibility should be considered**. Indian Railways may look at leveraging the proposed accreditation process proposed under National Logistics Policy.** This would ensure that non-serious operators are avoided. It is also suggested that the conditions for change of LSP's ownership be kept simple, with change permitted at any time, on an automatic approval process as long as the new owners/investors satisfy the original ownership criteria. This would facilitate attracting interest from financial investors who sometimes look at ease of exit to determine attractiveness of investment potential.

2. **Wagon Ownership and Type of Commodities to be covered** - LSPs should be allowed to own, lease or rent wagons as per their business models and requirements from customers. The proposed policy should **cover all commodity types** (with a possible exception list for some commodities like Coal, Ores, Fertiliser, POL etc. that do not required active LSP intervention). Further, **all covered and open wagon types should be covered** to enable LSP to consolidate cargo faster, as per demand of shippers. The core principle from a policy perspective would be that commodity consolidation and wagon ownership under different commodity types and wagon ownership schemes such as CTO, LSFTO, GPWIS etc. would get consolidated into a single service provision policy with full flexibility in terms of types of wagons that can be owned or types of commodities that can be carried.

3. **Single Interface** – The proposed policy should enable LSP to act as single point of contact for the customer. This, in turn, would require:
   a. Enabling LSP to requisition Trains (in cases where these are not owned by LSPs) from IR and undertaking the volume risk during consolidation.
   b. FIFO based operations: Principal of **FIFO movements for private wagons** should be followed for all rail operations. Where LSPs wish to prioritize movements of their owned wagons, a provision for **transit commitments upon payment of a freight premium** could also be put in place. Failure to meet such commitments once a premium freight has been collected could be compensated through refund of the premium and/ or payment of certain penalties so that the idea of service quality can be commercially embedded in the system.
   c. Issue of Rail Receipts in the name of end users, even where wagons are being provided by LSPs should be permitted, and issue of multiple RRs for multiple customers with cargo on a single train should also be permitted. This will encourage movement of smaller parcel sizes (from road to rail) through cargo consolidators such as LSPs.

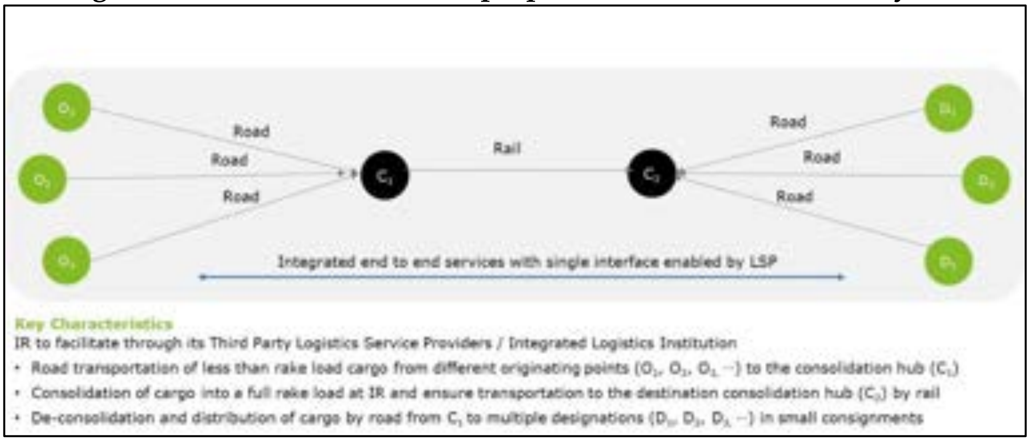
4. **Assured Transit** – Enabling LSP to offer transit reliability to its customers would in turn require IR to establish a back to back penalty/reward based transit assurance or time-table freight mechanism with LSPs.

5. **Freight/Haulage Charges –** The proposed policy could look at providing a transparent and predictable haulage and cost structure to LSPs on the following principles:
   a. Discounts and rebates against wagon ownership. A revamped wagon ownership policy would be required where the cost of wagon ownership is removed from haulage and not levied upon any private wagon owner for the life of the wagon.
   b. In order to encourage cargo consolidation, discounts to LSPs who combine cargo from multiple customers on a single train can be provided.

In parallel to a policy framework for enabling LSPs, IR may also need to consider developing capabilities within the organisation to support provision of value-added services beyond the pure rail transport product. Instead of creating an organic 'Ground-up' Model where such skills are developed in-house, an alternative could be acquisition of / partnership with road freight operators/LSPs that provide end-to-end logistics services and combining their first and last mile offering with a rail solution. The roles and responsibilities to be fulfilled under such a partnership could include:

- Fleet operations and management;
- Monitoring of prevalent road prices and developing a suitable blended pricing model to keep cost of end-to-end product competitive with a pure road product;
- Providing additional value added services such as storage, distribution, sorting of cargo etc. using the terminal locations already in place; and
- Identification of, and creating suitable partnerships with, potential partner companies/vendors (established freight forwarders, large logistics service providers or local trucking companies etc.) which specialize in providing first and last mile connectivity along with other value added services like storage, packaging, labelling, track and trace etc.

Figure 5-18. Salient features of proposed end to end services by IR



Source: Consultant Analysis

A prime objective of creating such a partnership is to re-focus the commercial attention of IR from a supply-determined to a demand-driven organisation. It is essential therefore, that the partnership(s) be structured in a manner that promotes an environment of innovation, helps facilitate coordination and is flexible and responsive to the customer/market requirements. A horizontal/ flat structure is therefore recommended for the unit, to allow for greater collaboration and promoting the ability to provide a holistic product offering. The institutional setup should ideally be structured around the following three functional themes:

a) *Customer Interface*: This would include understanding and analysing customer requirements, gathering market feedback, providing design inputs for product/service design, conflict management and resolution among others.

b) *Product/ Service Design*: This would include bridging gaps between the expected performance and current services offered by IR by way of designing comprehensive rail-road based solutions. Additionally, this role will also be responsible for reviewing global best practices and benchmarking activities in the domain of intermodal transportation and services over time.

c) *Operations and Management*: This would focus on aspects related to 'on ground' implementation of planned services comprising entering into agreements/ contracts with respective logistics players across the value chain, allocating resources for conducting processes seamlessly, and scheduling activities in coordination with existing railway management systems.

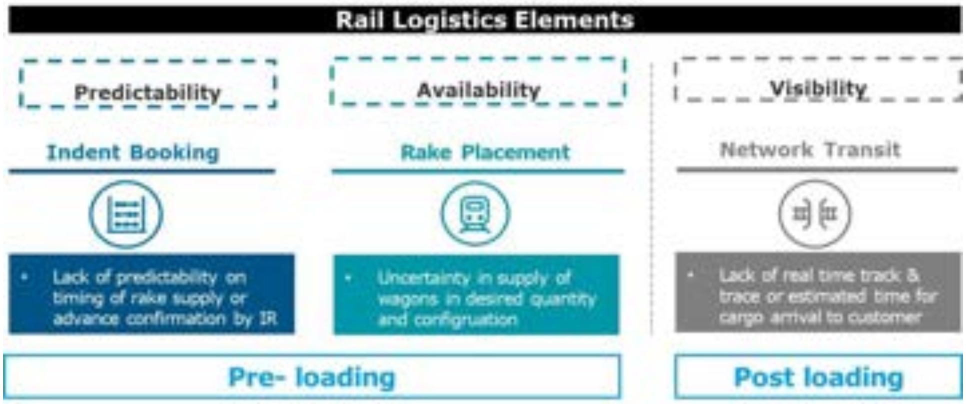
Figure 5-19. Key themes of Operational structure of the proposed Business development units

Source: Consultant analysis

3. *Data Driven Solutions*

The process of rail freight transportation begins with a customer placing an indent (or demand for wagons/rake to load cargo), followed by sanction/approval of indent by IR, placement of a rake at the required loading terminal, loading and subsequently network transit.

Figure 5-20. Key elements of Rail Transit



Consultation with stakeholders across the various stages involved in this process indicate three primary areas of concern with respect to information provision/ certainty as indicated below:

a) Predictability in wagon supply – Customers find it difficult to plan their supply chain flows in advance if they use rail as a dispatch mode;
b) Availability of wagons on demand – Due to lack of visibility, and uncertainty in supply of wagons, any sudden demand spurts or supply line disruptions are usually met through road despatches; and
c) Adequate Track and Trace functionality – Customers need to get better visibility of their cargo movements in order to integrate these with their larger supply chains, production, and market delivery plans.

There is accordingly a need for IR to provide information with adequate periodicity and transparency, to enable advance planning for rail services in line with customer requirements.

Figure 5-21. IT based tools

Source: Consultant Analysis

A. IT Based tools –
   - Using the existing FOIS platform, IR can extract historical data related to rake indents, identify existing gaps in rake availability for different terminals, zones, customers as well as commodities and devise appropriate solutions to create a more optimum match between demand and supply of rakes.
   - Inputs can be further sought from potential customers, with regards to their load planning, and these can be integrated into a future rake

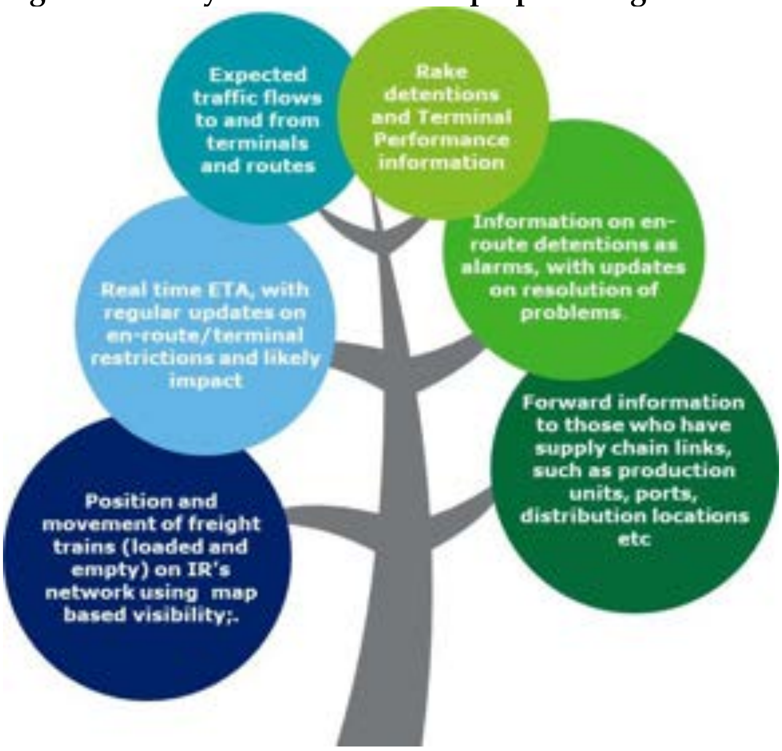
movement plan to ensure that the most efficiently available rakes in terms of time, distance etc. are made available to customers based on their advance plans.

- In cases where there is a change in demand, this can be received from customers and used to create alternate supply patterns with least delay or inefficiency in terms of rake movements.
- Providing data on route and terminal restrictions along with details of likely lifting of such restrictions, as well as historical analysis of congestion outcomes based on demand raised for rakes or cargo movements along such routes/terminals.

B. Digital Customer Interface –

- A digital interface does exist through the FOIS system. This can be further enhanced for providing better visibility and enabling more active planning support (through tools) for IR customers. Some of the potential functionalities for such an interface could include:

Figure 5-22. Key Functionalities of proposed digital interface



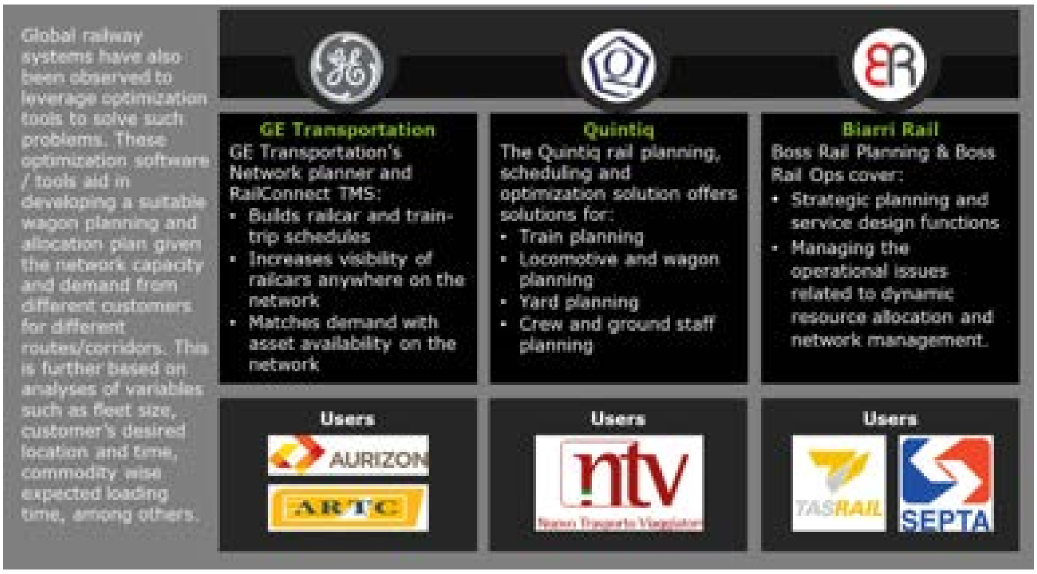
Source: Consultant analysis

- Such an interface will enable IR to extend and provide visibility to customers from the time of placement of indent with reference to 'how', 'when' and in "what" configuration rakes will be made available for loading. The information will further enable supply chain planning, reduction in inventory holdings, improved linkages with first/last mile and terminal operations, and in all help improve efficiency of transit for end-users.

C. Establishing service level commitments for rake supply and movements –

- In the present scenario, a customer has to pay a 'Wagon Registration Fee' as a security deposit at the time of placing indents. On successful delivery of the rake by IR, followed by timely loading of the rake by the customer, this amount is adjusted against the overall tariff that the customer has to pay. As a penalty for false or speculative indenting, the registration fee is forfeited in case of cancellation of the placed indent (after physical supply of wagon). There is also a penalty mechanism for detention to the wagon for loading beyond the allowed free time.
- Presently, there is no system of reverse penalty to be paid by IR in case there is a delay in the provision of the required rakes at a confirmed time. While a penalty backed transit assurance has been suggested earlier, as we move away from a supply-driven institutional set up to a market-oriented system, there is a need to introduce a 'two-way penalty' mechanism with respect to confirmation of rake availability, placing of trains for cargo handling, detentions for provision of locomotives etc. by IR.
- In addition, IR can also consider adopting a premium/differential pricing model based on the urgency of customer demand. This can be with relation to priority for rake allocations, transit, placing of trains for handling etc.

Figure 5-23. Illustrative rake optimization tools



Source: Website for GE, Quintiq and Biarri Rail; Consultant Analysis

4. *Policy Formulation*

In order to support modal shift, railways need a stable policy framework with fair operating conditions and based on certain key tenets.

Figure 5-24. Key tenets for stable policy framework

Clarity and Transparency – Ease of Access	Implement ability – Lack of Complexity	Attractiveness for Investment on Win-Win basis

Source: Consultant Analysis

The existing policy framework with respect to freight operations on the Indian Railways is characterized by multiple policies and corrigenda over time that hinders transparency and clarity of such policies for rail users. Based on an overall analysis on this account, IR may consider the following recommendations.

a) All relevant policies be consolidated into a database with ease of searching across topics, updates etc. While the mere posting of policy and circular PDFs does place this information in the public space, it remains difficult to search and collate any information to support investment decisions, understand available use options, discounts, restrictions on applicability etc. An IT application needs to be developed for this purpose, which captures existing policy formulations on an as-is basis, and also creates a mechanism for updates and new policy introductions so that the commercial policy regime can be maintained as a searchable data-base with ease of access for rail users.
b) A strategic deep dive into existing policies and consolidation of these into broad sub-headings with simpler, more transparent, and investment friendly frameworks. Possible action agenda on two key areas reviewed as part of this study (and study of existing policies) - Pricing and Definition of Rail Products and Development of Terminals, have been presented in this section.
c) Presently, in the absence of a formal regulator, the Indian Railways (IR) itself functions as the operator, policy maker, service provider and regulator. This can lead to conflicts of interest and situations where key issues relating to pricing, and service quality remain unaddressed. There has been a substantial increase of private participation in various aspects of rail operations. There may be merit in considering an independent institutional mechanism for regulation at this stage. The institutional mechanism could span and also cover aspects pertaining to investment returns for private investors, as well as smooth operationalisation of Public Private Partnership (PPP) initiatives for development of rail infrastructure. This aspect has been discussed in another section of this report.

5.8.2. Pricing Reforms

It is estimated that while the operating ratio for IR's freight business in FY19 was 0.59, it was 1.92 for IR's passenger business. This inherent cross-subsidy is contributing to IR's haulage charges being higher than its global peers even after adjusting for purchasing power parity.

Figure 5-25. IR Passenger vs Freight Revenue, FY 2019 (Rs cr)

Source: Indian Railways Yearbook (FY 2018), Consultant Analysis

Figure 5-26. Indian Railways Vs Gloal Peers

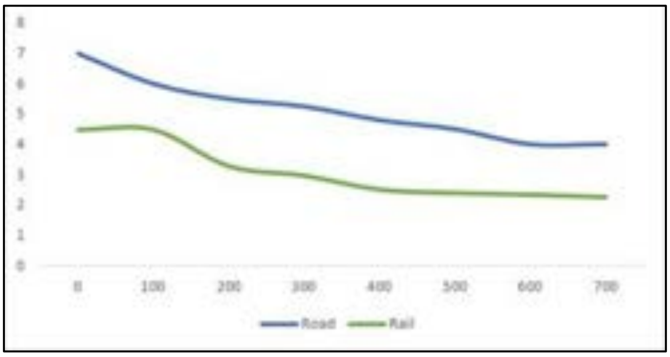
Source: Indian Railways Yearbook (FY 2018), Data from respective rail authorities' websites

The haulage charges, and their market competitiveness/ impact, however, vary across commodities. Rail has a clear advantage/ competitiveness in transporting large and heavy volumes over longer leads, in terms of landed cost, for bulk commodities. As bulk commodity transportation involves point to point (e.g. mine to thermal plant for coal) movement with no first/last mile movement and automated handling, rail tends to be cheaper than road.

Also, since the market for certain bulk commodities like food grain, fertilizers etc. is often controlled or influenced by certain "national policy interests", rail pricing for such commodities (determined by their commodity classification in the IR goods tariff) often keeps them competitive vis-à-vis road movement.

For high value commodities such as steel and cement, and for non-bulk commodities like containers and 'other non-conventional domestic goods', rail tends to 'lose out' to the road sector on a landed cost basis even for longer leads. This is again due to the impact of costs for first/last mile transportation, and terminal handling at one end, as well as the haulage charges such commodities being under a higher commodity class in the IR goods tariff on the other.

Figure 5-27. Logistics Cost for Bulk Commoditis-
Road vs Rail (Rs/Tkm)



Source: Industry Consultations, Indian Railways Goods tariff, Consultant Analysis

Figure 5-28. Pricing issues for certain high-value commodities

Source: Industry Consultations, Indian Railways Goods tariff, Consultant Analysis

With the operationalisation of the eastern and western DFCs, rail logistics cost is expected to come down considerably (by 10 to 20%). However, such savings may

Figure 5-29. Potential cost savings for double stack operations on DFCs – mainly for upper stacked containers

not provide rail transport with a decisive edge over road transport mainly because of emerging technological as well as operational improvements[14] in the road sector, which are expected to parallelly drive down trucking cost as well.

14 Electric trucks, Improved Asset utilization etc.

Source: Industry Consultations, Indian Railways Goods tariff, Consultant Analysis

Mundra – Kashipur		
Cost Elements	Cost per FEU (in Rs.)	
Single Stack Operations (C)		
Cost per FEU	57,902	
Double Stack Operations	**Case 1 – Heavy FEU below and light above**	**Case 2 – Only 25 FEUs above**
Haulage Charge to Patli (A)	26,440	29724
THC/TAC	5400	10793
Haulage Patli – Kashipur (B)	10,793	3500
Rake holding cost	5,333	6857
Cost per FEU	47,966	50874
Savings	**17%**	**12%**

Mundra – Patli	
Cost Elements	Cost per FEU (in Rs.)
Single Stack Operations (A)	
Cost per FEU	43933
Double Stack Operations (A)	
Haulage Charge to Patli	26,440
THC/TAC	5400
Rake holding cost	4,000
Cost per FEU	35840
Savings	**19%**

In light of this background, certain broad recommendations are provided below on issues related to pricing - on what needs to be considered to rationalize pricing and make it more aligned to market considerations.

1. *Financing Passenger Subsidies:*

IR must actively rationalize and reduce the burden of a much higher operating ratio of its passenger business on freight tariffs – potentially in a phased manner by gradually adopting alternative mechanisms to finance such subsidies.

a) Such mechanisms could include targeted subsidies through commitment/ support from specific government departments as required. For example, HRD ministry can support student discounts, Ministry of Social Justice and Empowerment can fund senior citizen discounts, Ministry of Defence can support discounts for defence personnel etc.
b) Besides direct funding of discounts, state governments and local bodies that seek to benefit from economically unviable passenger train services can be requested to provide budgetary support, through operational grants, for the same.
c) Finally, if there is an imperative (social) for keeping passenger charges pegged at "affordable" levels which are below reasonable cost of service provision, direct government budgetary support targeted at such passenger operations could be considered.

Direct Grants are used globally to fund passenger service deficits. For instance:

- Russian Railway has increasingly phased out cross subsidization of passenger operations by freight services. In FY 2016, Russian Railway received direct grant of Rb 32.5 bn to compensate for losses by Russian Railways associated with the regulation of tariffs for passenger services.
- In UK, government provided direct grant support of 6.4p for every rail passenger kilometer travelled in Great Britain in 2018-19.

2. *Revision of Pricing Philosophy:*

The current pricing philosophy on Indian Railways has reference to a fully distributed cost model, with organizational inefficiencies contributing to higher costs across lines of businesses.

Table 5-2. Indian Railways working expenses (2018-19)

Expense Heads	% share	INR (bn)
General Superintendence & Services	4.28%	79.1
R&M-Pway & Works	7.89%	145.8
R&M-Motive Power	3.57%	66.1
R&M-C&W	8.28%	152.9
R&M-P&E	4.36%	80.6
Op Expenses-RS & Equip	7.46%	137.9
Op Expenses-Traffic	14.65%	270.7
Op Expenses-Fuel	16.44%	303.9
Staff Welfare & Amenities	3.89%	71.9
Misc. Working Expenses	3.84%	70.9
PF, Pension & other Retirement Benefits	1.26%	23.2
App. To DRF and Pension Fund	24.09%	445.1
TOTAL		1846.6

Source: Indian Railways, Annual Statistical Statement, 2018-19, Statement 7

As discussed earlier, for railways to enhance their market share of transportation of focus commodities, they would need to have reference to various aspects like total logistics costs for customers, varying discounting regimes during initial stages of market creation and capture, prioritisation with reference to net accretive contribution vis-à-vis volumes/ leads/ network utilization, etc.

Accordingly, there is need for IR to revisit its freight pricing levels and align them with competition considerations. This exercise would include:

a) Understanding pricing dynamics of road sector – IR could set up a market intelligence mechanism (which would ideally be independent or outsourced) for assessing the pricing structure of road sector and how it varies across commodity segments, peak/off peak seasons, empty load directions, and leads, among others.

b) Indexing rail price escalation based on transparent parameters – Freight tariff escalation linked to variation in specified parameters/ indices can help provide longer-term visibility and pricing guidance/ certainty for customers to plan their logistics networks/ operations.

c) Calculating demand elasticity to pricing changes – Based on analysis of the above two factors, assessment of price sensitivity of different commodities with respect to changes in road as well as rail haulage charges needs to be undertaken to establish the potential range within which rail haulage can be varied, as well as identify and subsequently monitor potential modal share changes/ benefits from such variations.

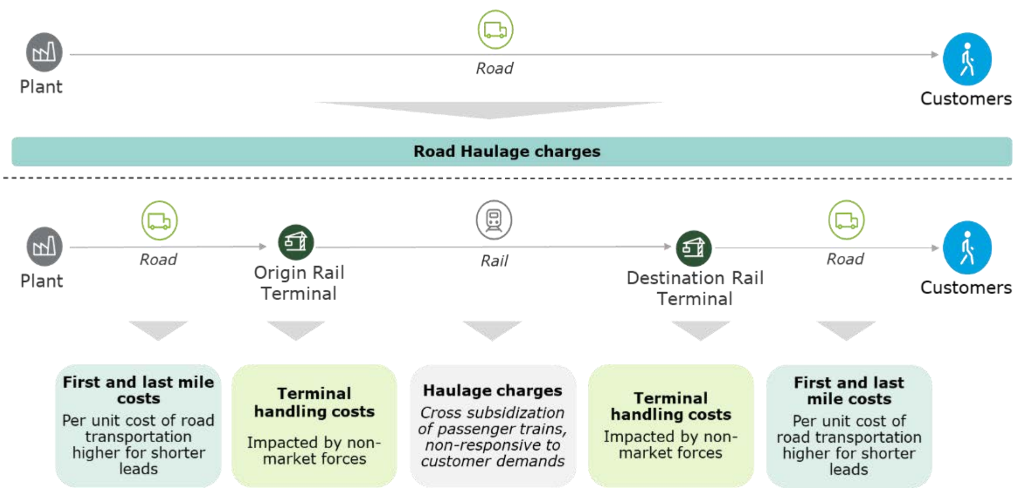
These changes will require modification of the existing pricing framework from a cost-driven to a data and market intelligence driven system. The primary objective of such an exercise would be to help identify commodity segments where IR can adopt differential pricing based on mechanisms of discounting and premium charges such that prices are competitive vis-à-vis costs for road transportation and can therefore be used to effect modal shift from road to rail.

3. *Specific Pricing Initiatives:*

(a) An Integrated Haulage Charge

As indicated in the figure below, the total logistics cost for customers incorporates multiple elements – rail haulage, terminal handling costs, first and last mile transportation costs and even empty wagon repositioning charges in some cases. In comparing transportation by rail versus road therefore, it is this overall cost that determines modal choice and not merely the per tonne/km rail and road haulage charges.

Figure 5-30. **Total logistics costs for customers transporting freight by**



Source: Consultant Analysis

As discussed earlier, IR needs to consider the possibility of providing/ enabling first and last mile connectivity, as well as terminal handling services for its customers through establishing relevant institutional and policy mechanisms and encouraging partnership with LSPs. The benefits of providing such end-to-end products, in terms of inducing modal shift to rail, can however only be fully realized by institutionalizing a pricing structure which makes the total logistics cost for customers of rail transportation competitive vis-à-vis that for road transportation.

Presently, first and last mile as well as terminal handling services are provided through the market, and customers are free to make their own arrangements for the same. This practice however has tended to create scale inefficiencies and certain market imperfections in the form of control of transport and handling services in certain locations, as a result of which such services are often provided at higher costs and with reduced efficiencies.

In this context, IR can consider offering a single landed price to its customers covering costs across the entire chain, with an apportionment mechanism for first and last mile or even terminal handling services. Vendors can be appointed for transport and handling activities through a competitive bidding process, with scale efficiencies being provided through commitment of volumes or clustering of locations.

Two factors however need to be kept in mind in this context. The first is that this activity should not be seen as a potential for generating incremental revenue for IR, as this could lead to a padding and inflation on costs. Accordingly, IR should not seek a revenue or margin share from potential vendors – other than as required for covering certain minimum administrative costs for provision of such a service. The incremental freight volumes that can be attracted through consolidated pricing should remain the primary focus of such an exercise. The second factor that needs to be kept in mind is that such a practice should not lead to market monopolization by selected vendors, as even with controlled pricing, such monopolization can lead to poor service efficiencies through reduced asset reliability or availability. In order to retain efficiency in both cost and service provision, either multiple vendors could be appointed for a single location, or private vendors allowed to continue to offer services in competition with selected vendors – creating choice for end users and driving market-based efficiency in operations.

(b) Volume and Train based pricing for Light Cargo

Presently, rail freight charges are based on a minimum weight per wagon basis. This often results in light cargo such as FMCG products, Consumer Durables, and many other general and Containerizable goods not finding rail transport competitive due to a relatively high component of dead-weight haulage being paid based on defined carrying capacity of wagons (rather than what is physically being carried). Even in instances where there are differing weight slabs offered for haulage, the baseline charging is linked with the heavier slabs as a result of which light cargo gets disadvantaged. In comparison, road either follows a volumetric charging concept for lighter cargo, and also does not add the weight of the vehicle or container as part of the chargeable freight element. As investment planning under the NRP (as further fine-tune from time to time) generates additional capacity in the network, IR must look to develop a volume based pricing mechanism to attract light cargo, which today has a miniscule share on the rail network. Increasing the envelope of moving dimensions where possible with the introduction of DFC corridors, and even within the existing rail network will also help increase the volume capacity on rail carriage and make volume based pricing more effective for both IR as well as rail users.

Another possible mechanism for volume based pricing could be to price for some select commodity groups (especially those being carried in containers) on a "per train load" basis instead of on a "weight per wagon or slab" basis, allowing cargo consolidators and rake owners to determine the overall cargo mix based on a blended train rate instead of a targeted per wagon or per tonne rate.

Figure 5-31. **Select examples of Pricing across international rail systems**

Source: Websites for DB Rail, CN and BNSF, Consultant Analysis

(c) Station and Route Based Pricing

Presently, pricing on IR is independent of any OD specificities, as a result of which the same distance and weight based rates are applicable irrespective of demand and supply conditions on specific routes. By offering innovative pricing structures on select routes or for select commodities, IR can induce modal shift from road in addition to shifting traffic from congested routes to underutilized routes. For instance, on select routes, IR may consider 'Corridor Based Pricing' instead of static pricing structure - which is route neutral, to promote new routes by offering discounts on:

- Top OD pairs for key commodities – For example special rates for rice and retail cargo exports from North India
- Routes with spare capacity
- Routes with specific imbalance – For example EXIM routes for containers between NCR and Punjab and ports on the West coast

Figure 5-32. Illustrative example of possible 'corridor based pricing' on IR

Source: Industry Consultations, Indian Railways Goods tariff, Consultant Analysis

(d) Discounts provided by Indian Railways

The Indian Railways have provided incentives for attracting additional rail volumes through various discounting schemes that are presently in operation. These include encouraging empty flow movements, long term contracts and volume commitments, round trip moves, short lead and long lead incentives etc. among others. The following table shows the broad coverage of such initiatives along with recommendations for areas of improvement in extant policies.

Table 5-3. **Broad coverage of existing discounts/ initiatives on IR and possible areas of improvement**

IR Policy	Extant Features/Terms	Recommendations
Traditional Empty Flow Direction (TEFD) *TCR/1078/2019/2* *Dated: 23/04/2020*	Policy aims to reduce empty return ratio and generate additional revenue by attracting cargo in empty flow. Empty flow streams have been identified in the policy and FOIS auto discounts cargo moving on these routes. Allows small parcels of up to 10 wagons for covered, and 30 for open wagon types to be covered. All empty flows are charged at 100 Class rates.	Extend policy to include Containers as cargo imbalance is a major cost impediment for private rail operators. Removal of rule for applicability only beyond certain threshold volumes in instances will widen the scope and applicability of the discount and also result in greater transparency.
Long Term Tariff Contracts (LTTC) *TCR/1078/2016/14* *Dated: 30/03/2017*	Policy targets volume commitments, price stability, and incremental volumes. Rebate offered is increased based on percentage of volume growth committed from base year (5% growth is minimum). Overall volume linked discounts are also offered in the policy. No price escalation to take place in mid-year for participants, even if such increases have been announced by IR.	Extend to include containers and automobile operators, where long term customer contracts are the market norm. Consider reduction of eligibility from 1 MTPA to ½ MTPA to expand scope to customers offering light weight cargo. A pure volume-based discount tends to work more in favour of larger players – An alternate measure could be to offer discounts based on modal share of traffic offered by the customer rather than on overall volume. Relax the minimum three-year time commitment required to participate in the policy. For price stability, expand the concept to include longer price visibility with pre-agreed escalation terms on an annual basis.
Round Trip Traffic (RTT) *TCR/1078/2020/3* *Dated: 05/06/20*	Policy targets empty flow reduction by incentivizing the booking of round-trip cargo If cargo is booked on round trip basis on exact circuit or within a 200 km range, the lower of the two commodity class rates is charged for both streams.	A round trip scheme is also needed for containers, but as containers are currently not charged on a commodity class basis, a fixed discount as a percentage can be considered for round trip moves. Policy is currently restricted in terms of applicability for some terminal categories – such restrictions should be lifted for wider applicability and flexibility.

IR Policy	Extant Features/Terms	Recommendations
Short Lead and Long Lead Discounts *TCR/1078/2020/07* *Dated: 30/06/2020*	10-50% discounts are offered for leads up to 100 km. Discounts can be committed for long term up to 10 years basis customer commitments. Long lead discounts beyond 1400-1500 Km offered for Coal/Coke, Iron/Steel, and Iron Ore – Discounts are in the range of 15-20%.	The minimum distance for short lead discounts needs to be increased to at least 300 kms as many commodities like Cement have considerable road share on such short lead traffic. The extension of policy for Containers will help attract port to ICD volumes for facilities closer to the port area that are currently entirely based on road flows. (This can also help decongest port facilities whenever there are import surges.) There are some long lead domestic cargo circuits (such as Delhi-Chennai, Delhi-Bangalore, Mumbai-Kolkata, Delhi-Guwahati etc.) which will benefit from a long lead discount offering to other commodities like Auto, Containers and light weight cargo.
Dynamic Pricing *TCR/1078/2015/14* *Dated: 20/09/2015*	Dynamic pricing is generally covered in three categories – Busy Season Surcharge Development Surcharge Congestion Surcharge At present a 9 month busy season surcharge of 15% stands withdrawn 5% Development surcharge is applicable on all commodities Congestion surcharge of 25% and 20% is applicable on Bangladesh and Pakistan Cargo, while 10% Port congestions surcharge stands withdrawn	The system of surcharges should ideally be done away with as capacity is built into the system. A premium service charge may be considered where customers are provided commitments on transit, guaranteed wagon supply etc. but such a charge should also be accompanied with a corresponding penalty to be paid for failure on part of the IR to meet commitments for which premium is charged. The 5% development surcharge may be incorporated within the tariff structure for simplicity.

Source: Consultant Analyses

Figure 5-33. Key considerations for reviewing freight discount schemes

Source: Consultant Analysis

Across various policies announced by IR from time to time, there are some common elements that also need to be addressed. These mostly relate to simplification and ease of use, and include the following:

- Most of the policies are aimed at retention of existing customers instead of targeting new ones. The focus needs to be expanded to attracting fresh cargo profile alongside expanding wallet share from existing customers.
- Automation of applicability through the FOIS system.
- Railways may also consider concurrent applicability of certain policies for key/ focus commodities, service types, etc.
- Instead of announcing policies only for limited validity, to provide certainty/ visibility to customers to plan their logistics/ operations, typically the default mode should be for policies to be valid for a certain minimum time period (1 or 2 years) unless the policy is only proposed to address a short-term issue/ tactical objective (which itself should be rare)
- Instead of updating policies through corrigenda, ideally the revised policy should be issued when changes are required, so users do not need to keep track of master circulars, and multiple changes over time.

(e) Weighment related issues:

Since all pricing on IR is based on cargo weight, accurate weighment of cargo, as well as means to identify the difference between tare weight of rolling stock and cargo payload are important factors to be addressed to bring about a fairness in the weighment process.

Presently, weighment of rakes is done on in-motion weighbridges located either inside private sidings, or at specified locations on the IR network. Some of the problems related to weighment of cargo include:

- Inaccuracy of weighbridges due to calibration problems – Difference in weighment between weighbridges often leads to disputes or high penalty impositions that act as a disincentive for rail movement.
- Inability for bi-directional weighment (especially at older sidings), leading to inability to weight empty wagons – Using printed tare weight of wagons

leads to inaccuracy as wagons may increase in weight over time due to rusting, deposition of cargo residue etc.
- In the case of containerised cargo, the weight of containers is included as part of cargo weight as there is no mechanism for recognising container weight separately from cargo. As a result, almost 2.5 tonnes per TEU of dead freight has to be paid for containerised cargo, which leads to a competitive disadvantage in comparison to road freight for containerised or containerisable cargo.

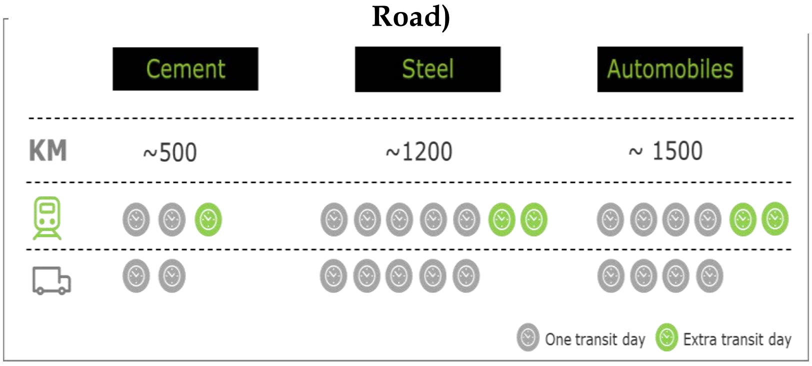
Possible solutions to address/ ease some of these problems – to be implemented in conjunction with other suggestions on pricing reform/ initiatives above, could include:

- Streamlining of calibration process and gradual upgradation of older weighbridges with modern facilities that are not limited to uni-directional weighment and which have higher error tolerances to speed of movement for weighment.
- Legislating a standard container weight of 2.5 tonnes per TEU as container weight that can be excluded from chargeable weight in the case of containerised traffic.
- Accepting 'Said to Contain' cargo weight for charging for commodities where the actual carrying capacity for such commodities is below the permitted carrying capacity for the wagons given light weight of such commodities.
- Revising Permitted Carrying Capacities for wagons and commodity combinations to reduce the impact of dead freight haulage which disincentivises rail transportation, especially for light cargo.

5.9. Transit

As discussed earlier, overall transport & logistics cost and time are often seen as the two key drivers in decision making on modal choice between road and rail. Customer requirements for shorter transit times stem from a need to reduce inventory levels in the supply chain by getting efficient, on-demand dispatches and deliveries. In the current market construct, road transport tends to deliver shorter transit times when compared to rail across multiple commodity segments as illustrated below.

Figure 5-34. Transit Time for key commodities (Rail vs Road)

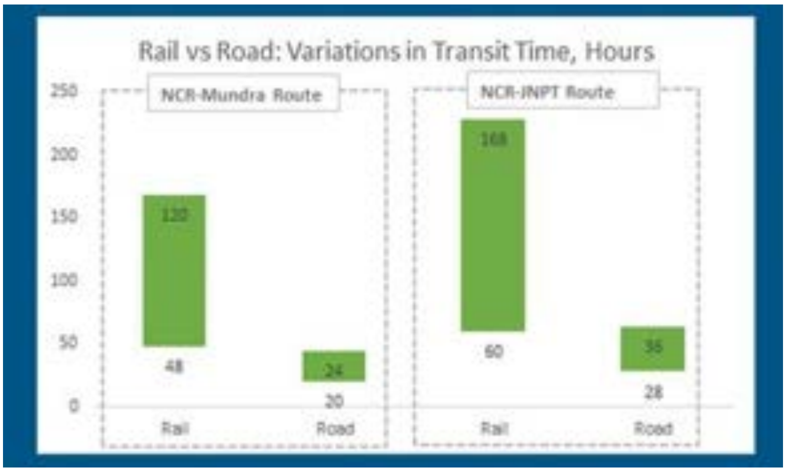


Source: Industry Consultations, Consultant Analysis

On the Indian Railway (IR) system, freight operates on an 'available path' instead of an 'allocated path' basis. As the overall network is currently overutilized, with 46% of the network operating at greater than 80% capacity utilization levels, there results a lack of predictability or certainty for freight transit on a system where freight and passenger services are shared on common routes.

Besides overall transit times, IR's inconsistent service offerings with respect to transit are often incompatible with the desired value proposition of "service reliability" that is crucial for most shippers. This is especially so in case of EXIM and Domestic containers, Parcel traffic, and other higher value retail cargo, which is crucially dependent on predictable, on-time transit performance.

Figure 5-35. Illustrative variance in transit time between road and rail modes



The issue of longer transit times and transit variability can be attributed primarily to the overall capacity constraints and system of operations in force on the IR network. While issues related to capacity enhancement are dealt with elsewhere in this report, some improvements can also be achieved through systemic or policy related changes.

5.9.1. Improving Daily Runs/ Average Speeds of Goods Trains

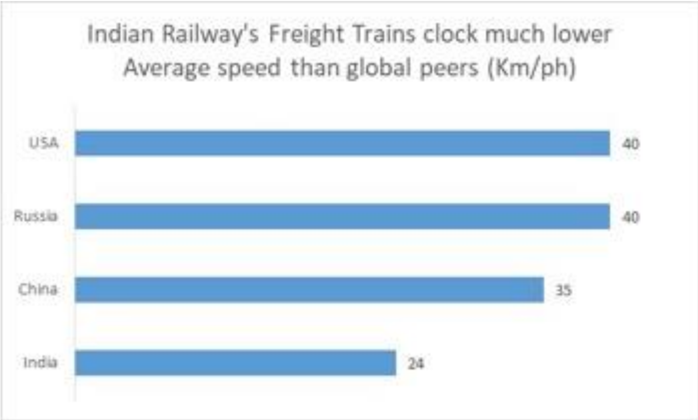
Freight traffic in the Indian scenario operates on a mixed traffic operational construct where freight trains compete with (and generally lose to) passenger trains for preference on train paths and line capacity on common track sections. This is evident from much lower average freight train speeds on Indian Railway's network compared to passenger trains[15], and also when Indian Railway freight train speeds are compared to its global peers as illustrated below.

In recent times, when passenger train services have been significantly impacted (terminated or considerably reduced) due the CoVID-19 pandemic, average freight train speeds on the IR network have seen an increase (from the earlier 24 kilometers

[15] Average speed of Goods trains on IR is 24 kilometers per hour (kmph), and for Passenger services (combined) it is 44 kmph

per hour) to more than 40 kilometers per hour in the absence of (competing) passenger train services on common tracks.

Figure 5-36. Average Speed of Freight Trains



Source: Annual Reports of various railways, Consultant Analysis

While average speed does tell us how effectively the network is being leveraged, for the end-users or railway customers, it is not speed but instead transit (i.e. the time taken for goods to reach from one place to another) that is more important. The distance covered per day is therefore a better measure for evaluating effectiveness of network use if we look at it from a customer service lens.

In this context, the current average daily run of 200-250 km on Indian Railways remains low compared to what freight customers realize on road via trucking as illustrated below. It is pertinent to highlight that the daily runs for rail's main competitor viz. trucking are also expected to increase by at least 100-150 km per day in the coming decade with the advent of better/faster trucks[16], highway upgrades under the Bharatmala initiative, rise of new business models like relay trucking etc. In this context, in order for Indian Railways to attract and carry more freight, it must improve its daily run performance for freight trains and achieve targets equating or bettering those that are prevalent for road-based transport.

[16] Electric trucks provide operational cost savings for various heads in range of 5%-30%, further resulting in lifecycle cost savings in range of 5%-10% as per "*Analysis of long haul battery electric trucks in EU: Marketplace and technology, economic, environmental, and policy perspectives, 2018*"

Figure 5-37. Average Daily Runs: Road vs Rail

Besides improving track capacity, the following can also facilitate improvement in daily run for freight trains:

5. **Maximum Permissible Speed for Rolling Stock**: As most new wagons being introduced on the IR network are already rated to operate at speeds of 70-100 kmph, the constraint of rolling stock speeds will likely get eased over time. Increased focus on private wagon procurement, and replacement of existing fleet with better designs after their useful life/ retirement will also ease this possible constraint to a higher average daily run outcome.
6. **Reducing time spent at Terminals**: Activities such as loading and unloading of cargo, waiting time for trains to be placed or removed from handling lines, and maintenance time for rolling stock, require considerable time which takes away from the availability of rolling stock for open line movement. Optimization of terminal use/ time spent by improving terminal capacity and quality could also reduce some of the time spent at terminals and help improve time on open line – translating into a better performance in terms of average daily run for freight rolling stock.
7. **Reducing idle time when cargo is in transit**: Another enabler could be efficiency of track use and reduction of idle time or congestion while cargo is in transit. Reducing idle time would need a multipronged approach and some suggestions that could be considered independently of physical capacity expansion of track infrastructure are:
   5. ***Shift from zone based planning to integrated corridor based planning:***

Besides operational planning, which is done at Divisional and Zonal levels, IR's current planning process also entails individual zones and divisions developing line capacity renewal and expansion proposals.

However, several key corridors or routes fall under the operational jurisdiction of multiple zones/divisions. As a corridor's capacity is invariably driven by its weakest link, zone-based planning can lead to shifting of bottlenecks from one zone to another while the corridor as a whole remains congested. To illustrate this problem, if we look at the Delhi Kolkata corridor, a quick capacity impact analysis, corresponding to increasing rail traffic levels, reveals shifting bottlenecks across zonal jurisdictions. In this context, shift to a Corridor based integrated planning would ensure holistic resolution of capacity constraints on the IR Network.

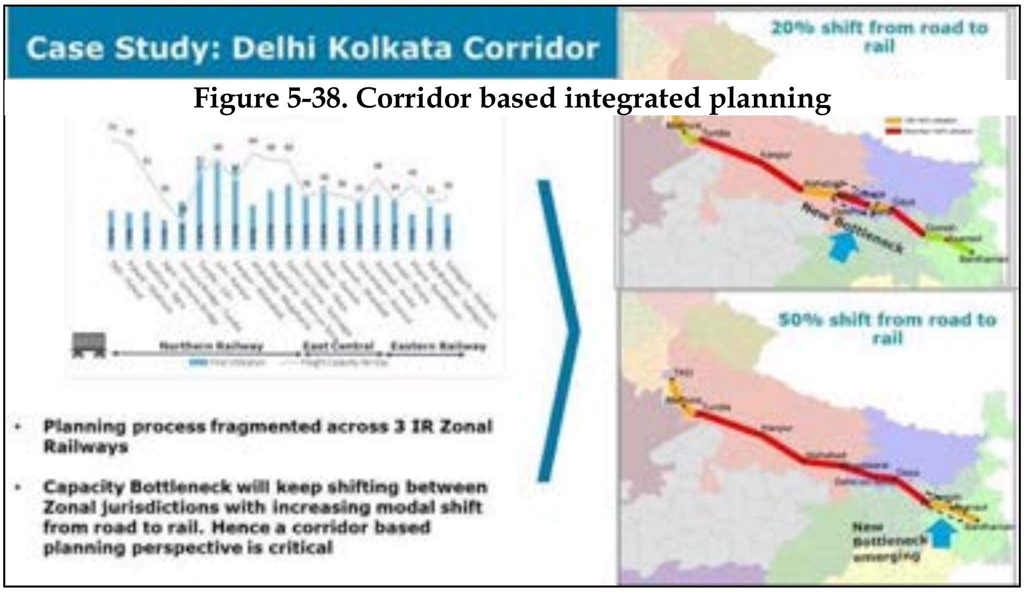


Figure 5-38. Corridor based integrated planning

Source: IR's Sectional Line Capacity Charts showcasing capacities for FY 17 and FY 21 sourced from Indian Railways. Existing Road volumes along the corridor were sourced from primary surveys undertaken earlier in this study and assigned assuming One rake carries 3000 tons. The congestion in the network was estimated by adding resulting rake volumes to various sections.

6. *Carving out a Ring Fenced Freight Sub-Network:*

Even with the operationalization of Eastern and Western Dedicated Freight Corridors (DFCs) and completion of other capacity enhancement works currently under execution, IR may not be able to generate adequate capacity for freight trains based on likely demand forecasts if operations are continued on an 'as-is' mixed network model. Capacity constraints on non-DFC corridors are expected to continue and even grow with several sections remaining saturated even after timely completion of all ongoing works[17] (Figure below).

[17] As listed in Indian Railways pink Book, 2018

Figure 5-39. Capacity on key rail corridors after completion of sanctions works

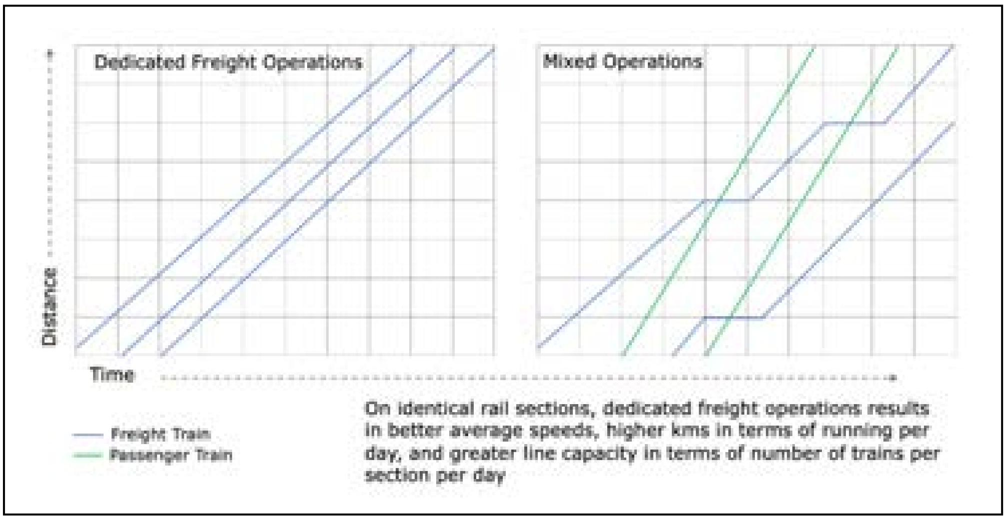
1. Source: IR's Sectional Line Capacity Charts showcasing capacities for FY 17 and FY 21; Ongoing Works as listed in IR's Pink Book FY 18; Consultant analysis
2. Congestion has been estimated after taking into account impact of all ongoing works as specified in Pink Book, 2018. It is assumed that incremental capacity thus created shall be distributed between passenger and freight trains in same proportion as currently exists. Freight Capacities have been estimated accordingly for a Mixed Network.

A congested mixed network will continue to impede IR's capability to provide adequate logistics performance/ assurance to its customers as a result of which the daily running time and kilometer runs of freights trains will remain low. On the other hand, on dedicated freight sub-networks, the conflict with passenger trains for running slots is eliminated, and a larger number of paths for trains running on similar average speeds can be scheduled. This would directly lead to comparatively longer and uninterrupted running hours at sustained speeds, thereby generating higher daily kilometer runs.

This hypothesis has actually been borne out in the post Covid period where reduced passenger services on the network created a dedicated network type of a situation and led to increased freight speeds from 24 to 40 kmph.

It is therefore recommended that even beyond the execution of DFC projects, as capacity enhancement works are executed in the form of third and fourth line projects, separate passenger and freight sub-networks should be carved out in order to ring fence IR's freight operations and generate adequate capacity to carry targeted volumes at the desired level of logistics performance required to encourage further modal shift to rail.

Figure 5-40. Increased Capacity for Dedicated Freight Operations

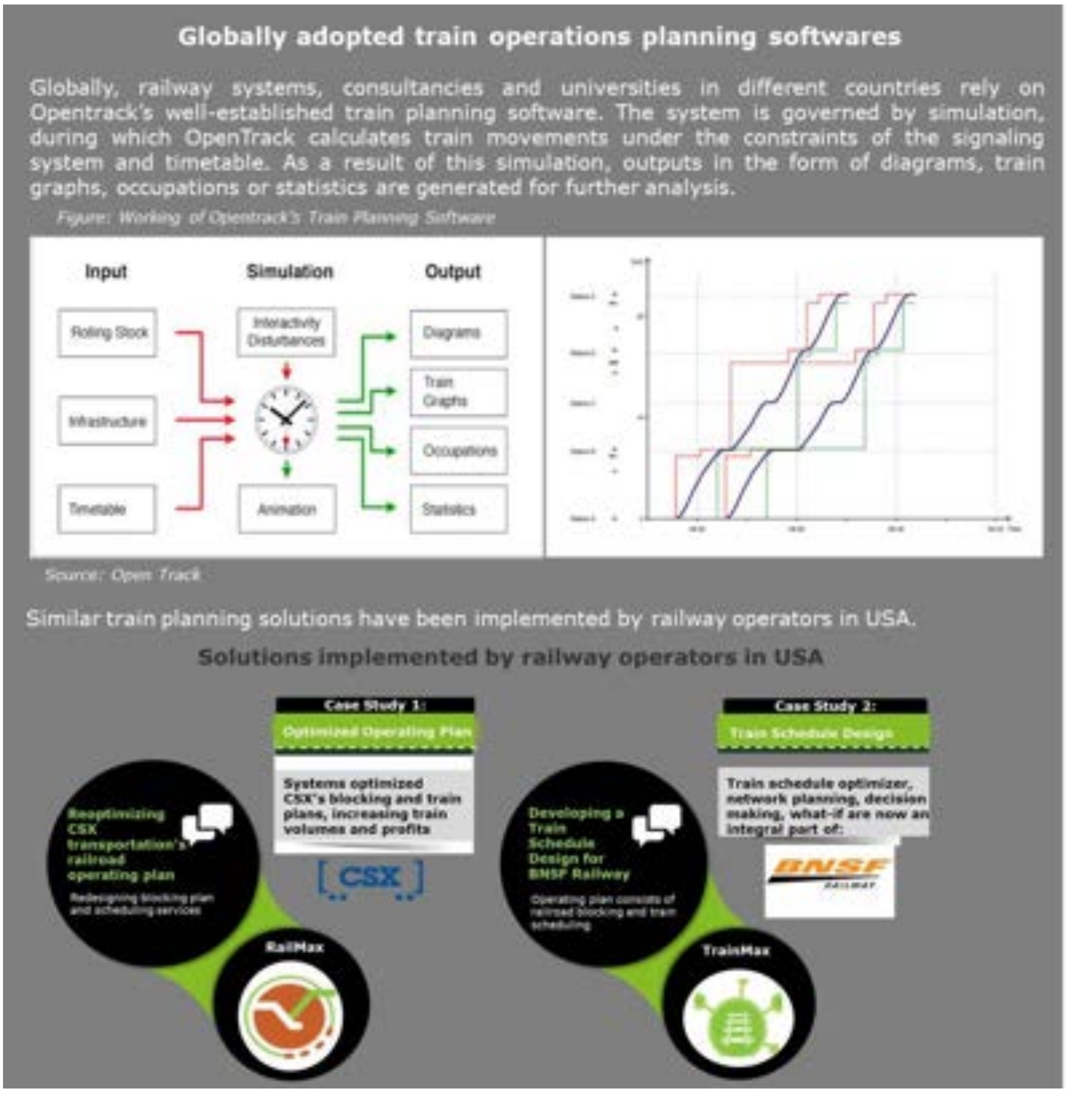


Source: Consultant Analysis

5.9.2. IT Enabled Operations Optimization and Train Planning Systems

Micro-level planning for current freight operations are generally undertaken at a "Divisional" level with train control horizon spans limited to sections of 60-200 km at a stretch. IT driven solutions that use data analytics, simulation modelling etc. can enable greater efficiency in rail planning as illustrated below.

Box 5. Select Train Planning Software used globally



Source: Websites of Open Track Railway technologies, Railmax, Trainmax, Consultant analysis

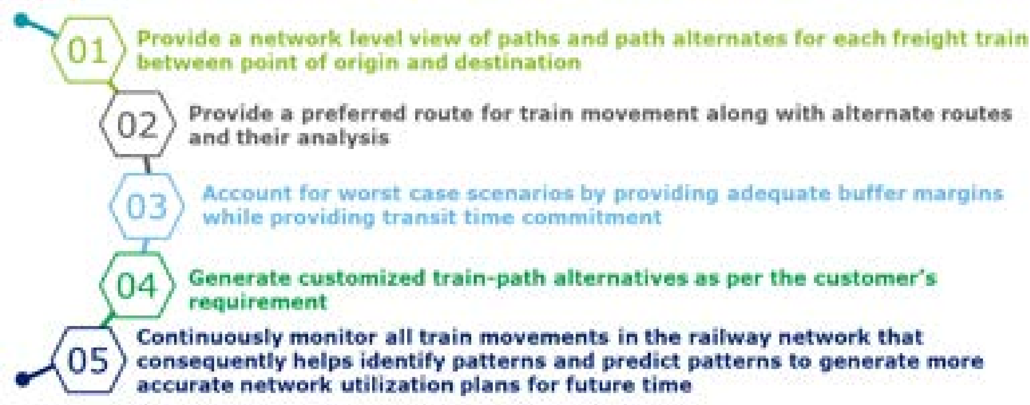
On the IR system, there already exist multiple software systems – operated mostly through the Centre for Railway Information Systems (CRIS), that support train operations in different ways. These include FOIS (Freight Operations Information System), COA (Control Office Application) , ICMS (Integrated Coach Management System), SATSaNG (Software Aided Train Scheduling and Network Governance), CMS (Crew Management System), TMS (Track Management System), LMS/SLAM (Loco Maintenance System) etc. These have a large amount of historical and real-time train running information. An integrated system that uses data already available in various applications and can act as a decision support system to optimize train movements along a corridor is the need of the hour to optimise network usage for higher logistics performance for IR's customers. The proposed system would need to interface with current IR systems to achieve the following objectives:

8. Efficient use of Railway Network by Freight and Passenger Trains leading to additional paths for traffic;
9. Reduction in cost and time by optimal use of assets (rolling stock, crew, track etc.).

This would also enable IR to offer scheduled operations or assured transit-based logistics products to freight customers[18].

Some of the features that such a potential software/IT deployment could address are illustrated below.

Figure 5-41. Features for inclusion in potential software deployment for optimization and train planning



5.9.3. Transit reliability as service offering by IR

While IT based tools and improved processes can help strengthen the decision-making process, they also need to be coupled with reward/penalty mechanisms that help ensure adherence of IR to the defined network plans and schedules.

Improved capability for service provision grants IR with the opportunity to provide premium and differentiated product offerings to its users. These could be defined using parameters such as priority given to customers over routes, priority given to movement of specific commodities among others, etc.

A possible scheme to provide transit guarantees based on lead and average speed formulae, and a penalty mechanism for failure to deliver service quality is indicated in the adjoining box.

[18] CRIS has already initiated an endeavor for development of such a system for "Route Optimization Using Operation Research Tools"

Proposed Transit Commitment Framework for Container Services

In order to improve the service quality and improve asset turnaround of container rakes on the IR system, the following system could be considered.

Turnaround Commitment:

The viability of the container business is heavily dependent upon the number of loadings that a rake can achieved in a monthly cycle. In order to increase loading performance by improving asset turnaround, the Railways can propose to provide transit commitments such **that a certain turnaround time will be achieved for each rake deployed based on the lead of the circuit.**

1. **Turnaround Formula:**

   In case of one-way trips:

   Average Transit in hours = [Lead of Traffic / 24*] + LP + PP + B

   Where:
   **24 Kms/hour taken as average running speed of train*
   LP – Loco Provision time = 6 Hours from indent of locomotive
   PP – Time for pre-placement detention at destination terminal = 6 Hours
   B – Buffer time for operations en-route = 12 Hours

   In case of pendulum (round trip) services:

   Average Turnaround in hours = 2 x [(Lead of Traffic / 24) + LP + PP+ B] + HT

   Where:
   HT – Handling time at turnaround terminal = 12 hours

   In case of pendulum (round trip) services, with one or more hub stops using hub-spoke operations:

   Average Turnaround in hours = 2 x [(Lead of Traffic / 24) + LP + PP+ B] + (1+H) x HT

   Where:
   H – Number of Hubs used en-route

   Estimates using this formula show that the transit commitments for different leads should be along the following lines:

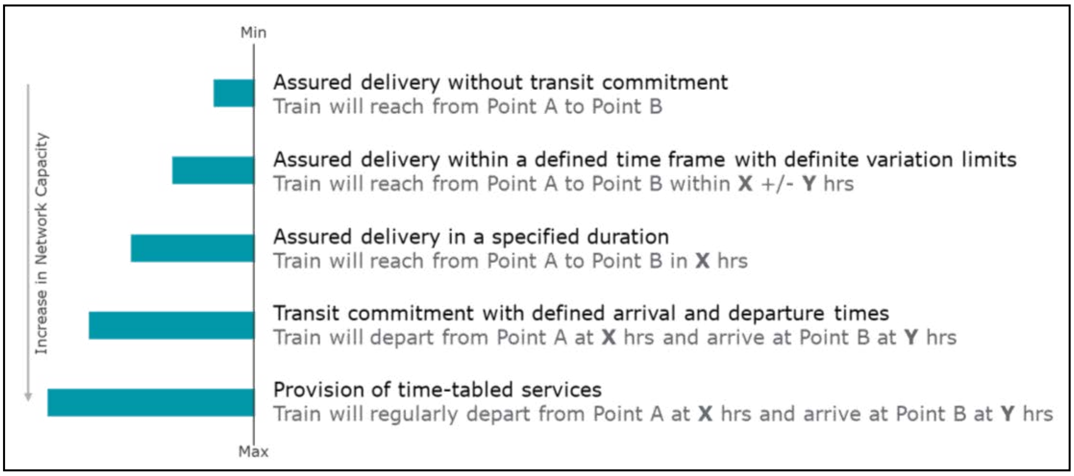
Lead in Kms	500	750	1000	1250	1500	1750	2000	2500
Round Trip Hours	102	123	143	164	185	206	227	268
Round Trip Days	4.2	5.1	6.0	6.8	7.7	8.6	9.4	11.2
Round Trip w one Hub (Hours)	126	147	167	188	209	230	251	292
Round Trip w one Hub (Days)	5.2	6.1	7.0	7.8	8.7	9.6	10.4	12.2
One Way Hours	45	55	66	76	87	97	107	128
One Way Days	1.9	2.3	2.7	3.2	3.6	4.0	4.5	5.3

In case such/ committed turnaround time is not achieved by the Railways, they could consider providing a certain rebate in freight charged for the trip either on a one way or round-trip basis as declared by the rail operator at the time of origination of train ordering.

While capacity constraints on the system may limit such offerings for the time being across commodities, IR may consider providing such offerings for the container segment which can best utilize this and leverage more cargo on the rail system.

In the long run, as capacity constraints are eased, IR can look at introducing diverse service offerings related to different levels of transit commitment as depicted in figure below.

Figure 5-42. Potential product offerings with enhanced infrastructure/ network



5.10. Terminals

5.10.1. Freight Terminal Capacity – a key enabler for rail modal share

The projected potential growth of freight transport demand in the national system – including potential modal share of rail discussed earlier in this section, indicate that freight traffic on railways has a potential for almost 2.5x growth over the next decade subject to improved 'logistics performance' on rail.

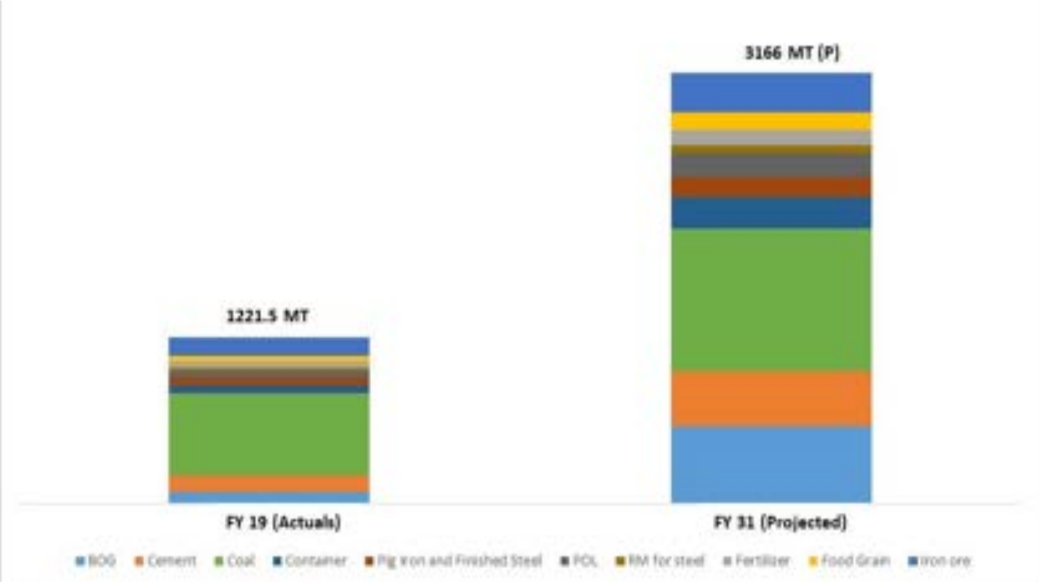
Key enablers for consideration of Indian Railways for enhancing their modal share of freight transport, vis-à-vis 'service provision' and 'transit', have been considered and discussed earlier in this section.

Creation of adequate capacity in the network – in terms of track infrastructure, terminals as well as appropriate and adequate rolling stock – would also contribute to improvement of logistics time and cost experienced by users.

While proposals for creation of track infrastructure as well as numbers and type of rolling stock have been discussed in other sections of this report, the requirement of freight terminals has been discussed as part of this section – including with reference to commodity types.

Any rail-based cargo transportation involves handling at terminals as well as first and last mile connectivity – unless it pertains to bulk commodity movement from point to point (e.g. mine to thermal plant for coal) with no first/last mile movement and automated handling instead of handling at terminals. Accordingly, additional freight terminal capacity will be required to service this potential traffic growth.

Figure 5-43: Potential growth in freight transport demand on railways



Source: CRIS FOIS Data for FY 18, Indian Railways. FY 31 Rail Traffic Projections; Consultant's Logit Model

During stakeholder consultations, issues were flagged with respect to lack of adequate terminal infrastructure capacity at desired locations, non-availability of facilities/mechanisms aligned with specific needs of different commodities, primitive nature of loading/unloading operations at existing terminals/good sheds, inefficiencies at terminals, etc. A summary of some of these issues and potential interventions for further terminal development is provided below.

Figure 5-44 Issues and potential interventions with respect to freight terminal capacity

Source: Stakeholder consultations and Consultants' analyses

In this context, IR needs to consider upgradation as well as expansion of the extant rail freight terminal network with the following basic objectives:

1. Upgradation of existing terminals or development of new terminals in districts which are expected to be underserved in reference to projected freight volumes over the next decade; and

Improvement in terminal quality at existing freight-handling terminals/good sheds to induce better service reliability, reduce overall logistics time & cost and enable provision of value-added services.

5.10.2. Focus on key commodities and terminal requirements

Each of the key commodity groups identified for analyses in this study are characterised by certain specific storage and handling requirements at origin and destination points of cargo (based on underlying logistics needs and industry norms).

It has been estimated[19] that certain high-potential commodities such as steel, cement, EXIM containers, and other non-conventional goods have the potential to significantly contribute to rail transport demand in the future.

	Origin Handling Point	Destination Handling Point
Fertilizer	Plant	Good shed ▪
Coal	Mine	Plant
Iron Ore	Mine	Plant
RM for Steel	Mine	Plant
Steel	Plant	Terminal ✓
Cement	Plant	Terminal ✓
EXIM Containers	Terminal ✓	Terminal ✓
POL	Refinery	Tank Farm
Food grains	FCI Siding	Terminal ▪
Domestic Other Goods	Terminal ✓	Terminal ✓

✓ Requirement of new terminal infrastructure

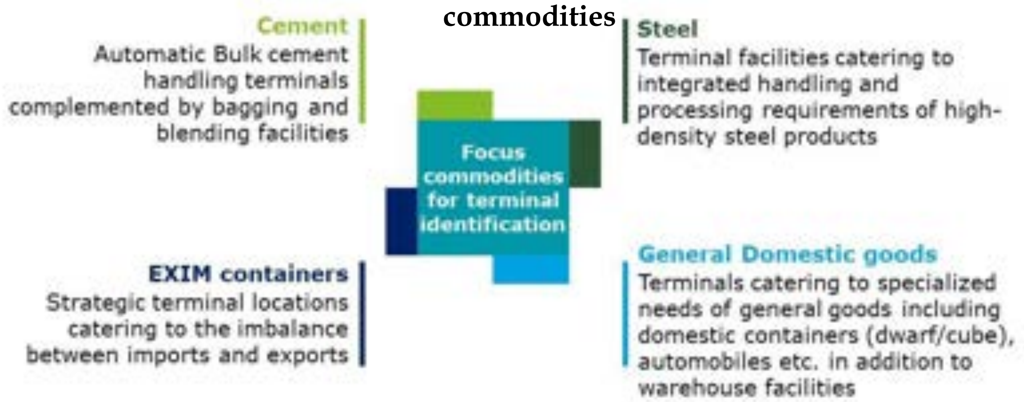
▪ Good shed upgradation will be adequate

Each of these have specific handling/ terminal requirements which need to be addressed in planning the development of a terminal network that can support future growth in traffic.

For example, the cement industry is moving towards bulk movement and needs terminals with bulk handling capabilities. The steel industry is realizing the need and advantages of setting up integrated logistics cum processing facilities (e.g. cutting, shaping of steel products) within terminals, thereby providing customer-oriented services/ adding value closer to the consumption points. The need for terminals capable of handling containers at strategic locations across the IR network necessitates intermodal handling facilities. Further, potential for containerization of domestic other goods and specific facilities for Automotive handling are expected to require special handling infrastructure/facilities catering to the handling and rail transfer of such goods.

The following schematic presents the nature of terminal development that is likely to be required to enable modal shift strategies for key commodities.

Figure 5-45 Terminal infrastructure required to enable modal shift for key commodities



[19] Refer Chapter 6: Optimum Modal Mix of Demand Forecast Report

Source: Consultants' Analyses

Certain bulk commodities like Coal, Iron Ore, RM for Steel and POL products tend to predominantly move from or to locations with integrated rail handling infrastructure in the form of private or industrial sidings. Such commodities have therefore not been considered for assessment of demand for common user or multi-cargo rail freight terminals.

Certain other generic commodities like food-grains and fertilizer move mostly in bagged form and a basic upgradation of existing goods sheds/rail terminal facilities will likely be adequate for sustaining the desired modal share for these commodities. In many cases, these commodities are also loaded from existing fertilizer plant sidings or FCI depot sidings which do not fall within the ambit of the railways as far as development of multi-user handling facilities is required.

5.10.3. Identification of districts/ locations

A typical terminal can be developed in around 2 to 3 years and accordingly, horizon year for analyses under this sub-section has been considered as 2031. Over the longer-term (2030-2050), variations in spread of production facilities/ consumption centres, commodity specific trends etc. are likely to continue to emerge with higher probability and impact. These, in turn, will directly impact the freight aggregation and distribution patterns and trade flows characteristics resulting in varying demand for terminal requirement as well as desired capacity levels over such period.

It would be prudent to review and realign the future terminal network, and plan for its further development, about every 5 years.

Box 6 Suitable addressable demand for basic viability of operations of a medium-sized freight terminals

Calculation of net revenue from setting up a medium sized terminal*

Expenditure

- Capital expenditure – INR 50 crores
- Monthly operating expenditure plus interests – INR 35-40 lacs

Revenue potential

- Monthly revenue from access, handling and other sources – INR 45-50 Lacs
- 20% from Access; 75% from handling; 5% from others
- 1 rake will yield ~ INR 50,000; 1 rake daily will yield access revenue of ~15 Lacs per month. (20 Rs/Tonne x 2500 tonnes/train x 30 days)

Break Even / Profitability

Based on the above, a 20% EBITDA and 6-7-year break even period can be achieved.

It is important to note that the numbers provided above can vary based on a number of factors including size of the terminal, type of commodities handled, mechanism of handling (i.e. mechanized or manual), among others

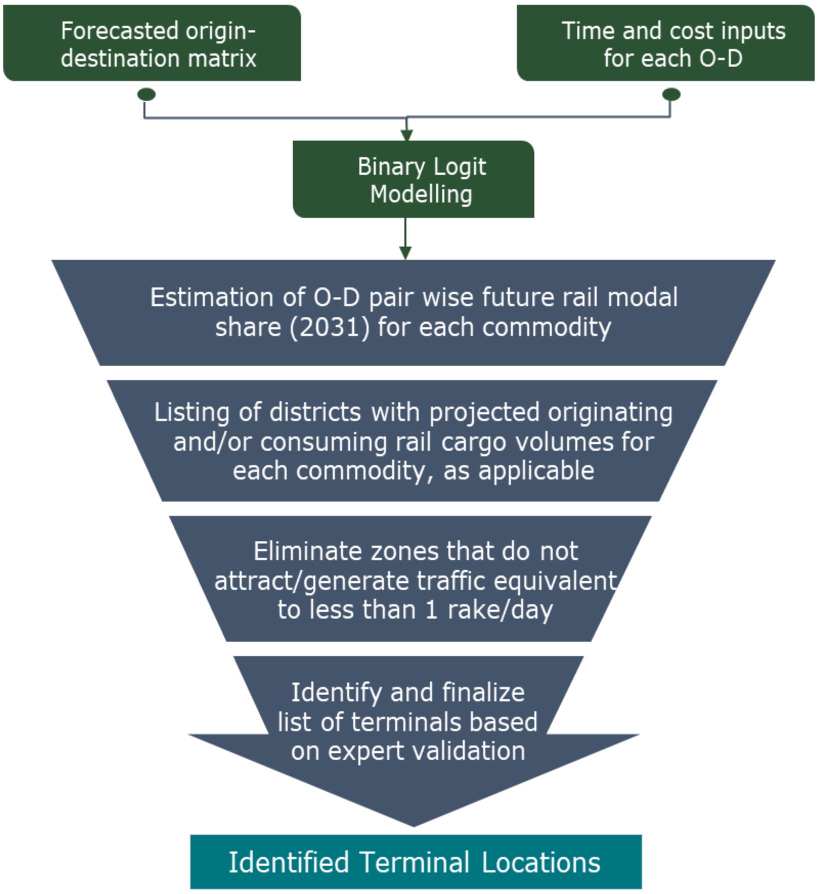
**Source: Consultants' Analyses*

For identification of districts (lowest unit of analyses) with potential demand for development of additional freight terminal capacity, a multi-step approach has been adopted under the study as illustrated in the following exhibit.

1. At the outset, commodity-wise projected volumes of potential rail cargo for the horizon year 2031 were considered (estimated rail volumes using logit model[20]).
2. Subsequently, districts were identified which presented suitable addressable demand/ market for rail transport (i.e. at least 1 rake per day). This was done to ensure that each identified district/ location had volumes that would result in basic viability for at least a medium sized terminal.
3. The districts that came up as having net demand for additional freight terminal capacities were assessed for potential clustering of locations and finalized based on inputs from stakeholders and validation from a group of subject matter experts. At this stage, factors such as geographical parameters, rail connectivity, traditionally defined catchment areas etc. were also considered.

[20] Logit Model developed under this study

Figure 5-46 Approach for identification of districts with potential demand for freight terminal capacity



Source: Consultants' Analyses

Based on the approach outlined above, potential districts were identified for development of additional rail freight terminal capacities (based on origin and destination demand) for the focus commodities.

5.10.4. Multi-commodity Terminals: Assessment of potential co-location/ clustering

Based on identification of potential districts for development of additional rail freight terminal capacities for the (four) focus commodities, a further assessment was undertaken to identify districts that are characterized by sizeable addressable freight volumes for more than one commodity.

In order to leverage potential economies of scale in development and operation of terminals, it is accordingly proposed that multi-commodity terminals be considered for such locations.

Concept of co-locating terminals could attract terminal developers/ operators with its inherent advantages

Co-locating two or more terminals can generate cost savings for the terminal operator with respect to investment in rail siding, connecting infrastructure, and equipment; facilities within the terminal; echnology for terminal operations, etc.

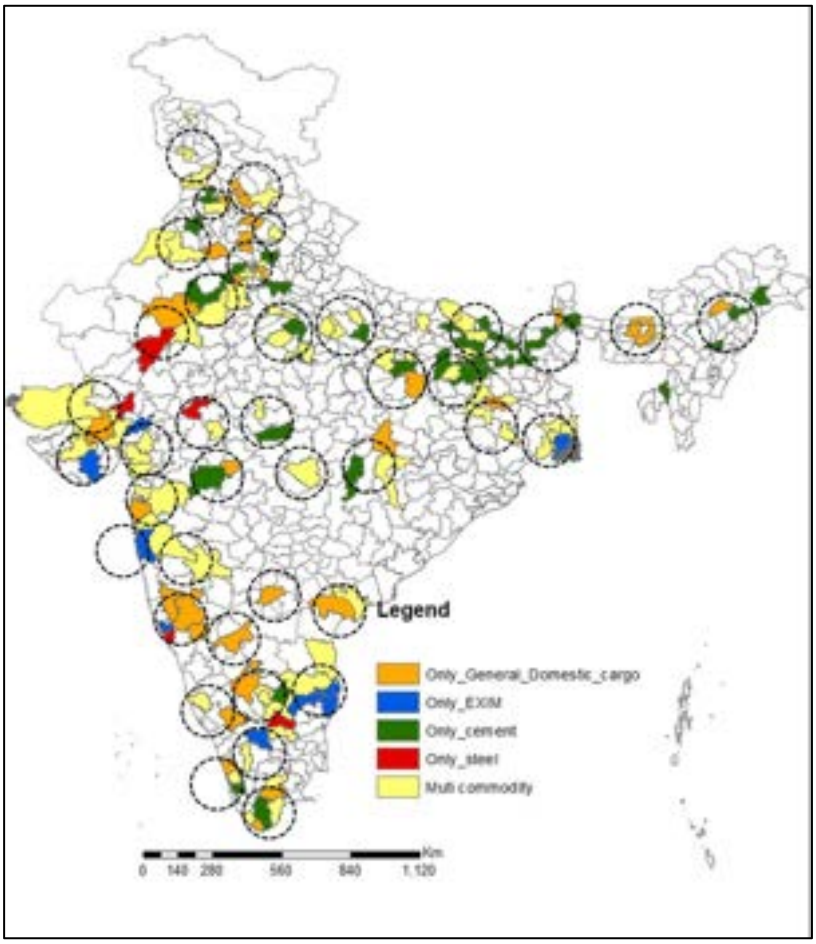
After identification of such locations, cargo potential in adjoining districts was also considered/ evaluated. Locations clusters (with more than one district) were accordingly identified such that terminal(s) could potentially cater to traffic produced and/or consumed within the cluster.

The process of cluster identification in itself was based on multiple factors including location/number of urban centres, geographic characteristics such as natural hinterland formation, freight volumes spread across districts etc.

Once the cargo clusters were identified, the volumes of cargo already being handled by rail in the base year 2019 were reduced from the projected volumes of potential rail cargo in the horizon year 2031 to enable reference/ consideration of incremental handling capacity requirements. Additional terminal capacity requirements were considered after account for potential upgradation/ capacity expansion of existing terminals based on certain industry norms (on aspects like number of lines that can be typically accommodated in a terminal, etc.)

A map with a consolidated view of clusters, thus arrived, having potential for development of multi-commodity terminals (with respect to overall cargo volumes), is presented below.

Figure 5-47 Map illustrating clusters with potential for development of multi-commodity terminals



Source: Consultants' Analyses

Finally, the list of identified clusters has been prioritized with reference to potential freight volumes produced/consumed within the cluster over the horizon period up to 2031.

Table 5-4 Priortised clusters for development of Multi-Commodity Terminals

S. No	Cluster	Potential Districts	Projected Rail Traffic, 2031 (MTs)	Existing MMLPs
1.	National Capital Region	Gurgaon/Hisar/Jhajjar/Karnal/Panipat/ Gautam Buddha Nagar/Ghaziabad/Meerut/ Faridabad/South West Delhi/New Delhi/ Central Delhi/	142.38	Yes
2.	Chennai	Chittoor/Nellore/Chennai/Kancheepuram/ Thiruvallur/Vellore	141.25	Yes

S. No	Cluster	Potential Districts	Projected Rail Traffic, 2031 (MTs)	Existing MMLPs
3.	Kolkata	Haora/Hugli/Kolkata/North 24 Parganas/Purba Medinipur/ South 24 Parganas/	139.53	Yes
4.	Bangalore	Bangalore Rural/Bangalore/Kolar/ Tumkur/Krishnagiri/	116.48	Yes
5.	Greater Mumbai	Mumbai/Raigarh/Thane	100.71	Yes
6.	Ahmedabad	Ahmedabad/Kheda/Mahesana/ Surendranagar/	82.67	Yes
7.	Rewari-Jaipur	Mahendragarh/Rewari/Alwar/Jaipur/ Sikar	60.99	Yes
8.	Hyderabad	Hyderabad/Mahbubnagar	55.61	Yes
9.	Patna	Arwal/Aurangabad/Buxar/Gaya/Jehanabad/Lakhisarai/Munger/Nalanda/ Nawada/Patna/Rohtas/Saran/Vaishali	49.82	Yes
10	Pune	Pune/Solapur/	45.87	Yes
11	Morbi	Kachchh/Morbi	41.65	Yes
12	Guwahati	Baksa/Barpeta/Kamrup Metropolitan/ Kamrup	40.68	Yes
13	Kanpur	Kanpur Dehat/Kanpur Nagar/Lucknow/Rae Bareli	35.67	Yes
14	Surat-Vadodara	Bharuch/Surat/Vadodara	35.49	Yes
15	Coimbatore	Ernakulam/Kottayam/Thrissur/ Coimbatore	34.08	Yes
16	Jammu-Amritsar	Jammu /Srinagar /Amritsar /Gurdaspur	27.2	No
17	Gorakhpur	Darbhanga/Gopalganj/Muzaffarpur/ Pashchim Champaran/Purba Champaran/Saharsa/Sitamarhi/ Gorakhpur/	25.72	Yes

S. No	Cluster	Potential Districts	Projected Rail Traffic, 2031 (MTs)	Existing MMLPs
18	Nashik	Valsad/Nashik/Palghar	22.69	Yes
19	Thiruvananthapuram	Thiruvananthapuram/Kanniyakumari/ Thoothukkudi/Tirunelveli/	22.53	Yes
20	Chandigarh-Haridwar	Chandigarh/Ambala/Yamunanagar/ Haridwar	22.29	Yes
21	Salem	Dharmapuri/Erode/Salem	21.91	Yes
22	Allahbad-Varanasi	Allahabad/Mirzapur/Sonbhadra/Varanasi	21.42	Yes
23	Ranchi	Purbi Singhbhum/Ranchi	20.28	Yes
24	Goa	North Goa/South Goa/Belgaum/ Dharwad/Kolhapur	19.73	Yes
25	Nagpur	Nagpur	19.47	Yes
26	Ajmer	Ajmer/Nagaur/Pali	17.83	Yes
27	Indore	Indore/Ratlam	17.55	Yes
28	Siliguri	Bhagalpur/Kishanganj/Purnia/Darjiling/ Jalpaiguri	17.19	No
29	Bilaspur	Bilaspur/Hamirpur/Shimla/Solan	16.76	Yes
30	Ludhiana	Jalandhar/Ludhiana/Shahid Bhagat Singh Nagar	16.06	Yes
31	Bokaro-Dhanbad	Bokaro/Dhanbad/Hazaribagh	15.13	Yes
32	Bhatinda	Bhatinda/Ganganagar/Hanumangarh	14.86	No
33	Rajkot	Amreli/Rajkot	11.17	No
34	Gwalior	Bhind/Gwalior/Jhansi	10.69	Yes

S. No	Cluster	Potential Districts	Projected Rail Traffic, 2031 (MTs)	Existing MMLPs
35	Guntur	Guntur/Krishna	10.2	Yes
36	Agra	Agra/Aligarh	10.16	Yes
37	Madurai	Madurai/Virudunagar	9.95	No
38	Mysore	Dakshina Kannada/Mysore	9.9	Yes
39	Tinsukhia-Dimapur	Lakhimpur/Sivasagar/Tinsukia/Dimapur/ Kohima	9.83	No
40	Bhopal	Bhopal/Hoshangabad	9.82	Yes
41	Jalgaon	Burhanpur/Jalgaon	6.65	Yes
42	Bellary	Bellary	5.61	No

Source: Consultants' Analyses

The above list was analysed against existing MMLPs/Freight Terminal Network operated by CONCOR and private players in the country. There are a number of clusters in the above list where no Freight Terminals/MMLPs capacity presently exists.

In absence of any other facility, the comparative priority for terminal capacity development in these clusters could be higher and IR may take up development of freight terminal capacities in these clusters accordingly.

5.10.5. Comparison with Locations Proposed by Other Agencies

The identified clusters/districts were also compared against various locations identified under other studies undertaken by different government agencies. The following studies were evaluated:

- Study on Logistic Efficiency and Enhancement Program (LEEP) by Ministry of Road Transport and Highways, 25 locations
- Marketing Plan for Dedicated Freight Corridor Corporation Limited, 34 locations
- Integrated Logistics Plan by Department of Logistics, Ministry of Commerce, locations

Table 5-5 Proposed Terminal Locations by Other Agencies

Studies	DISTRICTS (not identified under NRP)	Identified Districts in Vicinity
DFC Marketing Plan	Banaskantha	Can be served by Kachchh
DFC Marketing Plan	Bulandshar	Can be served by Aligarh/ Ghaziabad
DFC Marketing Plan	Palwal	Can be served by Gurugram
DFC Marketing Plan	Patiala	Can be served by Ludhiana
DFC Marketing Plan	Firozabad	Can be served by Agra
DFC Marketing Plan	Koderma	Can be served by Gaya/ Hazaribagh
Integrated Logistics Plan	Akola	Can be served by Nagpur
Integrated Logistics Plan	Jasidih	Can be served by Dhanbad
Integrated Logistics Plan	Ratnagiri	Can be Served by Raigarh/Pune

Source: Consultant Analysis

The list of districts identified under this study for development of freight terminal capacities broadly reconciles with locations identified under the above-mentioned studies barring a small number of exceptions.

Upon further analysis, it was revealed that such terminals (identified in the above-mentioned studies) were proposed either in a neighbouring district or within the same cargo cluster – as presented below.

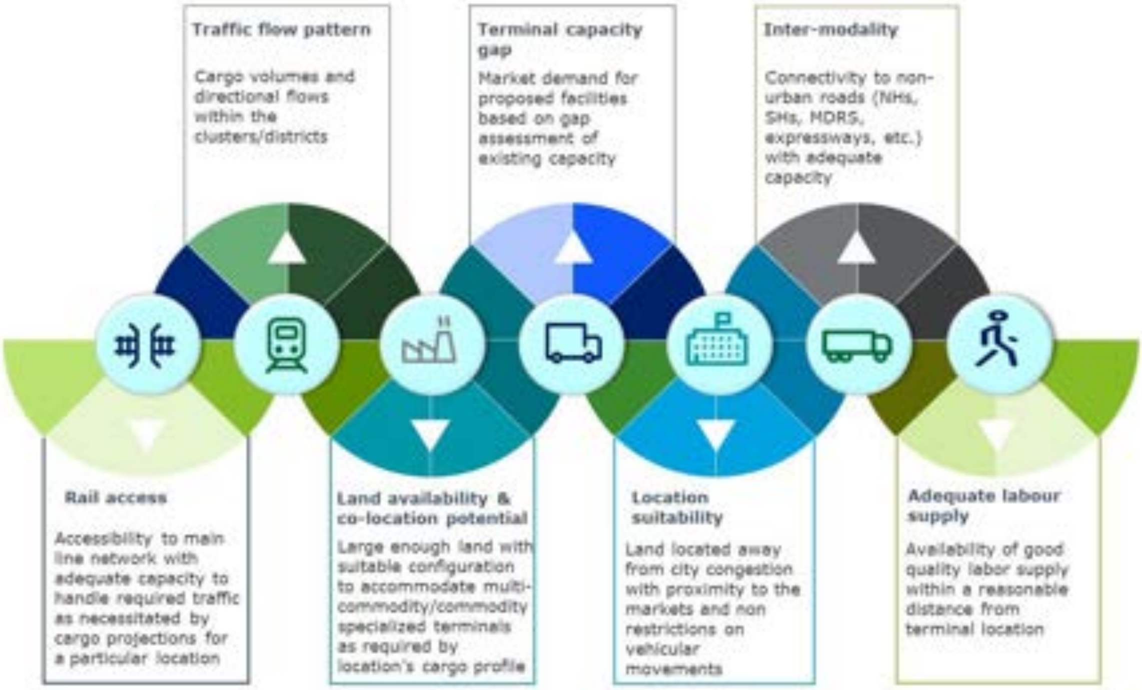
5.10.6. Factors informing identification of land parcels within districts

It is important to note that identification of potential locations under this study is based on overall cargo O-D patterns including volumes which are already being handled on the existing IR network of goods sheds/terminals. Some of the identified locations will therefore have some terminal capacity that may or may not be adequate.

As in case of development of such projects, a specific exercise (typically preparation of a Detailed Project Report) would need to be undertaken going forward for each terminal locations/clusters – focused on location specific feasibility assessment and identification of terminal features/ infrastructure requirements, in order to arrive at the final master plan and project structure for development of each of the terminals.

A few factors governing identification of suitable locations within districts and those which should form a part of detailed report preparation are presented in the figure below.

Figure 5-48 Factors to inform identification of terminal locations within a



Source: Consultants' Analyses

This section has hitherto presented classification and identification of focus commodity groups; approach for assessing their existing as well as projecting their potential future freight flows; and strategies for effecting modal shift of freight to railways.

The strategies are focused on addressing key strategic levers/ enablers to increase rail share – at a system level as well as at the level of key commodities, by enhancing the value proposition of rail transport with respect to overall logistics cost, time and quality.

Each of the following sub-sections now present – for each of the focus commodity groups, as-is assessment of flows, projection of potential transport demand in the national transport system, modal share, and any modal shift strategies that are specific to the commodity group (rail share having considerable potential for enhancement).

During the study, the team undertook stakeholder consultations and had reference to various inputs received in formulation/ recommendation on the modal shift strategies presented herein. However, some inputs received were more focused on alleviation of short-term issues faced by stakeholders and/ or tactical in nature. **ANNEXURE 5.6:** presents some such inputs for reference of Indian Railways.

5.11. Commodity Specific Sub-Sections

5.11.1. Coal

5.11.1.1. Current commodity landscape

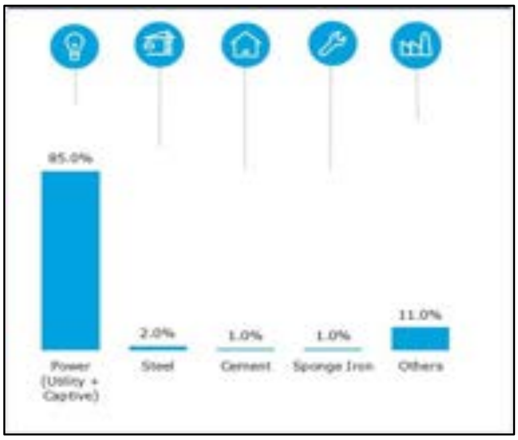
India produced about 690 MT of raw coal in FY 2018. Out of this, 645 MT was non-coking, and the remaining 45 MT was coking. Furthermore, 208 MT of coal was imported, 78% of which was non-coking coal used by the power plants[21]. Therefore, around 898 MT of non-coking coal was available in the ecosystem to be transported.

In India, coal has a number of key consumers. These primarily include thermal power stations, steel plants, cement plants, and sponge iron units. Within these, thermal power stations use most of the coal produced in India and are expected to remain the most important demand drivers for coal going forward.

Figure 5-50. Sources of coal imports

Source: Ministry of Coal, Consultant

Figure 5-49 Industry wise imports of coal



Source: Ministry of Coal, Consultant

Broadly, coal can be segmented into two categories – coking coal and non-coking coal. Coking coal is used predominantly in steel industry, whereas non-coking coal is used in thermal power, cement, fertilizers, brick manufacturing, among others. An overview of coal's value chain in India has been shown in Figure below.

[21] Coal Controller's Organisation, Ministry of Coal. 2018. India Coal Directory 2018. Government of India. New Delhi

Figure 5-51. Overview of domestic coal value chain

Source: Consultant Analysis

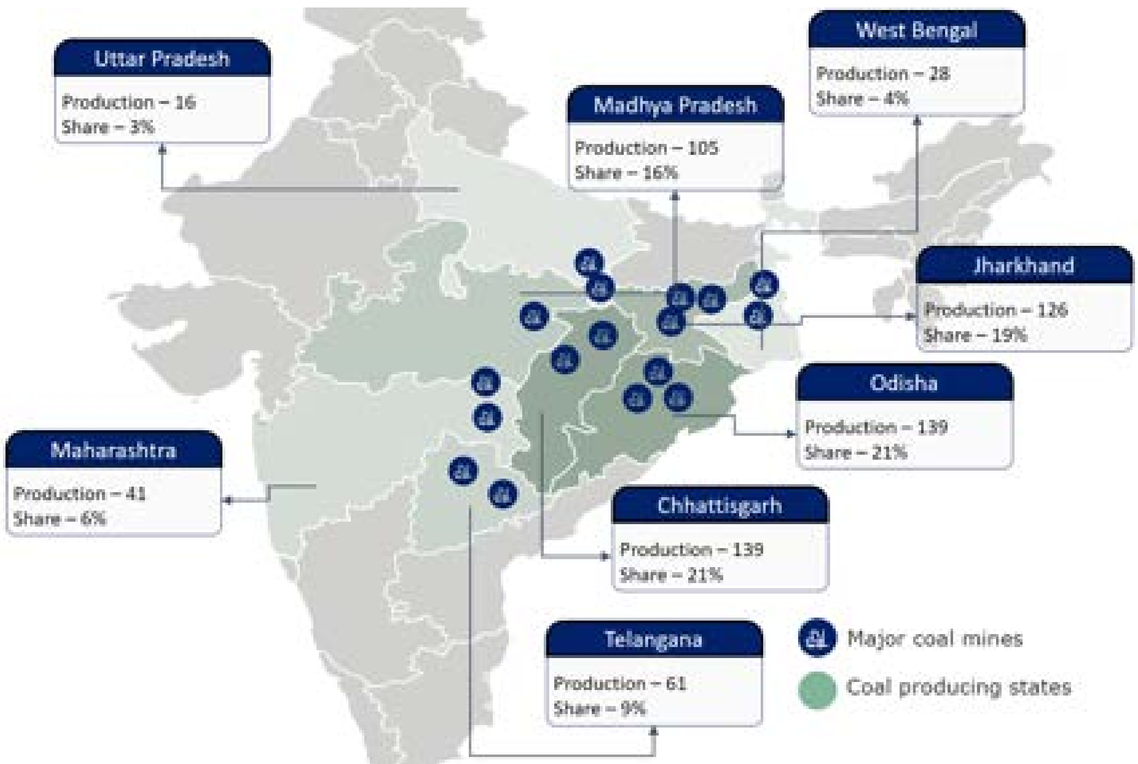
A significant locational mismatch between the production and consumption centers of coal has always led to demand for transportation of coal over longer than optimum leads. This is further analysed in the upcoming sections.

5.11.1.1.1.*Key Production and Consumption Centres*

Currently, coal is primarily produced in eastern parts of India with 75%[22] of throughput coming from four states viz. Odisha, Jharkhand, Chhattisgarh and

Figure 5-52. Major coal producing states and coal mines

Madhya Pradesh.



[22] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Coal. Government of India. Nagpur

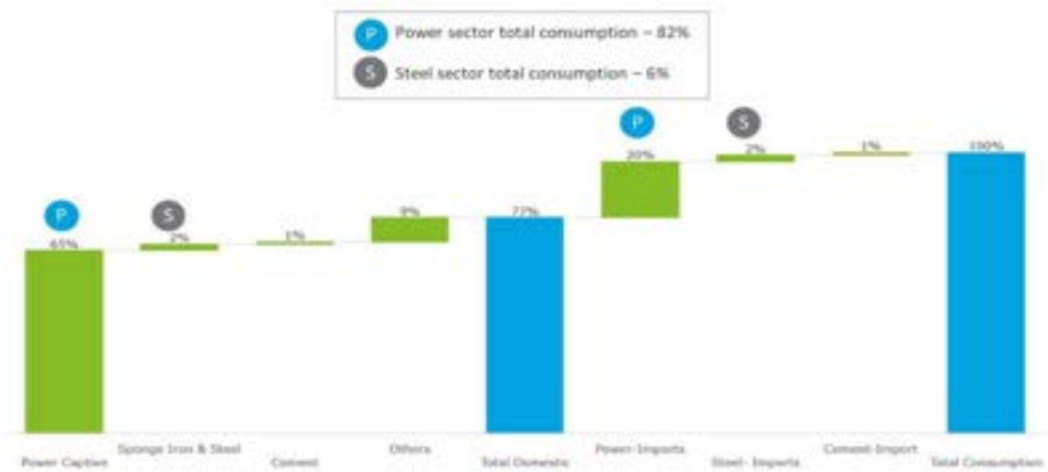
As can be seen in above figure, Odisha and Chhattisgarh produce the largest amount of coal by state in the country with a share of 21% each. In both these states, almost all the coal is non-coking in nature. Jharkhand produces about 19% of total coal production, approximately half of which is coking. Practically, all domestic coking coal comes from Jharkhand. Other important coal producing states are Madhya Pradesh (16%), Telangana (9%), Maharashtra (6%), West Bengal (4%) and Uttar Pradesh (2%).

Further, it's important to note that coal production in India, to a large extent, is a government sector activity. Coal India Ltd, a Government of India entity, produced 84%[23] of India's coal with its eight subsidiaries. The Singareni Collieries Company Limited (SCCL), another government entity, produced 9%. Other public sector entities produced 1%, and the private sector, through captive mines supporting power and steel plants, produced 5%.

5.11.1.1.2.*Consumption of coal*

India consumes most of the coal it produces. As mentioned above, with 645 MT of indigenous non-coking coal production and approximately 208 MT of imports, India consumed 898 MT[24] of non-coking coal in FY 2018. Exports were negligible at 1.6 million tons, about 0.2% of production. Most of the imports were consumed in power sector. As mentioned previously, while there are several uses of coal, the use that drives majority of its transportation demand is from its use in thermal power plants and steel plants. The users of coal have been presented in figure below.

Figure 5-53. India Coal Consumption Pattern FY 2018



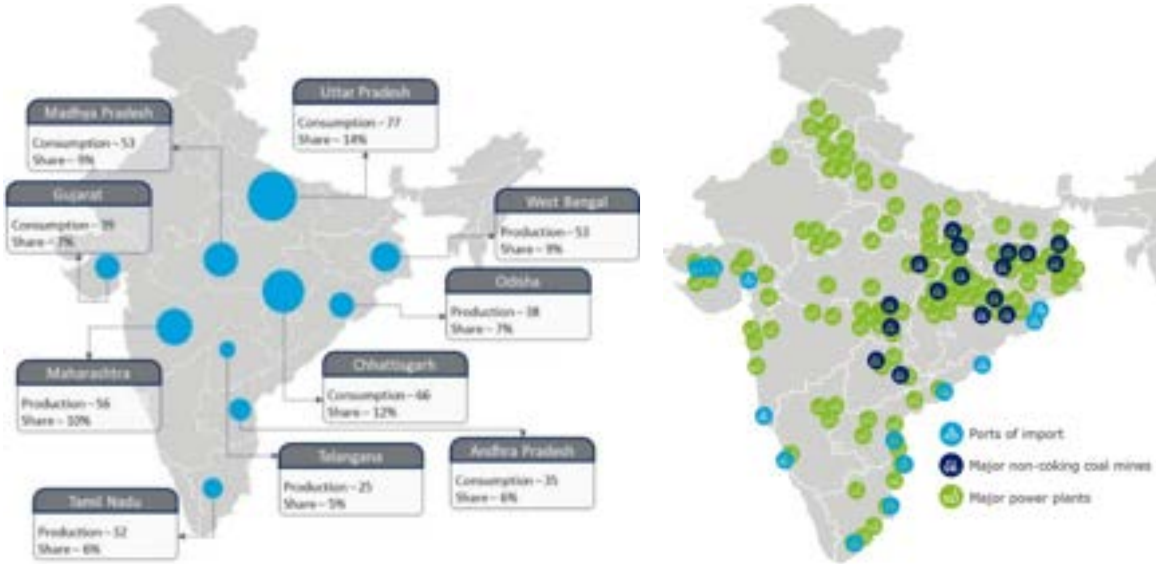
Source: India Coal Directory 2018, Consultant Analysis

Within the power sector, there were about 142 coal based thermal power stations in FY 2017. Out of these, the 50 biggest stations consumed about 71%[25] of domestic

[23] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Coal. Government of India. Nagpur
[24] Coal Controller's Organisation, Ministry of Coal. 2018. India Coal Directory 2018. Government of India. New Delhi
[25] Central Electricity Authority, Ministry of Power. (2018). National Electricity Plan 2018. Government of India. Delhi; Various sources and websites

coal. Combining the locations of domestic production with locations of domestic consumption, a significant locational mismatch becomes apparent, which has led to demand for transportation services. This mismatch is clearer from figure below.

Figure 5-54. State-wise consumption and locational mismatch between points of origin and destination leading to demand for transportation of coal in India



Source: Various Sources, Consultant Analysis

5.11.1.2. Projections of potential transport demand

Coal continues to remain a key source of electricity generation in India with power generation accounting for ~85%[26] of total coal requirements/consumption. Remaining coal volumes are used in Steel, Cement and other sectors as a metallurgical input for production. Considerations for projecting coal volumes are presented below.

Power Sector Coal Requirements

Demand for electricity was projected with reference to various macroeconomic factors such as GDP and population growth and the factor(s) having significant impact on the electricity demand were selected for the purpose of projections.

Projected electricity requirements were adjusted against expected Transmission & Distribution losses to project potential electricity production levels. Against this, factors pertaining to expected electricity generation source mix between renewable, non-renewable non-coal (nuclear), and coal were considered based on National Electricity Plan, 2017 and CEA estimates. Further, coal consumption factors, including different thermal plant technologies and technology mix, transportation losses, expected reduction in share of thermal power beyond 2030 etc. were referenced to ascertain coal volumes required to cater to such demand. The

[26] Coal Controller's Organisation, Ministry of Coal. (2018). India Coal Directory 2018. Government of India. New Delhi

Projections were compared against estimates as per National Electricity Plan (NEP) and other reports[27].

Thermal Coal Projections: Key Assumptions, Inputs and Data Sources

- Macro-Economic Indicators evaluated: Real GDP, Population growth
- Preferred Indicator: Real GDP
- Elasticity co-efficient of electricity demand with respect to Real GDP was estimated at 1.05
- OECD GDP growth Projections[28] were adopted for assessing future Real GDP growth
- Transmission and Distribution losses were assumed at 18.75% for 2020, 16% for 2027 and 15% for 2030 as per Ministry of Power estimates and validated from stakeholder consultations
- Electricity Source mix for various years, within Projections period, adopted as per recommendations from National Electricity Plan and CEA estimates
- Given lack of policy guidance or industry estimates on dependence on Thermal power for period beyond 2030, a decline rate in share of thermal power was assumed at 10% per decade
- Coal consumption factor or coal required per unit of electricity was assumed at 0.65 for subcritical plants, 0.45 for super critical plants and 0.40 for ultra-critical plants. Further, coal transportation losses were assumed at 1%
- Share of thermal plant technologies in 2030 assumed at 55% for Sub-critical, 40% for super critical and 5% for ultra-critical plants, based on Brooking Institute estimates

Metallurgical Coal

The volumes for non-coking coal were projected based on expected production/ consumption patterns of key consuming industries – steel, cement and other industries like fertilizer, etc.

Metallurgical Coal Projections: Key Assumptions, Inputs and Data Sources

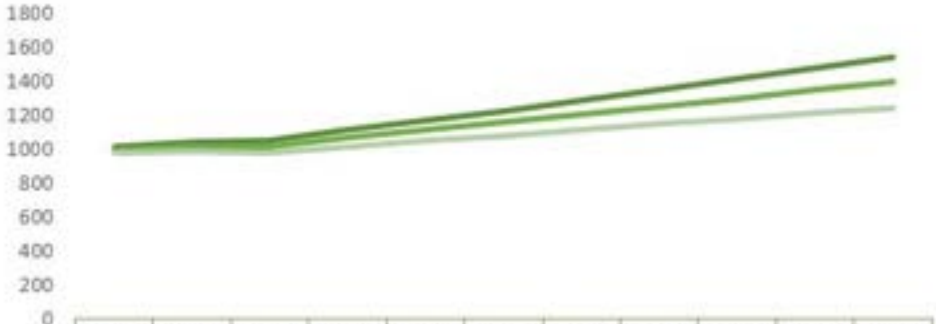
- Coal consumption factor for steel was assumed as 0.78 (780 Kg towards one tonne of steel) as per World Steel Association standards
- Coal requirement for cement production assumed at 7% (70 Kg coal required for one tonne of cement) based on past consumption trends within cement sector

The cumulative volumes projected are presented below:

[27] Tongia, Rahul and Ali, Sahil. (2018). The future of Indian electricity supply in India, Brooking Institution Delhi; Ministry of Coal. (2017). Draft Coal Vision 2030. Government of India. New Delhi; Consultant Analysis

[28] Organisation for Economic Co-operation and Development (OECD). Real GDP forecast (indicator). doi: 10.1787/1f84150b-en. https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September 2019

Figure 5-55. Coal volume Projections (in MT) under different scenarios (2020-2030)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	1021	1047	1058	1115	1173	1232	1293	1355	1418	1484	1547
Realistic	1003	1020	1022	1069	1115	1162	1209	1256	1305	1354	1400
Pessimistic	984	991	983	1018	1052	1086	1119	1152	1185	1218	1248

Optimistic Realistic Pessimistic

Figure 5-56. Coal volume projections (in MT) under different scenarios (2030-2050)

	2030	2035	2040	2045	2050
Optimistic	1547	1907	2267	2611	2921
Realistic	1400	1656	1888	2085	2237
Pessimistic	1248	1410	1536	1622	1664

Optimistic Realistic Pessimistic

- **Commodity Origination Allocation –** District-wise coal dispatch data for FY 2018 was used. Also, district-level dispatch figures for coal mines along with pattern of imported coal were extrapolated over the projections period. Further, reference was had to policies - Government of India's view on ceasing any further exploration for new coal mines[29], potential change in coal linkages based on coal auction policy[30], etc.
- **Commodity Destination Allocation** – Allocations were considered across districts based on locations of thermal power, steel and cement plants as well as expected development of new power, steel and cement plants (based on stakeholder consultations and data available). For other uses/ industries, it was assumed that current demand pattern (based on primary road surveys and rail data) shall prevail.

29 Central Electricity Authority, Ministry of Power. (2018). National Electricity Plan 2018. Government of India. Delhi; Various sources and websites
30 Ministry of Coal. (2017 and 2018). Multiple circulars. Government of India. Delhi

The allocated production and attraction centres for coal in 2030 are presented below:

Figure 5-57. Coal production centres

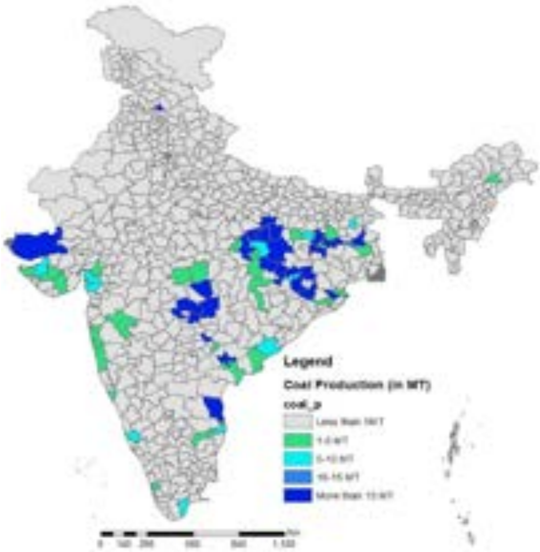
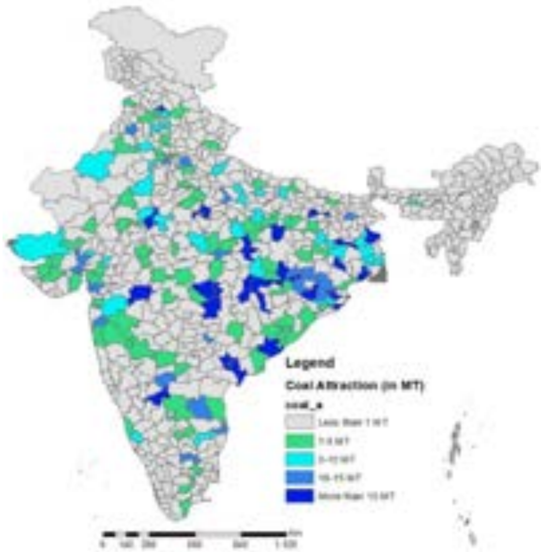


Figure 5-58. Coal attraction centres (2030

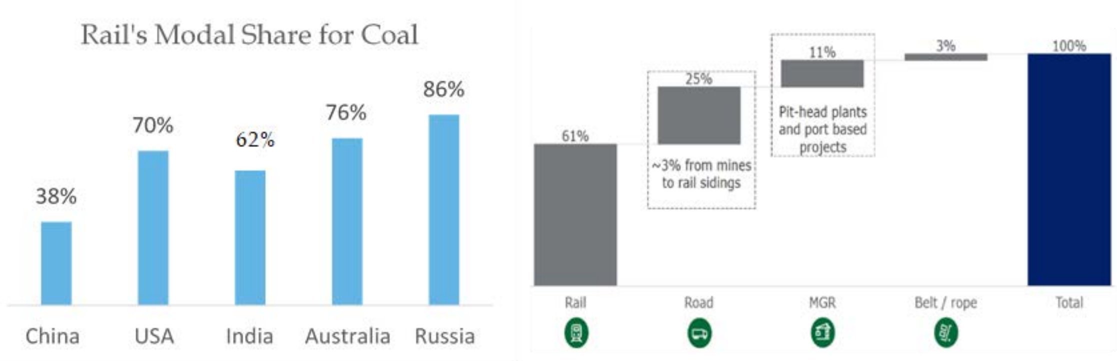


Source: Consultant Analysis

5.11.1.3. Extant rail modal share and logistics competitiveness

Coal is the largest market segment for IR, constituting around 45-50% of IR's freight business, both, in terms of revenue as well as throughput. In FY 2018, IR transported 555 MT of coal over average leads of 474 Km. Rail remains the preferred mode for coal transportation over longer leads. The modal mix is presented in the figure below.

Figure*59-5* **Global Rail Modal Shares and Modal mix of coal transportation in India**



Source: Various Sources, Consultant Analysis

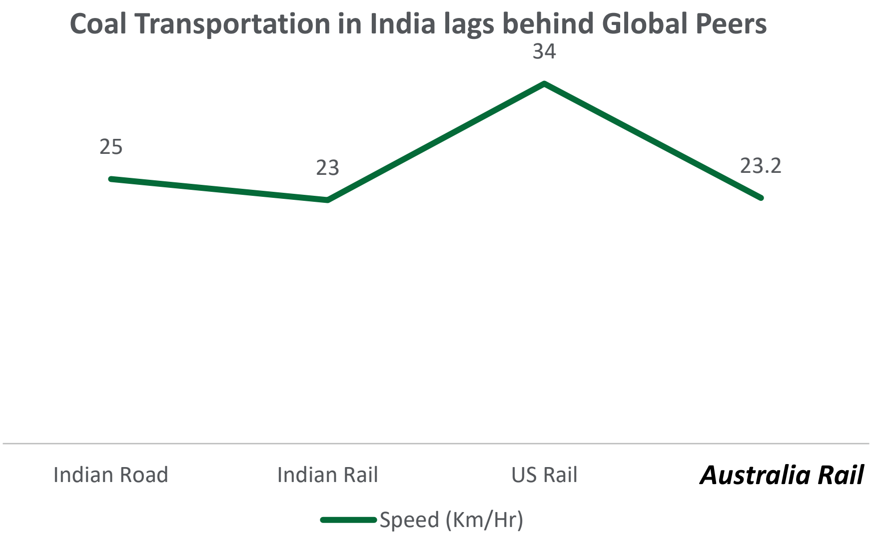
A comparison with global peers further highlights the high rail logistics cost for coal, prevalent in India. While the average coal leads in Australia were much shorter at 237 Km[31] compared to 474 for IR, the revenue earned per NTKM[32], adjusted for Purchasing power parity still provides an empirical basis to establish high rail logistics costs borne by the sector in India.

Figure 5-60. Revenue per NTKM Analysis

Source: Various Sources, Consultant Analysis

In respect of time, the performance of IR and its related ecosystem was similar to those reported in Australia but much behind North America, as illustrated in graph below. However, it must be noted that in case of Australia unlike in India, the average leads are much smaller and in the range of 200-250 km. Given the scale of heavy haul operations, such speed for smaller leads is acceptable unlike in India where the leads are much longer.

Figure 5-61: Transportation of Coal in terms of speed



Source: Various Sources, Consultant Analysis

[31] Aurizon Australia. (2018). Annual Report FY 2018. Australia

[32]Note: Revenue per NTK estimated as $\frac{\text{Freight Revenue}}{\text{Freight NTKs}\times\text{PPP Factor}}$; Exchange rates and Purchasing Power Parity index, to estimate PPI Factor, sourced from Various Authors, Various Dates, OECD Database at https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm#indicator-chart **accessed in August/September 2019**

5.11.2. Iron Ore

5.11.2.1. Current commodity landscape

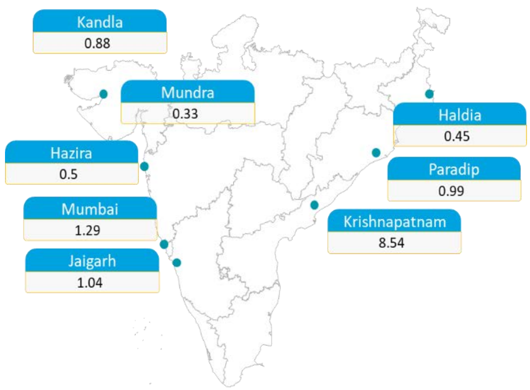
India's iron ore reserves, at 31.32 billion tonnes[23], are the 5th largest in the world after Australia, Brazil, Russia, and China. Two states, Karnataka and Odisha together hold 56 percent of these reserves and contributed 63 percent of total ore production in FY 2018. The total iron ore mining production in FY 2018 stood at 200.95 MT with 49 percent[23] of the total yield coming from Odisha followed by Chhattisgarh (16 percent), Karnataka (14 percent), and Jharkhand (11 percent)[33]. Additionally, 8.6 MT of iron ore was imported from five geographies[34] with JSW Steel alone responsible for 60 percent of these imports. In summary, a total of 219 MT of iron ore was present in the country to be transported.

5.11.2.1.1.*Iron Ore Distribution & Consumption*

Figure 5-62. Key iron ore producing states

Source: Indian Minerals Yearbook, 2018

Figure 5-63. Iron ore imports port wise, FY 2018



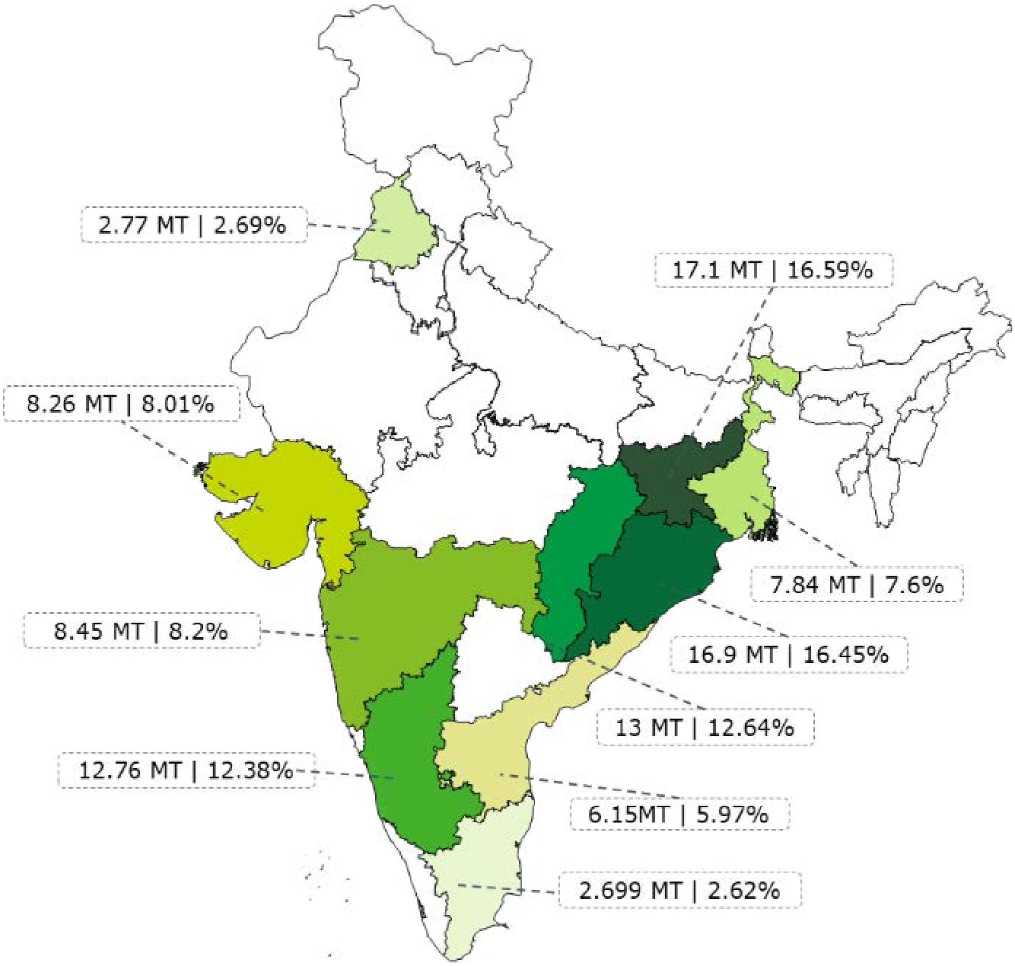
Source: Indian Minerals Yearbook, 2018

Steel manufacturing plants (for domestic production) and ports (for exports) are the two primary destinations for Iron ore. In FY 2018, about 154.60 MT[23] iron ore was consumed in various industries such as Iron & Steel, Sponge Iron, Ferro-alloys and Alloy steel. Iron & Steel (76 percent) including Sponge Iron industries (24 percent) were the major consumer of iron ore and accounted for over 99 percent of the consumption.

[33] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Iron Ore. Government of India. Nagpur

[34] Australia (38percent), South Africa(33percent), Brazil(25percent), Oman (3.6percent) and Iran (0.04percent)

Figure 5-64: Crude Steel Production, FY 2018



Source: Annual Statistics 2017-18, Joint Plant Committee

Iron ore is primarily consumed by the Steel industry. Accordingly, iron ore requirements were projected against the estimated steel projections above. Past iron ore consumption trends by the steel sector were referenced based on the assumption that these trends will continue in future.

5.11.2.2. Projections of potential transport demand

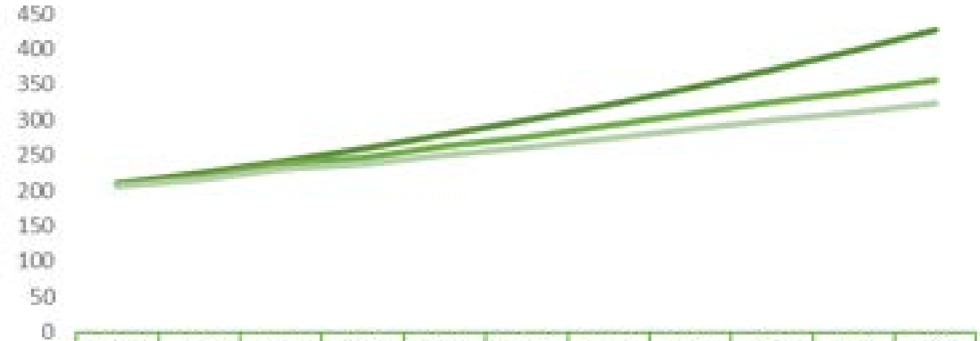
The projected volumes were calculated based on steel volume projections. For the same, an iron ore intensity factor for steel was identified and further, used to derive iron ore volumes with reference to projected volumes of steel. The projections were compared and calibrated against various targets and growth visions prescribed by Government of India or its agencies.

Iron Ore Projections: Key Assumptions, Inputs and Data Sources

- Iron Ore Intensity factor denotes amount of Iron Ore required to manufacture one tonne of steel. An Iron Ore intensity factor of 1.73x was assumed based on past consumptions trends by steel sector and validated through stakeholder consultations.

The projected volumes for Iron ore are presented below:

Figure 5-65. Iron ore projections, 2020-2030 (in MTs)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	210	225	242	260	279	299	321	345	370	398	427
Realistic	209	219	237	247	263	276	292	308	325	340	356
Pessimistic	206	215	230	238	250	261	274	286	300	311	323

Optimistic Realistic Pessimistic

Figure 5-66. Iron ore projections, 2030-2050 (in MTs)

	2030	2035	2040	2045	2050
Optimistic	427	594	795	1038	1321
Realistic	356	444	541	647	762
Pessimistic	323	385	447	510	573

Optimistic Realistic Pessimistic

- **Iron Ore origination and destination allocations**: Past pattern in dispatches from mines and EXIM traffic from ports[35] were assumed to prevail in future. Accordingly, originations were assigned in a similar pattern for different horizon years. For destinations, district wise steel production estimates as well as expansion plans were referenced to estimate the district wise destination pattern for Iron Ore.

[35]: Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Iron Ore. Government of India. Nagpur; Joint Plant Committee, Ministry of Steel. (2018). Annual Statistics 2017-18. Government of India, New Delhi; Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

The allocated production and attraction centres for iron ore in 2030 are presented below:

Figure 5-67. Iron ore prodcution centres (2030)

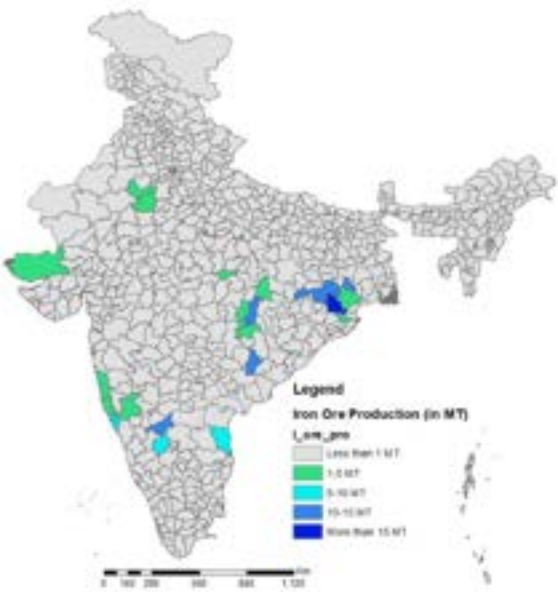
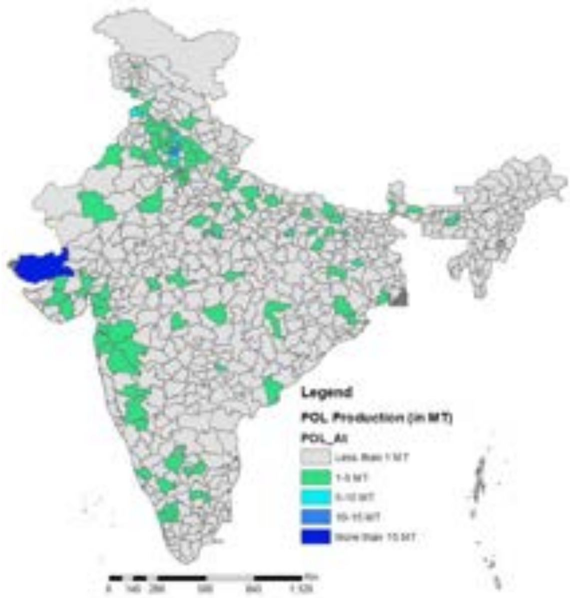


Figure 5-68. Iron ore attraction centres (2030)



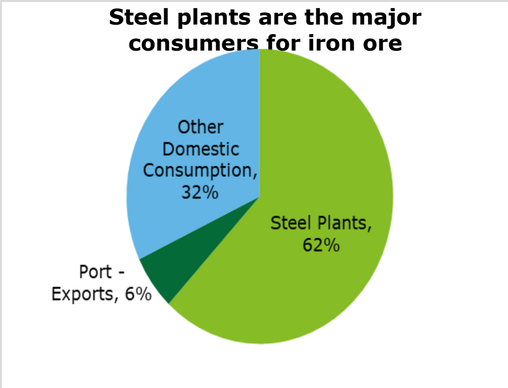
5.11.2.3. Extant rail modal share and logistics competitiveness

Railways is the most commonly used mode of iron ore transportation. In FY 2018, rail constituted ~70 percent[36] modal share and moved ~140 MT of Iron Ore to various sectors with an average lead of 305 km. Nearly two-third of this movement

[36] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Iron Ore. Government of India. Nagpur; Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

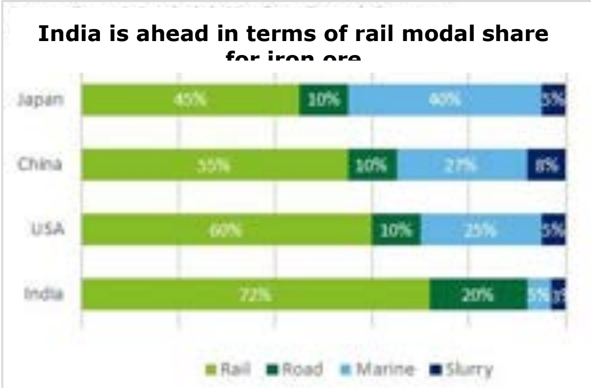
was for the steel sector. At the same time, the modal share for road is around 18-20 percent with coastal and slurry pipelines moving the rest.

Figure 5-69. Iron ore rail movement share



Source: Consultant Analysis

Figure 5-70. Rail's Modal Share: India vs Global



Source: Consultant Analysis

IR Cost Competitiveness (2017): When adjusted for purchasing power parity, it costs INR 7.18 to move per ton-km of iron ore compared to INR 1.89 in Australia.

Figure 5-71. Cost Economics (per Ton-KM) of various modes

Source: Consultant Analysis

Railways is costlier compared to road and slurry pipes for sub-500 km movement[37]. Nonetheless, about 90 percent of large steel producers use railways as a preferred mode of iron ore sourcing. This is mainly because of the scale that rail encompasses when compared to slurry pipelines that are still at a nascent stage of development in India. Road is preferred in cases of rail un-availability, for spill over cargo destined for mainly very short hauls, or for medium to small steel producers with a lower requirement for iron ore.

[37] Cost Economics estimated based on IR Revenue data and inputs from Department of Logistics, Ministry of Commerce for other modes

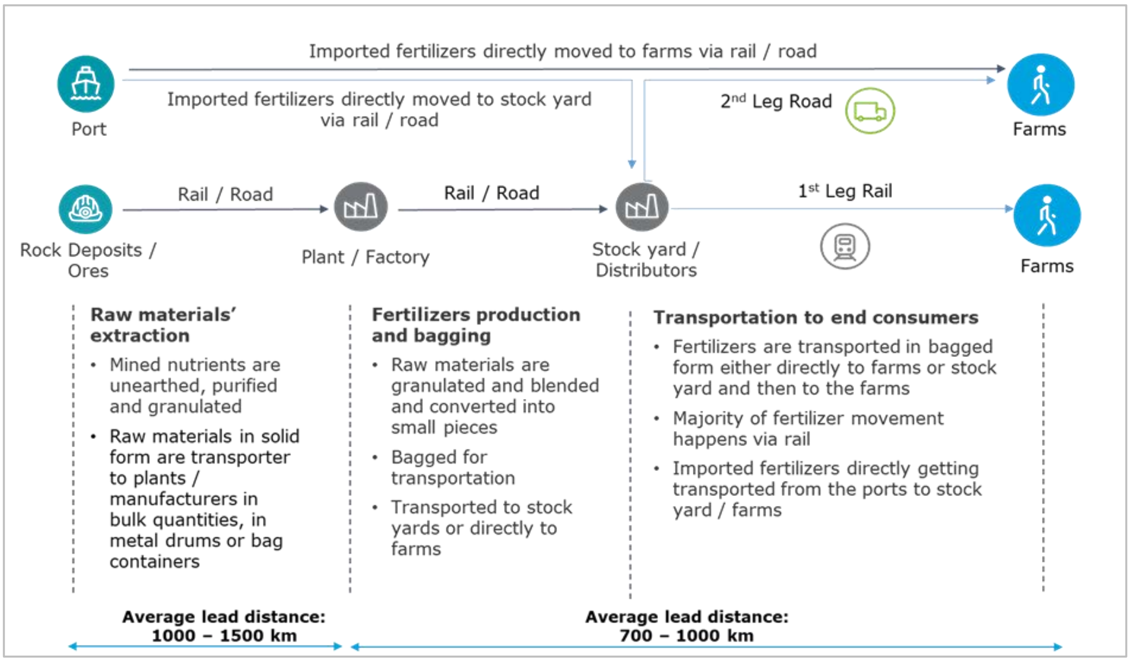
5.11.3. Fertilizers

5.11.3.1. Current commodity landscape

Fertilizers account for about 4 percent of the total rail freight transportation volume and contributes about 5 percent to the IR revenue. The industry is heavily reliant on the rail modality with about 86 percent of the total production and imports of fertilizers, cumulatively 48.53 MT[38], in the country moving by rail across an average lead of 836 km during FY 2018.

Major fertilizers used as key inputs for Indian Agriculture include Urea, Diammonium Phosphate (DAP), Complex (NP/NPKs), and Muriate of Potash (MOP), which are domestically manufactured as well as imported (MOP, a potassic fertilizer is 100 percent imported).

Figure 5-72. Fertilizer Value Chain Assessment

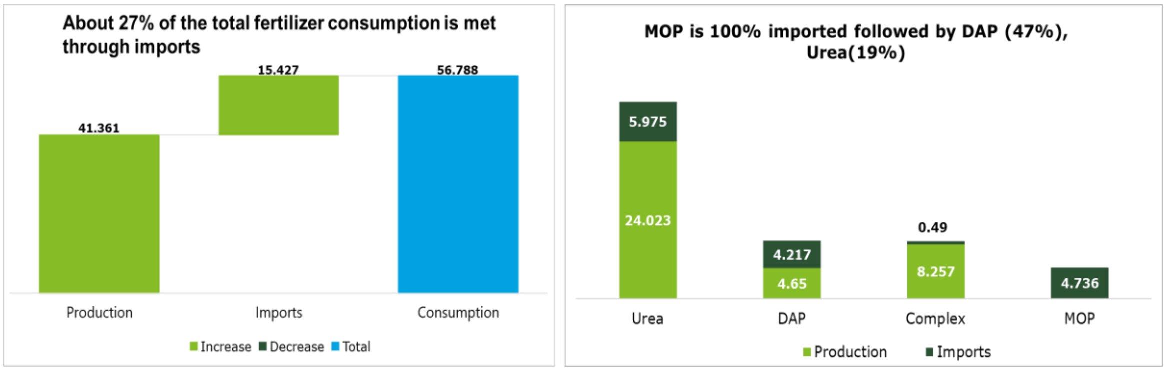


The primary solid raw materials used for production of DAP and Complex fertilizers are rock phosphate and potash, wherein the entire requirement of potash is met by imports. The key secondary element required is calcium, which is sourced through limestone and gypsum rocks.

The imported raw materials as well as the raw materials mined from ore deposits domestically are transported to the manufacturing units through rail / road mode. Domestically manufactured and imported rock phosphate and MOP together constituted ~2.2 MT[31] of freight moved by rail during FY 2018.

[38] Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

Figure 5-73. Fertilizer Consumption (in MT) in FY 2018



Source: Department of Fertilizers, Ministry of Chemicals and Fertilizers

The production of fertilizers stood at 41.36 MT[39] in FY 2018. Given the higher domestic demand, additional 7.4 MT of finished fertilizer and 7.5 MT of major raw material including Urea, DAP, NP/NPK and MOP were imported during FY 2018[40]. The imports are expected to continue in medium term with FY 2018 alone clocking growth of 9.24 percent, compared to 14.12 MT (finished plus raw materials) in FY 17.

5.11.3.1.1.*Key production centres*

In terms of total production, Gujarat, Uttar Pradesh and Andhra Pradesh are the top producers of fertilizers in India. While Western, Southern and Eastern parts of the county cater to the production of key fertilizers including Urea, DAP and Complex fertilizers, the Northern states mainly produce only Urea.

Although the fertilizer manufacturing plants are situated in major states of the country, ~84[31] percent of reserves of rock phosphate (which is the key raw material for production of DAP and Complex fertilizers) are concentrated in Jharkhand, Rajasthan and Madhya Pradesh, which are located at a distance from the producing states. In fact, Udaipur in Rajasthan and Chhatarpur, Sagar & Jhabua in Madhya Pradesh are the only principle producers of rock phosphate together contributing 1.5341 MT of production during FY 17.

This indicates the need for transportation of rock phosphate to the manufacturing units across other parts of the country. The same has also been reflected in the average lead distance for rail transportation of imported and domestically produced rock phosphate in a range of 1000 – 1500 km[42] during FY 2018.

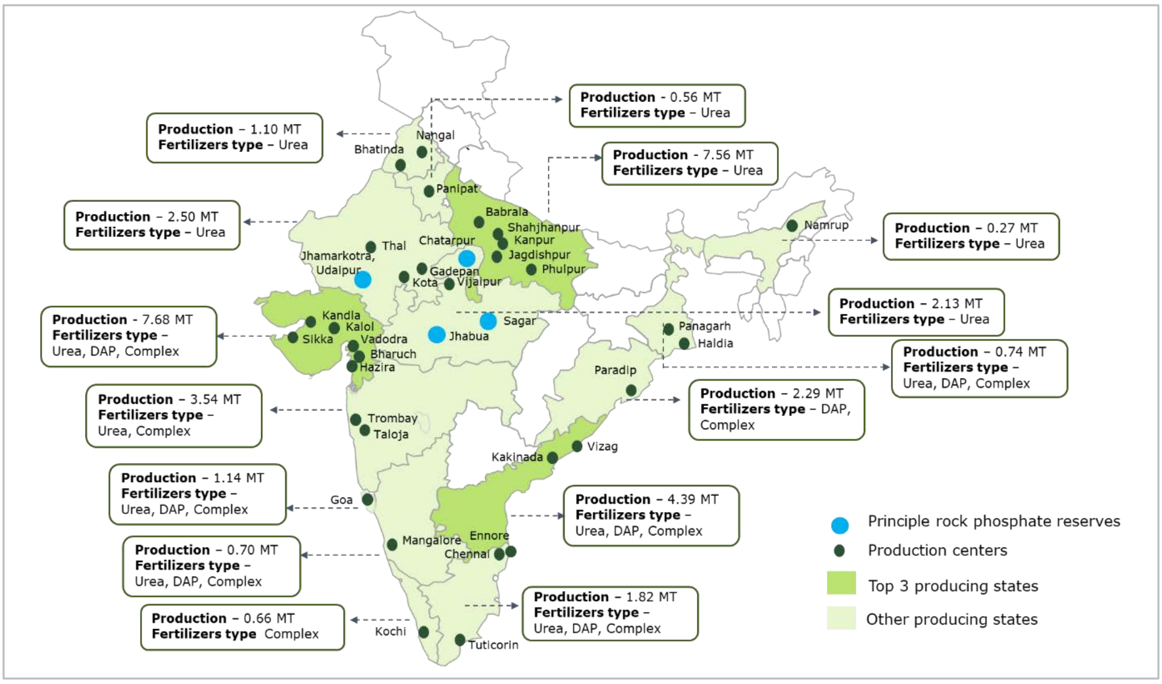
[39] Department of Fertilizers, Ministry of Chemicals and Fertilizers. (2019). Annual Report 2018-19. Government of India. New Delhi

[40] Department of Fertilizers, Ministry of Chemicals and Fertilizers. (2019). Indian Fertilisers Scenario 2018. Government of India. New Delhi

[41] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Apatite and Rock Phosphate. Government of India. Nagpur

[42] Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

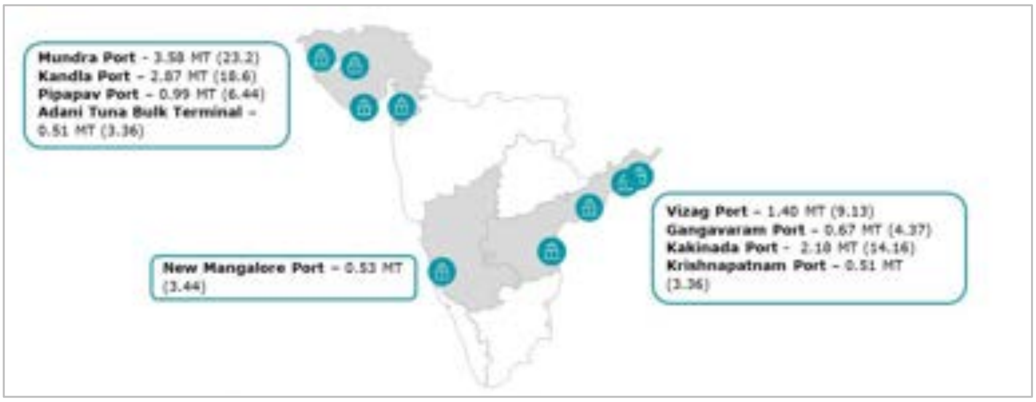
Figure 5-74. Key supply centres of major fertilizers (Urea, DAP and Complex) and production in FY 2018



Source: Department of Fertilizers, Ministry of Chemicals and Fertilizers

Not only are Gujarat and Andhra Pradesh major producers of fertilizers, they also contribute significantly in terms of imports of fertilizers (Urea, DAP, Complex, MOP). The ports in these two states and Karnataka together constitute around 86 percent of the total fertilizer imports in India.

Figure 5-75. Major ports contributing ~86 per cent imports of fertilizers in FY 2018

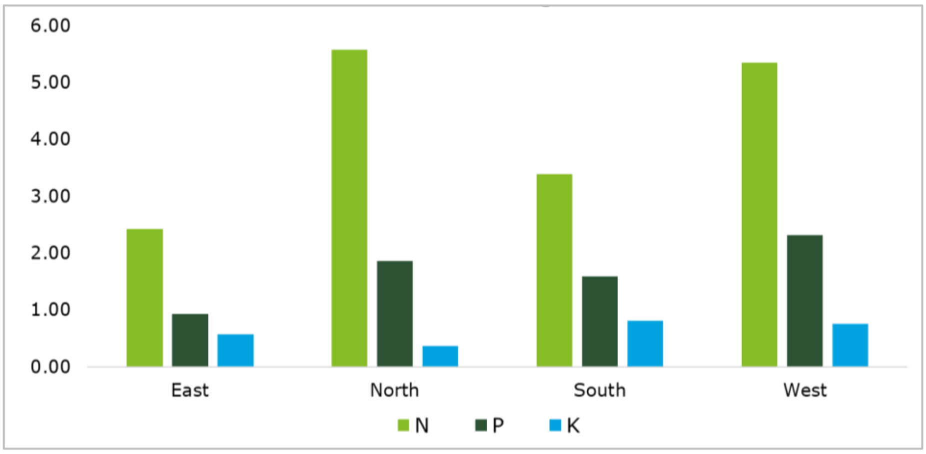


Source: Department of Fertilizers, Ministry of Chemicals and Fertilizers

5.11.3.1.2.*Consumption patterns*

The total consumption of fertilizers in terms of nutrients (N, P and K) stood at 26.79 MT[33] during FY 2018, an increase of 3.2 percent from the previous year. The concentration of consumption is primarily in the northern part of the country followed by the states in Western region together accounting around 62 percent[43] of total consumption in the county.

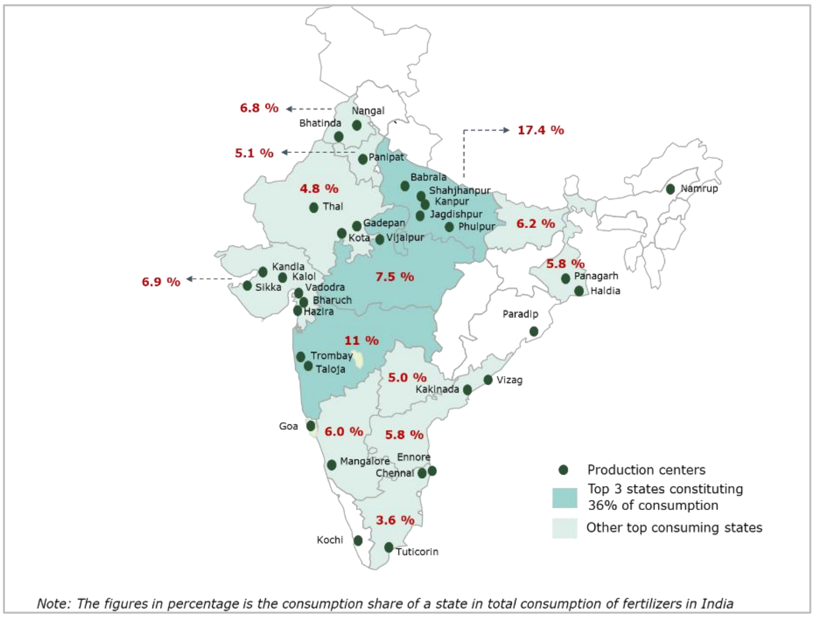
Figure 5-76. Region wise consumption of fertilizer nutrients (2016-17)



Source: Department of Fertilizers, Ministry of Chemicals and Fertilizers

In terms of state wise consumption pattern, about 92 percent[44] of the total consumption of fertilizers in India is concentrated in 13 states with Uttar Pradesh, Maharashtra and Madhya Pradesh being the top consumers together constituting around 40 percent of the total consumption.

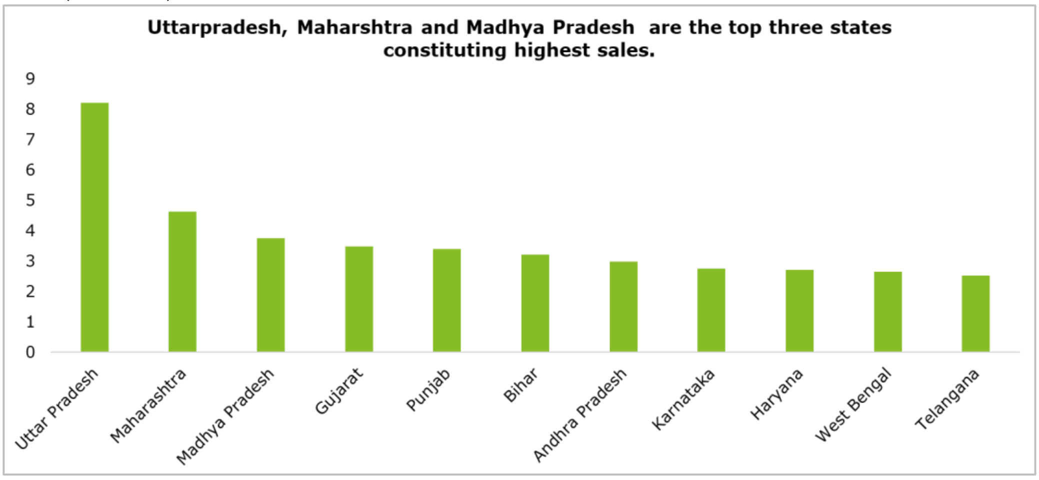
Figure 5-77. Top 13 states constituting 92 percent of consumption of fertilizers in FY 2018



[43] Department of Fertilizers, Ministry of Chemicals and Fertilizers. (2019). Indian Fertilisers Scenario 2018. Government of India. New Delhi
[44] Fertilizer Association of India. (2019). Annual Review of Fertiliser Production and Consumption 2018-19. https://www.faidelhi.org/general/AR-executive-summary.pdf

Source: Annual Review of Fertilizer Production and Consumption 2017-18, Fertilizer Association of India

Figure 5-78. Fertilizer sales for states constituting ~83 per cent of total sales in FY 2018 (in MTs)



Source: Department of Fertilizers, Ministry of Chemicals and Fertilizers

5.11.3.2. Projections of potential transport demand

Given that the agriculture sector is the sole user of fertilizers, the projected food grain volumes above formed the basis for assessing corresponding fertilizer demand. This involved developing a population nutrition model wherein fertilizer nutrient (N, P, K) requirements were projected in reference to response ratio of fertilizers with Foodgrains. The fertilizer nutrient demand, in turn, provided basis for projecting fertilizer products (Urea, DAP, MOP, Complex and SSP) volumes. In doing so, it was assumed that past nutrient to product conversion ratios shall prevail.

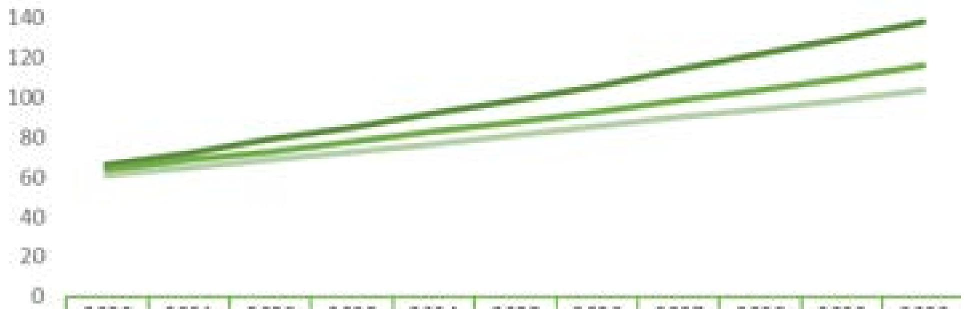
The fertilizers' volume Projections were compared and calibrated against various targets and growth visions prescribed by Government of India or its agencies.

Fertilizer Projections: Key Assumptions, Inputs and Data Sources

- Macro-Economic Indicators evaluated: Population growth, Per capita expenditure, GDP growth, Consumption to Production ratios, and Per capita Foodgrains consumption/availability, Food grains production
- Preferred Indicators:
  - Fertilizers: Foodgrains production
- Coefficients for Fertilizer was estimated at 2.24 against Food production
- Food grain production response ratio of fertilizer to agricultural output assumed as 1:6 as per past trends

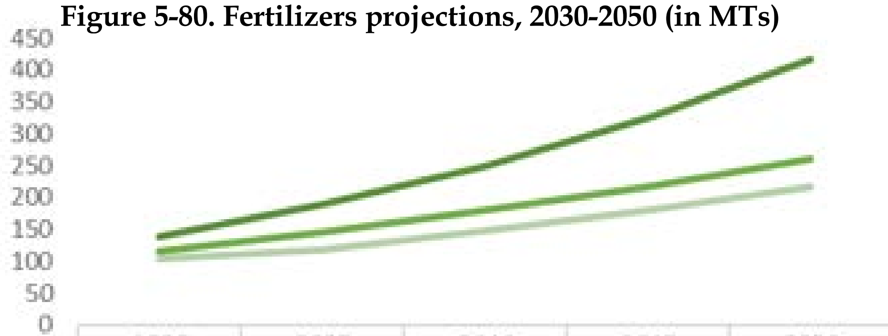
The volume Projections for fertilizers are presented below:

Figure 5-79. Fertilizers projections, 2020-2030 (in MTs)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	66	72	79	85	92	99	106	114	122	130	138
Realistic	64	69	73	78	83	88	93	99	104	110	116
Pessimistic	61	65	69	73	77	81	86	90	94	99	104

Figure 5-80. Fertilizers projections, 2030-2050 (in MTs)



	2030	2035	2040	2045	2050
Optimistic	138	189	250	325	416
Realistic	116	145	179	217	260
Pessimistic	104	118	147	180	216

Optimistic Realistic Pessimistic

Fertilizer origination and destination allocation: The study team prepared a comprehensive list of district wise fertilizer plants, associated capacity and production for the base year (2018). Thereafter, port wise export/ import trends and district wise capacity expansion plans[45] were also referenced to allocate production from various districts across projections period. Specific to destination assignment, district wise base year consumption patterns were estimated through primary road surveys and Rail movement data sourced from FOIS. The base year trends and district wise food grain production Projections were also taken into consideration to assess district wise consumption demand.

The allocated production and attraction centres for fertilizers in 2030 are presented

Figure 5-82. Fertilizers production centres (2030)

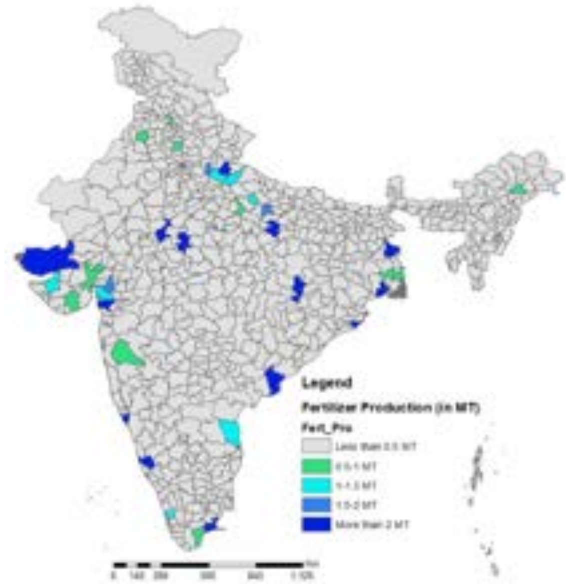
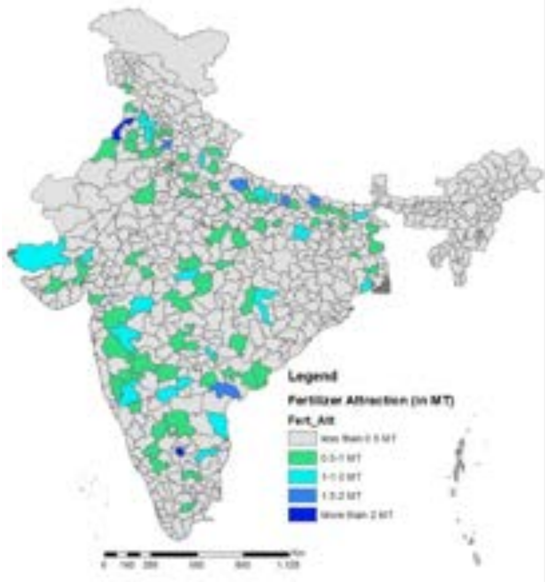


Figure 5-81. Fertilizers production centres (2030)



below:

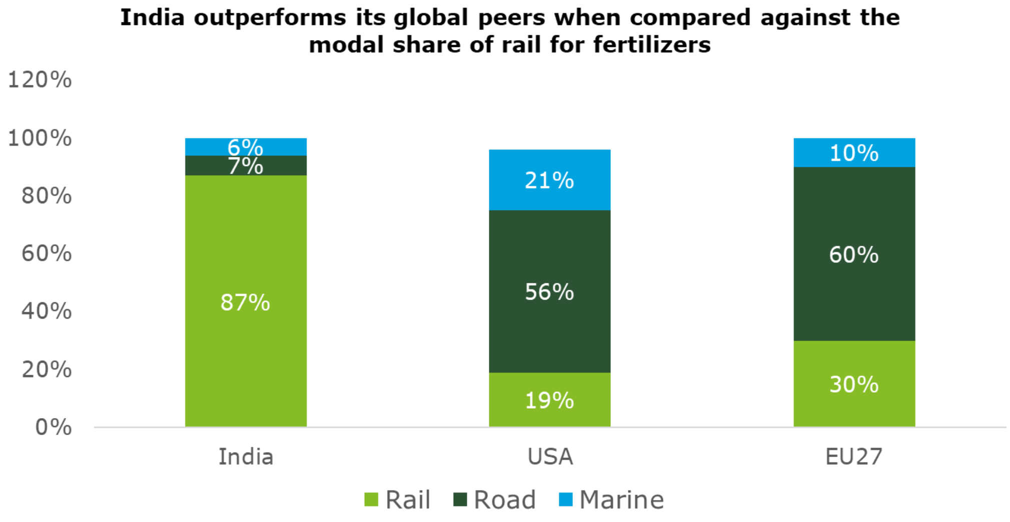
5.11.3.3. Extant rail modal share and logistics competitiveness

Rail occupies the major modal share for fertilizer transport. Rail enjoys significant cost advantage, which is further boosted by government subsidies[46]. However, recent expansion of this regulation to include marine transport (coastal shipping and inland waterways) may further optimize this modal mix. Specific to logistics competitiveness, IR remains an expensive proposition when compared to its global peers.

[45] Department of Fertilizers, Ministry of Chemicals and Fertilizers. (2019). Indian Fertilisers Scenario 2018. Government of India. New Delhi; Various company annual reports and websites

[46] Reimbursement of rail freight expenditure covering movement of fertilizer by rail from the plant or the port to various rake points in various districts under Government of India's Policy for reimbursement of freight for movement of phosphatic and potassic (P&K) fertilizers and for urea

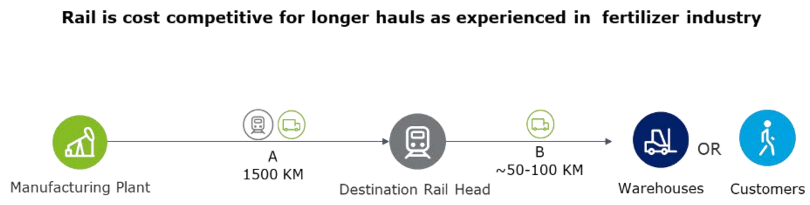
Figure 5-83. Modal share of fertilizers



Source: Consultant Analysis

Based on industry reports, it is further understood that the primary reason for this high modal share is cost competitiveness of rail as compared to road. Fertilizers generally have longer hauled which makes its transportation more convenient when using rail. Furthermore, the transit cost of fertilizer by rail coupled with handling cost is lower when compared to an all road transportation. Thus, on a consolidated basis rail becomes cheaper than road. One such instance of the cost involved in the movement of fertilizers from Kakinada to Siliguri viz. rail and road is provided below.

Figure 5-84. Logistic cost competitiveness of Rail and Road



Route	Rail+Road		Road	
A+B	Freight	A: 1897 B: 400	Freight	A+B: 3000
	Handling	200		
	Rail-head charges	200		
Total	**2597**		**3000**	

Source: Industry Consultations

5.11.4. Food grains

5.11.4.1. Current commodity landscape

Food grains accounted for about 4 percent[47] of the total rail freight transported and generated 7.26 percent of revenue for Indian Railways during FY 2018. The production of food grains is skewed towards some surplus states from where these are transported to the meet requirements of the deficit states under National Food Security Act (NFSA)/Targeted Public Distribution System (TPDS), other welfare schemes (OWS) and to create buffer stockpiles.

Moreover, there is also intra-state movement based on the requirement of deficit districts from surplus ones, and this movement is generally via roads due to shorter lead distances (less than 400 kms).

The public distribution of food grains across the country happens through a variety of stakeholders particularly Food Corporation of India (FCI), and other traders & associations with FCI designated as the Central Agency for transportation under the TPDS. The value chain describing the movement of food grains in the ecosystem is presented below:

Figure 5-85. Value Chain for food grains and logistics ecosystem

Source: Consultant Analysis

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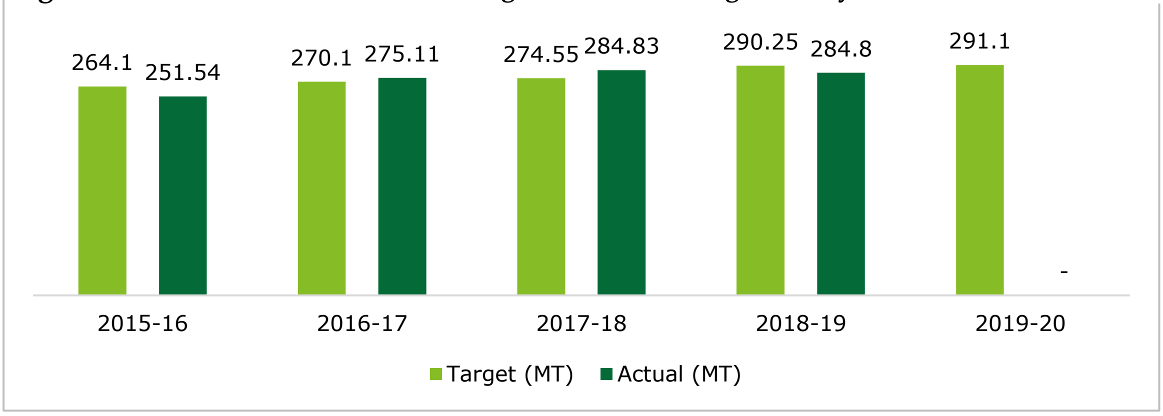
47 Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

5.11.4.1.1.*Production of Food Grains*

The total production of food grains in India stood at 284.83 MT[48] in FY18. The production of food grains depends on multiple factors such as availability of land, adequate fertilizers, suitable irrigation facilities, rainfall, productivity (yield) and such others. The GoI has set targets for food grains production and every year the actual production is measured vis-à-vis targets set. Following is a comparative analysis of the actual production of the food grains vis-a-vis targets set by GoI for the last 5 years.

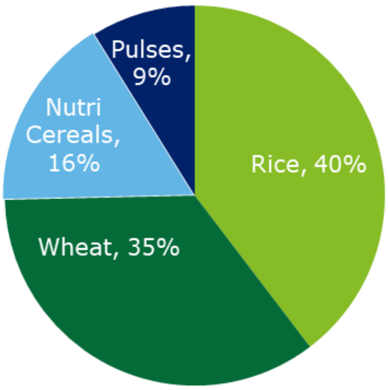
Figure 5-86. Actual Production of Food grains vis-à-vis target sets by GoI



Source: Department of Agriculture, Cooperation & Farmers Welfare (DoAC & FW)

The actual production has shown a positive Compound Annual Growth (CAGR) of 3.81 percent during the last three years. Given that the historical difference (variation) between the targets set and the actual production is not more than (+/-) 5 percent, it is probable the estimates for the upcoming years are likely to be met.

Figure 5-87. Commodity-wise share of Food grains during FY 2017-18

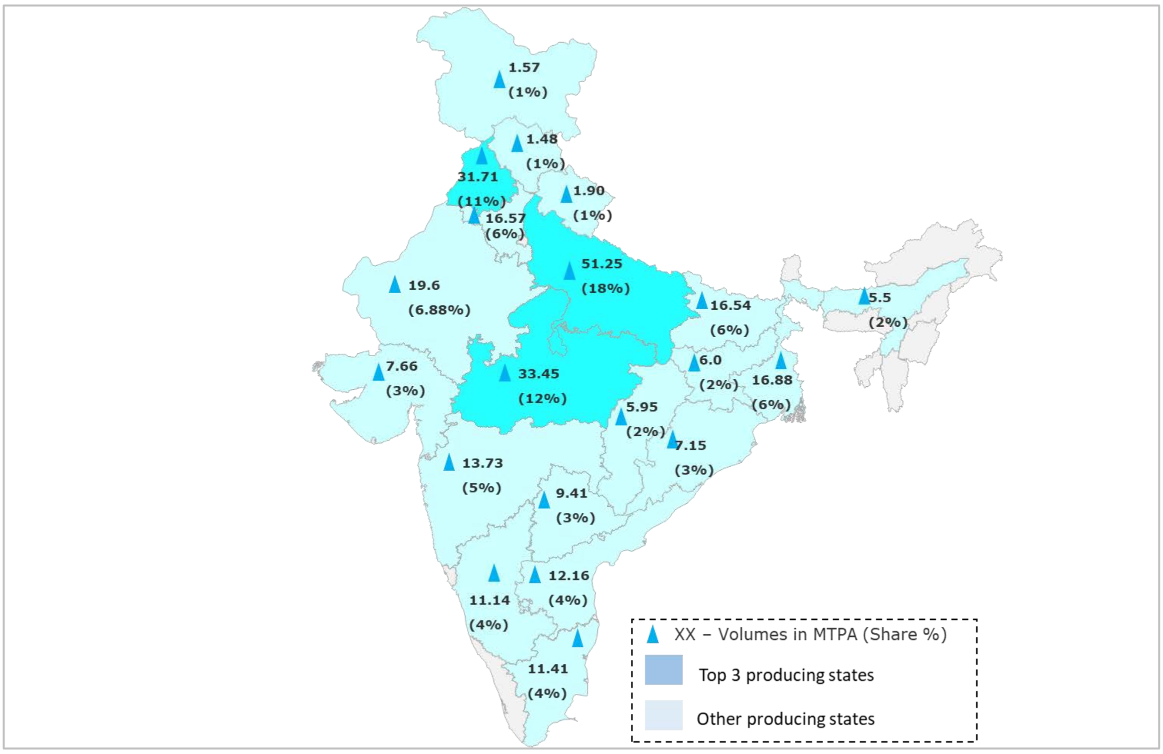


Source: Pocket Book of Agricultural Statistics, FY 2018, Directorate of Economics & Statistics, Ministry of Agriculture & Farmers Welfare

[48] Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare. (2018). Pocket Book of Agricultural Statistics 2018. Government of India. Delhi

Additionally, India imported ~7.53 MT[39] of food grains in the FY 2018. Altogether, the net inflow (supply of food grains to the Indian market) of food grains in the Indian market rose to about 292.56 MT. The major regions/states producing food grains are represented in the following graphic. The volumes are represented in MTPA and the respective share in percentage for each state.

Figure 5-88. Major states producing food grains in FY 2018



Source: Pocket Book of Agricultural Statistics, FY 2018, Directorate of Economics & Statistics, Ministry of Agriculture & Farmers Welfare; Consultant Analysis

Uttar Pradesh (17.99 percent) recorded the highest production of food grains followed by Madhya Pradesh (11.74 percent), Punjab (11.13 percent), Rajasthan (6.88 percent) and others[49]. Most of the food grains produced in the respective states are primarily consumed within these states and any surplus volumes are transported to the deficit states through private industry, Public Distribution System or the Targeted Public Distribution System of the Government of India. The Food Corporation of India (FCI), the central agency responsible from Central Government, generally controls this movement.

FCI dispatched 37.51 MT of food grains during FY 2018 with 80 percent to 85 percent of the total freight movement of the commodity via rail. The average lead for rail transportation of food grains is ~1400 km and road is typically found feasible in the areas where rail connectivity is poor or non-existent.

[49] Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare. (2018). Pocket Book of Agricultural Statistics 2018. Government of India. Delhi

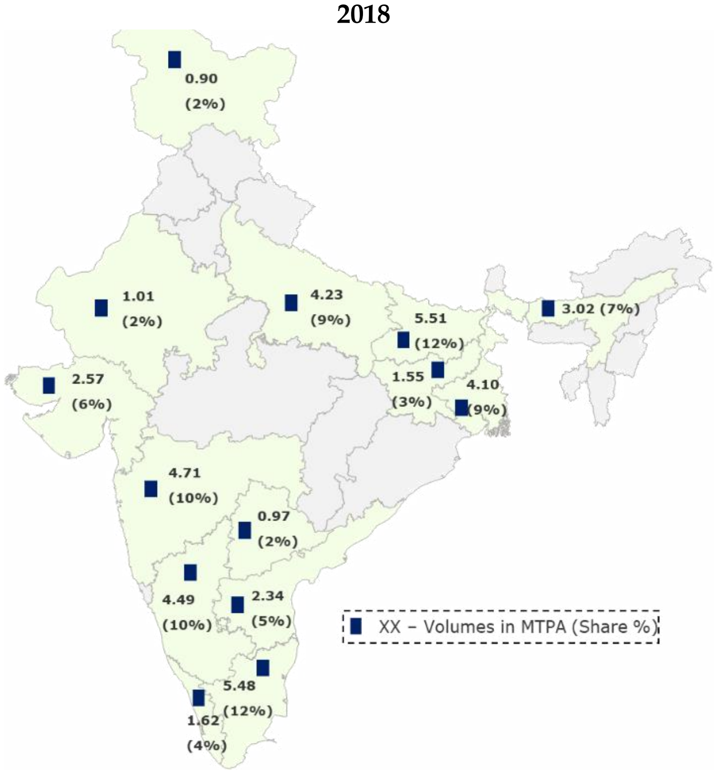
5.11.4.1.2. *Consumption of Food Grains*

The consumption of food grains depends on the population in that specific state and the net availability of the per capita consumption. However, the states that have enhanced production capabilities, fulfil their own demand and provide the surplus volumes to the deficit states.

No reliable data exists on cumulative food grain consumption in India except for Public Distribution system receipts. The overall movement of PDS food grains within India including the inter-state movement and intra-state movement via rail, road and river transport was about 42.02 MT in the FY 2017-18. Apart from its internal consumption, India was able to export about 14.24 MT of food grains in the FY 2017-18.

The following graphical representation depicts the receipts of the PDS food grains by the major respective states. The volumes are represented in MTPA and respective share in percentage for each major state.

Figure 5-89. Receipts of PDS grain by key states in FY 2018



Source: Department of Food & Public Distribution & Consultant Analysis

Bihar receives the most is the highest PDS food grain followed by Tamil Nadu, Maharashtra, Karnataka and others. These states as shown in the map constitute about 93 percent of the total PDS consumption. Whereas the other states include Odisha, Madhya Pradesh, Uttarakhand, Nagaland, Tripura, Delhi, Punjab, Chhattisgarh, Mizoram, Haryana, Manipur and Goa, altogether constituting the remaining 7 percent of the total PDS receipts.

Out of the total movement of PDS food grains in 2017-18 by rail, about 83 per cent of the freight originated from the states of Punjab, Haryana, Madhya Pradesh, Andhra Pradesh, Chhattisgarh, and Telangana.

5.11.4.2. Projections of potential transport demand

To assess the future production trends for Food grains, various macro-economic and demographic factors like population, expenditure, GDP growth, consumption to production ratios, and per capita food grain consumption/availability were referenced by evaluating past trends, respective correlations and elasticities with food grain production and imports/exports.

The food grains volume Projections were compared and calibrated against various targets and growth visions prescribed by Government of India or its agencies.

Food grains Projections: Key Assumptions, Inputs and Data Sources

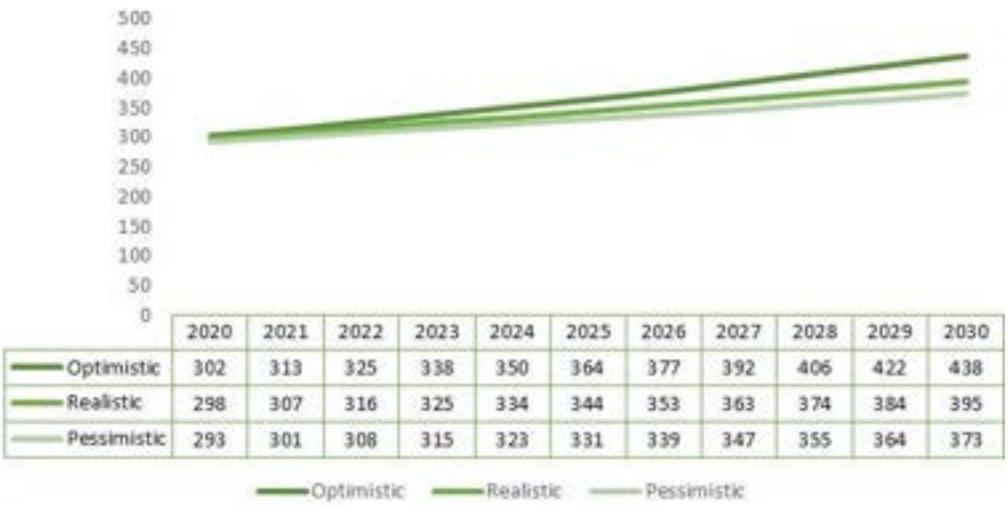
- Macro-Economic Indicators evaluated: Population growth, Per capita expenditure, GDP growth, Consumption to Production ratios, and Per capita Food grains consumption/availability, Food grains production
- Preferred Indicators:
    - Food grain: Population growth, Per capita availability of Food grains, Per capita income
- Estimated elasticity coefficient for Food grains was 2.97 against population growth, 1.58 against per capita availability of Food grains and 0.61 against per capita income;
- OECD estimates were adopted for per capita income and GDP growth forecasts[50]. The future growth of per capita income corresponding to growth in GDP was used for assessing future Real GDP growth and per capital income.
- Food and Agriculture Organization, United Nations' population growth estimates for India[51] were adopted for the purpose of future population Projections.
- Per capita availability of food grain sourced from Ministry of Agriculture and Farmers Welfare statistics

[50] Organisation for Economic Co-operation and Development (OECD). Real GDP forecast (indicator). doi: 10.1787/1f84150b-en. https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September 2019

[51] Food and Agricultural Organisation of the United Nations. (2019). Population growth estimates at http://www.fao.org/faostat/en/#data/OA

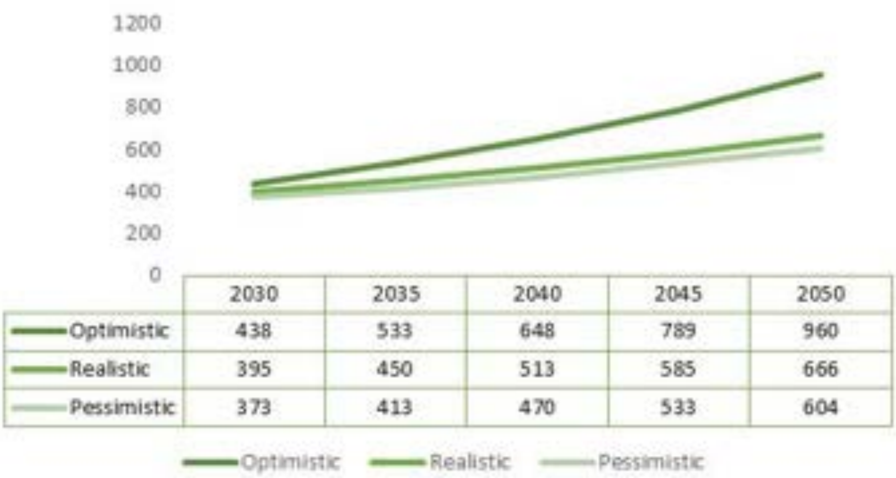
The volume projections for food grains are presented below:

Figure 5-90. Food grains Projections (in MT) under different scenarios (2020-2030)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	302	313	325	338	350	364	377	392	406	422	438
Realistic	298	307	316	325	334	344	353	363	374	384	395
Pessimistic	293	301	308	315	323	331	339	347	355	364	373

Figure 5-91. Food grains Projections (in MT) under different scenarios (2030-2050)



	2030	2035	2040	2045	2050
Optimistic	438	533	648	789	960
Realistic	395	450	513	585	666
Pessimistic	373	413	470	533	604

Food grain origination and destination allocation: Current trends in District-wise food grain production and consumption, generated from primary freight flow surveys and export import patterns were referenced. Current districts wise Production was extrapolated in same proportion as the current pattern while district wise destination was extrapolated with reference to district wise population growth estimates for the Projections period.

The allocated production and attraction centres for foodgrains in 2030 are presented below:

Figure 5-93. Foodgrains attraction centres (2030)

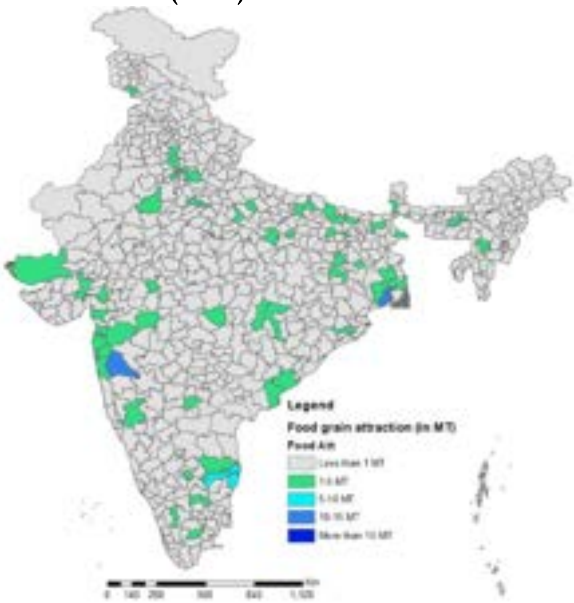
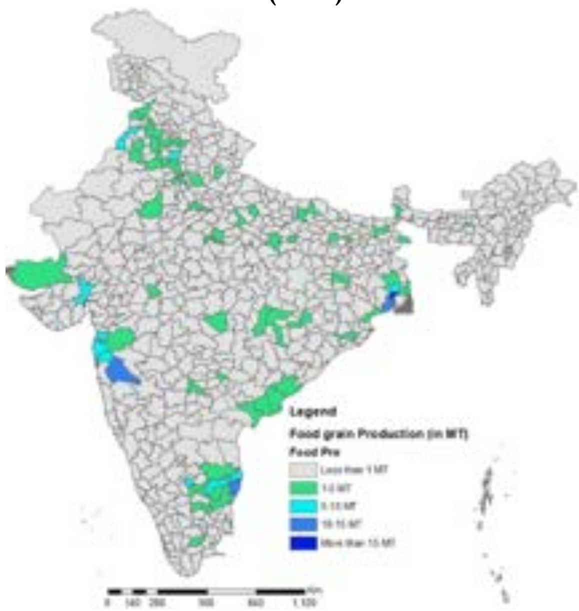


Figure 5-92. Foodgrains production centres (2030)



Source: Deloitee Analysis

5.11.4.3. Extant rail modal share and logistics competitiveness

The Indian Railways (IR) moved about 43.79 MT[52] of food grains in FY 2017-18, registering a marginal decline of ~1.40 percent over the preceding year (handling about 44.86 MT in FY 2016-17). IR handled these commodities at an average lead distance of ~1414 kms. According to Indian Railways annual report & accounts 2017-18, IR was able to realize earnings of about INR 8403 crores, which is about 8 percent of its total basket. The commodities transported via railways in the food grains basket include rice, wheat, maize, onion, and others. The share of each commodity transported via railways in FY 2017-18 is represented in the following graphic.

[52] Ministry of Railways (Railway Board). (2019). Indian Railways Annual Report & Accounts, 2018-19. Government of India, New Delhi. https://indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/Year_Book/Indianpercent20Railwayspercent20Annualpercent20Reportpercent20percent26percent20Accountspercent20Englishpercent202018-19.pdf

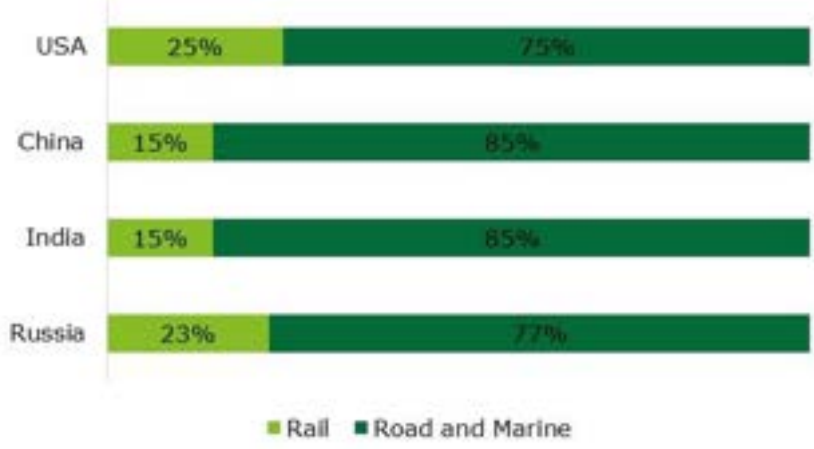
Figure 5-94: Rail movement share of food grains in FY 2018

Source: Indian Railways & Consultant Analysis

Others include fruits & vegetables, paddy, fine rice, pulses, bajra, seeds, husk, carbon black feed stock, fodder, flour, etc.

Rail only has 15 percent modal share for the transportation of food grain in India with road and marine (IWT and Coastal shipping) dominating the modal share breakup. This is primarily due to states producing and consuming food grains internally and preferring road-based movement because of shorter leads. A similar pattern exists globally as illustrated by below graphic[53]. It is pertinent to mention that coastal movement through inland water transportation is gaining momentum in India and currently it is at a share of 1 percent of the total food grains transport movement.

Figure 5-95. Food grains modal mix: India vs peers



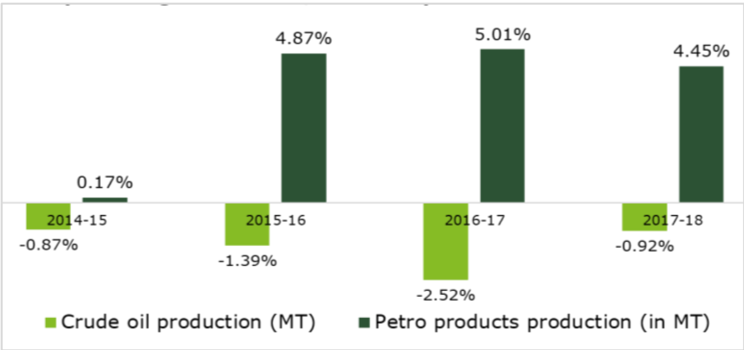
[53] National Agriculture Statistics Service, Unites States Department of Agriculture. (2016). United States Government. Washington DC; FY 2018 data for remaining countries sourced from respective railroad websites

5.11.5. Petroleum and Products (POL)

5.11.5.1. Current commodity landscape

The total production of POL in India mainly accounts for crude oil and petroleum products and stood at 35.68 MT[44] and 220.76 MT respectively during FY 2018. While the production of petroleum products has shown a positive growth trend, crude oil production has experienced negative growth since FY 2015. In fact, the country primarily relies on imports for crude oil, which is validated by the fact that India imported 220.43 MT of crude oil in FY 2018 as against the production of 35.68 MT[54].

Figure 5-96. Production growth trend of crude oil and petroleum products

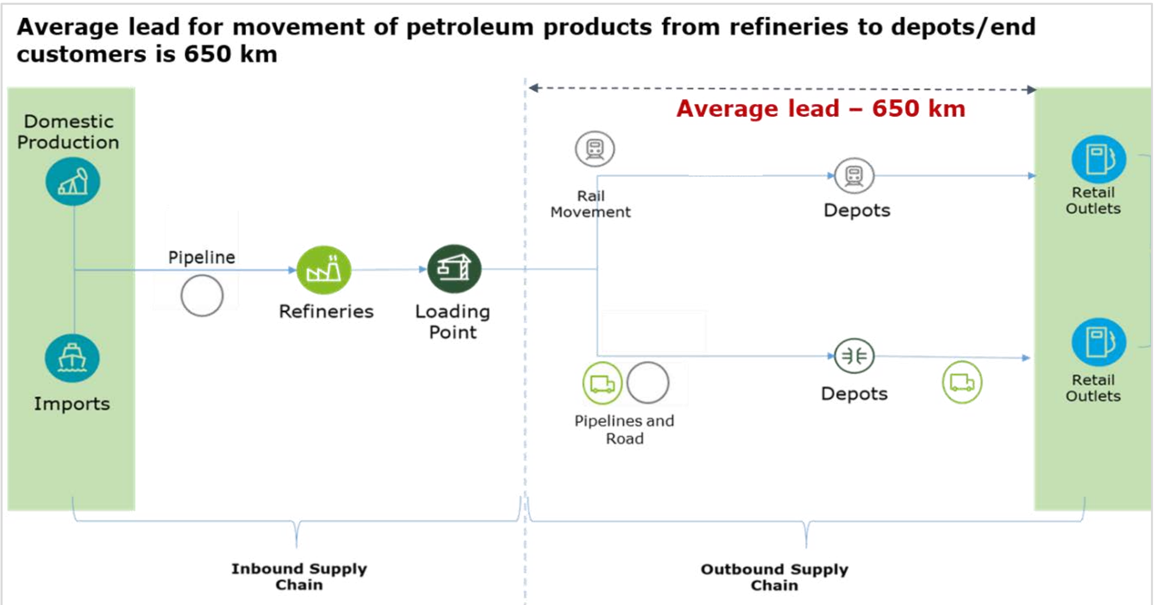


Source: Annual Report FY 2019, Ministry of Petroleum and Natural Gas, GOI

In contrast, India is a net exporter of petroleum products with exports of 66.83 MT[44] during the same period.

Ports, refineries and depots are at the epicenter of POL production. Typically, crude oil, both domestically produced and imported, is transported to refineries by pipelines. The crude oil is then converted into petroleum products for further

Figure 5-97. Value chain assessment for POL



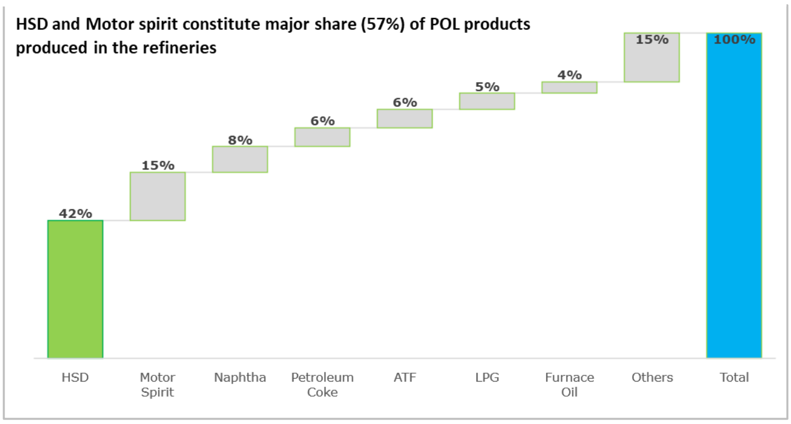
Source: Industry Consultations, Consultant Analysis

[54] Ministry of Petroleum and Natural Gas. (2019). Annual Report FY 2019. Government of India. Delhi

transportation to the depots followed by end customers, through either of the three modes – rail, road and pipelines.

The petroleum products include high-speed diesel (HSD) oils, motor spirit (also known as petrol), naphtha, petroleum coke, aviation turbine fuel (ATF), liquefied petroleum gas (LPG), furnace oils, among others. The share of these products produced from refineries during FY 2018 is presented in Figure below

Figure 5-98. Share of POL products produced from the refineries in FY 2018



Source: Indian Petroleum & Natural Gas Statistics 2017-18 and Consultant Analysis

In fact, ~43 million tonnes (MT) of POL products moved by rail, which accounted for only around 3-4 percent of the total rail freight transportation in FY 2018. The rail movement mainly accounts for transportation of petroleum products with an average lead of ~650 km from refineries to depots or end customers. At the same time, crude oil is primarily transported through pipelines.

5.11.5.1.1. *Key supply centres*

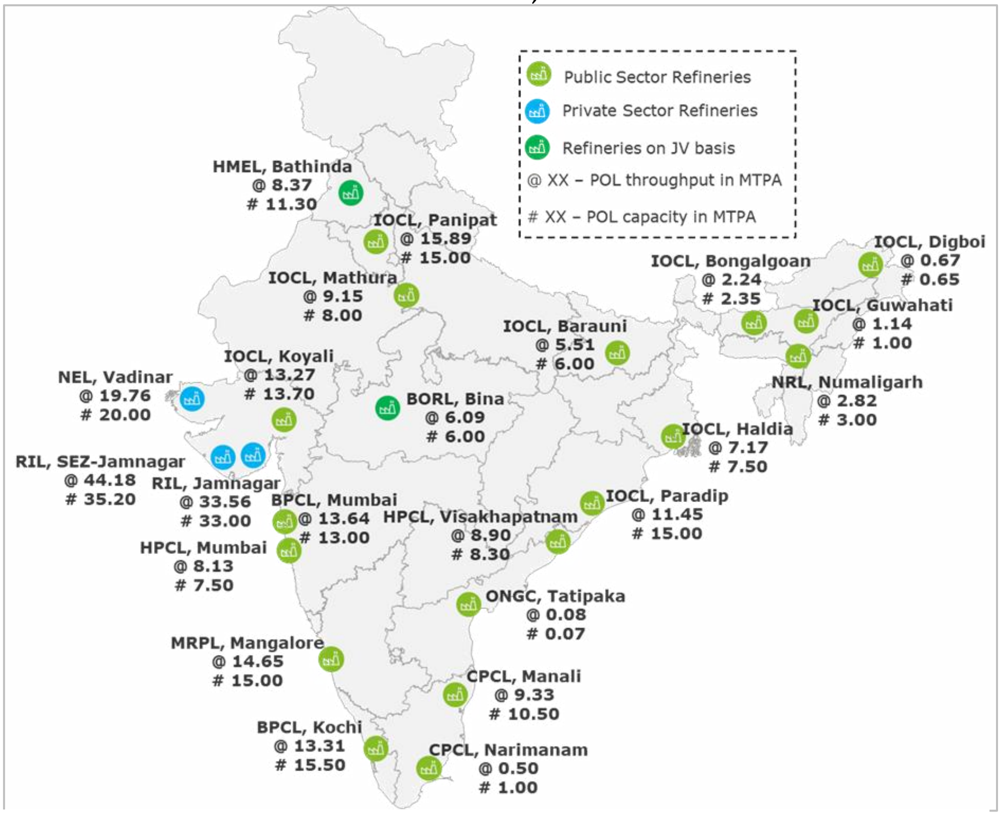
As on April 2018, the crude oil balance reserves in India are estimated at about 594.5 MT55 with Western Offshore, Assam and Gujarat together contributing 87 percent of the total reserves.

At the same time, the oil refining capacity stood at 247.57 MT during FY 2018 with 23 crude oil refineries located across the country. The majority of these refineries are strategically located near the ports to facilitate crude oil imports since India is a net importer of the commodity.

[55] Ministry of Petroleum and Natural Gas. (2018). Indian Petroleum & Natural Gas Statistics. Govt. of India, Delhi

Major refineries with their production capacity and throughput are presented in Figure 5-99 below.

Figure 5-99. Key refineries of petroleum products with throughput & capacity (in Million Tonnes) in FY 2018



Source: Indian Petroleum & Natural Gas Statistics 2017-18 and Consultant Analysis

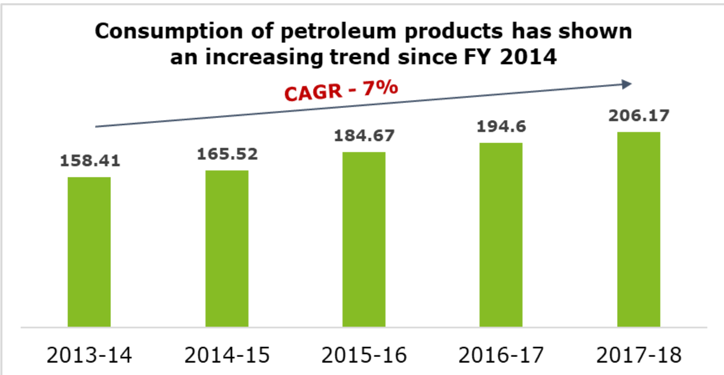
The majority of these oil refineries are operated by public sector with only 3 refineries owned by the private sector in addition to 2 refineries which are based on JV arrangements. Herein, while Indian Oil Corporation Limited (IOCL) dominates the POL market in the PSU category (as well as in the overall market), Reliance Industries Limited (RIL) is the largest player in the private category.

5.11.5.1.2.*Consumption Patterns*

The total consumption of petroleum products was ~206 MT during FY 2018 growing at a CAGR of 7 percent since FY 2014.

It is further observed that Maharashtra & Gujarat in West, Tamil Nadu & Karnataka in South, West Bengal & Odisha in East, and

Figure 5-100. Consumption of petroleum products (in MT)

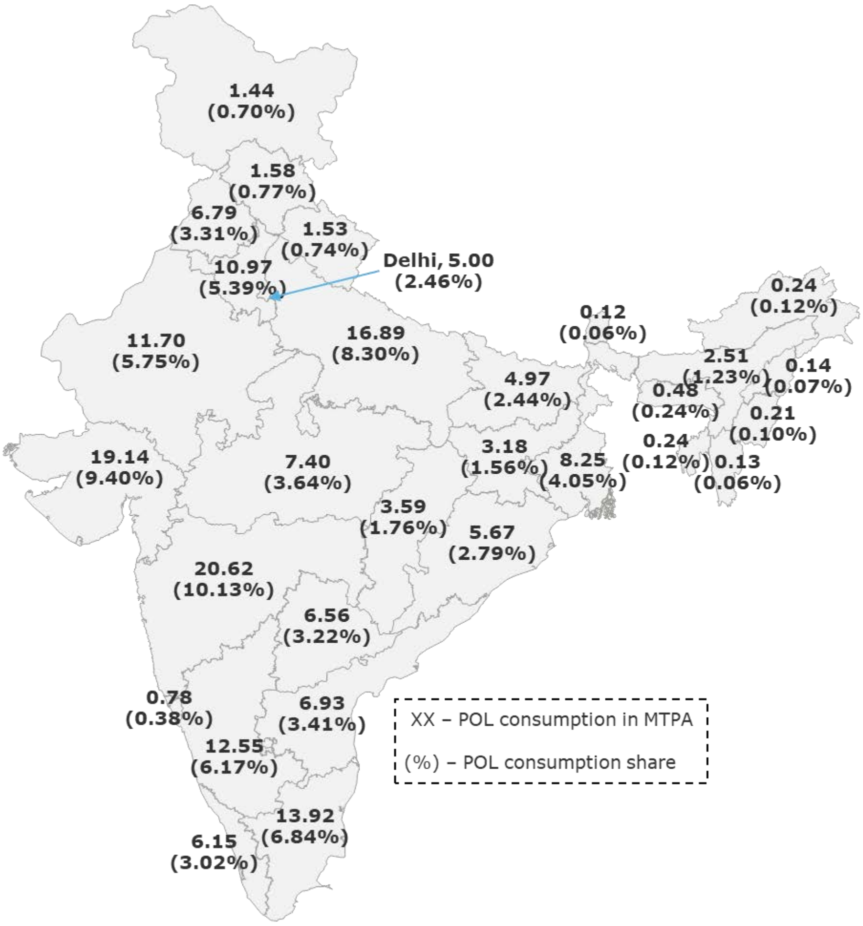


Source: Annual Report (FY 2018), Ministry of Petroleum and

Uttar Pradesh & Haryana in North together constituted 52 percent of total consumption.

The state-wise consumption of petroleum products and their corresponding shares are presented in figure below.

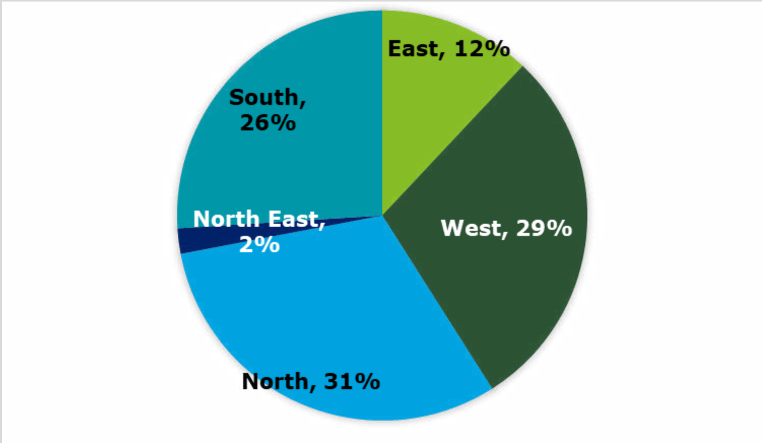
Figure 5-101. State wise petroleum products' consumption in FY 2018



Source: Annual Report (FY 2018), Ministry of Petroleum and Natural Gas

The regional sales of petroleum products also indicate the similar pattern with western and northern region constituting 60 percent of the total sales in the country.

Figure 5-102. Region-wise consumption share of POL in India



Source: Annual Industry Sales, Petroleum Planning & Analysis Cell

5.11.5.2. Projections of potential transport demand

POL industry has witnessed continuous growth with production increasing at a CAGR of about ~3 percent since 2011. This mainly caters to the demand from industries such as Transport and Agriculture, Power Generation, Chemical and Allied sectors among others.

POL production growth was projected based on real GDP growth and corresponding correlation and elasticity were also assessed. The study team also gathered feedback from stakeholder consultations to validate these projections.

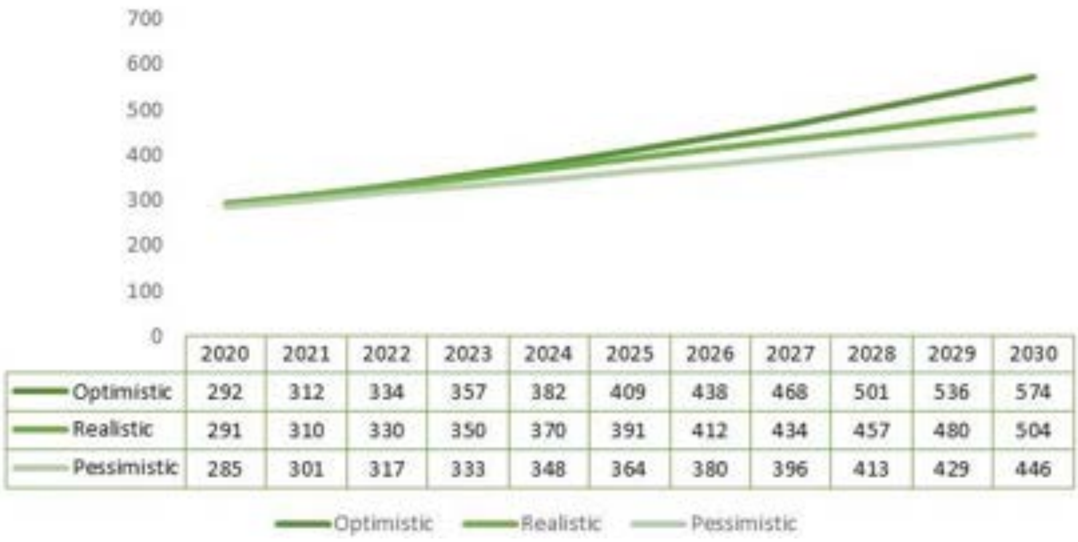
POL Projections: Key Assumptions, Inputs and Data Sources

- Macro-Economic Indicators evaluated: Real GDP
- Preferred Indicator: Real GDP
- Estimated elasticity coefficient for POL was 1.13 against Real GDP
- OECD GDP growth Projections[56] were adopted for assessing future Real GDP growth

[56] Organisation for Economic Co-operation and Development (OECD). Real GDP forecast (indicator). doi: 10.1787/1f84150b-en. https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September 2019

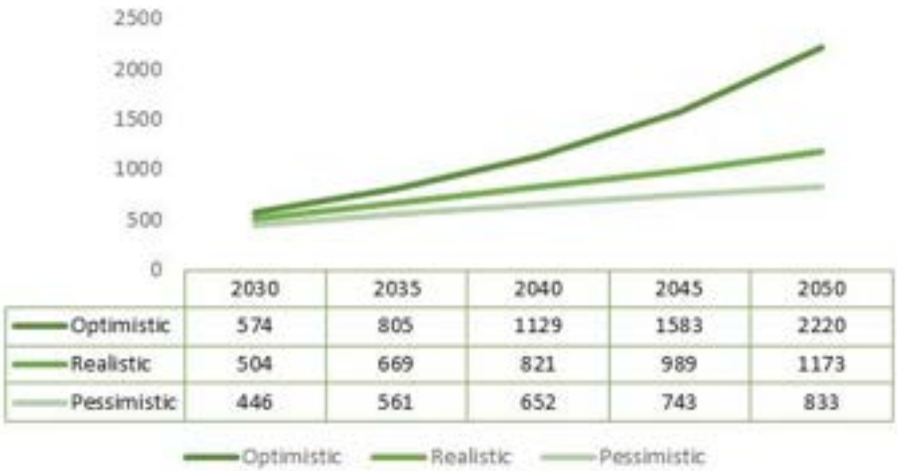
The volume Projections for POL thus generated are presented below:

Figure 5-103. POL Projections (in MT) under different scenarios (2020-2030)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	292	312	334	357	382	409	438	468	501	536	574
Realistic	291	310	330	350	370	391	412	434	457	480	504
Pessimistic	285	301	317	333	348	364	380	396	413	429	446

Figure 5-104. POL Projections (in MT) under different scenarios (2030-2050)



	2030	2035	2040	2045	2050
Optimistic	574	805	1129	1583	2220
Realistic	504	669	821	989	1173
Pessimistic	446	561	652	743	833

- **POL Origination Allocation:** Study team mapped the existing POL traffic from various importing ports and all refineries with respective capacities. Refinery utilization levels and expansion plans[57] were also referenced. These port wise imports and refinery wise production/expansion trends were assumed to prevail in future.

POL Destination Allocation: Base year destination patterns were estimated through primary road surveys, pipeline throughput data[58] and Rail FOIS data. This base year domestic demand pattern was extrapolated as per district-wise population growth rates to estimate corresponding consumption

[57] Ministry of Petroleum and Natural Gas. 2018. CHT Bulletin. Govt. of India, Delhi
[58] ndian Petroleum & Natural Gas Statistics, Ministry of Petroleum and Natural Gas. (2018). Govt. of India. Delhi

requirement/district wise consumption for POL. For exports, the current pattern was assumed to grow linearly in future subject to availability after meeting domestic demand.

The allocated production and attraction centres for foodgrains in 2030 are presented below:

Figure5-105. POL attraction centres (2030)

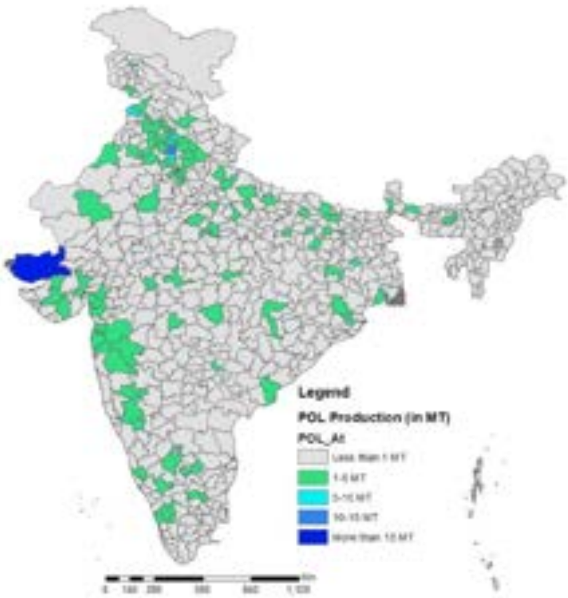
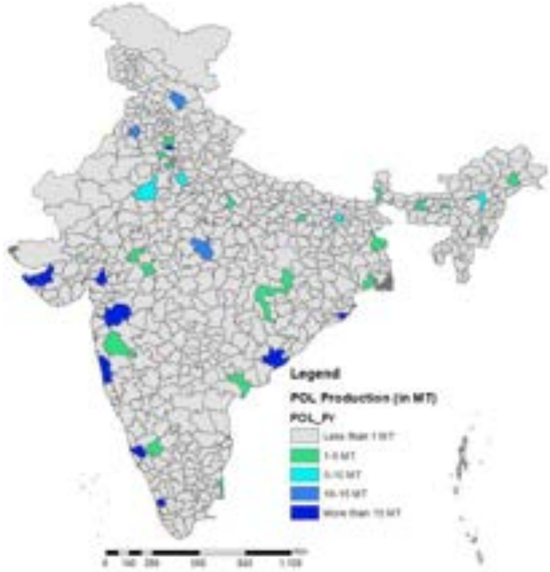


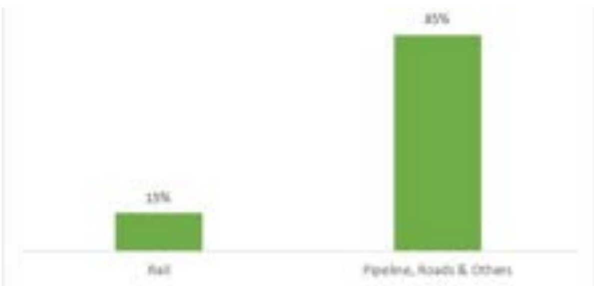
Figure5-106. POL production centres (2030)



5.11.5.3. Extant rail modal share and logistics competitiveness

Indian Railways Modal Share: Of the total petroleum products available for transportation in the country, rail's contribution to the industry has been ~15 percent59 during FY 2018. This included the production and import of petroleum products that amounted to a total of ~290 MT. The sector accounts for only 3-4 percent of total rail freight transportation, which further indicates strong reliance on other modes of transportation.

Figure5-107. Modal share of petroleum



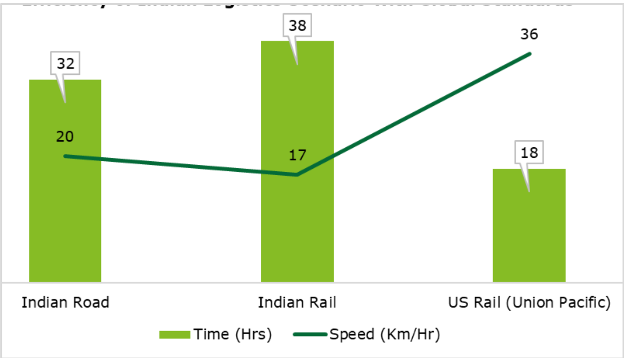
Source: CRIS Data, Consultant Analysis

In fact, pipelines dominate the movement of petroleum products in India in addition to the movement of crude oil. The major pipelines for the movement of petroleum products are spread for more than 16,000 km, with a total throughput of 106 MT in FY 2018, and a modal share of ~31 percent. Road movement typically involves movement from depots to retail outlets, mainly to serve the end customers with an average lead of 300-350 km. Whereas, average lead for rail transportation is ranges between 600-700 km.

[59] Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

Indian Railways Cost and Time Competitiveness: Based on industry reports, it is further understood that the primary reason for this low modal share is cost competitiveness of pipelines as compared to rail and road. While pipelines dominate the sector and can potentially further increase its modal share, rail is considered to be cheaper than road. The latter is especially true for the cases where pipelines are not being used for transportation. In fact, rail costs an average of INR 1.7 per NTKM whereas road costs around INR 3.11 per MTKM. Road movement for POL is preferred for a distance less than 400 km and in the areas where rail connectivity is poor. Furthermore, while rail movement is primarily between refineries and consumption depot points, road movement is only used for the last leg of the transport i.e. between depots and retail outlets.

Figure 5-108. Time comparison for POL movement



Source: Consultant Analysis

However, India lags its US peers when compared in terms of transit time for transportation of the commodity across the two modes.

5.11.6. Steel

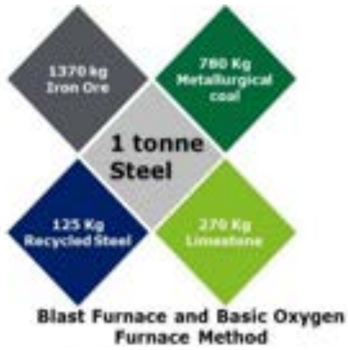
5.11.6.1. Current commodity landscape

5.11.6.1.1.*Production*

Steel sector constituted movement of 54.36[60] MT (MT) by rail during FY 2018 which accounted for ~5% of total freight traffic moved by rail. In fact, the sector contributed 7.2%[61] of the IR's freight revenues.

The commodity's value chain is illustrated in Figure 5-109below. The sector's value chain demands high capacity on traced paths making rail the natural choice especially for inbound logistics. Typically, production of one ton of steel requires about three times or 2.5x volume of raw material. Hence, production of each ton of steel generates a total of 3.5x volume of freight to be transported within the industrial ecosystem.

Figure 5-109. Value Chain Assessment



Source: World Steel Association

In FY 2018, India produced approximately 103 MT of crude steel dislodging Japan to become the second largest steel producer in the world. Six key players hold around 54% of the country's total production capacity and contribute approximately 60% of the actual production[62]. Accordingly, of the total crude steel produced in FY 2018, the combined production of top players, including Steel Authority of India Limited (SAIL), Rastriya Ispat Nigam Limited (RINL), TATA Steel, Essar, JSW Steel Limited, and Jindal Steel & Power Limited (JSPL), was 59.39 MT, while the balance was produced by other smaller players in the country. Public sector plants including SAIL and RINL contributed only approximately 19%

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[60] Ministry of Railways (Railway Board). (2019). Indian Railways Annual Report & Accounts, 2018-19. Government of India, New Delhi. https://indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/Year_Book/Indianpercent20Railwayspercent20Annualpercent20Reportpercent20percent26percent20Accountspercent20Englishpercent202018-19.pdf

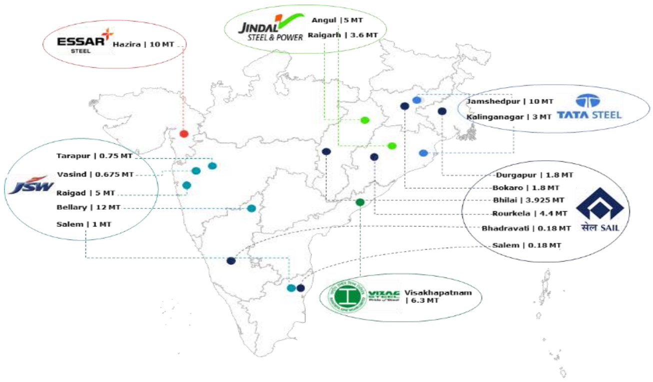
[61] Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

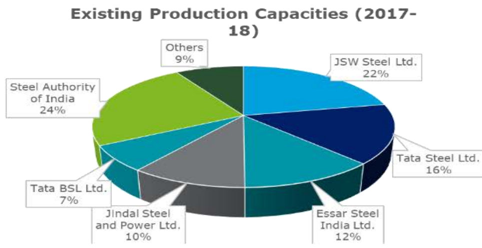
[62] Joint Plant Committee, Ministry of Steel. (2018). Annual Statistics 2017-18. Government of India, New Delhi

of the total crude steel production, while private sector players accounted for 81% of the production.

As against the crude steel production, total finished steel stood at 134.33 MT, comprising domestic production of 126.85 MT and additional imported volume of 7.48 MT[63].

Figure 5-110. Production and Reserve Capacities of Steel of major players

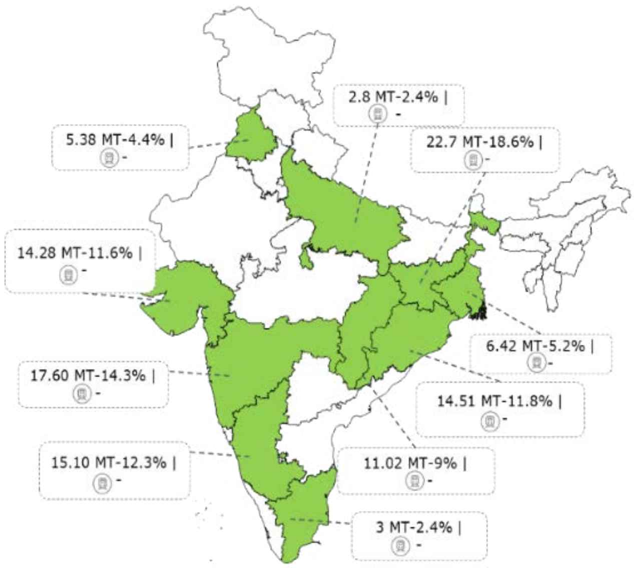




Source: Consultant Analysis, Annual Statistics 2017-18, Joint Plant Committee, Ministry of Steel

Steel plants (production centres) are largely concentrated in the vicinity of iron ore mining clusters. States like Jharkhand, Orissa, Maharashtra and Karnataka are the major steel-producing states responsible for 55% of steel dispatches for domestic consumption and exports.

Figure 5-111. Finished Steel Production, 2017-18



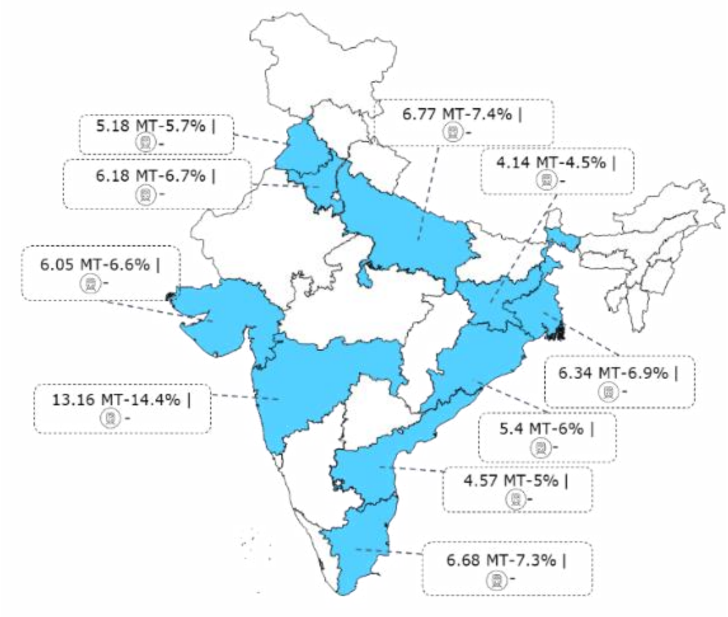
Source: Annual Statistics 2017-18, Joint Plant Committee, Ministry of Steel

[63] For the purpose of this study and assessing rail freight transportation, crude steel production and imports have been taken into consideration

5.11.6.1.2.*Consumption*

In FY 2018, total finished steel consumption stood at 90.7 MT[64], which is 67 Kg per capita against a world average of 215 Kg per capita. Maharashtra is the largest steel consuming state in the country, followed by other states like Uttar Pradesh, Tamil Nadu, West Bengal, Haryana, and Gujarat (refer Figure below).

Figure 5-112. Finished Steel Consumption, 2017-18



Source: Indian Minerals Yearbook, Indian Bureau of Mines (FY 2018)

5.11.6.2. Projections of potential transport demand

The steel sector has been on a consistent growth path, registering a CAGR of 6% between FY 2014 and FY 2018. The key consuming sectors were machinery (consuming 43% of total volumes), construction and infrastructure (40%), automobiles (3%), power (4%), and railways (2%), collectively accounting for 92% of total steel consumption in India[65].

The demand for steel was projected with reference to various macro-economic factors like real Gross Domestic Product (GDP), Iron & Steel Price Index, Coke Price Index among others, and corresponding correlations and elasticities were assessed. Further, the growth plans of each of the above listed steel consuming sectors were analysed to compare and calibrate the above projected volumes against potential steel requirements throughout the projection horizon. These projections were then compared with estimates provided in the National Steel Policy 2017 and other relevant policy documents of Government of India for final validation.

[64] Joint Plant Committee, Ministry of Steel. (2018). Annual Statistics 2017-18. Government of India, New Delhi

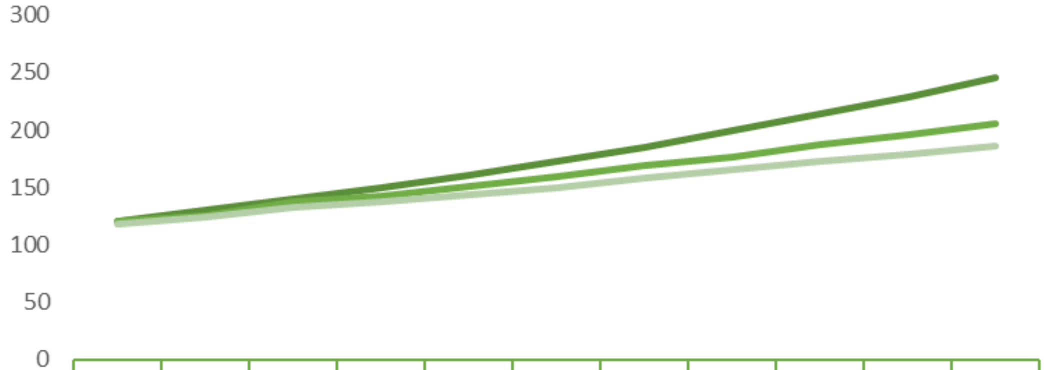
[65] Ministry of Steel. (2017). National Steel Policy, 2017. Government of India, New Delhi

Steel and Iron Ore Projections: Key Assumptions, Inputs and Data Sources

- Macro-economic indicators evaluated: Real GDP, Iron & Steel Index, Coke Price Index, Population growth
- Preferred indicators: Real GDP, Iron & Steel Price Index, Coke Price Index
- Estimated elasticity coefficient for Steel was 0.92 against Real GDP, -0.1 against Iron & Steel Price Index and 2.9 against Coke Price Index
- OECD projections of GDP growth[66] were adopted for assessing future Real GDP growth
- Iron & Steel Price Index as well as Coke Price Index were sourced from data issued by the Office of Economic Advisor, Ministry of Commerce and Industry, Government of India In the absence of industry forecasts, the historical growth pattern was assumed to continue in future, thereby resulting in a CAGR of 2% for Iron & Steel Price Index and 1% for Coke Price Index.

The projected volumes for steel are presented below:

Figure 5-113. Steel projections (in MT) under different scenarios (2020-2030)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	121	130	140	150	161	173	185	199	214	229	246
Realistic	120	126	137	143	151	159	169	177	187	196	205
Pessimistic	118	124	133	137	144	150	158	165	173	179	186

Optimistic Realistic Pessimistic

[66] Organisation for Economic Co-operation and Development (OECD). Real GDP forecast (indicator). doi: 10.1787/1f84150b-en. https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September 2019

Figure.114-5. **Steel projections (in MT) under different scenarios (2030-2050)**

	2030	2035	2040	2045	2050
Optimistic	246	342	459	598	761
Realistic	205	256	312	373	439
Pessimistic	186	222	258	294	330

- **Potential Origination Pattern:** As noted earlier, around 60% of India's steel production is generated by top six players through approximately 20 steel plants. The rest 40% production is highly fragmented and is contributed by other medium and small-scale players spread across the country. For identification of potential origin-wise steel production over the projection period, reference was made to district-level steel dispatch figures and expansion plans[67] of major players. Further, for identifying the remaining origin-wise steel production for the remaining smaller players, it was assumed that the current dispatch or production pattern shall grow linearly to meet the residual production projections over the horizon period

- **Potential Destination Pattern:** The starting point for ascertaining future destination patterns was assessment of the base year steel consumption pattern, estimated through primary road surveys and rail FOIS data. The analysis assumes that regional demand for steel is directly driven by industrial activity (represented by state domestic product or SDP indicators) along with infrastructure construction and housing market (which are further dependent on population growth). Accordingly, the base year steel demand was extrapolated vis-à-vis district-wise projected population and SDP growth to arrive at the zone-wise future consumption demand for various destinations over the projection period.

[67] Joint Plant Committee, Ministry of Steel. (2018). Annual Statistics 2017-18. Government of India, New Delhi; websites and annual reports of various players

The allocated production and attraction centres for steel in 2030 are presented below:

Figure 5-115. Steel production centres (2030)

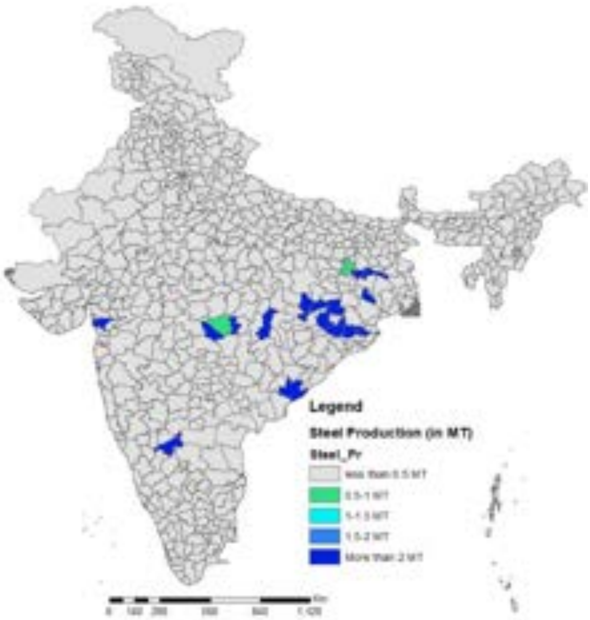
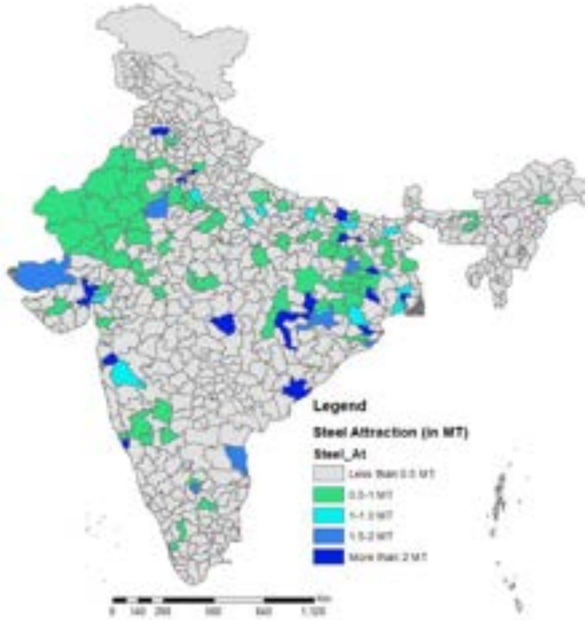


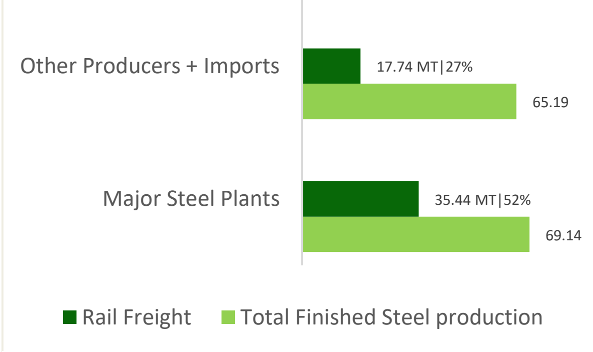
Figure 5-116. Steel attraction centres (2030)



5.11.6.3. Extant rail modal share and logistics competitiveness

In FY 2018, IR moved 54.36 MT over an average distance of 800+ km, thereby taking the modal share of rail to approximately ~49%[68] considering 103.13 MT production of crude steel in the Indian ecosystem and 7.48 MT of imports. In fact, rail modal share is significantly higher in the case of with public sector players such as SAIL (85%) and RINL (70%)[69] for transportation of finished steel to various consumption centers. Meanwhile, among private sector players, Tata Steel

Figure 5-117. Rail usage by Industry Segment



Sources: Joint Plant Committee, Annual Statistics 2017-18

[68] Ministry of Railways (Railway Board). (2019). Indian Railways Annual Report & Accounts, 2018-19. Government of India, New Delhi. https://indianrailways.gov.in/railwayboard/uploads/directorate/stat_econ/Year_Book/Indianpercent20Railwayspercent20Annualpercent20Reportpercent20percent26percent20Accountspercent20Englishpercent202018-19.pdf; Joint Plant Committee, Ministry of Steel. (2018). Annual Statistics 2017-18. Government of India, New Delhi

[69] Joint Plant Committee, Ministry of Steel. (2018). Annual Statistics 2017-18. Government of India, New Delhi; Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

and JSW Steel have emerged as the largest rail users, with 60% and 40% rail modal share respectively.

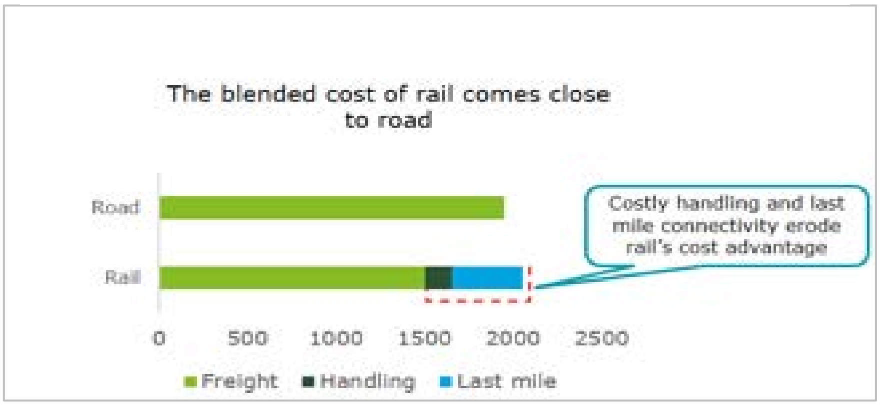
5.11.6.4. Logistics Competitiveness

Traditionally, while rail has been the preferred mode for transportation of bulk iron ore, road transportation has been able to capture significant volumes of finished products such as steel, even in cases where leads exceed 500 Km owing to factors such as costly handling and additional last mile costs associated with rail transportation as well as competitive freights offered by road transportation service providers.

Assessment of the logistics value chain of RINL, which produced 5 MT of finished steel products during FY 2019, indicated that the total freight cost via rail worked out to be higher than road for key routes even when the leads travelled exceeded 1000 km.

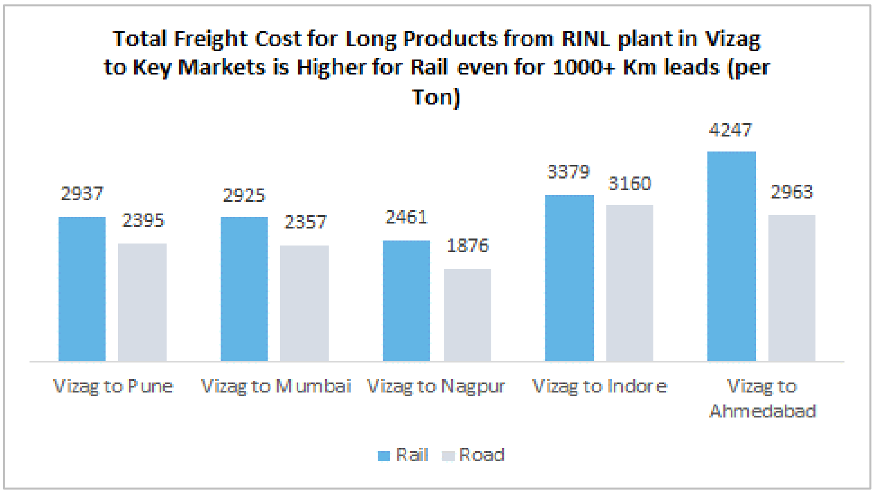
Figure 5-118. Rail vs Road Assessment

For average rail leads of 900 Km, rail is costlier than road



Source: Stakeholder Interactions, Consultant Analysis

Figure 5-119. Rail vs Road Assessment: RINL



Source: Rashtriya Ispat Nigam Limited, RINL

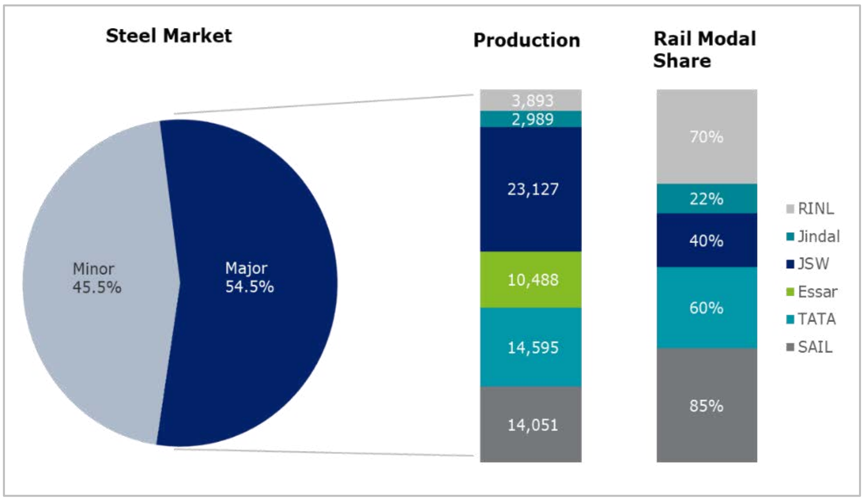
5.11.6.5. Strategies for Increasing Rail Share

The modal share of 49% signifies a high affinity of steel for rail movement. As per production projections conducted under this study, steel sector is expected to contribute more than 200 MT of cargo to the total freight ecosystem in 2030. At its current modal share, this would lead to a doubling of steel volumes on rail, and if this modal share is enhanced, the volume of steel on rail can grow even further.

The sector is broadly structured into two segments based on scale of operations of its players. Around 54.5% of the total finished steel production is controlled by six dominant integrated steel players, while the balance 45.5% is contributed by medium/small scale players[70].

In terms of transportation needs, major players are typically able to generate full rake loads of cargo towards identified distribution hubs on a regular basis. However, small scale players often generate less than rake load volumes for single destinations compounded by only sporadic movements toward such destinations.

Figure 5-120. Steel market captured by minor vs major players, FY 2018 (production in '000 tonnes)



Source: Joint Plant Committee, Ministry of Steel

Consequently, the larger players together contributed significantly to transportation of pig iron and finished steel on rail, accounting for 95% of the total steel volumes transported by rail during FY 2018[71].

Further, even among the larger players, public sector players have higher reliance on rail transportation, while private players like JSPL, JSW Steel, and Essar operate at less than 50% rail modal share.

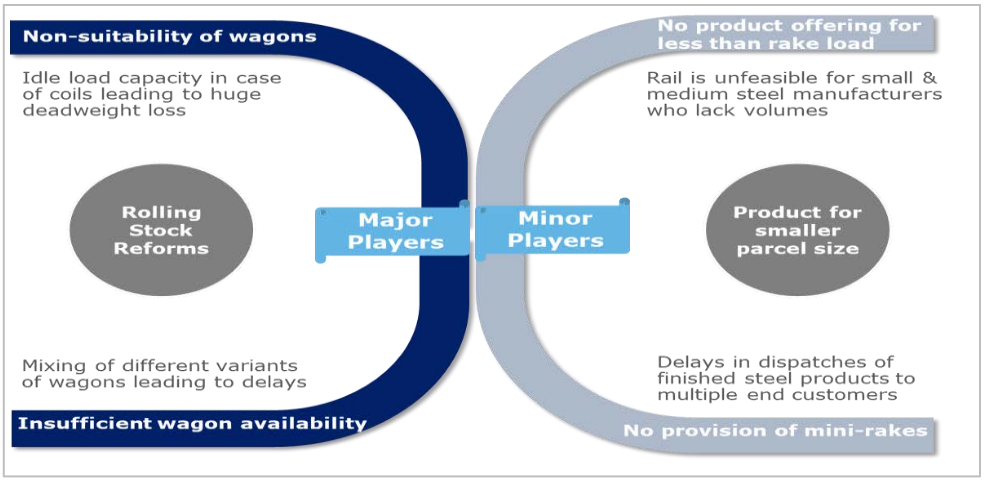
Through extensive stakeholder interactions with players across the sector, it is understood that the sector requires separate strategies to address the specific problems faced in the two segments of players. While large players predominantly

[70] Joint Plant Committee, Ministry of Steel. (2018). Annual Statistics 2017-18. Government of India, New Delhi

[71] Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

experience inadequate availability and suitability of rolling stock, as well as constrained track capacity for movement of large volumes, medium and small-scale players do not find suitable product offerings for transportation of smaller

Figure 5-121 Issues faced by major and minor steel players



and sometimes disaggregated volumes through rail, as depicted in figure below.

5.11.6.5.1.*Strategies to be adopted by IR for Major Players*

In the steel sector, suitability and efficiency of wagon type varies with the product type being transported. While dead weight loss for Flats and Longs is limited (approximately 2%) for rail transportation, coils witness a considerable dead weight loss (approximately 15%)[72] on account of some design inefficiency of existing IR wagons such as BFNS and BFNSM1. Coil production dominates the large-scale market segment of steel producers, and alone comprised 45% share of total production of finished steel products during FY 2018[73]. One of the potential solutions to address the problem of deadweight could therefore emerge from the induction of wagons with improved design.

[72] Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi; Consultant Analysis

[73] Joint Plant Committee, Ministry of Steel. (2018). Annual Statistics 2017-18. Government of India, New Delhi

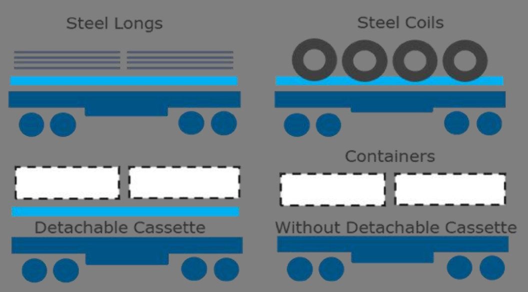
Box 7. Wagon design efficiency: Existing IR designs vs other designs

	Wagon	Coil Weight	20 MT	25MT	30MT	20&25	25&30	20&30
Existing IR designs	BFNS (64.89)	**Dead weight loss (%)**	**8%**	**23%**	**8%**	**31%**	**15%**	**23%**
	BFNSM1 (69.6)	**Dead weight loss (%)**	**14%**	**28%**	**14%**	**7%**	**21%**	**28%**
New design by IR and JRIL	22.9 New Versa (66.8)	Number of coils loaded	3	2	2	20: 1 25: 1	25: 1 30: 1	20: 1 30: 1
		Tonnage (58 wagons)	3480	2900	3480	2610	3190	2900
		Dead weight loss (%)	**10%**	**25%**	**10%**	**33%**	**18%**	**25%**
	25 New Versa (75.2)	Number of coils loaded	3	3	2	20: 1 25: 2	25: 1 30: 1	20: 2 30: 1
		Tonnage (58 wagons)	3480	2900	3480	2610	3190	2900
		Dead weight loss (%)	**20%**	**0%**	**20%**	**7%**	**27%**	**7%**
BNSF wagon for coil (USA)	Covered Railcar (110)	Number of coils loaded	5	4	3	20: 1 25: 3	25: 2 30: 2	20: 1 30: 3
		Dead weight loss (%)	**9%**	**9%**	**18%**	**14%**	**0%**	**0%**

Need for better design elements to be incorporated in steel wagon designs:

Detachable frames facilitate deployment of same wagon on to-and-fro direction by enabling transportation of both steel coils and longs

Possible Design Modifications



Current IR Design

BFNS Wagon

Country:	Commodity:	Proposed Design:	Design benefit:
Europe	All Bulk commodities	Detachable frames (cassettes) provide flexibility & versatility to transport different bulk commodities. For instance, this wagon can be used to transport both coils and flats (steel)	Increased wagon load capacity & utilisation

As exhibited above, such modular design elements if introduced in steel wagon design development will enable multi-product and multi-commodity movement on steel wagons, which is likely to encourage private sector investment in wagon design.

Besides improving specific design for steel carrying wagons, some of the other strategies to address the problem of asset availability could be to introduce improvements in wagon procurement policy (please refer to section on wagon policy in Financing Strategy Chapter), as well as devise mechanisms for improving and optimising rake supply for the existing wagon fleet

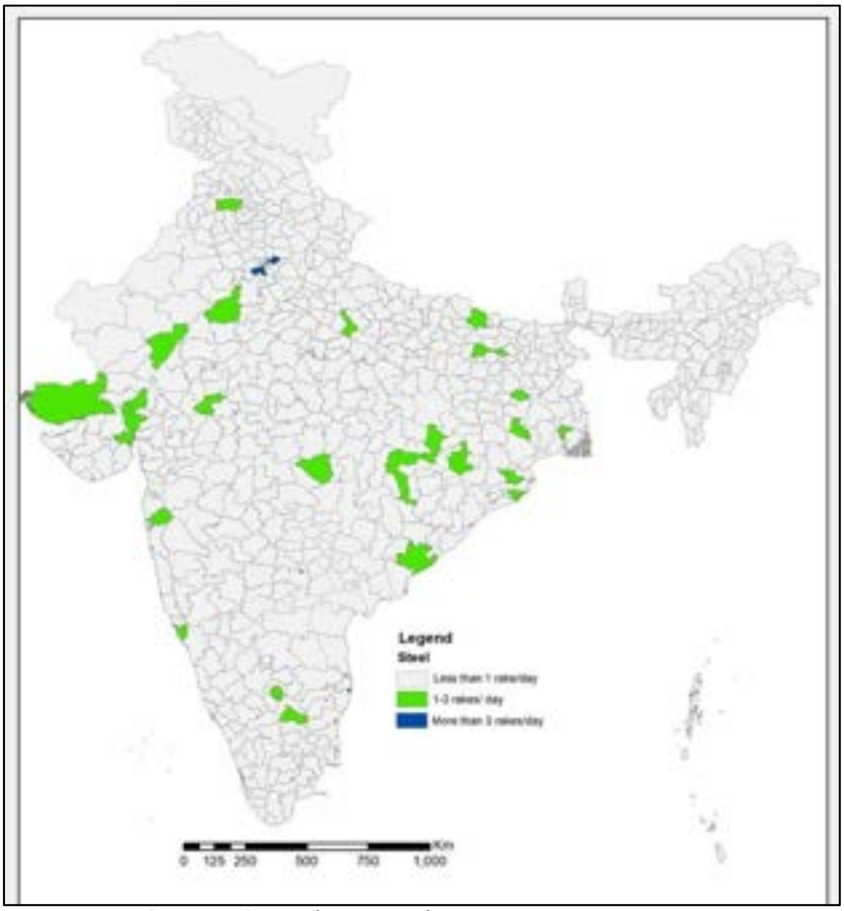
Terminals at steel consumption clusters

In case of large-scale players, rake formation and handling (loading/unloading) of the originating cargo typically takes place at the rail siding of the steel plant. However, at the destinations/consumption centers, these rakes are mostly handled in good sheds which are often basic facilities lacking suitable handling equipment and yard area for handling/storing steel products and are also characterized by high detention times due to peak hour congestion and evacuation issues.

In the absence of efficient handling operations at such terminals, rake turnarounds get severely impacted, further leading to reduction in wagon availability as well as constrained corridor capacity. There is, therefore, a critical need for development of dedicated terminals for handling steel products at major consumption centers.

A list of potential terminal locations has been identified based on projected district-level steel consumption volumes, and potential originating volumes for 2031 while removing expected plants with private sidings and overlaps with consumption-based terminals. The list is presented below:

Figure 5-122. Terminal location for handling steel



Source: Consultant Analysis

Table 5-6. Terminal locations for handling steel

S.No.	Districts	Projected Rail Traffic, 2031 (MTs)
1.	Ludhiana	2.1
2.	Ghaziabad/ Gurgaon/ Delhi	7.8
3.	Jaipur	1.5
4.	Pali	2.4
5.	Kachchh	1.5
6.	Mehsana/Ahmedabad	4.2
7.	Thane	2.4
8.	Ratlam	1.9
9.	Nagpur	2.3
10.	Kanpur Nagar	1.0
11.	Purba Champaran/ Patna	2.7
12.	Dhanbad/ Purbi Singhbhum/ Howrah	4.6
13.	Jajpur/ Jagatsinghpur	2.1
14.	Raigarh/Sambalpur/ Raipur	4.7
15.	Vishakhapatnam	1.5
16.	Hyderabad	2.7
17.	Chennai	4.4
18.	Bangalore/ Dharmapuri	3.5
19.	South Goa	1.7
20.	Kamrup Metropolitan	4.4

Interventions to be undertaken by IR

For development of terminals at identified locations, IR will need to facilitate the process for attracting investments. This can be done by incentivizing private participation for development of these terminals through suitable PPP models (Please refer to section on terminal policy in financing strategies **Chapter 21**)

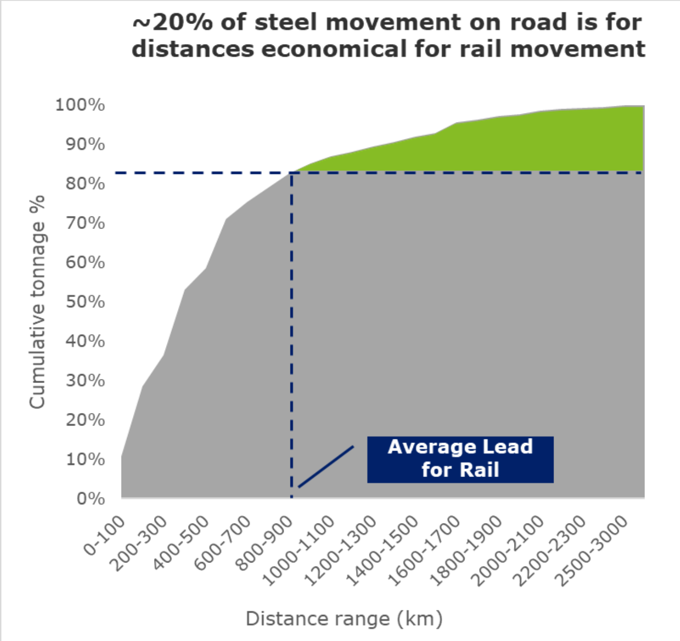
Key facilities that would be part of the design and development of such terminals would include:

1. Dedicated rail lines for coil handling with EOT cranes
2. Steel storage yards with covered sheds fitted with EOT cranes
3. Value added facilities for cutting and re-packing smaller delivery consignments

5.11.6.5.2.*Product designs for smaller parcel sizes*

Railways has traditionally been a carrier of full rake loads of steel and inherently, has only catered to the segment with larger players. Consequently, the other segment of the market in the form of medium and smaller players, which together contribute 45.5% of the total steel market, remains untapped. This untapped segment, however, has different logistics requirements as it is characterised by a fragmented market, with smaller parcel sizes contributed by larger number of players. Further, the segment also caters to scattered consumption centers with multi-destination delivery/complex distribution networks.

Figure 5-123. Cumulative tonnage of steel over distance ranges



Source: Primary road surveys, Consultant analysis

This market segment has tended to choose road transportation over rail as a preferred mode in the past due to the inherent flexibility offered by the former in terms of parcel size and ease of first and last mile multi-point delivery.

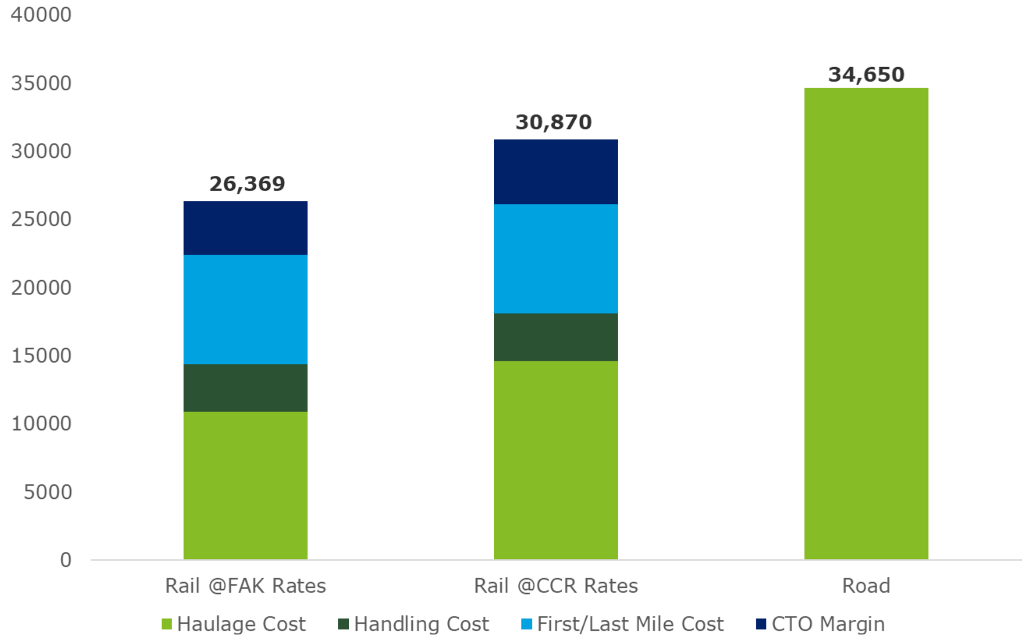
Within this segment, however, an addressable market can be carved out by leveraging the inherent cost advantage of rail over longer distances. As shown in **Error! Reference source not found.**, of the total movement of steel on road, about 20% of the share is beyond the existing average leads for rail. As the economics for these leads are likely to be favourable for rail, IR would need to enable an ecosystem through suitable product designs that could be used to cater to the needs of this segment and capture traffic.

For a fragmented market, consolidation of cargo becomes a key initiative.

Containerization for enabling consolidation

Medium and small-scale steel players typically manufacture steel products which are smaller in size and lighter in weight when compared to the larger integrated players. Given the product design, parcel size, and distribution needs, containerization of steel can be effectively used for consolidating and attracting this cargo on rail.

Figure 5-124. Cost comparison for moving steel (18T) over 500 km)



Source: Stakeholder Consultations, Consultant analysis

Currently, IR effectively discourages containerization of notified commodities (including iron and steel) by mandating a higher container class rate[74] payable by CTOs/customers for any rake with more than 50 containers of notified commodities[75]. This higher rate nullifies rail's cost advantage over road transportation (see Figure above) consequently, leading to loss of market share to road. It would be pertinent for IR to recognize that while some degree of overlap between conventional and containerized cargo will remain in commodities like steel, removing the Container Class (CC) rate for steel will go a long way in attracting higher traffic of steel on rail in containers. In addition, easing restrictions on handling of containers at goods terminals (as also mentioned in the section on modal shift for containers) will also encourage containerised movement of steel on rail.

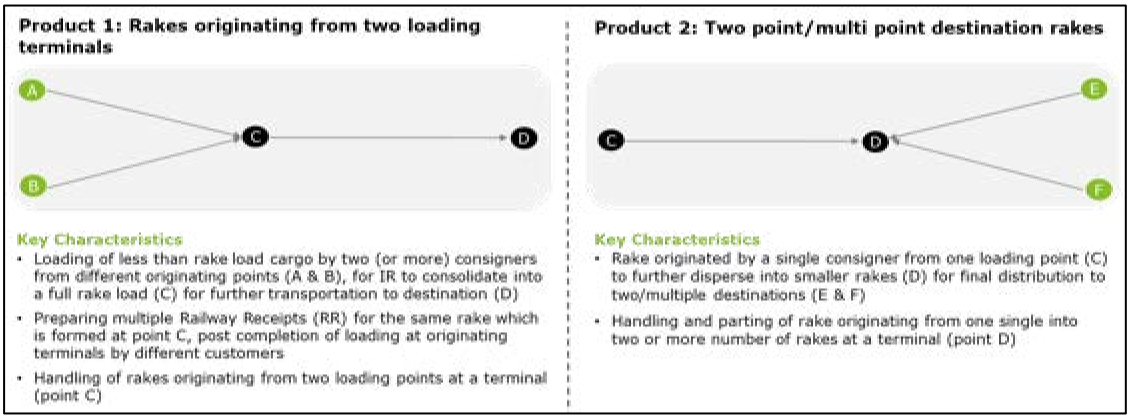
[74] Calculated as 20 percent discount (only for steel coils) over applicable class rates for that commodity as published in good tariff. However, this 20percent savings get nullified once CTO's margin is levied

[75] Ministry of Railways. (multiple years). IR's Rates Master circular /CRT –CCR –Hub & Spoke/2015/0, Chapter 2, clause 1.2 and subsequent amendments. Government of India. Delhi

Providing mini-rakes and multi-point rakes to complement containers

Often, even in cases where parcel size is small, rail remains the preferred mode for steel movement due to other factors like suitability of wagons according to product design, handling of cargo and relatively higher cost of transporting on road. Typically, mini-rake and multi-point destination handling of steel cargo value chains requires consolidation at the first leg and disaggregation at the last leg.

Figure 5-125. Products for mini-rakes and multi point rakes



It is understood from stakeholder interactions that players often require mini-rakes for shorter leads, or multi-point rakes for longer leads where parcel sizes may not always be of standard full rake load.

While two-point loading is currently permitted for steel rakes for over 150 destination pairs, movement of mini rakes and multipoint rakes, and loading from multiple origin points is not permitted. Consequently, majority of this cargo is lost to road transportation.

IR may consider removing restrictions with respect to formation of mini rakes from multiple originating points to enable consolidation of cargo. However, provision of such product would also require provision of adequate terminal infrastructure, details of which have already been provided in the section above.

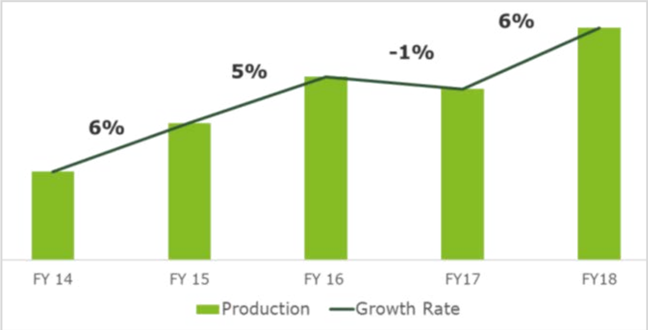
5.11.7. Cement

5.11.7.1. Current commodity landscape

Cement is the second largest revenue generating commodity for the IR, and third largest in terms of volumes (constituting around 10 percent of the total rail freight transportation) with a movement of ~113 MT (MT)[76] during FY 2018.

India is globally the second largest manufacturer of cement after China as production volumes stood at 297.71 MT[77] in FY 2018, registering a CAGR of 4.43 percent since 2011-12. The year-on-year growth rate of production exhibited a significant jump during 2017-18, which could potentially be on account of rising demand for cement for government infrastructure projects and flexible interstate movement of cement due to roll-out of the Goods and Services Tax (GST).

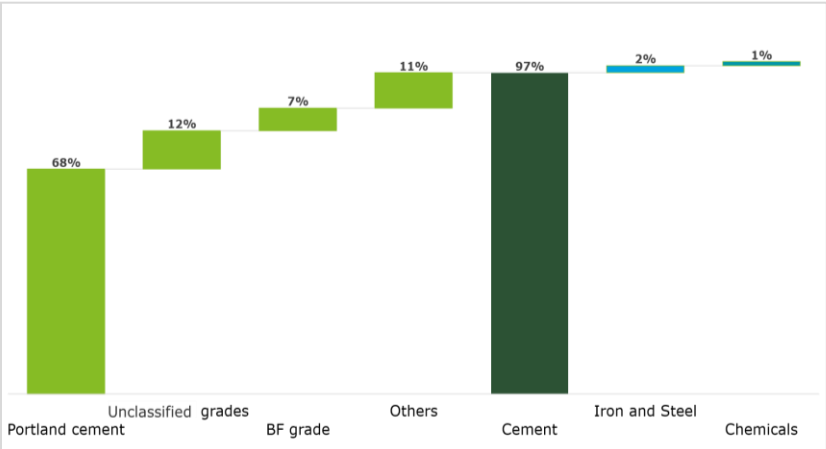
Figure 5-126. Cement production and growth trend



Source: Indian Bureau of Mines, Consultant Analysis

Cement plants are typically, situated close to limestone reserves given their dependence on limestone as a raw material for cement manufacturing. In fact, cement industry is among the principle consumers of limestone, accounting for over 95 percent of total limestone

Figure 5-127. Percentage share of limestone in different grades



Source: Indian Bureau of Mines, Consultant Analysis

[76] Ministry of Railways (Railway Board). (2019). Indian Railways Annual Report & Accounts, 2018-19. Government of India, New Delhi and Consultant analysisa

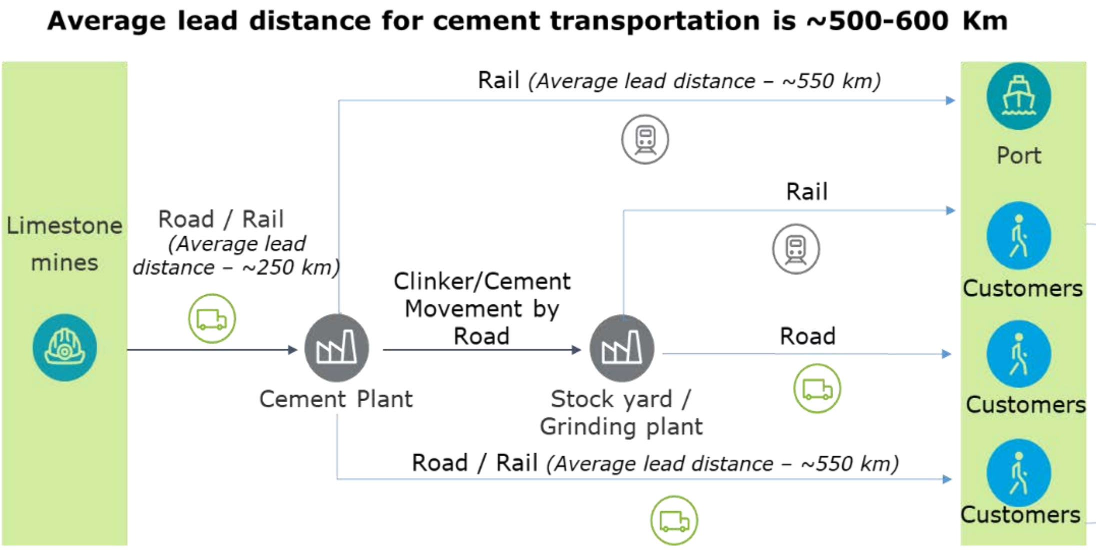
[77] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Cement. Government of India. Nagpur

consumption in India[78]. It has been seen that limestone constituted around ~18 MT of rail movement during FY 2018.

Cement Manufacturers Association of India (CMA) reports that, "Inward movement of input materials such as coal, gypsum, … and outward movement of the finished product to consumption centres builds a huge demand for

Figure128Cement Value Chain Assessment-5

transportation."[79]



In most cases, instead of direct transportation of cement from cement plants to customers/final users, clinker is transported to the grinding plant[80], which is then converted into cement for transportation to final customers. In fact, cement players have actively moved towards industry consolidation and improved their grinding network resulting in average leads being reduced to less than 500 km.

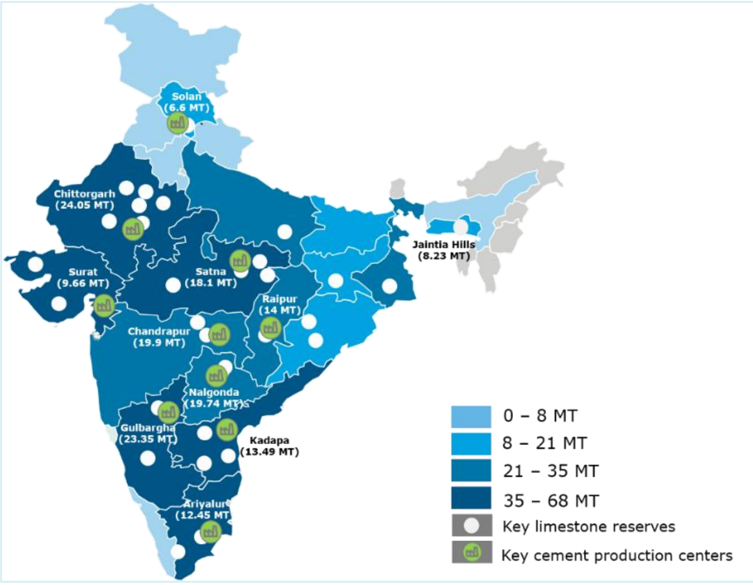
5.11.7.2. Key production centres

The total installed capacity of cement plants in India stood at ~504 MT[81] in FY 2018. Cement is largely produced in western, southern and central parts of the country with majority of the supply centres (about 131 plants) concentrated in Rajasthan, Andhra Pradesh, Karnataka, Tamil Nadu, Gujarat, Madhya Pradesh and Maharashtra.

[78] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Cement. Government of India. Nagpur
[79] Consultations with Cement Manufacturers Association, India
[80] Often situated closer to consumption centres
[81] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Cement. Government of India. Nagpur

Further, these states also account for about 73 percent[82] of the country's limestone production, with Rajasthan accounting for 22 percent, followed by Madhya Pradesh (13 percent), Andhra Pradesh (11 percent), Karnataka (9 percent), Gujarat (7 percent), Tamil Nadu (6 percent) and Maharashtra (4 percent).

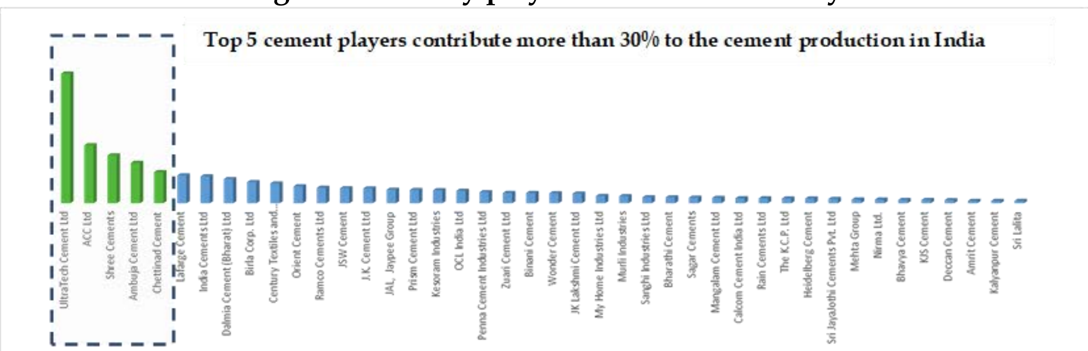
Figure 5-129. Installed capacities, limestone reserves and key production centers



Source: Indian Bureau of Mines, 2018

The industry is characterized by presence of multiple players with the top five players together constituting about 32 percent[83] of the total installed capacity in India having a total of 57 plants located across the country.

Figure 5-130. Key players in cement industry



Source: Indian Bureau of Mines, 2018

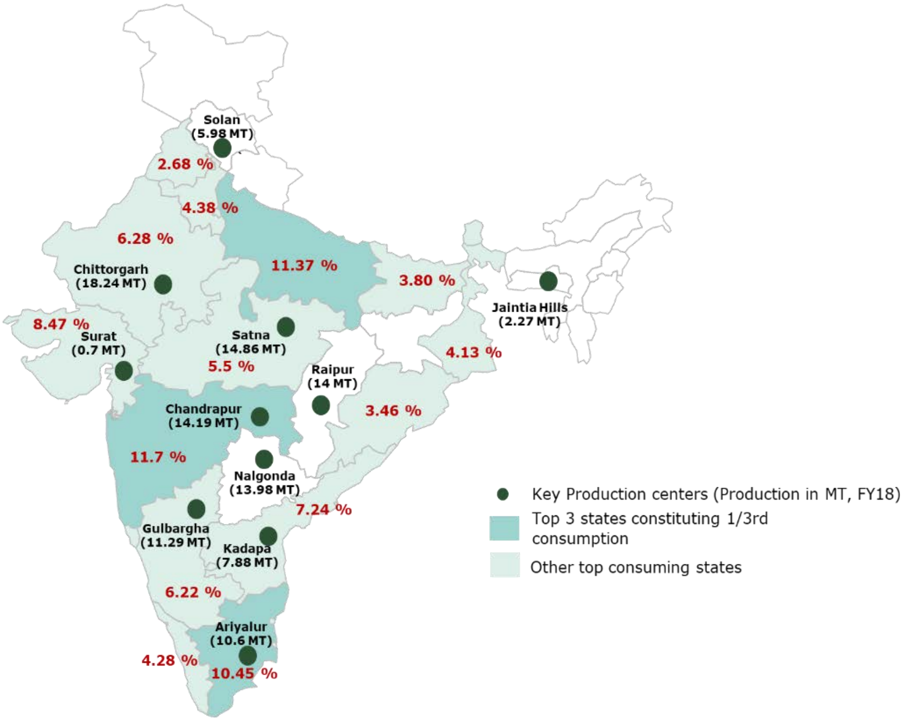
[82] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, limestone & other calcareous materials. Government of India. Nagpur

[83] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Cement. Government of India. Nagpur

5.11.7.2.1.*Consumption patterns*

With 6.66 MT of exports and 2.6 MT of imports of cement during FY 2018, the total volume of cement available for net domestic consumption in the country stood at 293 MT[84], as against the total production of 297.71 MT.

Figure 5-131. State-wise distribution of cement production and consumption

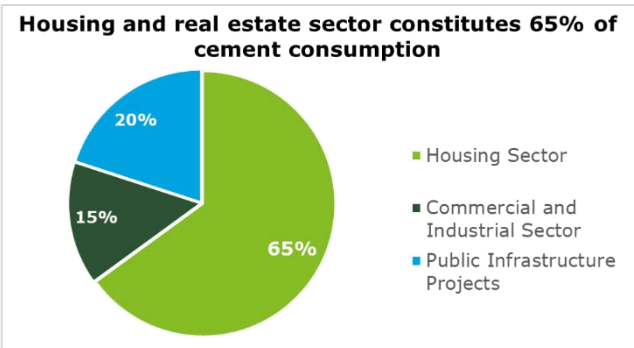


Source: Indian Minerals Yearbook 2018, Indian Bureau . **State-wise distribution of cement production and consumption** of Mines; Cement Manufacturers Association

Note: The figures in percentage are the consumption shares of states in total cement consumption in India during FY 2012

The construction activity across sectors of housing, commercial and public infrastructure is the primary source of demand for cement with housing and real estate sector being the major demand driver, accounting for ~65 percent of the total consumption in India during FY 2018. Herein, it is pertinent to

Figure 5-132. Sector wise cement consumption



Source: Industry consultations

[84] State-wise cement consumption data is only available till FY 2012, as per CMA. As per the judgement of Competition Commission of India (CCI) post 2012, the industry is not allowed to collect and disseminate data on consumption demand for cement in the country.

note that demand for cement by these consuming industries is also complemented with demand for steel as these commodities are simultaneously used for construction and infrastructure projects.

5.11.7.3. Projections of potential transport demand

The demand for cement was projected with reference to various macro-economic factors like real Gross Domestic Product (GDP), Lime and Cement Price Index, and the corresponding correlations and elasticities were assessed.

Growth plans of housing, infrastructure and other industry players along with investments planned by various government agencies in these sectors were analysed to calibrate projected volumes against potential cement requirements throughout the projection horizon. Finally, projected volumes were validated through discussions with Cement Manufacturers' Association and other major industry stakeholders.

With 95 percent of limestone volumes being consumed by the cement industry, demand for limestone was also projected on similar macro-economic factors that were considered for forecasting cement production.

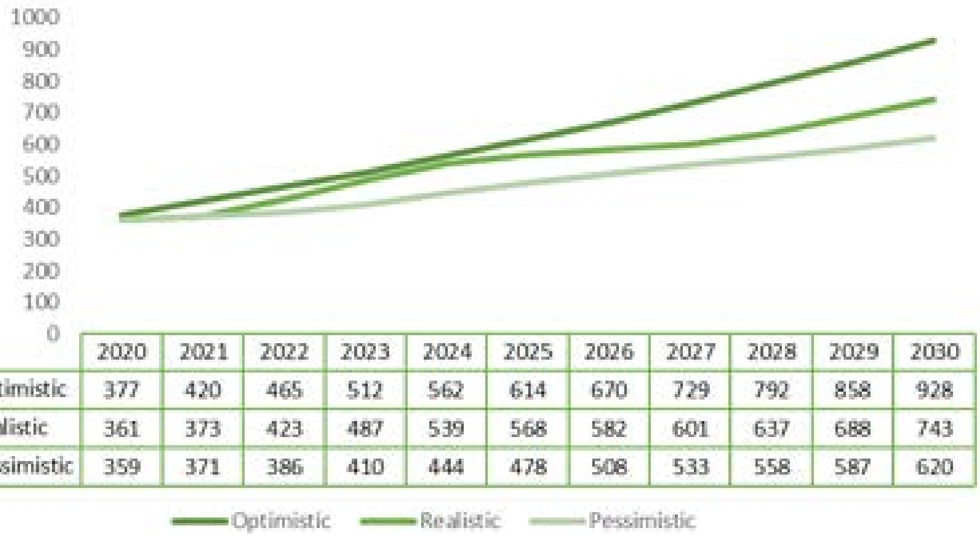
Cement and Limestone Projections: Key Assumptions, Inputs and Data Sources

- Macro-economic indicators evaluated: Real GDP, Lime and Cement Price Index, Population growth
- Preferred indicators:
  - Cement: Real GDP, Lime and Cement Price Index
  - Limestone: Real GDP
- Estimated elasticity coefficient for cement was 1.06 against Real GDP and 1.01 against Lime and Cement Price Index, whereas coefficient for limestone was 0.95 against Real GDP
- OECD projections of GDP growth[85] were adopted for assessing future Real GDP growth
- Cement and Lime Price Index was sourced from data issued by Office of Economic Advisor, Ministry of Commerce and Industry, Government of India in the absence of industry forecasts, historical growth pattern was assumed to continue in future, which resulted in a CAGR of 5.02 percent
- Investment plans for cement consuming sectors were sourced from various perspective plans, and policy and budget announcements made by government departments and public sectors agencies

[85] Organisation for Economic Co-operation and Development (OECD). Real GDP forecast (indicator). doi: 10.1787/1f84150b-en. https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September 2019

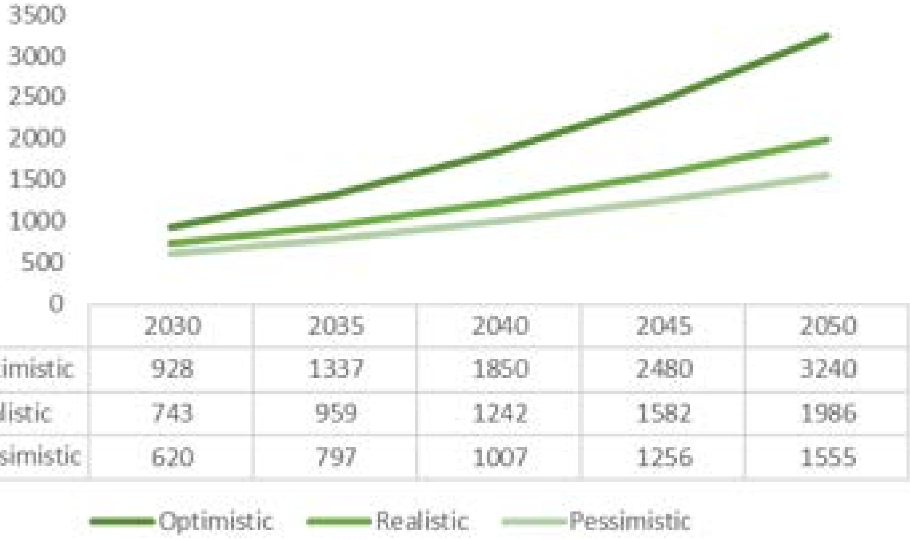
The projected volumes for cement are presented below:

Figure 5-133. Cement projections (in MT) under different scenarios (2020-2030



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	377	420	465	512	562	614	670	729	792	858	928
Realistic	361	373	423	487	539	568	582	601	637	688	743
Pessimistic	359	371	386	410	444	478	508	533	558	587	620

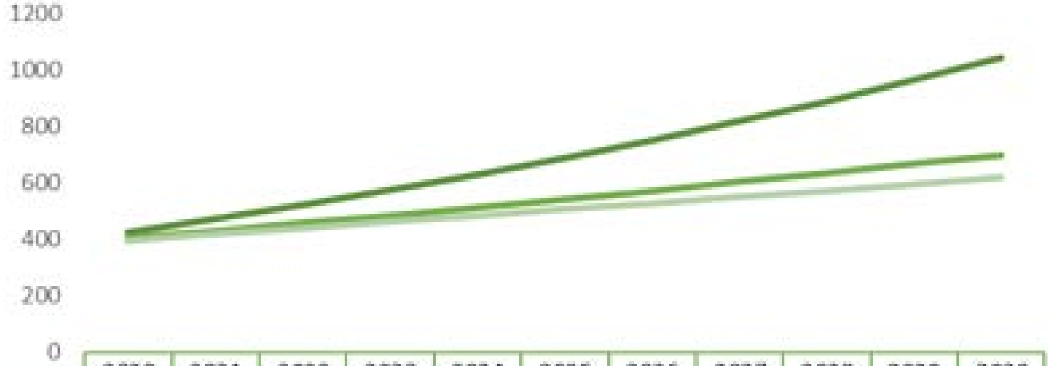
Figure 5-134. Cement projections (in MT) under different scenarios (2030-2050)



	2030	2035	2040	2045	2050
Optimistic	928	1337	1850	2480	3240
Realistic	743	959	1242	1582	1986
Pessimistic	620	797	1007	1256	1555

The projected volumes for limestone are presented below:

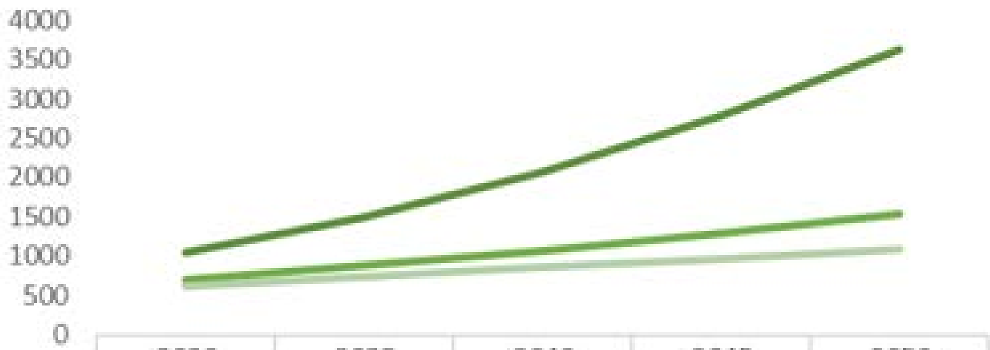
Figure 5-135. Limestone projections (in MT) under different scenarios (2020-2030)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	423	471	521	574	629	689	751	818	888	962	1041
Realistic	403	430	457	485	513	542	571	602	633	666	699
Pessimistic	396	418	439	461	483	505	527	550	572	595	618

Optimistic Realistic Pessimistic

Figure 5-136. Limestone projections (in MT) under different scenarios (2030-2050)



	2030	2035	2040	2045	2050
Optimistic	1041	1499	2074	2780	3632
Realistic	699	878	1077	1298	1538
Pessimistic	618	736	855	974	1093

Optimistic Realistic Pessimistic

- **Cement Origination allocation:** For estimating origin patterns, reference was made to data on plant wise dispatches[86]. Further, future expansion plans of various cement manufacturers including newly proposed cement capacities[87]

[86] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Cement. GovernCent of India. Nagpur
[87] Primary Stakeholder Consultations; Company websites and Annual Reports; Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Cement. Government of India. Nagpur

were assessed to estimate district-wise cement production for various projections period

- **Cement Destination allocation:** For estimating destination-wise consumption patterns, base year (2018) of the cement consumption behavioral pattern was estimated based on primary road surveys and rail FOIS data. Regional cement demand is also directly driven by industrial activity (represented by state domestic product or SDP indicators) as well as infrastructure construction and housing market (which in turn is dependent on population growth). Accordingly, base year demand was extrapolated vis-a-vis district-wise projected population and SDP growth to arrive at the future district-wise consumption demand throughout the projection period.

The allocated production and attraction centres for cement in 2030 are presented below:

Figure 5-138. Cement production centres (2030)

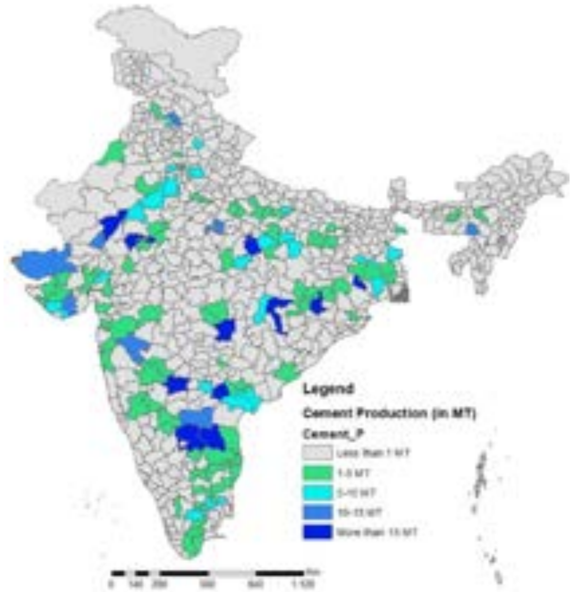
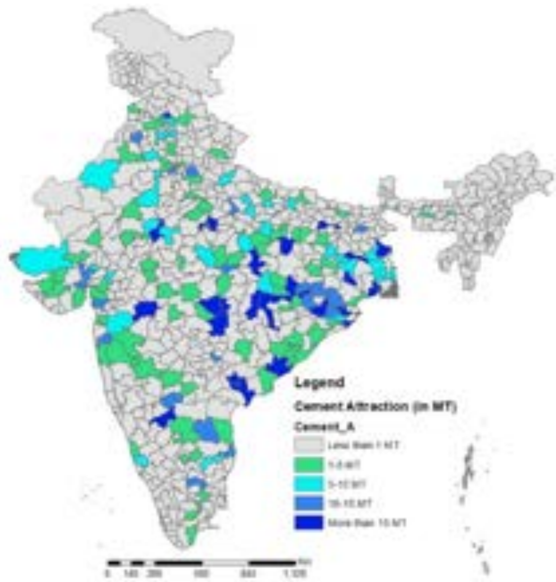


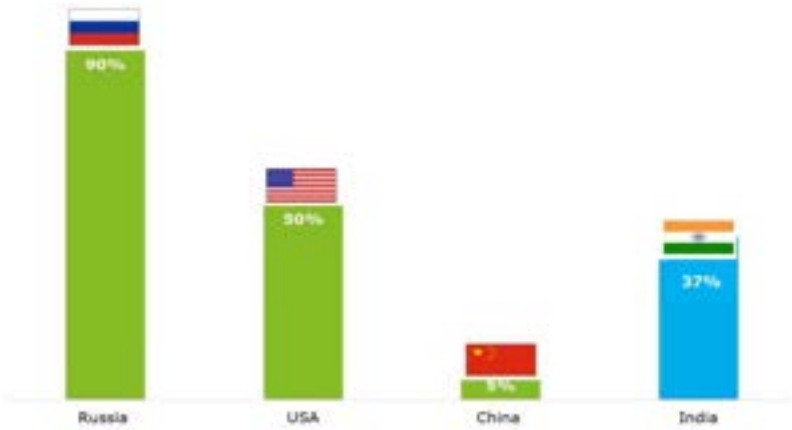
Figure 5-137. Cement attraction centres (2030)



Source: Consultant Analysis

5.11.7.4. Extant rail modal share and logistics competitiveness

Figure 5-139. Modal share of different railway systems – India vs peers



Source: Respective Railway Authorities, Consultant Analysis

With total production of 297.71 MT and imports volumes of 2.62 MT, the total cement available for transportation turns out to be 300.33 MT. Of the total cement volumes available for transportation in the country, rail's modal share has been ~37 percent[88] (inclusive of clinker volumes) during FY 2018, thereby, contributing approximately 8.5 percent to the total revenues of IR during this period. When compared with global peers, India's rail modal share for cement movement is significantly lower than other countries (except in the case of China).

A comparative analysis of costs reveals that road transportation emerges as a more cost competitive mode, consequently leading to low rail modal share in the bagged cement segment. This is illustrated through a comparative cost analysis of rail and road movement of finished cement along one of the top cement corridors viz. Chandaria to Delhi:

[88] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Cement. Government of India. Nagpur; Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

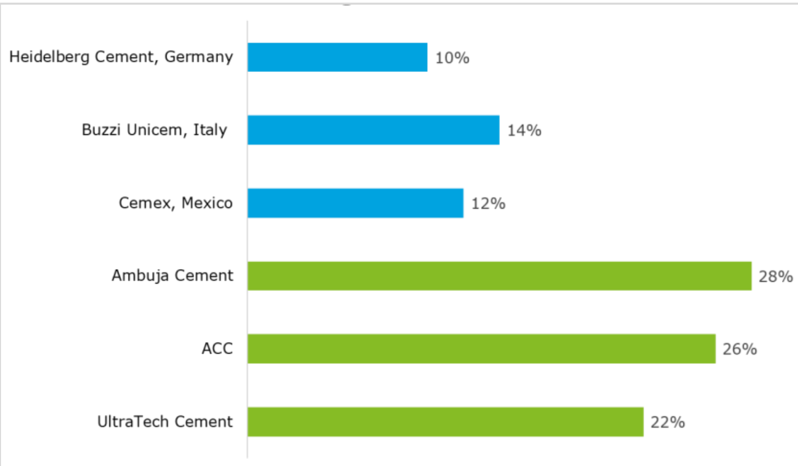
Figure 5-140 Mode wise cost comparison: Delhi to Chanderia

	Cost Element	Rail	Road
Bagged	Freight Cost	A: 850	1100
	Handling	150	Not Applicable
	Last Mile	300-350	Not Applicable
Total		1300-1350	1100

Source: Stakeholder consultations; Consultant Analysis

As illustrated, while transit cost works out cheaper in the case of rail, high last mile handling and delivery costs associated with it make road the preferred mode. Road transportation providers offer point-to-point solutions, eliminating an additional layer of last mile handling and delivery costs. They also take on liabilities associated with damage and theft during transit. Such cost differentials have contributed to the skewed modal share in favour of road transportation in an ultra-cost sensitive industry - an average cement player in India spends about 20-30 percent of retail revenue on logistics compared to 10-15 percent spent by global players.

Figure 5-141. Logistics Cost as % of retail price v/s global peers

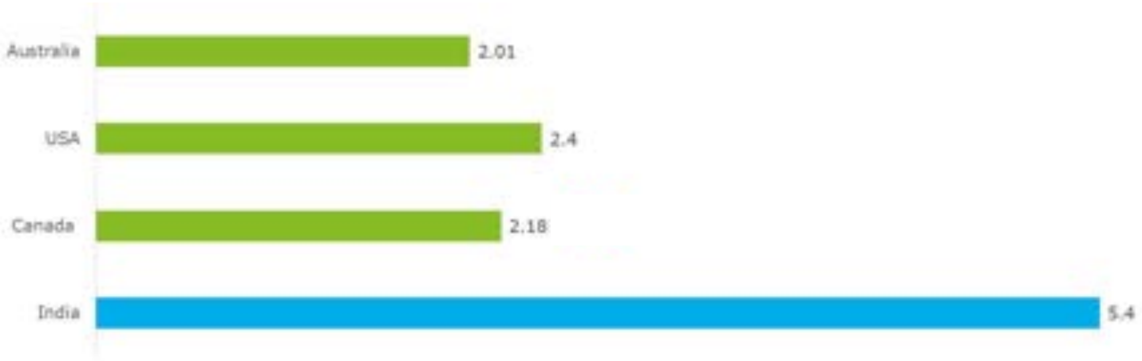


Source: Balance sheet of respective companies

The cost of rail transportation of cement in India is still perceived as high. A comparative analysis of revenue earned per NTKM, adjusted for Purchasing Power

Parity[89], provides an empirical basis to estimate the high rail logistics costs borne by the sector in India

Figure 5-142. Rail's revenue per NTKM, adjusted for Purchasing Power Parity: India vs global peers, FY 2018



Source: Consultant Analysis, Annual Reports of Various Railroads viz. Australia- Aurizon, USA- Union Pacific, Canada- Canadian Pacific and Canadian National Railways

5.11.7.5. Strategies for Increasing Rail Share

In terms of transportation, while cement movement through rail accounted for ~114 MT or 37 percent[90] of total cement available for transportation during FY 2018, it only accounted for approximately 10 percent of the total freight volumes moved by railways.

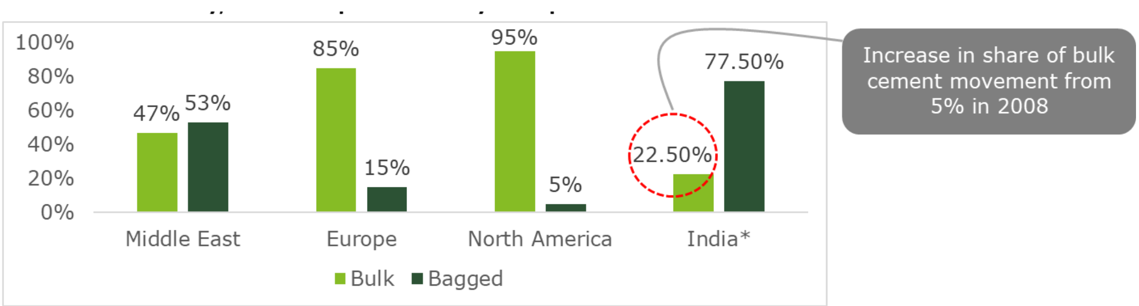
The sector is expected to expand at a significant pace in the coming years, driven by rising investments in public infrastructure and housing sectors. As per production projections undertaken as part of this study, the sector is likely to generate ~750 MT of cargo in the year 2030, which is over 2.5 times of present volumes of cement produced in the country in FY 2018. Given the growth potential of the sector along with the potential to enhance existing rail modal share, focused designing of a strategy that enables IR to drive incremental growth in its favour and derive maximum possible modal share in the segment would be critical. This would require IR to design a logistics product that solves the present needs of the customers while also anticipating developments likely to shape the logistics needs of the segment in the future. One such development is the increasing affinity towards bulk movement of cement.

[89] Note: Revenue per NTK estimated as $\frac{Freight\ Revenue}{Freight\ NTKs \times PPP\ \ Factor}$; Exchange rates and Purchasing Power Parity index, to estimate PPI Factor, sourced from https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm#indicator-chart accessed in August/September 2019

[90] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition, Cement. Government of India. Nagpur; Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

Unlike India, major economies predominantly transport cement in bulk on account of reduced logistics cost and ease of transportation and handling. In fact, the trend has been catching up in India too with transportation of bulk cement increasing from 5% in 2008[91], to over 20% in FY 2018[92].

Figure 5-143. Movement of bulk and bagged cement (FY 2017): India vs Global



* Note: Movement of bulk cement for FY 2018 was in the range of 20-25% of total cement in the freight ecosystem, as reported by various stakeholders.

5.11.7.6. Bagged vs Bulk in India

Currently, while movement of cement on rail is predominantly in the bagged form, it is more economical to transport cement in bulk. A detailed comparative cost analysis associated with moving cement in bulk and bagged form through both road and rail is presented below.

Movement of bulk cement on rail (at Rs 3 per ton per km) is not only more economical than bagged cement on rail (at Rs 4.5 per ton per km) but also significantly cheaper than bulk on road (at Rs 5 per ton per km), as well as bagged on road (at Rs. 3.5 per ton per km). The reduced cost of moving bulk on rail can be mainly attributed to elimination of multiple handling, bagging and pilferage costs across the rail transportation chain, whereas bulk movement on road can become costlier on account of requirement of large and specialized fleet of trucks, and absence of return loads for hauliers. Thus, bulk movement on rail presents itself as the most economical and convenient mode of cement movement.

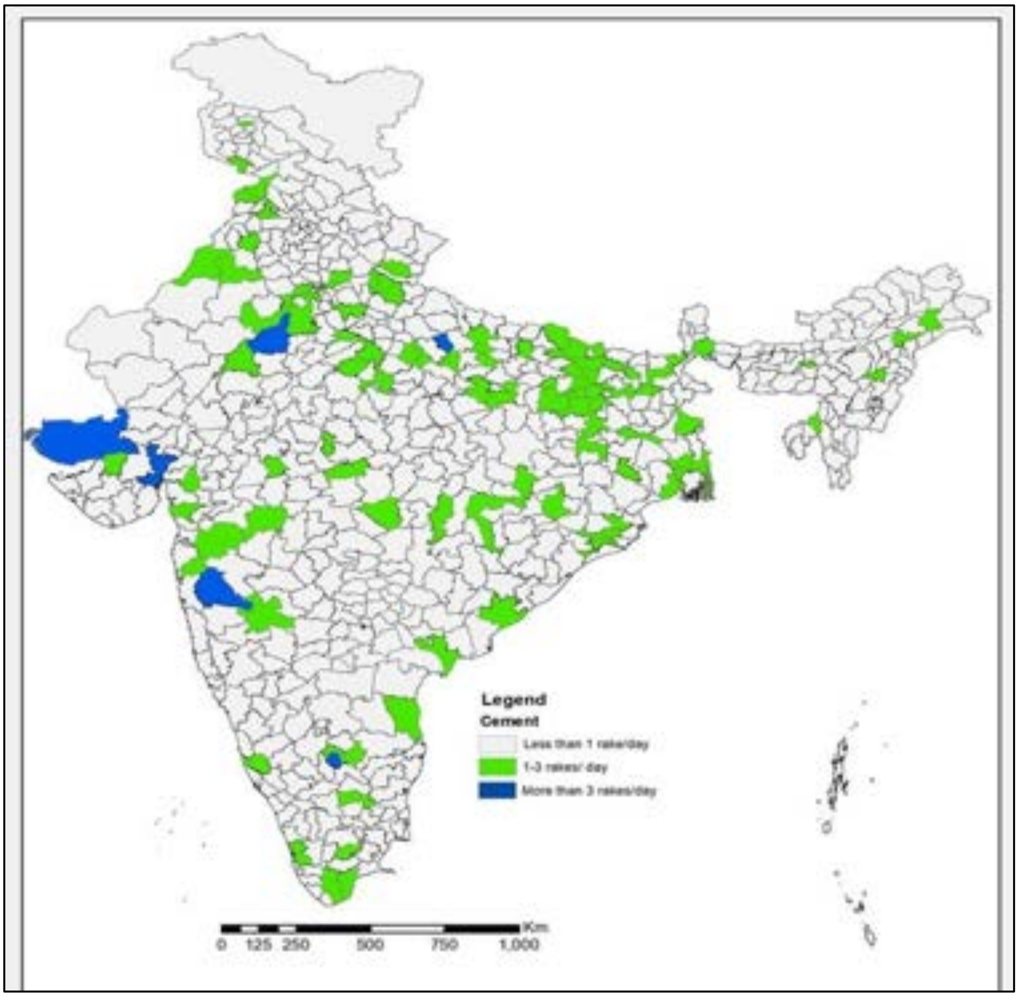
Despite the cost advantage, however, only ~3%[93] of all cement movement on IR is in the bulk form owing to absence of a conducive ecosystem for bulk transportation. There is a need for creating a better product/ecosystem for bulk cement transportation, which in turn could induce increased modal share of cement on rail .

[91] Planning Commission. 2008. Working Group Report. Government of India
[92] Industry stakeholders, Annual Report analysis of various cement companies
[93] Ministry of Railways. (2018). Centre for Rail Infromation Systems FOIS Data, FY 2018. Government of India, New Delhi

5.11.7.7. Terminal strategies to be adopted to enable bulk transportation

Stakeholder discussions revealed that paucity of rail linked bulk cement terminals adjacent to consumption centres was the main reason for majority of the movement happening by road. At present, there are only eight operational bulk terminals that have been set up and are owned by private cement players for exclusive use. As a result, availability of existing bulk terminal handling infrastructure capacity is severely constrained when compared to the existing demand. Therefore, identification of locations for IR to develop bulk handling terminals becomes critical. The list of such terminal locations identified based on projected district-level cement consumption volumes for 2031 and corresponding potential for rail

Figure 5-144. Suitable locations for setting up bulk handling terminals for cement



absorption is provided below. Sour

Source: Consultant Analysis

Table 5-7 Proposed Terminal locations for cement

S.No.	Districts	Projected Rail Traffic, 2031 (MTs)
	Srinagar	1.4
2.	Jammu/ Gurdaspur/ Jalandhar	6.6
3.	Chandigarh	1.9
4.	Bhatinda/ Ganganagar/ Hanumangarh	3.6
5.	Meerut/ Jhajjar/ Aligarh/ Delhi	11.0
6.	Alwar/Sikar/ Jaipur/ Ajmer	10.4
7.	Nainital/ Bareilly/ Moradabad	5.7
8.	Agra/ Bhind/ Jhansi/ Gwalior	5.0
9.	Vadodara/ Ahmedabad	4.6
10.	Kachchh/ Morbi	4.8
11.	Vishakhapatnam/ Krishna	3.7
12.	Lucknow/ Kanpur Nagar/ Kanpur Dehat/ Raebareli/ Gonda/ Faizabad/ Sultanpur	12.4
13.	Allahabad/ Mirzapur/ Varanasi	4.4
14.	Gorakhpur/ Gopal Ganj/ Purba Champaran/ Muzaffarpur/ Saran/ Vaishali	14.2
15.	Patna/ Nalanda/ Buxar/ Rohtas/ Aurangabad/ Gaya/ Nawada	12.5
16.	Ranchi/ Hazaribagh/ Dhanbad/ Purbi Singhbhum	6.9
17.	Bhagalpur/ Purnea/ Kishanganj/ Jalpaiguri	5.1
18.	Kamrup Metropolitan	1.2
19.	Tinsukia/ Shivsagar	2.2
20.	Madurai/ Tirunelvelli/ Kottayam/ Ernakulam	5.2
21.	Bangalore / Bangalore rural/ Kolar	11.0
22.	Kohima/ North Tripura	3.6
23.	Hugli/ Purba Medinipur/ North 24 Paraganas	9.6
24.	Jajpur/ Cuttack/ Khorda	4.1
25.	Raigarh/ Raipur/ Sambalpur/ Rajnandgaon	6.1
26.	Nagpur	1.7
27.	Hoshangabad/ Bhopal/ Indore	4.9
28.	Surat/ Nashik/ Jalgaon	4.6
29.	Mumbai/ Thane/ Pune/ Solapur	9.5
30.	Chennai/ Nellore	7.1
31.	Hyderabad	3.3
32.	Kottayam / Ernakulam	3.9
33.	Murshidabad / Paschim Bardhaman	4.7

Essential design features that need to be considered for bulk cement terminals include:

- Automatic pneumatic evacuation from rail for faster handling and minimum losses
- Multi-user facility design with co-located silos for different users
- Value added services like mixing plants, bagging units, and crushers for clinker
- In addition to the development of bulk handling facilities, for loading and unloading from bulk wagons to silos, terminals for cement handling also require bagging facilities for further distribution of cement to retail/non-bulk locations.

It is understood that bulk transportation of cement would require time and investment for industry-wide adoption. It is also expected that substantial movement of bagged cement will continue on account of distribution needs of retail market, where bagged cement would continue to dominate as the preferred product.

In order to cater to the bagged cement segment, which is characterized by need for a vast distribution network and smaller parcel size, positioning of good sheds as potential terminal facilities becomes pertinent. However, this would require development of suitable facilities and/or upgradation of existing facilities currently part of the IR network.

Some of the facilities that would need to be developed for such terminals would include:

- State of the art warehousing with temperature and moisture control
- Raised pallet-based storage for more efficient storage
- Special handling equipment (reach truck and pallet push trolleys) to eliminate the need for hooks or forks
- Certifications (CT-PAT, AEQ, BVQI, ISO etc.) for process, safety, and security of cargo

For development of terminals at identified locations, IR will need to play a facilitative role to be able to attract investments including incentivizing private participation through suitable PPP models (please refer to section on terminal policy in financing strategies chapter)

Other initiatives to increase rail modal share of cement

According to the Cement Manufacturers Association[94], reducing the freight rate of clinker, which is only a raw material of cement, by reducing it to class 120 could propel clinker movement on rail. This move in addition to the more generic strategies such as focusing on improved wagon designs and incentivising investment in wagons, improving rake availability, improvements in pricing initiatives, and increasing access to mini and two point rakes etc., could help enhance rail modal share for cement transportation in the country.

In addition to incentivizing private players for induction of rolling stock suitable for bulk cement movement, IR can also facilitate adoption of innovative concepts such as tank containers, which are being extensively used globally. Finally, appropriate policy interventions can also help in promoting inter-modality for seamless movement in addition to catering to logistics needs of players with smaller parcel sizes.

[94] CMA presentation made to Ministry of Railways in October 2020

Box 8. Cement tank containers globally

Cement Tank Containers are being used globally to facilitate movement of bulk cement and promoting inter modality

ISO 20Ft Cement Bulk Container; Source: Danteco Netherlands

ISO 20Ft Cement Clinker/Bitumen Container; Source: ALP UK

Tank containers are suitable for transportation of bulk cement, clinker or fly ash by all modes and provide seamless intermodal integration across rail, road and water.

Key Specifications:

- Max. Gross Weight 32 Tonnes / Loading weight 27.8 Tonnes
- 20FT ISO Full Frame Design

Cement tank containers by rail shall provide flexibility in parcel size while sustaining rail's cost advantage over road

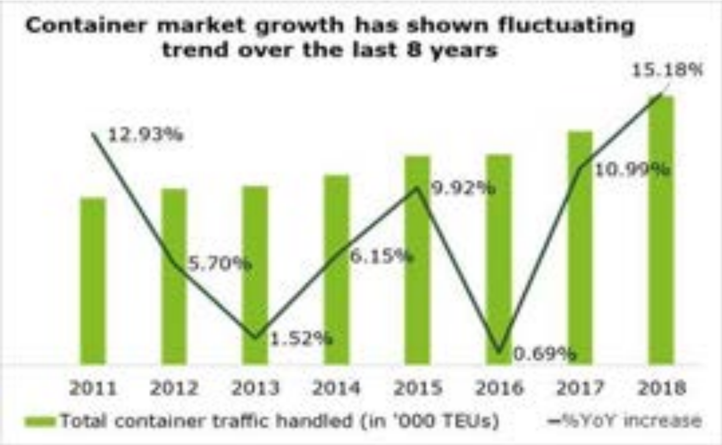
	Tank container by Rail (20ft X 2)	Road Bulk (10 to 12 wheeler)	Road Bagged (40-44 tons capacity)
Load	55.6 T	30 T	45 T
Distance	400 Km	400 Km	400 km
Haulage	22,919	60,000	45,000 – 48,000
Handling	5500	0	Included in haulage
Logistics cost / ton	525	2000	1050

Note: Rail haulage for containers referenced from IR Haulage Charges; last mile cost (rail terminal/trucking hub to customer) is assumed to be similar in all cases.
Source: Stakeholder consultations and Consultant Analysis; Rate circular of IR, 2018

5.11.8. EXIM Containers

5.11.8.1. Current commodity landscape

Figure 5-145. Container market growth trend



Source: Indian Ports Association Data (FY 2018)

The share of containers in the total traffic handled at the ports was around 20% and 14% for the major and non-major ports respectively[85]. In terms of total throughput, 15.07 million TEUs[95](or 208.3 MTs) of containers were handled at Indian port container terminals (including major and non-major ports) in India during FY 2018. The sector has witnessed a fluctuating growth trend (year-on-year) over the same period with a significant upward jump in recent years.

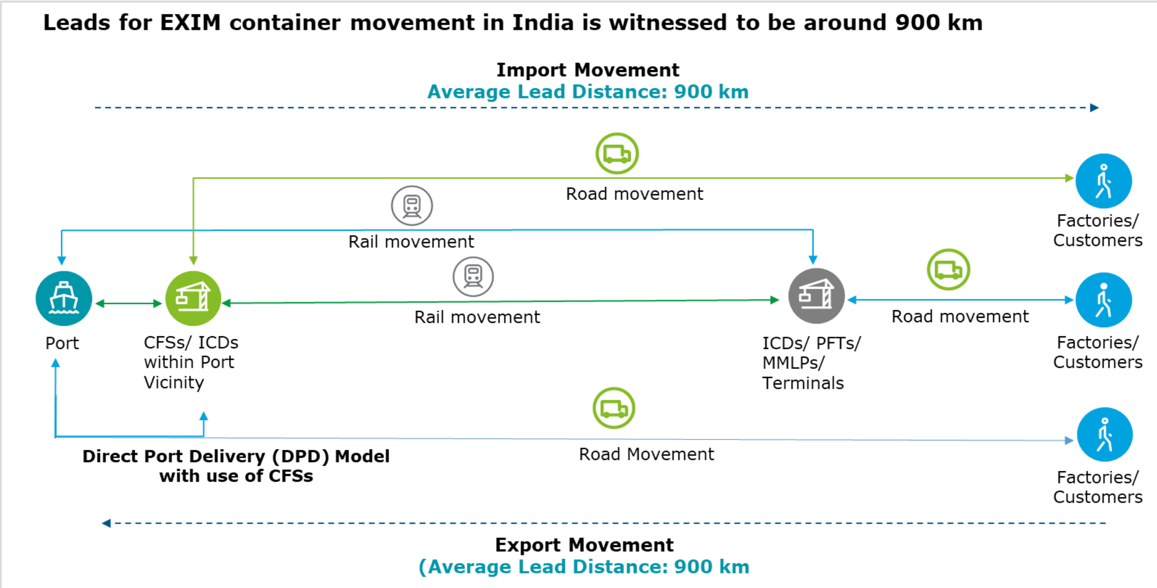
In terms of modal share, road dominates EXIM container transportation in India with only 21%[96] of the total Exim movement (42.82 MT) carried through rail during FY 2018.

The port-based container terminals are at the epicentre of EXIM container movement in India. For this movement, the average lead distance for rail movement is around 900 km, which is mainly attributed to the corridors connecting:

- Ports in Western region viz. Mundra, Pipapav and Kandla to the northern hinterland
- JNPT to central India, Maharashtra, Andhra Pradesh, Telangana, Uttar Pradesh, NCR
- Chennai port to Bengaluru, Andhra Pradesh and Telangana
- Krishnapatnam port to Andhra Pradesh, central India and Telangana
- Vizag port to central India, Odisha, Jharkhand, Uttar Pradesh and Nepal
- Kolkata/Haldia ports to North Eastern Region (NER)

[95] Indian Ports Association. (2018). Major Ports of India: A Profile Indian Ports Association , New Delhi
[96] Note: Rail's Modal Share is ~21percent for Exim containers and ~26percent on cumulative basis including Domestic containers as well. Source: Various Authors, 2018, Annual Report, Indian Railways, New Delhi; Same as 1; Consultant Analysis

Figure 5-146. Containers' Value Chain Assessment

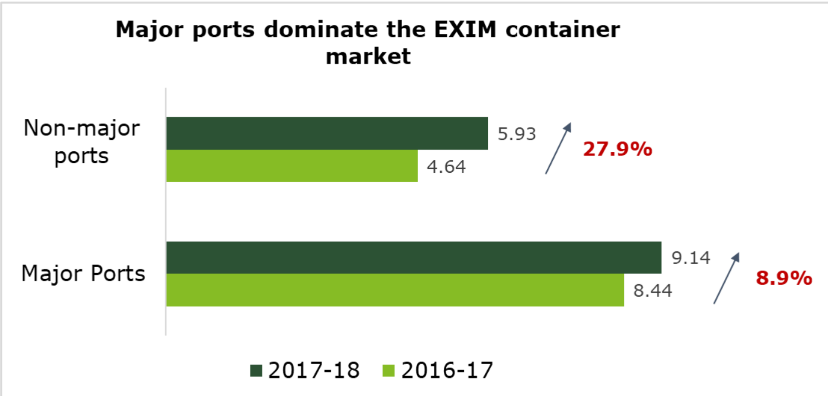


Source: Industry Consultations, Consultant Analysis

5.11.8.2. Key container handling ports

Major ports[97] have traditionally dominated the EXIM container market, accounting for approximately 60%[98] container market share. During FY 2018, the total container throughput at the major ports stood at 9.14 MT as against 5.93 MT for non-major ports[99]. Although major ports are leading the container market, non-major ports are increasingly growing their contribution to this segment. This has been validated by the fact that the volume handled at non-major ports has shown year-on-year increase of 27% during FY 2018 as compared to an 8% increase in the case of major ports.

Figure 5-147. Container traffic at major & non-major ports (million TEUs



Source: Indian Ports Association Data (FY 2018)

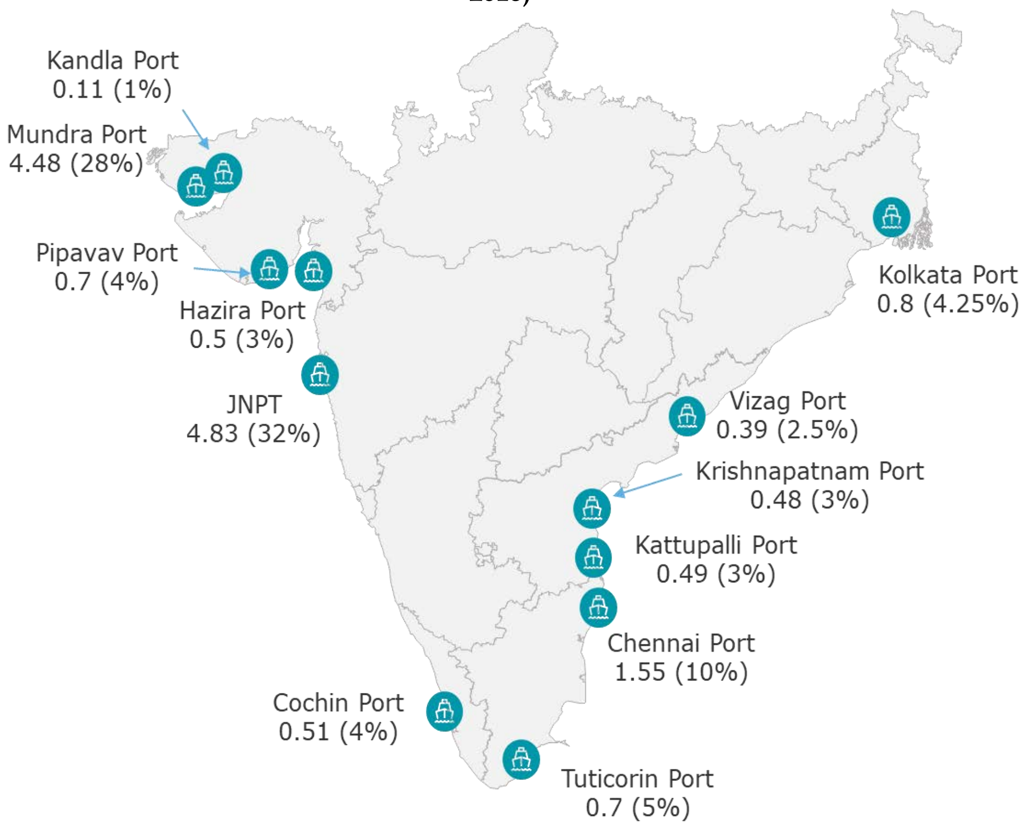
[97] Major ports are represented by the 12 major ports operated by the Central Government trough Port Trusts, whereas Non-Major ports are those operated by State Maritime boards often with private sector participation.
[98] Calculated based on traffic data for containers in TEUs
[99] Same as 1

The ports of JNPT and Chennai together constituted 70% of the total containers handled at major ports during FY 2018 with JNPT alone accounting for 53% of the total share. At the same time, the ports of Gujarat, predominantly Mundra and Pipavav, accounted for 89% of the total container traffic handled at non-major ports.

While JNPT has traditionally been the major container handling port in the country, it started losing its market dominance to competing facilities due to its own capacity constraints as well as rapid expansions/development of infrastructure in other ports, especially to Mundra and Pipavav along the Gujarat Coast, which are privately developed and share the advantage of double stack operations and a shorter lead to the northern hinterland. Consequently, JNPT's market share in total container traffic handled in India has decreased from 57% in FY04 to 31% in FY18[100]

The map below shows that EXIM container traffic is also skewed towards the western coast. The ports in the region handle around 70% of the total container throughput and mainly includes contribution of 32% from JNPT and a combined 35% from Mundra, Hazira & Pipavav.

Figure 5-148. **Container traffic handled (share) at ports and their share in traffic (FY 2018)**

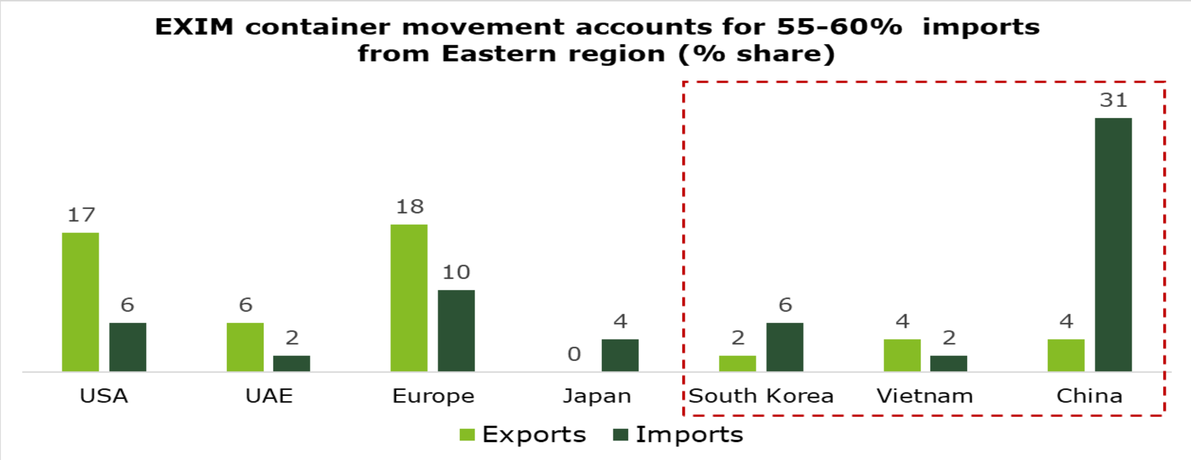


Source: Indian Ports Association Data (FY 2018); Consultant Analysis

[100] Same as 1

It has been observed that exports from India are predominantly bound toward Western countries such as those in the Middle East, Europe and North America, while imports are dominated by flows from Eastern countries such as China and others in SE Asia. However due to the overall cost economics on the West Coast, and the nature of global shipping where pricing is determined by global cargo flow balances, EXIM container cargo has not been distributed along the Indian coastline

Figure 5-149. EXIM container movement – Exports & Imports



Source: Indian Ports Association Data (FY 2018); Consultant Analysis

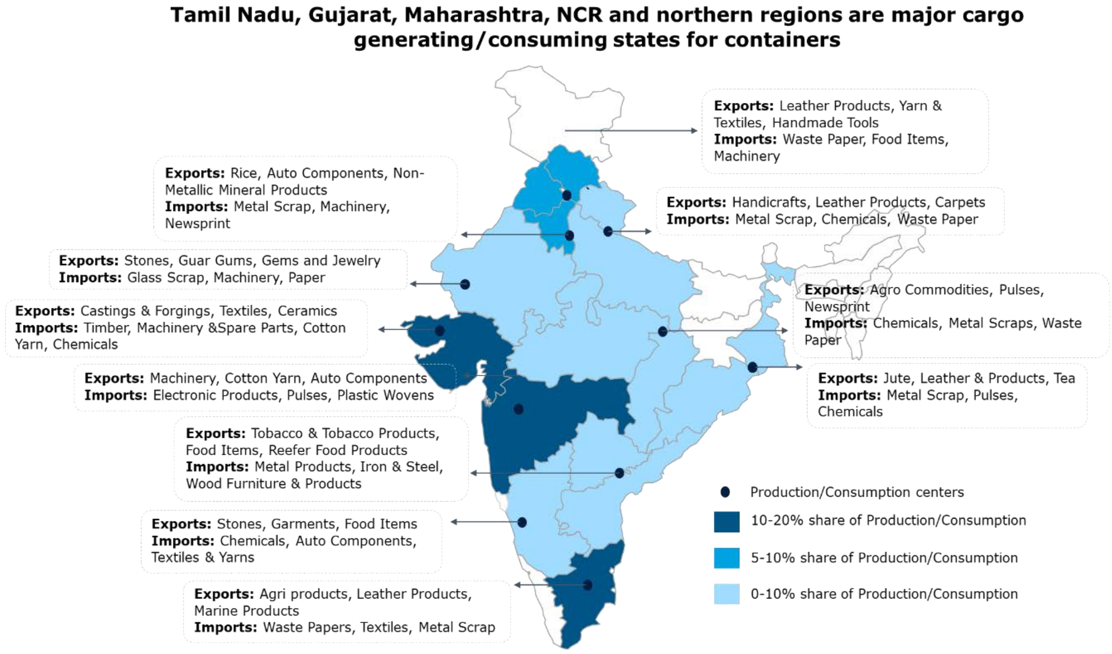
based on direction of movement.

5.11.8.2.1.*Major Production and Consumption clusters of container movement*

The major cargo originating centres for containers in India are in Maharashtra, Gujarat, NCR & other northern regions, which collectively account for more than 50% of the total container traffic handled at the ports. These states are also the major consumers for imported containerized cargo. Furthermore, the NCR region and Mumbai are the major cargo consolidation hubs, which adds to the substantial volumes of the container traffic serving the western region ports.

The share of states in generation and consumption of containerized cargo is presented below, highlighting the major production and consumption clusters.

Figure 5-150. Major Production and Consumption Clusters of Container movement (Share %) in FY 2018



Source: India Container Market Report (FY 2018) and Consultant Analysis

5.11.8.3. Projections of potential transport demand

For EXIM container traffic, multiple macro-economic factors like real Gross Domestic Product (GDP), Merchandise Trade as a percentage of GDP, Exchange Rate, Population, World Output, Index of Industrial Output, etc. impacting containerized EXIM traffic were analysed. Corresponding correlations and elasticities were established in order to ascertain preferred indicators impacting EXIM traffic growth. Lastly, past trends for imports and exports were referenced to assess the import export mix of projected traffic.

EXIM containers Projections: Key Assumptions, Inputs and Data Sources

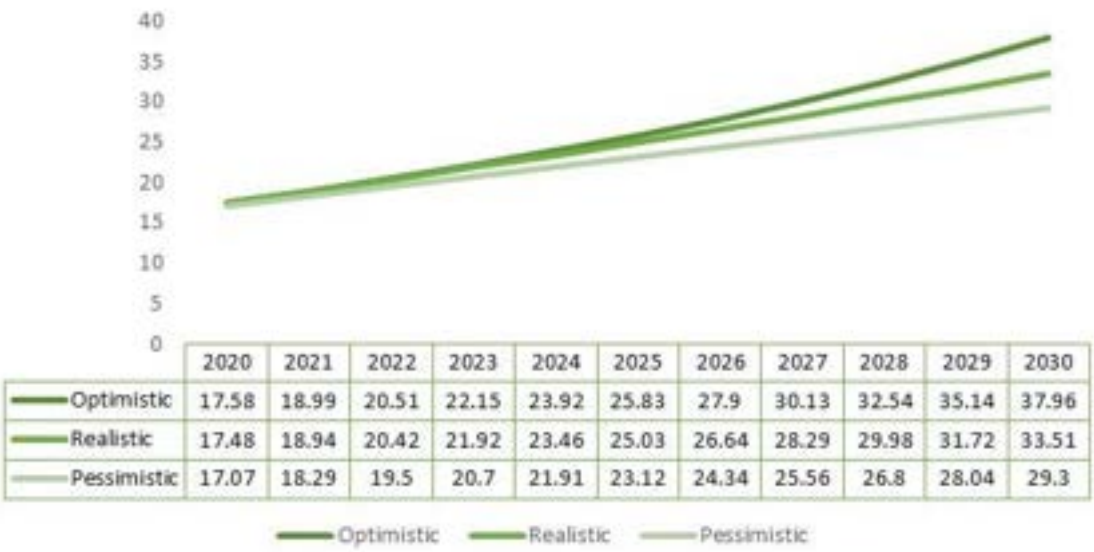
- Macro-Economic Indicators evaluated: Real Gross Domestic Product (GDP), Merchandise Trade as a percentage of GDP, Exchange Rate, Population, World Output, Index of Industrial Output
- Preferred Indicators: Real Gross Domestic Product (GDP), Merchandise Trade as a percentage of GDP
- Estimated elasticity coefficient for containers was 1.06 against Real GDP and 5.09 against Merchandise Trade as a percentage of GDP
- OECD GDP growth Projections[101] were adopted for assessing future Real GDP growth

[101] Organisation for Economic Co-operation and Development (OECD). Real GDP forecast (indicator). doi: 10.1787/1f84150b-en. https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September 2019

- Past trends on Merchandise Trade as a % of GDP sourced from The World Bank[102]. In the absence of forecasts, the historical growth pattern was assumed to continue in future, which resulted in a CAGR of 0.64%

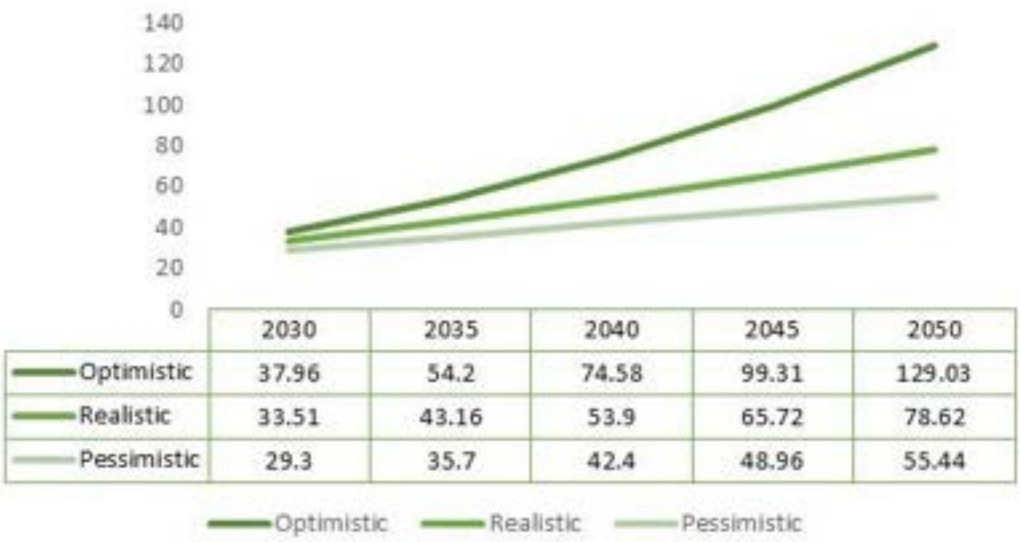
The scenario wise volume Projections for EXIM container volumes are presented below:

Figure 5-151. EXIM Container Projections (in MT) under different scenarios (2020-2030)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	17.58	18.99	20.51	22.15	23.92	25.83	27.9	30.13	32.54	35.14	37.96
Realistic	17.48	18.94	20.42	21.92	23.46	25.03	26.64	28.29	29.98	31.72	33.51
Pessimistic	17.07	18.29	19.5	20.7	21.91	23.12	24.34	25.56	26.8	28.04	29.3

Figure 5-152. EXIM Container Projections (in MT) under different scenarios (2030-2050)



	2030	2035	2040	2045	2050
Optimistic	37.96	54.2	74.58	99.31	129.03
Realistic	33.51	43.16	53.9	65.72	78.62
Pessimistic	29.3	35.7	42.4	48.96	55.44

[102] The World Bank. (various dates). Merchandise Trade as a percent of GDP data, The World Band Database at https://data.worldbank.org/indicator/TG.VAL.TOTL.GD.ZS accessed in August/September 2019

Regional allocation of EXIM container traffic: It was assumed that Majority (~70-80%) of hinterland Export/Import traffic shall originate as per existing patterns derived from primary road surveys and Rail movement data. The residual traffic was further assigned to emerging districts where there were policy initiatives[103] toward faster industrial growth. For port of entry/exit, traffic via west coast ports was extrapolated, assuming linear growth, till residual capacity and planned expansions within the projection period (including new ports)[104] were exhausted. The traffic via east coast ports was extrapolated by a faster growth factor than west coast ports keeping in mind a comparatively smaller base of existing traffic and large spare capacity.

The allocated production and attraction centres for EXIM containers in 2030 are presented below:

Figure 5-154: Exim Containers Production

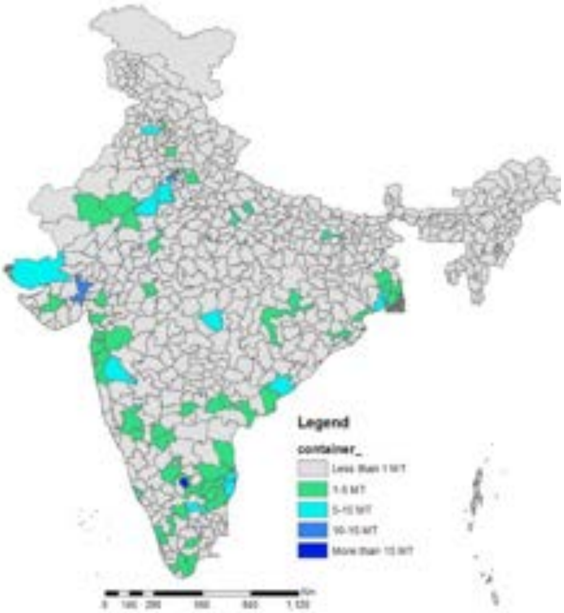
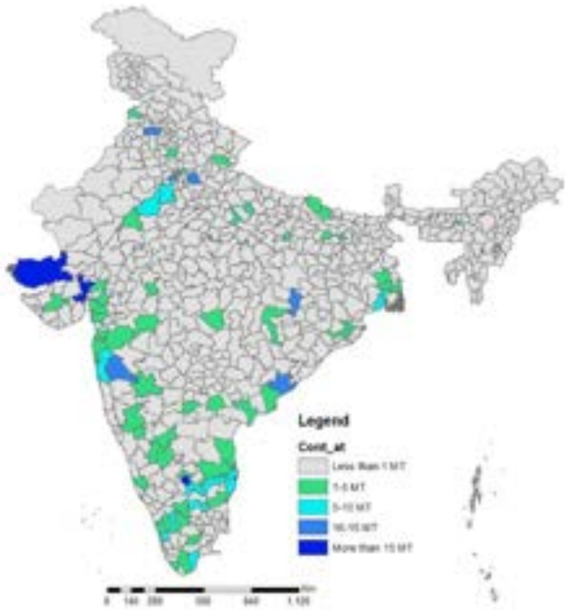


Figure 5-153: Exim Containers Attraction



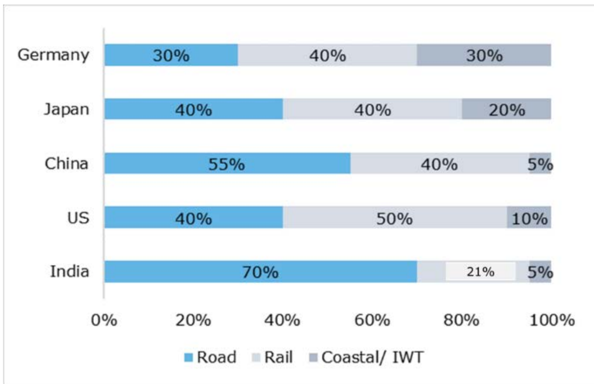
Source: Consultant Analysis

5.11.8.4. Extant rail modal share and logistics competitiveness

As mentioned earlier, EXIM container transportation in India is mainly dominating by road with only 21% rail modal share.

[103] Source: Stakeholder consultations, state government and industrial department plans
[104] Sourced from Various Authors, 2016, Sagarmala National Perspective plan, Ministry of Shipping, India, New Delhi; Individual port operator websites and stakeholder discussions

Figure 5-155. Global comparison of containers' modal share



Source: Websites of Respective railways and other transport authorities; Consultant analyis

In comparison with global peers, it is observed that a significant share of container movement in countries such as US, China, Japan and Germany is also dependent on road, but the share of rail and coastal shipping is significantly higher when compared to India.

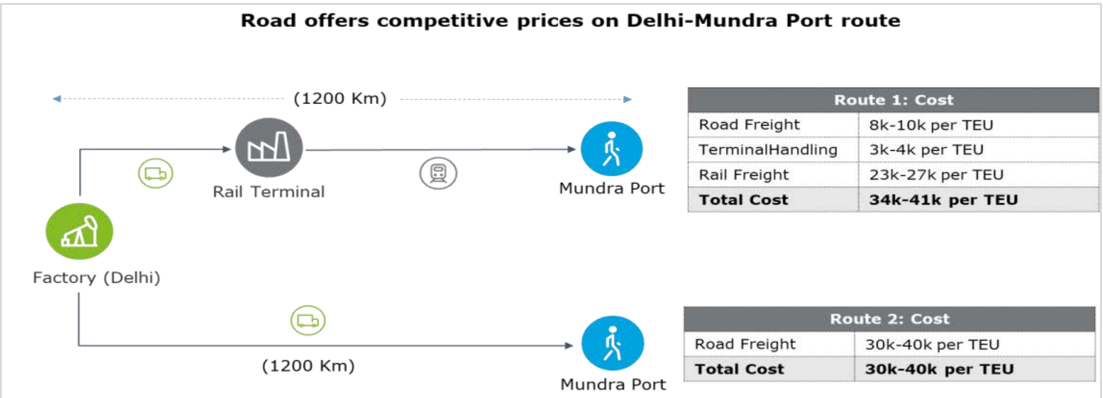
With the likely commissioning of the Western Dedicated Freight Corridor soon, this scenario might change with an expected diversion of a substantial number of containers from road to rail, particularly in the case of longer leads from NCR and Punjab/Haryana markets to Western Ports like Mundra, Pipavav and JNPT.

5.11.8.5. IR Logistics Competitiveness

Based on industry reports, it is estimated that the primary reason for a low modal share for rail is the superior cost competitiveness of road as compared to rail. The landed cost of container transportation by rail covering haulage charges, first/last mile connectivity, handling costs at intermodal terminals, and empty movement haulage costs, results in the total logistics cost for rail to be higher than that for road, especially for lightweight or volume based cargo moving in Forty ft containers (FEUs).

As an illustration, for a lead of around 1200 km from factory in Delhi to Mundra port, the typical logistics costs are presented below:

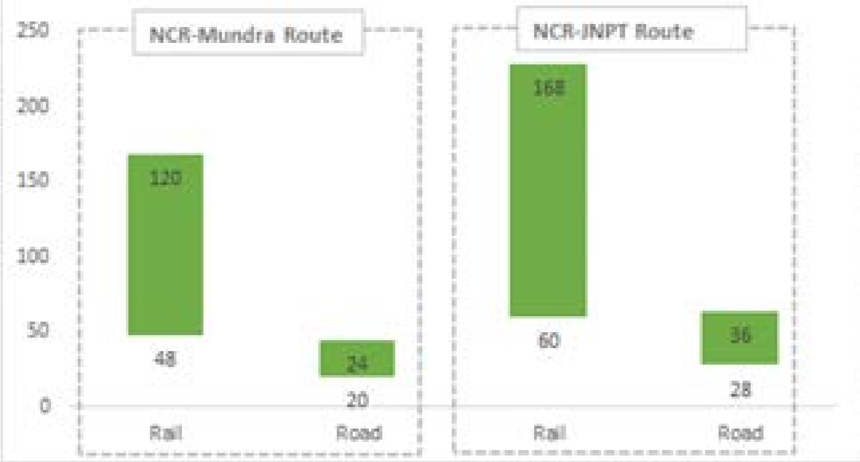
Figure 5-156. Containers logistics value chain: Delhi to Mundra route



Source: Industry Consultations

Even with regard to logistics time, Rail services tend to lag behind road which offers much-greater reliability and transit time guarantees to its customers. Given fixed vessel sailing deadlines, a transit time guarantee is one of the main requirements for the EXIM container industry (especially for Export cargo) in its Logistics chain.

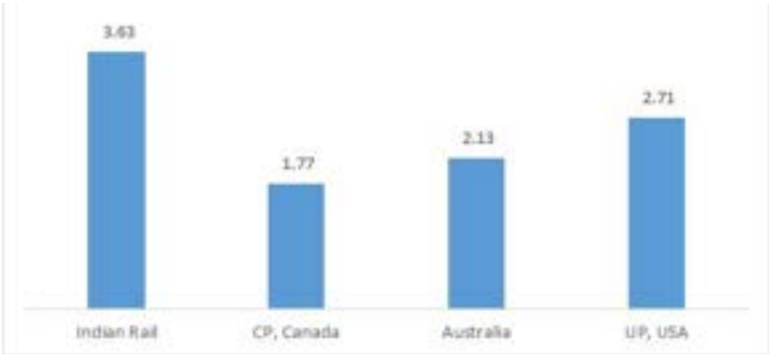
Figure 5-157. Comparison of transit time by rail and road (Hours)



Source: Industry Consultations; Consultant Analysis

A comparison with other global peers further highlights the high rail logistics cost for containers prevalent in India. The revenue earned per NTKM, adjusted for Purchasing power parity[105] provides an empirical basis to establish high rail logistics costs borne by the sector in India.

Figure 5-158. Rail's revenue per NTKM: India vs global peers (INR)

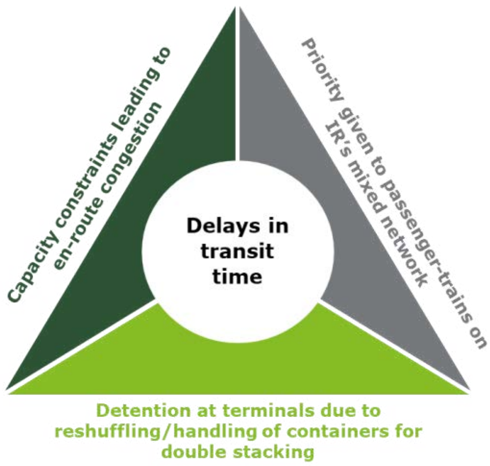


Source: Respective railway authorities, Consultant Analysis; Statistics for Australia covers performance of various Railways for FY17 given several railways stopped reporting results for FY18 for Intermodal segment

[105] Note: Revenue per NTK estimated as $\frac{Freight\ Revenue}{Freight\ NTKs \times PPP\ \ Factor}$; Exchange rates and Purchasing Power Parity index, to estimate PPI Factor, sourced from https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm#indicator-chart accessed in August/September 2019

5.11.8.6. Strategies for increasing Rail Share

Figure 5-159. Reasons for delay in transit time



The low rail modal share of EXIM containers can be attributed to several reasons. In addition to route congestion and operational issues on mixed networks, the reshuffling and handling of containers and shuttle trains as per the required combinations of double stack operations / movement has led to increased detention time at terminals which in turn leads to delays in transit time.

An analysis of the EXIM container value chain highlights the fact that even though CTOs are theoretically responsible for providing container transport services to the shippers, IR plays a more crucial facilitative role by providing track infrastructure, locomotives, governing the pricing structure and formulating related policies.

1. Enabling the DFC Ecosystem -

While the introduction of DFCs (especially WDFC since a majority of EXIM container traffic is concentrated along this route) is expected to decongest IR's network by adding significant capacity for freight transportation, the benefits of DFCs cannot be fully realized without IR providing strengthening support for enabling the DFC ecosystem. This can be achieved by facilitating smooth and efficient operations at the interface / interchange / junction points of DFC and IR network, upgrading IR's infrastructure as per DFC's network configurations and establishing a mechanism that helps translate DFC's reduced cost of operations into a benefit for the customer through reduced haulage/pricing. Each of these interventions require IR to take the following actions:

Box 9. Development of Feeder Routes for Ludhiana Market

- The Ludhiana cargo cluster contains a potential for at least 20-25 thousand TEU per month of EXIM container volumes, making it the second largest demand cluster for EXIM containers after the NCR market
- The cluster is served by seven different private ICDs, none of which at present are able to connect to any feeder route that would bring this volume of cargo directly to the Western DFC.
- Ensuring that the requisite number of road and food overbridges and other barriers to raising OHE along the Ludhiana – Jakhal – Hisar – Rewari route are removed will ensure that this feeder route to the WDFC will be able to connect these volumes to the DFC network.
- This in turn will ensure better capacity utilisation, greater scale of operation and the

All traffic meant to transit across the DFC might not originate or terminate on the DFC itself. Upgrading feeder routes to DFC specifications will become a critical exercise to be undertaken by IR to ensure both seamless as well as enhanced capacity utilisation on the upcoming DFC networks.

To ensure that freight trains pass through the interchange points between IR and DFC networks in a planned and timely manner, it is also necessary that the proposed interface and operations coordination plan between DFC and IR should allow for seamless network entry and exit both in terms of operations process, as well as in terms of development of suitable yard infrastructure at the interchange points that allows for seamless transition between networks.

Finally, as a result of expected reduction in cost of operations with the advent of DFC, IR can not only provide its existing customers with a more competitively priced alternative for goods transportation but also attract new players that currently rely on alternative modes of transportation. While a reduced unit costing will certainly become possible due to the higher capacity on the DFC, converting this to a lower price for customer will be crucial and have to be actively piloted by IR. Since IR will primarily remain responsible for customer pricing along the DFC, any possible benefits it receives through longer, heavier, faster trains must get passed on to the customer through a lower price experience.

2. Improving Double Stack Efficiencies -

Double stacking operations enable railways to carry greater EXIM container volumes on the currently saturated network and at the same time, help correct the imbalance exists between import and export containers by allowing greater volumes to be carried on a train in the direction of imbalance. Double stacking also helps Container Train Operators (CTOs) save significant costs when compared to single stack operations (refer Box 2). In fact, such operations further make rail transportation cheaper than road (refer Box 3).

Box 10. Assessment of savings owing to double stack operations

Assessment of cost savings of double stack operations vis-à-vis single stack operations has been undertaken for sample routes of Mundra-Patli and Mundra-Kashipur. While Mundra-Patli allows for double stacking movement, the route connecting Patli-Kashipur only permits movement of single stacked container trains. The analysis indicates that the total cost savings for container train operators (CTOs) are expected to be in range of 10-20%.

Mundra – Kashipur		
Cost Elements	Cost per FEU (in Rs.)	
Single Stack Operations	57,902	
Double Stack Operations	**Case 1 – Heavy FEU below and light above**	**Case 2 – Only 25 FEUs above**
Haulage Charge to Patli	26,440	29724
THC/TAC	5400	10793
Haulage Patli – Kashipur	10,793	3500
Rake holding cost	5,333	6857
Cost per FEU	47,966	50874
Savings	**17%**	**12%**

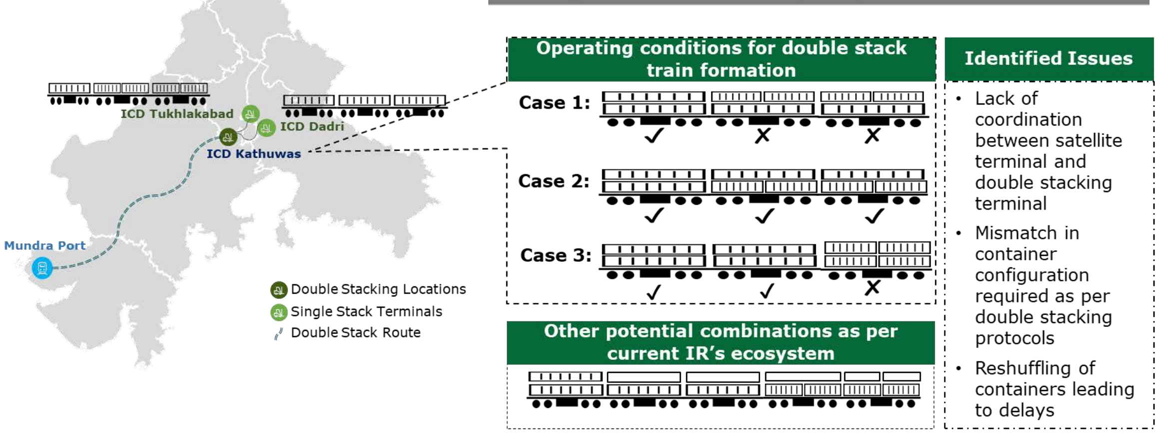
There are, however, certain operational inefficiencies in the existing DS system that lead to high detention time at terminals, which in turn affects IR's ability to provide its customers with a transit commitment which is often as critical as cost effectiveness in case of EXIM containers.

Box 11. Cost Comparison: Rail vs trucking sector

Cost Elements	Cost on Rail* (Rs.)		Cost on Road (Rs.)	
	Delhi-Mundra	Delhi-Pipavav	Delhi-Mundra	Delhi-Pipavav
Freight Charges (Discounted)	23,000 (21,500)	25,000 (23,000)	38,000**-42,000***	44,000**-50,000***
First/Last Mile Costs	8,000-10,000	8,000-10,000	-	-
Handling Costs	3,000-3,500	3,000-3,500	-	-
Total Costs	35000	36,500	42,000	50,000

*For a typical 10T-20T loaded container; **15T; ***20T

Figure 5-160. Issues identified
information betw



The main reason behind terminal detention is the need for compliance with certain operating conditions by the CTOs which govern the configurations of double stacked container train movement. Since terminal operators do not always have adequate number of containers of each type (TEUs and FEUs) or weight configuration necessary to undertake double stack operations, additional waiting time at terminals adds to the delay. Additionally, since CTOs also do not have visibility on (a) number and type of containers available with other operators and (b) combination of containers originating from different satellite terminals on single stacked rakes destined for consolidation at hub terminal, there are detentions and inefficiencies that can be attributed to planning failures, and multiple reshuffling of containers.

In order to improve service quality and subsequently cater to the expanding EXIM container market (expected to reach 485 MT by 2030), there is a need for creation of an IT-enabled platform that facilitates exchange of information between CTOs and terminal operators with respect to:

- Dispatch/departure and arrival schedules of each CTO and terminal operator
- Configuration of containers on single stacked trains, arriving from different directions
- Type and number of containers available at consolidation points and ports

Such a platform can be created privately but using FOIS data and IR's network capability will likely lead to the most effective and widely available solution.

Box 12. Different configurations of double stacking operations and volumes carried

Alternatives	Container (Bottom)	Container (Top)	Allowed
1	40 ft	40 ft	Yes
2	2*20 ft	40 ft	Yes
3	2*20 ft	2*20 ft	No
4	40 ft	2*20 ft	No

With double stacking of two 20 ft containers on another two 20 ft containers, higher volumes can be carried when compared to other options.

The guidelines that currently govern the configurations of containers in a double-stack formation do not allow for stacking 2 x 20-feet containers on top of 2 x 20-feet containers due to safety and stability considerations which in turn limits IR's ability to achieve the maximum potential container rake's throughput. In addition, ensuring loading of rakes with such defined configurations further adds to detention time at the terminals.

As a solution, IR can consider introducing/adopting well type wagons or lock designs suitable for transportation of EXIM containers that provide greater steadiness and enhanced safety resulting in improved speeds and higher payload capacity. These may also allow for loading 2 x 20 over 2 x 20 container boxes and better utilise the eventual axle load capacity being developed on the DFC network.

3. **Commercial Initiatives -**

Besides network enhancement and improvement of efficiencies, there is also a need to improve the commercial viability for the EXIM container business in various ways. While generic suggestions on enabling LSPs, pricing reforms etc. have been made elsewhere in the study, for the EXIM container sector in particular, the following initiatives will go a long way to enhance rail volumes:

Access to Terminals:

- Create common user facilities at all terminals developed on publicly owned land
- Permit stacking of containers and encourage handling (lift on- lift off operations) at low cost to enable more multi-modal operations. Allow the application of the rule for leasing of commercial plots to be applicable to CTOs as well
- Notify Railway goods sheds as CRT (container rail terminals) on a long-term or permanent basis – There must be sufficient reason and notice (at least 6 months) for closure
- Modify CRT access rates on a per TEU basis to align these with market norms.[106]

[106] Recommendations made for these access rates by the Association of Container Train Operators are as follows: For Goods shed based CRTs, suggest a rate equated with the INR 20Rs/Tonne access, i.e.

- Allow CRTs to be permitted for Hub-Spoke operations [107]
- Remove access restrictions on private sidings-co-user permissions etc.

Pricing Initiatives:

- To deal with the problem of empty container flows that are built into EXIM flows, suggest that any empty movement (with or without containers) up to 400 Km be allowed for free. The actual cost for such a discount can be rolled back into loaded container rates so that the cost of discount is borne by the end-user/customer instead of a service provider like the Container train operator.
- Consider further discount (15-20%) for light commodities – primarily to focus on lightweight manufactured export goods that tend to move entirely on road
- Volume based discounts will favour larger operators who can meet benchmarks purely on basis of size. Consider an incremental volumes system based on introduction of fresh wagon capacity.
- Application of specialised station to station rates to attract specific cargo such as rice, paper etc. that has moved to road due to local transport economics.
- Consider implementation of a rake based pricing system that does away with TEU wise and slab wise charging. IR is paid a haulage per train that can be made representative of the current average earning by train by a CTO, who is then permitted to manage the commodity and weight mix of containers and wagons as long as this remains within the prescribed safety norms.

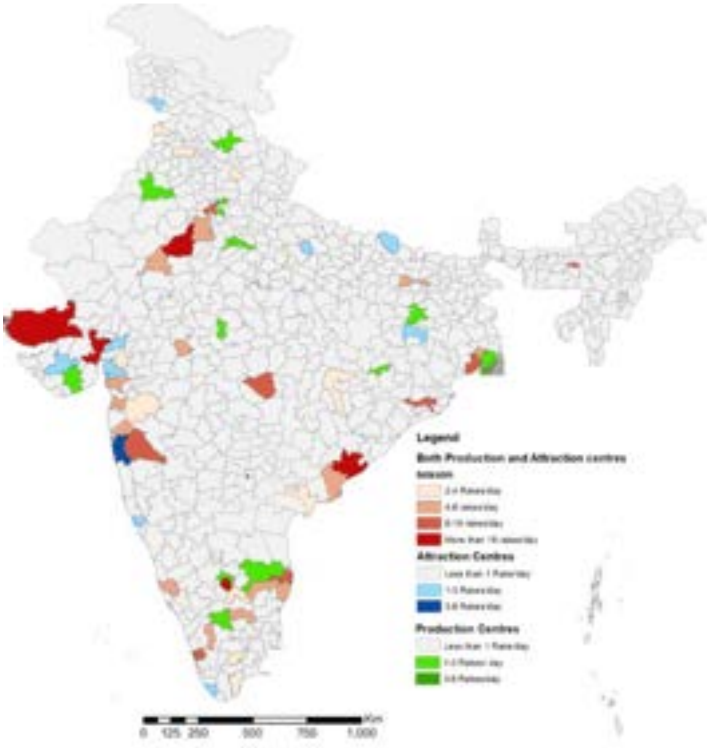
INR 500 per loaded container, and INR 50 per empty container - this would mean an in/out rate of INR 50,000 for a train.

[107] Recommendations made for hub-spoke operations by ACTO include zero access for empty train brought in to pick up upper stack boxes, and permission of the 15 day time allowed for hubbing operations

4. Container terminal (ICD) infrastructure-

With total container market expected to grow at a CAGR of ~7% by 2030 and reach a level of 485 MT, IR is expected to increase its share in container market segment from current modal share of ~21%[108] to 43% by 2031[109]. This brings in a requirement for an adequate number of container handling terminals on the IR network catering to the growing volumes.

Figure 5-161. Identified terminal locations for EXIM containers



While the maximum number of private terminals developed on the IR network thus far have been in the form of Container handling terminals (ICDs), currently only a limited number of terminals are equipped for handling double stacking operations. With the commissioning of DFCs and overall container volumes, the need for further expansion of the terminal network will need to be considered. Projections of locations and capacity for a container terminal network have accordingly been carried out in the study and are identified in the accompanying map and list of locations.

Table 5-8 Proposed districts for development of terminals catering to EXIM containers:

S.No.	Districts	Projected Rail Traffic, 2031 (MTs)
1.	Jammu/ Amritsar	5.1
2.	Ludhiana	2.3
3.	Shimla/ Haridwar	3.9
4.	Ghaziabad/ Gurugram/ New Delhi/ Faridabad	40.3
5.	Alwar/ Jaipur/ Ajmer	29.5
6.	Kachchh	33.1
7.	Rajkot/ Amreli	4.2
8.	Ahmedabad/ Kheda/ Bharuch/ Surat	52.6

108 As mentioned in sections above, ~21percent for exim containers only

109 Refer to Chapter's Annexure 4: Output of Logit Model on commodity-wise rail shares for horizon years

9.	Valsad/ Nashik	7.4
10.	Thane/ Pune/ Raigarh/ Mumbai	102.5
11.	North Goa	2.5
12.	Dakshina Kannada	4.6
13.	Bangalore Rural/ Bangalore	32.8
14.	Chennai/ Thiruvallur/ Chittoor/ Vellore/ Kancheepuram	119.1
15.	Erode/ Salem/ Coimbatore/ Ernakulam	22.9
16.	Thiruvananthapuram/ Thoothukkudi	4.3
17.	Krishna/ East Godavari/ Vishakhapatnam	27.0
18.	Nagpur	8.1
19.	Raipur/ Jharsuguda	4.8
20.	Cuttack	9.7
21.	Howrah/ Kolkata/ Purba Medinipur/ South 24 Paraganas	116.2
22.	Ranchi/ Hazaribagh	4.1
23.	Patna	4.3
24.	Paschim Champaran	1.4
25.	Lucknow/ Kanpur	5.1
26.	Hyderabad	21.8
27.	Kamrup Metropolitan	9.7
28.	Bhopal/ Indore	7.3

5.11.9. Balance Other Goods

5.11.9.1. Current commodity landscape

Balance other goods, as per Railway classification, comprises of:

- Acid and Alcohols
- Caustic Potash and Soda
- Clay and Sand
- Leather, Rubber and Plastic
- Oil Cakes and Seeds
- Salt
- Sugar
- Electrical Appliances
- Paints
- Timber & Bamboo
- Paper and Paper products
- Cotton and Other Textiles
- Fruits & Vegetables
- Fodder & Husk
- Groceries
- Automobiles
- Other

Given the extremely fragmented nature of this commodity group and limitations on data availability, the group was further restructured into following sub-groups:

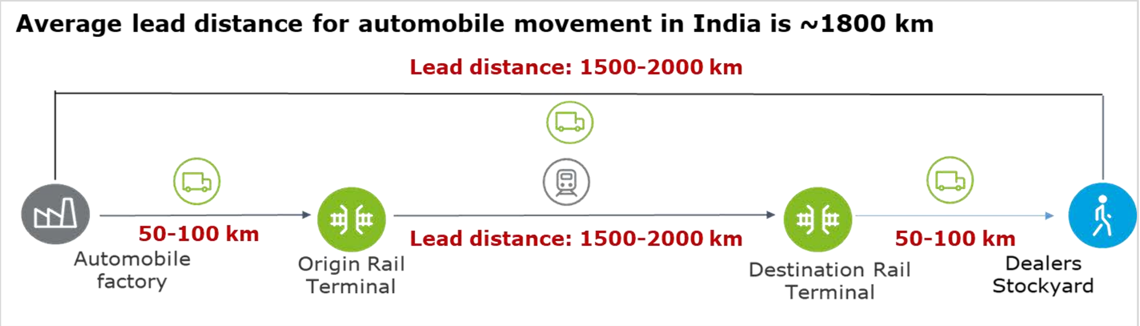
- Automobile
- Stones and aggregates
- Non-ferrous metals and
- Miscellaneous Other Goods

5.11.9.2. Automobiles

Road transportation has traditionally dominated the movement of automobiles in the country. It continues to do so with rail only holding a 6.8% share of the total movement of automobiles in FY 2018[110]. However, it is noteworthy that this share has significantly increased from about 1.1% in FY 2014. This reflects the potential for rail to make inroads into the automobiles segment.

[110] Centre for Rail Information Systems FOIS Data, 2018, Indian Railways, Delhi

Figure 5-162. Automobiles value chain



Source: Industry Consultations, Consultant analysis

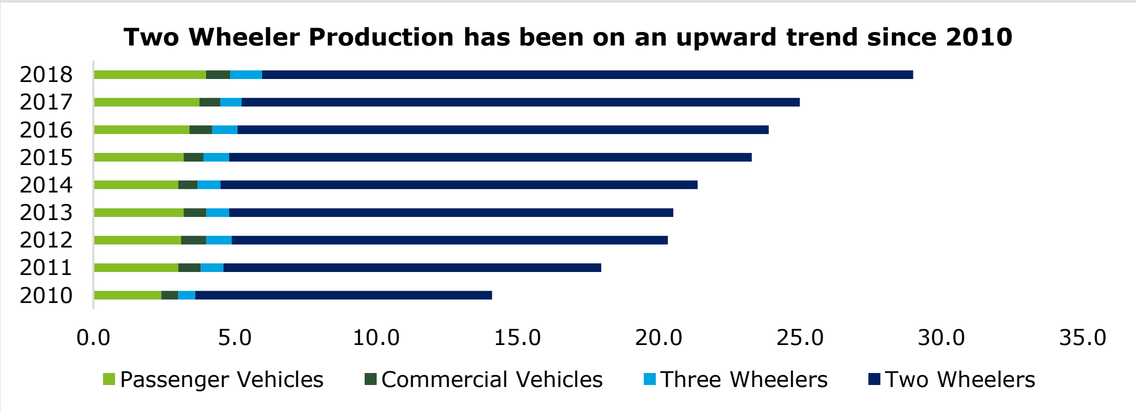
Furthermore, the average lead distance for automobile movement in India is ~1800 km thereby increasing the viability of rail transportation as an economical mode, as per industry estimates.

In terms of production, India stands as the fourth largest auto market in the world with total production of automobiles growing at a CAGR of ~8% since 2010 and stood at 28.2 million units in FY 2018[111]. In fact, the year-on-year growth rate of automobiles segment was 16% during FY 2018.

The automobile production is mainly spread across four markets in India:

- **Passenger vehicles** including passenger cars, utility vehicles, and multi-purpose vehicles.
- **Commercial vehicles** including light commercial vehicles and medium and heavy commercial vehicles
- **Three wheelers** including passenger and goods carriers
- **Two wheelers** including mopeds, scooters and motorcycles

Figure.163-5 **Automobiles Production in India (in million units)**



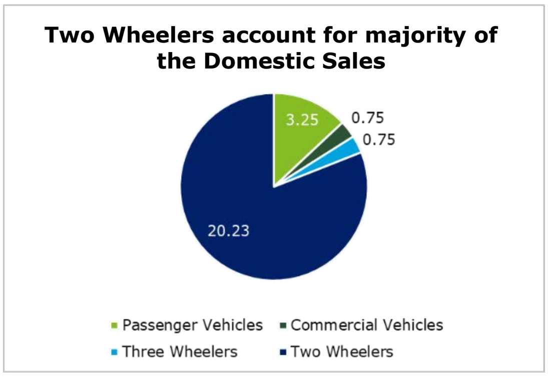
Source: Society of Indian Automobile Manufacturers (SIAM) data

The market is dominated by the two-wheeler segment, which accounts for 80% of the total production in India and has been on an upward trend since 2010.

[111] 2018, Automobile Statistics, Society of Indian Automobile Manufacturers (SIAM), Bangalore

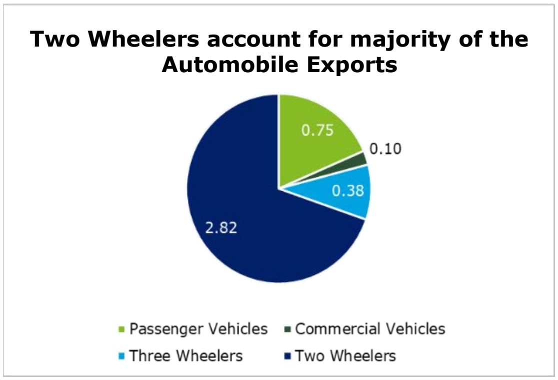
In addition, the domestic demand for and exports of automobiles both witnessed a significant growth over the past 10 years in India. The two wheelers' market segment has also shown dominance in both of these markets, accounting for 81% and 70% of the respective domestic demand and exports from the country during FY 2018.

Figure 5-165. Share of Market Segments in Domestic Sales of Automobiles



Source: Society of Indian Automobile

Figure 5-164. Share of Market Segments in Automobile Exports



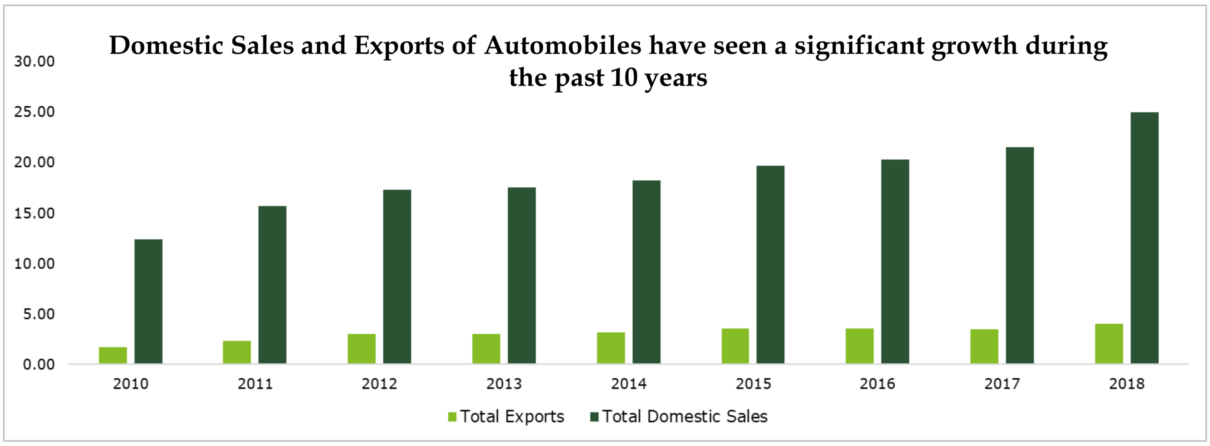
Source: Society of Indian Automobile

5.11.9.2.1.*Key supply centres*

There are three key automobiles production clusters in India with Manesar, Pune and Chennai being the major production hubs within the clusters located in northern, western, and southern part of the country respectively. The industry consensus is that Sanand in Gujarat will be the automobile cluster of the future replacing Pune with several automakers having made plans to develop and operate new facilities. At the same time, a few plants are also located in Kolkata to cater to the limited demand from eastern part of the country.

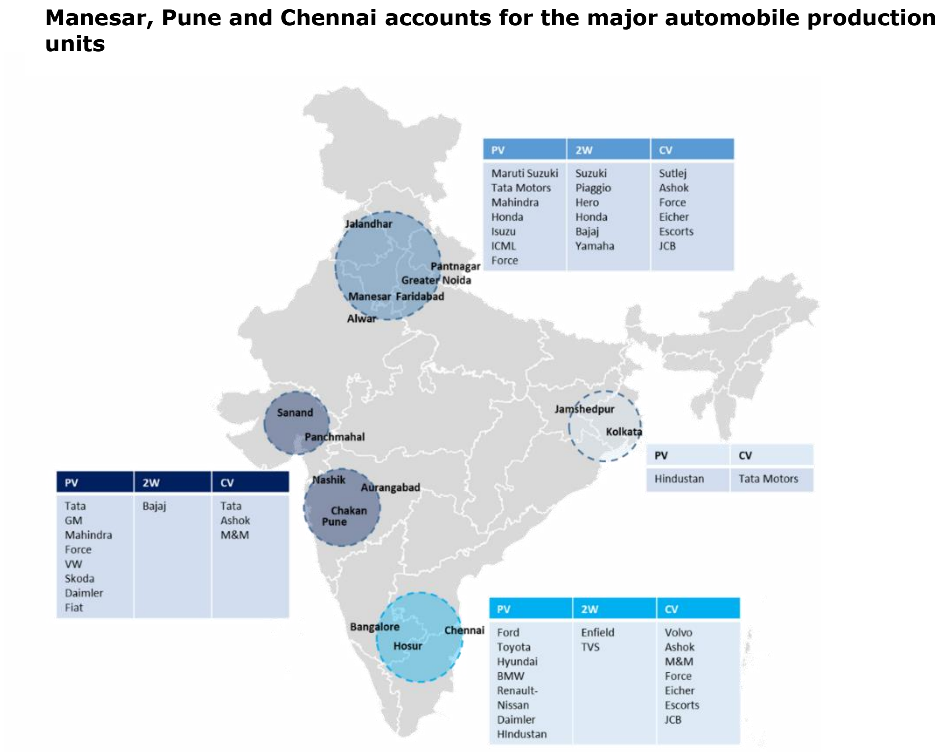
Further, it is understood that because of the proximity of these clusters to ports, rail is unable to compete for export traffic for automobiles, therefore rail transportation majorly caters to movement of automobiles accounting for domestic sales.

Figure 5-166. Domestic Sales and Exports of Automobiles (in million units)



Source: Society of Indian Automobile Manufacturers (SIAM)b

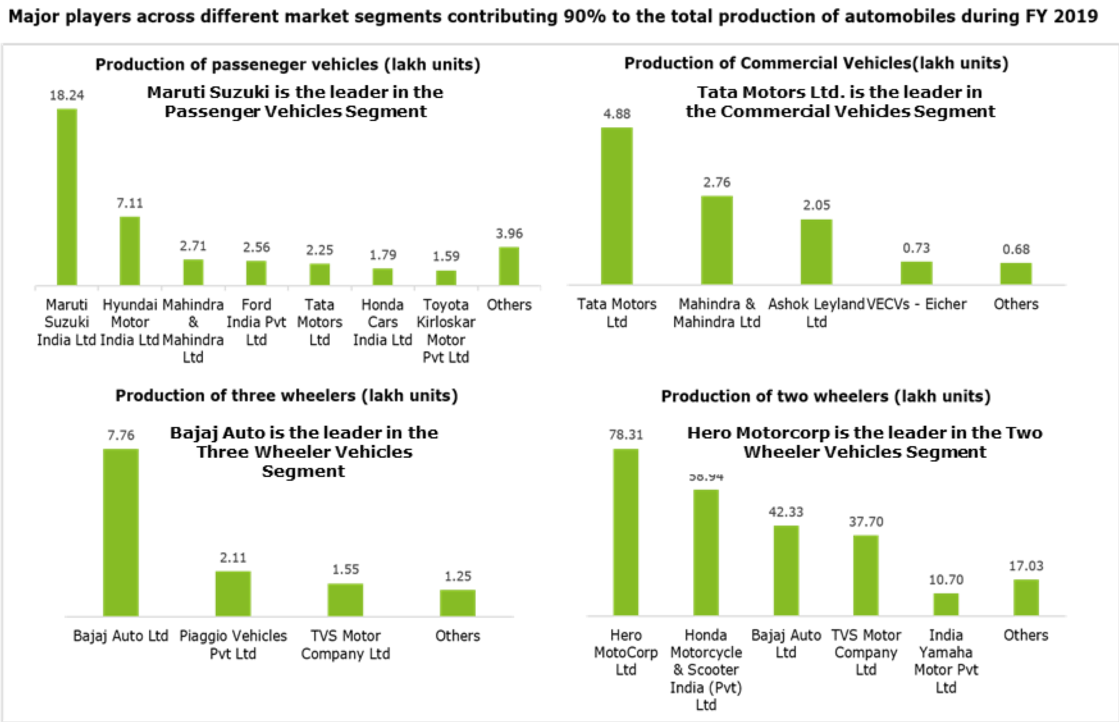
Figure 5-167. Key Automobile Production Clusters



Source: Secondary Research, Industry Consultations, Consultant Analysis

The major players who contribute 90% of the total production of automobiles in India in their respective segments are presented below:

Figure 5-168: Automobile Production by major players across key segments (in lakh units)



Source: Society of Indian Automobile Manufacturers (SIAM)

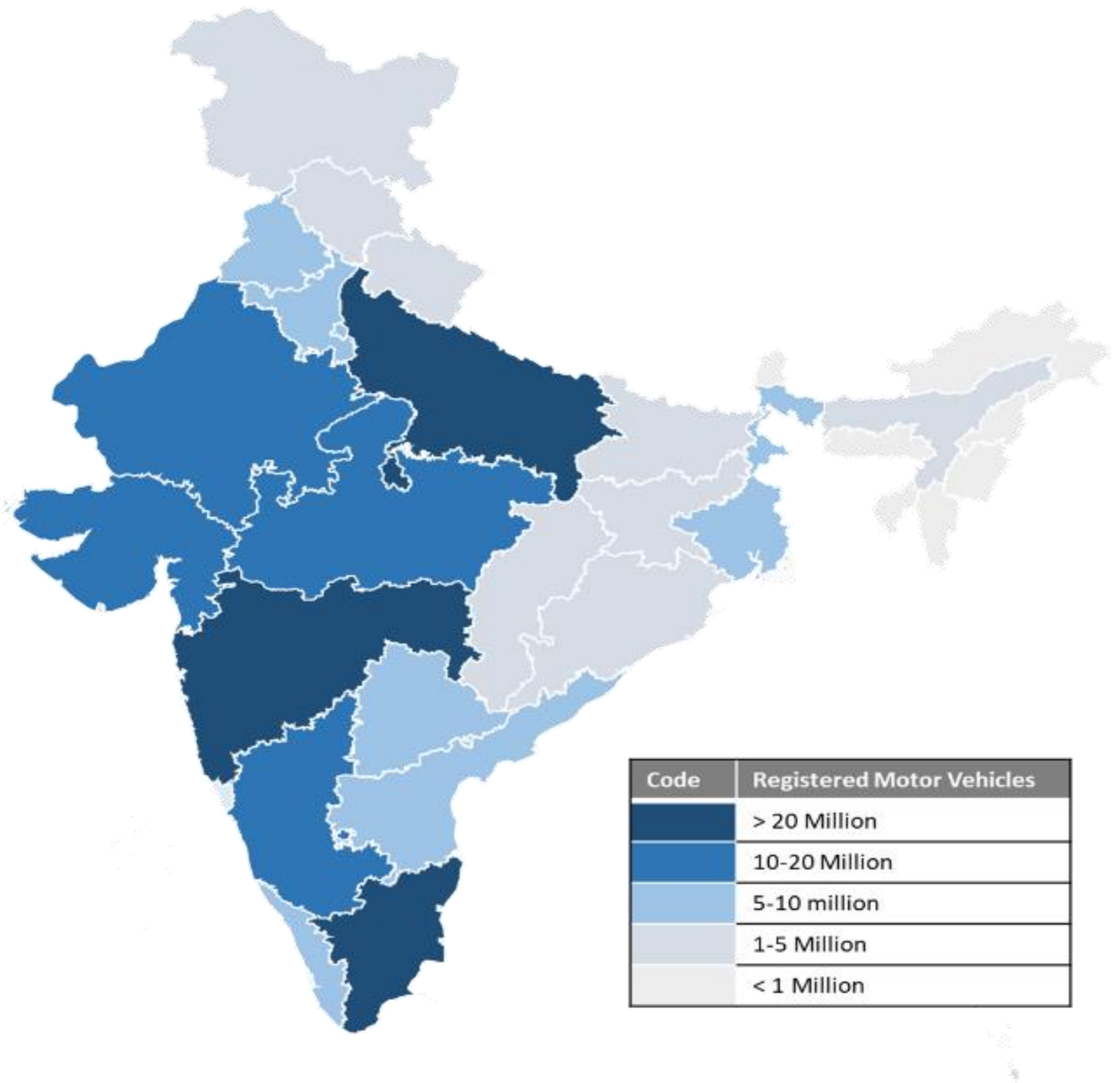
Maruti Suzuki is the market leader in passenger vehicle segment capturing ~50% of the market share in FY 2019 and majorly dominates the production in northern part of the country. Similarly, Tata Motors in commercial vehicles segment and Bajaj Auto in three-wheeler segment have constituted market shares of ~43% and ~61% respectively. Hero MotoCorp Ltd and Honda Motorcycle & Scooter India (Pvt.) Ltd. together constituted ~53% of the production of two wheelers in India during FY 2019 and both have their production units in the north.

5.11.9.2.2.*Consumption patterns*

The motor vehicles' registration data reflects that automobiles sales are concentrated in Western, Central and Southern part of the country with Maharashtra, Uttar Pradesh and Tamil Nadu being the major markets.

Figure 5-169. Number of motor vehicles registered across the country

UP, Maharashtra and Tamil Nadu have the maximum number of registered motor vehicles



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5.11.9.3. Non-Ferrous Metals and Ores

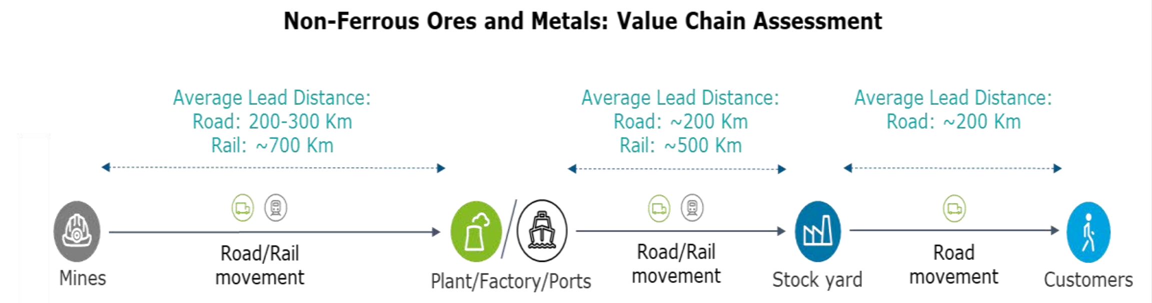
Total production of non-ferrous metals in India stood at ~7.5112 MT in FY 2018[113], a 12% increase from the previous year. Aluminium, copper, lead and zinc are the major non-ferrous metals that together constitute more than 75% of the total production. In addition to these, cadmium, tin and cobalt are produced in very limited quantities.

The epicentre for production of non-ferrous metals are ores/mines and production plants, which are often located in the close vicinity. The Eastern states of India are the key production centres for non-ferrous metals.

[112] This also includes production of ferrous alloys, which involves contribution of metals in certain proportion.
[113] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part II: Metals & Alloys Reviews), 57th Edition. Government of India. Nagpur

While average lead distance for rail transportation for metals is 500 km, transportation of non-ferrous ores from mines to production plants has experienced an average lead of ~700 km during FY 2018. This further varies for different ores with rail leads ranging from 120 km for zinc ore to 1650 km for Beryl ore during FY 2018. At the same time, road is an optimal mode for transportation

Figure 5-170. Value chain assessment for non-ferrous metals and ores



Source: Indian Minerals Yearbook, 2018

for routes with shorter leads of 200-300 km.

The production of ores required for fabrication of major non-ferrous metals was reported as 38.6 MT during FY 2018[114]. This includes bauxite ore, copper ore, lead ore and zinc ore required for production of aluminium, copper, lead and zinc respectively.

In FY 2018, the movement of non-ferrous metals on rail was ~6.5 MT, which provides railways a significant modal share of more than 85% in this commodity segment. However, the non-ferrous ores sector is dominated by road transportation with only ~4% of the total production moved by rail during FY 2018[115]. Herein, mainly bauxite ore is moved by rail, which constituted ~33% modal share of the commodity during FY 2018. At the same, zinc ore had a minor share in rail movement (0.06%) during the same period.

[114] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part II: Metals & Alloys Reviews), 57th Edition. Government of India. Nagpur

[115] Indian Bureau of Mines (IBM) – Please note production of cement, limestone, coal, petroleum, natural gas, precious stones and other dimensional stones are excluded from total production of non-ferrous minerals and have been separately assessed in detail. This also excludes production for some minerals/ores for which data is not reported to IBM. Precious stones have been excluded from analysis as they are not expected to have potential movement by rail.

Figure 5-171: Production of non-ferrous metals and Ores FY 2018

Source: Indian Minerals Yearbook, 2018

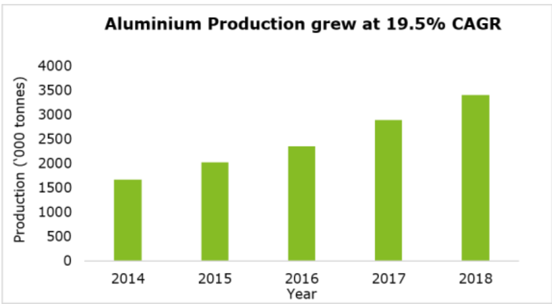
There are other ores such as manganese ore, beryl ore and chromite ore for which rail movement constituted 38.87%, 4.87% and 2.19% share of total production of the respective ores in FY 2018.

5.11.9.4. Aluminium

During FY 2018, the production of aluminium stood at 3.4116 MT growing at a CAGR of 19.5% over the last 5 years. Four major players including NALCO, BALCO, HINDALCO and Vedanta dominate the sector with HINDALCO being the highest contributor to the overall production of aluminium in India with 38% of the total.

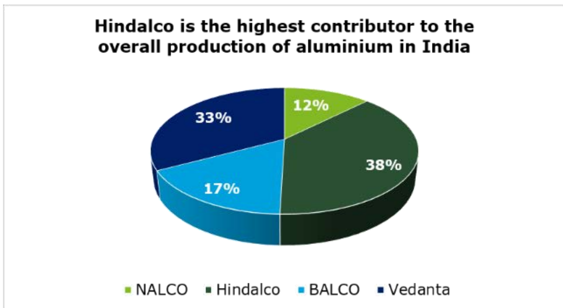
The total installed capacity of aluminium plants in India was observed to be 4.06 MT during FY 2018 with Odisha being the leader at ~69% of the total capacity. The

Figure 5-173. Aluminium Production ('000 tonnes)



Source: Indian Minerals Yearbook, 2018

Figure 5-173 Share in Aluminium Production (%)



Source: Indian Minerals Yearbook, 2018

state is also the leading producer of aluminium with ~61% contribution to the total production during FY 2018 followed by Chhattisgarh (17%), Uttar Pradesh (12%) and Madhya Pradesh (10%).

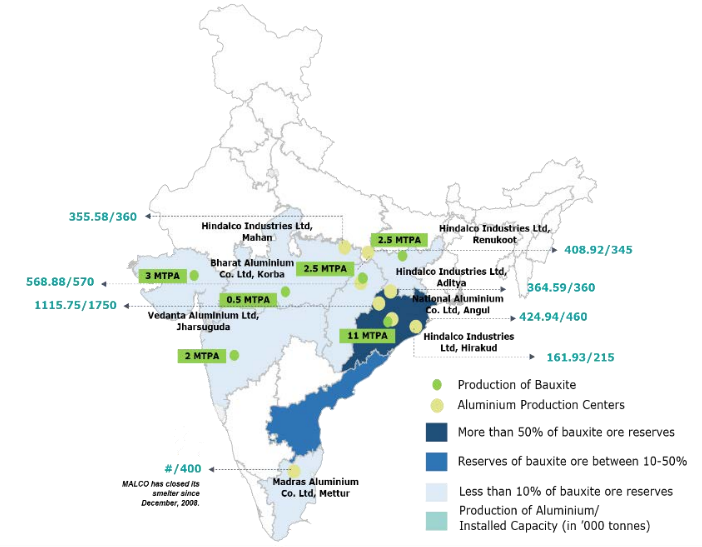
Furthermore, Odisha accounted for 51% of the total production of bauxite during FY 2018, which is the principle raw material for the production of aluminium. In fact, aluminium accounted for 90% share of total consumption of bauxite ore during FY 2018.

[116] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part II: Metals & Alloys Reviews), 57th Edition. Government of India. Nagpur

The production of bauxite stood at 22.3 MT during FY 2018, growing at a CAGR of 8.6% over the last seven years. NALCO is the major producer of bauxite with Panchpatmali bauxite mines contributed 32% to the total production of bauxite in India during FY 2018.

The production of one tonne of aluminium requires about 7x the throughput of bauxite ore which results in total 8x throughput's transportation requirement. It is also witnessed that 33% of the total production of bauxite was transported by rail during FY 2018. However, most of the aluminium smelters are located near their respective bauxite ores, thereby, saving time and cost of transportation for movement of ores from mines to production plants.

Figure 5-174. Bauxite Reserves and Aluminium Production Centres



Source: Indian Minerals Yearbook, 2018

With respect to external trade, India was a net exporter of aluminium (inclusive of scrap) and bauxite during FY 2018. The country had 2.01 MT of exports and 1.96 MT of imports during FY 2018. In case of bauxite ore, the domestic consumption and exports of bauxite were for 20.34 MT and 1.5 MT respectively and the imports were for 1.46 MT.

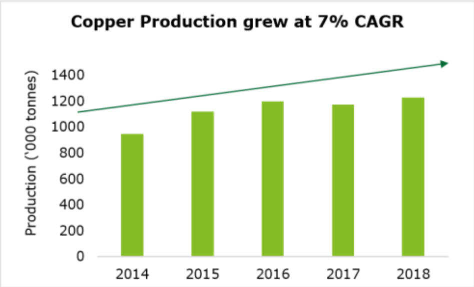
The primary sectors that consume aluminium include the electrical sector (48%), followed by automobile and transport sector (15%), construction sector (13%), consumer durables sector (7%), machinery & equipment sector (7%), packaging sector (4%) and others (6%). This demand for aluminium is expected to grow at a CAGR of 18.9%[117] over the next 5 years from existing consumption levels.

5.11.9.5. Copper

During FY 2018, the production of copper stood at 1.2 MT[118] growing at a CAGR of ~7% over the last 5 years. The production is attributed to three major players HCL, HINDALCO and Vedanta with the latter two dominating the sector with respect to production of CCWR and copper cathodes.

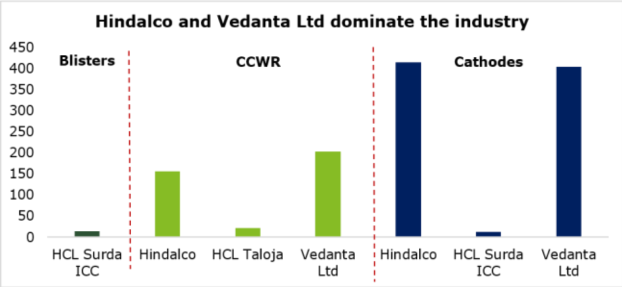
[117] Industry estimates
[118] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part II: Metals & Alloys Reviews), 57th Edition. Government of India. Nagpur

Figure 5-176. Copper Metal Production (FY18)



Source: Indian Minerals Yearbook, 2018

Figure 5-176. Plant-wise Production (by metal type)



Source: Indian Minerals Yearbook, 2018

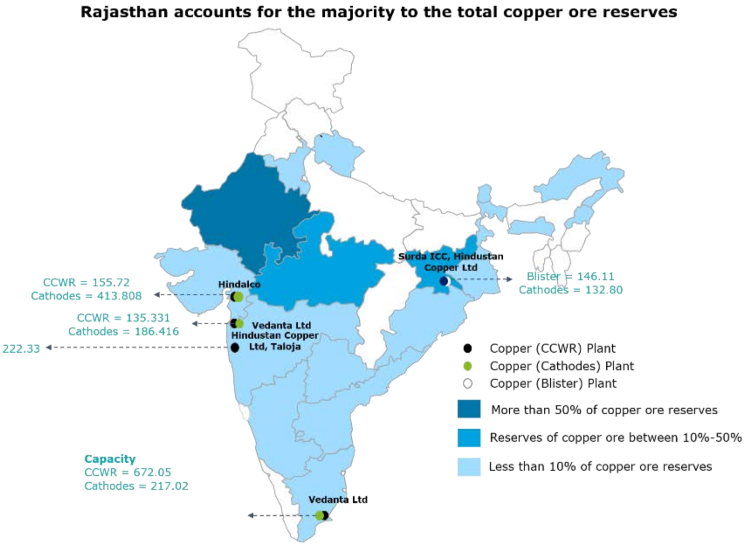
At the same time, the production of copper ore, the principle raw material for copper, stood at 3.84 MT in 2017-18. Over the last five years, year-on-year growth rate has witnessed a fluctuating trend with a falling growth rate in FY 2018.

The total reserves/resources of copper ore as on 1.4.2015 as per NMI database are estimated at 1.51 billion tonnes of which 86.25% comes under non-reserved category. Thus, the total metal content out of these copper resources is reported to be 9.43 MT[115]. Rajasthan, Jharkhand and Madhya Pradesh together constitute 92% of the total reserves/resources of copper in India with Rajasthan being the highest contributor with 53.81% to the total reserves.

The overall installed capacity of copper plants in India was observed to be ~1 MT[119] during FY 2018. Gujarat is the leading producer of copper with ~47% contribution to the total production during FY 2018 followed by Dadra & Nagar Haveli (26%), Tamil Nadu (23%), Jharkhand (2%) and Maharashtra (2%).

[119] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part II: Metals & Alloys Reviews), 57th Edition. Government of India. Nagpur

Figure 5-177. Production and Installed Capacity of Copper Plants



Source: Indian Minerals Yearbok 2018 (Part 2: Metals and Alloys), Indian Bureau of Mines, Government of India

The location of majority of reserves in the states of Rajasthan, Madhya Pradesh and Jharkhand indicates the need for transportation of raw materials to the production centers mainly concentrated in Gujarat, Maharashtra, and Tamil Nadu. This is further corroborated by the fact that metal content available in the reserves of producing states is not commensurate to the production levels of these states.

With respect to external trade, India was a net exporter of refined copper during FY 2018. The country had 0.37 MT of exports and 0.04 MT of imports during FY 2018. In case of copper ore, exports of copper ore accounted for 0.06 MT and the imports accounted for 1.49 MT.

The sectors that consume copper mainly include Electrical and Telecommunication (56%), followed by Transport (8%), Consumer Durables (7%), Building & Construction (7%), General Engineering goods (6%) and other industries including Process Industries (16%), as per estimate of ICSG. The demand for copper is expected to grow at 6-7%120 due to increased focus of government on its various schemes and programs.

5.11.9.6. Lead and Zinc

During FY 2018, the production of lead stood at 0.16 MT growing at a CAGR of ~8% over the last 5 years. Similarly, zinc metal production grew at a CAGR of ~1% over the last 5 years with total production for FY 2018 is witnessed as 0.79 MT. The total production for lead and zinc is attributed to only one private player, Hindustan Zinc Ltd. constituting 100% of the output for both primary lead and zinc ingot metal.

At the same time, the production of lead and zinc ore, the principle raw material for production of lead and zinc metals, stood at 12.6 MT during FY 2018 growing

[120] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part II: Metals & Alloys Reviews), 57th Edition. Government of India. Nagpur

at a CAGR of 8% over the last five years. The principle producer of lead and zinc ore in India is also Hindustan Zinc Ltd. in Rajasthan.

Figure 5-178. Lead Production (FY 2018)

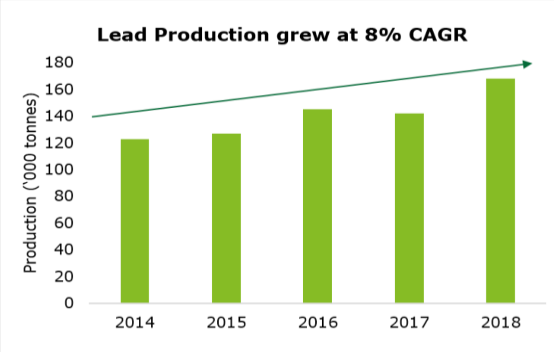
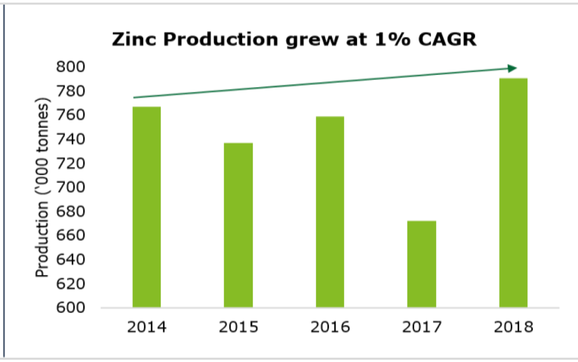


Figure 5-179. Zonv Production (FY 2018)



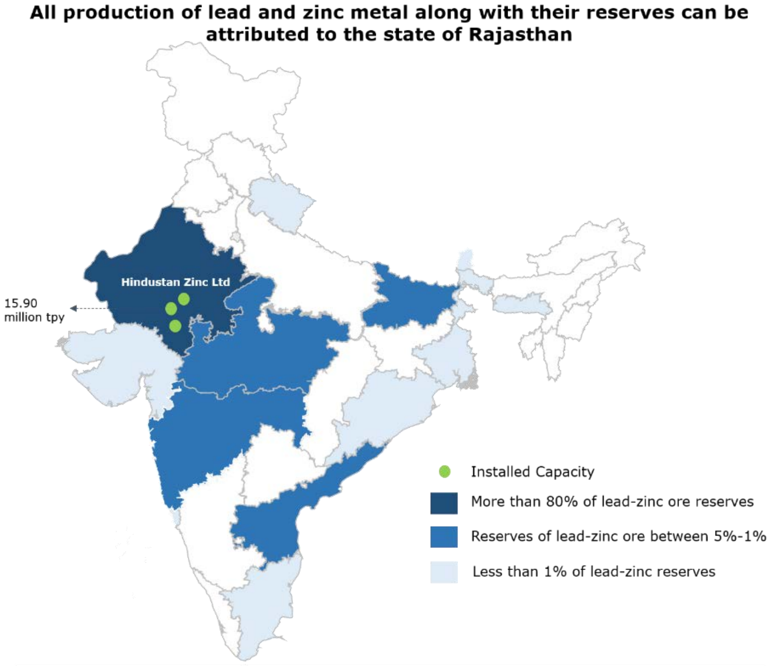
Source: Indian Minerals Yearbook, 2018

The total reserves/resources of lead and zinc ore as on 1.4.2015 as per NMI database based on UNFC system have been estimated at 749.46 MT. Out of this, 643.34 MT are available under non-reserved category. The average metal content of ore during FY 2018 was 1.77% for Lead and 6.56% for Zinc which translates to a total metal content in reserves/ resources of lead to be 13 MT and that of zinc to be 36.36 MT.

Rajasthan has the largest reserves/resources of lead-zinc ore amounting to 670.34 MT, which accounts for 89.44% of all known reserves in India. It is followed by Andhra Pradesh 22.69 MT (3.03%), Madhya Pradesh 14.84 MT (1.98%), Bihar 11.43 MT (1.52%) and Maharashtra 9.27 MT (1.24%).

All production of lead and zinc can also be attributed to the state of Rajasthan where Hindustan Zinc

Figure 5-180. Lead-Zinc Reserves and Production Plants (FY18)



Source: Indian Minerals Yearbook 2018 (Part 2: Metals and Alloys), Government of India, Ministry of Mines, Indian Bureau of Mines

Limited is the only producer of primary lead and primary zinc in 2017-18 due to shutdown of the operation of Edayar Zinc Limited (EZL). This indicates limited share available to be captured by rail as against highly competitive road transportation suitable for such shorter leads.

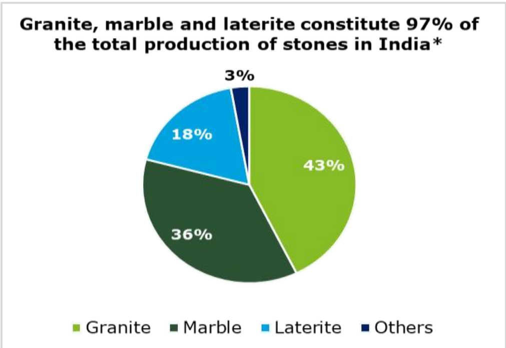
With respect to external trade, India was a net importer of lead during FY 2018, mostly in the form of lead-alloys and scrap. Imports of lead ores & concentrates decreased drastically by 64% to 2,220 tonnes in 2017-18 as compared to 6,217 tonnes in 2016-17. As for zinc, exports of zinc ores & concentrates decreased drastically by 98% year on year. In the case of zinc alloys and scrap, India was a net exporter with 2,86,979 tonnes of export compared to 1,91,601 tonnes of import during FY 2018.

The primary sector for Lead consumption is the Battery industry, which consumes more than 80% of all production, and the remaining 20% is consumed in pigments and compounds, rolled and extruded products, alloys, cable sheathing among other industries. The expected consumption is expected to be 1,63,435 tonnes in 2017-18. For zinc, galvanising industry is the major consumer of zinc with 56% share followed by coatings (16%), die-casting alloys (14%), oxides & chemicals (7%) and extruded products (6%). The apparent consumption of zinc is expected to be 6,50,755 tonnes in 2017-18.

5.11.9.7. Stones and Aggregates

Total production of major dimensional stones in India stood at 38.5121 MT during FY 2018 with granite, marble and laterite together constituting 97% of the total production. In addition to these, quartzite and slate are produced in limited quantities. Also, sandstone is another major dimensional stone available in abundance with reserves of more than 1,000122 MT in India. However, the production data of sandstone is not being reported in India.

Figure 5-181: Production share of stones (2017-18)



Source: Indian Minerals Yearbook, 2018

The epicentre for production of dimensional stones is ores/mines and production plants, which are often located in close vicinity.

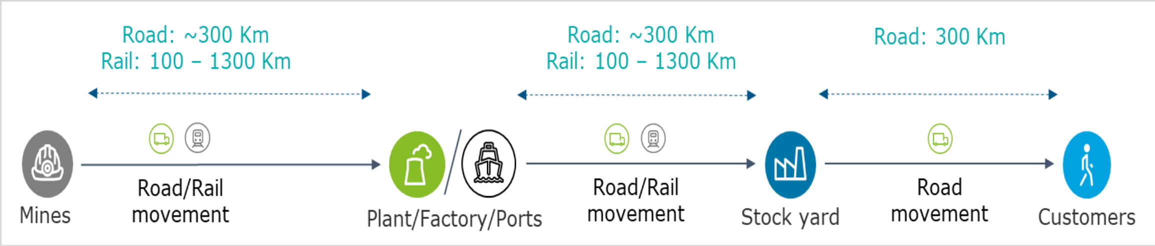
121 Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition. Government of India. Nagpur. It is to be noted that data is collected by IBM from the respective state governments and thereby can have the issue of non-completeness. Also, the production figure excludes limestone that has been analyzed separately as a raw material to its principle consuming industry i.e. cement

122 The Centre for Development of Stones (CDOS), a 'Government of Rajasthan Undertaking'

While lead distance for rail transportation ranged from ~100 km to ~1300[123] km during 2017-18, road is an optimal mode for transportation for routes with shorter leads of 300-400 km in majority of the cases.

In FY 2018, the movement of stones on rail was ~12124 MT, which provides railways a modal share of more than 30% in this commodity segment.

Figure 5-182. Value Chain Assessment for dimensional stones



5.11.9.7.1. *Major dimensional stones and their production during FY 2018*

During FY 2018, the production of granite stood at 16.45125 MT with Rajasthan being the leading producer having a share of 51% followed by Telangana (20%), Andhra Pradesh (19%) and others (10%).

At the same time, the production of marble stood at 14.03 MT with the state of Rajasthan again being the leader having a share of 94%.

For laterite, the production stood at 6.9 MT having grown at a CAGR of 19% over the last 5 years. Andhra Pradesh is the leading state to produce laterite having a share of 48% followed by Telangana (43%), Maharashtra (6%) and others (3%).

5.11.9.7.2. *Major dimensional stones and their reserve capacity*

The total reserves/resources of granite, marble and laterite under non-reserved category, as on 1.4.2015 as per NMI database, are estimated at 46,056 million cubic meters, ~1940 MT and ~581 MT respectively.

Herein, Rajasthan, Karnataka, Jharkhand and Gujarat together constitute ~80% of the total reserves/resources of granite in India. Rajasthan, Jammu & Kashmir, Gujarat and Chhattisgarh together constitute 94% of the total reserves/resources of marble in India with Rajasthan being the major state holding 63% of the total reserves.

Madhya Pradesh and Rajasthan are the principle states together constituting 72% of the total reserves of laterite in India.

[123] Center for Rail Information Systems FOIS Data, 2018, Indian Railways, Delhi
[124] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition. Government of India. Nagpur; Consultant Analysis
[125] Indian Bureau of Mines, Minstry of Mines (2018). Indian Minerals Year Book 2018 (Part III: Mineral Reviews), 57th Edition. Government of India. Nagpur.

5.11.9.8. Projections of potential transport demand

5.11.9.8.1. *Automobiles*

During FY 2018, the total production of automobiles in India stood at 28.2 million units. The demand for the industry is mainly driven by two-wheelers segment which constitutes about 80% of the total automobile unit sales in the country.

Automobile demand was projected with reference to correlation/elasticities with various macro-economic indicators like real Gross Domestic Product (GDP), real interest rate, index of industrial production, investments in infrastructure, private final consumption expenditure, and total final consumption expenditure etc. Key mega trends like recent industry slow-down, push for electric vehicles and technology changes which are likely to impact the automobile demand were also analysed to calibrate Projections across various categories viz. passenger vehicles, commercial vehicles, three-wheelers and two wheelers.

Automobile Projections: Key Assumptions, Inputs and Data Sources

- Macro-Economic Indicators evaluated: Real Gross Domestic Product (GDP), Real Interest Rate, Index of Industrial Production (IIP), Investments in Infrastructure, Private Final Consumption Expenditure, and Total Final Consumption Expenditure
- Preferred Indicators (Elasticity Coefficients):
  - Passenger Vehicles: Real GDP (0.44), Private Final Consumption Expenditure (1.03), Real Interest Rate (-2.71)
  - Commercial Vehicles: Real GDP (0.89), Real Interest Rate (-4.01)
  - Three Wheelers: Real GDP (0.73)
  - Two-Wheelers: Private Final Consumption Expenditure (2.36)
- OECD GDP growth Projections[126] were adopted for assessing future Real GDP growth
- Private Final Consumption Expenditure and Real Interest Rate trends sourced from World Bank database[127]. In the absence of forecasts, the historical growth pattern was assumed to continue in future, which resulted in a CAGR of 1.84% for Private final consumption expenditure and -0.63% for Real Interest rate

[126] Organisation for Economic Co-operation and Development (OECD). Real GDP forecast (indicator). doi: 10.1787/1f84150b-en. https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September 2019

[127] The World Bank. (various dates). Private Final Consumption Expenditure and Real Interest Rate trends, The World Band Database at https://data.worldbank.org/ accessed in August/September 2019

The projected volumes for each of the four auto categories are presented below:

Figure 5-183. Passenger Vehicles Projections (in MTs) under different scenarios (2020-2030)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	3.82	3.99	4.17	4.34	4.51	4.68	4.87	5.06	5.26	5.47	5.69
Realistic	3.41	3.35	3.36	3.42	3.5	3.6	3.71	3.82	3.94	4.08	4.22
Pessimistic	3.08	2.66	2.43	2.31	2.26	2.26	2.29	2.34	2.4	2.48	2.57

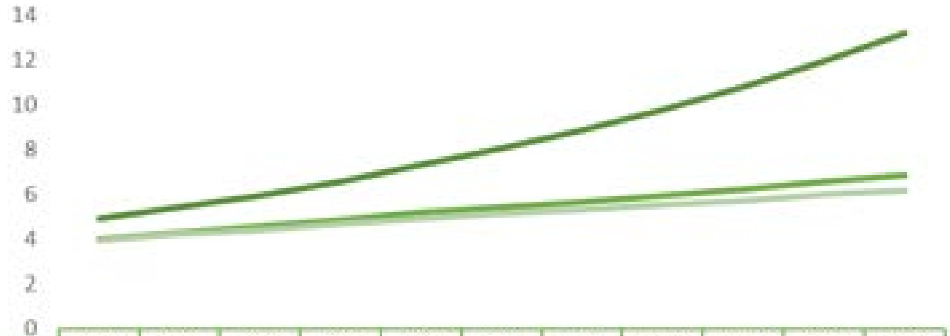
Optimistic Realistic Pessimistic

Figure 5-184. Passenger Vehicles Projections (in MTs) under different scenarios (2030-2050)

	2030	2035	2040	2045	2050
Optimistic	5.69	6.79	7.94	9.14	10.39
Realistic	4.22	4.92	5.66	6.3	6.95
Pessimistic	2.57	3.04	3.55	3.97	4.41

Optimistic Realistic Pessimistic

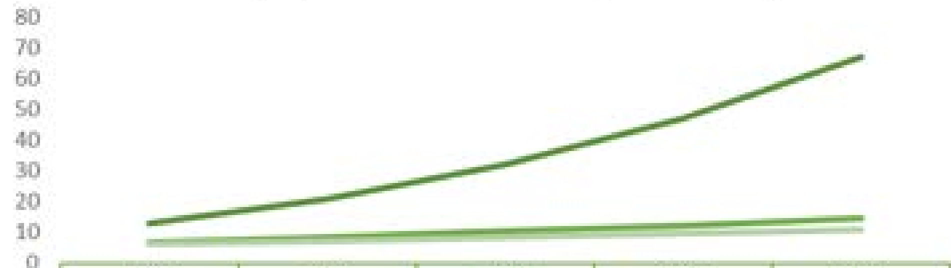
Figure 5-185. Commercial Vehicle Projections (in MTs) under different scenarios (2020-2030)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	4.92	5.42	5.96	6.6	7.32	8.06	8.86	9.79	10.81	11.95	13.2
Realistic	4.04	4.33	4.58	4.88	5.19	5.44	5.69	5.97	6.26	6.57	6.88
Pessimistic	3.98	4.22	4.43	4.69	4.94	5.14	5.32	5.54	5.76	5.99	6.21

Optimistic Realistic Pessimistic

Figure 5-186. Commercial Vehicle Projections (in MTs) under different scenarios (2030-2050)



	2030	2035	2040	2045	2050
Optimistic	13.2	21.08	32.13	47.12	66.94
Realistic	6.88	8.55	10.4	12.33	14.49
Pessimistic	6.21	7.38	8.56	9.66	10.81

Optimistic Realistic Pessimistic

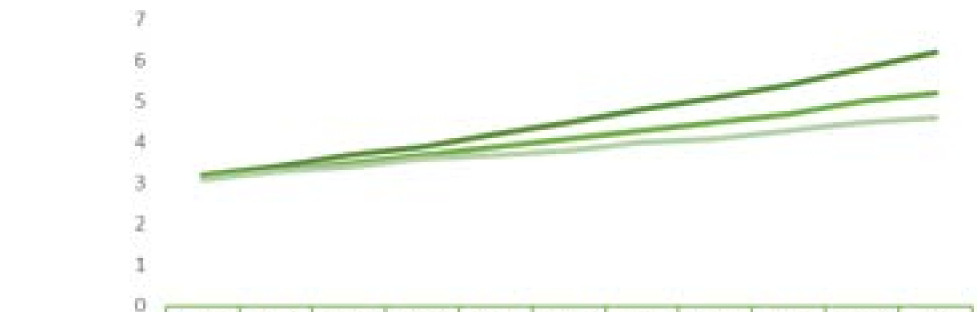
Figure 5-187. Three Wheelers Projections (in MTs) under different scenarios (2020-2030)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	0.5	0.54	0.57	0.61	0.64	0.69	0.73	0.77	0.83	0.88	0.95
Realistic	0.48	0.51	0.53	0.56	0.58	0.61	0.63	0.66	0.7	0.73	0.76
Pessimistic	0.47	0.5	0.52	0.54	0.56	0.59	0.6	0.63	0.66	0.68	0.71

Figure 5-189. Three Wheelers Projections (in MTs) under different scenarios (2030-2050)

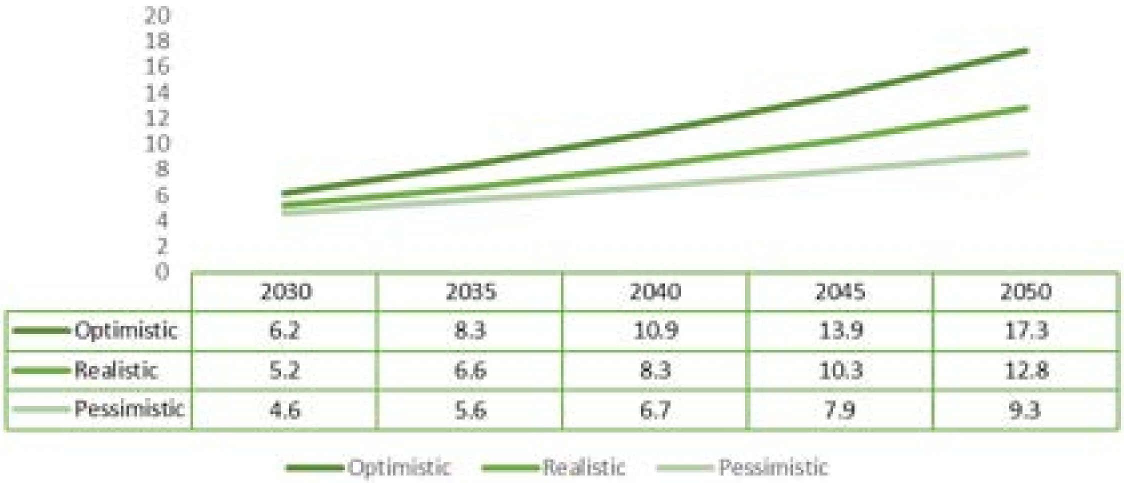
	2030	2035	2040	2045	2050
Optimistic	0.95	1.27	1.68	2.15	2.72
Realistic	0.76	0.92	1.1	1.29	1.49
Pessimistic	0.71	0.83	0.96	1.08	1.21

Figure 5-188. Two Wheelers Projections (in MTs) under different scenarios (2020-2030)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	3.2	3.4	3.7	3.9	4.2	4.5	4.8	5.1	5.4	5.8	6.2
Realistic	3.2	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	5	5.2
Pessimistic	3.1	3.3	3.4	3.6	3.7	3.8	4	4.1	4.3	4.5	4.6

Figure 5-190. Two Wheelers Projections (in MTs) under different scenarios (2030-2050)



	2030	2035	2040	2045	2050
Optimistic	6.2	8.3	10.9	13.9	17.3
Realistic	5.2	6.6	8.3	10.3	12.8
Pessimistic	4.6	5.6	6.7	7.9	9.3

5.11.9.8.2.<u>Non-ferrous metals and ores</u>

Four metals viz. aluminium, copper, lead and zinc, constituted more than 75% of the 5.62 MT metal production in India. The major consuming sectors for these metals include Electronic and Telecommunication, Automobile and Transport, Construction, Consumer Durables, Machinery and Equipment industries.

Macroeconomic factors such as real Gross Domestic Product (GDP) and Index of Industrial Production (IIP), formed the main basis for future projections and corresponding correlations and elasticities were assessed. The corresponding Ore production requirement for each of these metals was estimated with reference to respective ore's utilization factors in metal production.

Non-Ferrous Metals and Ores Projections: Key Assumptions, Inputs and Data Sources

- Macro-Economic Indicators evaluated: Real Gross Domestic Product (GDP), and Index of Industrial Production (IIP)
- Preferred Indicators (Elasticity Coefficients):
    - Aluminum: Real GDP (1.10)
    - Bauxite: Real GDP (1.10)
    - Copper : Real GDP (1.06)
    - Copper Ore: Real GDP (1.06)
    - Lead: Real GDP (1.17)
    - Zinc: Real GDP (0.96)
    - Lead and Zinc Ore: Real GDP (1.17)
- OECD GDP growth Projections[128] were adopted for assessing future Real GDP growth
- Ore utilization factors indicates amount of ore required to produce one tonne of metal. Utilization factor was estimated based on past consumption trends which were assumed to prevail in future. Ore utilization factor was estimated at 15.95

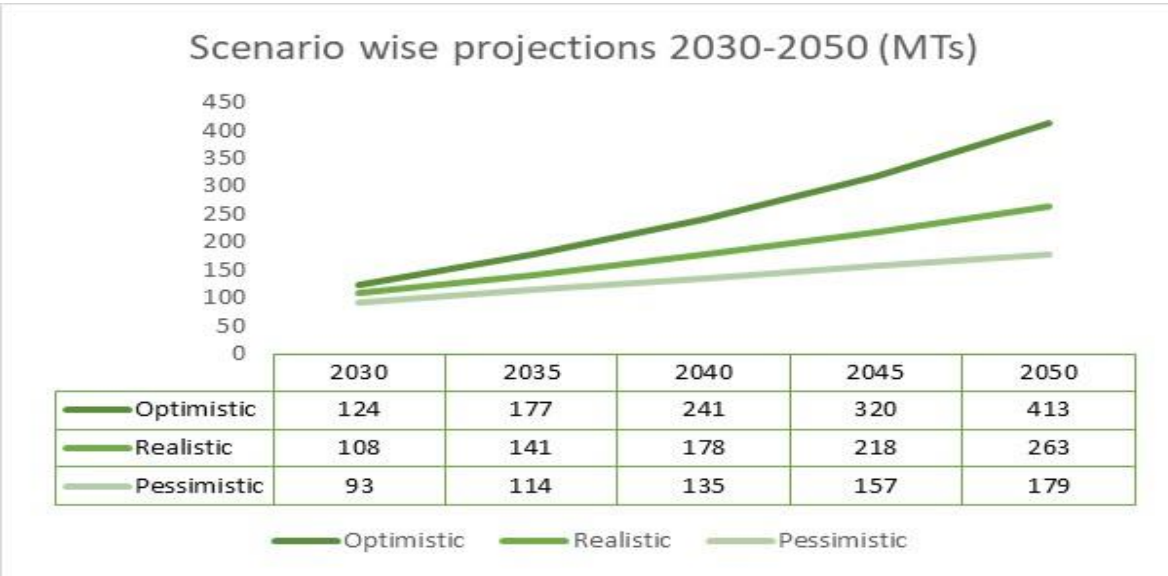
[128] Organisation for Economic Co-operation and Development (OECD). Real GDP forecast (indicator). doi: 10.1787/1f84150b-en. https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September 2019

for Lead & Zinc, 4.07 for Copper, 3.25 for bauxite to alumina and 2 for alumina to aluminum

The cumulative Projections for non-ferrous metals and respective ores is presented below:

Figure 5-191. Non-Ferrous metals and ores projections (in MT) under different scenarios (2020-2030)

Figure 5-192. Non-Ferrous metals and ores projections (in MT) under different scenarios (2030-2050)



5.11.9.8.3. *Stones and aggregates*

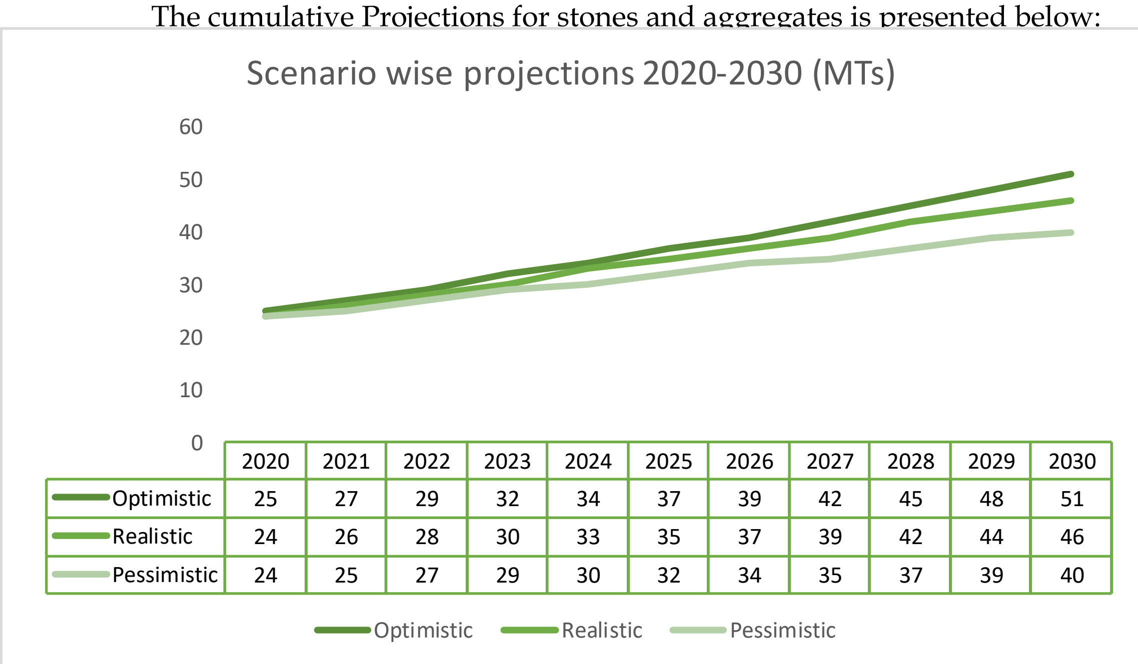
Study team's analysis revealed that two stones groups- laterite and marble, constituted 54% of total production. During FY 2018, the cumulative production of these two commodities was ~20 MT, growing at a CAGR of about 7% since 2011. Granite and sandstone are other two significant stones, available in abundance across India. However, Projections could not be made for these two stone groups, mainly due to lack of adequate data availability.

Past production trends for laterite and marble correlated with real Gross Domestic Product (GDP) growth. Accordingly, production were made by referencing future GDP growth trend and corresponding elasticity.

Stones and Aggregates Projections: Key Assumptions, Inputs and Data Sources

- Macro-Economic Indicators evaluated: Real Gross Domestic Product (GDP)
- Preferred Indicators (Elasticity Coefficients):
  - Marble: Real GDP (0.87)
  - Laterite: Real GDP (1.29)
- OECD GDP growth Projections[129] were adopted for assessing future Real GDP growth

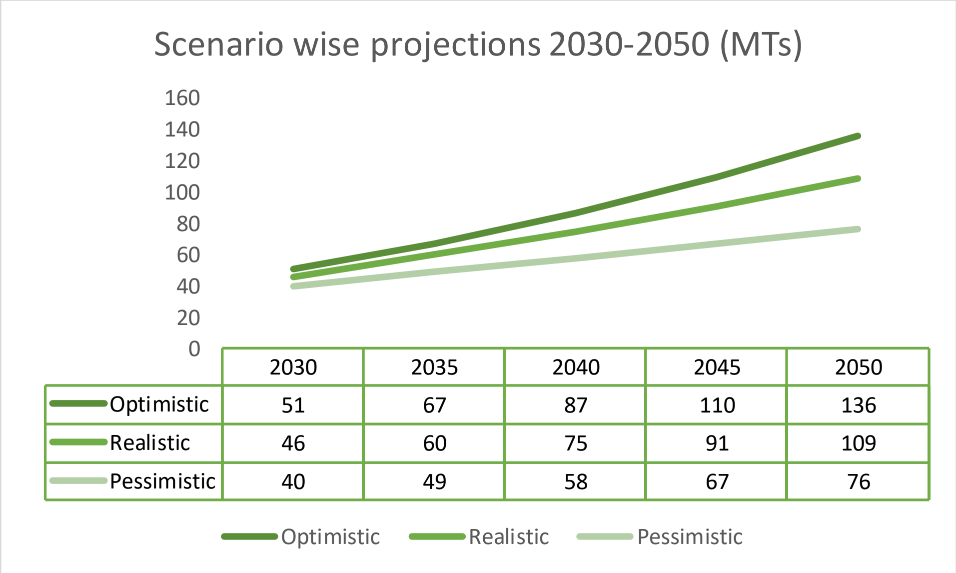
The cumulative Projections for stones and aggregates is presented below:



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	25	27	29	32	34	37	39	42	45	48	51
Realistic	24	26	28	30	33	35	37	39	42	44	46
Pessimistic	24	25	27	29	30	32	34	35	37	39	40

[129] Organisation for Economic Co-operation and Development (OECD). Real GDP forecast (indicator). doi: 10.1787/1f84150b-en. https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September 2019

Figure 5-194. Stones and Aggregates Projections (in MT) under different scenarios (2030-2050)



	2030	2035	2040	2045	2050
Optimistic	51	67	87	110	136
Realistic	46	60	75	91	109
Pessimistic	40	49	58	67	76

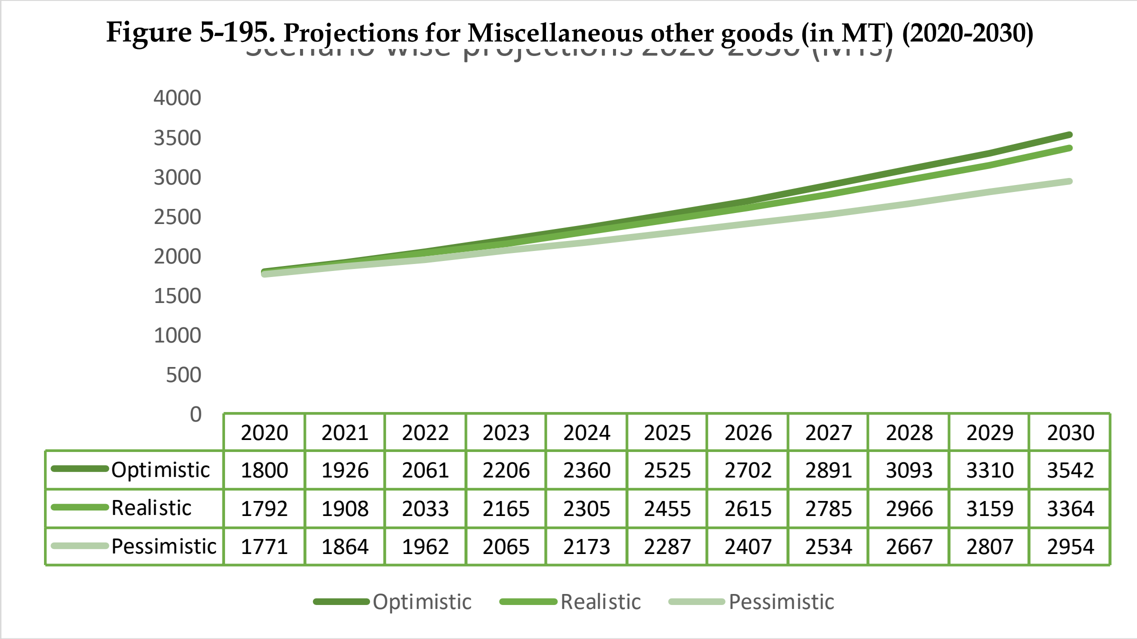
5.11.9.8.4. *Miscellaneous Other Goods (2020-2030)*

This sub segment represents an extremely large and disjointed bouquet of goods. Accordingly, in order to project future volumes, an analysis of the difference in current cumulative movement[130] across various modes and above listed commodity wise volume estimates was computed. This difference formed the total "Miscellaneous other Goods" volume for the base year. This volume was extrapolated in line with GDP growth to project future volumes for various time horizons.

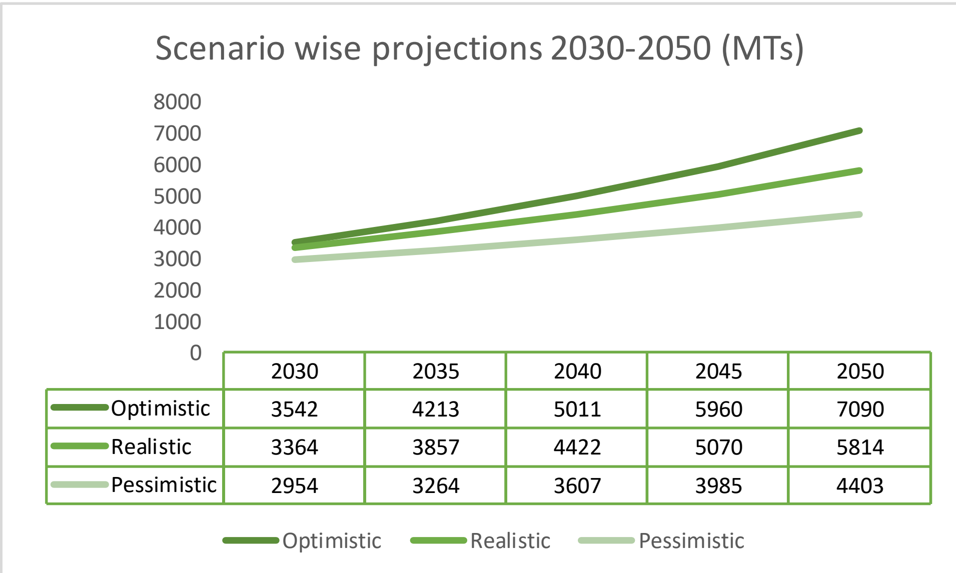
[130] Source: Centre For Rail Information Systems FOIS Data,2018, Indian Railways, Delhi; Primary Road Surveys by AECOM; Consultant Analysis; Primary Road Surveys by AECOM; Ministry of Shipping. (Various Dates), IWAI and IPA statistics, Government of India. Delhi

The scenario wise volume Projections are presented below:

Figure 5-195. Projections for Miscellaneous other goods (in MT) (2020-2030)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Optimistic	1800	1926	2061	2206	2360	2525	2702	2891	3093	3310	3542
Realistic	1792	1908	2033	2165	2305	2455	2615	2785	2966	3159	3364
Pessimistic	1771	1864	1962	2065	2173	2287	2407	2534	2667	2807	2954



	2030	2035	2040	2045	2050
Optimistic	3542	4213	5011	5960	7090
Realistic	3364	3857	4422	5070	5814
Pessimistic	2954	3264	3607	3985	4403

Regional allocation of origination and consumption of Balance Other Goods - Existing Freight Flow data for base year, gathered from primary road surveys, rail movement data and other sources, was extrapolated on existing pattern to estimate corresponding district wise origins and destinations for Projections period.

The allocated production and attraction centres for Balance Other Goods in 2030 are presented below:

Figure 5-198. Balance Other Goods production centres (2030)

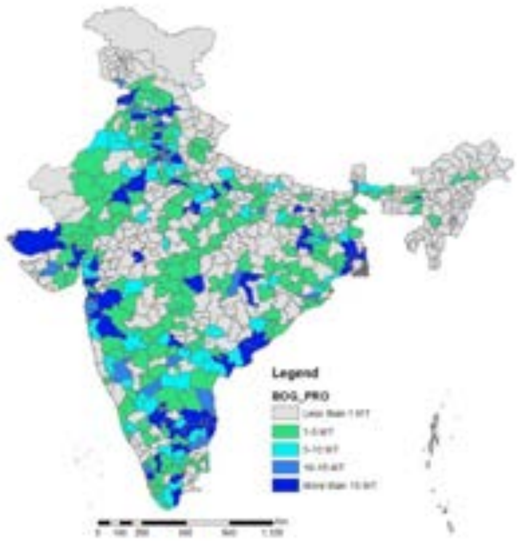
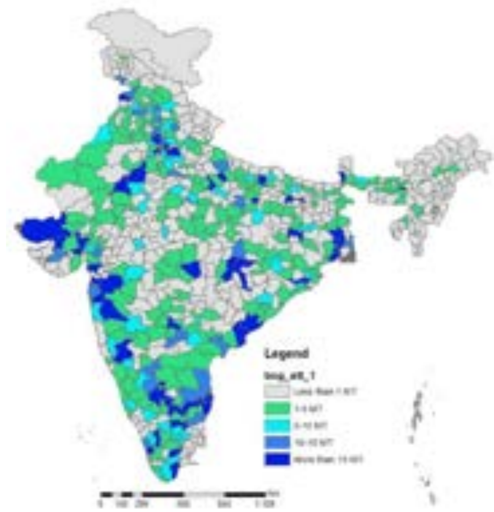


Figure 5-197. Balance Other Goods attraction centres (2030)



5.11.9.9. Extant rail modal share and logistics competitiveness

5.11.9.10. Automobiles

IR Modal Share: As mentioned earlier, railways has always maintained a small share of the automobile segment, with less than 7% share in FY 2018. The share has however increased steadily over the years, providing scope for expansion of rail's modal share in this fast-growing segment.

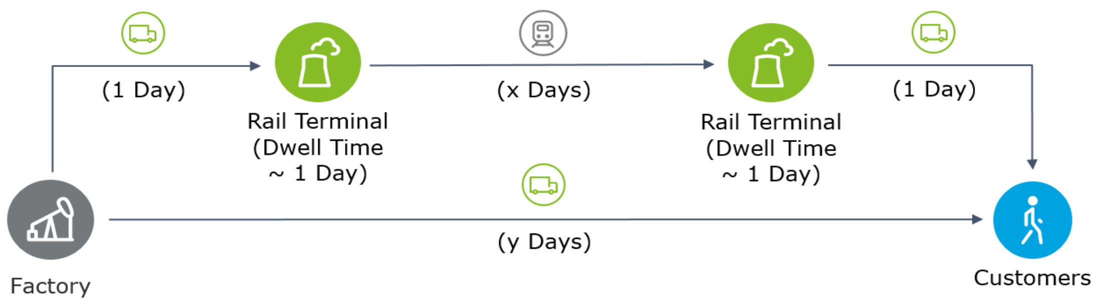
IR Cost Competitiveness: Based on industry reports, it is understood that road transportation has been able to capture the automobile movement market by providing shorter transit times than railways, which provides the benefits of both time and cost. However, with the average lead distance of automobile movement being ~1800 km, rail transportation is understood to become economical for the same route given its competitive haulage charges on longer routes.

At the same time, it is further highlighted that the movement of automobiles via rail adds an additional element of handling and holding time delays at the origin and destination rail terminals, which indirectly leads to cost escalations as well. The cost advantage is also eroded due to addition of first mile, and last mile costs to the haulage charges making the end-to-end logistics costs higher than road in most cases.

The following example exhibits that rail lags in transit time due to addition of holding time at terminals at both ends of the value chain.

Figure 5-199. Automobile Value Chain with Transit Times

Road offers competitive times on all routes



Routes	Rail Transit Time		Total Rail Transit Time	Total Road Transit Time (Y)
	Handling Time	Transit Time (X)		
Delhi – Guwahati	4	5	**9**	**7**
Delhi – Nagpur	4	3	**7**	**4**
Delhi – Ahmedabad	4	2	**6**	**4**
*Penalties of a min Rs 150 per day of late delivery				

Source: Consultant Analysis

5.11.9.11. Stones and Aggregates

Location of majority of reserves in close vicinity of production centers make road a more competitive mode of transportation as compared to rail. However, stones movement by rail has been observed even for the lead distances ranging between 100-400 km during FY 2018, in some of the cases.

5.11.10.Strategies for Increasing Rail Share

Domestic other goods together constitute the largest cargo segment with (~40%) share of freight ecosystem but remains least penetrated (less than 4%[131] modal share) by rail. Based on economic development and traffic projections made in this study, healthy growth is expected in this segment with total output expected to be 3500 MT in 2030. Thus, domestic other goods segment presents itself as the largest target segment for railways to gain significant modal share.

The logistics requirements of this segment are unique when compared to those of other rail-friendly commodities. Various commodity types from different industries make up the commodity basket and require a logistics product based on their unique logistics requirements. These requirements can broadly vary based on:

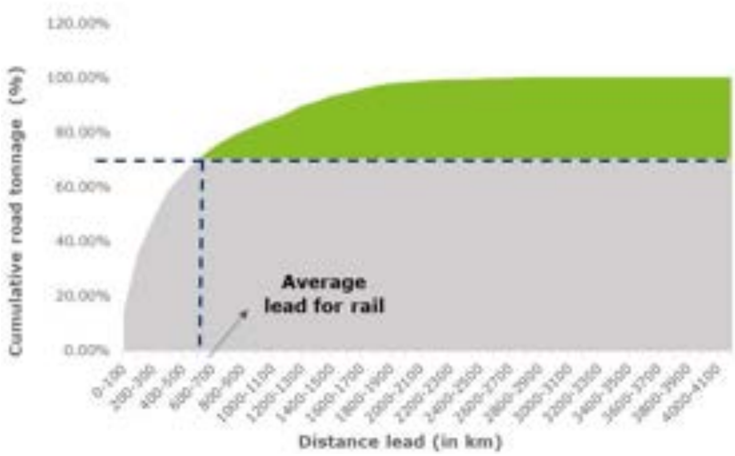
(a) Nature of cargo (Liquid, Break-Bulk, Bulk)
(b) Lead

[131] Centre For Rail Information Systems FOIS Data,2018, Indian Railways, Delhi; Primary Road Surveys by AECOM; Consultant Analysis

(c) Parcel Size (varying from small to large, with a need to target small parcels to attract greater rail share)
(d) Time Sensitivity (varying from high to low, with a need to target more reliable transit to attract greater rail share)

Rolling stock designs are impacted by nature of cargo: The nature of cargo has a bearing on the type of wagon that would be required for transportation of the commodity on rail. Liquid cargo and automobiles generally require special wagons, while break-bulk and bulk commodities require different kind of wagons. Besides special wagons targeted for commodities, such as tanks for liquid cargo, auto carriers, etc., containerisation of cargo in this sector is perhaps the most effective strategy to attract greater cargo volumes on rail.

Figure 5-200. Cumulative road tonnage over different leads

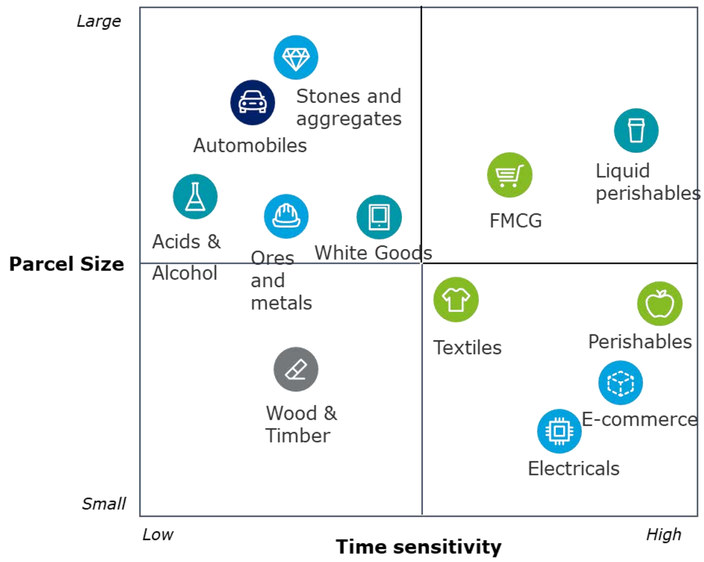


Leveraging IR's inherent economic advantage for longer leads: It has also been estimated based on available data that, though the market for domestic other goods is fragmented with varying level of localised production and consumption patterns, a sizeable volume of cargo this segment moves on longer leads. This market for BOG has been largely untapped by railways, with road transportation being the preferred mode, even for transit distances where railways has traditionally been the preferred modal choice.

~25% (~875 MT) of freight on road in this segment moves beyond average rail leads, where railways can focus on making inroads by bringing in the cost effectiveness on longer distances, pushing for increased containerisation, and focussing on solving specific logistics requirements of such commodities.

The adjacent figure maps some commodities from the commodity basket of this segment based on average parcel size and time sensitivity for delivery. It can be inferred from the mapping that some commodities clusters have similar parcel size-delivery time dynamics and thus can be catered to by providing a similar product. At the same time, other commodities require a special product with either unique parcel size or faster delivery requirements.

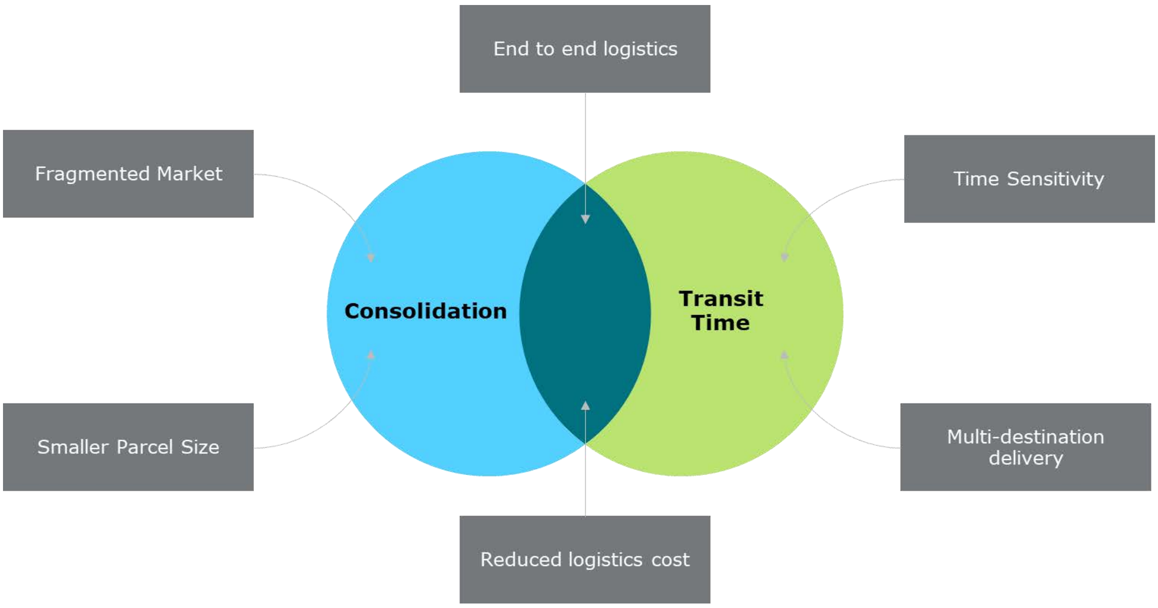
Figure 5-201. Commodities suitable for containerization



Source: Consultant Analysis

Two broad themes emerged as a result of trying to meet all the above stated needs/requirements of the commodities across the BOG segment (Refer figure below). These themes broadly lay down the pillars for creating a logistics product for each commodity cluster. Consolidation, which tends to parcel size, can be

Figure 5-202. Needs of the BOG segment require solutions on two fronts

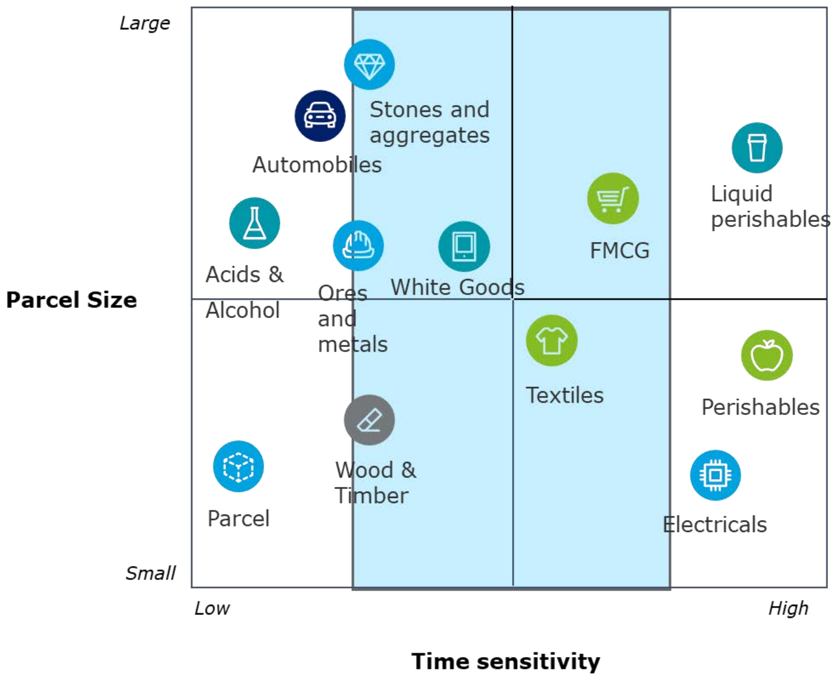


enabled by infrastructural elements and different type of product offerings, and transit time can be enabled through various transit service offerings.

1. Increased domestic containerization-

Penetration of domestic containerisation on IR is quite low at present, with less than 12 MT of cargo moving in domestic containers. A recent study carried out by NCAER[132] indicates that as much as 66% of all Road traffic can be moved in Containerised Closed Body Trucks. Thus, even though other factors also help in determining rolling stock requirements of these mixed commodities, one of the key strategies for increased rail penetration would emerge from the development of increased domestic containerisation on rail. Containerization as a logistics product provides flexibility of catering to different type of commodities with varying parcel sizes. It is capable of consolidating cargo for commodities with smaller parcel sizes and carrying full rake loads of cargo as a consolidated product. Container movement also allows for providing transit time performance in the accepted range for most commodities that not on the extreme spectrum of time sensitivity. This makes containerization a widely applicable logistics product (refer figure below) likely to unlock maximum potential for gaining cargo volumes from different commodities in the segment.

Figure 5-203. Commodities suitable for containerization



However, in order to ensure increased containerization of existing commodities as well as containerization of new commodities, a supporting ecosystem has to be enabled. This includes providing suitable fixed and rolling infrastructure along with transit services that respectively tend to the parcel size and time sensitivity needs for the commodities amenable to containerization. Also, additional initiatives on existing policies relating to containerization of commodities in the

132 NCAER. (2019). Analysis of India/s Logistics Costs, Report submitted to Ministry of Commerce. Government of India at Delhi

Indian Railway network are required to solve existing challenges and increase the scope for containerization of commodities.

2. Domestic Terminal Network-

Domestic container terminals are expected to act as hubs of aggregation and disaggregation of cargo of all parcel sizes. Thus, availability of terminal infrastructure is essential to ensure consolidation of cargo in this segment, especially for less than rake load parcel sizes. A wide spread and far reaching network of terminals will enable an ecosystem where smaller players will be encouraged to choose rail due to its reach. The list of such terminal locations identified based on projected district-level consumption volumes for 2031 and corresponding potential for rail absorption is provided below:

Figure 5-204.Locations of terminals for handling balance other goods

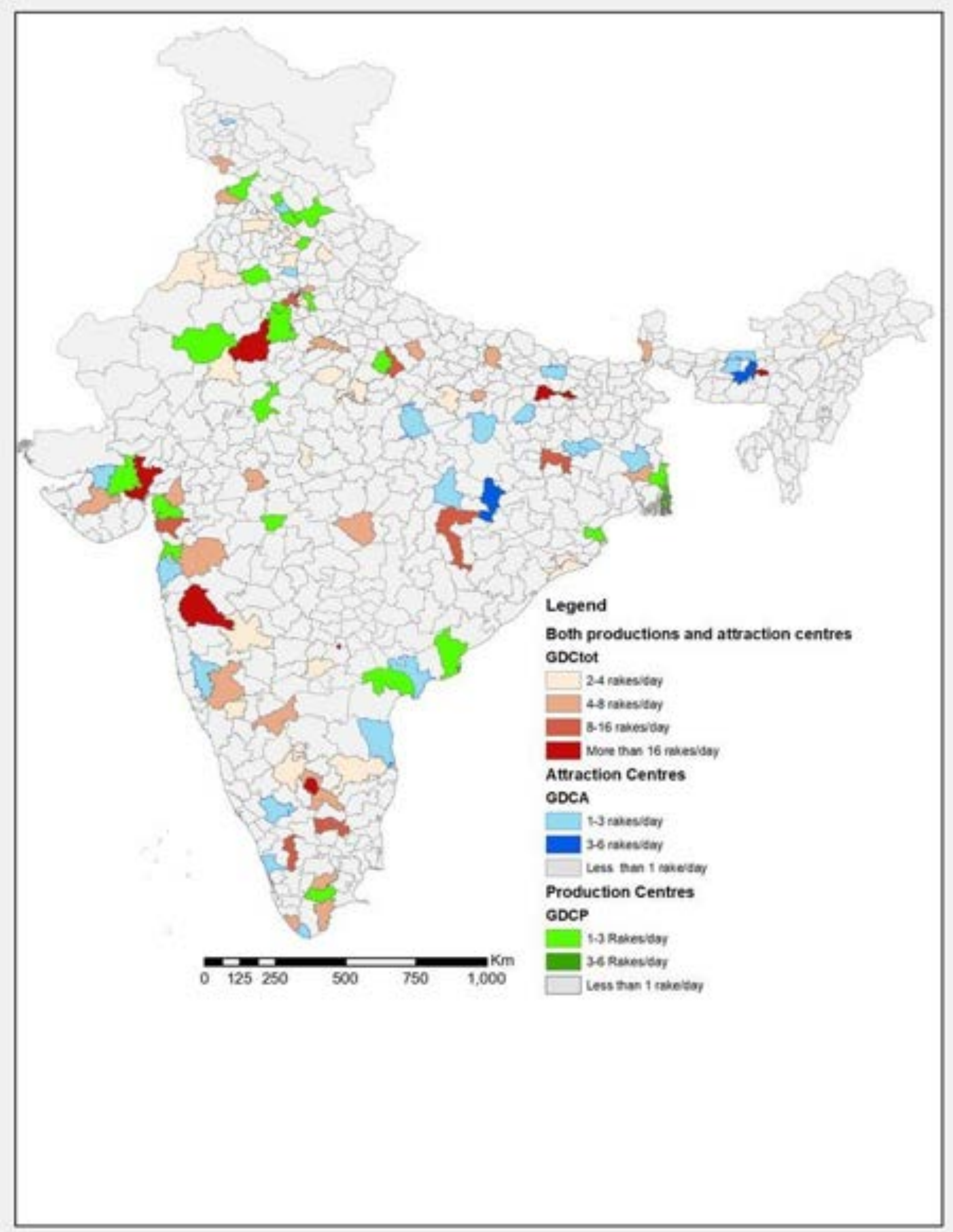


Table 5-9 : . Proposed districts for development of terminals catering to domestic general goods

S.No.	Districts	Projected Rail Traffic, 2031 (MTs)
1.	Srinagar	2.1
2.	Jammu/ Gurdaspur/ Amritsar	11.4
3.	Ludhiana/ Shahid Bhagat Singh Nagar/ Solan/ Shimla/ Hamirpur/ Chandigarh	18.1
4.	Ambala/ Yamuna Nagar/ Karnal/ Panipat/ Haridwar	15.1
5.	Ganganagar/ Hanumangarh/ Hisar	8.9
6.	Jaipur/ Nagaur/ Ajmer	21.6
7.	Rajkot/ Surendranagar/ Ahmedabad/ Morbi	36.9
8.	Vadodara/Bharuch/ surat	18.5
9.	Valsad/ Nashik/Palghar	11.4
10.	Nagpur/Burhanpur	9.1
11.	Pune/ Solhapur	29.0
12.	Kolhapur/ Belgaum/ Bellary/ Dharwad	13.0
13.	Tumkur/ Bangalore/ Bangalore rural/ Krishnagiri/ Mysore/ Salem	81.5
14.	Coimbatore/Thrissur	10.6
15.	Thiruvananthapuram/Kanyakumari	6.9
16.	Hyderabad/ Mahabubnagar	27.0
17.	East Godavari/ West Godavari/ Guntur/ Krishna	6.9
18.	Raipur/ Bilaspur/ Raigarh	15.8
19.	Bhadrak/ Khorda / Puri	7.7
20.	Hugli/ North 24 Paraganas/ Purba Bardhaman	9.0
21.	Baksa/ Barpeta/ Kamrup Metropolitan	25.3
22.	Lakhimpur	2.5
23.	Gorakhpur	4.5
24.	Ranchi/ Bokaro/Dhanbad	14.1
25.	Aurangabad/ Patna/ Muzaffarpur	20.7
26.	Lucknow/ Kanpur Nagar/ Kanpur Dehat	18.0
27.	Varanasi/ Allahabad/ Sonebhadra/ Satna	12.7
28.	Gwalior/ Jhansi/ Agra	8.7
29.	Kota	1.9
30.	Bhopal/ Indore	9.8
31.	Madurai/ Virudhunagar/ Thoothukudi	10.2
32.	Ghaziabad/ Gautam Budh Nagar/ Faridabad/ Gurgaon/ Rewari/ Delhi/ Alwar	69.6
33.	Chitoor/ Nellore	4.0

3. New Container Designs –

In addition to providing fixed terminal infrastructure, facilitating induction of efficient container designs, fit for purpose of hauling domestic cargo is important. The cost-economics of domestic container movement largely driven by dependency on existing ISO type container designs, does not usually provide incentive for domestic cargo owners to containerise their cargo and move it on rail. Introduction and promotion of new container designs, capable of increasing load carrying capacity, improving use of the loading envelope, providing special features to meet commodity needs etc. could have significant impact on industry players' affinity to containerise cargo. Newer, more efficient container types can enable cost savings which in turn can make domestic container movement economical against existing container operations and road haulage.

Box 13. Adoption of dwarf containers for domestic market

Promoting adoption of dwarf containers for domestic market

Dwarf containers (External Dimension L*W*H: 12192*2600*1930 mm) for domestic container movement has the potential to provide a win-win solution for the railways and its customers.

1) Ability to double stack on existing OHE configuration: Due to the reduced height of the container, there is scope for double stacking as clearance from OHE required for full speed operations is 0.25m and minimum clearance required is 0.2m. This does not require Indian Railways to invest in upgrading OHE configuration for all routes.
2) Increased rake throughput: Throughput of double stacked dwarf container configuration (5040 tonnes) when compared 40' standard ISO container configuration (3015 tonnes) gives 67% additional volumes. This translates into cost savings for the shipper.
3) Suitable for last mile road transportation: Due to its reduced height, passing through urban areas with height restricted highways and subways becomes easier when compared to existing container designs

Presented below is a cost comparison between road haulage, and rail haulage of ISO 50' container and dwarf container:

Distance Travelled	Charges	(Road Transport)	(ISO 40' Containers)	(Dwarf Containers)
800 km	Haulage Charges (1.8 times of the container haulage charges)	55,000	32,537	20,062
	Handling + First/Last Mile Charges	-	21,000	21,000
	CTO Margin(15% of haulage charges)	-	3253	2006
	Total	**55,000**	**56,790**	**43,068**
600 km	Haulage Charges	47,000	27,013	17,655
	Handling + First/Last Mile Charges	-	21,000	21,000
	CTO Margin	-	2701	1765
	Total	**47,000**	**50,714**	**40,420**
400 km	Haulage Charges	33,000	17,598	10,433
	Handling + First/Last Mile Charges	-	21,000	21,000
	CTO Margin	-	1759	1043
	Total	**33,000**	**38,539**	**32,476**

As shown in the table above, for distances above rail's average leads (600km), dwarf containers become an economically viable option, costing less than competing alternatives on road and rail.

Similar designs for cube or mini containers, 4 ft, 6 ft 8 ft and 12 ft containers, refrigerated mini containers etc. can also be developed to target specific commodity types on containers in rail at cost effective pricing.

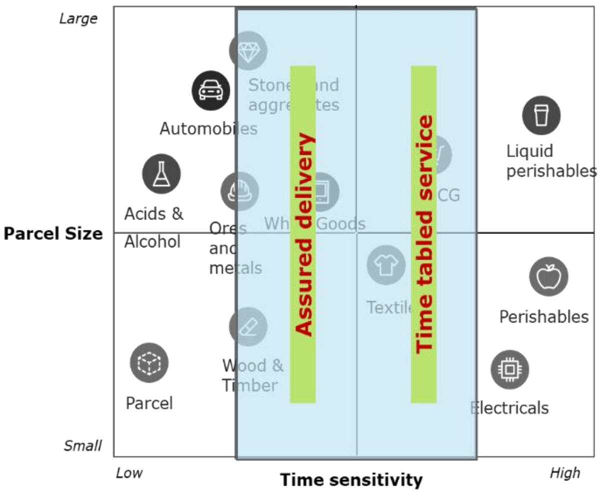
4. Commercial Initiatives -

While some of the initiatives for other goods would be common with those suggested for access to terminals or pricing for EXIM containers, some specific suggestions for domestic cargo can also be made here to help expand the domestic container market:

- To deal with the problem of empty flows that are built into domestic cargo movements, suggest that any empty movement (with or without containers) up to 400 Km be allowed for free.
    - This would help support and build up A-B-C-D type circuits where B-C and D-A legs are empty repositioning moves.
- Remove the CC rates concept altogether, and allow all containers to move on FAK rates
- Extend discounts available on general cargo to domestic cargo in containers as well – these can include short lead discounts, round trip, long term contracts etc.

Transit reliability through offering of special services with transit commitments have already been discussed elsewhere and these can be critical to attract container services on rail.

Figure 5-205. Commodities suitable for containerization

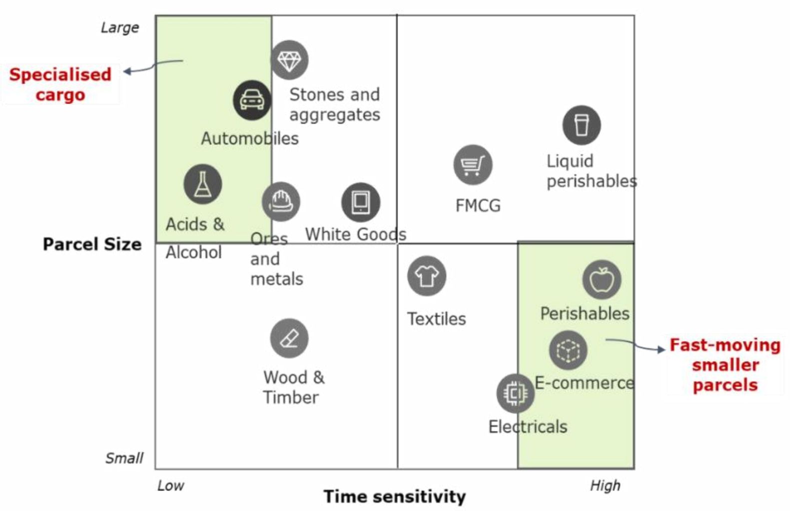


For commodities that can be delivered within the accepted time frame of container movements, assured delivery within agreed time frames, would ensure timely delivery and increased reliability for the customers. However, in case of more time sensitive commodities that are fast-moving, require delivery at scheduled time with visibility and additional reliability, time-tabled container train operations would prove to be a suitable offering.

5. Non Containerizable Cargo -

Some commodities within the domestic other goods segment have unique logistics requirements that cannot be catered by containerisation. Such requirements include high time sensitivity, nature of cargo that requires special wagon designs and smaller parcel unit size that requires further consolidation in order to be railed. Such commodities and their characteristics have been presented below:

Figure 5-206. Commodities not suitable for containerization



For the two identified groups of commodities, different logistics product would need to be developed

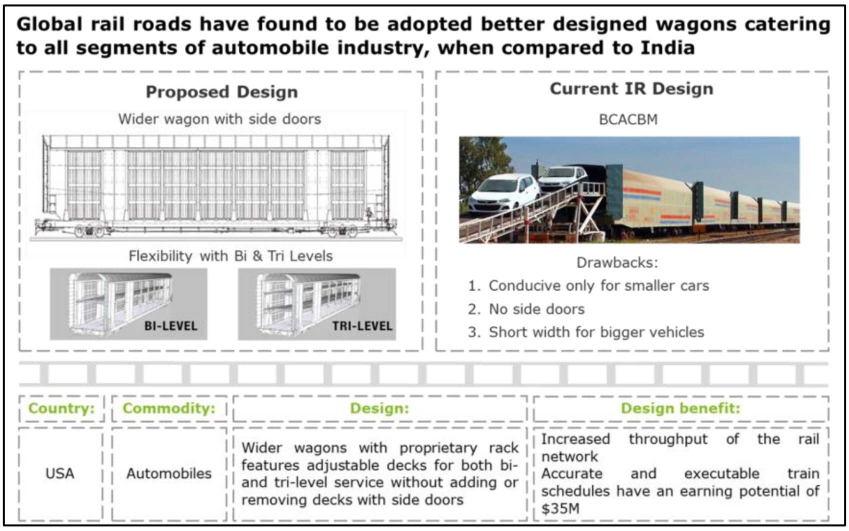
- **For specialized cargo, facilitating induction of efficient wagon designs is required**

In case of commodities that can be categorized as specialized cargo, the need for moving larger parcel sizes over longer distances is the priority over highly time sensitive transit. These commodities also require special wagon designs different from standard containers and wagon designs deployed for other commodities. Thus, providing adequate infrastructure, especially suitable rolling stock for such commodities has the potential to increase rails' attractiveness for this segment. IR needs to encourage increased induction of specialized wagon designs primarily through private investment by LSPs or End Users. (see details on policy prescription on wagon ownership in later section)

Automobiles is one such important commodity in this segment, which at present only moves 6% of all cargo on rail. In fact, this rail share is minuscule in comparison with global peers such as North America where globally the rail is pre-dominant mode with 70% + modal share for automobiles. At present, auto car wagons (i.e. BCACBM) are used for rail transportation of automobiles, designed with a height of 4305 mm above rail level with an interior space of 3320 mm. While the design provides higher utilisation rates for smaller cars, it leads to increasing deadweight loss in case of transporting bigger cars like SUVs. In addition to passenger vehicles, the design is also not suitable for transporting commercial vehicles which require a wider base. Similarly, loading of two-wheelers in two decks is typically difficult for a length of over 600 m with no side doors.

However, globally more flexible designs with wider wagons and side doors are available for automobile movement making loading/unloading more convenient and hence saving handling time and deadweight loss.

Box 14. Need for a more efficient wagon designs for Automobiles



- **For fast-moving smaller parcel sizes, IR can provide a product that enables consolidation of cargo and delivers at express speeds**

Commodities, in this segment, for instance E-commerce, are characterised as having multiple parcels of smaller unit size which require timely delivery. Thus, this leads to the requirement of a logistics product that enables consolidation of multiple parcel sizes from multiple locations and assures timely delivery with shorter transit times. Designing a product on the lines of existing parcel business of IR has the potential to solve for above stated requirements.

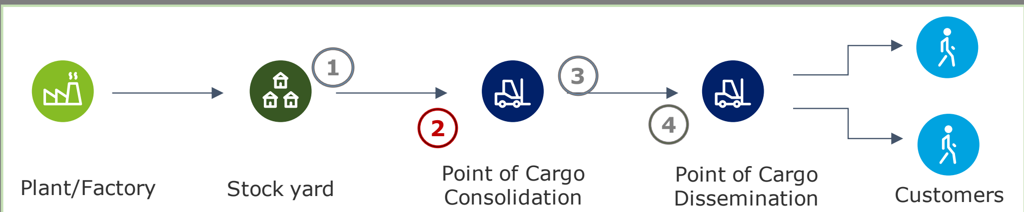
Special express cargo trains, which make use of existing station network and respective platform infrastructure for consolidation of cargo and run on time-tabled providing faster and reliable transit times can be a reliable alternative to road transportation for cargo owners.

Box 15. Cube containers for packaging smaller parcel unit size and consolidation

Cube container with external dimensions of L*W*H: 2400*1300*1630 mm with loading capacity of 3t per cube container, is capable of reducing the threshold for unitization of cargo in rail from a container load to cube container load.

Use of such container type can cater to needs of small cargo owners who wish to transport cargo on rail. Cube containers could provide multiple benefits to the shipper as well the transporter:

a. **Can help consolidate smaller parcel sizes for express /container trains:** Cube containers carrying cargo from multiple cargo owners can be loaded on an express cargo train as well as in dwarf container trains (9 of such can be loaded in one dwarf container) which can then be unloaded and disaggregated to be carried to their respective location
b. **Can perform function of storage (container):** Since the container can be handled as an independent container box, it eliminates the need for storage required for loose cargo stuffed in containers/wagons.
c. **Can eliminate the need for additional warehousing/handling** before container stuffing



Handling Point	Road Transport	Rail Transport using Cube and Dwarf Containers
1	• Loose cargo handling for transporting goods to a central warehouse	• Stuffing in cube containers that facilitates first level of consolidation
2	• Loose cargo consolidation at a covered warehouse	• Consolidation of cube containers at the terminal/platform thus eliminating the need of covered infrastructure an as intermediary step
3	• Stuffing of cargo in trucks for subsequent movement	• Mechanized handling for stuffing of cube containers into double stack dwarf containers for subsequent movement
4	• Disaggregation of cargo	• De-stuffing of dwarf containers for direct transfer to the end customer

Number of points where the cargo is directly handled reduces to two from six and requirement for a covered infrastructure is eliminated as consolidation now takes place directly at the terminals/platform. Thus, this eliminates costs associated with additional handling and warehousing usually incurred with even road transportation.

Providing time-tabled express cargo train services: In order to meet the time critical delivery expectations of this market segment, it is necessary for IR to provide time-tabled services. These services will be route based. Routes will be designed based on demand for such consolidation from various production clusters and mapping of this demand with the nearest station infrastructure. With demand expected from stations spread across its network, and nature of cargo moving in certain directions, routes can be mapped out.

Scheduled Container Train Services for Mumbai-Nagpur-Rourkela-Kolkata

		Mumbai-Nagpur	Nagpur-RKR	RKR-Kolkata
Rail	Distance (Kms)	896	650	454
	Haulage Charges	29795	21876	15543
	Handling + First/ Last Mile Charges	15000	15000	15000
	CTO Margin	37244	27345	19429
	Total Cost	52244	42345	34429
Road	Distance (Kms)	816	780	530
	Total Cost	51408	49140	33390

Figure 5-207. Scheduled container train service

These services can be run on a return trip basis, running on routes connecting cargo generating centres, capturing cargo consolidated at each of these centres. As illustrated, rail costs on these routes are expected to be at par or below road costs on the identified routes. However, other inherent advantages of scheduled container train services, which could tip the scale in Rail’s favour are the consistency in service, assured times, and other services provided by private train operators.

Chapter 6 RAIL NETWORK CORRIDOR DEMAND

6.1. Background

One of the main objective of NRP is to identify potential demand corridors for passenger and freight based existing and forecast traffic demand. The identified demand corridors shall lay the foundation for performing capacity analysis and identifying congested and bottlenecked corridors for which subsequently capacity enhancement proposals shall be provided. the chapter discusses in detail the potential demand corridors both existing and future for each of the demand sub segment of passenger and freight.

6.2. Railway Classification of High Demand Corridors

As per the Indian Railways a total of 7 High-Density Network (HDN) routes and 11 Highly Utilised Network (HUN) routes have been classified. HDN Comprise of 16% (11,000 Km) of total Indian Railway Network and transports 41% of total traffic of the entire network. HUN comprise of 35% (24,230 Km) of the total railway network and transports 40% of the total traffic moving on Indian Railway network. Combined HDN+HUN account for almost 50% (34,214 Km) of the total network.

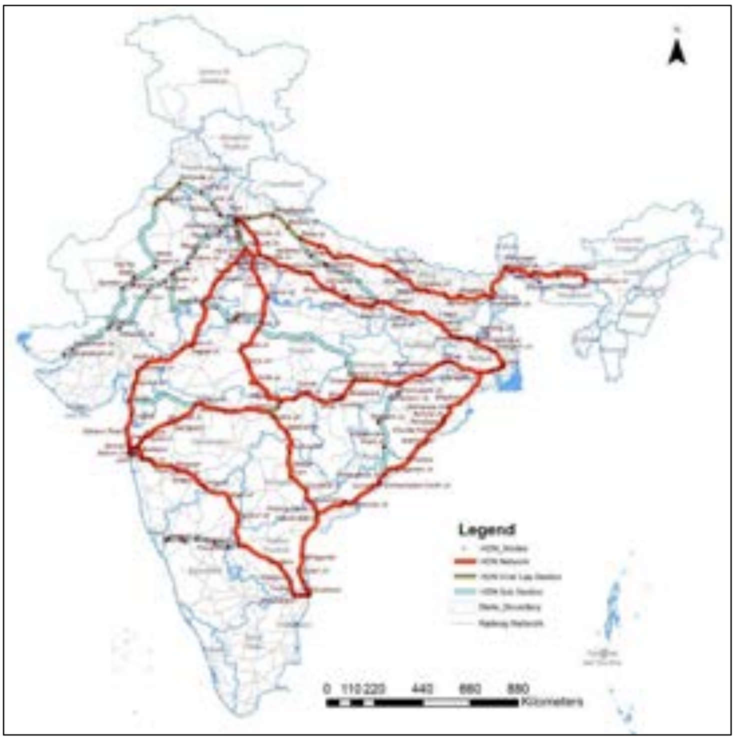


Figure 6-1: HDN Routes

6.2.1. High Density Network (HDN)

As the name suggest, HDN comprise of network that has high density of traffic movement. As mentioned above HDN Comprise of 16% (11,000 Km) of total Indian Railway Network and transports 41% of total traffic of the entire network.

Refer **Figure 6-1: HDN** and **Table 6-1: HDN Routes.**

Table 6-1: HDN Routes

HDN No	Routes
HDN1	Delhi Howrah Main Route via ALD MGS Gaya
HDN2	Howrah - Mumbai main route via Jalgaon, Nagpur, Bilaspur
HDN3	Delhi-Mumbai Main Route via Kota Ratlam
HDN4	Delhi-Guwahati via Rosa-Gorakhpur-Kumedpur

HDN No	Routes
HDN5	Delhi-Chennai Main Route via BPL-NGP-BPQ-BZA-Gudur
HDN6	Howrah Chennai Main Route
HDN7	Mumbai-Chennai main route

6.2.1. Highly Utilized Network (HUN)

A total of 11 routes have been identified as Highly Utilized Network (HUN), which has a total length of 23,347 km. HUN comprise of 35% (24,230 Km) of the total railway network and transports 40% of the total traffic moving on Indian Railway network.

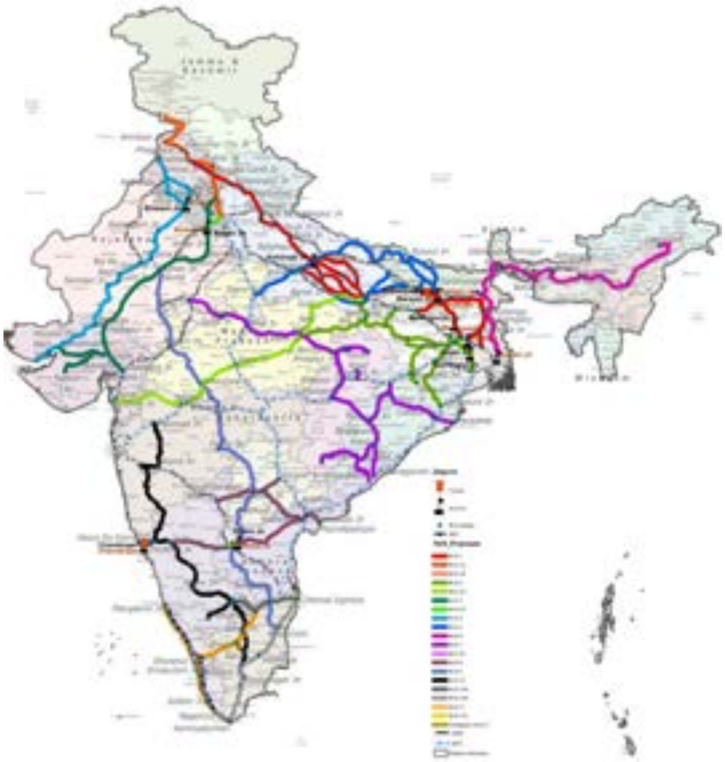


Figure 6-2: HUN Routes

Table 6-2: HUN Routes

S.NO	HUN Routes	Total Length (Km)
HUN 1	Amrit Sagar Sampark Corridor	3,049
HUN 2	Bengal Arab Sagar Sampark Corridor	3,035
HUN 3	Kathiawar Shivalik Sampark Corridor	1,685
HUN 4	Sagar Sutlej Sampark Corridor	1,529
HUN 5	Bundelkhand Tarai Sampark Corridor	2,151
HUN 6	Sagar Purvodaya Sampark Corridor	1,490
HUN 7	Sagar Chambal Sampark Corridor	2,737
HUN 8	Purv Paschim Deccan Sampark Corridor	1,501
HUN 9	Aravali Dakshin Sampark Corridor	2,803
HUN 10	Satpura Coromandel Sampark Corridor	2,232
HUN 11	Konkan Malabar Sampark Corridor	1,134
Total		24,230

6.2.2. Demand Share of HDN & HUN

The demand share of HDN and HUN has been estimated by analysing the quantum of passenger and freight Km that travel on these networks and their respective to total passenger and freight ton km.

Table 6-3: Existing Demand Share of HDN and HUN

	Existing		Total	Share of Passenger Train Km	Share of Freight Train Km
Entire Network	67,368	100.0%	100.0%	100.0%	100.0%
HDN	10,969	15.9%	41.0%	40.6%	42.0%
HUN	24,230	35.2%	39.6%	39.0%	40.9%
HDN + HUN	34,214	49.7%	77.2%	76.3%	79.4%
Others	40,979	59.5%	22.8%	23.7%	20.6%

Table 6-4: Future Demand Share of HDN and HUN

	Share of Total Train Km (%)					Share of Passenger Train Km (%)					Share of Freight Train Km (%)				
	Existing	2026	2031	2041	2051	Existing	2026	2031	2041	2051	Existing	2026	2031	2041	2051
Entire Network	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
HDN	41.0	42.3	39.4	37.5	36.9	40.6	41.4	41.8	40.8	40.4	42.0	44.6	31.6	25.6	24.6
HUN	39.6	40.3	42.0	41.8	41.4	39.0	39.8	40.1	40.0	39.0	40.9	41.8	48.3	48.2	50.0
HDN + HUN	77.2	78.7	77.5	75.6	74.4	76.3	77.7	78.2	77.1	75.8	79.4	81.3	75.3	69.7	69.5
Others	22.8	21.3	22.5	24.4	25.6	23.7	22.3	21.8	22.9	24.2	20.6	18.7	24.7	30.3	30.5

As evident from tables above, both HDN and HUN shall continue to remain high demand corridors for both passenger and freight. Share of HDN and HUN combined will remain 77% in total train Km on the entire network. This fact also establishes that is essential to augment the capacity of both HDN and HUN either by providing additional lines or dedicated Freight Network and dedicated high capacity passenger corridors such as HSR.

Subsequent sections explain the demand corridors for passenger and freight segments.

6.3. Passenger Demand Corridors

As described above utilizing the PRS Data, passengers OD matrices for AC and Non-AC passengers were developed for the purpose of identifying major passenger demand corridors. Based on this analysis, top 10 passenger corridors were identified. Majority of the passenger demand is in between the OD Pairs which are located on all 7 HDNs and 3 HUNS namely HUN 1, HUN 9 and HUN 10.

6.3.1. Long Distance AC (LDAC) Passenger Demand Corridors

Based on the demand forecast matrices for AC passengers, the AC passenger Km were estimated. sections/ corridors having higher share of passenger km have been identified as AC passenger demand corridors. These corridors cater to 68-70% of total passenger km on the entire railway network. Refer table below.

Top AC passenger routes are observed between Delhi-Chennai via Bhopal, Mumbai – Howrah, Kharagpur – Udhna, Amritsar to Patna via Mughalsarai and Delhi-Guwahati via Katihar. AC Passenger Trains for each cardinal year are presented in Error! Reference source not found.**, Figure 6-6: ,** Error! Reference source not found. and **Figure 6-6: .**

Table 6-5: Long Distance AC (LDAC) Passenger Demand Corridors

Route	LDAC 2018		LDAC 2026		LDAC 2031		LDAC 2041		LDAC 2051	
	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)
Delhi - Chennai via Jhansi - Bhopal	25.36	6.20%	80.8	8.20%	119.53	8.00%	208.48	7.60%	332.93	7.00%
Mumbai - Howrah via Nagpur - Jharsuguda	22.95	5.60%	66.62	6.80%	101.9	6.80%	190.24	6.90%	327.57	6.90%
Kharagpur - Udhna via Bhusawal	23.62	5.80%	55.65	5.70%	87.88	5.90%	171.6	6.20%	326.93	6.90%
Vizianagram/Paradeep - Kota	15.75	3.80%	54.97	5.60%	86.46	5.80%	163.24	5.90%	288.97	6.10%
Amritsar - Andal via Mughalsarai - Patna	24.93	6.10%	53.25	5.40%	79.23	5.30%	141.09	5.10%	263.6	5.60%
Delhi - Howrah via Kanpur - Gaya	22.46	5.50%	47.28	4.80%	70.45	4.70%	125	4.50%	242.38	5.10%
Delhi - Mumbai via Kota - Ratlam	27.1	6.60%	55.28	5.60%	79.79	5.30%	134.47	4.90%	219.52	4.60%
Delhi - Guwahati via Moradabad - Chhapra - Katihar	14.13	3.40%	37.64	3.80%	57.14	3.80%	109.92	4.00%	200.8	4.20%
Kolkata - Vijayawada via Jharsuguda - Sambalpur	12.12	3.00%	38.01	3.90%	59.23	3.90%	108.14	3.90%	196.75	4.20%
Manmad - Kanyakumari via Hubli - Birur	16.42	4.00%	38.58	3.90%	60.26	4.00%	100.71	3.70%	136.26	2.90%
Mumbai - Chennai via Guntakal - Hospet	11.23	2.70%	29.22	3.00%	43.82	2.90%	75.73	2.80%	113.32	2.40%
Jhansi - Muzaffarpur - Katni	8.99	2.20%	18.52	1.90%	27.82	1.90%	55.16	2.00%	112.15	2.40%
Chandigarh - Rajkot Via Panipat - Rewari	11.71	2.90%	24.89	2.50%	36.87	2.50%	62.49	2.30%	103.93	2.20%
Bandel - Dibrugarh via Azimganj - Barsoi	5.64	1.40%	14.57	1.50%	23.56	1.60%	51.51	1.90%	96.69	2.00%
Ajmer - Dindigul via Nanded	10.76	2.60%	23.21	2.40%	34.93	2.30%	59.52	2.20%	94.51	2.00%
Mangalore - Kanyakumari via Shoranu	7.01	1.70%	17.95	1.80%	32.65	2.20%	65.13	2.40%	87.94	1.90%
Vasco - Machlipatnam via Dharwad - Vijaywada	9.5	2.30%	20.32	2.10%	30.94	2.10%	57.88	2.10%	85.27	1.80%
Firozpur - Mundra Port via Bhatinda-Jakhal	6.84	1.70%	15.26	1.50%	21.98	1.50%	38.25	1.40%	64	1.40%
Total	276.52	68%	692.02	70%	1054.44	71%	1918.56	70%	3293.52	70%
All HDN	**135.36**	**33 %**	**354.85**	**36.00%**	**531.86**	**35.40%**	**951.99**	**34.60%**	**1,633.28**	**34.50%**

Route	LDAC 2018		LDAC 2026		LDAC 2031		LDAC 2041		LDAC 2051	
	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)
All HUN	143.02	34 %	340.98	34.60%	528.24	35.20%	979.75	35.60%	1,687.31	35.60%
HDN+HUN	266.61	65 %	667.07	67.70%	1,016.21	67 %	1,853.39	67.40%	3,183.24	67.20%
Entire Network	409.88	100 %	984.79	100%	1,501.60	100%	2,748.64	100%	4,733.47	100%

Figure 6-6: AC Passenger Demand Corridors (Trains) - 2026

Figure 6-6: AC Passenger Demand Corridors (Trains) - 2031

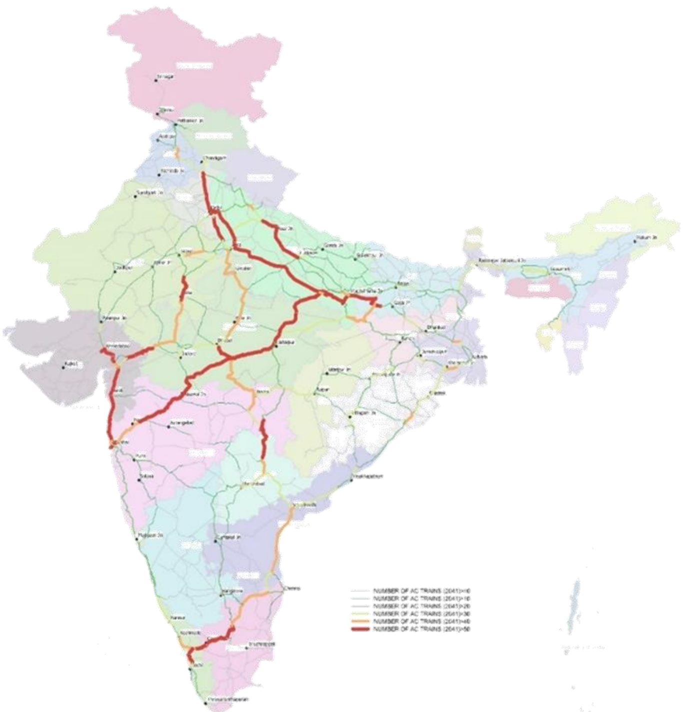


Figure 6-6: AC Passenger Demand Corridors (Trains) - 2041

Figure 6-6: AC Passenger Demand Corridors (Trains) - 2051

6.3.2. Long Distance Non-AC (LDNA) Passenger Demand Corridors

Similar to LDAC, based on the demand forecast matrices for Non-AC passengers, the Non-AC Passenger Km were estimated. Sections/ corridors having higher share of Passenger Km have been identified as Non-AC passenger demand corridors. These corridors are more or less similar to the demand corridors as estimated for AC passengers. These corridors cater to 66-70% of total passenger km on the entire railway network. Refer table below.

Non-AC Passenger Trains for each cardinal year are presented in

, Figure 6-10: , Figure 6-10: and Figure 6-10:

Table 6-6: Long Distance Non-AC (LDNA) Passenger Demand Corridors

Route	LDNAC 2018		LDNAC 2026		LDNAC 2031		LDNAC 2041		LDNAC 2051	
	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)
Mumbai - Howrah via Nagpur - Jharsuguda	235.73	6.00	802.14	10.80	943.93	10.20	1,357.44	9.30	1,789.67	8.60
Delhi - Chennai via Jhansi - Bhopal	216.96	5.60	524.46	7.10	683.38	7.40	1,048.27	7.20	1,443.68	6.90
Kharagpur - Udhna via Bhusawal	232.38	6.00	494.5	6.70	587.61	6.30	972.46	6.70	1,441.04	6.90
Delhi - Mumbai via Kota - Ratlam	257.05	6.60	527.28	7.10	608.52	6.60	837.2	5.70	1,198.54	5.80
Vizianagram/Paradeep - Kota	145.08	3.70	383.37	5.20	482.89	5.20	801.54	5.50	1,171.99	5.60
Amritsar - Andal via Mughalsarai - Patna	232.79	6.00	293.19	3.90	369.36	4.00	580.7	4.00	868.3	4.20
Delhi - Howrah via Kanpur - Gaya	205.27	5.30	264.92	3.60	373.92	4.00	529.95	3.60	812.39	3.90
Kolkata - Vijayawada via Jharsuguda - Sambalpur	97.02	2.50	248.13	3.30	296.56	3.20	538.54	3.70	752.39	3.60
Manmad - Kanyakumari via Hubli - Birur	173.09	4.40	305.97	4.10	392.89	4.20	601.09	4.10	742.02	3.60
Mumbai - Chennai via Guntakal - Hospet	124.58	3.20	278.22	3.70	354.89	3.80	566.63	3.90	705.05	3.40
Delhi - Guwahati via Moradabad - Chhapra - Katihar	110.5	2.80	193.18	2.60	248.83	2.70	443.91	3.00	686.03	3.30
Vasco - Machlipatnam via Dharwad - Vijaywada	92.3	2.40	193.3	2.60	231.95	2.50	398.5	2.70	534.88	2.60
Chandigarh - Rajkot Via Panipat - Rewari	98.15	2.50	175.65	2.40	247.34	2.70	334.65	2.30	522.73	2.50
Ajmer - Dindigul via Nanded	98.89	2.50	165.26	2.20	228.07	2.50	319.83	2.20	451.93	2.20
Bandel - Dibrugarh via Azimganj - Barsoi	42.57	1.10	80.44	1.10	122.05	1.30	247.83	1.70	408.08	2.00
Jhansi - Muzaffarpur - Katni	85.36	2.20	127.84	1.70	164.73	1.80	226	1.50	352.13	1.70
Firozpur - Mundra Port via Bhatinda-Jakhal	54.57	1.40	129.48	1.70	195.34	2.10	222.62	1.50	327.25	1.60
Mangalore - Kanyakumari via Shoranu	71.01	1.80	108.84	1.50	131.95	1.40	240.16	1.60	326.64	1.60
Total	2573.3	66	5296.17	71	6664.21	72	10267.32	70	14534.74	70
All HDN	**1,247.10**	**32.00**	**2,838.33**	**38.20**	**3,510.02**	**37.80**	**5,321.94**	**36.50**	**7,387.74**	**35.50**
All HUN	**1,342.45**	**34.40**	**2,478.85**	**33.40**	**3,183.66**	**34.30**	**4,995.88**	**34.20**	**7,216.65**	**34.70**
HDN+HUN	**2,488.88**	**63.80**	**5,130.28**	**69.10**	**6,436.61**	**69.40**	**9,905.03**	**67.90**	**14,002.32**	**67.30**

Route	LDNAC 2018		LDNAC 2026		LDNAC 2031		LDNAC 2041		LDNAC 2051	
	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)
Entire Network	3,900.35	100.00	7,423.19	100.00	9,274.66	100.00	14,592.46	100.00	20,811.17	100.00

Figure 6-10: Non-AC Passenger Demand Corridors (Trains) - 2026

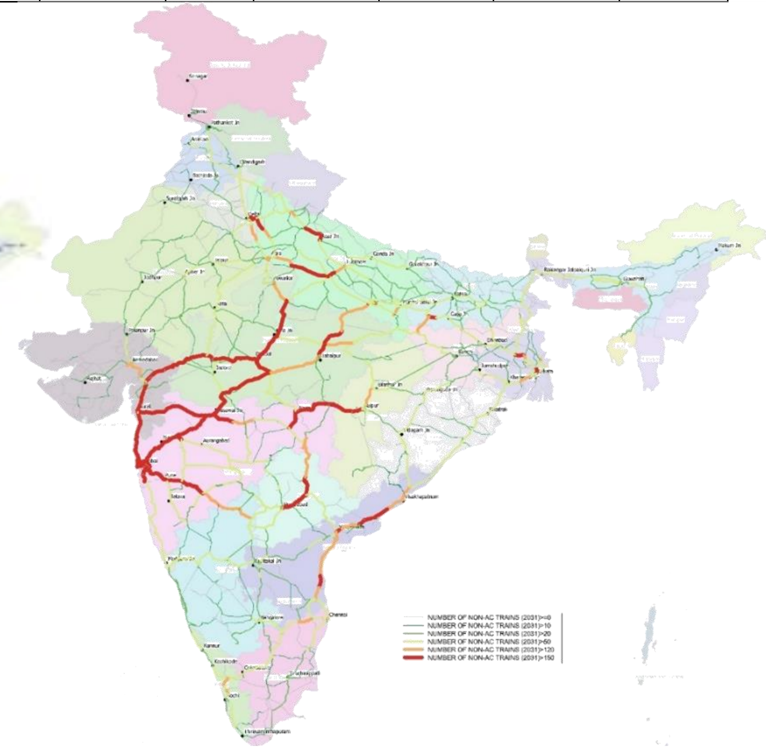


Figure 6-10: Non-AC Passenger Demand Corridors (Trains) - 2031

Figure 6-10: Non-AC Passenger Demand Corridors (Trains) - 2041

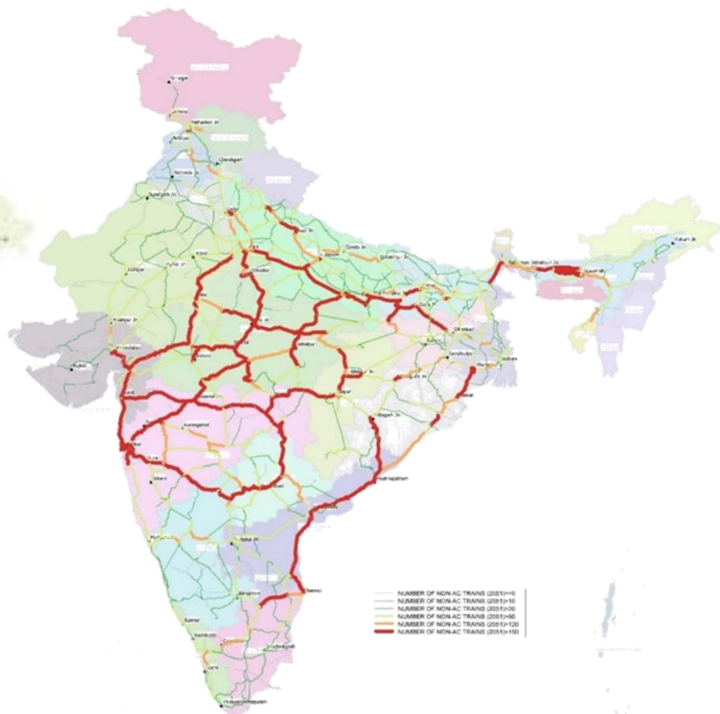


Figure 6-10: Non-AC Passenger Demand Corridors (Trains) - 2051

6.3.3. Overall Passenger Demand Corridors

Both AC and Non-AC passenger demand has been summed up and assigned on the rail network in order to identify total passenger demand corridors. Overall passenger demand corridors are described in table below:

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, Figure 6-14: and **Figure 6-15: .**

Table 6-7: Overall Rail Passenger Demand Corridors

Route	Total 2018		Total 2026		Total 2031		Total 2041		Total 2051	
	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)
Mumbai - Howrah via Nagpur - Jharsuguda	258.68	6.00	868.76	10.30	1,045.83	9.70	1,547.68	8.90	2,117.24	8.30
Delhi - Chennai via Jhansi - Bhopal	242.32	5.60	605.26	7.20	802.91	7.50	1,256.75	7.20	1,776.61	7.00
Kharagpur - Udhna via Bhusawal	256	5.90	550.15	6.50	675.49	6.30	1,144.05	6.60	1,767.96	6.90
Delhi - Mumbai via Kota - Ratlam	284.15	6.60	582.56	6.90	688.31	6.40	971.67	5.60	1,418.06	5.60
Vizianagram/Paradeep - Kota	160.83	3.70	438.34	5.20	569.35	5.30	964.78	5.60	1,460.96	5.70
Amritsar - Andal via Mughalsarai - Patna	257.72	6.00	346.44	4.10	448.59	4.20	721.79	4.20	1,131.89	4.40
Delhi - Howrah via Kanpur - Gaya	227.72	5.30	312.2	3.70	444.37	4.10	654.95	3.80	1,054.77	4.10
Kolkata - Vijayawada via Jharsuguda - Sambalpur	109.14	2.50	286.14	3.40	355.79	3.30	646.68	3.70	949.14	3.70
Manmad - Kanyakumari via Hubli - Birur	189.52	4.40	344.55	4.10	453.14	4.20	701.8	4.00	878.27	3.40
Mumbai - Chennai via Guntakal - Hospet	135.81	3.20	307.44	3.70	398.71	3.70	642.36	3.70	818.37	3.20
Delhi - Guwahati via Moradabad - Chhapra - Katihar	124.63	2.90	230.82	2.70	305.97	2.80	553.83	3.20	886.83	3.50

Route	Total 2018		Total 2026		Total 2031		Total 2041		Total 2051	
	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)	Passenger Km (Million)	Share (%)
Vasco - Machlipatnam via Dharwad - Vijaywada	101.79	2.40	213.62	2.50	262.89	2.40	456.38	2.60	620.15	2.40
Chandigarh - Rajkot Via Panipat - Rewari	109.86	2.50	200.53	2.40	284.21	2.60	397.14	2.30	626.66	2.50
Ajmer - Dindigul via Nanded	109.65	2.50	188.48	2.20	262.99	2.40	379.35	2.20	546.43	2.10
Bandel - Dibrugarh via Azimganj - Barsoi	48.21	1.10	95.01	1.10	145.61	1.40	299.34	1.70	504.78	2.00
Jhansi - Muzaffarpur - Katni	94.36	2.20	146.37	1.70	192.56	1.80	281.16	1.60	464.28	1.80
Firozpur - Mundra Port via Bhatinda-Jakhal	61.41	1.40	144.74	1.70	217.31	2.00	260.87	1.50	391.25	1.50
Mangalore - Kanyakumari via Shoranu	78.02	1.80	126.79	1.50	164.6	1.50	305.29	1.80	414.57	1.60
Total	2849.82	66	5988.2	71	7718.63	72	12185.87	70	17828.22	70
All HDN	**1,382.460**	**32**	**3,193.180**	**38**	**4,041.880**	**38**	**6,273.930**	**36**	**9,021.020**	**35**
All HUN	**1,485.470**	**35**	**2,819.830**	**34**	**3,711.900**	**34**	**5,975.630**	**35**	**8,903.960**	**35**
HDN+HUN	**2,755.490**	**64**	**5,797.350**	**69**	**7,452.820**	**69**	**11,758.420**	**68**	**17,185.560**	**67**
Entire Network	**4,310.230**	**100**	**8,407.980**	**100**	**10,776.250**	**100**	**17,341.100**	**100**	**25,544.630**	**100**

Figure 6-14: Total Passenger Demand Corridors (Trains) - 2021

Figure 6-14: Total Passenger Demand Corridors (Trains) - 2026

Figure 6-14: Total Passenger Demand Corridors (Trains) - 2031

Figure 6-14: Total Passenger Demand Corridors (Trains) - 2041

Figure 6-15: Total Passenger Demand Corridors (Trains) – 2051

6.3.4. Share of High Passenger Demand Corridors

For further analysis, share of identified high demand passenger corridors was estimated with respect to the total demand. The identified corridors shall continue to cater to higher share of passenger traffic the respective share of these corridors shall be 64-67% till 2051.

Share of passenger demand corridors to the entire demand is described in table below:

Table 6-8: Passenger Share on Demand Corridors

	Passenger Category	2018	2026	2031	2041	2051
Total Passenger Km (Million)	LDAC	409.88	984.79	1,501.60	2,748.64	4,733.47
	LDNAC	3,900.35	7,423.19	9,274.66	14,592.46	20,811.17
	Total	**4,310.23**	**8,407.98**	**10,776.25**	**17,341.10**	**25,544.63**
Passenger Km on High Demand Corridors	LDAC	266.61	667.07	1,016.21	1,853.39	3,183.24
	LDNAC	2,488.88	5,130.28	6,436.61	9,905.03	14,002.32
	Total	**2,755.49**	**5,797.35**	**7,452.82**	**11,758.42**	**17,185.56**
Share of High Demand Corridors	LDAC	65.0%	67.7%	67.7%	67.4%	67.2%
	LDNAC	63.8%	69.1%	69.4%	67.9%	67.3%
	Total	**63.9%**	**69.0%**	**69.2%**	**67.8%**	**67.3%**

6.4. Freight Demand Corridors

Similar to the passenger demand corridors, the commodity wise freight demand matrices were converted in to wagons and then into rake matrices for respective commodities. These forecast rake matrices were then assigned on the rail network for identifying the freight demand corridors.

As of 2018, the Indian Railways transported around 4059 million tons of freight per day on its network. Of which, over 50% of the freight was carried by the following major corridors:

1. Delhi- Kolkata
2. Mumbai- Kolkata
3. Mumbai- Delhi
4. Delhi- Guwahati
5. Palwal- Chennai
6. Kharagpur- Vijayawada
7. Mumbai- Chennai

The existing as well as proposed capacity along with forecast traffic volumes on these major corridors are given in tabular format below.

Table 6-9: Existing and Proposed Capacity on Major Freight Corridors

Sr. No.	Corridor	Existing Capacity Pass+ Frgt (in rakes/ day)	Proposed Capacity Pass+ Frgt (in rakes/ day)	Peak Freight Traffic Volume (in rakes/ day)				
				2021	2026	2031	2041	2051
1	Delhi- Kolkata	98	98	102	149	197	288	412
2	Mumbai- Kolkata	93	118	153	200	344	362	540
3	Mumbai- Delhi	158	158	131	174	265	343	438
4	Delhi- Guwahati	45	61	86	147	204	321	449
5	Palwal- Chennai	72	105	92	134	211	299	506
6	Kharagpur- Vijayawada	75	101	85	115	183	267	389
7	Mumbai- Chennai	86	102	110	139	159	174	226

From the above table it can be observed that the freight volumes on Delhi- Kolkata, Mumbai- Kolkata, Delhi- Guwahati and Mumbai- Chennai corridors exceed the proposed track capacities in 2021 itself. On Mumbai- Delhi, Palwal- Chennai and Kharagpur- Vijayawada corridors the freight volumes shall exceed the proposed capacities by 2026. Thus, the existing railway infrastructure will not be able to accommodate the envisaged freight volumes even after the sanctioned upgradation.

Subsequent sections detail out demand corridors for each of the commodity.

6.4.1. Balance Other Goods

Balance other Goods (BOG) shall drive the rail freight market share in future as demand for other commodities will shrink. BOG will form majority share of freight commodity basket that will be transported by Indian Railways. Commodities that form BOG will have longer as well as shorter haulage. The potential demand corridors for BOG include Delhi – Kolkata, Kolkata – Guwahati, Mumbai – Nagpur, Nagpur Chennai, Chennai Bengaluru, Mumbai – Ahmedabad and Mumbai – Delhi.

Figure 6-16: Freight Demand (Trains) Corridors -BOG - 2051

Figure 6-17: Freight Demand (Trains) Corridors - Cement (2051)

6.4.2. Cement

Cement forecast and its regional allocation in the form of demand matrices were assigned on the rail network. The demand of the Cement is dependent on the construction industry comprising of Infrastructure and Real Estate. Maximum demand of Cement transportation shall be between Mumbai - Bharuch, Gujarat to Delhi and Mumbai, Kolkata to North East, Chennai – Bengaluru and Vijayawada- Hyderabad.

Figure 6-18: Freight Demand (Trains) Corridors - Coal (2051)

6.4.3. Coal

Coal will have localized movement from the mostly from the quarry to thermal power plant. maximum share of coal movement has been observed in the eastern part of the Country.

6.4.4. Container (Exim)

Exim container movement is restricted to shorter haulage mostly in Gujarat and Chennai. These movement depends on the import export and international trade.

Figure 6-19: Freight Demand (Trains) Corridors - Containers (2051)

6.4.5. Fertilizers

Fertilizer movement is short haul movement in western India and Eastern

India. Gujarat, Maharashtra, Hyderabad, Tamilnadu and West Bengal. Fertilizer industries are located on the east coast and west coast of India.

Figure 6-20: Freight Demand (Trains) Corridors – Fertilizers (2051)

6.4.6. Food Grains

Food grains are moved from the production centers to the consumption centers, i.e. Punjab/ Haryana to UP, Bihar and West Bengal along EDFC and HDN 1, HUN 1 and HDN 4.

6.4.7. Iron Ore

Movement of Iron Ore is restricted mostly to the quarries and the steel plants situated in the eastern India, and East Coast.

6.4.8. Pig Iron/ Finished Steel

Movement of Finished Steel and the Cement are corelated, linked to the development centers.

6.4.9. POL

POL is most dominant commodity on the western part of India, Maharashtra and Gujarat. Movement also happens to the North Eastern states through HDN 4.

Figure 6-21: Freight Demand (Trains) Corridors – Food Grains (2051)

6.4.10. Raw Material for Steel

RM for steel are located near the steel plants mostly situated in Eastern India and South India. Vijayawada – Chennai, Vijayawada Madgaon, Kolkata – Jamshedpur.

Figure 6-25: Freight Demand (Trains) Corridors – Iron Ore (2051)

Figure 6-25: Freight Demand (Trains) Corridors – Pig Iron/ Finishes Steel (2051)

Figure 6-25: Freight Demand (Trains) Corridors - POL (2051)

Figure 6-25: Freight Demand (Trains) Corridors – Raw Material for Steel (2051)

6.5. Overall Freight Demand Corridors

Rake matrices of all commodities were added up and then assigned on the rail network for obtaining overall freight demand corridors for each of the cardinal years.

The major freight corridors where share of freight traffic > 50% have been further considered for development of Dedicated Freight Corridors (DFCs). These are listed below:

- Kharagpur- Vishakapatnam- Vijayawada- Guntakal
- Delhi- Agra- Bhopal- Nagpur- Vijayawada- Chennai
- Agra- Mughalsarai- Gaya- Dhanbad- Kolkata
- Mumbai- Nashik- Nagpur- Raipur- Bilaspur- Jharsuguda- Jamshedpur- Kharagpur
- Mumbai- Pune- Guntakal- Chennai
- Delhi- Kota- Surat- Mumbai
- Delhi- Ajmer- Ahmedabad

Apart from above and Based on the freight demand forecast, commodity wise rake requirement was assigned on the railway network. Accordingly, corridors where number of freight trains for each commodity are estimated to be higher than 50/ day have been identified as freight demand corridors.

Refer **Figure 6-29: Freight Demand (Trains) Corridors -** 2026**,** Error! Reference source not found.**, Figure 6-29: Freight Demand (Trains) Corridors -2041** and **Figure 6-29: Freight Demand (Trains) Corridors -2051**

Table 6-10: Major Freight Corridors

Route	Rake KM 2018	Rake KM 2026	Rake KM 2031	Rake KM 2041	Rake KM 2051
Delhi - Mumbai via Kota - Ratlam	142,646	128,116	128,065	253,709	607,395
Mumbai - Howrah via Nagpur - Jharsuguda	153,322	191,886	284,575	302,143	556,427
Delhi - Chennai via Jhansi - Bhopal	115,208	194,157	191,792	329,236	514,105
Amritsar - Andal via Mughalsarai - Patna	88,587	118,788	185,734	237,116	436,096
Kharagpur - Udhna via Bhusawal	127,437	109,995	189,481	345,518	411,105
Vasco - Machlipatnam via Dharwad - Vijaywada	39,373	37,102	52,356	131,095	397,948
Vizianagram/Paradeep - Kota	144,061	201,973	278,433	371,369	380,241
Delhi - Guwahati via Moradabad - Chhapra - Katihar	64,102	213,776	260,253	377,942	342,465
Delhi - Howrah via Kanpur - Gaya	125,474	72,888	174,326	204,722	341,716
Kolkata - Vijayawada via Jharsuguda - Sambalpur	65,425	143,314	201,958	265,061	298,949
Bandel - Dibrugarh via Azimganj - Barsoi	32,330	77,377	88,269	144,652	274,620
Ajmer - Dindigul via Nanded	27,163	21,154	37,437	128,934	268,808
Chandigarh - Rajkot Via Panipat - Rewari	74,797	71,354	144,795	178,936	225,608
Jhansi - Muzaffarpur - Katni	43,542	72,708	112,270	190,810	215,763
Manmad - Kanyakumari via Hubli - Birur	37,650	42,495	67,090	113,590	187,530
Mumbai - Chennai via Guntakal - Hospet	39,624	32,510	47,117	107,025	174,203
Firozpur - Mundra Port via Bhatinda-Jakhal	53,199	50,325	93,634	113,955	170,565
Mangalore - Kanyakumari via Shoranu	17,076	17,111	27,900	40,100	58,892

Figure 6-29: Freight Demand (Trains) Corridors - 2026

Figure 6-29: Freight Demand (Trains) Corridors - 2031

Figure 6-29: Freight Demand (Trains) Corridors - 2041

Figure 6-29: Freight Demand (Trains) Corridors - 2051

Chapter 7 CAPACITY UTILISATION AND IDENTIFICATION OF BOTTLENECKED SECTIONS

7.1. Introduction

For the purpose of identifying the bottlenecked sections, the demand corridors as estimated in previous chapter of both passenger and freight.

Next step is to analyse the available network capacity with respect to forecast demand for each of the LC Sections for the rail network. For this purpose, existing and forecast train numbers (passengers + freight) were analysed with respect to the existing capacity of each of the section as per the LC charts. Based on the available capacity and forecast train number, congested sections were identified for each of the cardinal year till 2050.

Present chapter explains in detail the capacity analysis and bottlenecked sections.

7.2. Hierarchy of Indian Rail Network

Indian Railways operates on three gauges: Broad gauge, Meter gauge and Narrow gauge. All major routes are served by broad gauge (61,680 route km as on 2016-17). The width of each railway gauge is described in Figure below and route distribution under each gauge is shown in Table below. The details of the route length under each gauge are as below:

Table 7-1: Size of the Network - Gauge-wise as on 31st March 2017

Gauge	Route Km	Running Track Km	Total Track Km
Broad Gauge (1676 mm)	61,680	87,962	1,14,912
Metre Gauge (1000 mm)	3,479	3,731	4,099
Narrow Gauge (762 mm and 610 mm)	2,209	2,209	2,396
Total	**67,368**	**93,902**	**1,21,40**

Source: - Indian Railway Yearbook, 2016-17

7.3. Existing Capacity

After mapping the existing pan India rail network, the capacity of the rail network was provided as per the LC Data shared by Indian Railway.

Table 7-2: Existing Capacity Utilization

Existing	<70%	70%-100%	100%-150%	>150%
Entire Network	45%	29%	25%	1%
HDN	2%	18%	58%	22%
HUN	24%	28%	35%	13%
HDN+HUN	20%	36%	41%	3%
Others	69%	22%	9%	0%

Existing capacity utilization was calculated as per the LC data. Existing Passenger trains, Existing Goods Trains and Other Trains were to assess the Existing Capacity Utilization and mapped accordingly. Some of the salient findings are listed below:

- 74% of the overall entire network is operating below 100% capacity utilization, 25% of entire network is operating in-between 100%-150% capacity utilization and 1% of network is operating 1.5 times higher than its capacity.
- HDN network has the highest utilization, 20% of the entire HDN network is operating below 100% capacity utilization and only 2% is operating below 70% utilization.
- 58% of HDN network is operating in-between 100%-150% capacity utilization and 22% of network is operating with capacity utilization higher than 150%.
- 52% of HUN network is operating below 100% capacity utilization, 35% of HUN network is operating in-between 100%-150% capacity utilization and 13% is operating 1.5 times of its capacity.

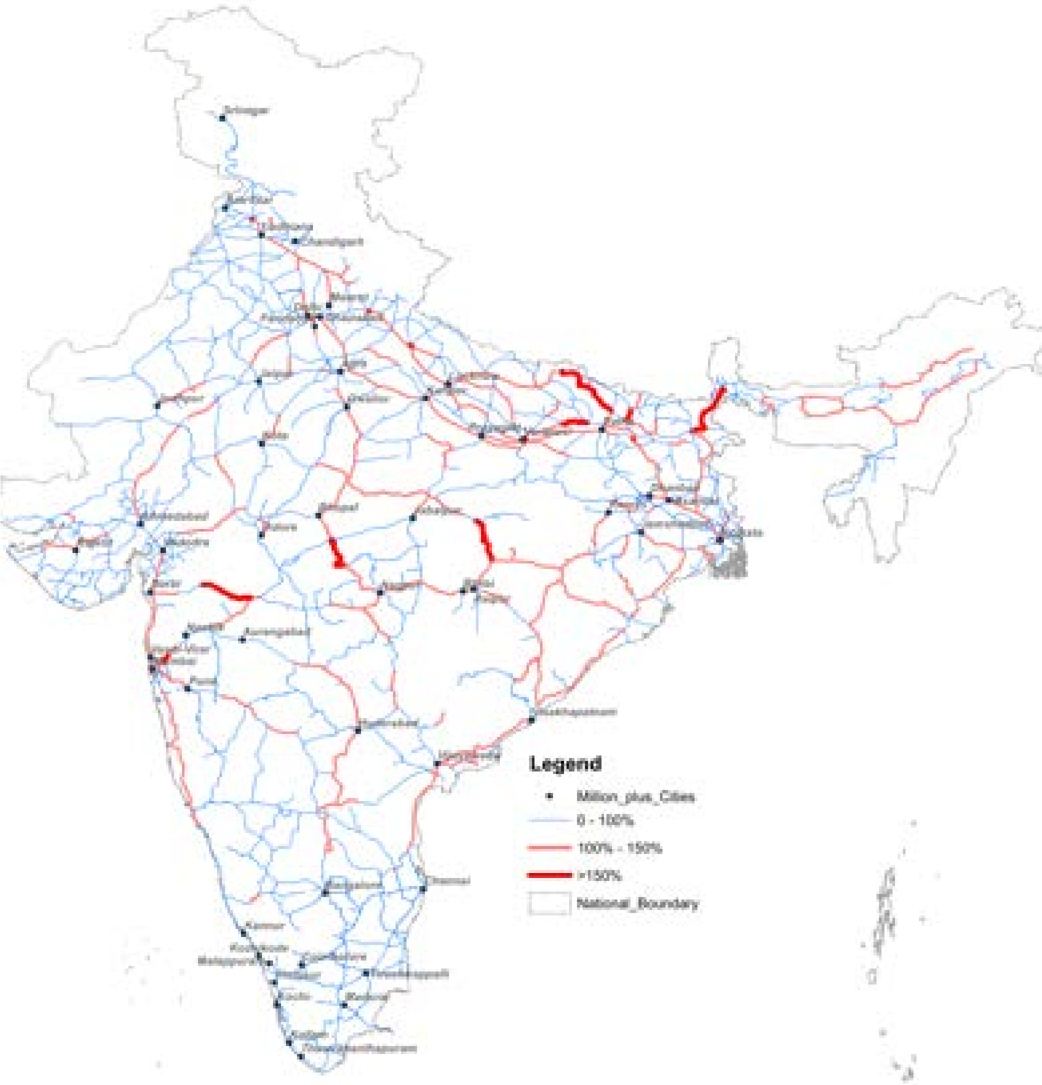


Figure 7-1: Indian Railway Network Existing Capacity Utilization

7.4. Sanctioned works

All the sanctioned works of Indian Railways as per the latest Pink Book and other projects which are either in the stage of Implementation or in the planning stage have been considered to be implemented by 2026 for the purpose of capacity utilisation. The upgraded capacity after the implementation of these projects has been analysed with respect to forecast train number for each of the cardinal years for the identifying bottlenecked sections.

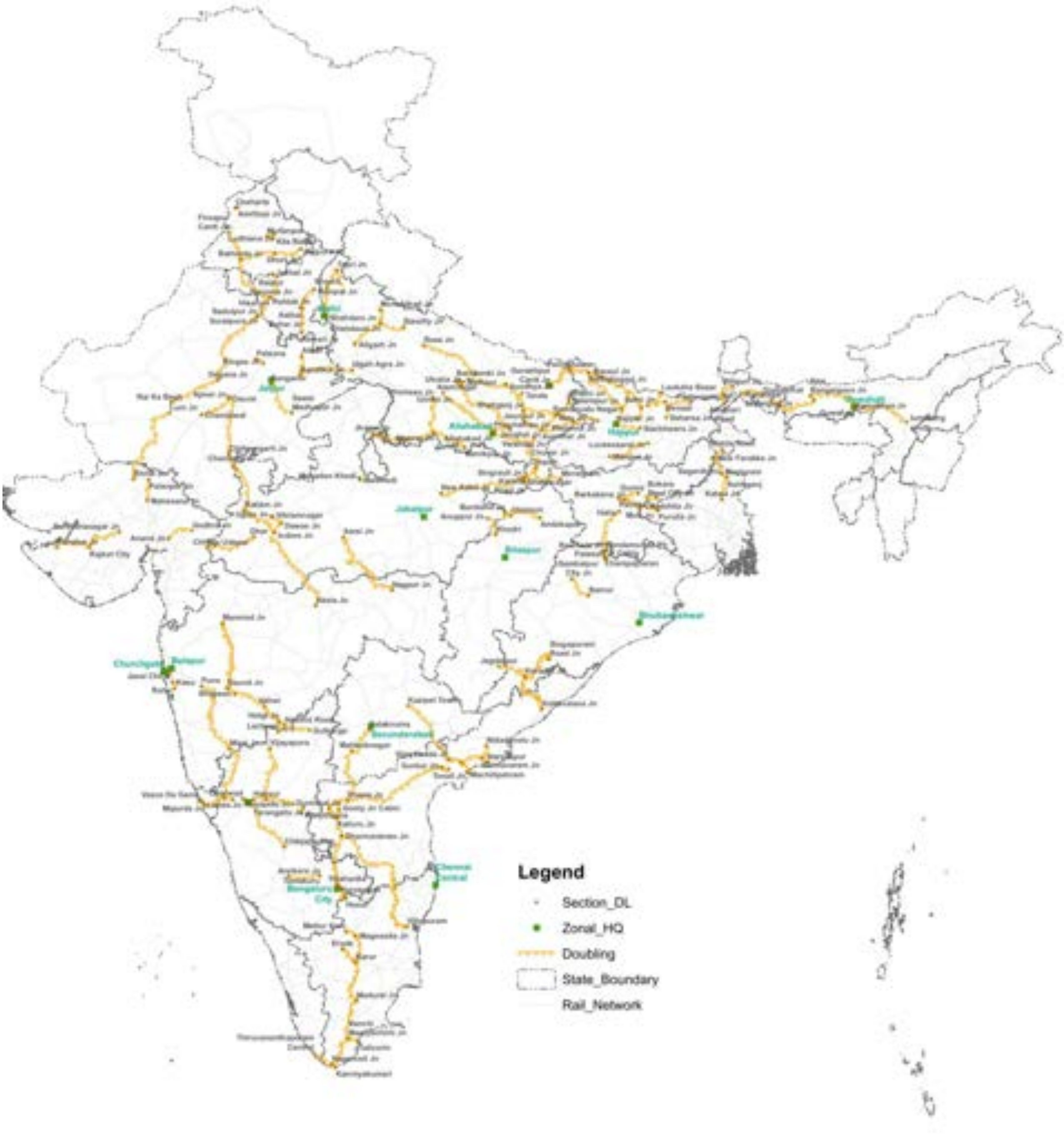


Figure 7-2: Sanctioned Railway Projects of Doubling Line Works

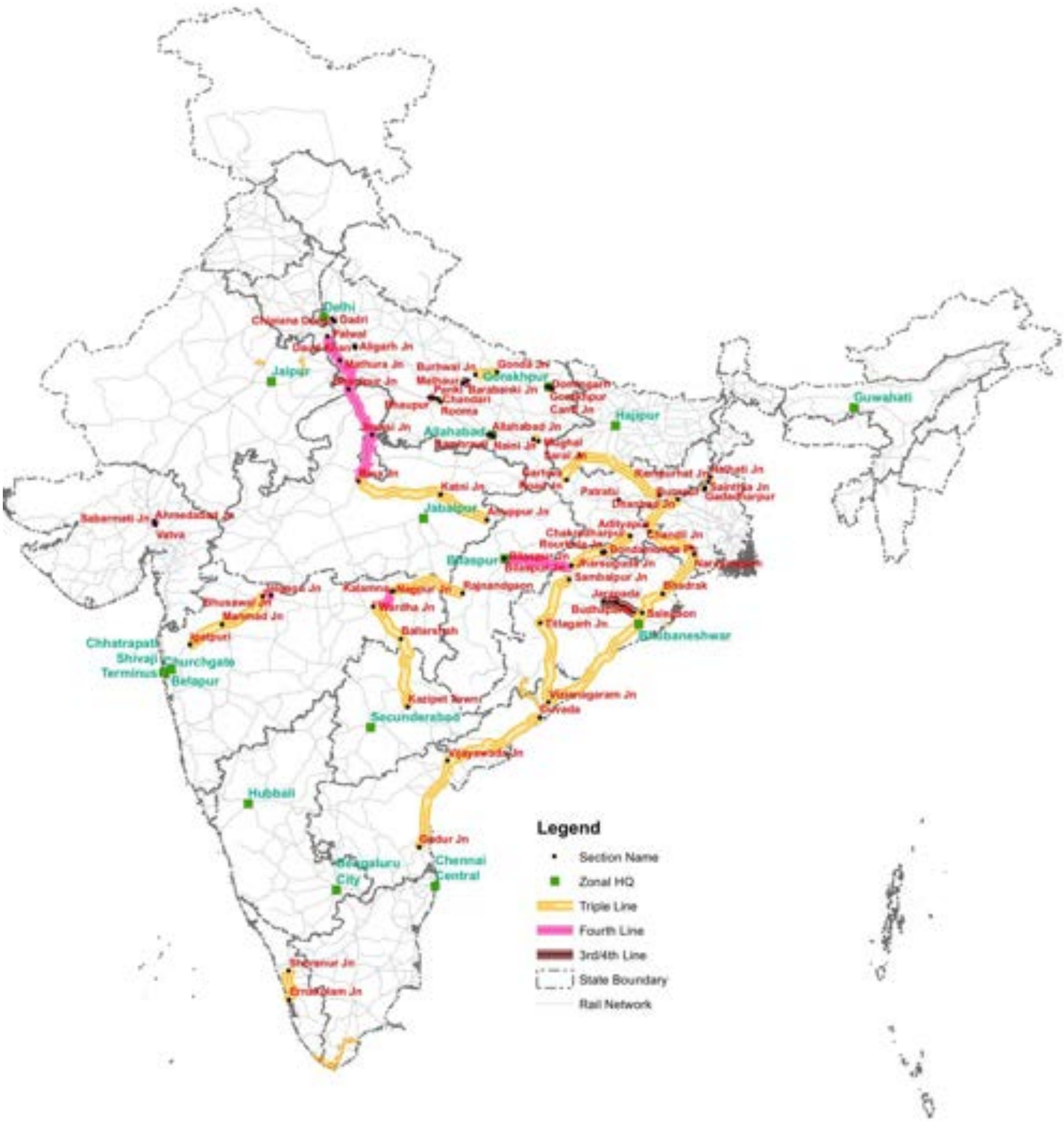


Figure 7-3: Sanctioned Railway Projects of 3rd Line, 4th Line and 3rd & 4th Line

List of Sanctioned Works are in ANNEXURE 7.1: to ANNEXURE 7.6:

7.5. Train/ Network Demand Forecast

For the purpose of estimating forecast train number on each of the LC Section, the passenger and freight demand matrices were converted into train matrices. Forecasted, passenger and goods train matrices for the cardinal years were assigned on the rail network for obtaining bottlenecked sections.

7.5.1. Passenger Train Forecast

As described in previous sections, Passenger trains have been classified as Long distance and Suburban. Passenger train quantum forecast was estimated by considering following passenger capacity per train.

- 2000 for Long Distance Trains
- 3000 for Sub Urban Commuters Trains

7.5.2. Freight Train Forecast

For the purpose Freight train forecast, Rake capacity and Rake typology by commodity type was forecasted and assigned on the network. For empty rakes, the transposed growth factor matrix was assigned.

The wagon forecast for freight trains also includes the phasing out of old wagons. Discarding the old wagons and procurement of new wagons having 25 Ton axle load are described in table below:

Table 7-3: Phasing of New Wagons

Year	BCN	BOXN	BCACBM	BLC	BRN	BCFC	BTPN	Total
2018	84,128	1,31,573	-	30,073	20,622	290	13,189	**2,79,876**
2026	1,57,456	1,47,738	6,523	48,162	29,671	4,158	14,062	**4,07,769**
2031	2,12,727	1,71,242	10,221	73,525	35,243	7,979	34,288	**5,45,225**
2041	2,79,539	2,22,115	14,293	1,15,135	47,895	21,074	79,020	**7,79,071**
2051	3,54,684	2,59,050	19,754	1,65,333	68,413	57,413	1,43,483	**10,68,130**

As the new wagons with higher capacity are procured, the average carrying capacity per rake shall also increase.

Table 7-4: Procure Plan per year

Year	BCN	BOXN	BCACBM	BLC	BRN	BCFC	BTPN	Total
2018-26	10,274	1,956	815	2,246	1,814	520	397	18,022
2026-31	10,258	10,013	740	5,613	1,386	764	4,267	33,041
2031-41	8,880	8,682	407	4,490	1,687	1,310	4,695	30,151
2041-51	12,145	10,651	546	6,468	2,775	3,634	6,856	43,075

7.6. Future Capacity Utilization and Bottlenecked Sections

Future capacity utilizations were calculated for each cardinal year 2026, 2031, 2041 and horizon year 2051. As per the forecasted demand, the rakes were assigned on the network.

7.6.1. Bottlenecked Sections - 2026

The demand forecast for the year 2026 was analysed with respect to the capacity enhanced due to implementation of sanctioned works. It has been estimated that by 2026, 71% of the entire network will be operating below 100% capacity and 55% below 70% of utilisation. Whereas 17% of the network will be operating between 100%-150% of capacity utilization and 12% of network will exceed 1.5 times of its capacity.

In case of HDN only 5% network will be operating at capacity below 70% and 32% network will be below 100% capacity utilisation. Whereas 69% of HDN will operate beyond 100% capacity by 2026

In case of HUN, 64% of the network will be operating below 100% capacity, whereas 19% network is operating in between 100%-150% capacity and 17% of network will exceed 1.5 times of its capacity by 2026.

Table 7-5: Capacity Utilization - 2026

Network Type	<70%	70%-100%	100%-150%	>150%
Entire Network	55%	16%	17%	12%
HDN	5%	27%	45%	24%
HUN	41%	23%	19%	17%
HDN+HUN	30%	24%	28%	18%
Others	75%	10%	9%	6%

Figure 7-4: Capacity Utilization & Bottlenecked Sections - 2026

7.6.2. Bottlenecked Sections - 2031

The demand forecast for the year 2031 was analysed with respect to the capacity enhanced due to implementation of sanctioned works. It has been estimated that by 2031, 59% of the entire network will be operating below 100% capacity and 44% below 70% of utilisation. Whereas 18% of the network will be operating between

100%-150% of capacity utilization and 24% of network will exceed 1.5 times of its capacity.

In case of HDN only 2% network will be operating at capacity below 70% and 32% network will be below 100% capacity utilisation. Whereas 89% of HDN will operate beyond 100% capacity by 2031.

In case of HUN, 41% of the network will be operating below 100% capacity, whereas 27% network is operating in between 100%-150% capacity and 32% of network will exceed 1.5 times of its capacity by 2031.

Table 7-6: Capacity Utilization - 2031

Network Type	<70%	70%-100%	100%-150%	>150%
Entire Network	44%	15%	18%	24%
HDN	2%	9%	39%	50%
HUN	22%	19%	27%	32%
HDN+HUN	16%	17%	30%	37%
Others	66%	13%	7%	13%

Figure 7-5: Capacity Utilization & Bottlenecked Sections - 2031

7.6.3. Bottlenecked Sections - 2041

The demand forecast for the year 2041 was analysed with respect to the capacity enhanced due to implementation of sanctioned works. It has been estimated that by 2041, 39% of the entire network will be operating below 100% capacity and 30% below 70% of utilisation. Whereas 14% of the network will be operating between 100%-150% of capacity utilization and 48% of network will exceed 1.5 times of its capacity.

In case of HDN only 1% network will be operating at capacity below 100%. Whereas 99% of HDN will operate beyond 100% capacity by 2041.

In case of HUN, 17% of the network will be operating below 100% capacity, whereas 17% network is operating in between 100%-150% capacity and 63% of network will exceed 1.5 times of its capacity by 2041.

Table 7-7: Capacity Utilization - 2041

2041	<70%	70%-100%	100%-150%	>150%
Entire Network	30%	9%	14%	48%
HDN	0%	1%	10%	89%
HUN	6%	11%	20%	63%
HDN+HUN	4%	8%	17%	71%
Others	51%	10%	11%	28%

Figure 7-6: Capacity Utilization - 2041

7.6.4. Bottlenecked Sections - 2051

The demand forecast for the year 2051 was analysed with respect to the capacity enhanced due to implementation of sanctioned works. It has been estimated that by 2051, 33% of the entire network will be operating below 100% capacity and 24% below 70% of utilisation. Whereas 11% of the network will be operating between 100%-150% of capacity utilization and 57% of network will exceed 1.5 times of its capacity.

In case of HDN by 2051, none of the sections will be operating with capacity utilisation of less than 100% and 92% network shall be operating on capacity utilisation higher than 150%.

In case of HUN, 8% of the network will be operating below 100% capacity, whereas 14% network is operating in between 100%-150% capacity and 82% of network will exceed 1.5 times of its capacity by 2051.

Table 7-8: Capacity Utilization - 2051

2051	<70%	70%-100%	100%-150%	>150%
Entire Network	24%	9%	11%	57%
HDN	0%	0%	7%	92%
HUN	3%	5%	14%	78%
HDN+HUN	2%	3%	12%	82%
Others	42%	13%	10%	35%

Figure 7-7: Capacity Utilization - 2051

Chapter 8 OPTIONS IDENTIFICATION, EVALUATION & PRIORTISATION – METHODOLOGY

8.1. Background

Indian Railways network is heterogeneous in nature and serves variety of demand segments offering variety of services both for passenger and freight. Therefore, once future high demand corridors and future capacity requirements are established, the next logical step is to frame rail network upgradation proposals.

However, due to variety of services and availability of various capacity enhancement options, it is important to frame a clear methodology and test all the possible options for optimising the capital expenditure before arriving at network proposals.

The methodology and optioneering is required to be accompanied with certain assumptions or underlying parameters that will help in concluding the projects. in this endeavour. Present Chapter details out various options for enhancing capacity and methodology for sequencing the same along with assumptions that have been adopted for framing projects for HSR, DFC, HDN, HUN, etc.

8.2. Overall Methodology for Network Requirements

To start with an overall sequence of activities have been developed for working out network improvement options. These are generic and shall be converted into specific for each network type.

As first step, the proposals on the networks has been worked out on to ensure that right interventions are identified to generate the capacity which meet the forecasted demand with least cost. The process of identification for interventions in carried out as peer following steps.

1. Step 1: Traffic Forecasts are made for different cardinal years (2026, 2031, 2041 and 2051) in terms of Originating and Destined Traffic for different Passenger categories and different commodities
2. Step 2: Forecasted traffic is converted into Origin Destination Matrices (OD Matrices) for passengers and freight separately. These are converted to Trains and Rakes respectively.
3. Step 3: Priority Network is prepared for different cardinal years which incorporate the existing network and proposals under implementation (Pink Book).
4. Step 4: Train OD Matrices are then assigned on the Priority Network for each cardinal year in sequential manner. The sequence of assignment will be passenger trains followed by freight trains and finally empty trains.
5. Step 5: The assignment will result in the forecasted number of Trains (separately for passenger, freight and empty) for each section. Total

number of trains on each sections are compared with existing Line Capacities and line capacity utilization is estimated for each section for each cardinal year.

6. Step 6: Option of Minimum intervention is identified for each section on the basis of forecasted line capacity utilization and split of trains by passenger and freight trains.
7. Step 7: Line Capacity enhancement on account of selected option is analysed with respect to forecasted train number for each section. In case the line capacity is higher than demand, Option is selected as network proposal. In case the capacity enhancement is lower than the forecast train number, next level of option is evaluated till the time the line capacity becomes higher than forecast.
8. Step 8: Wherever the demand of freight is high, options of providing DFCs have been recommended. Similarly, options of providing HSR higher demand of AC Passengers have been recommended.

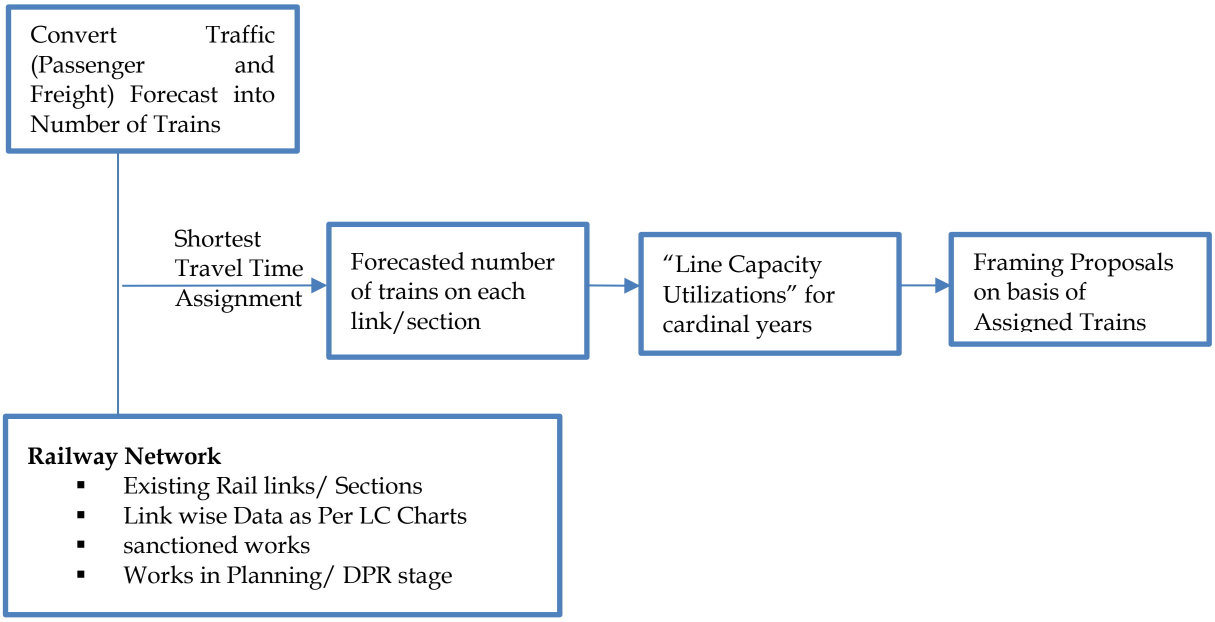


Figure 8-1: – Overall Methodology for Network Requirements

8.3. Optioneering/ Methodology for Developing Detailed Network Proposals

Forecasted matrices of the trains have been assigned on the network using "All or Nothing" Assignment on the shortest route by time taken. Forecasted number of trains on each link have been estimates. These have been further adjusted as per the Railway Sections used in the Railways Line Capacity Charts. Due to increase in demand, the congestion levels are increasing in the overall network despite of increase in the capacity due to implementation of the sanctioned works.

Accordingly, projects on the Indian Railway network are identified based on the assigned number of trains on each section. The interventions are identified in a sequential manner for all the cardinal years in the following steps:

1. Option/ Step 1: If the number of freight trains exceeds 40% share on any section along any corridor which falls on the DFC Master Plan, DFC is

proposed along that section. After identifying the DFC Corridors, assignment model is run again till all DFC sections are identified for the particular cardinal year.

2. Option/ Step 2: After identifying the DFCs, HSR corridors are identified as any corridor if:
   i. Corridor falls on the HSR Master Plan
   ii. Share of passenger trains is more than 80%
   iii. AC Passengers share is greater than 30% and
   iv. if dedicated passenger corridors are is not provided.

   After the HSRs are identified, assignment model is run again till all HSR sections are identified for the cardinal year.

3. Option/ Step 3: After identifying the DFCs and HSR sections, an assignment is done again. The links where the Number of trains exceed the capacity in the priority network, the signaling intervention are identified. TCAS+ABS+CTC is proposed for the Golden Quadrilateral and Golden Diagonal, and TCAS Signaling is proposed for other HUN network and Automatic signaling has been proposed for the remaining network. These interventions will provide additional safety and capacity.
4. Option/ Step 4: After signaling proposals are identified, capacity numbers are updated. It the number of trains still exceed the new capacity numbers; the additional lines are proposed, and the capacities are updated. This process is carried in loop until the new capacity exceeds the number of trains assigned on network.

Subsequent sections detail out methodology for estimating network requirements specific to DFC, HSR, etc.

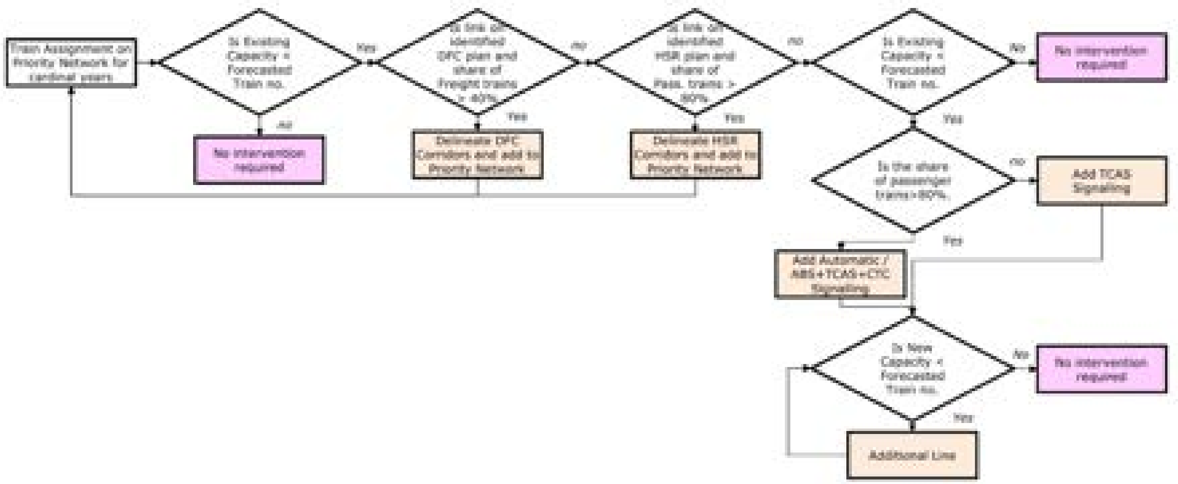


Figure 8-2: – Detailled Methodology for Network Requirements

8.3.1. Methodology for Identifying New Dedicated Freight Corridors (DFCs)

Based on the projected freight, a complete DFC masterplan has been prepared. This includes 5 new DFC Corridors. These also coincide with those identified as part of National Infrastructure Pipeline (NIP).

The identification and phasing of DFC has been based upon following criteria:

Train Assignment for Freight Trains on Network - 2051

↓

Identify "Top Corridors" for Freight Movement which carry 60% of total Freight on the Network

↓

Identify DFC Master Plan

Figure 8-3: –Methodology for DFC Network

8.3.1.1. Rail Network with Freight Share >50%

One of the criteria for identifying the potential DFC routes is the network which is having freight share in excess of 50% of the total traffic. Accordingly following corridors where freight share is more than 50% were identified:

- Kharagpur-Vishakhapatnam-Vijayawada- Guntakal
- Delhi- Agra- Bhopal-Nagpur- Vijayawada-Chennai
- Agra- Pandit Deen Dayal Upadhyay Nagar- Gaya-Dhanbad- Kolkata
- Mumbai- Nashik-Nagpur- Raipur-Bilaspur- Jharsuguda-Jamshedpur- Kharagpur
- Mumbai- Pune-Guntakal- Chennai
- Delhi- Kota- Surat-Mumbai
- Delhi- Ajmer- Ahmedabad

Figure 8-4: –Corridors with Freight Share > 50%

8.3.1.2. Additional Line Requirement > 4

The forecast freight and passenger demand is assigned in terms of forecast number of trains for each rail link. Accordingly, additional rail line requirement is worked out for the purpose of achieving network capacity utilisation of under 70%.

Considering this, an analysis has been carried out by forecasting freight trains on the high demand corridors in Without DFC Scenario. The existing as well as proposed capacity as well as expected traffic volumes on these major corridors are given in tabular format below.

Table 8-1: Freight Trains Forecast Without DFC Scenario

S. No	Corridor	Existing Capacity Pass+ Frgt (Rakes/ Day)	Proposed Capacity Pass+ Frgt (Rakes/ Day)	Peak Freight Traffic Volume (Rakes/ Day)				
				2021	2026	2031	2041	2051
1	Delhi- Kolkata	98	98	102	149	197	288	412
2	Mumbai- Kolkata	93	118	153	200	344	362	540
3	Mumbai- Delhi	158	158	131	174	265	343	438
4	Delhi- Guwahati	45	61	86	147	204	321	449
5	Palwal- Chennai	72	105	92	134	211	299	506
6	Kharagpur-Vijayawada	75	101	85	115	183	267	389
7	Mumbai-Chennai	86	102	110	139	159	174	226

Note: Proposed Capacity Refers to the capacity Enhancement due to Sanctioned works

From the above table it can be observed that the freight volumes on Delhi- Kolkata, Mumbai-Kolkata, Delhi- Guwahati and Mumbai- Chennai corridors exceed the proposed track capacities in 2021 itself.

On Mumbai- Delhi, Palwal-Chennai and Kharagpur-Vijayawada corridors the freight volumes shall exceed the proposed capacities by 2026. Thus, the existing railway infrastructure will not be able to accommodate the envisaged freight volumes even after the sanctioned upgradation.

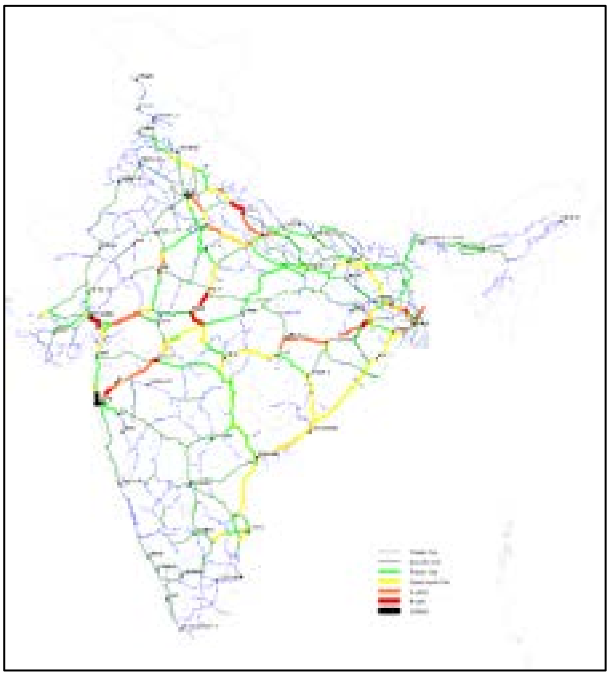


Figure 8-5: –Additional Line Requirements without DFC (2031)

While doing so, in case of high demand corridors, additional line requirement is exceeding 4 during various cardinal years. Therefore, for the purpose of creating high capacity infrastructure, instead of proposing additional lines in excess of 4, developing DFC network has been recommended. DFC not only segregates freight from passenger but also offers higher line capacity for running freight trains. In addition, the DFC freight trains shall be having higher axle load and therefore single DFC rake can carry higher volume of freight then conventional rakes. This not only enhances the capacity but also reduce the requirement for additional infrastructure.

Considering above, following sections have been identified:

FY 2031

As per the demand forecast for year 2031, following corridors require additional lines more than 4 (quadrupling) and therefore qualify for DFC network in the year 2031.

- Mumbai- Bhusawal (HDN 3),
- Raipur- Jamshedpur (HDN 2),
- Kolkata- Dhanbad (HDN 1),
- Ahmedabad- Vadodara-Ratlam (HDN 3),
- Itarsi- Bina (HDN 5),
- Bareilly- Lucknow (HDN 4),
- Delhi- Nagpur- Vijayawada (HDN 5),
- Kolkata- Vishakhapatnam- Vijayawada.

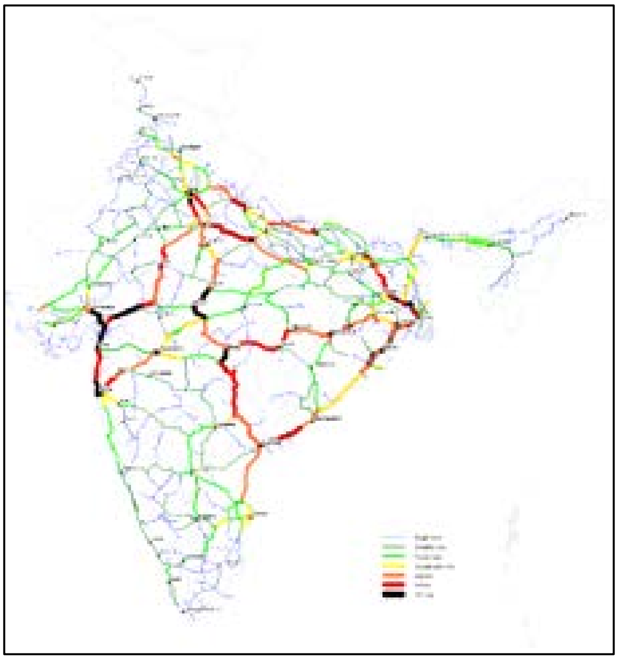


Figure 8-6: –Additional Line Requirements without DFC (2041)

FY 2041

As per the demand forecast for year 2031, following corridors require additional lines more than 4 (quadrupling) and therefore qualify for DFC network in the year 2041.

- Nagpur- Jamshedpur (HDN 2),
- Mumbai- Nagpur- Kolkata,

FY 2051

- Palwal - Itarsi

8.3.2. Methodology for Identifying New High-Speed Rail Corridors (HSRs)

Similar to DFC corridors, a detailed methodology has been adopted for identifying and recommending new High-Speed Rail (HSR) Corridors. some of these corridors have already been identified as part of National Infrastructure Pipeline (NIP).

Given the long lead time and inherent risk in high-speed rail investments, it is essential that suitable corridors are selected where the conditions exist to support strong passenger demand for high-speed services. In other words, it is critical to identify the corridors across the country with the maximum potential to support high-speed rail in order to minimize this investment risk.

To do so, a ranking system based on an index of five criteria was developed to judge the extent of demand for High-Speed Rail between any two city pairs. Each city pair consists of two cities, each with a population of at least 1 Million that are separated by a distance of 300 to 700 Km.

The parameters considered for identifying HSR network are listed below:

1. Major Passenger Movement/ Demand Corridors
2. City Population (greater than 1 million people)
3. Intercity Distance (between 300-700 Km).
4. Regional Connectivity
5. Religious/ Tourism Potential Cities
6. Forecast AC Passenger Share
7. Cities with restricted Air Connectivity

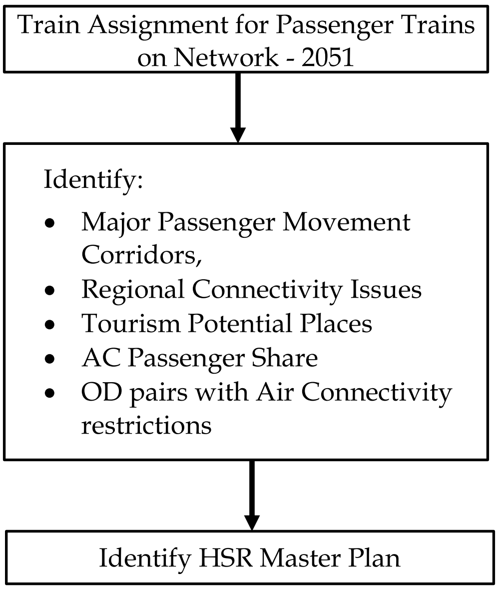


Figure 8-7: –Methodology for HSR Network

8.3.3. Optioneering/ Methodology for Identifying Network Improvement Projects for High Density Network (HDN)

As explained above, based on the forecast trains, HSR and DFC network has been identified. The HSR and DFC corridors are along the HDN routes only. Therefore, after segregating dedicated freight and passenger network, significant amount of traffic shall be diverted from HDN. Subsequently proposals were identified based on remaining traffic for HDN rail network. The HDN network upgradation identification methodology has been explained in Section 5.4 and Figure 5-2. The steps involved in identifying HDN network proposals are reiterated below:

1. <u>Option/ Step 1:</u> After identifying the DFCs and HSR sections, an assignment is done again. The links where the Number of trains exceed the capacity in the priority network, the signaling intervention are identified. TCAS+ABS+CTC is proposed for the Golden Quadrilateral and Golden Diagonal, and TCAS Signaling is proposed for other HUN network and Automatic signaling has been proposed for the remaining network. These interventions will provide additional safety and capacity.
2. <u>Option/ Step 2:</u> After signaling proposals are identified, capacity numbers are updated. It the number of trains still exceed the new capacity numbers; the additional lines are proposed, and the capacities are updated. This process is carried in loop until the new capacity exceeds the number of trains assigned on network.

8.3.4. Methodology for Identifying Network Improvement Projects for Highly Utilized Network (HUN)

After addressing the HDN, the next in line network having high demand is Highly Utilised Network (HUN). Unlike, HDN, HUN does not have a single line haul demand and serves multiple Origins and Destinations. Also, HUN does not have any parallel DFC or HSR. Therefore, train forecast quantum has been used as basis. The steps involved are listed below:

1. Step 1: Train forecast number is compared with link capacity.
2. Step 2: the link will be checked whether it is overlapping with any HDN/ GQ/ GD corridor. If Yes, proposals shall be as per the methodology of HDN.
3. Step 3: If No in case of Step 2, then it will be evaluated that whether the link is a feeder route to DFC or not. If Yes, then separate line shall be proposed for segregating freight trains.
4. Step 4: If No in case of Step 3, then the present capacity of the link shall be analyzed with that of train forecast. If the capacity is higher than no interventions are required. If not, then next shall be followed.
5. Step 5: In case the capacity of the link is lesser in Step 4, the capacity offered due to introduction of advance signaling including Automatic Signaling shall be analyzed with that of train forecast. If the capacity offered is higher than no further intervention is required.
6. Step 6: in case the capacity offered even after introduction of advance signaling as per Step 6, then additional line shall be proposed.

Detailed methodology flow chart for HUN is presented in figure below;

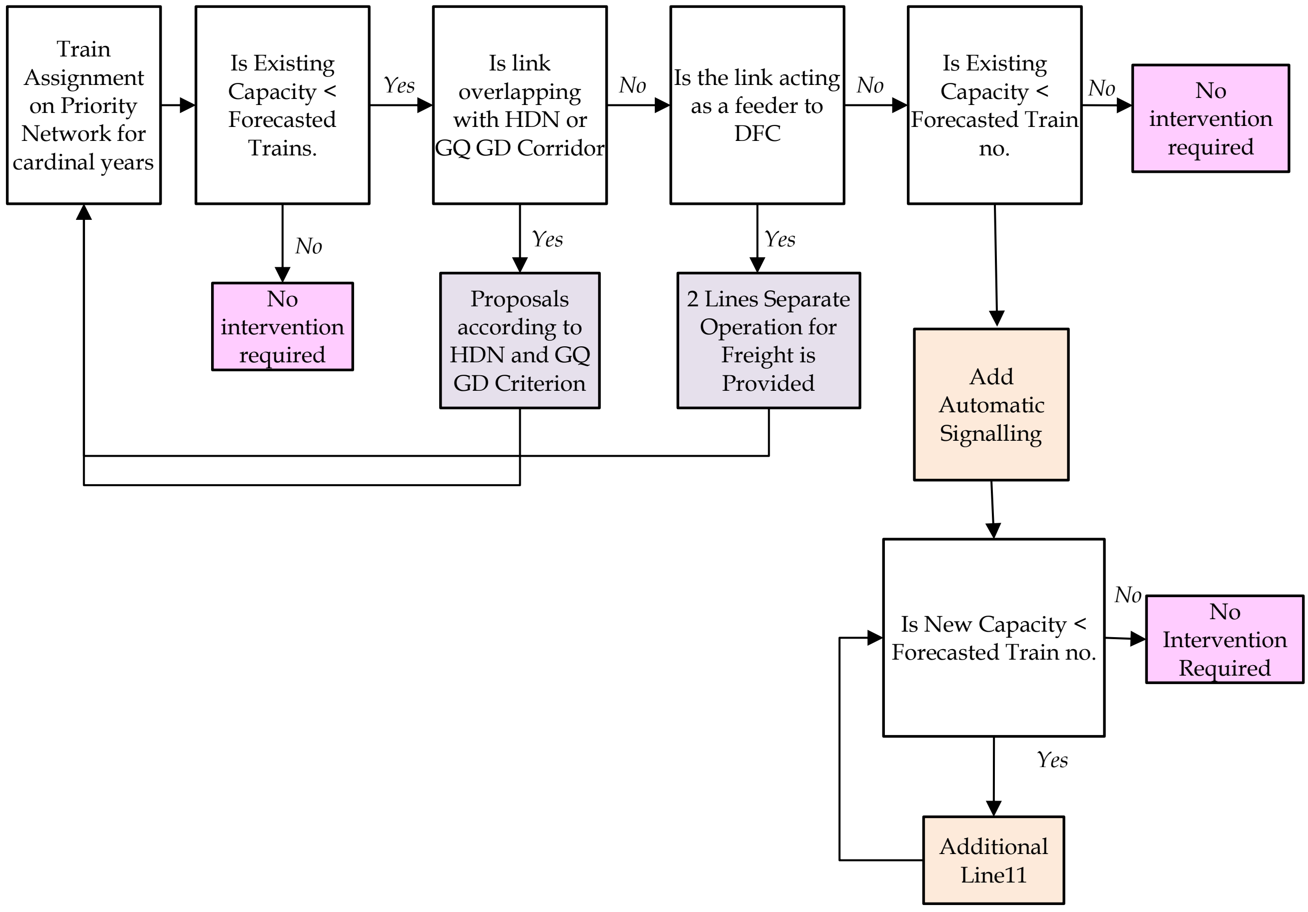


Figure 8-8: –Methodology for HUN Network

8.4. Assumptions

The assumptions are related to capacities for rail network based on various signalling type and for coaches and wagons in terms of quantum and freight that can be transported in each coach and wagon.

8.4.1. Assumptions for Conversion of Passengers and Freight to Trains

For the purpose of estimating the capacity utilisation requirements, the forecast passenger and freight estimated to be carried by rail is required to be converted into trains. Therefore, capacity related to coaches and wagons has been adopted. Same is described below:

Passenger Trains

The numbers of passengers have been converted into passenger trains, based on the existing occupancy of the long-distance trains. On the basis of the existing data, average occupancy is worked out as 1600 passengers per train for the base year (2018). In discussions with stakeholders, it was put forward that with the due to technology, private participation and other factors, there is a substantial potential to increase the occupancy of trains, which will be occur gradually. Passenger OD Matrices have been converted to train matrices for different cardinal years using the occupancy values given in following table. The migration path of increased occupancy is also presented in table below.

Table 8-2: Passenger to Train Conversion

Years	Long Distance Trains	Sub Urban Trains
2019	1,600	3,000
2026	1,800	3,200
2031	2,000	3,600
2041	2,200	3,800
2051	3,000	5,000

Freight Trains

For the freight traffic, five broad categories of wagons have been considered, which are as follows:

1. Covered Container (BCN)
2. Open Container (BOXN)
3. Flat Container (BLC)
4. Rapid Discharge (BRN)
5. Tank Container (BTPN)

Existing Tonnage to Rake Ratio for the above categories of wagons has been used to convert forecast freight to the number of rakes required. It is further assumed that with the technological advancements over a period time, capacity of the rakes will increase over time and as a result the conversion factor changes. Tonnes to rake conversion presented in table below:

Table 8-3: Tones to Rake Conversion

S. N.	Description of wagon	Covered BCNS	Open BOXNS	Container BLCSA	Flat Proto BRN 22.9	Tank Proto BTFLN
1	Length over Hd. Stock	10678	9784	13625		
2	Length over Buffer / Couplers	11478	10713	14554		
3	Length inside	10500	9808	12192		
4	Width Inside / Overall	3328	3111/3135	2200/2100		
5	Height Inside / From Rail	4174	2300/3581	1009		
6	Bogie Centres	7426	6524	9675		
7	Journal Centres	2222	2260	2260		
8	Wheel dia. on Tread	1000	840	840		
9	Nominal Max. Axle load	25 T	25 T	25 t	25	25
10	Tare	22.7 T	19.85 T	19.2	23.3	23.3
11	Pay Load	77.3 T	80.15 T	80.8	76.7	76.7
12	Ratio Pay Load / Tare	3.4 T	4.04	4.21		
13	Gross Load	100 T	100 T	100		
14	No. of wagons / Rake	55	59	18	42	51
15	Through - Put / Rake	4251	4729	2181.6	3221.4	3911.7
16	Track Load Density	9.33 T/M	9.33 t./m	6.87 t/m		
17	Cubic Capacity	9.87 m³	69.36 m³			
18	Speed (Empty / Loaded)	100 / 100	85 / 65	65		
19	Type of Coupler	CBC	CBC	CBC		
20	Type of Bearing	CTRB	CTRB	CTRB K-Class		

8.5. Capacity Standards - HDN

For analysis of capacity deficiency with respect to train forecast, capacity offered by the HDN has been adopted based on various parameters. These are described in table below;

Table 8-4: Adopted Capacity Standards for HDN

<table>
<tr><th rowspan="2">Configuration</th><th colspan="5">Capacity (Trains /Day/Direction)</th></tr>
<tr><th colspan="4">HDN 1 and HDN 3 in 2026, other HDNs 2031 onwards*</th><th>Other HDNs till 2026** (Mixed Traffic)</th></tr>
<tr><th colspan="6">One-Side capacity for Mixed Traffic</th></tr>
<tr><th></th><th>Type of Operation</th><th>Cap.</th><th>Type of Operation</th><th>Cap.</th><th>Cap.</th></tr>
<tr><td>Double Line</td><td rowspan="2">Mixed Operation</td><td>60</td><td rowspan="4">Dedicated Passenger Operation</td><td>-</td><td>60</td></tr>
<tr><td>Double Line Automatic TCAS+ABS+CTC Signalling</td><td>90</td><td>200</td><td>90</td></tr>
<tr><td>Triple line Automatic TCAS+ABS+CTC Signalling</td><td>Segregated, 2 Passenger Lines, 1 Freight Line</td><td>225</td><td>300</td><td>120</td></tr>
<tr><td>Quadruple line with Automatic TCAS+ABS+CTC Signaling</td><td>Segregated, 2 Passenger Lines, 2 Freight Lines</td><td>290</td><td>450</td><td>180</td></tr>
<tr><th colspan="6">Capacity of Passenger Dominated Operations***</th></tr>
<tr><th></th><th>Type of Operation</th><th colspan="4">Capacity</th></tr>
<tr><td>Single Line</td><td rowspan="3">Dedicated Passenger Operations</td><td colspan="4">25</td></tr>
<tr><td>Double Line</td><td colspan="4">60</td></tr>
<tr><td>Double Line Automatic TCAS+ABS+CTC Signalling</td><td colspan="4">200</td></tr>
</table>

Configuration	**Capacity (Trains /Day/Direction)**	
	HDN 1 and HDN 3 in 2026, other HDNs 2031 onwards*	**Other HDNs till 2026** (Mixed Traffic)**
Triple line Automatic TCAS+ABS+CTC Signalling		300
Quadruple Line Automatic TCAS+ABS+CTC Signalling		450

* *HDN 1 and HDN 3 will have Automatic TCAS+ABS+CTC Signalling 160 kmph Passenger Operation by 2026*

** *Other HDNs will also have the Automatic TCAS+ABS+CTC Signalling but at lower Speed and mixed nature of traffic, Lower Line capacity will be achieved along with Higher safety by 2026 and 160 kmph Passenger Operations by 2031 and beyond*

*** *Passenger Dominated Operations with 160 kmph Speed, highest capacity can be achieved by Automatic TCAS+ABS+CTC Signalling, It is possible after providing DFCs along the HDN Corridors*

8.6. Capacity Standards - HUN

Similar to HDN capacity norms for HUN have been adopted. These are described in table below;

Table 8-5: Adopted Capacity Standards for HUN

Configuration	**Capacity (Trains /Day/Direction)**	
	For all HUNs Networks and Other Networks	
One-Side capacity for Mixed Traffic*		
	Type of Operation	**Capacity**
Single Line	Mixed Operation	25
Double Line		60
Double Line Automatic Signalling		90
Triple line Automatic Signalling	Segregated, 2 Passenger Lines, 1 Freight Line	120
Quadruple line Automatic Signalling	Segregated, 2 Passenger Lines, 2 Freight Lines	270
Capacity of Passenger Dominated Operation#		
	Type of Operation	**Capacity**
Single Line	Dedicated Passenger Operation	25
Double Line		60
Double Line Automatic Signalling		150
Triple line Automatic Signalling		225
Quadruple line Automatic Signalling		300

Chapter 9 DEDICATED FREIGHT CORRIDORS (DFC)

9.1. Background

Dedicated Freight Corridors (DFC) have been envisioned by Ministry of Railways as dedicated high speed, high axle load carrying corridors for freight movement. These have been envisioned along the golden quadrilateral network of Indian Railways that accounts for 16% of network but carries 58% of freight traffic. Of the Golden Quadrilateral, the Delhi- Mumbai on the Western Corridor and Delhi-Howrah on the Eastern Corridor are highly saturated with capacity utilisation in excess of 100%, which has led to loss of freight business for Indian Railways. Therefore, in order to maintain the capacity and speed, Dedicated Freight Corridors along Eastern (HDN 1) and Western (HDN 3) Corridors were envisioned.

DFFCIL has also envisioned to developed Dedicated Freight Corridors along East West (HDN 2), East Coast (HDN 6) and North South (HDN 5) Corridors.

As part of National Rail Plan, a detail exercise has been carried out for identifying the DFC Master Plan requirement for the year 2051 based upon the freight demand forecast. Methodology of identifying and phasing the DFC corridors has been explained in previous chapter.

Present Chapter details out the nature and quantum of freight (NTKMs) that will be carried by the proposed DFC Corridors, Phasing of DFC corridors based upon the freight demand in each cardinal years, traffic that will be diverted from other IR Network and recommendations of feeder network required to be developed for enhancing the overall efficiency of proposed DFC Corridors.

9.2. Need for DFC

As of 2018, the Indian Railways transported around 4,059 Million Tons of freight per day on its network. Of which, over 50% of the freight was carried by the following major corridors:

1. Delhi- Kolkata
2. Mumbai- Kolkata
3. Mumbai- Delhi
4. Delhi- Guwahati
5. Palwal- Chennai
6. Kharagpur- Vijayawada
7. Mumbai- Chennai

With growing freight demand, the freight along these corridors will also grow and which will in turn increase the freight train requirement. The increased freight trains shall further increase the capacity requirements of the above-mentioned corridors. One option is to do nothing and another to develop alternative high capacity infrastructure that takes away the load and decongest the existing rail network.

9.3. Potential Dedicated Freight Corridors (DFCs) Routes

Dedicated Freight Corridors have been identified based on a detailed ranking criteria and methodology as explained in detail in **0**. Refer **Optioneering/ Methodology for Developing Detailed Network Proposals**

9.4. Recommended Dedicated Freight Corridor (DFC) Network

Based on the above considerations, the following DFC corridors have recommended.

Table 9-1: Recommended DFC Corridors

S. No.	DFC Name	Start	End
1	Eastern DFC	Ludhiana	Dankuni
2	Western DFC	Dadri	Navi Mumbai
3	East- West DFC	Palghar	Andal
4	North- South DFC	Pirthala (near Palwal)	Arakonnam (near Chennai)
5	East Coast DFC	Hijli (near Kharagpur)	Vijayawada

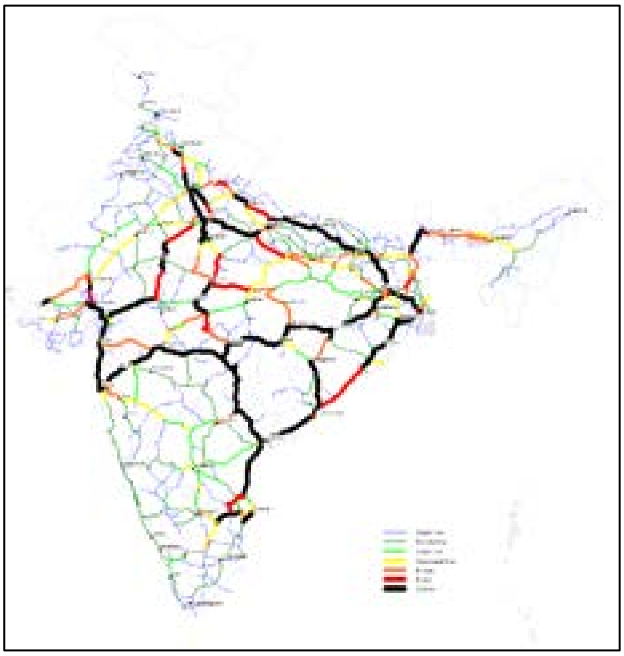


Figure 9-1: –Additional Line Requirements without DFC (2051)

The eastern and western DFC are already under construction. The other 3 identified DFCs are also concurrent with the proposals identified under National Infrastructure Pipeline (NIP). These are discussed in the following sections.

9.4.1. The East-West DFC

East West DFC connects Palghar to Dankuni.

Proposed Route

- East-West DFC starts from Palghar (on Western DFC, near Vangaon station on IR), as direct connectivity with Mumbai is not feasible.
- On the Eastern end, one route ends at Andal (on Eastern DFC station) and the other route at Kamarkundu (new station on Eastern DFC, near Dankuni), as direct connectivity with Howrah/Dankuni is not feasible.
- Total route length of East-West Dedicated Freight Corridor between Howrah (Andal/Kamarkundu near Dankuni) and Mumbai (near Palghar) is 2,328 km.
- Total of 37 Junction Stations (31 on Palghar - Andal Line and 6 on Rajkharswan – Kamarkundu Line) and 29 Crossing Stations are proposed on this corridor.

Phasing:

- Section between Nagpur to Dankuni along with EDFC connectors (1077 km) is proposed to be operational by 2031.

- Remaining section from Palghar to Nagpur (936 km) is proposed to be operational by 2041.

9.4.2. The North- South DFC

Proposed route:

- North-South DFC starts from Pirthala (on Western DFC, near Palwal station on IR), as direct connectivity with Delhi is not feasible at the Northern-end.
- At the Southern-end, the proposed Arakkonam station is connected with Chennai-Bangalore line.
- One connection is proposed towards Chennai at IR station Trubalangadu and another connection is proposed with Melapakkam towards Bangalore side.
- Total route length between Pirthala (near Delhi) and Arakkonam (near Chennai) is 2,327.6 km.
- A total of 21 Junction Stations and 43 crossing stations have been proposed along the North-South DFC.

Phasing

- Section from Itarsi- Nagpur- Vijayawada- Chennai (1206 km) is proposed to be operational by 2041.
- Remaining section from Palwal to Itarsi (751 km) is expected to become operational by 2051.

9.4.3. The East Coast DFC

Proposed Route

- East-Coast DFC starts from Hijli (near Kharagpur), as direct connectivity with Kharagpur is not feasible.
- At the Southern-end, the proposed Vijayawada DFC terminal is connected with Vijayawada IR station and North-South DFC line.
- Total route length from Kharagpur to Vijayawada is 1,114.7 km.
- This route has 31 stations between Kharagpur and Vijayawada, out of which 15 are junction stations and 16 are crossing stations.

Phasing

- The entire section from Hijli to Vijayawada is proposed to be operational by 2031.

Table 9-2: Proposed Phasing of DFC Network

Phasing	**2026**	**2031**	**2041**	**2051**
Length (Km)	**2,807**	**3,278**	**1,206**	**751**
New DFC Corridors	**Eastern DFC**, 1,324 Km (Under Construction till Sonnagar)	**East Coast DFC**, 1,265 Km (Kharagpur to Vijayawada)	**North South DFC**, 1,206 Km (Itarsi to Chennai via Nagpur and Vijayawada)	**North South DFC**, 751 Km (Palwal to Itarsi)
	Western DFC 1,483 Km (Under Construction)	**East West DFC**, 2,013 Km (Palghar to Dankuni and EDFC Connectors)		

Phasing	2026	2031	2041	2051
Length (Km)	2,807	3,278	1,206	751
		Eastern DFC, 515 Km (Sonnagar to Dankuni)		

Figure 9-2: –Proposed DFC Master Plan and Phasing

9.4.4. Intersections

All the DFCs are planned to be interconnected with one another to allow for seamless transfer of freight traffic.

The East-West DFC is planned to intersect all the other DFCs at the following locations:

- Western DFC at Palghar near Vangaon (Maharashtra)
- North- South DFC at Sindi near Nagpur
- Eastern DFC at Andal and Kamarkundu near Dankuni
- East coast DFC at Hijli near Kharagpur

Similarly, intersections for the North- South DFC are as follows:

- Western DFC at Palwal

- Eastern DFC at Tundla
- East Coast DFC at Vijayawada

9.5. Traffic Diversion on DFC Network

After establishing DFC Network Master Plan and its phasing, based on forecast freight traffic assignment on the proposed network, the diverted quantum of forecast freight NTKMs were estimated for each cardinal year and for the horizon year.

Once all the planned corridors of the DFC network become fully operational. The details of the corridor-wise traffic volumes carried on the DFC up to 2051 are presented in table below.

Table 9-3: Total Freight Traffic (Billion NTKMs) Diversion to DFC

	2021	2026	2031	2041	2051	2021 Share	2026 Share	2031 Share	2041 Share	2051 Share
IR Network	948	922	1034	1414	2007	100.0%	64.2%	48.4%	39.3%	39.2%
WDFC	0	234	275	451	590	0.0%	16.3%	12.9%	12.5%	11.5%
EDFC	0	281	435	594	662	0.0%	19.6%	20.3%	16.5%	12.9%
East West DFC	0	0	128	499	651	0.0%	0.0%	6.0%	13.8%	12.7%
East Coast DFC	0	0	266	350	400	0.0%	0.0%	12.5%	9.7%	7.8%
North South DFC	0	0	0	294	808	0.0%	0.0%	0.0%	8.2%	15.8%
Total	948	1,437	2,139	3,602	5,118	100.0%	100.0%	100.0%	100.0%	100.0%

9.5.1. Traffic Diversion on DFC Network by Commodity

The diverted freight traffic on DFC was further analysed for estimating quantum/ share of commodities that will be transported on respective DFC corridors.

Table 9-4: Commodity Forecast on DFC

Commodity	WDFC				EDFC				E-W DFC			E-Co DFC			N-S DFC	
	2026	2031	2041	2051	2026	2031	2041	2051	2031	2041	2051	2031	2041	2051	2041	2051
BOG	50%	38%	34%	27%	37%	39%	34%	33%	32%	28%	25%	39%	39%	27%	45%	35%
Cement	9%	11%	13%	14%	25%	10%	11%	12%	9%	11%	11%	9%	9%	10%	14%	14%
Coal	10%	13%	13%	13%	8%	21%	25%	24%	27%	26%	23%	18%	18%	17%	16%	17%
Container	7%	10%	10%	11%	2%	2%	2%	2%	1%	8%	9%	4%	4%	4%	7%	6%
Fertilizer	2%	3%	3%	4%	3%	3%	3%	3%	8%	3%	4%	5%	5%	4%	2%	3%
Food grains	5%	5%	4%	3%	9%	8%	7%	7%	4%	3%	3%	4%	4%	3%	3%	4%
Iron ore	1%	1%	1%	1%	1%	1%	1%	1%	2%	5%	5%	8%	8%	13%	3%	4%
Pig iron	3%	3%	3%	3%	5%	5%	5%	5%	15%	9%	9%	6%	6%	6%	5%	4%
Pol	11%	14%	14%	13%	9%	10%	9%	9%	2%	5%	5%	7%	7%	7%	4%	6%
Rm for steel	1%	1%	1%	11%	1%	1%	2%	3%	1%	1%	5%	1%	1%	9%	1%	6%
Maximum Number of Rakes / Day	91	55	158	186	73	61	123	181	23	116	135	62	101	113	100	151

9.5.2. NTKMs by Commodity by DFC Corridor

Forecasted freight demand diverted onto DFC network was further analysed in the form NTKMs by Commodity Type for respective DFC Corridor. Billion NTKMs by Commodity, by DFC Corridor for each cardinal year are presented in table below:

Table 9-5: Forecast Freight Traffic in Billion NTKMs by Commodity by DFC Corridor

DFC Corridor	BOG	Cement	Coal	Container	Fertilizer	Food Grains	Iron Ore	Pig Iron	POL	RM For Steel	Total
2026											
Eastern DFC	56	10	36	1	4	12	2	9	10	140	281
Western DFC	102	24	29	7	7	14	2	8	39	2	234
Grand Total	**159**	**34**	**65**	**9**	**11**	**26**	**4**	**17**	**49**	**142**	**515**
2031											
East-Coast DFC	118	25	42	3	5	12	19	18	21	2	266
Eastern DFC	189	35	91	4	8	30	8	29	35	6	435
Western DFC	108	27	38	10	11	15	2	8	54	2	275
East -West DFC	24	13	52	2	4	4	10	15	2	3	128
Nagpur to Durg	5	1	4	0	1	1	0	2	0	0	14
Durg to Dankuni	19	12	49	1	3	4	10	13	1	3	113
Grand Total	**439**	**99**	**224**	**18**	**28**	**61**	**39**	**72**	**112**	**13**	**1,105**
2041											
East-Coast DFC	120	31	84	5	9	14	28	24	30	4	350
Eastern DFC	223	53	155	7	15	39	13	38	42	9	594
East -West DFC	168	49	128	21	14	17	23	44	27	7	499
Palghar to Akola	67	12	11	11	4	5	2	9	10	2	134
Akola to Nagpur	47	9	10	7	3	4	1	7	7	1	97
Nagpur to Durg	10	3	11	0	2	1	2	5	2	0	36
Durg to Dankuni	43	24	95	2	5	8	18	24	9	4	233
North - South DFC	150	34	37	15	6	11	7	17	14	3	294
Palwal to Itarsi	-	-	-	-	-	-	-	-	-	-	-
Itarsi to Nagpur	5	2	5	0	1	1	1	1	1	0	17
Nagpur to Vijayawada	75	20	26	8	4	4	5	8	8	1	159
Vijayawada to Chennai	70	11	6	7	2	5	2	8	5	2	119
Western DFC	170	58	67	18	18	18	4	13	81	4	451
Grand Total	**831**	**225**	**471**	**66**	**61**	**99**	**76**	**138**	**194**	**27**	**2,188**
2051											
East-Coast DFC	127	42	69	7	11	16	52	30	41	4	400
Eastern DFC	238	69	163	9	16	47	17	37	55	10	662
East -West DFC	204	70	151	35	22	18	32	65	45	8	651
Palghar to Akola	77	15	16	19	7	5	3	12	18	1	173
Akola to Nagpur	55	12	16	12	5	3	2	10	11	1	127
Nagpur to Durg	15	5	15	1	4	2	1	10	3	1	57
Durg to Dankuni	57	38	104	4	7	8	25	33	13	5	295
North -South DFC	376	98	108	28	18	33	25	44	63	14	808
Palwal to Itarsi	87	27	46	1	6	11	2	14	20	4	220
Itarsi to Nagpur	35	11	20	1	2	4	1	8	8	2	91
Nagpur to Vijayawada	136	39	34	14	6	9	8	15	25	3	290
Vijayawada to Chennai	118	21	8	12	3	9	13	8	10	5	207
Western DFC	175	89	107	29	30	20	6	16	114	5	590
Grand Total	**1,120**	**369**	**598**	**108**	**98**	**133**	**132**	**192**	**318**	**41**	**3,111**

9.6. DFC Connectors

In order to enhance the outreach of DFC network and reduce the travel time on access and dispersal links, certain rail links have been proposed as Greenfield DFC connectors and have been recommended to be developed as dedicated freight subnetwork for the purpose of reducing delays.

Table 9-6: Proposed Greenfield DFC Connectors, Forecast Train Number & Commodity Distribution

Station Name	Length (Km)	DFC	Trains 2026	Trains 2031	Trains 2041	Trains 2051	BOG	Cement	Coal	Container	Fertilizer	Food Grains	Iron Ore	Pig Iron	POL	RM for Steel
Beawar	6.09	WDFC	4	7	6	15	31%	9%	24%	28%	1%	3%	2%	0%	1%	1%
Chandawal	2.90	WDFC	63	75	85	53	15%	2%	48%	6%	2%	2%	0%	9%	7%	9%
Chandlodiya	15.80	WDFC	36	56	77	114	37%	9%	10%	13%	6%	3%	1%	5%	15%	1%
Dahanu Road	12.88	WDFC	55	94	154	233	41%	8%	6%	13%	4%	4%	1%	6%	16%	0%
Diva Jn	5.77	WDFC	16	22	36	49	8%	5%	2%	62%	2%	4%	5%	1%	10%	1%
Kalyan Jn	3.13	WDFC	66	73	87	125	50%	5%	4%	14%	2%	4%	1%	2%	17%	1%
Mahesana Jn	9.74	WDFC	3	4	10	33	32%	17%	3%	10%	14%	0%	0%	5%	20%	0%
Palanpur Jn	7.57	WDFC	46	75	106	142	18%	13%	11%	16%	8%	2%	1%	3%	27%	0%
Palghar	6.56	WDFC	2	2	3	5	19%	1%	7%	46%	3%	11%	1%	1%	9%	2%
Phulera Jn	5.33	WDFC	19	32	65	48	42%	6%	17%	25%	3%	2%	1%	1%	2%	1%
Rewari Jn	5.11	WDFC	66	94	120	118	40%	11%	11%	11%	5%	5%	1%	4%	11%	0%
Ringas Jn	4.29	WDFC	2	3	6	10	28%	11%	38%	3%	1%	1%	8%	3%	7%	0%
Swarupganj	2.56	WDFC	3	5	1	12	3%	6%	87%	0%	0%	0%	0%	2%	3%	0%
Thane	4.19	WDFC	2	3	4	6	21%	4%	0%	28%	4%	15%	4%	0%	21%	3%
Vasad Jn	6.18	WDFC	71	100	156	212	44%	8%	13%	7%	5%	4%	1%	5%	13%	0%
Andal Jn	2.10	EDFC	141	241	319	323	28%	15%	15%	5%	4%	4%	12%	9%	7%	2%
Bhimsen Jn	5.71	EDFC	38	56	64	93	38%	15%	17%	4%	5%	6%	1%	4%	11%	0%
Bulandshahr	2.16	EDFC	26	46	91	167	39%	12%	18%	2%	3%	12%	1%	3%	9%	0%
Dankuni Jn	0.36	EDFC	63	85	130	163	52%	11%	7%	11%	5%	6%	2%	2%	3%	1%
Hapur	2.07	EDFC	7	15	24	20	27%	2%	35%	9%	9%	2%	0%	0%	15%	0%
Hathras Jn	3.99	EDFC	2	2	10	8	14%	19%	38%	1%	10%	3%	0%	4%	11%	0%
Khurja Jn	1.78	EDFC	12	18	49	62	45%	18%	9%	4%	3%	11%	0%	2%	7%	0%
Meerut City Jn	2.51	EDFC	2	2	3	10	34%	2%	23%	3%	11%	2%	0%	8%	18%	0%
Mirzapur	3.44	EDFC	6	10	11	22	8%	50%	28%	4%	4%	1%	0%	1%	3%	1%
New Sasaram Jn	2.34	EDFC	6	7	11	166	35%	27%	11%	2%	3%	5%	2%	10%	4%	2%
NSC Bose Jn Gomoh	2.31	EDFC	80	64	118	134	36%	23%	9%	3%	4%	4%	2%	11%	5%	3%
Sanehwal	1.99	EDFC	62	81	135	165	32%	30%	11%	0%	2%	7%	1%	4%	11%	2%
Sonnagar Jn	1.64	EDFC	101	84	166	134	36%	23%	9%	3%	4%	4%	2%	11%	5%	3%
Tapri Jn	3.03	EDFC	8	13	30	35	38%	16%	11%	3%	2%	9%	0%	4%	17%	0%
Tundla Jn	3.59	EDFC	25	39	48	39	38%	6%	24%	2%	4%	8%	2%	9%	7%	0%
Anakapalle	4.54	E-Co DFC	0	1	11	9	4%	54%	3%	2%	6%	1%	31%	0%	0%	0%
Barang Jn	4.71	E-Co DFC	0	241	201	219	9%	40%	3%	2%	3%	1%	15%	12%	12%	2%
Bhadrak	5.30	E-Co DFC	0	3	4	8	19%	19%	15%	8%	2%	2%	26%	3%	7%	0%
Brahmapur	4.04	E-Co DFC	0	3	4	5	7%	32%	19%	4%	3%	4%	13%	4%	4%	10%
Jenapur	6.89	E-Co DFC	0	34	67	91	2%	12%	4%	3%	0%	0%	69%	6%	0%	3%
Khurda Road Jn	3.81	E-Co DFC	0	48	62	78	36%	7%	12%	2%	9%	4%	12%	1%	17%	0%
Nidadavolu Jn	6.62	E-Co DFC	0	13	18	60	16%	21%	20%	12%	24%	3%	0%	1%	1%	2%
Samalkot Jn	4.55	E-Co DFC	0	30	29	57	17%	19%	7%	14%	3%	2%	24%	7%	5%	2%
Vijayawada Jn	3.50	E-Co DFC	0	175	44	80	12%	8%	27%	7%	4%	2%	15%	8%	13%	4%
Vizianagaram Jn	4.53	E-Co DFC	0	62	40	53	20%	28%	8%	10%	3%	3%	8%	9%	10%	1%
Akola Jn	5.37	E-W DFC	0	33	12	13	21%	29%	15%	7%	13%	6%	0%	2%	7%	0%

Station Name	Length (Km)	DFC	Trains 2026	Trains 2031	Trains 2041	Trains 2051	BOG	Cement	Coal	Container	Fertilizer	Food Grains	Iron Ore	Pig Iron	POL	RM for Steel
Badnera Jn	3.28	E-W DFC	0	2	1	3	14%	11%	11%	16%	13%	3%	2%	31%	0%	0%
Bilaspur Jn	4.58	E-W DFC	0	20	45	44	8%	21%	25%	7%	13%	3%	6%	12%	2%	3%
Durg Jn	1.74	E-W DFC	0	31	19	59	39%	11%	15%	5%	1%	4%	4%	12%	9%	2%
Gondia Jn	2.82	E-W DFC	0	68	64	67	40%	14%	14%	5%	2%	3%	3%	4%	11%	3%
Igatpuri	1.59	E-W DFC	0	2	3	5	33%	3%	26%	7%	1%	4%	3%	21%	0%	1%
Jalgaon Jn	6.70	E-W DFC	0	23	31	44	23%	17%	23%	9%	5%	6%	1%	4%	12%	0%
Jharsuguda Jn	4.32	E-W DFC	0	80	113	96	4%	49%	14%	4%	1%	1%	9%	14%	1%	3%
Manmad Jn	3.72	E-W DFC	0	8	20	30	27%	12%	28%	3%	7%	8%	1%	2%	13%	0%
Nagpur Jn	2.11	E-W DFC	0	36	35	48	20%	36%	6%	24%	1%	2%	2%	9%	1%	0%
Nasik Road	2.49	E-W DFC	0	5	7	8	18%	9%	4%	48%	4%	2%	1%	0%	12%	0%
Rajkharswan Jn	12.06	E-W DFC	0	158	200	214	5%	17%	17%	1%	0%	0%	37%	17%	1%	5%
Rourkela Jn	7.64	E-W DFC	0	15	36	88	14%	24%	5%	1%	1%	2%	40%	6%	3%	4%
Wardha Jn	2.52	E-W DFC	0	523	158	162	49%	6%	13%	16%	1%	2%	2%	4%	6%	1%
Amla Jn	1.68	N-S DFC	0	0	7	7	5%	56%	17%	1%	8%	2%	2%	2%	7%	0%
Ballarshah Jn	3.63	N-S DFC	0	0	13	28	1%	48%	47%	0%	1%	1%	1%	0%	0%	0%
Bellampalli	3.51	N-S DFC	0	0	29	73	7%	31%	47%	1%	6%	3%	0%	0%	5%	0%
Bhopal Jn	4.24	N-S DFC	0	0	0	18	40%	9%	17%	12%	2%	6%	1%	3%	10%	0%
Bina Jn	3.01	N-S DFC	0	0	0	67	15%	39%	16%	1%	9%	3%	0%	3%	14%	0%
Dornakal Jn	4.92	N-S DFC	0	0	43	48	1%	5%	7%	7%	1%	1%	77%	0%	1%	0%
Gwalior Jn	5.24	N-S DFC	0	0	0	38	37%	8%	25%	1%	5%	7%	2%	7%	8%	0%
Itarsi Jn	4.00	N-S DFC	0	0	31	29	38%	13%	16%	5%	3%	8%	6%	2%	9%	0%
Jhansi Jn	4.36	N-S DFC	0	0	0	23	21%	27%	27%	2%	3%	4%	1%	5%	9%	0%
kazipet Jn	4.18	N-S DFC	0	0	108	116	29%	11%	16%	31%	4%	3%	1%	3%	3%	1%
Majri Jn	5.34	N-S DFC	0	0	169	160	47%	9%	12%	16%	1%	2%	2%	4%	6%	1%
Mathura Jn	2.93	N-S DFC	0	0	0	26	21%	8%	30%	4%	10%	3%	0%	2%	22%	0%
Ongole Jn	3.59	N-S DFC	0	0	3	4	18%	17%	21%	6%	27%	2%	5%	0%	2%	1%
Reningunta Jn	3.02	N-S DFC	0	0	135	166	55%	3%	9%	11%	2%	4%	6%	4%	4%	3%

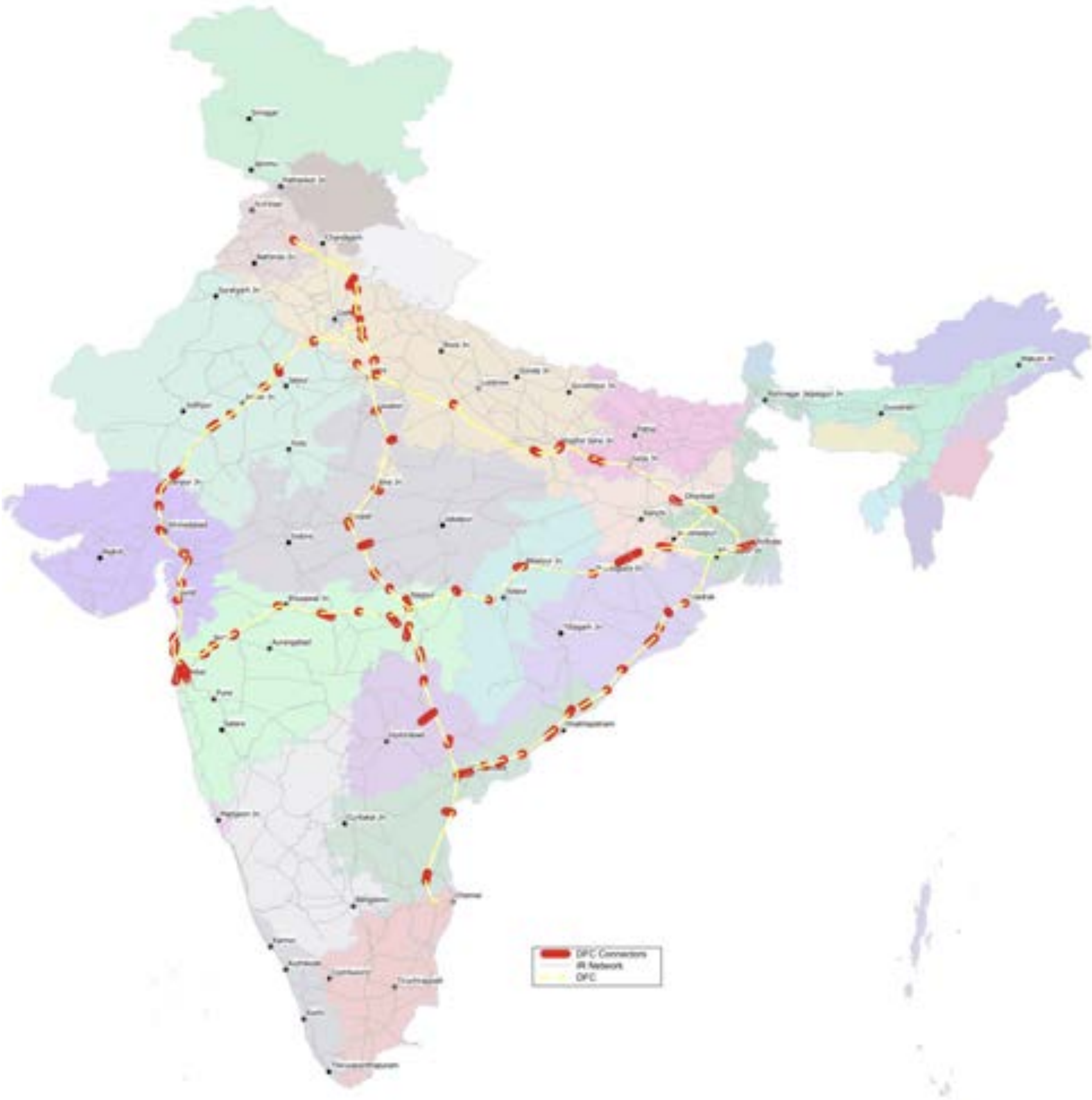


Figure 9-3: –Proposed Greenfield DFC Connectors

Chapter 10 HIGH SPEED RAIL (HSR) CORRIDORS

10.1. Background

Need for transportation in India has grown manifolds in last 2 decades and reason being the high growth economy. Rapid increase in transport of passengers and goods has put tremendous pressure on the level of service offered by Indian Railways which has resulted in constantly reduced speed. to overcome this Dedicated Freight Corridors (DFC) have been envisioned for segregating freight from passenger traffic. 2 DFC corridors at the moment are under construction.

In the passenger segment, Some of the highly utilised passenger transport corridors include Delhi Guwahati via Lucknow, Gorakhpur, Delhi-Kolkata via Kanpur, Prayagraj, Mughalsarai and Delhi-Mumbai via Kota Ratlam. Due to increased traffic there is a considerable reduction in speed and Indian Railways is constantly losing demand to other modes on account of speed despite potential demand being available.

Therefore, in order to address this issue, Indian Railways envisioned development of High-Speed Rail on certain corridors.

Accordingly, the chapter in detail describes the development and explains the rationale for identifying the HSR corridors in India in a prioritised and phased manner.

10.2. High Speed Rail Corridors Development in India

Ministry of Railways formulated the "Indian Railways Vision 2020" in 2009 as a long-term vision till year 2020. This Vision 2020 envisages the implementation of HSR projects to provide bullet train services at 250-350 km/hour, one in each of the regions of the nation. An expert committee on modernization of Indian Railways established by Minister of Railways designated Mumbai -Ahmedabad route (approximately 500 km) as the first high-speed railway section to be constructed with speed of 350 km/hour.

The expert committee further recommended to undertake detailed studies for 6 other HSR corridors already identified. These include:

i. Delhi-Chandigarh-Amritsar (450 km);
ii. Hyderabad-Dornakal-Vijayawada-Chennai (664 km);
iii. Howrah-Haldia (135 km);
iv. Chennai-Bangalore-Coimbatore-Ernakulam (850 km);
v. Delhi-Agra-Lucknow-Varanasi-Patna (991 km)
vi. Ernakulam-Trivandrum (194 km).

However, except Mumbai Ahmedabad Route, no further corridors were progressed.

High-speed rail projects have spread to the US – yet while ground has been broken on an HSR project in California, it faces ballooning costs. Saudi Arabia and Morocco have also commenced HSR construction, and Indonesia is considering HSR between Jakarta, Bandung and Surabaya, but plans for the HSR connecting Singapore and Malaysia have recently stalled.

Highly competitive with air travel for distances between 200 and 900km, HSR can connect city centres without the inconvenience of airport delays. It can improve accessibility for freight transport, a cornerstone of Germany's HSR strategy.

10.3. HSR from an International Perspective

The European Union Directive 96/48/EC defines HSR with precise criteria that can be abstracted as below.

a) Infrastructure: Tracks built specially for high-speed travel or specially upgraded for high-speed travel (including intermediate connecting lines).

b) Rolling Stock: Trains at speeds more than 250 kmph on specially built HSR lines or trains at speeds more than 200 kmph on upgraded lines.

c) Compatibility of infrastructure and rolling stock to ensure performance levels, safety, quality of service and cost.

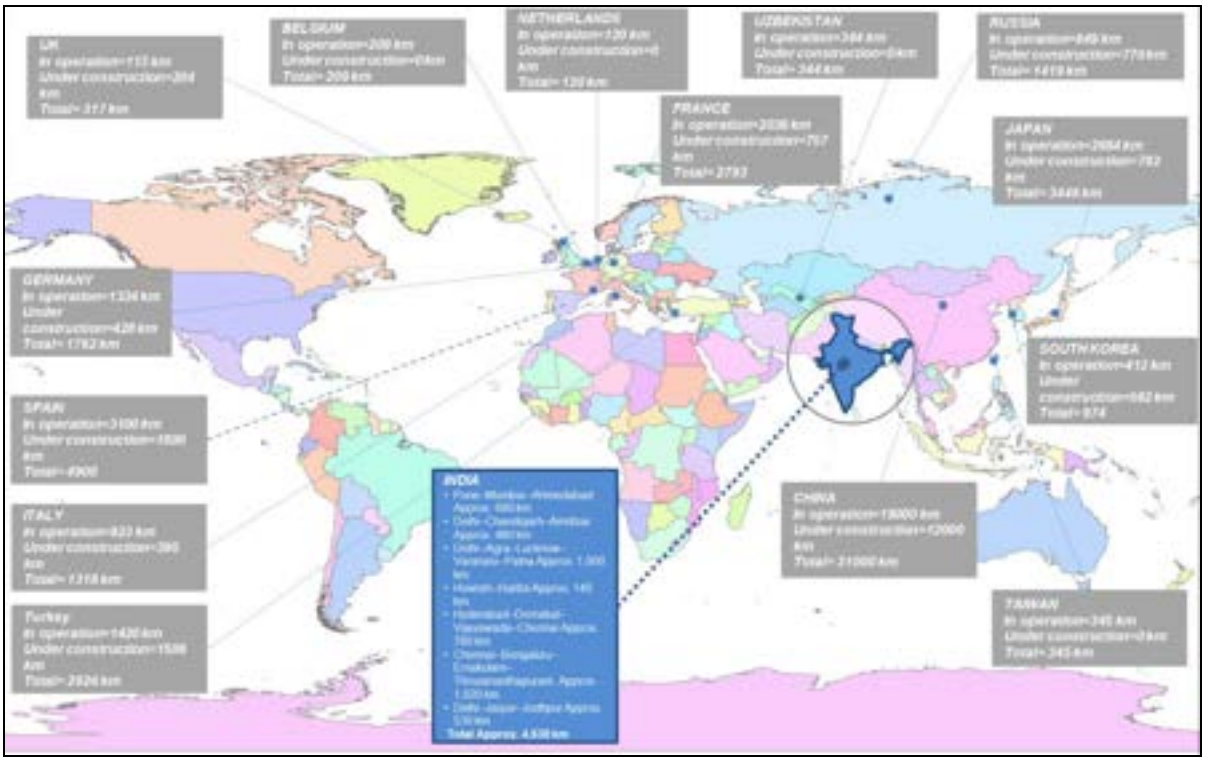


Figure 10-1: High Speed Rail Overview of different countries in the World

Table below lists the countries with an operational HSR network length of more than 100 km, with their route lengths, electrification specification and gauge type.

Table 10-1: High Speed Rails in Various Countries

S.No.	Country	In operation	Under Construction (km)	Total Country (km)	Electrification	Track Gauge (mm)
1	China	19000	12000	31000	25 kV 50 Hz	1435
2	Spain	3100	1800	4900	25 kV 50 Hz	1435
3	Japan	2664	782	3446	25 kV 50/ 60 Hz	1435
4	France	2036	757	2793	25 kV 50 Hz (partially)	1435
5	Turkey	1420	1506	2926	25 kV 50 Hz	1435
6	Germany	1334	428	1762	25 kV 50 Hz	1435
7	Italy	923	395	1318	15 kV 16.7 Hz	1435
8	Russia	649	770	1419		1520
9	South Korea	412	562	974	25 kV 50 Hz, 3 kV DC	1435
10	Taiwan	345	0	345	25 kV 60 Hz	1435
11	Uzbekistan	344	0	344	25 kV 60 Hz	1520
12	Belgium	209	0	209	25 kV 50 Hz	1435
13	Netherlands	120	0	120	25 kV 50 Hz	1435
14	United Kingdom	113	204	317	25 kV 50 Hz	1435

(Source: Raghuram, G. and Udayakumar, P.D., 2016. Dedicated high speed rail network in India: issues in development.)

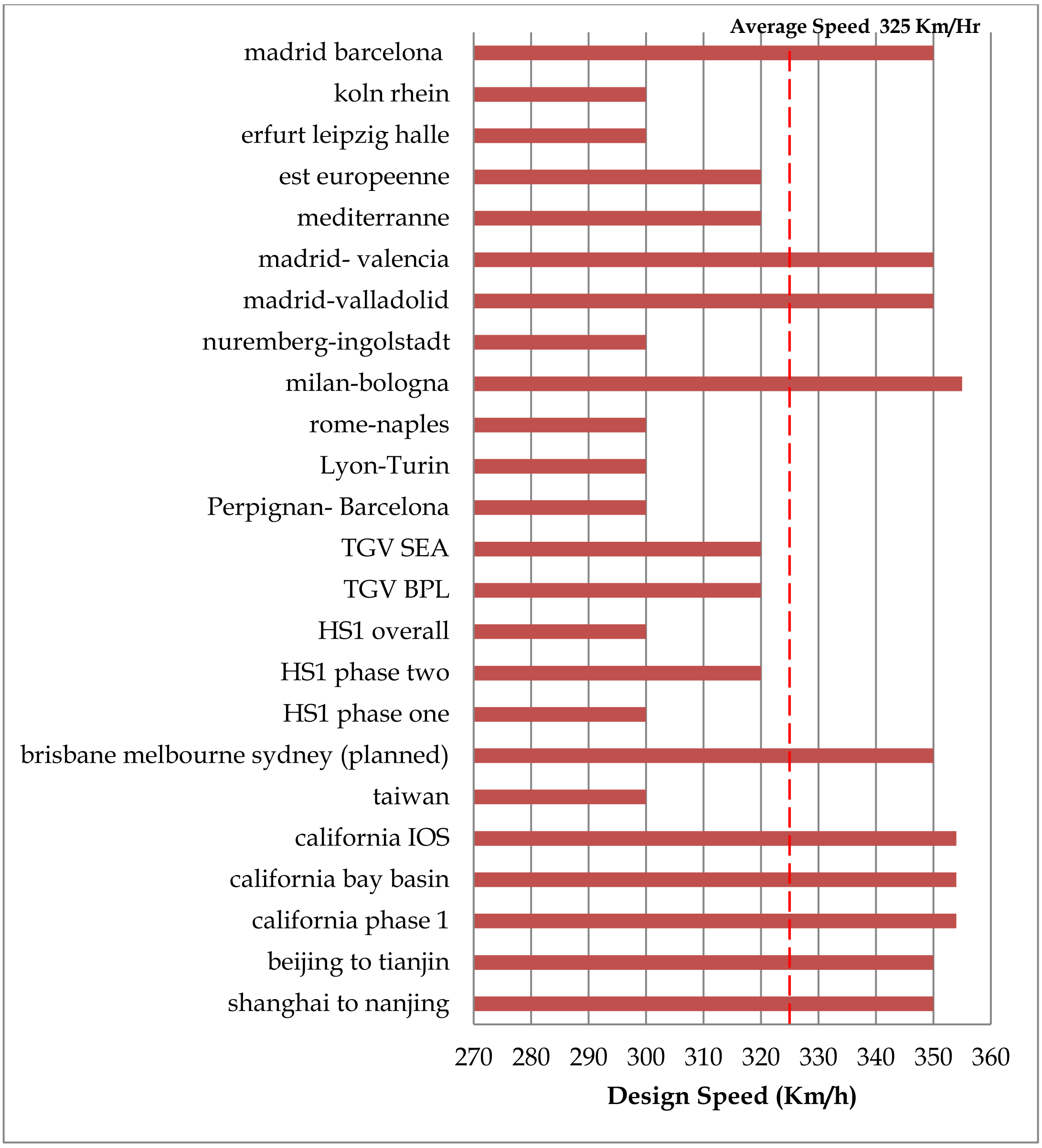


Figure 10-2: Average Speed Variation of Different HSR

10.4. High Speed Rail (HSR) Corridors Identification

For the purpose of identifying the potential High-Speed Rail Corridors in India, detail evaluation criteria and study of urbanisation pattern along with economic development has been carried out. Sections below explain the criteria for identifying potential HSR corridors.

10.4.1. Population Growth and Million Plus Cities

The latest population figures are based on the Census of India, 2011. India. 72.2 % of Indian population resides in rural areas while remaining 27.8 % of population is urban population which lives in more than 5,100 towns and over 380 urban agglomerations. According to the 2011 census, there were 46 million-plus cities in India, with Mumbai, Delhi and Kolkata having populations over 10 million. There are 53 urban agglomerations in India with a population of 1 million or more as of 2011 against 35 in 2001. About 43 percent of the urban population of India lives in these cities. The description of million plus cities with their population, area and gross domestic product (GDP) are presented in the table shown below. Further, the geographical locations of these cities with the population and GDP are also presented in figure below.

Table 10-2: Description of population, area and GDP of Million Plus Cities

City	Population (2011)	Area (sqkm)	GDP (in Billion US dollars)
Mumbai	1,83,94,912	1063.49	310
Delhi	1,63,49,831	1139.48	294
Kolkata	1,40,57,991	1056.13	150
Chennai	86,53,521	932.47	79
Bangalore	85,20,435	748.42	110
Hyderabad	76,77,018	1,225.59	75
Ahmedabad	63,57,693	1060.95	68
Pune	50,57,709	502.78	69
Surat	45,91,246	431.01	60
Jaipur	30,46,163	484.64	24
Kanpur	29,20,496	301.16	26
Lucknow	29,02,920	393.6	22
Nagpur	24,97,870	229.2	18
Ghaziabad	23,75,820	263.29	29
Indore	21,70,295	233.6	14
Coimbatore	21,36,916	696.25	13
Kochi	21,19,724	843.84	68
Patna	20,49,156	142.46	15
Kozhikode	20,28,399	909.79	25
Bhopal	18,86,100	336.06	50
Thrissur	18,61,269	990.91	22
Vadodara	18,22,221	310.35	22
Agra	17,60,285	166.21	21
Visakhapatnam	17,28,128	513.61	44
Malappuram	16,99,060	819.39	21
Thiruvananthapuram	16,79,754	542.57	20
Kannur	16,40,986	1003.66	5
Ludhiana	16,18,879	159.37	20
Nashik	15,61,809	321.98	18
Vijayawada	14,76,931	283.58	17
Madurai	14,65,625	151.34	18
Varanasi	14,32,280	118.68	2
Meerut	14,20,902	186.61	15
Faridabad	14,14,050	204	11
Rajkot	13,90,640	185.38	17

City	Population (2011)	Area (sqkm)	GDP (in Billion US dollars)
Jamshedpur	13,39,438	184.07	16
Jabalpur	12,68,848	237.16	15
Srinagar	12,64,202	304.27	15
Asansol	12,43,414	369.34	15
Vasai-Virar	12,22,390	319.39	15
Allahabad	12,12,395	115.46	5
Dhanbad	11,96,214	240.66	10
Aurangabad	11,93,167	148.12	14
Amritsar	11,83,549	277.4	14
Jodhpur	11,38,300	132.97	14
Ranchi	11,26,720	197.36	14
Raipur	11,23,558	192.55	14
Kollam	11,10,668	364.51	13
Gwalior	11,02,884	183.71	13
Bhilai	10,64,222	335.63	13
Tiruchirappalli	10,22,518	211.51	6
Kota	10,01,694	527.03	20
Chandigarh	10,55,602	105.68	4

(Source: Census of India, 2011)

Therefore, considering the details mentioned above, based on comprehensive criteria, the proposed HSR corridors have been reviewed as part of National Rail Plan and an HSR Master Plan has been recommended along with prioritised development of respective corridors.

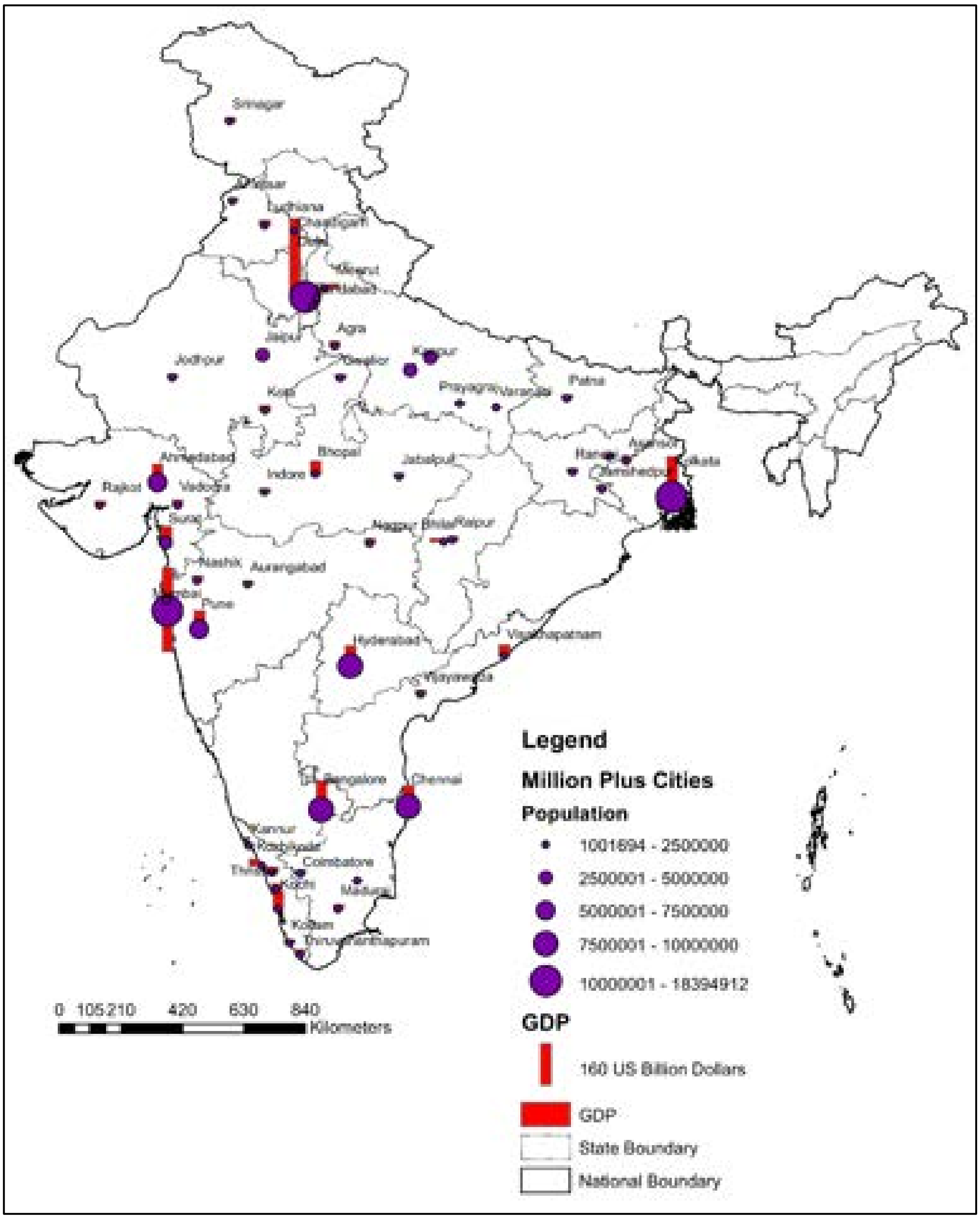


Figure 10-3: Million Plus Cities in India

10.4.2. HSR Corridor Identification and Prioritization Criteria

As discussed, above, the HSR Corridors as proposed as part of National Infrastructure Pipeline (NIP) have been reviewed with an objective of enhancing the outreach of HSR network and increasing the connectivity to cities of importance.

Given the long lead time and inherent risk in high-speed rail investments, it is essential that suitable corridors are selected where the conditions exist to support strong passenger demand for high-speed services. In other words, it is critical to identify the corridors across the country with the maximum potential to support high-speed rail in order to minimize this investment risk.

To do so, a ranking system based on an index of five criteria was developed to judge the extent of demand for high-speed rail between any two city pairs. Each city pair consists of two cities, each with a population of at least 10,00,000 that are separated by a distance of 300 to 700 Km.

The criteria is listed below:

12. City Population (> 1 million)
13. Distance between city pairs, confined to distances between 300-700 Km
14. City GDP
15. High levels of congestion
16. Passenger flow between city pairs- AC rail and air trips

Further, corridors having AC passenger share of more than 50% were identified and are presented in the figure below. Corridors having forecast AC Passenger share > 50% are listed below:

1. Jalandhar-Delhi,
2. Delhi- Agra-Lucknow-Patna- Kolkata,
3. Delhi- Mumbai, Ahmedabad-Mumbai,
4. Mumbai-Varanasi, Nagpur-Bilaspur,
5. Mumbai- Pune-Chennai and
6. Chennai-Bangalore.

Figure 10-4: –Corridors with AC Passenger Share > 50%, 2051

10.4.3. High Speed Rail (HSR) Corridors as per National Infrastructure Pipeline (NIP)

Indian Railways have already envisioned developing High-Speed Rail Corridors in India. Accordingly, a total of 7 HSR Corridors have been identified as part of NIP. Mumbai – Ahmedabad HSR Corridor is already under implementation. Other identified corridors are at DPR stage. HSR Corridors identified as part of NIP are listed in table below:

Table 10-3: Proposed High Speed Routes in India

S.No.	Corridors Planned for HSR	Length (Km)
1	Mumbai - Ahmedabad	650
2	Delhi – Agra – Lucknow - Varanasi	865
3	Delhi–Chandigarh–Amritsar	460
4	Delhi–Udaipur - Ahmedabad	886
5	Mumbai – Nasik - Nagpur	753
6	Mumbai - Hyderabad	711
7	Chennai – Bengaluru - Mysore	435
Total		**4,760**

10.4.4. Recommended High Speed Rail (HSR) Corridors as per National Rail Plan (NRP)

Based on the considerations and criteria explained in previous sections and with an aim to meet the growing passenger demand and to optimise the high-speed rail connectivity between major cities/ commercial/economic centres, the following high-density passenger routes were identified for developing High Speed Railway (HSR) corridors.

The corridors are more or less same as proposed as part of NIP. In addition, certain extensions/ new corridors have been proposed for enhancing HSR outreach and providing connectivity to other towns:

7. Delhi- Chandigarh- Ludhiana - Jalandhar- Amritsar HSR Corridor is recommended to be extended to Jammu via Pathankot for enhancing regional connectivity and for giving economic boost to the Jammu and Pathankot Region. It will cater to the religious tourism potential of Vaishno Devi Shrine and other places.
8. Delhi- Agra- Kanpur- Lucknow- Varanasi- HSR corridor is recommended to route via Ayodhya due to Religious Tourism Potential.
9. Delhi- Agra- Kanpur- Lucknow- Varanasi- HSR corridor is also recommended to be extended to connect Patna and Kolkata.
10. Additional HSR Line from Patna to Guwahati via Katihar and New Jalpaiguri thereby connecting Guwahati with Delhi Varanasi Kolkata HSR Corridor.
11. Additional HSR Line between Hyderabad and Bengaluru by extending Mumbai Hyderabad HSR Line. This shall connect Mumbai with Chennai and also will bring North India from Jammu – Amritsar – Delhi – Jaipur – Ahmedabad – Mumbai – Hyderabad – Bengaluru – Chennai on HSR corridor and all the major towns of North, West and South India shall be connected with 1 HSR Corridor. This will help in boosting the regional economy.
12. Additional HSR line is proposed between Nagpur and Varanasi by extending the Mumbai – Nashik – Nagpur HSR Corridor. This shall connect Mumbai with Varanasi which will further connect with Delhi – Varanasi – Patna – Guwahati HSR corridor.

The proposed HSR master plan shall bring all major cities on HSR network.

10.4.5. HSR Phasing

The above mentioned recommended and proposed corridors have been prioritised for development based on need and demand forecast. Proposed HSR phasing is described in table below.

Table 10-4: Proposed HSR Phasing

Phasing	2026	2031	2041	2051
New HSR Corridor	Mumbai Ahmedabad, 508 Km (As per NIP also)	Delhi Varanasi via Ajodhya, 855 Km (As per NIP also, Ajodhya included)	Hyderabad Bangalore, 618 Km (New)	Mumbai Nagpur, 789 Km *(As per NIP)*
		Varanasi to Patna, 250 kms (New)	Nagpur Varanasi, 855 Km (New)	Mumbai Hyderabad, 709 Km *(As per NIP)*
		Patna to Kolkata, 530 Km (New)		Patna Guwahati 850 Km (New)
		Delhi Udaipur Ahmedabad 886 Km *(As per NIP also)*		Delhi Chandigarh Amritsar, 485 Km *(As per NIP)*
				Amritsar - Pathankot - Jammu, 190 Km (New)
				Chennai to Mysuru via Bangalore, 462 Km *(As per NIP)*
Length (Km)	**508**	**2,521**	**1473**	**3485**

Figure 10-5: – Proposed HSR Corridors and Phasing

Chapter 11 HIGHLY DENSE NETWORK (HDN)

11.1. High Density Network (HDN)

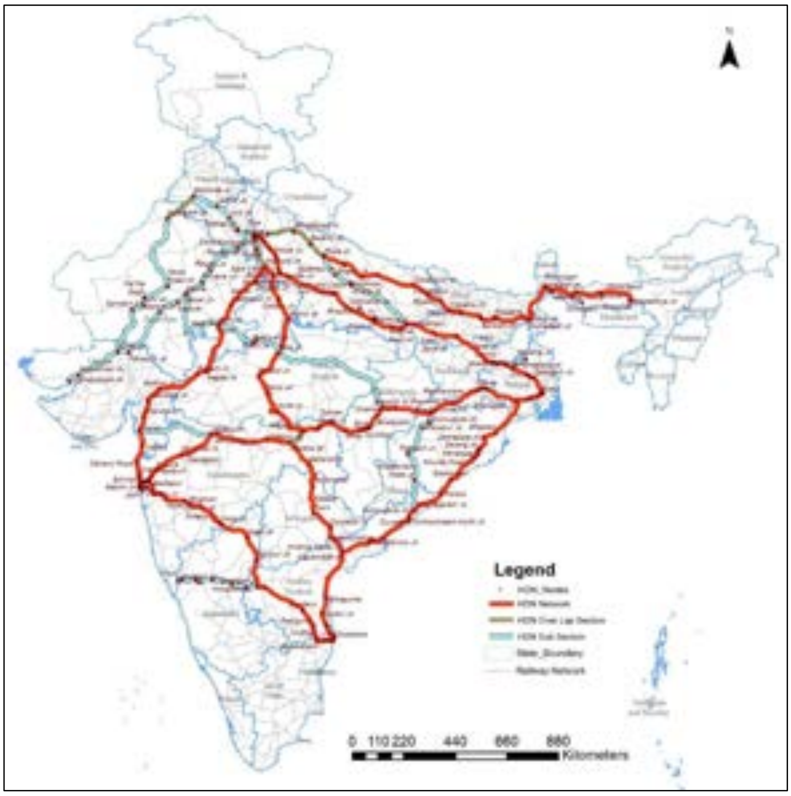


Figure 11-1: –HDN Network of Indian Railways

Indian Railways have classified the major network comprising of GQ, GD and some other routes as part of High-Density Network (HDN). Total length of HDN network is 10,969 Km, comprising of around 16% of total Indian Railways' network but caters to 41% of total traffic (passenger + freight).

Over 80% of this HDN is operating with a capacity utilization above 100% 98% above 70%.

There are a total of 7 HDN routes. These primarily include Golden Quadrilaterals (GQs) and Golden Diagonals (GDs) along with Delhi- Guwahati Route.

Table 11-1: Indian Railways HDN Routes

HDN No	Routes
HDN1	Delhi Howrah Main Route via ALD MGS Gaya
HDN2	Howrah - Mumbai main route via Jalgaon, Nagpur, Bilaspur
HDN3	Delhi-Mumbai Main Route via Kota Ratlam
HDN4	Delhi-Guwahati via Rosa-Gorakhpur-Kumedpur
HDN5	Delhi-Chennai Main Route via BPL-NGP-BPQ-BZA-Gudur
HDN6	Howrah Chennai Main Route
HDN7	Mumbai-Chennai main route

The chapter discusses in detail, each HDN network in terms of existing capacity utilisation and network upgradation proposals based on traffic demand forecast for each cardinal year. The methodology for arriving at network upgradation proposals has been discussed in detail in **0**.

Along certain HDNs, DFC and HSR have been proposed, therefore, the upgradation proposals have been worked out after estimating the traffic diversion that will occur due to operationalisation of DFCs and HSR in respective cardinal years.

11.2. Existing Capacity Utilization

Majority of the HDN Network is congested. Capacity utilisation of entire HDN is presented in table below.

Table 11-2: Existing Capacity Utilization of HDN

Capacity Utilization	Network KM	Share
0%-70%	189	2%
70%-100%	2,003	18%
100%-150%	6,326	58%
>150%	2,450	22%
Total	**10,969**	**100%**

11.3. HDN 1 – Delhi Howrah Main Route via Prayagraj, Mughalsarai and Gaya

HDN 1 is a part of Golden Quadrilateral, running from Delhi to Kolkata (Howrah) via Allahabad (Prayagraj), Mughal Sarai (Pandit Deen Dayal Upadhyaya Nagar) and Gaya. It is the shortest route between two main Metros of India, Delhi and Kolkata. HDN 1 is 1463 km Long. As the route is connecting the Capital city with 4 more metropolitan cities, both passenger and freight demand will show quantum increase. The section describes in detail the forecast train demand on HDN 1, capacity shortfall and upgradation proposals.

11.3.1. Existing Capacity Analysis

In the existing situation, the HDN 1 is designed to operate passenger trains having a maximum speed of 130 kmph. This route is the oldest route to conceive the "Rajdhani Express" since 1968. Majority of the route has been upgraded minimum to triple line except some short stretches which still have double line only.

Majority of the sections of HDN 1 are operating beyond their capacity in terms number of trains/ day which is causing congestion, delay in passenger operations and enormous delay in freight operations.

Existing Configuration and Capacity Utilization by sections of HDN 1 are presented in **ANNEXURE 11.1:**

Table 11-3: Existing Capacity Utilization of HDN 1

Capacity Utilization	Network KM	Share
0%-70%	0	0%
70%-100%	262	18%
100%-150%	1187	81%
>150%	15	1%
Total	**1463**	**100%**

Only 18% of HDN 1 network is having capacity utilisation below 100%. This is one of the highly congested networks and requires more immediate capacity augmentation.

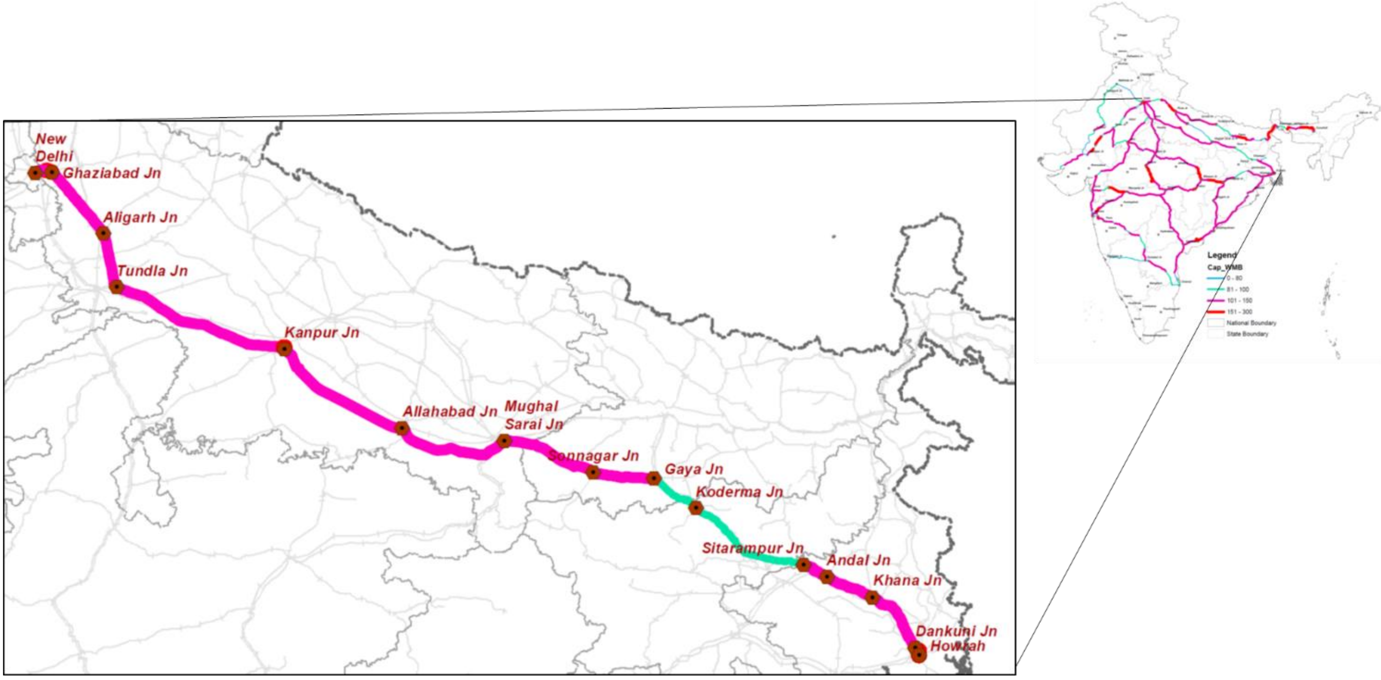


Figure 11-2: HDN 1 Existing Capacity Utilization

11.3.2. HDN 1 - Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HDN 1 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HDN 1 for each of the cardinal years and is presented in **ANNEXURE 11.2:**.

11.3.3. Capacity Analysis after Sanctioned Works (Pink Book)

For the purpose of decongesting various sections of HDN 1, some of the sanctioned works in pipeline and are expected to be completed by year 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works. Major sanctioned works which have been considered are listed below:

1. Implementation of Eastern DFC from Ludhiana to Sonenagar by the year 2026 and its extension till Dankuni by 2031.
2. Implementation of Delhi – Agra – Lucknow – Varanasi by 2031.

Analysis of Capacity utilisation post implementation of sanctioned works is described in table below:

Table 11-4: Capacity Utilization after Implementation of Sanctioned Works (Pink Book)

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	221	6	0	0	15%	0%	0%	0%
70%-100%	591	71	8	6	40%	5%	1%	0%
100%-150%	627	602	153	92	43%	41%	10%	6%
>150%	24	784	1301	1364	2%	54%	89%	93%
Total	**1463**	**1463**	**1463**	**1463**	**100%**	**100%**	**100%**	**100%**

As evident from the above table, the benefits of implementation of Sanctioned works will not last long. Based on demand forecast, by the year 2026, only 55% of HDN 1 shall be having capacity utilisation less than 100% and only 15% network shall be under 70%. By the year 2031, only 5% of HDN 1 shall be having capacity utilisation less than 100% and 89% network shall be having capacity utilisation more than 150%. Therefore, in order to meet the objectives of National Rail Plan which mandates to create railway infrastructure that shall be adequate to cater to the demand till the year 2051, a comprehensive review of each section of HDN 1 has been carried out and list of projects has been identified.

11.3.4. HDN 1 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

11.3.4.1. Signaling

As per the ongoing though process within Indian Railways, the entire GQs and GDs covering HDN, 1,2,3,5, 6 and 7 have been proposed to be upgraded for operating trains at a speed of 160 Kmph. Therefore, for this purpose Automatic Signalling with TCAS+ABS+CTC for HDN 1 has been recommended.

Automatic Signalling with TCAS+ABS+CTC type signalling not only enhances the operation speed and safety but also increases the line capacity of the section.

Therefore, after adopting Automatic Signalling with TCAS+ABS+CTC, the capacity increase shall be analysed with the train forecast and accordingly additional line requirements for each section has been recommended.

11.3.4.2. HDN 1 – Additional Line Requirements

HDN 1 has been recommended to be upgraded to triple line for the entire length. at certain sub-urban sections such as Kolkata and Delhi there shall be a requirement of 6 lines configuration for segregated operations.

Consolidated upgradation proposals including Automatic Signalling with TCAS+ABS+CTC and additional line requirements by cardinal years for entire HDN 1 is presented in **ANNEXURE 11.3:.**

Table 11-5: HDN 1 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line KM
Double to Triple Line	191	191
Quadruple Line to 6 Lines	9	18
Total	200	209

11.3.4.3. Other Infrastructure Proposals

Apart from signalling and line upgradation, proposals related to debottlenecking at junctions by proposing bypasses and flyovers has also been recommended along the HDN 1 for enhancing overall capacity. A total of 29 bypasses and 15 flyovers have been proposed along HDN 1.

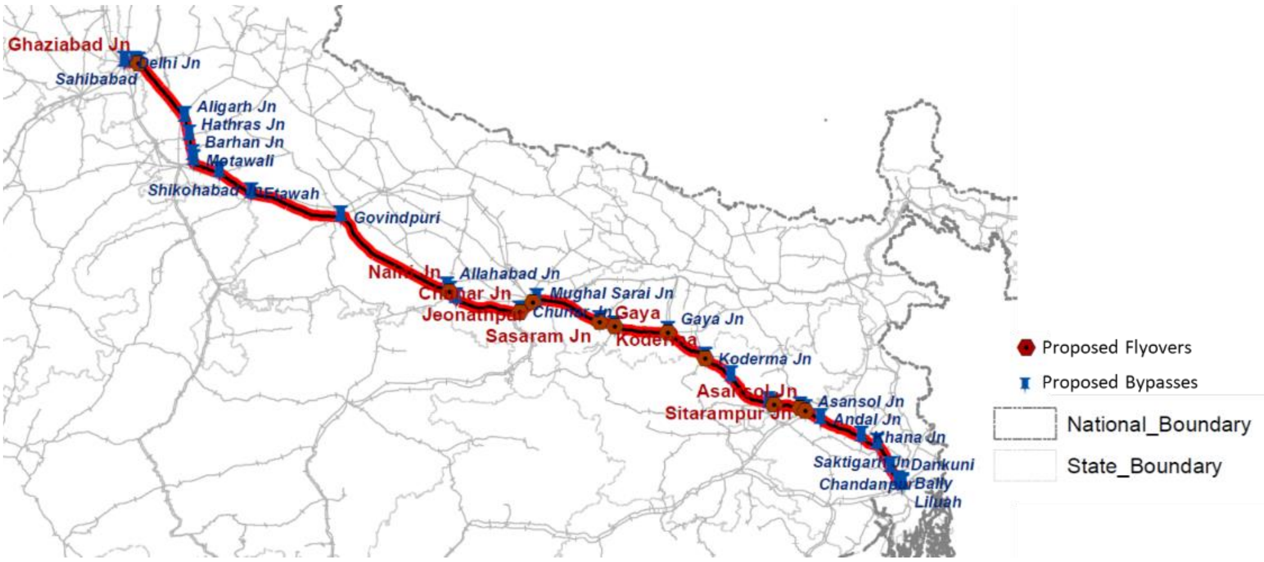


Figure 11-3: HDN 1 Proposed Flyovers and Bypasses

11.3.4.4. DFC and HSR Along HDN 1

Eastern DFC is proposed from Ludhiana to Sonenagar (year 2026) and Dankuni (year 2031) along the HDN 1. This will enable HDN 1 to operate passenger only operations with higher speeds.

In addition to this Delhi – Agra – Lucknow – Varanasi High Speed Rail Corridor is proposed. This will also help in further decongestion and reducing load on HDN 1. As part of NRP, the Delhi Varanasi HSR has been recommended to connect Ajodhya and is also recommended to connect to Patna and Kolkata by the year 2051.

Consolidated proposals for HDN 1 are presented in figure below:

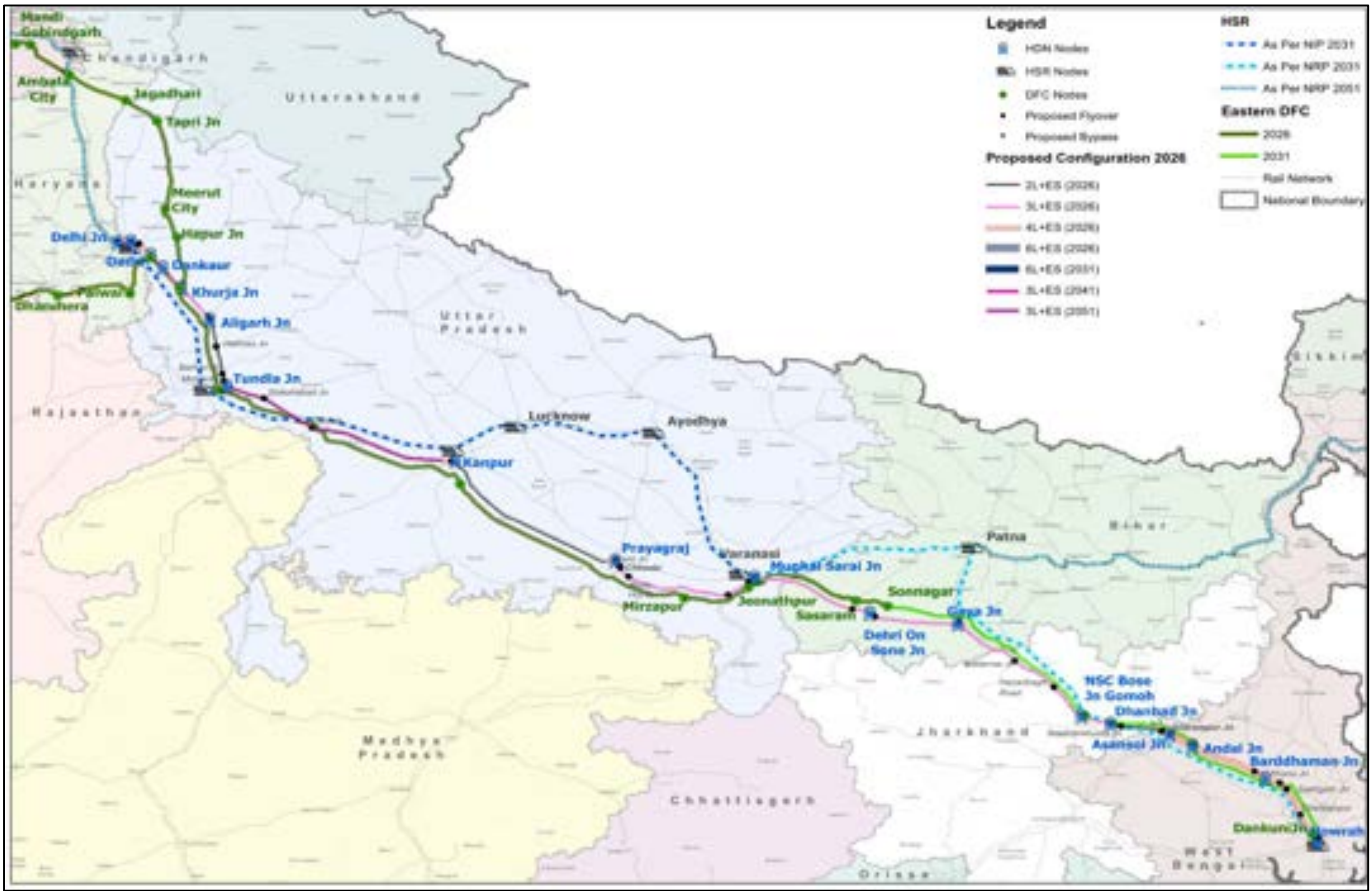


Figure 11-4: Consolidated Network Upgradation Proposals - HDN 1

11.3.4.5. Capacity Enhancement – HDN 1

Capacity analysis has been carried out for each section of HDN 1 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HDN 1 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 11-6: Capacity Utilization Post Implementation of Projects – HDN 1

	Network Km	% Share

Line Capacity Utilization	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	1003	1200	1212	873	69%	82%	82%	60%
70%-100%	308	263	251	520	21%	18%	18%	35%
100%-150%	152	0	0	70	10%	0%	0%	5%
Total	**1463**	**1463**	**1463**	**1463**	**100%**	**100%**	**100%**	**100%**

11.4. HDN 2 – Mumbai to Howrah via Jalgaon, Nagpur, Bilaspur, Jharsuguda and Tata Nagar

HDN 2 is a part of Golden Diagonal, from Kolkata (Howrah) to Mumbai via Jalgaon, Nagpur, Bilaspur and Jharsuguda. It is the shortest route between the cities of, Mumbai and Kolkata. Total length of HDN 2 is 1,889 km. Since, the route connects the Financial Capital with another Million plus cities passing through different states, HDN 2 witness high levels of passenger and freight demand.

The section describes in detail the forecast train demand on HDN 2, capacity shortfall and upgradation proposals.

11.4.1. Existing Capacity Analysis

HDN 2 being part of GD, has been designed for operating passenger train with maximum speed of 130 kmph. Most of the route has been upgraded minimum to triple line except some short stretches having double line as of 2019.

Majority of the network is operating beyond its capacity and it is causing congestion and delay in passenger and freight operations.

Existing Configuration and Capacity Utilization by sections of HDN 2 are presented in **ANNEXURE 11.1:.**

Table 11-7: Existing Capacity Utilization of HDN 2

Capacity Utilization	Network KM	Share
0%-70%	17	1%
70%-100%	130	7%
100%-150%	1509	80%
>150%	233	12%
Total	**1,889**	**100%**

At present, HDN 2 is operating over 100% of capacity Utilization. Only 8% of the network is having capacity utilisation less than 100% and 1% less than 70%. Therefore, being one of the most congested networks, upgradation proposals have bene worked out based on demand forecast.

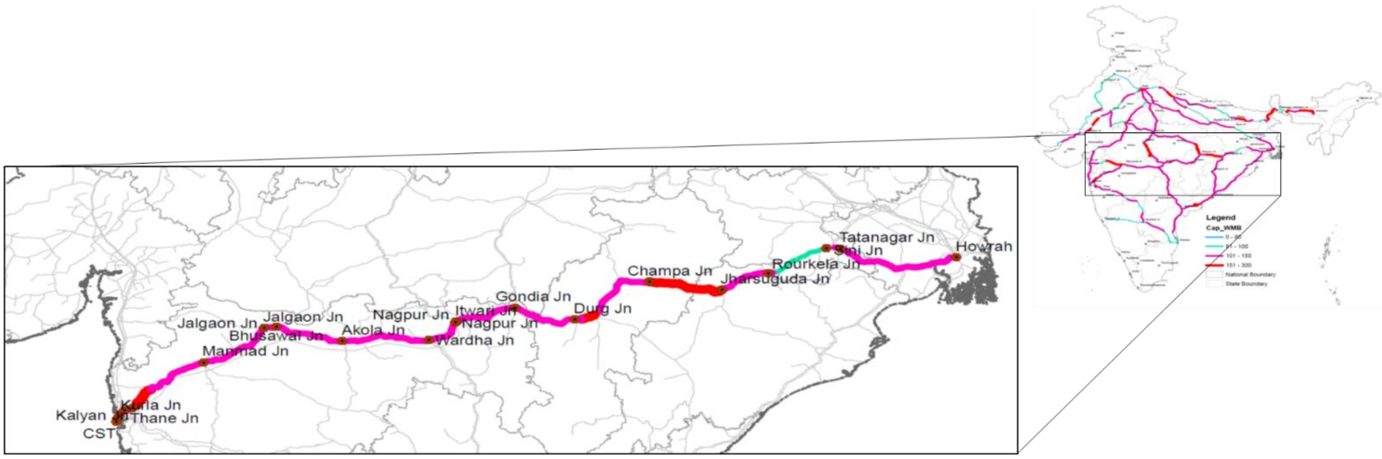


Figure 11-5: –HDN 2 Existing Capacity Utilisation

11.4.2. HDN 2 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HDN 2 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HDN 2 for each of the cardinal years and is presented in **ANNEXURE 11.2:**.

11.4.3. Capacity Analysis after Sanctioned Works (Pink Book)

For the purpose of decongesting various sections of HDN 2, some of the sanctioned works in pipeline and are expected to be completed by year 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works. Major sanctioned works which have been considered are listed below:

Table 11-8: HDN-2 Sanctioned works (Pink Book)

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% utilization (6/5)	Ongoing works	New Capacity
1	2	3	4	5	6	7	8	9
1	Kharagpur Tatanagar	DL	134	61	63	103	3rd line	86
2	Tatanagar Gamarhia	DL Auto	10.6	113	105	93	3rd line	138
3	Gamarhia Sini	DL Auto	16.2	138	64	47	3rd line	163
4	Sini Rajkharsawn	DL Auto	15.3	138	92	67	3rd line	163
5	Rajkharsawn Chakrdharpur	DL	20.3	75	59	79	3rd line	100
6	Chakradharpur Bondamunda	DL	92.9	67	51	76	3rd line Chakradh	92

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% utilization (6/5)	Ongoing works	New Capacity
1	2	3	4	5	6	7	8	9
							arpur Goelkera	
7	Bondamunda Rourkela	TL	9	67	93	138	4th Line	120
8	Rourkela Jharsuguda	DL	101	70	72	103	3rd line	95
9	Jharsuguda Champa	DL/TL	151.7	69	101	142	3rd and 4th line	129
10	Champa Bilaspur	TL	52.5	90	117	128	4th line	120
11	Bilaspur Urkura	TL	105	115	135	121		115
12	Urkura Sarona	DL	9.4	45	61	134		45
13	Sarona Bhilai	TL	17.3	90	127	131		90
14	Bhilai Durg	TL	13.6	88	112	115		88
15	Durg Gondia	DL	134.9	70	88	137	3rd line and Auto Sig	125
16	Gondia Tumsar Road	DL	49.8	67	82	136	3rd line Auto Sig	122
17	Tumsar Road Kalumna	DL	73.8	70	79	121	3rd line Auto Sig	125
18	Kalmuna Nagpur	SL	6.3	57	58.6	103	Auto Sig	90
19	Wardha Nagpur	DL	79	63	76	126	3rd & 4th Line	123
20	Wardha Badnera	DL	95	62	62	103	3rd line	87
21	Badnera Bhusaval	DL	219	62	58	100	3rd line	87
22	Bhusaval Jalgaon	DL	24	80	89	116	3rd & 4th Line	140
23	Nandgaon Jalgaon	DL	135	62	67	109	3rd line	87
24	Jalgaon Manmad	DL	25	62	65	109	3rd line	87
25	Manmad Igatpuri	DL	124	60	53	93	3rd line	87

The sanctioned works also include 6 Bypasses & 12 Flyovers along HDN 2.

After the implementation of sanctioned works, there shall be some relief from congestion till the year 2026 but the benefits shall diminish over the time.

By the year 2051, 100% of the network will operate more than 100% of capacity Utilization.

Capacity utilisation analysis considering the demand forecast and including the sanctioned works was carried out and is presented in table below:

Table 11-9: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HDN 2

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	73	26	9	9	4%	1%	0%	0%
70%-100%	562	212	17	0	30%	11%	1%	0%
100%-150%	822	560	172	23	43%	30%	9%	1%
>150%	432	1091	1691	1857	23%	58%	90%	98%
Total	**1889**	**1889**	**1889**	**1889**	**100%**	**100%**	**100%**	**100%**

As evident from the above table, the benefits of implementation of Sanctioned works will not last long. Based on demand forecast, by the year 2026, only 34% of HDN 2 shall be having capacity utilisation less than 100% and only 4% network shall be under 70%. By the year 2031, only 12% of HDN 2 shall be having capacity utilisation less than 100% and 58% network shall be having capacity utilisation more than 150%. Therefore, in order to meet the objectives of National Rail Plan which mandates to create railway infrastructure that shall be adequate to cater to the demand till the year 2051, a comprehensive review of each section of HDN 2 has been carried out and list of projects has been identified.

11.4.4. HDN 2 Network Upgradation Proposals

As described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

11.4.4.1. Signaling

As per the ongoing though process within Indian Railways, the entire GQs and GDs covering HDN, 1,2,3,5, 6 and 7 have been proposed to be upgraded for operating trains at a speed of 160 Kmph. Therefore, for this purpose Automatic Signalling with TCAS+ABS+CTC for HDN 2 has been recommended.

Automatic Signalling with TCAS+ABS+CTC type signalling not only enhances the operation speed and safety but also increases the line capacity of the section.

Therefore, after adopting Automatic Signalling with TCAS+ABS+CTC, the capacity increase shall be analysed with the train forecast and accordingly additional line requirements for each section has been recommended.

11.4.4.2. HDN 2 – Additional Line Requirements

HDN 2 has been recommended to be upgraded to triple or quadruple line for the entire length. at certain sub-urban sections such as Kolkata and Mumbai there shall be a requirement of 6- or 8-lines configuration for segregated operations.

Consolidated upgradation proposals including Automatic Signalling with TCAS+ABS+CTC Signalling and additional line requirements by cardinal years for entire HDN 2 is presented in **ANNEXURE 11.3:.**

Table 11-10: HDN 2 – Additional Line Requirements (2051)

Configuration Conversion	Network (Km)	Line (Km)
Triple to Quadruple Line	64	64
Triple Line to 6 Lines	11	33
Quadruple Line to 6 Lines	32	64
6 Lines to 8 Lines	17	34
Total	124	195

11.4.4.3. Other Infrastructure Proposals

Apart from signalling and line upgradation, proposals related to debottlenecking at junctions by proposing bypasses and flyovers has also been recommended along the HDN 2 for enhancing overall capacity. A total of 6 Bypasses & 12 Flyovers Proposed along the corridor as part of sanctioned works.

Figure 11-6: –HDN 2 Flyovers and Bypasses

11.4.4.4. DFC and HSR along HDN 2

East West DFC is proposed connecting Dankuni with Palghar (year 2031) for catering to the freight demand thereby leaving the HDN 2 for passenger only operations for and maintaining higher speed.

High Speed Rail Corridor is proposed between Mumbai to Nagpur via extended to Patna via Varanasi.

Figure 11-7: Consolidated Network Upgradation Proposals - HDN 2

11.4.4.5. Capacity Enhancement – HDN 2

Capacity analysis has been carried out for each section of HDN 2 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HDN 2 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 11-11: Capacity Utilization Post Implementation of Projects – HDN 2

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	1554	1678	1707	1634	82%	89%	90%	86%
70%-100%	292	211	182	256	15%	11%	10%	14%
100%-150%	0	0	0	0	0%	0%	0%	0%
>150%	43	0	0	0	2%	0%	0%	0%
Total	**1,889**	**1,889**	**1,889**	**1,889**	**100%**	**100%**	**100%**	**100%**

11.5. HDN 3 – Delhi to Mumbai via Kota, Bharatpur, Ratlam, Ahmedabad and Vadodara

HDN 3 is a part of Golden Quadrilateral, running from Delhi to Mumbai via Kota, Bharatapur and Ratlam. It is the shortest route between 2 major cities of Mumbai and Delhi. HDN 3 is 1387 km Long. As the route is connecting the Financial Capital of India city with National Capital via 6 more metropolitan cities, therefore both existing and future passenger and freight demand is very high.

11.5.1. Existing Capacity Analysis

HDN 3 being part of GQ, has been designed for operating passenger train with having maximum speed of 130 kmph. Most of the route has been upgraded minimum to triple line except some short stretches having double line as of 2019.

Most of the network is operating beyond its capacity to handle the number of trains per day and it is causing bottle neck situation, delay in passenger operation and enormous delay in freight operation.
Existing Configuration and Capacity Utilization by sections of HDN 3 are presented in **ANNEXURE 11.1:.**

Table 11-12: Existing Capacity Utilization of HDN 3

Capacity Utilization	Network KM	Share
0%-70%	0	0%
70%-100%	170	12%
100%-150%	1148	83%
>150%	70	5%
Total	**1,889**	**100%**

At present, HDN 3 is operating over 100% of capacity Utilization. Only 12% of the network is having capacity utilisation less than 100% and none less than 70%.

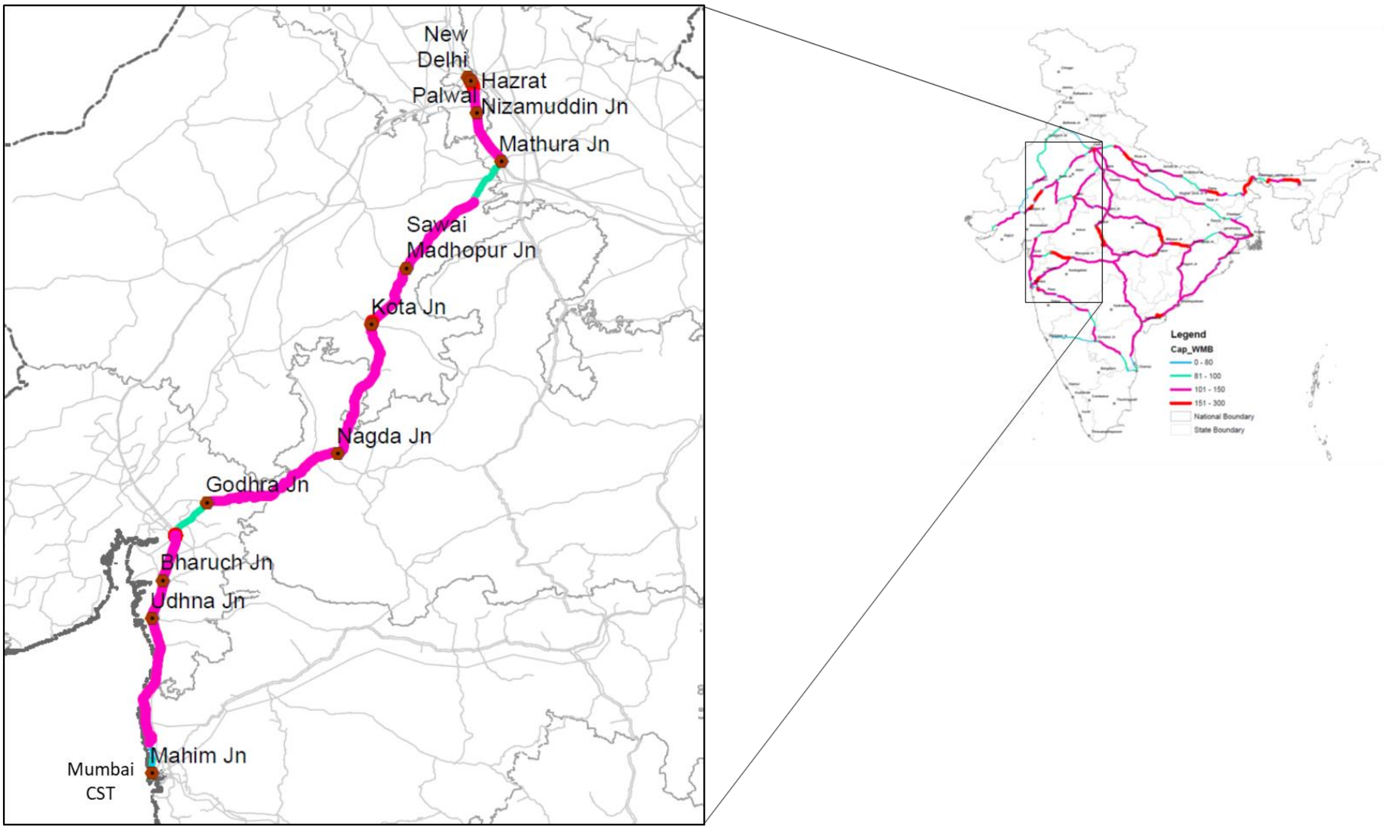


Figure 11-8: –HDN 3 Existing Capacity Utilisation

11.5.2. HDN 3 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HDN 3 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HDN 3 for each of the cardinal years and is presented in **ANNEXURE 11.2:**.

11.5.3. Capacity Analysis after Sanctioned Works (Pink Book)

As part of sanctioned works, no doubling works are proposed on HDN 3. However, 7 Bypasses & 9 Flyovers Proposed along the corridor. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works.

Table 11-13: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HDN 3

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	12	25	0	0	1%	2%	0%	0%
70%-100%	212	165	11	0	15%	12%	1%	0%
100%-150%	519	414	178	31	37%	30%	13%	2%
>150%	646	784	1,199	1,357	47%	56%	86%	98%
Total	**1,387**	**1,387**	**1,387**	**1,387**	**100%**	**100%**	**100%**	**100%**

As evident from the above table, the benefits of implementation of Sanctioned works will not last long. Based on demand forecast, by the year 2026, only 16% of HDN 3 shall be having capacity utilisation less than 100% and only 1% network shall be under 70%.

By the year 2031, only 14% of HDN 2 shall be having capacity utilisation less than 100% and 56% network shall be having capacity utilisation more than 150%. Therefore, in order to meet the objectives of National Rail Plan which mandates to create railway infrastructure that shall be adequate to cater to the demand till the year 2051, a comprehensive review of each section of HDN 3 has been carried out and list of projects has been identified.

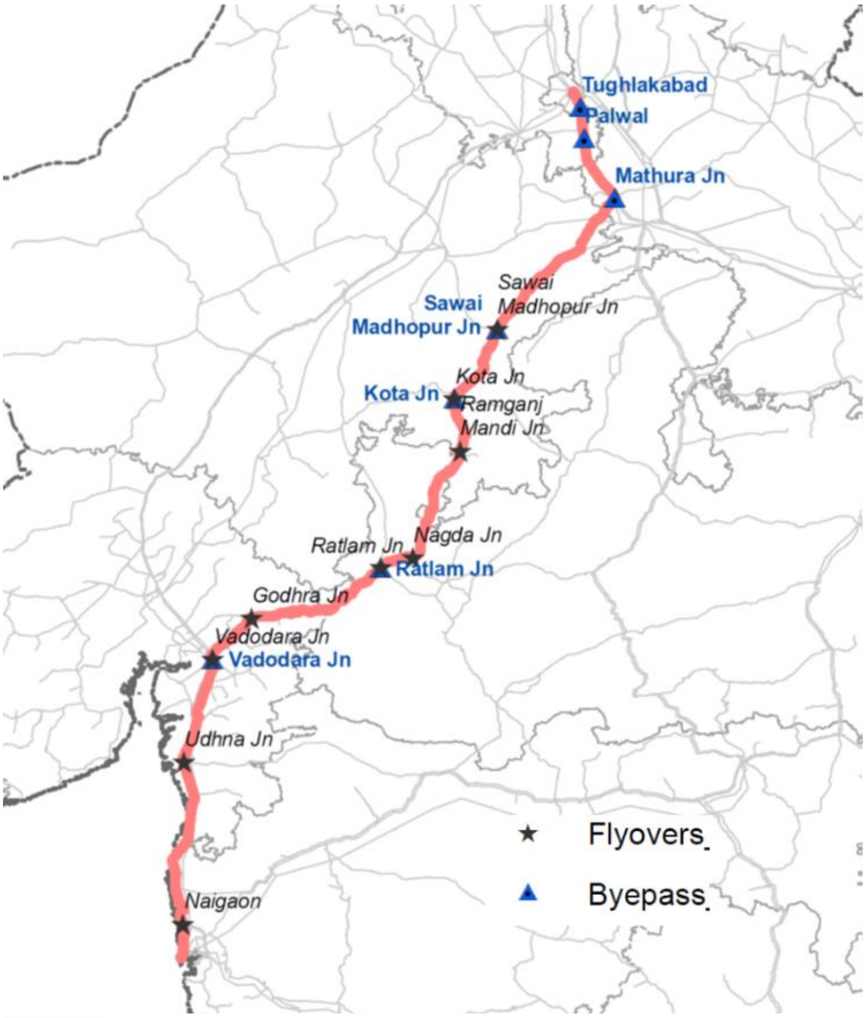


Figure 11-9: –HDN 3 Sanctioned Junctions and Flyovers

11.5.4. HDN 3 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

11.5.4.1. Signaling

As per the ongoing though process within Indian Railways, the entire GQs and GDs covering HDN, 1,2,3,5, 6 and 7 have been proposed to be upgraded for operating trains at a speed of 160 Kmph. Therefore, for this purpose Automatic Signalling with TCAS+ABS+CTC for HDN 3 has been recommended.

Automatic Signalling with TCAS+ABS+CTC type signalling not only enhances the operation speed and safety but also increases the line capacity of the section.

Therefore, after adopting Automatic Signalling with TCAS+ABS+CTC, the capacity increase shall be analysed with the train forecast and accordingly additional line requirements for each section has been recommended.

11.5.4.2. HDN 3 – Additional Line Requirements

HDN 3 has been recommended to be upgraded to triple or quadruple line. Consolidated upgradation proposals including Automatic Signalling with TCAS+ABS+CTC and additional line requirements by cardinal years for entire HDN 3 is presented in **ANNEXURE 11.3:.**

Table 11-14: HDN 3 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line KM
Double to Triple Line	562	562
Triple to Quadruple Line	338	338
Quadruple Line to 6 Lines	7	14
6 Lines to 8 Lines	2	4
Total	**909**	**919**

11.5.4.3. DFC and HSR along HDN 3

Western DFC is proposed from and Khurja to JNPT (before year 2026) along the HDN 3 to handle the freight demand and leave the HDN 3 as a passenger only operation for a higher efficient operation and maintaining higher speed.

High Speed Rail Corridor is proposed from Mumbai to Delhi via Surat, Ahmedabad.

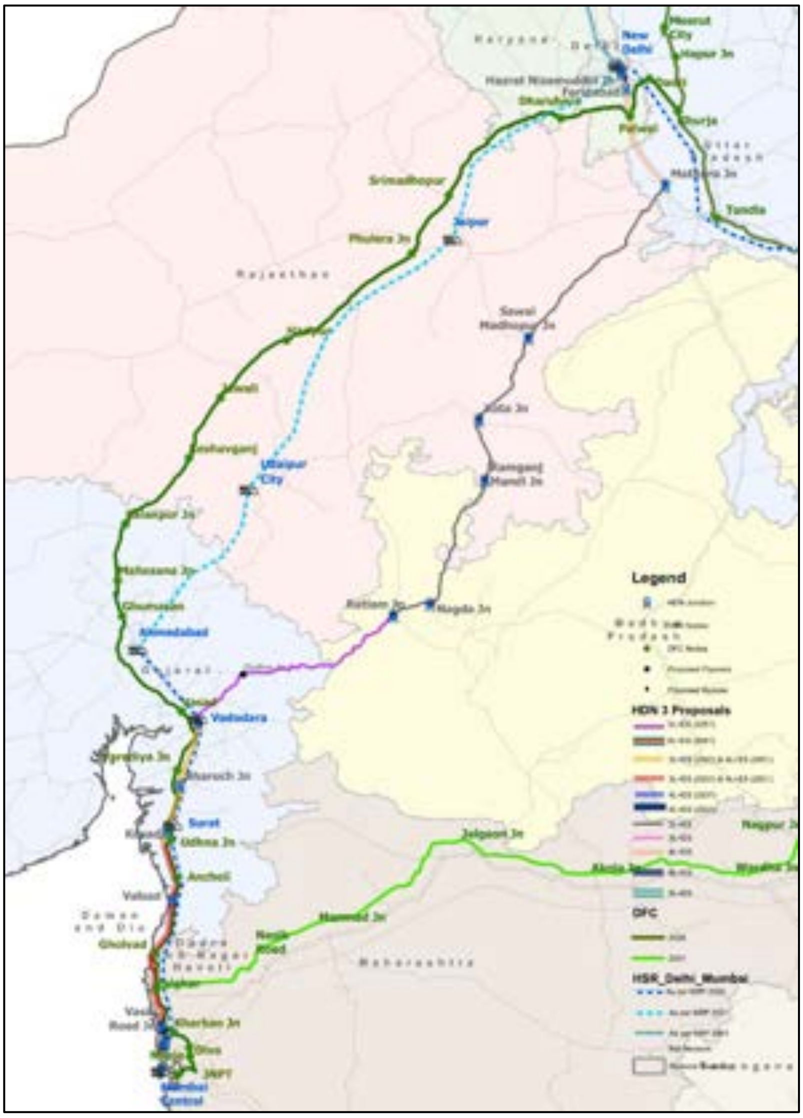


Figure 11-10: –Consolidated Network Upgradation Proposals – HDN 3

11.5.4.4. Capacity Enhancement – HDN 3

Capacity analysis has been carried out for each section of HDN 3 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HDN 3 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 11-15: Capacity Utilization Post Implementation of Projects – HDN 3

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	826	865	278	675	60%	62%	20%	49%
70%-100%	276	523	744	713	20%	38%	54%	51%
100%-150%	278	0	366	0	20%	0%	26%	0%
>150%	7	0	0	0	1%	0%	0%	0%
Total	**1387**	**1387**	**1387**	**1387**	**100%**	**100%**	**100%**	**100%**

11.6. HDN 4 – Delhi to Guwahati via Rosa and Gorakhpur

HDN runs from Delhi to Guwahati via Rosa and Gorakhpur. It is the shortest route between cities of Delhi and Guwahati having a length of 1,845 Km. As the route is connects the North-Eastern India with National Capital via 3 more metropolitan cities, the passenger demand as well as the freight demand is very high.

11.6.1. Existing Capacity Analysis

The entire HDN 4 is designed for operating passenger trains with maximum speed of 130 kmph. It is one of the oldest routes to operated Rajdhani Express. Most of the route has been upgraded minimum to double line except some short stretches having single line as of 2019 but to be upgraded soon to minimum of double line for the entire stretch.

Most of the network is operating beyond its capacity to handle the number of trains per day and it is causing bottle neck situation, delay in passenger operation and enormous delay in freight operation.

Existing Configuration and Capacity Utilization by sections of HDN 4 are presented in **ANNEXURE 11.1:.**

Table 11-16: Existing Capacity Utilization of HDN 4

Capacity Utilization	Network KM	Share
0%-70%	0	0%
70%-100%	498	27%
100%-150%	840	46%
>150%	507	27%
Total	**1,845**	**100%**

At present most of the HDN 4 is operating over 100% of capacity Utilization. Only 27% below 100% and nothing below 70%. This is one of the most highly congested networks and requires infrastructure Upgradation.

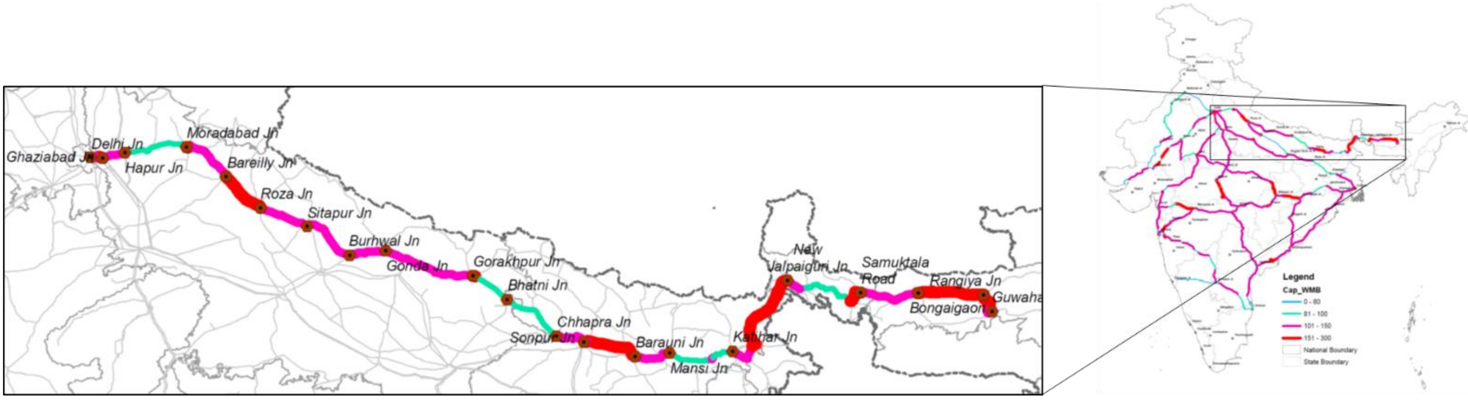


Figure 11-11: – HDN 4 Existing Capacity Utilisation

11.6.2. HDN 4 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HDN 4 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HDN 4 for each of the cardinal years and is presented in **ANNEXURE 11.2:**.

11.6.3. Capacity Analysis after Sanctioned Works (Pink Book)

For the purpose of decongesting various sections of HDN 4, some of the sanctioned works in pipeline and are expected to be completed by year 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works. Major sanctioned works which have been considered are listed below:

Table 11-17: HDN-4 Sanctioned works (Pink Book)

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% Utilization (6/5)	Ongoing works	New Capacity
1	2	3	4	5	6	7	8	9
1	Roza Jn. - Shahjahanpur Jn.	DL	7.35	60	91	152		60
2	Shahjahanpur Jn. - Bareilly Cantt.	DL	66.93	60	88	146	IBS	64
3	Bareilly Cantt-Bareilly Jn.	DL	3.46	60	83	138		60
4	Bareilly Jn.-Rampur Jn.	DL	63.23	60	80	133	IBS	62
5	Rampur Jn.-Katghar Left Bank	DL	22.32	60	82	136	IBS	62
6	Katghar Left Bank-Moradabad	DL	5.08	60	93	154		60
7	Roza Jn. - Sitapur City	SL	79.17	24	28	117	DL	60
8	Moradabad Jn. - Gajraula Jn.	DL	53.42	60	50	83		60

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% Utilization (6/5)	Ongoing works	New Capacity
1	2	3	4	5	6	7	8	9
9	Gajraula Jn. - Hapur Jn.	DL	50.6	60	49	82	IBS	62
10	Hapur Jn. - Ghaziabad Jn	DL	36.97	50	48	96		60
11	Sitapur Burhwal	SL	96.46	24	21.82	90.9	DL	60
12	Burhwal Gonda	DL	61.72	55	59.62	108.4	3rd Line	80
12	Gonda Mankapur	DL	27.94	52	54.91	105.6		60
13	Mankapur Gorakhpur	DL	125.16	50	57.82	115.6	3rd Line	80
14	Gorakhpur Cantt	TSL	3.22	52	66.06	127	3rd Line	80
15	Gorakhpur Cantt Chapra	DL	176.61	54	45	83.3	3rd Line	80
16	Chapra Gramin	DL	5.26	60	51	85		60
18	Chhapra Gramin-Sonpur	DL	51.6	50	44	88		60
19	Sonpur Hazipur	DL	5.58	50	117	137.65		60
20	Hazipur Bachwara	SL	71.31	22	30	136	DL	60
21	Bachwara Barauni	DL	16.5	50	68	136	DL	60
22	Barauni Khagaria	DL	55.5	50	44	88		60
23	Khagaria Mansi	DL	8.74	50	52.5	105		60
24	Mansi Koshi BH	DL	70	50	32.5	65		60
25	Koshi BH Kursela	SL	3.82	36	32.5	90	DL	60
26	Kursela Katihar	DL	39.2	45	32.5	72		60
27	Katihar-Mukuria	SL	35	18	30	167		18
28	Mukuria Barsoi	DL	5	49	76	155		60
29	Barsoi - New jalpaiguri	DL	145	49	74	151		60
30	New Jalpaiguri - Raninagar Jalpaiguri	DL	26	44	43	98		60
31	Raninagar Jalpaiguri - Samuktala road	SL	129	28	40	143	DL	60
32	Samuktala Road - New Bongaigaon	DL	96	49	48	98		60
33	New Bongaigaon-Rangiya jn.	SL	109	23	33	143	DL	60
34	Rangiya jn.- Agthori	SL	34	23	33.5	146	DL	60

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% Utilization (6/5)	Ongoing works	New Capacity
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
35	Agthori - Kamakhya	SL	7	24	29.5	123	DL	60
36	Kamakya New Guwahati	TSL	6	40	48	120		40

In addition to above 3 Bypasses & 10 Flyovers have also been sanctioned along HDN 4.

Figure 11-12: –HDN 4 Sanctioned Junctions and Flyovers

After the implementation of sanctioned works (pink book), some relief will be there by 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works.

Table 11-18: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HDN 4

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	0	0	0	0	0%	0%	0%	0%
70%-100%	7	7	0	0	0%	0%	0%	0%
100%-150%	886	668	30	173	48%	36%	2%	9%
>150%	952	1171	1815	1672	52%	63%	98%	91%
Total	**1845**	**1845**	**1845**	**1845**	**100%**	**100%**	**100%**	**100%**

As evident from the above table, the benefits of implementation of Sanctioned works will not last long. Based on demand forecast, by the year 2026, no section of HDN 4 shall be having capacity utilisation less than 100%. By the year 2031, 63% of the network shall be having capacity utilisation more than 150%. Therefore, in order to meet the objectives of National Rail Plan which mandates to create railway infrastructure that shall be adequate to cater to the demand till the year 2051, a comprehensive review of each section of HDN 4 has been carried out and list of projects has been identified.

11.6.4. HDN 4 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

11.6.4.1. Signaling

Automatic Signalling with TCAS has been recommended for entire HDN 4.

11.6.4.2. HDN 4 – Additional Line Requirements

HDN 4 has been recommended to be upgraded to triple line for the entire length. At certain sub-urban sections such as Guwahati and Katihar there shall be a requirement of 6- lines configuration for segregated operations.

Consolidated upgradation proposals by cardinal years for entire HDN 4 is presented in **ANNEXURE 11.3:.**

Table 11-19: HDN 4 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line KM
Double to Triple Line	637	637
Double to Quadruple Line	456	912
Triple to Quadruple Line	978	978
Total	2070	2,526

11.6.4.3. HSR along HDN 4

There is no parallel HSR proposed along HDN 4. However, the proposed Delhi Agra Kanpur Varanasi HSR has been recommended to be extended to Patna and Guwahati.

11.6.4.4. Capacity Enhancement – HDN 4

Capacity analysis has been carried out for each section of HDN 4 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HDN 4 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

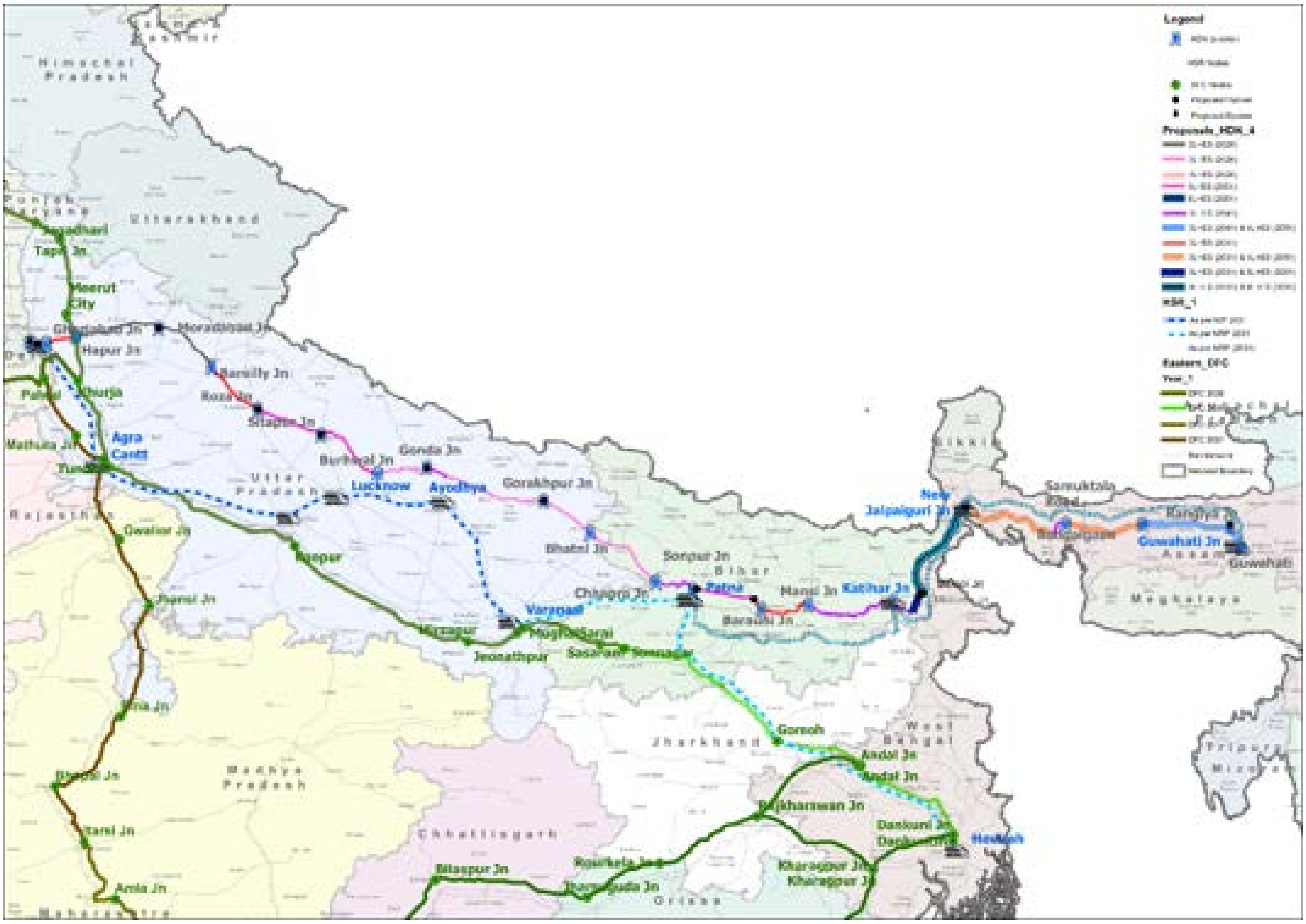


Figure 11-13: –Consolidated Network Upgradation Proposals – HDN 4

Table 11-20: Capacity Utilization Post Implementation of Projects – HDN 4

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	100	1554	1571	1087	5%	84%	85%	59%
70%-100%	1386	291	274	758	75%	16%	15%	41%
100%-150%	360	0	0	0	19%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**1845**	**1845**	**1845**	**1845**	**100%**	**100%**	**100%**	**100%**

11.7. HDN 5 – Delhi to Chennai via Bhopal, Nagpur, Vijayawada

HDN 5 is a part of Golden Diagonal, running North South, it connects Delhi with Chennai via Bhopal, Nagpur, Vijayawada and Gudur. It is the shortest route between, Delhi and Chennai. Having a length of 2,048 Km. the corridor provides connectivity of North India with South India and therefore caters to huge passenger and freight demand.

11.7.1. Existing Capacity Analysis

The entire HDN 5 is designed for operating passenger trains with maximum speed of 130 kmph. It is one of the oldest routes to conceive Rajdhani Express.

Most of the route has been upgraded minimum to double line except some short stretches having single line as of 2019 but to be upgraded soon to minimum of double line for the entire stretch.

Most of the network is operating beyond its capacity to handle the number of trains per day and it is causing bottle neck situation, delay in passenger operation and enormous delay in freight operation.

Existing Configuration and Capacity Utilization by sections of HDN 5 are presented in **ANNEXURE 11.1:.**

Table 11-21: Existing Capacity Utilization of HDN 5

Capacity Utilization	Network KM	Share
0%-70%	121	6%
70%-100%	33	2%
100%-150%	1693	83%
>150%	201	10%
Total	**2,048**	**100%**

At present most (83%) of the HDN 5 is operating over 100% of capacity Utilization. Only 2% is below 100% and 6% below 70%. This is one of the highly congested networks and requires infrastructure Upgradation.

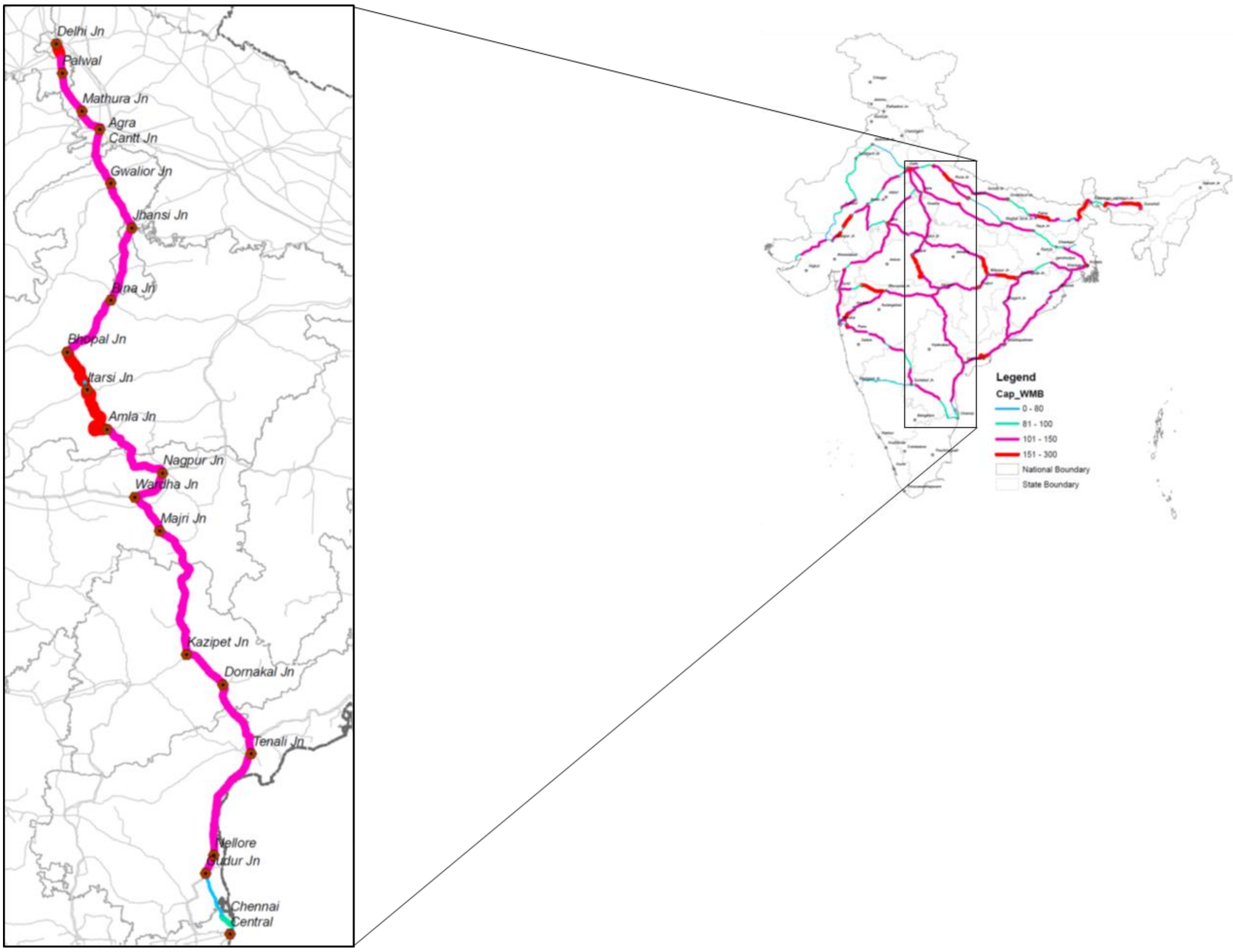


Figure 11-14: – HDN 5 Existing Capacity Utilisation

11.7.2. HDN 5 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HDN 5 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HDN 5 for each of the cardinal years and is presented in **ANNEXURE 11.2:**.

11.7.3. Capacity Analysis after Sanctioned Works (Pink Book)

For the purpose of decongesting various sections of HDN 5, some of the sanctioned works in pipeline and are expected to be completed by year 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works. Major sanctioned works which have been considered are listed below:

Table 11-22: HDN-5 Sanctioned works (Pink Book)

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% Utilisation (6/5)	Ongoing works	New Capacity
1	2	3	4	5	6	7	8	9
1	Mathura-Palwal	TL, Auto Sig	83.4	98	96	97	3rd&4th Lines with Auto Signalling	180
2	Mathura-Agra	DL, Auto Sig	54.1	78	74	83	3rd&4th line	180
3	Agra-Dhaulpur	DL	62.6	74	74	100	3rd&4th Line	180
4	Dhaulpur-Jhansi	DL	154.4	70	86	123	3rd&4th Line	120
5	JHS-Bina	DL	152	70	83	119	3rd&4th Line	120
6	Bina-Bhopal	DL	138.4	70	97.2	138	3rd line	95
7	Habibganj-Barkhera	DL	47.35	69	100.2	145.3	3rd line & Auto Sig	115
8	Barkhera-Budni	DL	19.39	70	106	143.2	3rd and 4th line	130
9	Budni-Itarsi	DL Auto Sig	24.9	72	100	49.6	3rd line Auto	202
10	Itarsi- Amla	DL	130	42	55	154	3rd line	70
11	Amla-Nagpur	DL	167	44	51	125	3rd line	76
12	Nagpur Wardha	DL	79	63	76	144	3rd& 4th line	128
13	Wardha Ballarshah	DL	132	58	64	118	3rd line	89
14	Ballarshah Belampalli	DL	108	63	63	100	3rd line	88
15	Belampalli Kazipeth	DL	126	65	70	108	3rd line	90
16	Kazipeth Dornakal	DL	94	69	65	94	3rd line	94
17	Dornakal Vijaywada	DL	125	70	67	96	3rd line	95
18	Vijaywada Krishna Canal	TL	6	80	86	86	3rd line	86
19	Krishna Canal Tenali	DL	26	62	70	88	3rd line	105
20	Tenali Ongole	DL	107	59	72	90	3rd line	105
21	Ongole Bitragunta	DL	82	59	73	88	3rd line	105
22	Bitragunta Nellore	DL	34	59	73	88	3rd line	105
23	Nellore Gudur	DL	38	67	83	98	3rd line	105

In addition to above 10 Bypasses & 10 Flyovers have also been sanctioned along HDN 5.

After the implementation of sanctioned works (pink book), some relief will be there by 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works.

Table 11-23: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HDN 5

Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	120	114	0	0	6%	6%	0%	0%
70%-100%	611	461	11	0	30%	22%	1%	0%
100%-150%	1084	869	346	348	53%	42%	17%	17%
>150%	234	603	1691	1700	11%	29%	83%	83%
Total	**2048**	**2048**	**2048**	**2048**	**100%**	**100%**	**100%**	**100%**

As evident from the above table, the benefits of implementation of Sanctioned works will not last long. Based on demand forecast, by the year 2026, only 36% of HDN 5 shall be having capacity utilisation less than 100% and only 6% network shall be under 70%. By the year 2031, only 28% of HDN 5 shall be having capacity utilisation less than 100% and 29% network shall be having capacity utilisation more than 150%. Therefore, in order to meet the objectives of National Rail Plan which mandates to create railway infrastructure that shall be adequate to cater to the demand till the year 2051, a comprehensive review of each section of HDN 5 has been carried out and list of projects has been identified.

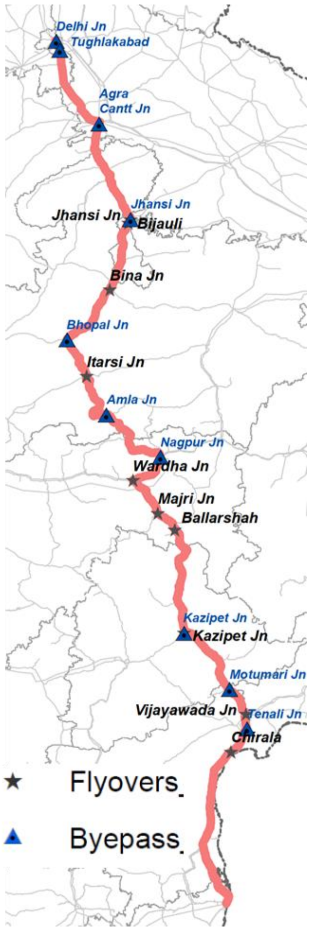


Figure 11-15: –HDN 5 Sanctioned Junctions and Flyovers

11.7.4. HDN 5 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

11.7.4.1. Signaling

Entire HDN 5 is recommended for Automatic Signalling with TCAS+ABS+CTC for operating passenger trains at a speed of 160 Kmph. this type of signalling enhances the operation speed and safety but also increases the line capacity of the section.

Therefore, after adopting Automatic Signalling with TCAS+ABS+CTC, the capacity increase shall be analysed with the train forecast and accordingly additional line requirements for each section has been recommended.

11.7.4.2. HDN 5 – Additional Line Requirements

HDN 5 has been recommended to be upgraded to triple line for the entire length. Consolidated upgradation proposals by cardinal years for entire HDN 5 is presented in **ANNEXURE 11.3:.**

Table 11-24: HDN 5 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line KM
No proposal required after ABS+TCAS+CTC	0	0
Total	**0**	**0**

11.7.4.3. HSR and DFC along HDN 5

There is no parallel HSR proposed along HDN 5.

North South DFC is proposed is Proposed in 2041 from Itarsi to Chennai and extended to Palwal in 2051 along the HDN 5 to handle the freight demand thereby the remaining network can be used for passenger only operation with higher speed.

Figure 11-16: –Consolidated Network Upgradation Proposals – HDN 5

11.7.4.4. Capacity Enhancement – HDN 5

Capacity analysis has been carried out for each section of HDN 5 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HDN 5 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 11-25: Capacity Utilization Post Implementation of Projects – HDN 5

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	2022	2022	1927	1961	99%	99%	94%	96%
70%-100%	25	25	121	87	1%	1%	6%	5%
100%-150%	0	0	0	0	0%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%

Total	**2048**	**2048**	**2048**	**2048**	**100%**	**100%**	**100%**	**100%**

11.8. HDN 6 – Kolkata to Vijayawada via Kharagpur and Vijayanagaram

HDN 6 is a part of Golden Quadrilateral, starting from Kolkata (Howrah) to Vijayawada via Kharagpur and Vijayanagaram and is also connected to HDN 5. It is the shortest route between two major cities of India, Vijayawada and Kolkata, which eventually connects Chennai with Kolkata via HDN 5. HDN 6 is 1113 km Long. As the route is running along the east coast and connecting 4 major ports, the passenger demand as well as the freight demand is very high

11.8.1. Existing Capacity Analysis

The entire HDN 6 is designed for operating passenger trains with maximum speed of 130 kmph. It is one of the oldest routes to conceive Rajdhani Express. Most of the route has been upgraded minimum to double line except some short stretches having single line as of 2019 but to be upgraded soon to minimum of double line for the entire stretch.

Most of the network is operating beyond its capacity to handle the number of trains per day and it is causing bottle neck situation, delay in passenger operation and enormous delay in freight operation.

Existing Configuration and Capacity Utilization by sections of HDN 6 are presented in **ANNEXURE 11.1:.**

Table 11-26: Existing Capacity Utilization of HDN 6

Capacity Utilization	Network KM	Share
0%-70%	0	0%
70%-100%	62	6%
100%-150%	978	88%
>150%	72	6%
Total	**1,113**	**100%**

At present most (94%) of the HDN 6 is operating over 100% of capacity Utilization. Only 6% is below 100% and none is below 70%. This is one of the highly congested networks and requires infrastructure Upgradation.

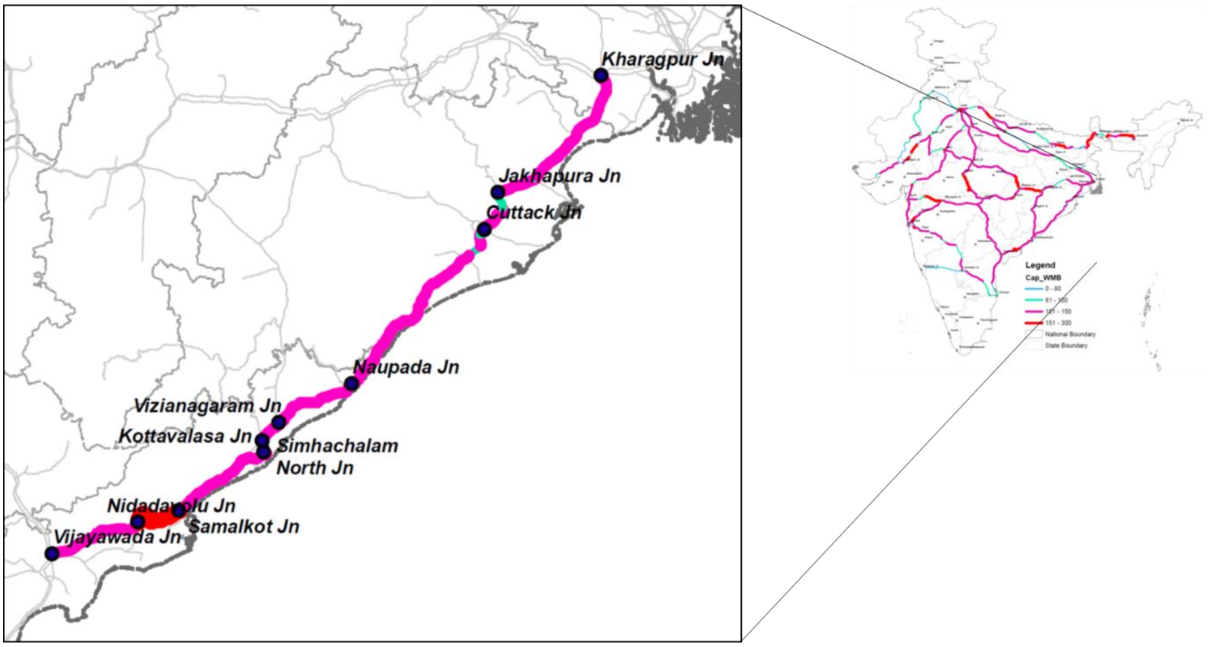


Figure 11-17: –HDN 6 Existing Capacity Utilisation

11.8.2. HDN 6 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HDN 6 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HDN 6 for each of the cardinal years and is presented in **ANNEXURE 11.2:**.

11.8.3. Capacity Analysis after Sanctioned Works (Pink Book)

For the purpose of decongesting various sections of HDN 6, some of the sanctioned works in pipeline and are expected to be completed by year 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works. Major sanctioned works which have been considered are listed below:

Table 11-27: HDN-6 Sanctioned works (Pink Book)

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% utilisation (6/5)	Ongoing works	Augmented Capacity
1	2	3	4	5	6	7	8	9
1	Kharagpur Bhadrak	DL	177	63	68	108	3rd line	88
2	Bhadrak Jakhpura	DL	51	68	80	117	3rd line	93
3	Jakhpura Haridaspur	TL	24	110	85	77		110
4	Haridaspur Nergundi	DL		77	87	114	3rd line	100

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% utilisation (6/5)	Ongoing works	Augmented Capacity
1	2	3	4	5	6	7	8	9
5	Nergundi Cuttuck	DL AUTO	11	93	104	107	3rd line	104
6	Cuttack Barang	DL AUTO	12	87	73	81	3rd line	112
7	Barang Bhubneswar	DL Auto	16	105	100	94	3rd line	130
8	Bhubneswar Khurda	TL Auto	19	120	100	86		120
9	Khurda Road Brahmapur	DL	147	66	76	126	3rd line	85
10	Brahmapur Palasa	DL	74	60	75	127	3rd line	82
11	Palasa Naupada	DL	26	64	68	112	3rd line	85
12	Naupada Vizianagaram	DL	117	61	66	111	3rd line	84
13	Vizianagaram Kottavalasa	TL	35	114	102	108	Auto Sig	115
14	Kottavalasa Simhachalam North	QL	17	128	117	96	Auto Sig	180
15	Simhachalam North Gopalpatnam	DL	3	65	56	89	Auto Sig	90
16	Gopalpatnam Vishakhapatnam	DL Auto	7	114	111	97		114
17	Gopalpatnam Duvada	DL	10	77	68	89	Auto Sig	97
18	Duvda Samalkot	DL	160	58	74	100	3rd line	97
19	Samalkot Rajamundry	DL	60	58	81	111	3rd line	97
20	Rajamundry Nidadvolu	DL	22	58	81	109	3rd line	97
21	Nidadvolu Vijayawada	DL	127	58	75	101	3rd line	97

In addition to above 1 Bypass & 4 Flyovers have also been sanctioned along HDN 6.

After the implementation of sanctioned works (pink book), some relief will be there by 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works.

Figure 11-18: –HDN 6 Sanctioned Bypasses and Flyovers

Table 11-28: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HDN 6

Line Capacity Utilization	Network km				% Share			
	2026	**2031**	**2041**	**2051**	**2026**	**2031**	**2041**	**2051**
0%-70%	0	0	0	0	0%	0%	0%	0%
70%-100%	57	0	0	0	6%	5%	0%	0%
100%-150%	828	324	0	0	88%	74%	29%	0%
>150%	227	788	1113	1113	6%	20%	71%	100%
Total	**1113**	**1113**	**1113**	**1113**	**100%**	**100%**	**100%**	**100%**

As evident from the above table, the benefits of implementation of Sanctioned works will not last long. Based on demand forecast, by the year 2026, only 6% of HDN 6 shall be having capacity utilisation less than 100%. By the year 2031, only 5% of HDN 6 shall be having capacity utilisation less than 100% and 20% network shall be having capacity utilisation more than 150%. Therefore, in order to meet the objectives of National Rail Plan which mandates to create railway infrastructure that shall be adequate to cater to the demand till the year 2051, a comprehensive review of each section of HDN 6 has been carried out and list of projects has been identified.

11.8.4. HDN 6 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

11.8.4.1. Signaling

Entire HDN 6 is recommended for Automatic Signalling with TCAS+ABS+CTC for operating passenger trains at a speed of 160 Kmph. this type of signalling enhances the operation speed and safety but also increases the line capacity of the section. Therefore, after adopting Automatic Signalling with TCAS+ABS+CTC, the capacity increase shall be analysed with the train forecast and accordingly additional line requirements for each section has been recommended.

11.8.4.2. HDN 6 – Additional Line Requirements

HDN 6 has been recommended to be upgraded to triple line or quadruple for the entire length. Consolidated upgradation proposals by cardinal years for entire HDN 6 is presented in **ANNEXURE 11.3:.**

Table 11-29: HDN 6 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line Km
Triple to Quadruple Line	158	158
Total	158	158

11.8.4.3. HSR and DFC along HDN 6

There is no parallel HSR proposed along HDN 6. East Coast DFC is proposed is to be implemented by 2031 from Kharagpur to Vijayawada for handling the freight demand thereby the remaining network can be used for passenger only

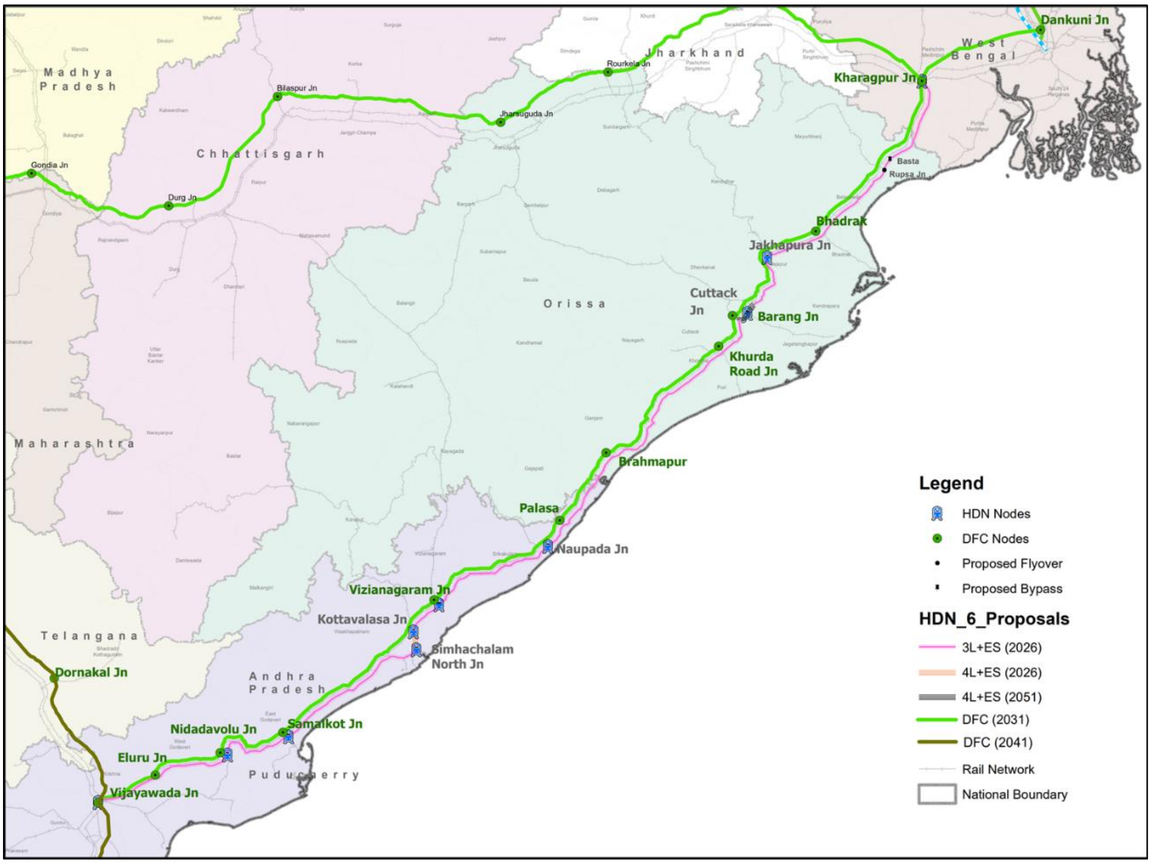


Figure 11-19: –Consolidated Network Upgradation Proposals – HDN 6

operation with higher speed.

11.8.4.4. Capacity Enhancement – HDN 6

Capacity analysis has been carried out for each section of HDN 6 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HDN 6 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 11-30: Capacity Utilization Post Implementation of Projects – HDN 6

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	1078	1097	1034	1029	97%	99%	93%	93%
70%-100%	34	16	79	83	3%	1%	7%	7%
100%-150%	0	0	0	0	0%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**1,055**	**1,113**	**1,050**	**1,019**	**100%**	**100%**	**100%**	**100%**

11.9. HDN 7 – Mumbai to Chennai via Pune

HDN 7 is a part of Golden Quadrilateral, starting from Mumbai to Chennai passing through Pune, Wadi, Nandalur. It is the shortest route between Mumbai and Chennai having a total length of 1,224 km. HDN 7 connects 2 major ports and 2 metro cities, therefore the passenger and freight demand is very high.

11.9.1. Existing Capacity Analysis

The entire HDN 7 is designed for operating passenger trains with maximum speed of 130 kmph. Most of the route has been upgraded minimum to triple line except some short stretches having double line as of 2019 but to be upgraded soon to minimum for the entire stretch.

Most of the network is operating beyond its capacity to handle the number of trains per day and it is causing bottle neck situation, delay in passenger operation and enormous delay in freight operation.

Existing Configuration and Capacity Utilization by sections of HDN 7 are presented in **ANNEXURE 11.1:.**

Table 11-31: Existing Capacity Utilization of HDN 7

Capacity Utilization	Network KM	Share
0%-70%	58	5%
70%-100%	466	38%
100%-150%	675	55%
>150%	25	2%
Total	**1,224**	**100%**

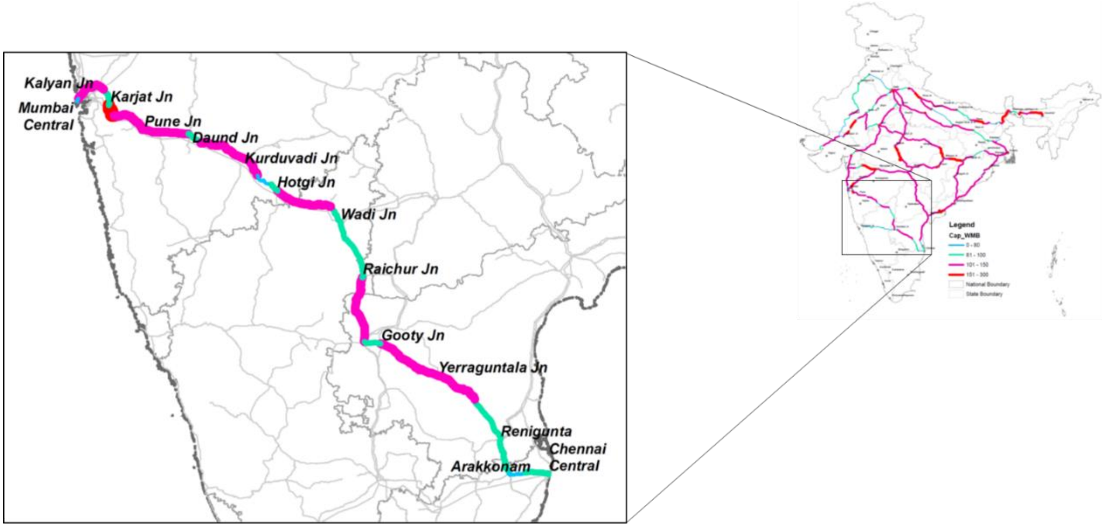


Figure 11-20: – HDN 7 Existing Capacity Utilisation

At present most (55%) of the HDN 7 is operating over 100% of capacity Utilization. Only 43% is below 100% and 5% is below 70%. This is one of the highly congested networks and requires infrastructure Upgradation.

11.9.2. HDN 7 – Train Forecast

Forecast train number for each section of HDN 7 has been estimated for developing the capacity augmentation proposals. Forecast train number (Passenger + Freight) by section has been estimated for HDN 7 for each of the cardinal years and is presented in **ANNEXURE 11.2:**.

11.9.3. Capacity Analysis after Sanctioned Works (Pink Book)

For the purpose of decongesting various sections of HDN 7, some of the sanctioned works in pipeline and are expected to be completed by year 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works. Major sanctioned works which have been considered are listed below:

Table 11-32: HDN-7 Sanctioned works (Pink Book)

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% utilisation (6/5)	Ongoing works	New Capacity
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	KYN-BUD	DL	14	144	171	119	3/4th Line	288
2	BUD - KJT	DL	32	144	86	60		144
3	KJT-LNL	TL	28	48	63	130		48

S. No.	Section	Configuration	Length (Km)	Capacity WOMB	Trains	% utilisation (6/5)	Ongoing works	New Capacity
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
4	LNL - TGN	DL	30	68	71	104	3/4th Line, Auto	144
5	TGN - PUNE	DL	35	64	73	114	3/4th Line, Auto	144
6	PUNE - DD	DL	76	65	58	89	IBS, OHE	70
7	DD - BGVN	DL	27	63	38	60	DL, OHE	63
8	BGVN - KWV	SL	81	31	38	123	Doubling	60
9	KWV - MO	SL	45	31	36	117	Doubling	60
10	MO-SUR	DL	34	64	36	57	Doubling	60
	SUR- HG	DL	16	64	45	70	Doubling	60
11	HG - GR	SL	98	31	37	120	Doubling	60
12	GR - WD	DL	37	63	39	62	Doubling	63
13	Reniguta - Nandalur	DL	85	46	33.3	72	IBS	60
14	Nandaluru - Gooty	DL	194	48	45.2	94		60
15	Gooty-Guntakal	DL	29	45	39.4	88	By-Pass	60
16	Guntakal - Raichur	DL	121	40	36.4	91		60
18	Raichur - Wadi	DL	107	47	38.9	83	IBS, By-pass	60
19	Gudur Reniguta	DL	83	54	41.4	77		60

In addition to above 2 Bypasses & 8 Flyovers have also been sanctioned along HDN 7.

After the implementation of sanctioned works (pink book), some relief will be there by 2026. However, given the demand forecast and the time horizon of 2051, the capacity of the network shall be saturated even after implementing the sanctioned works.

Figure 11-21: – HDN 7 Bypasses and Flyovers

Table 11-33: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HDN 7

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	79	49	5	1	6%	4%	0%	0%
70%-100%	897	65	50	32	73%	5%	4%	3%
100%-150%	117	847	169	107	10%	69%	14%	9%
>150%	131	263	1001	1083	11%	21%	82%	88%
Total	**1,224**	**1,224**	**1,224**	**1,224**	**100%**	**100%**	**100%**	**100%**

11.9.4. HDN 7 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

11.9.4.1. Signaling

Entire HDN 7 is recommended for Automatic Signalling with TCAS+ABS+CTC for operating passenger trains at a speed of 160 Kmph. this type of signalling enhances the operation speed and safety but also increases the line capacity of the section. Therefore, after adopting Automatic Signalling with TCAS+ABS+CTC, the capacity increase shall be analysed with the train forecast and accordingly additional line requirements for each section has been recommended.

11.9.4.2. HDN 7 – Additional Line Requirements

HDN 7 has been recommended to be upgraded to triple line or quadruple for the entire length.

Consolidated upgradation proposals by cardinal years for entire HDN 7 is presented in **ANNEXURE 11.3:.**

Table 11-34: HDN 7 – Additional Line Requirements (2051)

Configuration Conversion	Network Km	Line Km
Double to Triple	379	379
Quadruple to 6 Lines	38	76
Total	**417**	**455**

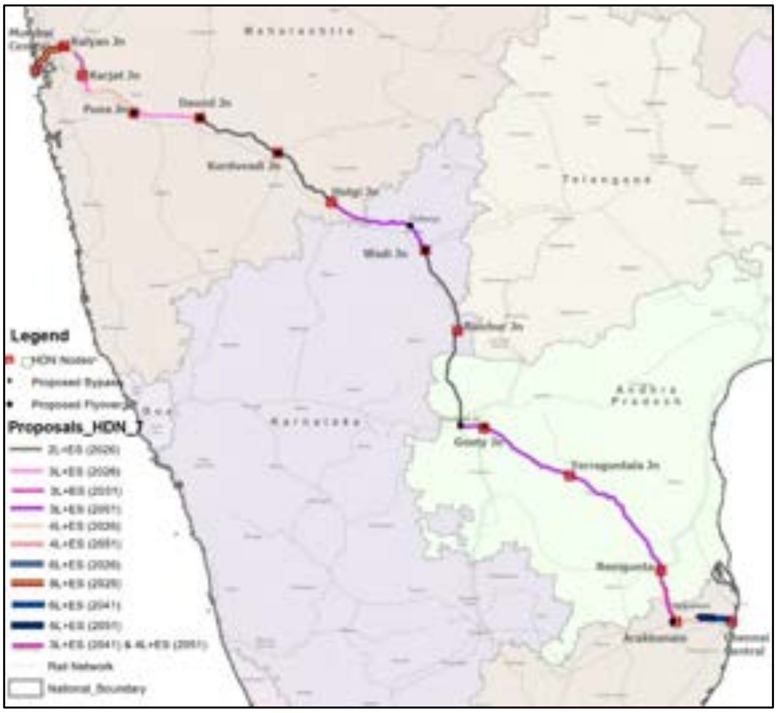


Figure 11-22: –Consolidated Network Upgradation Proposals – HDN 7

11.9.4.3. Capacity Enhancement – HDN 7

Capacity analysis has been carried out for each section of HDN 7 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HDN 7 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 11-35: Capacity Utilization Post Implementation of Projects – HDN 7

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	1114	1151	436	1046	91%	94%	36%	85%
70%-100%	110	73	492	178	9%	6%	40%	15%
100%-150%	0	0	296	0	0%	0%	24%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**1,224**	**1,224**	**1,224**	**1,224**	**100%**	**100%**	**100%**	**100%**

11.10. Consolidated HDN Infrastructure Upgradation Proposals

Detail infrastructure recommendations for each of the HDN has been explained in sections above. In this section, the recommendations have been classified by their respective nature and type. These are presented in detail in tables below.

11.10.1.Consolidated HDN - Additional Line Requirements

Of the total HDN, 3,879 Km of network shall be upgraded by provision of additional line that translates to 4,462 of HDN Line Km.

Table 11-36: Consolidated Additional Line Requirement for HDN

Conversion	Network KM				Line KM			
	2031	**2041**	**2051**	**Total**	**2031**	**2041**	**2051**	**Total**
Single to Double Line	0	0	0	0	0	0	0	0
Double to Triple Line	716	530	522	1,768	716	530	522	1,768
Double to Quadruple Line	306	150	0	456	612	300	0	912
Triple to Quadruple Line	239	347	952	1,538	239	347	952	1,538
Triple to 6 Lines	11	0	0	11	32	0	0	32
Quadruple to 6 Lines	40	8	39	87	79	16	79	174
6 Lines to 8 Lines	11	6	2	19	22	12	5	39
Total	**1,322**	**1,041**	**1,516**	**3,879**	**1,700**	**1,205**	**1,558**	**4,462**

11.10.2.Consolidated HDN - Signaling Requirements

Except HDN 4, Automatic Signalling with TCAS+ABS+CTC has been recommended on all other HDNs. On HDN 4, automatic Signalling with TCAS has been recommended. Network length and recommended phasing for implementation of Automatic Signalling with TCAS+ABS+CTC is described in tables below:

Table 11-37: Implementation Phasing of ABS+TCAS+CTC Signaling by Network Length

Line Type	2026	2031	2041	2051
Double Line	2916	0	0	0
Triple Line	2850	267	370	494
Quadruple Line	3291	47	0	513

6 Line	54	50	8	39
8 Line	12	11	6	2
Total Network Km	**9124**	**375**	**384**	**1049**
Total Line Km	**27972**	**1379**	**1207**	**3789**

Table 11-38: Implementation Phasing of Automatic Signaling by Network Length

	2026	**2031**	**2041**	**2051**
Single Line	0	0	0	0
Double Line	1148	37	205	80
Triple Line	368	449	160	28
Quadruple Line	0	497	503	439
Total Network Km	**1516**	**983**	**868**	**548**
Total Line Km	**3400**	**3409**	**2904**	**2002**

Table 11-39: Consolidated HDN Proposals (Line Km)

HDN Network	Single Line	Double Line	Triple Line	Quadruple Line	Sextuple Line	Octuple Line	Total	ABS+TCAS+CTC	TCAS	Bypasses	Flyovers
2026											
HDN 1	0	544	660	253	6	0	1463	1463	0	29	15
HDN 2	0	10	477	1392	11	0	1889	1889	0	6	12
HDN 3	0	1193	3	144	36	12	1387	1387	0	7	9
HDN 4	0	1470	368	7	0	0	1845	0	1516	3	10
HDN 5	0	119	588	1341	0	0	2048	2048	0	10	10
HDN 6	0	0	1096	17	0	0	1113	1113	0	1	4
HDN 7	0	1051	27	144	1	0	1224	1224	0	2	8
Total	**0**	**4386**	**3219**	**3298**	**54**	**12**	**10969**	**9124**	**1516**	**58**	**68**
2031											
HDN 1	0	544	660	253	6	0	1463	1463	0	-	-
HDN 2	0	10	418	1407	43	11	1889	1889	0	-	-
HDN 3	0	990	205	137	43	12	1387	1387	0	-	-
HDN 4	0	715	626	504	0	0	1845	0	1553	-	-
HDN 5	0	119	588	1341	0	0	2048	2048	0	-	-
HDN 6	0	0	1096	17	0	0	1113	1113	0	-	-
HDN 7	0	986	92	144	1	0	1224	1224	0	-	-
Total	**0**	**3364**	**3685**	**3803**	**93**	**23**	**10969**	**9124**	**1553**	**-**	**-**
2041											
HDN 1	0	537	667	245	14	0	1463	1463	0	-	-
HDN 2	0	10	418	1407	37	17	1889	1889	0	-	-
HDN 3	0	855	340	137	43	12	1387	1387	0	-	-
HDN 4	0	405	439	1000	0	0	1845	0	1764	-	-
HDN 5	0	119	588	1341	0	0	2048	2048	0	-	-
HDN 6	0	0	1096	17	0	0	1113	1113	0	-	-
HDN 7	0	759	319	144	1	0	1224	1224	0	-	-
Total	**0**	**2684**	**3868**	**4292**	**95**	**30**	**10969**	**9124**	**1764**	**-**	**-**
2051											
HDN 1	0	353	851	244	15	0	1463	1463	0	-	-
HDN 2	0	10	401	1424	37	17	1889	1889	0	-	-
HDN 3	0	631	226	474	41	15	1387	1387	0	-	-

Table 11-39: Consolidated HDN Proposals (Line Km)

HDN Network	Single Line	Double Line	Triple Line	Quadruple Line	Sextuple Line	Octuple Line	Total	ABS+TCAS+CTC	TCAS	Bypasses	Flyovers
HDN 4	0	377	28	1440	0	0	1845	0	1845	-	-
HDN 5	0	119	588	1341	0	0	2048	2048	0	-	-
HDN 6	0	0	938	175	0	0	1113	1113	0	-	-
HDN 7	0	672	406	106	39	0	1224	1224	0	-	-
Total	**0**	**2162**	**3438**	**5204**	**132**	**32**	**10969**	**9124**	**1845**	**-**	**-**

Chapter 12 HIGHLY UTILISED NETWORK (HUN)

12.1. Highly Utilized Network (HUN)

Similar to HDN, the Indian Railways have classified the next hierarchy of network catering to predominantly high traffic demand as Highly Utilised Network.

The fundamental difference between HDN and HUN is that, HDN caters to single line haul demand by connecting major metropolitans of the country. Therefore, the traffic that uses HDN has predominant share of passengers or freight either originating or destined to these metros.

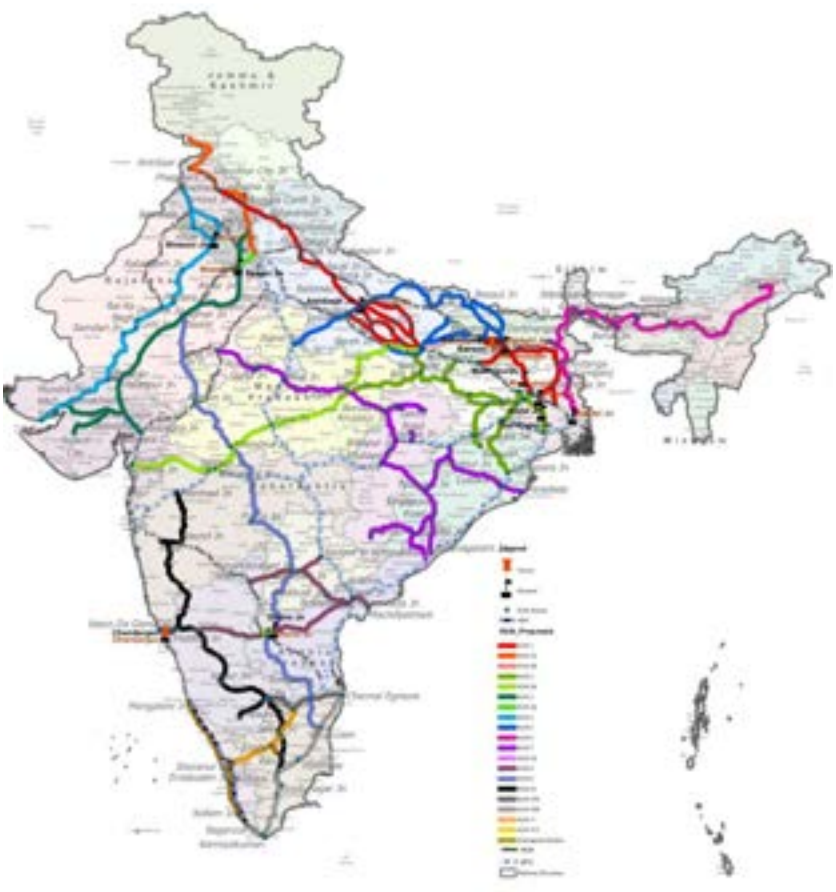


Figure 12-1: –HUN Network of Indian Railways

However, in case of HUN, the demand is high but there is no single line haul corridor and it serves multiple origins and destinations. Trains uses HUN for shorter distances and then leave the network and again some trains further join the network. Thereby the total train volume in sections remain high but there is no through movement. Also, in case of HDN, share of freight trains is quite high whereas in case of HUN passenger traffic is predominant.

A total of 11 routes have been identified as Highly Utilized Network (HUN), having a total length of 23,347 km. Indian Railways plan to electrify and double the HDN and highly utilized networks (HUN) network, with a length of 34,642 km, by March 2024.

Table 12-1: Indian Railways HUN Routes

S.NO	HUN Routes	HUN Routes	Length (Km)
HUN 1	Amrit Sagar Sampark Corridor	**Amritsar-Andal via** Amritsar-Jalandhar-Ludhiana-Ambala-Saharanpur-Moradabad, Moradabad - Chandausi – Chandausi - Barelli,Barelli – Roza – Lucknow – Sultanpur – Zafrabad – Varanasi – Mughalsarai – Patna – Bhaktiyarpur – Kiul –Bhagalpur – Sainthia - Andal, & Patna - Sonpur & Sainthia -	3,049

S.NO	HUN Routes	HUN Routes	Length (Km)
		Khana, Lucknow – Faizabad - Zafrabad, Lucknow - Raibareli - Chilbila – Pratapgarh - Janghai - Varanasi, Kanpur(Unnao) – Unchahar – Phaphamau - Janghai, Raibareli - Unchahar & Gaya-Kiul - Sitarampur.	
HUN 2	Bengal Arab Sagar Sampark Corridor	**Kharagpur to Udhna via** Kharagpur – Bankura – Katni – Bhusawal - Udhna & Asansol – Adra – Bhojudih - Pradhankuntha (Dhanbad) & Purulia – Chandil - Sini & Muri – Barkakhana – Barkakhana - Tori & Ranchi - Barsuan & Garwa Rd. - Sonnagar & Billi - Chunar & Rajkharswan - Jakhapura.	3,035
HUN 3	Kathiawar Shivalik Sampark Corridor	**Chandigarh to Rajkot Via** Chandigarh-Panipat-Rohtak-Asthalbohar-Rewari -Jaipur-Palanpur-Vadodara & Ahmedabad-Surendanagar-Rajkot & Samakhiyali-Viramgam.	1,685
HUN 4	Sagar Sutlej Sampark Corridor	**Firozpur to Mundra Port via** Firozpur – Bhatinda – Bhatinda – Jakhal – Hissar – Degana – Luni - Samdhari – Bhildi -Kandla/Mundra & Bhatinda-Sirsa-Hisar.	1,529
HUN 5	Bundelkhand Tarai Sampark Corridor	**Jhansi to Muzaffarpur to Katni** Jhansi-Kanpur-Lucknow-Barabanki-Burhwal, Gonda-Anandnagar-Gorakhpur-Valmikinagar-Valmikinagar-Sugauli, Muzafarpur-Bachwara and Narkatiyaganj-Raxual-Sitamarhi-Darbhanga-Samastipur, Sitamarhi-Muzafarpur-Hazipur including Bhatni-Varanasi-Naini(Allahabad)-Manikpur-Satna-Katni & Chhapra-Varanasi	2,151
HUN 6	Sagar Purvodaya Sampark Corridor	**Bandel to Dibrugarh via** Bandel – Katwa – Azimganj – Barsoi – Aluabari - New Coochbehar – Golakganj - Abhyapuri (Jogigopa) (NL under cosnstruction) - Goalpara Town – Guwahati – Lumding - Dibrugarh including Katihar - Kumedpur.	1,490
HUN 7	Sagar Chambal Sampark Corridor	**Vizianagram/Paradeep to Kota via** Vizianagram - Raipur, Bilaspur – Katni - Kota & Paradeep - Cuttack, Barang - Titlagarh & Sambalpur - Jharsuguda, Kottavalasa - Kinrandul, Singapur Rd. - Koraput, Champa - Gevra Rd. & Anuppur – Boridand - Ambikapur and Boridand - Chirimiri.	2,737
HUN 8	Purv Paschim Deccan Sampark Corridor	**Vasco to Machlipatnam via** Vasco - Londa, Dharwad – Vijaywada - Machilipatnam & Guntur - Bibinagar & Kazipet - Wadi.	1,501
HUN 9	Aravali Dakshin Sampark Corridor	**Ajmer to Dindigul via** Ajmer – Ratlam - Akola (under GC) – Nanded – Secundrabad – Dharmavaram - Villupuram - Dindigul & Katpadi - Jolarpettai & Chennai - Villupuram.	2,803
HUN 10	Satpura Coromandel Sampark Corridor	**Manmad to Kanyakumari via** Manmad - Daund, Pune – Hubli – Birur – Yashwantpur - Salem & Bypanhalli – Hosur, Hosur – Salem - Dindigul – Madurai - Kanyakumari & Bengluru - Mysuru.	2,232
HUN 11	Konkan Malabar Sampark Corridor	**Mangalorev to Kanyakumari via** Mangalore – Shoranur - Kanyakumari (via Kottayam & Alapphuza) & Shoranur - Salem & Erode - Karur	1,134
Total			23,347

The chapter discusses in detail, each HUN network in terms of existing capacity utilisation, traffic demand forecast and network upgradation proposals for each cardinal year. The methodology for arriving at network upgradation proposals has been discussed in detail in **0**.

12.2. Existing Capacity Utilization

The entire HUN Network is very much congested. More than 46% of HDN network is operating beyond 100% of its capacity. Only 24% of network is having less than 70% capacity Utilization.

Table 12-2: Existing Capacity Utilization of HUN

Capacity Utilization	Network KM	Share
0%-70%	5,896	24%
70%-100%	6,887	28%
100%-150%	8,361	34%
>150%	3,121	12%
Total	**24,266**	**100%**

12.3. HUN 1 – Amrit Sagar Sampark Corridor

HUN 1 connects Amritsar to Andal via Amritsar - Jalandhar - Ludhiana - Ambala - Saharanpur - Moradabad, Moradabad - Chandausi - Chandausi - Barelli, Barelli - Roza - Lucknow - Sultanpur - Zafrabad - Varanasi - Mughalsarai - Patna - Bhaktiyarpur - Kiul -Bhagalpur - Sainthia - Andal, & Patna - Sonpur & Sainthia - Khana, Lucknow - Faizabad - Zafrabad, Lucknow - Raibareli - Chilbila - Pratapgarh - Janghai - Varanasi, Kanpur(Unnao) - Unchahar - Phaphamau - Janghai, Raibareli - Unchahar & Gaya-Kiul - Sitarampur.

12.3.1. Recommended Modifications

Some of the recommendations and modifications are listed below:

Amritsar Ambala Section is part of HUN 1. For the Purpose single continuous corridor and for uniformity of Proposals, Jammu - Jalandhar, Chandigarh - Ambala and Panipat - Delhi Section is recommended to be included in HUN 1.

Chandigarh to Panipat is part of HUN 3, recommended to be included in HUN 1

Prayagraj to Patna section connects HUN 1 with HDN 1 and HDN 4.

Original Length - 3,049 km, Modified Length - 3,671 km.

12.3.2. Existing Capacity Analysis

The entire HUN 1 is built up to handle passenger trains as well as freight trains. Some of the part of the network acts as a feeder to DFCs.

Currently most of the HUN 1 is operating over 100% of capacity Utilization. Only 44% below 100%, 24% below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 1 are presented in **ANNEXURE 12.1:.**

Table 12-3: Existing Capacity Utilization of HUN 1

Capacity Utilization	Network KM	Share
0%-70%	865	24%
70%-100%	729	20%
100%-150%	1924	52%

>150%	153	4%
Total	**3,671**	**100%**

12.3.3. HUN 1 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 1 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 1 for each of the cardinal years and is presented in **ANNEXURE 12.2**:.

12.3.4. Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 1 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 97% of the network will operate more than 100% of capacity Utilization.

Table 12-4: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 1

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	1238	672	143	51	34%	18%	4%	1%
70%-100%	659	830	263	60	18%	23%	7%	2%
100%-150%	1137	744	1050	448	31%	20%	29%	12%
>150%	638	1425	2216	3112	17%	39%	60%	85%
Total	**3671**	**3671**	**3671**	**3671**	**100%**	**100%**	**100%**	**100%**

12.3.5. HUN 1 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.3.5.1. Signaling

Entire HUN 1 is recommended to be upgraded for Automatic Signalling with TCAS

12.3.5.2. HUN 1 – Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 1 is presented in **ANNEXURE 12.3**:.

Table 12-5: HUN 1 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single Line to Double Line	49	14	205	120	**388**	49	14	205	120	**388**
Double Line to Triple Line	98	102	298	133	**631**	98	102	298	133	**631**
Double Line to Quadruple Line	46	103	41	394	**584**	92	206	82	789	**1168**
Triple Line to Quadruple Line	43	19	193	183	**437**	43	19	193	183	**437**
Quadruple Line to 6 Lines	0	0	0	40	**40**	0	0	0	80	**80**

Total	**235**	**238**	**737**	**871**	**2,081**	**281**	**340**	**778**	**1,305**	**2,705**

Figure 12-2: –Consolidated Network Upgradation Proposals – HUN 1

12.3.5.3. Capacity Enhancement – HUN 1

Capacity analysis has been carried out for each section of HUN 1 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 1 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 12-6: Capacity Utilization Post Implementation of Projects – HUN 1

Line Capacity Utilization	**Network km**				**% Share**			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	2402	2654	1707	2078	65%	72%	47%	57%
70%-100%	1247	904	1922	1593	34%	25%	52%	43%
100%-150%	23	113	42	0	1%	3%	1%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**3,671**	**3,671**	**3,671**	**3,671**	**100%**	**100%**	**100%**	**100%**

12.4. HUN 2 – Bengal Arab Sagar Sampark Corridor

HUN 2 is Bengal Arab Sagar Sampark Corridor from Kharagpur to Udhna via Kharagpur - Bankura - Katni - Bhusawal - Udhna & Asansol - Adra - Bhojudih -

Pradhankuntha (Dhanbad) & Purulia - Chandil - Sini & Muri - Barkakhana - Barkakhana - Tori & Ranchi - Barsuan & Garwa Rd. - Sonnagar & Billi - Chunar & Rajkharswan - Jakhapura.

12.4.1. Recommended Modifications

Some of the recommendations and modifications are listed below:

For the purpose of having connectivity between HDN 3, HDN 1, HDN 4 and HDN 5, Section of Katni to Prayagraj has been excluded from HUN 5 and included in HUN 2.

By doing so Continuous Corridor Connecting Surat to Prayagraj via Bhusawal, Jalgaon, Itarsi, Katni is created.

Original Length was 3,035 km and Length after modification is 3,507 km

12.4.2. Existing Capacity Analysis

The entire HUN 2 is built up to handle passenger trains as well as freight trains. Some of the part of the network acts as a feeder to DFCs. At present most of the HUN 2 is operating over 100% of capacity Utilization. Only 40% below 100%, 21% below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 2 are presented in **ANNEXURE 12.1:.**

Table 12-7: Existing Capacity Utilization of HUN 2

Capacity Utilization	Network KM	Share
0%-70%	729	21%
70%-100%	672	19%
100%-150%	1316	38%
>150%	789	23%
Total	**3,507**	**100%**

12.4.3. HUN 2 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 2 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 2 for each of the cardinal years and is presented in **ANNEXURE 12.2:**

12.4.4. Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 2 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 91% of the network will operate more than 100% of capacity Utilization.

Table 12-8: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 2

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	1500	996	215	217	43%	28%	6%	6%

70%-100%	285	74	394	79	8%	2%	11%	2%
100%-150%	497	895	523	569	14%	26%	15%	16%
>150%	1225	1541	2376	2642	35%	44%	68%	75%
Total	**3507**	**3507**	**3507**	**3507**	**100%**	**100%**	**100%**	**100%**

12.4.5. HUN 2 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.4.5.1. Signaling

Entire HUN 2 is recommended to be upgraded for Automatic Signalling with TCAS

12.4.5.2. HUN 2 – Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 2 is presented in **ANNEXURE 12.3:.**

Table 12-9: HUN 2 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single Line to Double Line	76	106	0	4	**186**	76	106	0	4	**186**
Single Line to Triple Line	0	0	0	6	**6**	0	0	0	12	**12**
Single Line to Quadruple Line	0	0	21	0	**21**	0	0	62	0	**62**
Double Line to Triple Line	0	184	500	267	**951**	0	184	500	267	**951**
Double Line to Quadruple Line	0	0	206	0	**206**	0	0	412	0	**412**
Triple Line to Quadruple Line	0	0	16	0	**16**	0	0	16	0	**16**
Total	**76**	**290**	**742**	**277**	**1,386**	**76**	**290**	**990**	**284**	**1639**

Figure 12-3: –Consolidated Network Upgradation Proposals – HUN 2

12.4.5.3. Capacity Enhancement – HUN 2

Capacity analysis has been carried out for each section of HUN 2 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 2 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 12-10: Capacity Utilization Post Implementation of Projects – HUN 2

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	2251	2275	2301	1399	65%	66%	67%	41%
70%-100%	791	1170	1145	2047	23%	34%	33%	59%
100%-150%	127	0	0	0	4%	0%	0%	0%
>150%	276	0	0	0	8%	0%	0%	0%
Total	**3445**	**3445**	**3445**	**3445**	**100%**	**100%**	**100%**	**100%**

12.5. HUN 3 – Kathiawar Shivalik Sampark Corridor

HUN 3 is Kathiawar Shivalik Sampark Corridor. From Chandigarh to Rajkot Via Chandigarh - Panipat - Rohtak - Asthalbohar - Rewari -Jaipur-Palanpur - Vadodara & Ahmedabad - Surendanagar - Rajkot & Samakhiyali - Viramgam. Total corridor length is 1688 Km

12.5.1. Recommended Modifications

Some of the recommendations and modifications are listed below:

Original Length was 3,035 km and Length after modification is 3,507 km

For the purpose of creating continuous corridor Chandigarh Panipat Section is included in HUN 1.

Also, there is no continuous Passenger Corridor from Chandigarh to Rewari.

Remaining section of HUN 3 caters maximum to Delhi Jaipur Ahmedabad Traffic for which Bijwasan Satellite Terminal is being developed.

Therefore, it is prudent to include Delhi, Gurugram Rewari Section in HUN 3.

Further, Surendarnagar to Sabarmati Jn via Viramgam has been proposed as DFC Feeder.

Original Length: 1685 km, Length after Alteration: 1688 km

12.5.2. Existing Capacity Analysis

The entire HUN 3 is built up to handle passenger trains as well as freight trains. Some of the part of the network acts as a feeder to DFCs. Currently most of the HUN 3 is operating over 100% of capacity Utilization. Only 43% below 100%, 24% below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 3 are presented in **ANNEXURE 12.1:.**

Table 12-11: Existing Capacity Utilization of HUN3

Capacity Utilization	Network KM	Share
0%-70%	411	24%
70%-100%	314	19%
100%-150%	546	32%
>150%	418	25%
Total	**1688**	**100%**

12.5.3. HUN 3 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 3 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 3 for each of the cardinal years and is presented in **ANNEXURE 12.2:**.

12.5.4. Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 3 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 91% of the network will operate more than 100% of capacity Utilization.

Table 12-12: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 3

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	737	382	167	96	44%	23%	10%	6%
70%-100%	507	113	216	0	30%	7%	13%	0%
100%-150%	254	646	143	283	15%	38%	8%	17%
>150%	190	547	1162	1309	11%	32%	69%	78%
Total	**1,688**	**1,688**	**1,688**	**1,688**	**100%**	**100%**	**100%**	**100%**

12.5.5. HUN 3 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.5.5.1. Signaling

Entire HUN 3 is recommended to be upgraded for Automatic Signalling with TCAS for operating trains at a speed of 100 Kmph.

12.5.5.2. HUN 3 – Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 3 is presented in **ANNEXURE 12.3:**.

Table 12-13: HUN 3 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single Line to Double Line	113	0	0	0	**113**	113	0	0	0	**113**
Double Line to Triple Line	0	159	292	259	**709**	0	159	292	259	**709**
Double Line to Quadruple Line	0	0	0	6	**6**	0	0	0	13	**13**
Triple Line to Quadruple Line	0	0	94	51	**145**	0	0	94	51	**145**
Total	**113**	**159**	**386**	**316**	**974**	**113**	**159**	**386**	**323**	**981**

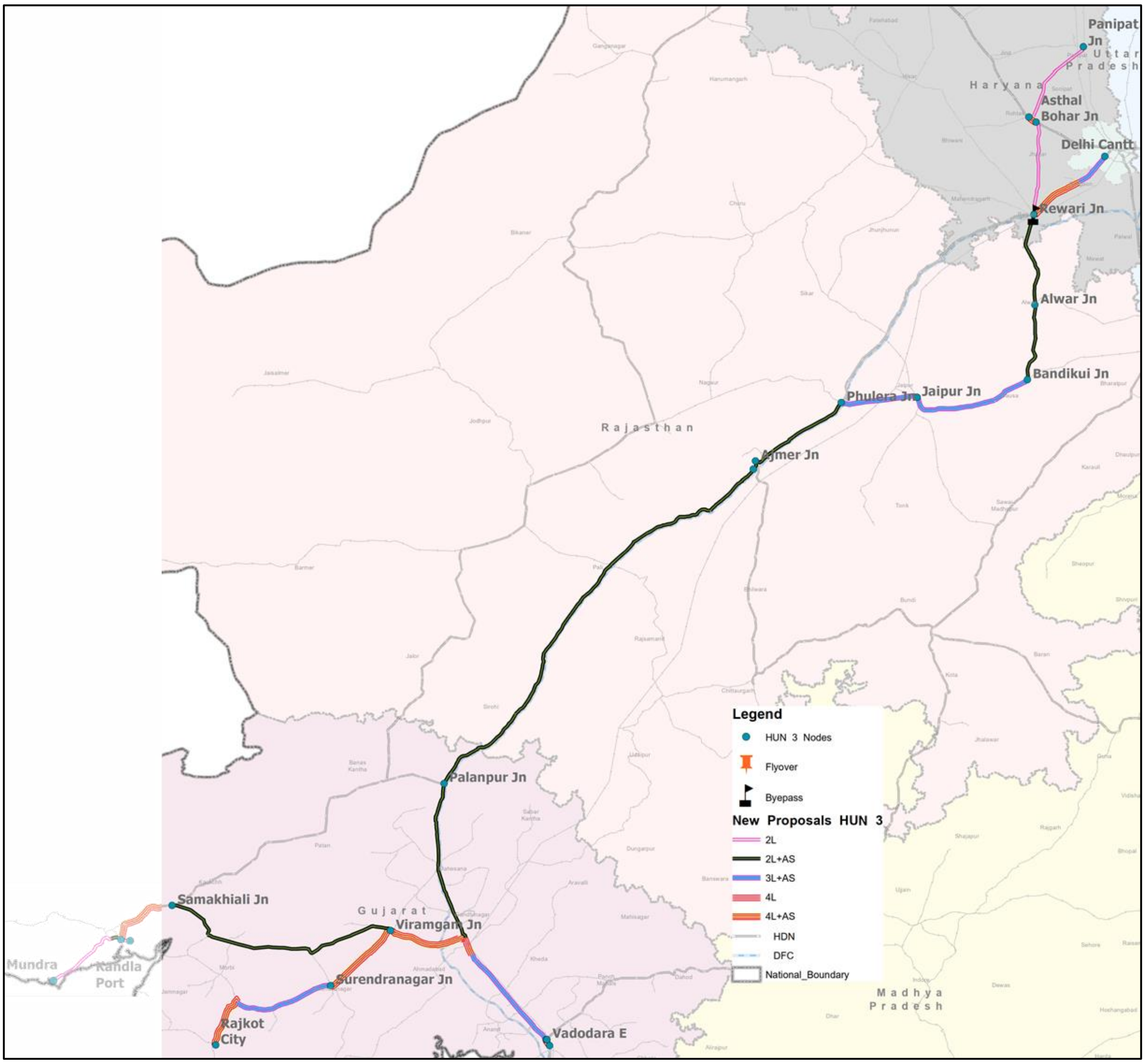


Figure 12-4: –Consolidated Network Upgradation Proposals – HUN 3

12.5.5.3. Capacity Enhancement – HUN 3

Capacity analysis has been carried out for each section of HUN 3 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 3 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 12-14: Capacity Utilization Post Implementation of Projects – HUN 3

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	1062	1306	872	1113	63%	77%	52%	66%
70%-100%	626	324	788	575	37%	19%	47%	34%
100%-150%	0	58	28	0	0%	3%	2%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**1,688**	**1,688**	**1,688**	**1,688**	**100%**	**100%**	**100%**	**100%**

12.6. HUN 4 – Sagar Sutlej Sampark Corridor

HUN 4 is Sagar Sutlej Sampark Corridor running along the India's Western Boundary. The corridor starts from Firozpur to Mundra Port via Firozpur - Bhatinda - Bhatinda - Jakhal - Hissar - Degana - Luni - Samdhari - Bhildi -Kandla / Mundra & Bhatinda - Sirsa - Hisar. Total length of corridor is 1,529 Km.

12.6.1. Recommended Modifications

Some of the recommendations and modifications are listed below:

Section between Gandhidham and Palanpur via Samkhyali provides connectivity to Kandla Port and therefore shall be a connector to WDFC.

Section between Bhildi Jn to Palanpur is recommended to be included as part of HUN 4.

Therefore, Gandhidham - Samkhyali - Bhildi - Palanpur is proposed as WDFC Connector for Mundra and Kandla Port and shall be proposed to be upgraded to additional 2 lines for dedicated freight operations.

Original Length: 1,529 km, Length after Alteration: 1527 km.

12.6.2. Existing Capacity Analysis

The entire HUN 4 is built up to handle passenger trains as well as freight trains. Some of the part of the network acts as a feeder to DFCs. The corridor is not that much congested. 73% of the network is below 100% capacity utilisation and 64% of network below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 4 are presented in **ANNEXURE 12.1:.**

Table 12-15: Existing Capacity Utilization of HUN 4

Capacity Utilization	Network KM	Share
0%-70%	974	64%
70%-100%	143	9%
100%-150%	154	10%
>150%	255	17%
Total	**1527**	**100%**

12.6.3. HUN 4 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 4 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 4 for each of the cardinal years and is presented in **ANNEXURE 12.2:**.

12.6.4. Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 4 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 98% of the network will operate more than 100% of capacity Utilization.

Table 12-16: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 4

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	733	19	92	10	48%	1%	6%	1%
70%-100%	398	607	9	0	26%	40%	1%	0%
100%-150%	395	421	670	22	26%	28%	44%	1%
>150%	0	480	757	1494	0%	31%	50%	98%
Total	**1527**	**1527**	**1527**	**1527**	**100%**	**100%**	**100%**	**100%**

12.6.5. HUN 4 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

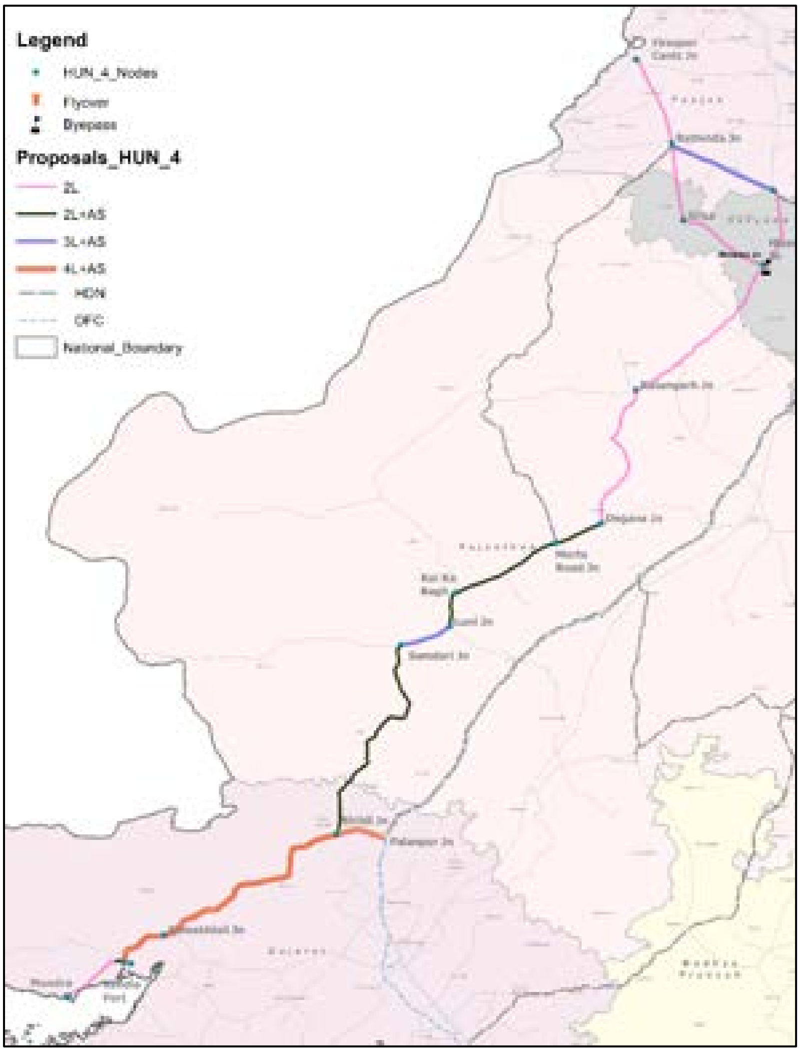


Figure 12-5: –Consolidated Network Upgradation Proposals – HUN 4

12.6.5.1. Signaling

Entire HUN 4 is recommended to be upgraded for Automatic Signalling with TCAS for operating trains at a speed of 100 Kmph.

12.6.5.2. HUN 4 – Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 4 is presented in **ANNEXURE 12.3:**.

Table 12-17: HUN 4 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single Line to Double Line	555	0	100	43	698	555	0	100	43	698
Double Line to Triple Line	0	53	300	0	353	0	53	300	0	353
Triple Line to Quadruple Line	0	0	53	203	255	0	0	53	203	255
Total	**555**	**53**	**453**	**246**	**1306**	**555**	**53**	**453**	**246**	**1306**

12.6.5.3. Capacity Enhancement – HUN 4

Capacity analysis has been carried out for each section of HUN 4 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 4 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 12-18: Capacity Utilization Post Implementation of Projects – HUN 4

Line Capacity Utilization	Network km				% Share			
	2026	**2031**	**2041**	**2051**	**2026**	**2031**	**2041**	**2051**
0%-70%	1285	1169	1195	1012	84%	77%	78%	66%
70%-100%	242	357	332	515	16%	23%	22%	34%
100%-150%	0	0	0	0	0%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**1,527**	**1,527**	**1,527**	**1,527**	**100%**	**100%**	**100%**	**100%**

12.7. HUN 5 – Sagar Sutlej Sampark Corridor

This Corridor connects Jhansi to Muzaffarpur to Katni via Jhansi - Kanpur - Lucknow - Barabanki - Burhwal, Gonda - Anandnagar - Gorakhpur - Valmikinagar - Valmikinagar - Sugauli, Muzafarpur - Bachwara and Narkatiyaganj - Raxual - Sitamarhi - Darbhanga - Samastipur, Sitamarhi - Muzafarpur - Hazipur including Bhatni - Varanasi - Naini (Allahabad) - Manikpur - Satna - Katni & Chhapra - Varanasi. Total length of the corridor is 2,151 Km.

12.7.1. Recommended Modifications

As explained above in previous sections, Katni to Paryagraj section included to HUN 2. Therefore, the Corridor length after modification is 1,786 km.

12.7.2. Existing Capacity Analysis

The entire HUN 5 is built up to handle passenger trains as well as freight trains. The corridor is congested. 30% of the network is below 100% capacity utilisation and 13% of network below 70%. Existing Configuration and Capacity Utilization by sections of HUN 5 are presented in **ANNEXURE 12.1:.**

Table 12-19: Existing Capacity Utilization of HUN 5

Capacity Utilization	Network KM	Share
0%-70%	240	13%
70%-100%	314	17%
100%-150%	815	44%
>150%	479	26%

Total	1786	100%

12.7.3. HUN 5 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 5 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 5 for each of the cardinal years and is presented in **ANNEXURE 12.2:**.

12.7.4. Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 5 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 98% of the network will operate more than 100% of capacity Utilization.

Table 12-20: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 5

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	709	282	150	61	38%	15%	8%	3%
70%-100%	494	491	281	157	27%	27%	15%	8%
100%-150%	209	477	345	384	11%	26%	19%	21%
>150%	435	597	1071	1245	24%	32%	58%	67%
Total	**1,786**	**1,786**	**1,786**	**1,786**	**100%**	**100%**	**100%**	**100%**

12.7.5. HUN 5 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.7.5.1. Signaling

Entire HUN 5 is recommended to be upgraded for Automatic Signalling with TCAS for operating trains at a speed of 100 Kmph.

12.7.5.2. HUN 5 – Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 5 is presented in **ANNEXURE 12.3:**.

Table 12-21: HUN 5 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single Line to Double Line	83	0	0	227	310	83	0	0	227	310
Double Line to Triple Line	53	9	100	37	198	53	9	100	37	198
Double Line to Quadruple Line	17	0	0	0	17	34	0	0	0	34
Triple Line to Quadruple Line	0	124	0	44	168	0	124	0	44	168
Quadruple Line to 6 Lines	0	0	0	18	18	0	0	0	37	37
Total	153	133	100	326	711	170	133	100	344	747

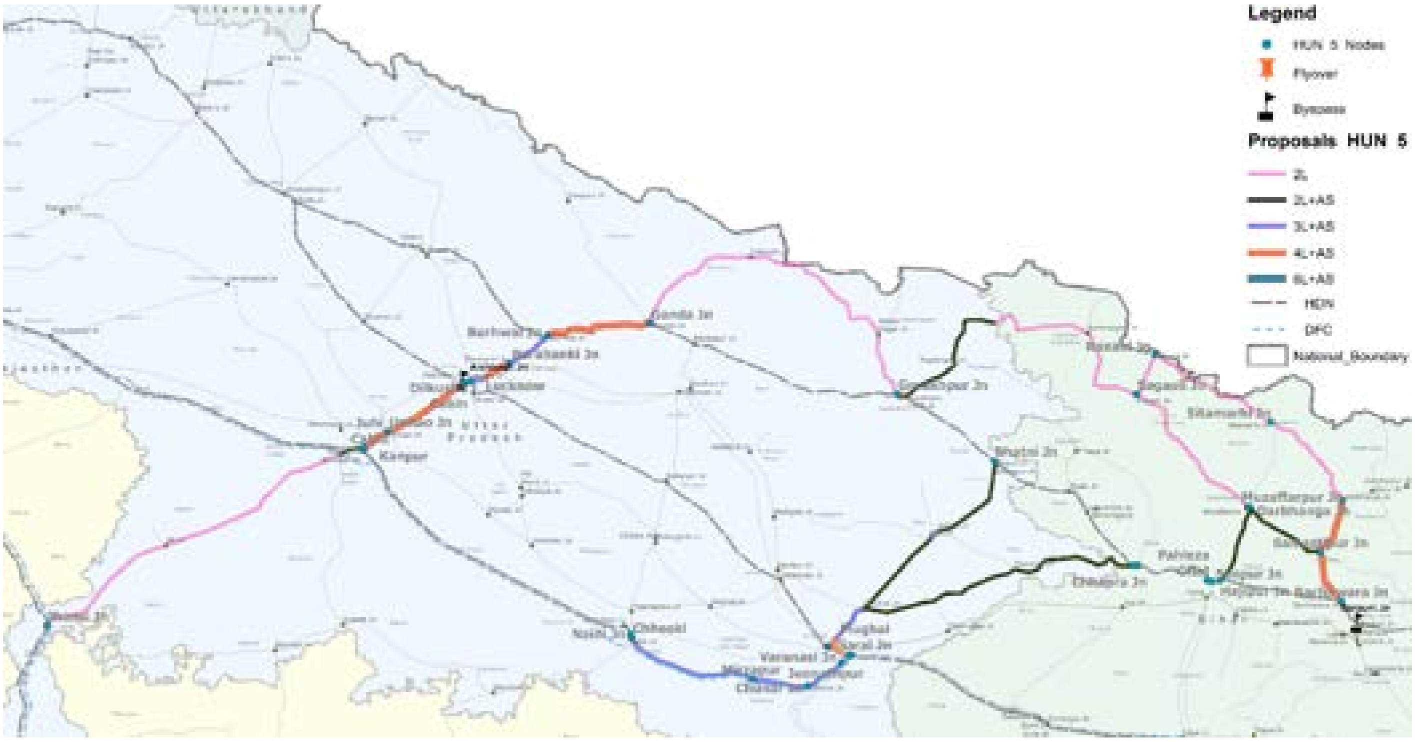


Figure 12-6: –Consolidated Network Upgradation Proposals – HUN

12.7.5.3. Capacity Enhancement – HUN 5

Capacity analysis has been carried out for each section of HUN 5 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 5 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 12-22: Capacity Utilization Post Implementation of Projects – HUN 5

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	1514	1561	1395	1169	82%	84%	76%	63%
70%-100%	333	287	452	678	18%	16%	24%	37%
100%-150%	0	0	0	0	0%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**1,786**	**1,786**	**1,786**	**1,786**	**100%**	**100%**	**100%**	**100%**

12.8. HUN 6 – Sagar Purvodaya Sampark Corridor

HUN 6 runs from Bandel to Dibrugarh via Bandel - Katwa - Azimganj - Barsoi - Aluabari - New Coochbehar - Golakganj - Abhyapuri (Jogigopa) (NL under construction) - Goalpara Town - Guwahati - Lumding - Dibrugarh including Katihar - Kumedpur. Total length is 1,490 Km.

Part of this corridor has an Overlapping Section with HDN 4 (Delhi Guwahati). It is passing through the "Chicken Neck" and making it the only corridor connecting North East States with rest of country, which makes is a highly utilized network and therefore requires capacity augmentation.

12.8.1. Existing Capacity Analysis

The entire HUN 6 is built up to handle passenger trains as well as freight trains. The corridor is congested. 30% of the network is below 100% capacity utilisation and 13% of network below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 6 are presented in **ANNEXURE 12.1:**.

Table 12-23: Existing Capacity Utilization of HUN 6

Capacity Utilization	Network KM	Share
0%-70%	82	5%
70%-100%	270	18%
100%-150%	975	65%
>150%	163	11%
Total	**1,490**	**100%**

12.8.2. HUN 6 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 6 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 6 for each of the cardinal years and is presented in **ANNEXURE 12.2:**.

12.8.3. Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 6 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 98% of the network will operate more than 100% of capacity Utilization.

Table 12-24: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 6

Line Capacity Utilization	Network km				% Share			
	2026	**2031**	**2041**	**2051**	**2026**	**2031**	**2041**	**2051**
0%-70%	350	84	16	16	24%	6%	1%	1%
70%-100%	135	401	180	39	9%	27%	12%	3%
100%-150%	349	297	173	141	23%	20%	12%	9%
>150%	656	708	1121	1294	44%	47%	75%	87%
Total	**1,490**	**1,490**	**1,490**	**1,490**	**100%**	**100%**	**100%**	**100%**

12.8.4. HUN 6 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.8.4.1. Signaling

Entire HUN 6 is recommended to be upgraded for Automatic Signalling with TCAS for operating trains at a speed of 100 Kmph.

12.8.4.2. HUN 6 – Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 6 is presented in **ANNEXURE 12.3:.**

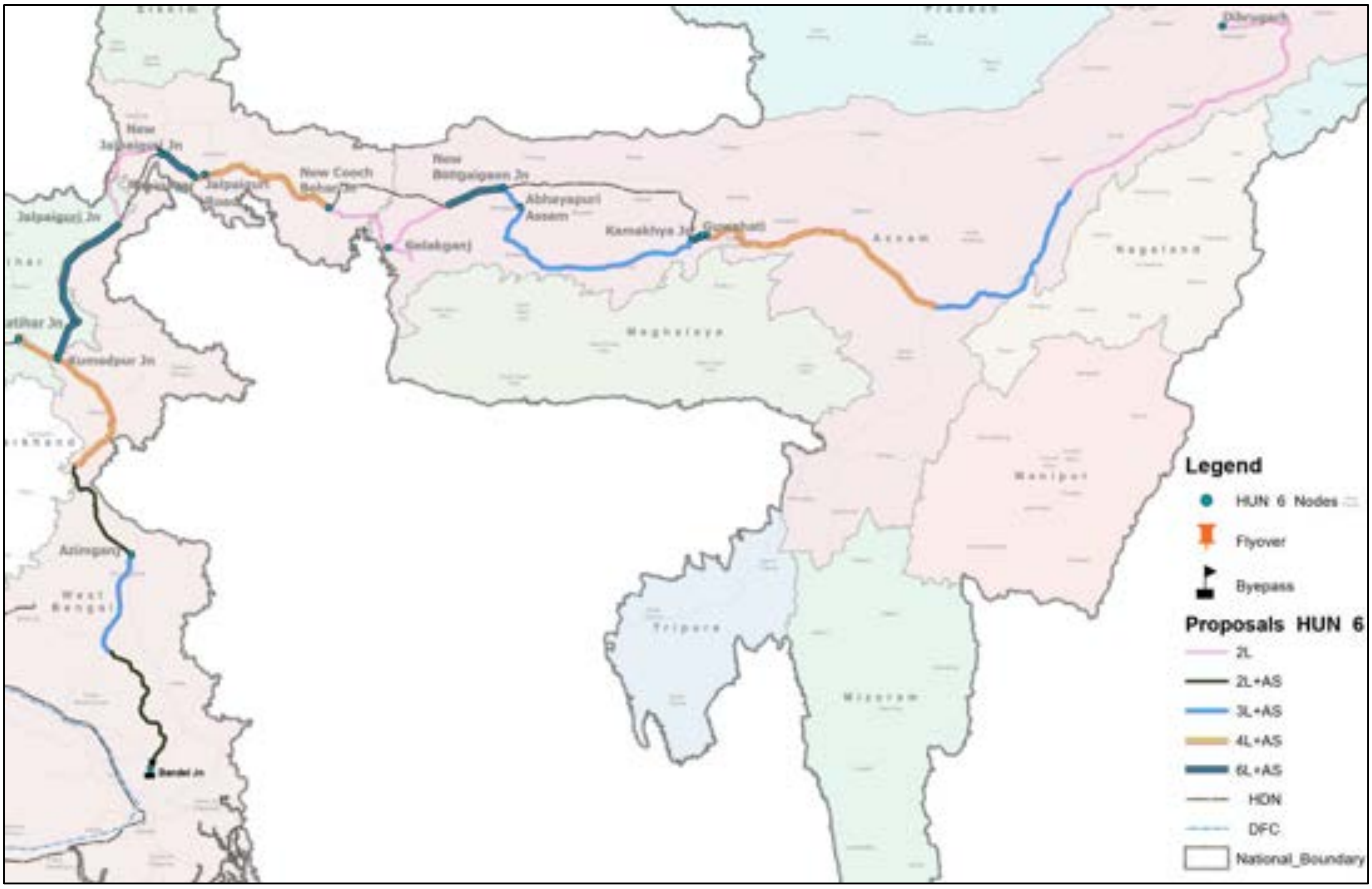


Figure 12-7: –Consolidated Network Upgradation Proposals – HUN 6

Table 12-25: HUN 6 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single Line to Double Line	174	204	177	35	590	174	204	177	35	590
Double Line to Triple Line	0	0	180	0	**180**	0	0	360	0	**360**
Double Line to Quadruple Line	0	223	43	143	**410**	0	223	43	143	**410**
Triple Line to Quadruple Line	0	118	182	0	**300**	0	236	363	0	**600**
Quadruple Line to 6 Lines	0	0	223	0	**223**	0	0	223	0	**223**
Total	**174**	**546**	**805**	**179**	**1704**	**174**	**664**	**1167**	**179**	**2183**

12.8.4.3. Capacity Enhancement – HUN 6

Capacity analysis has been carried out for each section of HUN 6 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 6 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 12-26: Capacity Utilization Post Implementation of Projects – HUN 6

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	809	1338	1213	1159	54%	90%	81%	78%
70%-100%	540	152	277	331	36%	10%	19%	22%
100%-150%	145	0	0	0	10%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**1,490**	**1,490**	**1,490**	**1,490**	**100%**	**100%**	**100%**	**100%**

12.9. HUN 7– Sagar Chambal Sampark Corridor

HUN 7 is Sagar Chambal Sampark Corridor connecting Vizianagram/Paradeep to Kota via Vizianagram - Raipur, Bilaspur - Katni - Kota & Paradeep - Cuttack, Barang - Titlagarh & Sambalpur - Jharsuguda, Kottavalasa - Kinrandul, Singapur Rd. - Koraput, Champa - Gevra Rd. & Anuppur - Boridand - Ambikapur and Boridand - Chirimiri. Total length of this corridor is 2,737 Km.

12.9.1. Recommended Modifications

Some of the recommendations and modifications are listed below:

Vijayanagaram to Vishakhapatnam are important OD pairs but were not included as part of HUN 7 and therefore are recommended to be included. However, Vijayanagaram to Vishakhapatnam section is also a part of HDN 6 (Kharagpur to Vijayawada).

Bina to Katni section has predominant passenger only demand.

Paradeep Port to Barang via Jagatsinghpur is recommended as DFC Connector.

Original Length : 2737 km, Length after modification: 3212 km

12.9.2. Existing Capacity Analysis

The entire HUN 7 is built up to handle passenger trains as well as freight trains. The corridor is congested. 40% of the network is below 100% capacity utilisation and 13% of network below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 7 are presented in **ANNEXURE 12.1:.**

Table 12-27: Existing Capacity Utilization of HUN 7

Capacity Utilization	Network KM	Share
0%-70%	418	13%
70%-100%	876	27%
100%-150%	1727	54%
>150%	192	6%
Total	**3,212**	**100 %**

12.9.3. HUN 7 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 7 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 7 for each of the cardinal years and is presented in **ANNEXURE 12.2:**.

12.9.4. Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 7 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 98% of the network will operate more than 100% of capacity Utilization.

Table 12-28: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 7

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	1903	1248	552	454	59%	39%	17%	14%
70%-100%	637	648	318	409	20%	20%	10%	13%
100%-150%	456	743	459	293	14%	23%	14%	9%
>150%	216	573	1884	2056	7%	18%	59%	64%
Total	3,212	3,212	3,212	3,212	100%	100%	100%	100%

12.9.5. HUN 7 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.9.5.1. Signaling

Entire HUN 7 is recommended to be upgraded for Automatic Signalling with TCAS for operating trains at a speed of 100 Kmph.

12.9.5.2. HUN 7– Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 7 is presented in **ANNEXURE 12.3:.**

Table 12-29: HUN 7 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single Line to Double Line	0	0	385	0	**385**	0	0	385	0	**385**
Double Line to Triple Line	100	0	0	508	**607**	100	0	0	508	**607**
Double Line to Quadruple Line	0	0	45	12	**58**	0	0	91	24	**115**
Triple Line to Quadruple Line	0	136	397	0	**533**	0	136	397	0	**533**
Total	**100**	**136**	**827**	**520**	**1,583**	**100**	**136**	**873**	**532**	**1,640**

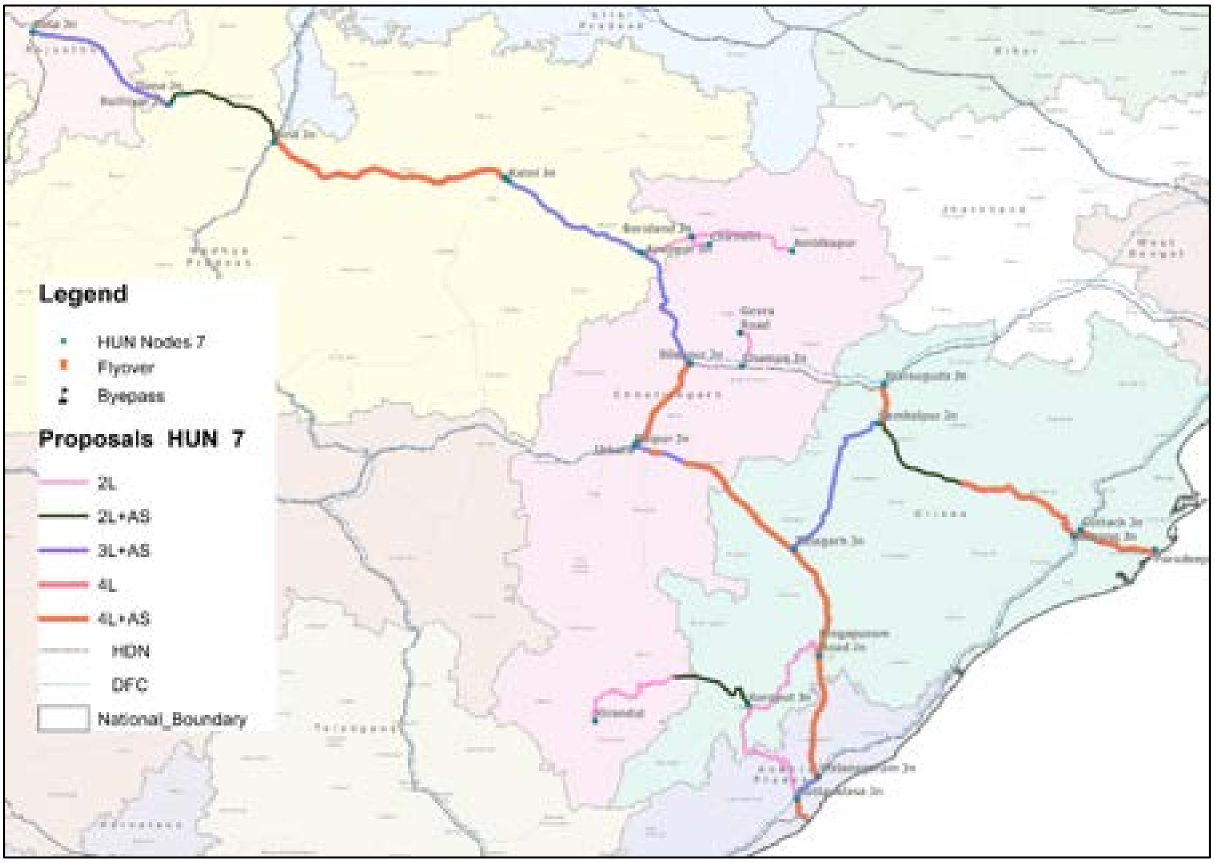


Figure 12-8: –Consolidated Network Upgradation Proposals – HUN 7

12.9.5.3. Capacity Enhancement – HUN 7

Capacity analysis has been carried out for each section of HUN 7considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 7 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 12-30: Capacity Utilization Post Implementation of Projects – HUN 7

Line Capacity Utilization	Network km				% Share			
	2026	**2031**	**2041**	**2051**	**2026**	**2031**	**2041**	**2051**
0%-70%	2679	2986	2289	2522	83%	93%	71%	79%
70%-100%	527	226	923	690	16%	7%	29%	21%
100%-150%	6	0	0	0	0%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**3,212**	**3,212**	**3,212**	**3,212**	**100%**	**100%**	**100%**	**100%**

12.10. HUN 8– Purv Paschim Deccan Sampark Corridor

HUN 8 is Purv Paschim Deccan Sampark Corridor connecting Vasco with Machlipatnam via Vasco - Londa, Dharwad - Vijayawada - Machilipatnam & Guntur - Bibinagar & Kazipet - Wadi. Total length of the corridor is 1501 corridor. Hyderabad to Warangal (Kazipet) Section has been recommended to be developed as Feeder Route to DFC in the year 2041.

12.10.1.Existing Capacity Analysis

The entire HUN 8 is built up to handle passenger trains as well as freight trains. The corridor is not much congested. 81% of the network is below 100% capacity utilisation and 21% of network below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 8 are presented in **ANNEXURE 12.1:.**

Table 12-31: Existing Capacity Utilization of HUN 8

Capacity Utilization	Network KM	Share
0%-70%	327	21%
70%-100%	895	60%
100%-150%	278	19%
>150%	0	0%
Total	**1501**	**100%**

12.10.2.HUN 8 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 8 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 8 for each of the cardinal years and is presented in **ANNEXURE 12.2:**.

12.10.3.Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 8 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 93% of the network will operate more than 100% of capacity Utilization.

Table 12-32: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 8

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	464	85	27	62	30%	5%	1%	4%
70%-100%	575	552	50	44	39%	37%	3%	3%
100%-150%	131	296	240	111	9%	20%	16%	7%
>150%	332	568	1184	1284	22%	38%	79%	86%
Total	**1501**	**1501**	**1501**	**1501**	**100%**	**100%**	**100%**	**100%**

12.10.4.HUN 8 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.10.4.1. Signaling

Entire HUN 8 is recommended to be upgraded for Automatic Signalling with TCAS for operating trains at a speed of 100 Kmph.

12.10.4.2. HUN 8– Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 8 is presented in **ANNEXURE 12.3:.**

Table 12-33: HUN 8 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single Line to Double Line	41	0	239	0	**280**	41	0	239	0	**28**
Double Line to Triple Line	0	0	138	139	**278**	0	0	138	139	**278**
Double Line to Quadruple Line	0	0	138	0	**138**	0	0	276	0	**276**
Triple Line to Quadruple Line	0	0	0	64	**64**	0	0	0	64	**64**
Quadruple Line to 6 Lines	0	0	0	38	**38**	0	0	0	77	**77**
Total	**41**	**0**	**515**	**242**	**798**	**41**	**0**	**653**	**281**	**974**

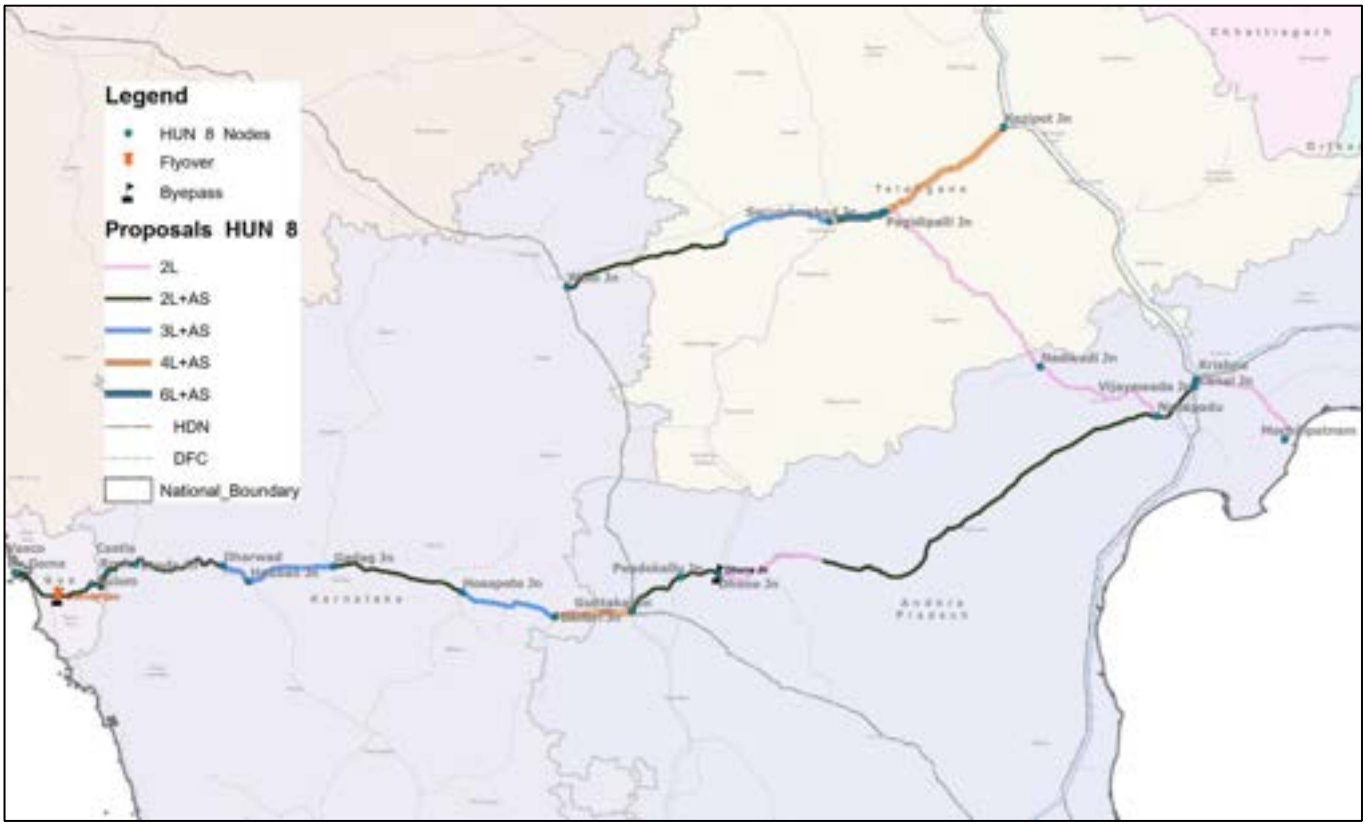


Figure 12-9: –Consolidated Network Upgradation Proposals – HUN 8

12.10.4.3. Capacity Enhancement – HUN 8

Capacity analysis has been carried out for each section of HUN 8 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 8 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Table 12-34: Capacity Utilization Post Implementation of Projects – HUN 8

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	981	487	955	653	65%	32%	64%	44%
70%-100%	415	1009	386	848	28%	67%	26%	56%
100%-150%	5	5	160	0	0%	0%	11%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**1501**	**1501**	**1501**	**1501**	**100%**	**100%**	**100%**	**100%**

12.11. HUN 9– Aravalli Dakshin Sampark Corridor

HUN 9 is Aravalli Dakshin Sampark Corridor. Starting from Ajmer till Dindigul the corridor passes through Ajmer - Ratlam - Akola (under GC) - Nanded - Secundrabad - Dharmavaram - Villupuram - Dindigul & Katpadi - Jolarpettai & Chennai - Villupuram. Total length of the corridor is 2803 Km.

12.11.1.Recommended Modifications

Some of the recommendations and modifications are listed below:

Bangalore to Jolarpetai is part of HUN 10, Jolarpetai to Katpadi is part of HUN 9, Katpadi to Chennai Part of HDN 7, therefore for creating continuous section from Bangalore to Chennai, Jolarpetai to Katpadi is recommended to be excluded from HUN 9 and included in HUN 10.

Similarly, section of Madurai to Chennai via Tambaram, Chengalpattu, Villupuram section Excluded from HUN 9 and added to HUN 10 for creating a continuous corridor from Trivandrum to Chennai.

Original Length: 2803 km, Length after modification: 2240 km

12.11.2.Existing Capacity Analysis

The entire HUN 9 is built up to handle passenger trains as well as freight trains. The corridor is congested. 61% of the network is below 100% capacity utilisation and 49% of network below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 9 are presented in **ANNEXURE 12.1:.**

Table 12-35: Existing Capacity Utilization of HUN 9

Capacity Utilization	Network KM	Share
0%-70%	1099	49%
70%-100%	263	12%
100%-150%	641	29%
>150%	237	11%
Total	**2,240**	**100%**

12.11.3.HUN 9 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 8 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 9 for each of the cardinal years and is presented in **ANNEXURE 12.2:**.

12.11.4.Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 9 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 99% of the network will operate more than 100% of capacity Utilization.

Table 12-36: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 9

Line Capacity Utilization	Network km				% Share			
	2026	**2031**	**2041**	**2051**	**2026**	**2031**	**2041**	**2051**
0%-70%	1070	687	445	29	48%	31%	20%	1%
70%-100%	431	246	97	0	19%	11%	4%	0%
100%-150%	439	546	120	428	20%	24%	5%	19%
>150%	300	762	1578	1783	13%	34%	70%	80%
Total	2240	2240	2240	2240	100%	100%	100%	100%

12.11.5.HUN 9 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.11.5.1. Signaling

Entire HUN 9 is recommended to be upgraded for Automatic Signalling with TCAS for operating trains at a speed of 100 Kmph.

12.11.5.2. HUN 9– Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 9 is presented in **ANNEXURE 12.3:.**

Table 12-37: HUN 9 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single to Double Line	875	207	39	387	1508	875	207	39	387	1508
Double to Triple Line	0	0	2	13	**15**	0	0	2	13	**15**
Double to quadruple Line	0	0	7	0	**7**	0	0	13	0	**13**
Total	**875**	**207**	**48**	**400**	**1530**	**875**	**207**	**55**	**400**	**1536**

12.11.5.3. Capacity Enhancement – HUN 9

Capacity analysis has been carried out for each section of HUN 9 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 9 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

Figure 12-10: –Consolidated Network Upgradation Proposals – HUN 9

Table 12-38: Capacity Utilization Post Implementation of Projects – HUN 9

Line Capacity Utilization	Network km				% Share			
	2026	**2031**	**2041**	**2051**	**2026**	**2031**	**2041**	**2051**
0%-70%	2085	1702	1870	1353	93%	76%	83%	60%
70%-100%	141	538	370	887	6%	24%	17%	40%
100%-150%	14	0	0	0	1%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**2,240**	**2,240**	**2,240**	**2,240**	**100%**	**100%**	**100%**	**100%**

12.12. HUN 10– Satpura Coromandel Sampark Corridor

HUN 10 is Satpura Coromandel Sampark Corridor starting from Manmad to Kanyakumari via Manmad - Daund, Pune - Hubli - Birur - Yashwantpur - Salem & Bypanhalli - Hosur, Hosur - Salem - Dindigul - Madurai - Kanyakumari & Bengaluru - Mysuru. The total length of the corridor is 2,232 Km

12.12.1.Recommended Modifications

Some of the recommendations and modifications are listed below:

Jolarptai to Salem is recommended to be excluded from HUN 10 and included in HUN 11 for creating a continuous corridor from Thrissur to Chennai.

Bangalore to Jolarpetai was a part of HUN 10 & Jolarpetai to Katpadi part of HUN 9 and Katpadi to Chennai is a part of HDN 7 therefore, Jolarpetai to Katpadi recommended to be excluded from HUN 9 and included in HUN 10 for creating a continuous corridor from Bangalore to Chennai via Jolarpetai and Katpadi.

Madurai to Chennai section recommended to be excluded from HUN 9 and added to HUN 10 for creating a continuous corridor from Trivandrum to Chennai.

Original Length: 2,232 km, Length after Alteration: 3,028 km

12.12.2.Existing Capacity Analysis

The entire HUN 10 is built up to handle passenger trains as well as freight trains. The corridor is congested. 89% of the network is below 100% capacity utilisation and 36% of network below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 10 are presented in **ANNEXURE 12.1:.**

Table 12-39: Existing Capacity Utilization of HUN 10

Capacity Utilization	Network KM	Share
0%-70%	1081	36%
70%-100%	1619	53%
100%-150%	13	0%
>150%	315	10%
Total	3,028	100%

12.12.3.HUN 10 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 10 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 10 for each of the cardinal years and is presented in **ANNEXURE 12.2:**.

12.12.4.Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 10 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 99% of the network will operate more than 100% of capacity Utilization.

Table 12-40: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 10

Line Capacity Utilization	Network km				% Share			
	2026	**2031**	**2041**	**2051**	**2026**	**2031**	**2041**	**2051**
0%-70%	1631	1281	174	125	54%	42%	6%	4%
70%-100%	836	757	752	337	28%	25%	25%	11%
100%-150%	470	814	875	707	16%	27%	29%	23%
>150%	91	176	1227	1859	3%	6%	41%	61%
Total	3,028	3,028	3,028	3,028	100%	100%	100%	100%

12.12.5.HUN 10 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.12.5.1. Signaling

Entire HUN 10 is recommended to be upgraded for Automatic Signalling with TCAS for operating trains at a speed of 100 Kmph.

12.12.5.2. HUN 10– Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 10 is presented in **ANNEXURE 12.3:.**

Table 12-41: HUN 10 – Additional Line Requirements (2051)

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single to Double Line	147	0	117	74	**338**	147	0	117	74	**338**
Double to Triple Line	177	0	122	343	**642**	177	0	122	343	**642**
Double to Quadruple Line	3	0	0	0	**3**	5	0	0	0	**5**
Triple to Quadruple Line	0	177	0	0	**177**	0	177	0	0	**177**
Quadruple to 6 Lines	0	0	0	38	**38**	0	0	0	76	**76**
Total	**327**	**177**	**239**	**455**	**1,199**	**330**	**177**	**239**	**493**	**1,239**

12.12.5.3. Capacity Enhancement – HUN 10

Capacity analysis has been carried out for each section of HUN 10 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 10 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

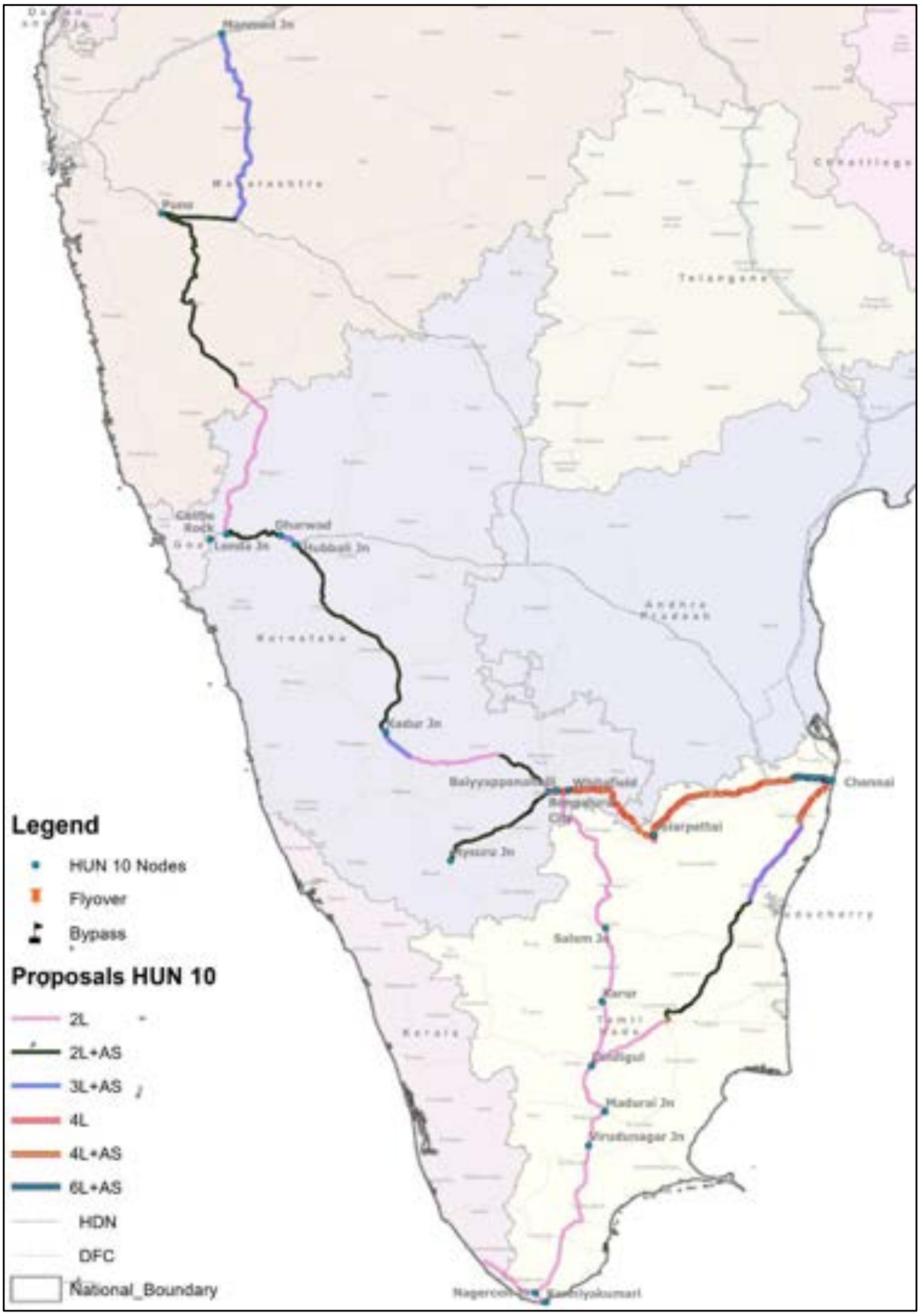


Figure 12-11: –Consolidated Network Upgradation Proposals – HUN 10

Table 12-42: Capacity Utilization Post Implementation of Projects – HUN 10

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	2551	2402	1920	2341	84%	79%	63%	77%
70%-100%	477	626	1108	687	16%	21%	37%	23%
100%-150%	0	0	0	0	0%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**3,028**	**3,028**	**3,028**	**3,028**	**100%**	**100%**	**100%**	**100%**

12.13. HUN 11– Konkan Malabar Sampark Corridor

HUN 11 is Konkan Malabar Samapark Corridor. From Mangalore to Kanyakumari via Mangalore - Shoranur - Kanyakumari (via Kottayam & Alappuzha) & Shoranur - Salem & Erode - Karur. The total length of the corridor is 1,134 Km

12.13.1.Recommended Modifications

Some of the recommendations and modifications are listed below:

HUN 11 Continuous corridor, created from Tiruchchirappalli to Jolarpetai via Coimbatore, Erode & Salem, which will eventually connect Bangalore and Chennai by HUN 10.

Trivandrum to Madurai section Excluded from HUN 11 and added to HUN 10 for creating a continuous corridor from Trivandrum to Chennai.

Kerala Rail Development Corporation Limited (KRDCL) has envisioned Semi HSR Corridor, from Trivandrum to Kasadgod via Kollam, Chengannur, Kottayam, Ernakulam, Thrissur, Malappuram, Kozhikode, Kannur, Kasargod. This has been included in HUN 11

Original Length: 1134 km, Length after Alteration: 1050 km

12.13.2.Existing Capacity Analysis

The entire HUN 11 is built up to handle passenger trains as well as freight trains. The corridor is congested. 89% of the network is below 100% capacity utilisation and 36% of network below 70%.

Existing Configuration and Capacity Utilization by sections of HUN 11 are presented in **ANNEXURE 12.1:.**

Table 12-43: Existing Capacity Utilization of HUN 11

Capacity Utilization	Network KM	Share
0%-70%	145	14%
70%-100%	906	86%
100%-150%	0	0%
>150%	0	0%
Total	**1050**	**100%**

12.13.3.HUN 11 – Train Forecast

Forecast train number for each section (as defined per LC Charts of Indian Railways) of HUN 11 has been estimated for developing the capacity augmentation proposals. Each section has been analysed and proposals have been made. Forecast train number (Passenger + Freight) by section has been estimated for HUN 11 for each of the cardinal years and is presented in **ANNEXURE 12.2:**.

12.13.4.Capacity Analysis after Sanctioned Works (Pink Book)

No doubling works proposed on HUN 11 as per Pink Book 2021. After the implementation of pink book proposals on adjacent network, congestion will keep increasing. By the year 2051, 99% of the network will operate more than 100% of capacity Utilization.

Table 12-44: Capacity Utilization after Implementation of Sanctioned Works (Pink Book) for HUN 11

Line Capacity Utilization	Network km				% Share			
	2026	2031	2041	2051	2026	2031	2041	2051
0%-70%	164	161	30	99	16%	15%	3%	9%
70%-100%	559	28	131	3	53%	3%	12%	0%
100%-150%	328	544	150	98	31%	52%	14%	9%
>150%	0	317	740	850	0%	30%	70%	81%
Total	**1,050**	**1,050**	**1,050**	**1050**	**100%**	**100%**	**100%**	**100%**

12.13.5.HUN 11 Network Upgradation Proposals

Based on demand forecast and as described in the methodology for identifying improvement proposals in **0**, a series of network upgradation projects covering various components such as signalling, line addition have been worked out.

12.13.5.1. Signaling

Entire HUN 11 is recommended to be upgraded for Automatic Signalling with TCAS for operating trains at a speed of 100 Kmph.

12.13.5.2. HUN 11– Additional Line Requirements

The network will be upgraded to triple line for the entire stretch. Consolidated upgradation proposals by cardinal years for entire HUN 11 is presented in **ANNEXURE 12.3:.**

Table 12-45: HUN 11 – Additional Line Requirements (2051)

	Network Km					Line Km				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single to Double Line	11	65	0	0	**76**	11	65	0	0	**76**
Double to Triple Line	0	184	83	346	**613**	0	184	83	346	**613**
Triple to Quadruple Line	0	0	184	185	**369**	0	0	184	185	**369**
Total	**11**	**249**	**267**	**531**	**1059**	**11**	**249**	**267**	**531**	**1059**

12.13.5.3. Capacity Enhancement – HUN 11

Capacity analysis has been carried out for each section of HUN 11 considering the proposals for estimating capacity utilisation till 2051.

It has been concluded that the above-mentioned proposals will reduce the line capacity utilization of HUN 11 below 100% till 2051 and substantial network shall operate below 70% capacity utilisation.

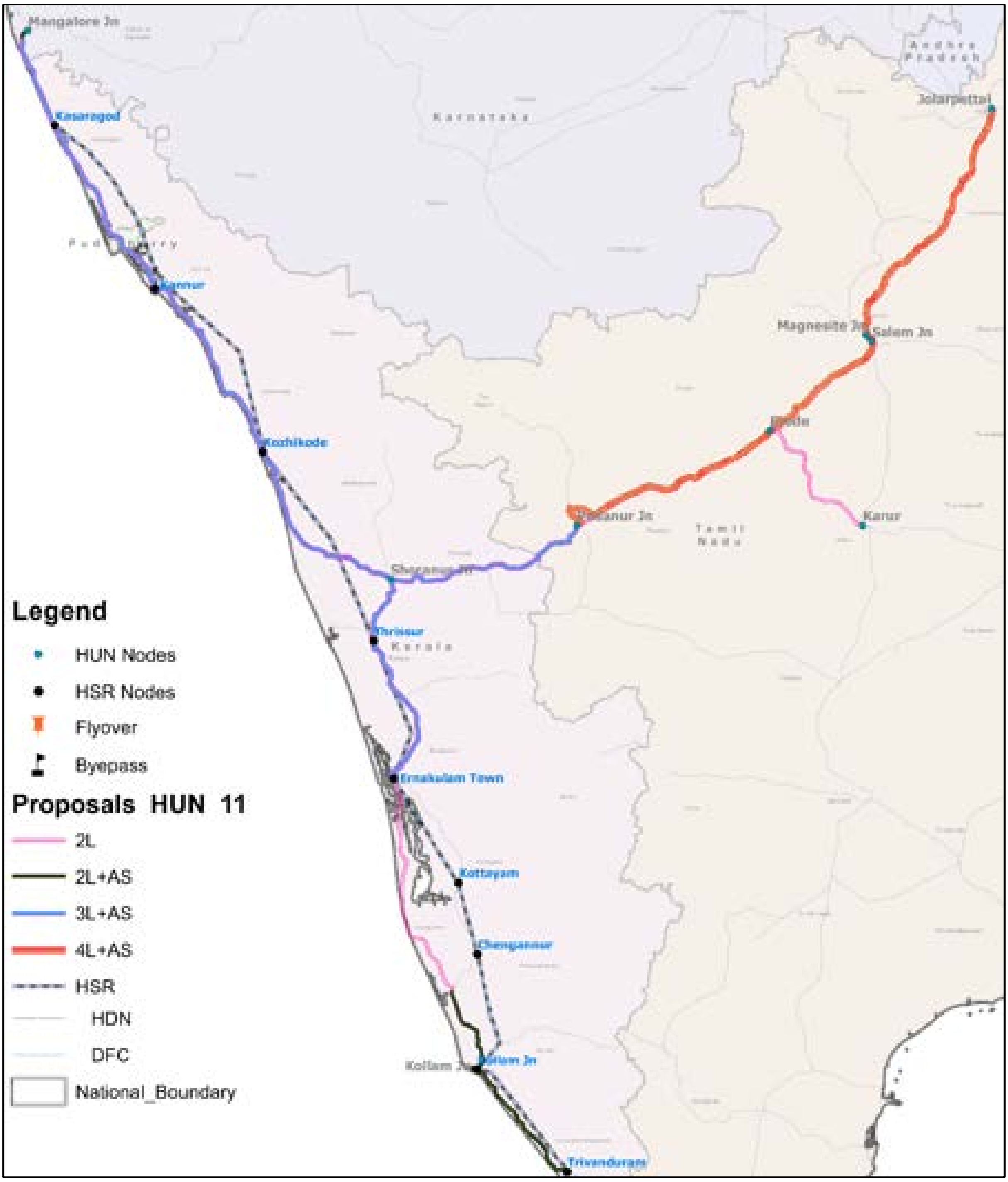


Figure 12-12: –Consolidated Network Upgradation Proposals – HUN 11

Table 12-46: Capacity Utilization Post Implementation of Projects – HUN 10

Line Capacity Utilization	Network km				% Share			
	2026	**2031**	**2041**	**2051**	**2026**	**2031**	**2041**	**2051**
0%-70%	329	661	852	982	31%	63%	81%	93%
70%-100%	721	390	198	69	69%	37%	19%	7%
100%-150%	0	0	0	0	0%	0%	0%	0%
>150%	0	0	0	0	0%	0%	0%	0%
Total	**1050**	**1050**	**1050**	**1050**	**100%**	**100%**	**100%**	**100%**

12.14. Consolidated HUN Infrastructure Upgradation Proposals

Detail infrastructure recommendations for each of the HUN has been explained in sections above. In this section, the recommendations have been classified by their respective nature and type. These are presented in detail in tables below.

12.14.1. Consolidated HUN - Additional Line Requirements

Of the total HUN, 13,710 Km of network shall be upgraded by provision of additional line that translates to 15,391 of HUN Line Km.

Table 12-47: Consolidated Additional Line Requirement for HUN

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single to Double Line	1,966	596	963	829	**4,354**	1,966	596	963	829	**4,354**
Single to Triple Line	0	0	180	6	**186**	0	0	360	12	**372**
Single to Quadruple Line	0	0	21	0	**21**	0	0	62	0	**62**
Double to Triple Line	428	913	1,783	2,188	**5,312**	428	913	1,783	2,188	**5,312**
Double to Quadruple Line	66	221	619	413	**1,318**	132	442	1,237	826	**2,637**
Triple to Quadruple Line	43	451	1,160	730	**2,384**	43	451	1,160	730	**2,384**
Quadruple to 6 Lines	0	0	0	135	**135**	0	0	0	270	**270**
Total	**2,502**	**2,181**	**4,725**	**4,302**	**13,710**	**2,568**	**2,402**	**5,565**	**4,856**	**15,391**

12.14.2. Consolidated HUN - Signaling Requirements

HUN Sections overlapping with HDN have been recommended for ABS+TCAS+CTC Signalling. Remaining HUN Network has been recommended with Automatic Signalling with TCAS. Network length and recommended phasing for implementation of ABS+TCAS+CTC and Automatic Signalling is described in tables below:

Table 12-48: Implementation Phasing of ABS+TCAS+CTC Signaling by Network Length (Overlapping Section)

	2026	2031	2041	2051
Single Line	0	0	0	0
Double Line	94	0	0	0
Triple Line	211	0	7	0
Quadruple Line	215	0	0	4
6 Line	1	0	0	39
Total Network Km	**521**	**0**	**7**	**44**
Total Line Km	**1687**	**0**	**21**	**255**

Table 12-49: Implementation Phasing of Automatic Signaling by Network Length

	2026	2031	2041	2051
Single Line	0	0	0	0
Double Line	3949	1549	3028	3357
Triple Line	898	1196	2223	2237
Quadruple Line	142	688	1819	1221
6 Lines	0	0	0	96
Total Network Km	**4989**	**3433**	**7070**	**6911**
Total Line Km	**11160**	**9438**	**20002**	**18884**

Table 12-50: Consolidated HUN Proposals (Line Km)

HUN Proposals	Single Line	Double Line	Triple Line	Quadruple Line	Sextuple Line	Octuple Line	Total	ABS+TCAS +CTC	TCAS	Bypasses	Flyovers
2026											
HUN 1	359	3,067	156	89	0	0	**3,671**	0	1,109	3	1
HUN 2	196	3,045	237	29	0	0	**3,507**	42	1,314	1	
HUN 3	145	1,525	5	14	0	0	**1,688**	9	276	2	
HUN 4	623	903	0	0	0	0	**1,527**	0	134		
HUN 5	477	1,058	278	35	0	0	**1,847**	147	184		
HUN 6	596	1,085	0	11	0	0	**1,693**	0	785		
HUN 7	385	1,500	1,080	247	0	0	**3,212**	172	457		
HUN 8	239	1,208	4	0	0	0	**1,451**	4	19		1
HUN 9	798	1,439	3	0	0	0	**2,240**	2	7	1	
HUN 10	191	2,542	180	114	1	0	**3,028**	145	441		
HUN 11	65	835	150	0	0	0	**1,050**	0	269		
Total	**3,714**	**17,924**	**2,087**	**538**	**1**	**0**	**24,266**	**521**	**4,989**	**7**	**2**
2031											
HUN 1	345	2,876	240	210	0	0	**3,671**	0	1,497		
HUN 2	90	2,967	421	29	0	0	**3,507**	42	1,702		
HUN 3	145	1,366	163	14	0	0	**1,688**	9	424		
HUN 4	623	851	53	0	0	0	**1,527**	0	337		
HUN 5	477	1,049	162	159	0	0	**1,847**	147	211		
HUN 6	392	948	223	130	0	0	**1,693**	0	785		
HUN 7	385	1,500	945	382	0	0	**3,212**	172	584		
HUN 8	239	1,208	4	0	0	0	**1,451**	4	173		
HUN 9	592	1,646	3	0	0	0	**2,240**	2	60		
HUN 10	191	2,542	2	291	1	0	**3,028**	145	441		
HUN 11	0	717	334	0	0	0	**1,050**	0	637		
Total	**3,118**	**17,386**	**2,550**	**1,210**	**1**	**0**	**24,266**	**521**	**6,845**	**0**	**0**
2041											
HUN 1	140	2,743	345	444	0	0	**3,671**	0	2,140		
HUN 2	69	2,262	904	272	0	0	**3,507**	42	1,998		
HUN 3	145	1,075	360	108	0	0	**1,688**	9	1,053		
HUN 4	523	651	300	53	0	0	**1,527**	0	434		

Table 12-50: Consolidated HUN Proposals (Line Km)

HUN Proposals	Single Line	Double Line	Triple Line	Quadruple Line	Sextuple Line	Octuple Line	Total	ABS+TCAS +CTC	TCAS	Bypasses	Flyovers
HUN 5	477	949	262	159	0	0	**1,847**	147	359		
HUN 6	35	900	223	535	0	0	**1,693**	0	1,204		
HUN 7	0	1,840	548	825	0	0	**3,212**	172	1,347		
HUN 8	0	1,171	142	138	0	0	**1,451**	4	689		
HUN 9	553	1,676	5	7	0	0	**2,240**	2	180		
HUN 10	74	2,536	125	291	1	0	**3,028**	145	1,029		
HUN 11	0	633	233	184	0	0	**1,050**	0	806		
Total	**1,955**	**15,948**	**3,353**	**3,009**	**1**	**0**	**24,266**	**521**	**11,214**	**0**	**0**
2051											
HUN 1	20	2,335	295	981	40	0	**3,671**	0	2,642		
HUN 2	59	1,998	1,178	272	0	0	**3,507**	42	2,272		
HUN 3	145	809	569	165	0	0	**1,688**	9	1,521		
HUN 4	480	694	97	255	0	0	**1,527**	0	893		
HUN 5	250	1,139	255	184	18	0	**1,847**	147	636		
HUN 6	0	791	367	535	0	0	**1,693**	0	1,486		
HUN 7	0	1,320	1,055	837	0	0	**3,212**	172	2,045		
HUN 8	0	1,031	217	164	38	0	**1,451**	4	987		
HUN 9	166	2,050	18	7	0	0	**2,240**	2	488		
HUN 10	0	2,268	467	253	39	0	**3,028**	145	1,479		
HUN 11	0	287	394	369	0	0	**1,050**	0	811		
Total	**1,119**	**14,176**	**4,816**	**4,017**	**136**	**0**	**24,266**	**521**	**15,235**	**0**	**0**

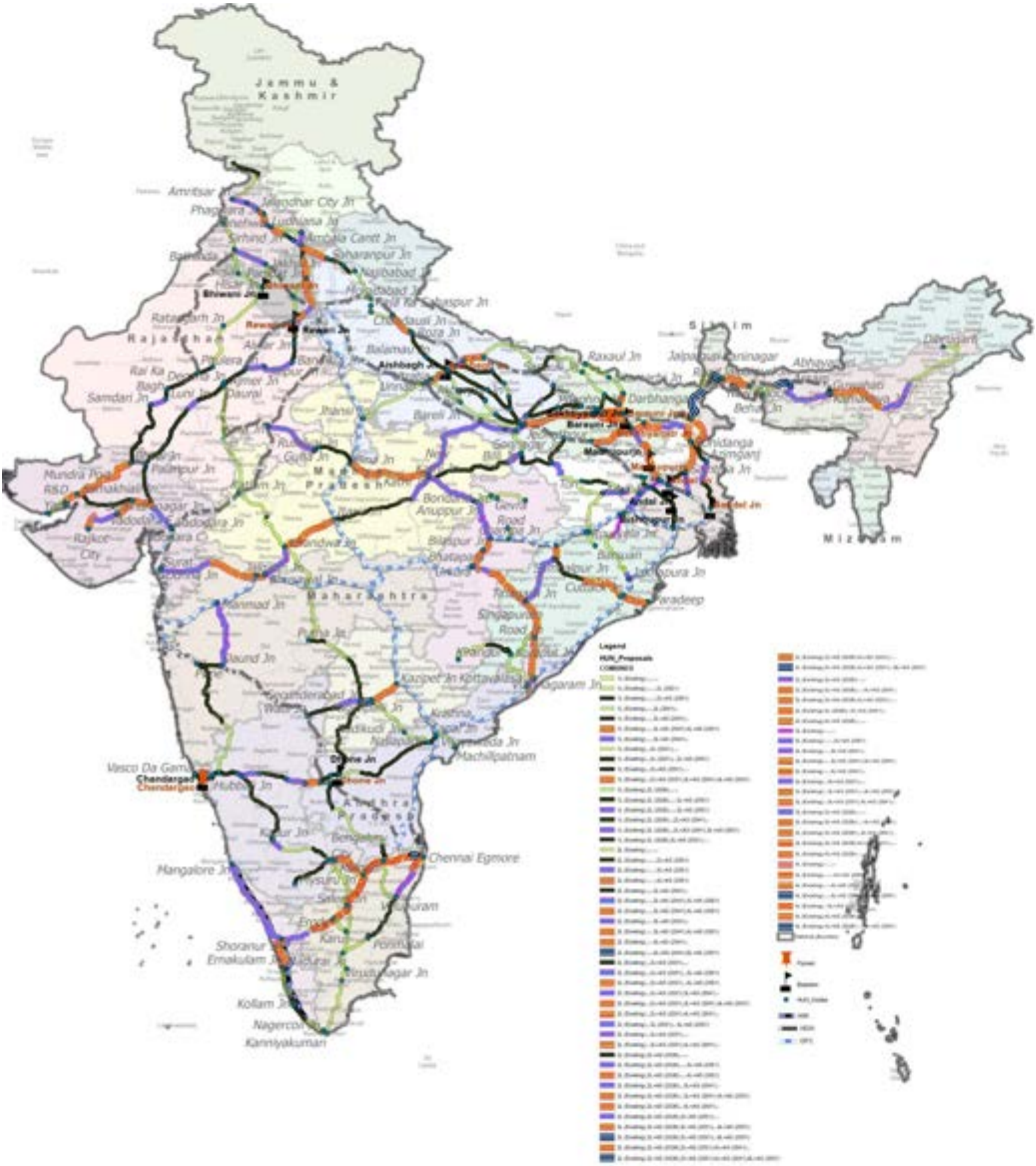


Figure 12-13: –Consolidated HUN Network Upgradation Proposals

Chapter 13 PORT CONNECTIVITY

13.1. Ports in India

India has a coastline spanning 7516.6 Km, forming one of the biggest peninsulas in the world. It is serviced by 12 major ports (11 Government-owned and one private) and 205 notified minor and intermediate ports. Majority of the ports are present in Maharashtra, Gujarat, Tamil Nadu, and Karnataka. The major ports in India are given in table below:

Table 13-1: Major Ports in India

Sr. No.	Name of Major Port	State	Type
1	Deendayal (Kandla) Port Trust	Gujarat	Government
2	Paradip Port Trust	Odisha	Government
3	Jawaharlal Nehru Port Trust	Maharashtra	Government
4	Mumbai Port Trust	Maharashtra	Government
5	Visakhapatnam Port Trust	Andhra Pradesh	Government
6	Chennai Port Trust	Tamil Nadu	Government
7	Kolkata Port Trust	West Bengal	Government
8	New Mangaluru Port Trust	Karnataka	Government
9	V. O. Chidambaram (Tuticorin) Port Trust	Tamil Nadu	Government
10	Kamarajar Port Limited	Tamil Nadu	Private
11	Kochi Port Trust	Kerala	Government
12	Mormugao Port Trust	Goa	Government

Indian government has a quasi-federal structure, and according to its constitution, maritime transport is to be administered by both the Central and the State governments. While the central government's shipping ministry administers the major ports, the minor and intermediate ports are administered by the relevant departments or ministries in the nine coastal states Andhra Pradesh, Odisha, West Bengal, Tamil Nadu, Kerala, Karnataka, Goa, Maharashtra and Gujarat. Several of these 205 minor and intermediate ports have been identified by the respective governments to be

Figure 13-1: –Major Ports in India

developed, in a phased manner, a good proportion of them involving public–private partnership.

13.2. Cargo Handled at Major Ports

The Indian ports and shipping industry plays a vital role in sustaining growth in the country's trade and commerce. India is the sixteenth largest maritime country in the world. According to the Ministry of Shipping, around 95 per cent of India's trading by volume and 70 per cent by value is done through maritime transport.

The monthly capacity of the Major Ports is given in table below.

Table 13-2: Monthly Cargo Handling Capacity of Major Ports (Million Tonnes)

Sr. No.	Port	As on 31st March 2012	as on 31st March 2013	As on 31st March 2014	As on 31st March 2015	As on 31st March 2016
1	Kolkata (KDS)	17.14	17.14	17.14	21.10	21.10
2	Haldia (HDC)	50.75	46.75	49.75	49.75	65.89
3	Paradip	80.30	102.30	108.80	119.80	126.94
4	Visakhapatnam	66.33	67.33	88.92	96.76	107.75
5	Ennore	31.00	31.00	31.00	37.00	45.00
6	Chennai	83.19	85.59	86.04	86.04	93.44
7	Tuticorin	33.34	33.34	42.06	44.55	59.26
8	Cochin	41.86	44.66	49.66	49.66	49.66
9	New Mangalore	50.97	76.77	77.77	77.77	77.77
10	Mormugao	41.90	36.40	36.65	43.76	48.79
11	Mumbai	44.53	44.53	44.53	44.53	49.33
12	Jawaharlal Nehru	64.00	65.88	65.88	79.37	89.37
13	Kandla	91.22	93.22	102.32	121.43	131.06
	TOTAL	**696.53**	**744.91**	**800.52**	**871.52**	**965.36**

During FY 18, cargo traffic at major ports in the country was reported at 679.36 million tonnes (MT). In FY19 traffic has increased 2.90 per cent year-on-year to 699.05 million tonnes. Cargo traffic at non-major ports was estimated at 491.95 million tonnes in FY18 and grew at 9.2 per cent CAGR between FY 07-18.

As per IBEF, the major ports had a capacity of 1,452 million tonnes by FY18 end. The Maritime Agenda 2010-20 has a 2020 target of 3,130 MT of port capacity.

The summary of cargo traffic handled at each of the major ports in the FY 2017-18 is given in table below.

Table 13-3: Cargo Handled by Major Ports (Million Tonnes)

Sr. No.	Name	Cargo Handled (FY 2017-18)		Container Traffic (FY 2017-18)	
		in million tonnes	% Increase (over previous FY)	in '000 TEUs	% Increase (over previous FY)
1	Deendayal (Kandla) Port Trust	110.1	4.42% ↑	117	95.73% ↑
2	Paradip Port Trust	102.01	14.68% ↑	7	71.43% ↑
3	Jawaharlal Nehru Port Trust	66	6.20% ↑	4,833	6.89% ↑
4	Mumbai Port Trust	62.83	-0.35% ↓	42	-2.38% ↓
5	Visakhapatnam Port Trust	63.54	4.12% ↑	389	5.66% ↑
6	Chennai Port Trust	51.88	3.32% ↑	1,549	3.49% ↑
7	Kolkata Port Trust	57.89	13.61% ↑	796	3.02% ↑
8	New Mangaluru Port Trust	42.06	5.28% ↑	115	17.39% ↑
9	V. O. Chidambaram Port Trust	36.58	-4.91% ↓	698	8.02% ↑
10	Kamarajar Port Limited	30.45	1.42% ↑	3	100.00% ↑
11	Kochi Port Trust	29.14	16.52% ↑	556	11.69% ↑
12	Mormugao Port Trust	26.9	-18.94% ↓	32	6.25% ↑
	All Ports	**679.37**	**4.77%** ↑	**9,138**	**7.62%** ↑

13.3. Issues identified under Sagarmala study

The Sagarmala initiative was conceived by the Government of India to address the challenges and capture the opportunity of port-led development comprehensively and holistically.

The study found that logistics costs account for a large part of total cost of Indian goods compared to developed nations. This can be attributed to lack of seamless connectivity across modes and complexity in procedures, resulting in high variability in transit times. This further impacts delivery schedules and results in requirement of higher working capital. Moreover, the master planning of industrial clusters and zones (with high EXIM traffic) does not adequately consider proximity to ports. The port land itself is inadequately utilized for setting up industries and manufacturing. Existing policies are focused on maximizing rental yields, rather than maximization of overall economic value-add and job creation. Also, Indian ports are small, inefficient and lack adequate draft to accept larger vessels, due to which India is unable to maximize on its geographical location to draw significant international traffic.

13.3.1. Issues related to port connectivity

Adequate linkages to and from ports are vital to reducing logistics costs and maintaining competitive EXIM and domestic industrial growth. Main issues affecting port connectivity in India are:

- Under-utilization of domestic waterways
- Severely constrained rail infrastructure along key routes
- Sub-optimal modal mix for container freight

Poor connectivity to west coast ports through Western Ghats
Lack of coordinated end-to-end planning for bulk logistics
Constrained last mile connectivity between ports and key hinterlands

The study identified four broad areas of improvement under which projects could be implemented:

Port Modernization – Improving port capacity and efficiency and creation of new ports to cater to future demand
Port connectivity- Improving rail, road and pipeline linkages to ports, reducing freight transport costs, development of ICDs and easing customs procedures to reduce transit times
Port led industrialization- Development of 14 Coastal Economic Zones (comprising of energy, bulk material and discrete manufacturing industrial clusters), benefiting from port proximity
Coastal Community Development- Creation of Community Development Fund for skill development as well as sustainable improvement of marine fisheries and related products

13.4. Port Traffic Forecast

Port Traffic is expected to grow by 4.5 times by 2051 from 1.71 Million Tonnes to 8.03 Million Tonnes per day.

Table 13-4: Port Traffic Forecast (,000 Tonnes)

	2026			2031			2041			2051		
Ports	Import	Export	Total	Import	Export	Total	Import	Export	Total	Import	Export	Total
Kandla	12,489	531	13,019	20,643	1,249	21,892	22,940	2,706	25,645	41,783	4,653	46,436
Haldia	732	2,585	3,317	1,215	3,807	5,021	1,341	6,085	7,426	2,589	8,601	11,191
Paradip	66,095	24,835	90,929	88,509	34,350	122,858	51,549	57,184	108,733	138,682	71,208	209,891
Visakhapatnam	61,967	5,924	67,890	88,117	8,659	96,776	53,180	13,766	66,946	142,930	18,963	161,893
Chennai/Ennore	11	94	105	20	169	189	46	280	325	113	405	518
Tuticorin	361	923	1,284	810	1,347	2,158	1,200	2,251	3,451	1,783	3,436	5,219
Kochi	628	820	1,448	912	1,951	2,862	1,237	5,038	6,276	1,630	9,785	11,415
Mangalore	6,628	0	6,628	12,863	0	12,863	21,537	0	21,537	42,077	0	42,077
Marmagoa	2	0	2	9	0	9	17	0	17	24	0	24
JNPT	15,041	2,806	17,847	26,230	5,217	31,447	46,056	10,047	56,103	68,247	15,976	84,223
Mumbai	5,405	14,287	19,692	7,652	25,358	33,010	12,785	43,119	55,903	19,298	62,833	82,131
Pipavav	6,267	370	6,637	9,847	334	10,181	16,714	578	17,293	26,019	885	26,904
Mundra	34,227	297	34,524	53,292	743	54,035	71,185	1,563	72,749	119,378	2,610	121,988
Total	**209,853**	**53,471**	**263,324**	**310,118**	**83,184**	**393,302**	**299,785**	**142,617**	**442,402**	**604,552**	**199,357**	**803,909**

13.5. Port Connectivity Proposals

A total of 2,722 network Km has been selected for Port Connectivity. This includes part of HUNs and HDNs also. For port Connectivity, the undermentioned sections are selected as per nearest port to Nearest HDN or DFC.

Table 13-5: Infrastructure Upgradation Proposals for Port Connectors

Section	Port Name	Configuration after completion of Works as per Pink Book	Proposed Configuration			
			2026	2031	2041	2051
Attipattu - Gummidipundi	Chennai/ Ennore Port	2L	2L+ ABTS	-	-	-
Chennai Beach - Chennai Egmore		4L	-	4L+TC	-	-
Chennai Beach - Royapuram		4L	4L+ TC	-	-	-
Chennai Egmore - Tambaram		4L	4L+ TC	-	-	-
Ennore - Attipattu		4L	4L+ ABTS	-	-	-
Gummidipundi - Sullurupeta		2L	2L+ ABTS	-	-	-
Korukkupet Jn. - Tiruvottiyur		3L	3L+ ABTS	-	-	-
Royapuram - Washermanpet.		4L	-	-	4L+TC	-
Sullurupeta - Gudur		2L	2L+ ABTS	-	-	-
Tiruvottiyur - Ennore		4L	4L+ ABTS	-	-	-
Gandhidham - Adipur	Kandla Port	2L	-	-	-	2L+TC
Jhund - Maliya Miyana		2L	-	-	2L+TC	3L+TC
Maliya Miyana - Samakhiyali		2L	-	-	2L+TC	-
Samakhiyali - Gandhidham		2L	2L+TC	3L+TC	4L+TC	-
Shoranur Jn. - Kozhikode	Kozhikode Port	2L	-	2L+TC	-	3L+TC
ANDUL - ULUBERIA	Kolkata/Haldia Port	3L	3L+ ABTS	-	-	-
MECHEDA - PANSKURA		3L	3L+ ABTS	-	-	-
PANSKURA - HALDIA		2L	-	-	-	2L+TC
PANSKURA - KHARAGPUR		3L	3L+ ABTS	-	-	-
SANTRAGACHI - ANDUL		3L	3L+ ABTS	-	-	-
ULUBERIA - MECHEDA		3L	3L+ ABTS	-	-	-
Kulem - Vasco - Da - Gama	Madgaon Port	2L	-	-	2L+TC	-
ROHA - Madgaon	Mangalore Port	1L	2L	-	3L+TC	-
Kannur - Netravati		2L	-	-	2L+TC	3L+TC
Kozhikode - Kannur		2L	-	2L+TC	-	3L+TC
Mangaluru Jn. - Thokur		1L	2L	-	-	2L+TC
Netravati - Mangaluru Jn.		2L	-	-	-	2L+TC

Section	Port Name	Configuration after completion of Works as per Pink Book	Proposed Configuration			
			2026	2031	2041	2051
Chhatrapati Shivaji Terminus, MUMBAI - Dadar	Mumbai port	4L	4L+ ABTS	-	-	-
Dadar - Kurka		4L	4L+ ABTS	6L+ ABTS	8L+ ABTS	-
Dadar - Mahim Jn		6L	6L+ ABTS	-	-	8L+ ABTS
Bhildi - Samakhiyali		1L	2L	2L+TC	3L+T C	4L+TC
Budhapank - Rajathgarh	Paradeep	4L	-	-	-	4L+TC
Cuttack - Barang		3L	3L+ ABTS	-	-	-
Cuttack - Paradeep		2L	-	-	-	3L+TC
Haridaspur- Paradeep		1L	2L+TC	-	-	4L+TC
Nergundi - Cuttack		3L	3L+ ABTS	-	-	-
Talcher - Budhapank		1L	4L+TC	-	-	-
Gopalpatnam - Duvvada	Vishakhapttanam	3L	3L+ ABTS	-	-	-
Gopalpatnam - Visakhapatnam		3L	3L+TC	4L+TC	-	-
Kottavalasa - Simhachalam North		4L	4L+ ABTS	-	-	-
Simhachalam North - Duvvada (By - Pass)		2L	2L+TC	-	-	-
Simhachalam North - Jaggayyapalem		3L	-	-	-	-

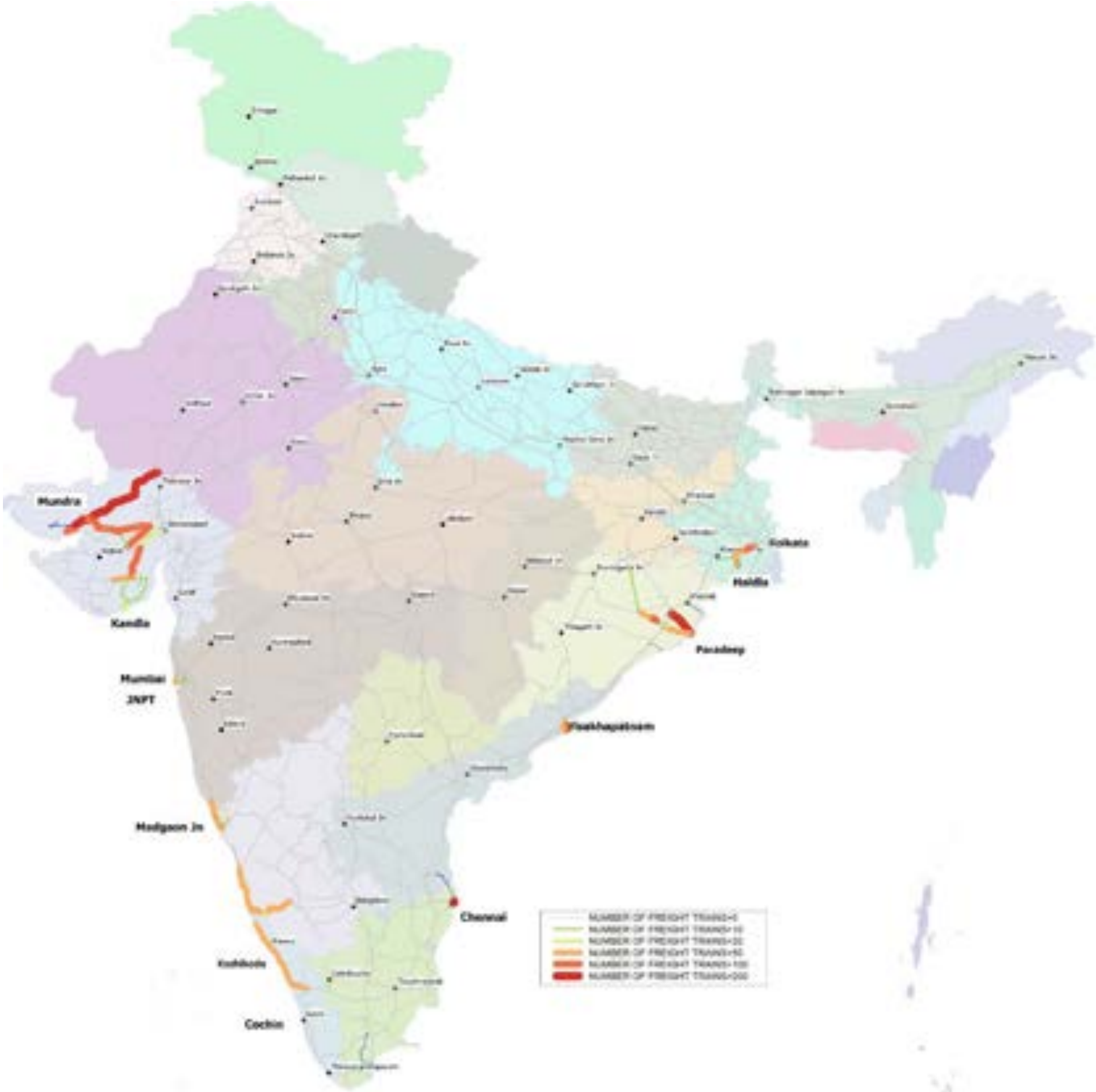


Figure 13-2: –Quantum of Train Forecast on Proposed Port Connectors

Proposals on the Port Connectivity includes in 1,720 network km and it increases 2092 Line Km.

Table 13-6: Port Connectivity Doubling Proposals

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single to Double Line	218	137	81	215	**650**	218	137	81	215	**650**
Single to Quadruple Line	141	0	0	0	**141**	424	0	0	0	**424**
Double to Triple Line	0	53	160	475	**687**	0	53	160	475	**687**
Double to Quadruple Line	0	0	0	76	**76**	0	0	0	151	**151**
Triple to Quadruple Line	0	6	53	92	**151**	0	6	53	92	**151**
Quadruple to 6 Lines	0	6	0	0	**6**	0	12	0	0	**12**
6 Lines to 8 Lines	0	0	6	2	**8**	0	0	12	5	**17**
Total	**359**	**202**	**299**	**859**	**1720**	**642**	**208**	**305**	**937**	**2092**

To increase the line capacity on a segregated freight line, signalling interventions are required. The sections on the HDN (Golden Quadrilateral and Golden Diagonal), are upgraded to ABS+TCAS+CTC signalling. For Passenger and Freight segregated operation.

Table 13-7: ABS+TCAS+CTC Signaling in Port Connectivity along HDNs

	2026	**2031**	**2041**	**2051**
Single Line	0	0	0	0
Double Line	116	0	0	0
Triple Line	147	0	0	0
Quadruple Line	46	0	0	0
6 Lines	2	6	0	0
8 Lines	0	0	6	2

Automatic Signalling has been proposed to create safety and excess capacity than normal signalling. 1,934 network km and 5,413-line km will require automatic Signalling

Table 13-8: Automatic signaling in Port Connectivity

	2026	**2031**	**2041**	**2051**
Single Line	0	0	0	0
Double Line	137	267	314	98
Triple Line	6	53	160	475
Quadruple Line	156	11	54	205

Chapter 14 TRANS ASIAN NETWORK CONNECTIVITY

14.1. Introduction

A reliable transport system is considered indispensable for national development and for the integration of the country's concern into the regional and global economy. Trans-Asian Railway (TAR) under the Asian Land Transportation Infrastructure Development (ALTID) project of ESCAP was identified for promoting infrastructure development in the ESCAP region. The ALTID project was initiated by UN-ESCAP in 1992 with the objective of infrastructure development in the ESCAP region and to facilitate International Trade & Tourism. Trans-Asian Highway Network which entered into force in July 2005 has been signed by 28 countries. India has signed Trans-Asian Highway Network Agreement and ratified it.

14.2. The Trans-Asian Railway (TAR) Network

The Trans-Asian Railway (TAR) is a project of the UNESCAP to create an integrated freight railway network across Europe and Asia. The project was initiated in the 1950s, with the objective of providing a continuous 8,750 miles (14,080 km) rail link between Singapore and Istanbul, Turkey, with possible further connections to Europe and Africa. At the time shipping and air travel were not as well developed, and the project promised to significantly reduce shipping times and costs between Europe and Asia. Progress in developing the TAR was hindered by political and economic obstacles throughout the 1960s, 1970s and early 1980s. By the 1990s, the end of the Cold War and normalisation of relations between some countries improved the prospects for creating a rail network across the Asian continent.

The TAR was conceived to accommodate the huge increases in international trade between Eurasian nations and facilitate the increased movements of goods between countries. Its objective was also to improve the economies and accessibility of landlocked countries like Laos, Afghanistan, Mongolia, and the Central Asian republics. By 2001, four corridors had been finalised under the TAR network plan:

a. Northern Corridor:

The Northern Corridor will link Europe and the Pacific, via Germany, Poland, Belarus, Russia, Kazakhstan, Mongolia, China, and the Koreas. The 5,750 miles (9,250 km) Trans-Siberian Railway covers much of this route and currently carries large amounts of freight from East-Asia to Moscow and on to the rest of Europe. Due to political problems with North Korea, freight from South Korea must currently be shipped by sea to the port of Vladivostok to access the route.

b. Southern Corridor:

The Southern Corridor will go from Europe to Southeast Asia, connecting Turkey, Iran, Pakistan, India, Bangladesh, Myanmar, and Thailand, with links to China's Yunnan Province and, via Malaysia, to Singapore.

c. Southeast Asian Network

The southeast Asian network primarily consists of the Kuming- Singapore Railway.

d. North- South Corridor:

The North-South Corridor will link Northern Europe to the Persian Gulf. The main route starts in Helsinki, Finland, and continues through Russia to the Caspian Sea, where it splits into three routes: a western route through Azerbaijan, Armenia, and western Iran; a central route across the Caspian Sea to Iran via rail ferry; and an eastern route through Kazakhstan, Uzbekistan and Turkmenistan to eastern Iran. The routes converge in the Iranian capital of Tehran and continue to the Iranian port of Bandar Abbas.

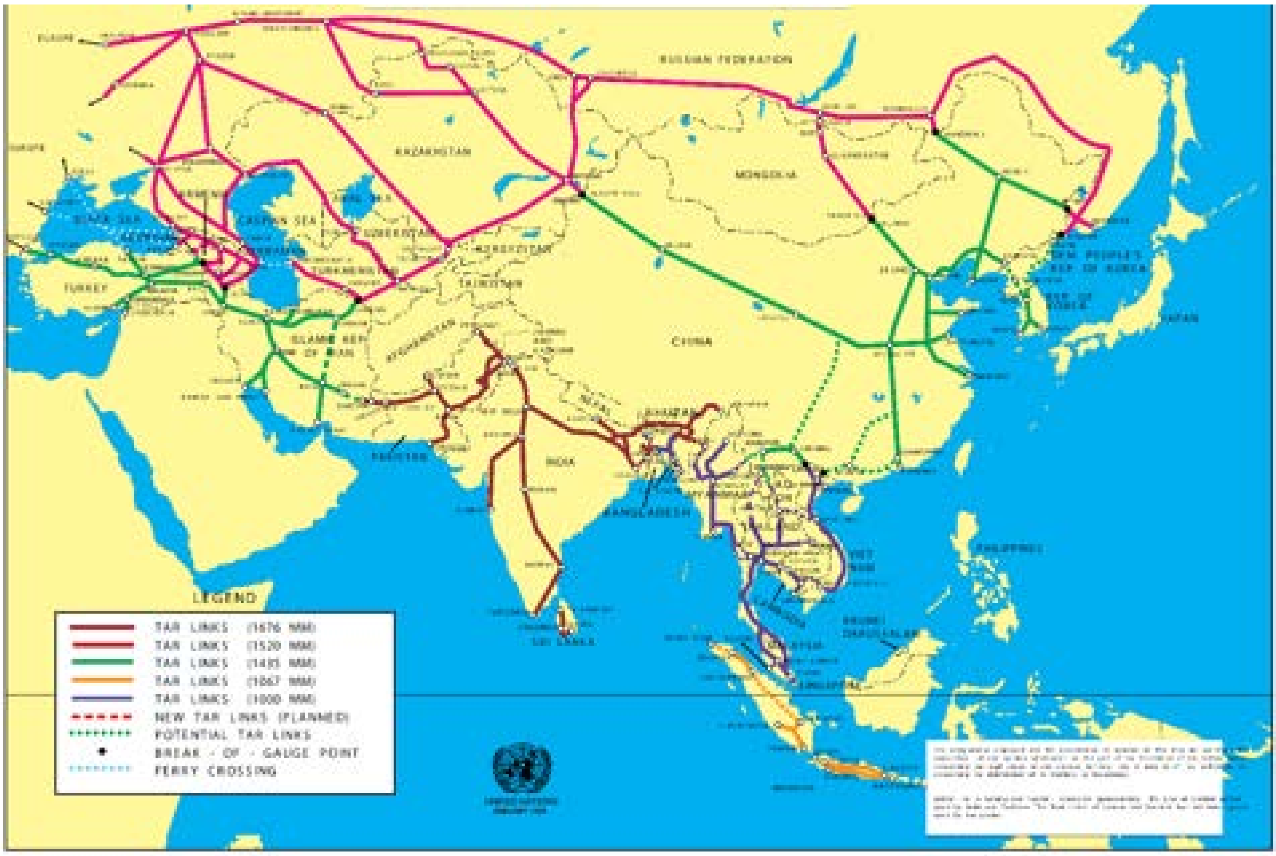


Figure 14-1: UNESCO Proposed Trans Asian Railway Network

14.3. Benefits of TAR

Efficient rail transport will mean more competitive economies for the region and, therefore, more opportunities for jobs and enhancement of trade. By providing reliable services over large distances, railway companies will bring to populations in remote areas standards of living equal to those found in larger urban areas. By carrying consumer products, trains will allow people a wider range of options in their daily lives. Most importantly, rail transport is environment friendly, i.e. all these benefits will materialize without damaging the environmental heritage of the region. Trans-Asian Railway Network is highly relevant to India. The network will provide a viable land route to promote trade relations with the Middle East, Central Asia and South-East Asia. The development of Trans-Asian Railway Network in the Southern Corridor has a good potential for container traffic between South Asia and Europe and between Central and South Asia in terms of transit time. Trans-Asian Railway will also provide connectivity to the North-Eastern region of the country through Bangladesh.

14.4. Connectivity to South Asia

While discussion on Capacity Expansion up to now centered around, internal rail connectivity – both sectional and terminal, the Committee felt it necessary to also discuss in fleeting reference to the issues of South East Asian Rail Connectivity. While Trans-Asian Rail networks of North and Central Routes involving China, Russia, Far East have taken off and maturing fast, the connectivity of the Trans Asian South Route, is still in a fledgling state.

The connectivity status to neighbouring countries is depicted hereunder:

Table 14-1: Connectivity Status to Neighboring Countries

	Traffic Interchange Points	Remarks
India-Pakistan		
Existing Links	Attari (India)-Wagah (Pakistan)	Freight and Passenger Services
	Munabao (India) —Khokrapar (Pakistan)	Passenger Services
India-Bangladesh		
Existing Links	Gede (India)- Darshana (Bangladesh)	
	Singhabad (India)- Rohanpur (Bangladesh)	
	Petrapole (India)-Benapole (Bangladesh)	
New links under Execution	Agartala (India)- Akhaura (Bangladesh)	
	Mahisasan (India) – Zero Point Bangladesh) 2.7km	
New Links Surveyed	**Belonia (India) – Belonia (Bangladesh) 3km**	
India-Nepal		
Existing Links	Raxaul-Birganj	Train services w.e.f. 16.07.2004 after operationalization of Birganj ICD

New links under Execution	Jogbani-Birammpr (18kms)	Sanctioned in 2010-2011
	Jayanagar-Bijalpura with extn. To Bardibas (69 kms)	Sanctioned in 2010-2011
New links surveyed		
	Baba Jang (India)- Nepalganj (Nepal)- 15.75 kms	
	Nautanwa (India)- Bhairahawa (Nepal)- 25 kms	
	Naxalbari (India)- Kakarbhita (Nepal) - 16 kms	
	Raxaol (India) – Katmandu (Nepal) – 136 km	
India-Bhutan		
New links Surveyed	Hashimara (India)- Phuentaoling (Bhutan)- 17.5 kms	
	Rangia (India)- Samdrupjongkhar (Bhutan) via Darranga	
	Khokrajhar (India)- Gelephu (Bhutan)	
	Banarhat (India)- Samtae (Bhutan)	
	Pathshala (India)- Nanglam (Bhutan)	
	Mujnai (India) – Nyoenpaling (Bhutal) 36km	
India-Myanmar		
New links under Execution	Jiribam and Imphal	
Survey for new links planned/ in progress	Imphal-Moreh (India)	Taken up in 2012-13
	Tamu- Kalay (in Myanmar)	
India-Sri Lanka		
	Rameshwaram (India)- Talaimannar (Sri Lanka)	Ferry services being planned

14.5. Southern Corridor of the Trans-Asian Railway

The southern corridor of the Trans-Asian Railway is intended to provide, ultimately, a continuous railway connection between Southeast Asia and Europe as well as between Southwestern China and Europe. While it has other functions, such as the connection by rail of the hinterland regions of the countries in the corridor with their nearest seaports, its primary purpose is to provide a conduit through which it is possible for trains to pass without interruption between Asia and Europe. The Southern Corridor consists of two types of routes:

i. Routes of international significance: which will facilitate uninterrupted transportation between Southeast Asia and Europe; Southwestern China and Europe; Central Asia and Europe; and Central, South and Southeast Asia
ii. Routes of sub-regional significance: which will facilitate country to country, or hinterland to port, transportation within the corridor.

The main east-west trunk routes from Thailand and Southwestern China to Europe through Myanmar, Bangladesh, India, Pakistan, the Islamic Republic of Iran and Turkey constitute routes of type (i), while routes connecting the hinterland of India to its ports, for example, are routes of type (ii). Routes of both categories are shown in Map below, which illustrates the entire network comprising the southern corridor of the Trans-Asian Railway.

14.6. Routes of International Significance

3 routes of international significance were identified in the southern corridor of the Trans-Asia Railway. For convenience, they have been designated TAR-S1, TAR-S2, and TAR-S3.

A. Route TAR-S1

Eastern Extremities: China (Kunming)— —> Myanmar (Mandalay)— —> India— —> Bangladesh— —> India— —> Pakistan— —> Iran— —> Turkey— —> Bulgaria— —> Romania— —> Hungary— —> Austria: Western Extremities

This is the main route of international significance within the corridor. It would commence in Kunming (China), running southwest from the existing Chinese railhead at Xiaguan (near Dali) to the border with Myanmar at Ruili, thence to the existing railhead of Lashio in Myanmar and along what is currently a branch line, to Mandalay. From Mandalay, it would follow a broadly east-west axis, crossing the territory of Myanmar, India (twice), Bangladesh, Pakistan, the Islamic Republic of Iran, as far as the border between Turkey and Bulgaria, at Kapikule. From its western extremity it would allow access to Western Europe via Bulgaria, Roumania, Hungary and Austria. From Kunming to Kapikule, it would have a total length of 11,700 km of which 9,790 km (or 84 per cent) is in place, 95 km (1 percent) comprises ferry links, and 1,820 km (15 per cent) would need to be constructed, most of it through difficult mountainous terrain.

From the border between Turkey and Bulgaria, Frankfurt (Germany) is another 1,785 km by rail, giving a total distance between Kunming and Frankfurt of approximately 13,500 km.

Between its eastern and western extremities, route TAR-S1 would cross 7 national borders (with another 5 to be crossed west of Turkey) and would contain three different track gauges - metre (1,000 mm), standard (1,435 mm) and broad (1,676 mm).1 In future if it is to provide a continuous rail link, Route TAR-S1 could have up to five inter-gauge transfer points, but if it were currently to be used for intercontinental traffic, freight shippers could face up to 12 locations at which modal transfer (transhipment) would be necessary.

Figure 14-2: Southern Corridor of TAR

B. Route TAR-S2

Nam Tok-Bangkok— —>Myanmar— —>join existing Myanmar Railway Network— —>connects with TSR-S1

This route would start from the westernmost railhead on the Thai system at Nam Tok, 210 km by rail from Bangkok, proceeding west or northwest to the border with Myanmar and joining the existing railway network of the Myanmar Railways before running north to Mandalay where it would connect with Route TAR-S1. A connection to Yangon would be provided at the junction station of Bago, which is 75 km north of Yangon on the Yangon- Mandalay trunk line.

C. Route TAR-S3

It would start from Sarakhs on the border between the Islamic Republic of Iran and Turkmenistan, running 164 km southwest to Fariman on the existing trunk line linking Sarakhs with the border between the Islamic Republic of Iran and Turkey at Razi. From Fariman, Route TAR-S3 would follow the alignment of a new line of 790 km to be constructed on a north-south axis between Fariman and Bafq (which is located on Route TAR-S1). From Bafq, it would run 635 km south, via the recently completed single track trunk line, to the port complex at Bandar Abbas on the Persian Gulf. The total length of this route would be 1,589 km, all of it likely to be (initially) standard gauge, single track, nonelectrified line.

14.7. Routes of Sub-Regional Significance- India

Routes which are of sub-regional or national significance are considered within the description of links comprising the TAR network in each participating country. They comprise a considerable number of long routes connecting major hinterland locations with seaports, such as for example the 1,319 km route linking

Delhi with Mumbai (Bombay) and the 2,866 km route linking Delhi with Chennai (Madras) and Tuticorin, as well as the main rail transit route linking Birganj in Nepal with Calcutta, Haldia and Mumbai ports and the TAR connecting route in Sri Lanka.

A total of 6 TAR links has been recommended for India.

(i) Link In.1

This link forms part of the main intercontinental route TAR-S1.

- starts Gede (on the Indian side of Bangladesh's western border, follows the Indian broad gauge east-west trunkline system up to the border with Pakistan at Attari)– –> passing through Ranaghat– –> Naihati– –> Bandel– –> Saktigarh– –> Sitarampur– –> Gaya– –> Sonnagar– –> Mughalsarai– –> Allahabad– –> Kanpur– –> Tundla– –> Aligarh– –> Ghaziabad– –> Delhi– –> Ambala– –> Sirhind– –> Ludhiana– –> Jalandhar– –> Amritsar.
- This link which is entirely broad gauged (1,676 mm) has a total length of 1,975 km, of which 138 km consists of quadrupled track, 127 km of triple track, 1,682 of double track and 28 km of single-track line. Additionally, all the links are electrified except for two sections at the eastern and western extremities: 44 km between Gede and Ranaghat and 268 km between Ambala and Attari.
- Apart from serving the Indian capital, New Delhi, and providing connections to port facilities at Calcutta and Haldia, the link is used intensively for the rail movement of coal and raw steel products from mines and steel plants in eastern India to power stations and manufacturing plants in western India.
- It also provides the sole effective land transport connection with Pakistan, although there is currently only a limited exchange of freight and passenger traffic between the Indian border station of Attari and the Pakistani border station of Wagah.
- Since Link In.1 crosses the Northern India plain, for most of its length it has gradients no steeper than 0.3 - 0.5 per cent, the only gradient of any significance being 1.25 per cent on a section of only 16 km between Mughalsarai and Sitarampur.

(ii) Link In.2

This link, also broad gauged for its entire length, constitutes a route of regional significance in that it connects Delhi with the ports of Chennai (Madras) and Tuticorin on the eastern and southern coasts of India respectively. It also provides a transit route for traffic to and from Sri Lanka, which arrives at and departs from the port of Tuticorin.

- Delhi (Link In.2 runs for 2,866 km on a north-south axis, passing through the important commercial centres)– –> Faridabad– –> Mathura– –> Agra– –> Gwalior– –> Jhansi– –> Bhopal– –> Itarsi– –> Nagpur–

—> Wardha— —> Vijaywada— —> Chennai— —> Salem— —> Erode— —> Tiruchchirappalli.

- The link runs through predominantly undulating country and has a maximum gradient of 1.7 % within the 135 km section between Itarsi and Amla, where it traverses the Mahadeo Range. With the exception of a 39 km section at its northern end between Tuklakabad (Delhi) and Palwal (which is triple tracked and electrified) and a 360 km section at its southern end between Erode and Tuticorin (which is single tracked and non-electrified), the entire link is double tracked and electrified.

(iii) Link In.3

Link In.3 constitutes another route of regional significance, since its primary purpose is to connect Delhi with the two gateway ports in the Mumbai (Bombay) area, i.e. Mumbai and Jahawal Nehru ports which together handle nearly 60 per cent of container traffic through India's principal ports.

For its first 130 km (Delhi-Mathura) it shares the alignment of Link In.2. From Mathura it runs for 1,380 km in a southwesterly direction to Mumbai. It passes through mainly flat terrain and is broad gauged, multiple tracked and electrified throughout.

Important commercial centres served by Link In.3 include Faridabad— —> Mathura— —> Kota— —> Ratlam— —> Baroda— —> Bharuch— —> Mumbai— —> Vasco.

(iv) Link In.4

Link In.4 provides a regional route for the movement of transit cargoes between Nepal and its principal port outlets in Calcutta and Haldia.

- Starts from Raxaul (on India/Nepal border and runs southeast, through predominantly flat terrain, for 471 km to the principal junction station) — —> Sitarampur (located on Link In.1. and from Sitarampur, the link shares the alignment of In.1 for a further 200 km) — —> Calcutta.
- In early 1998, it was announced that the World Bank would be providing a loan of US$ 27 million to fund construction of an Inland Container Depot at the Nepali border town of Birgunj opposite Raxaul. The Indian government has agreed to undertake construction of a 5.4 km broad gauge line linking the new ICD with Raxaul. Broad-gauging of Link In.4 was completed in 1995. The rail links also exist for connecting the gateway ports of Mumbai and Chennai with the link In.4.

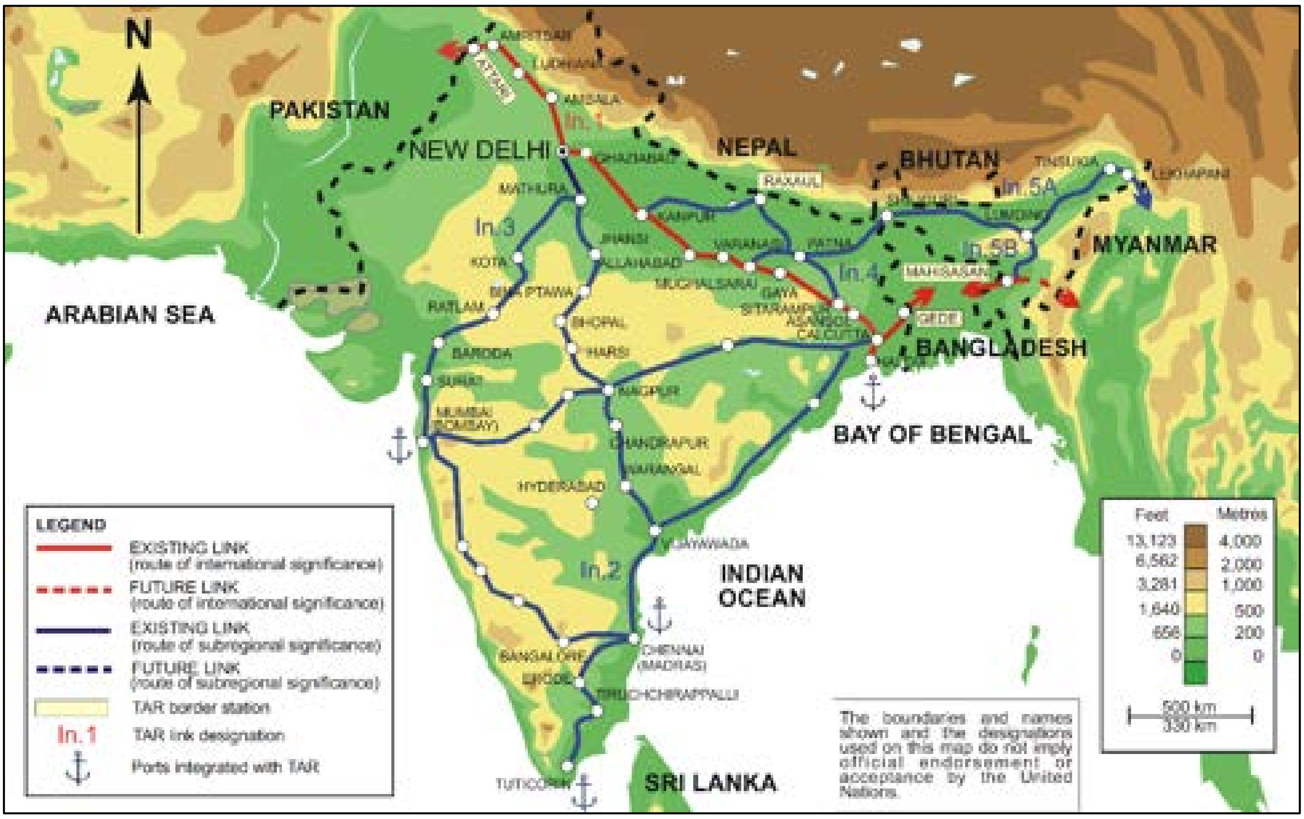


Figure 14-3: TAR Southern Corridor in India

(v) Link In.5a

Link In.5a would provide a connection between the north-eastern states and the rest of India. It would also have the potential to provide an international connection with Yunnan Province of China via northern Myanmar should it be decided in the future to construct the missing link along a more northerly alignment.

(border between India and Myanmar, about 45 km east of the existing Indian railhead) Lekhapani in the north-eastern part of Assam state——> the existing alignment of Link In.5a runs for 1,830 km east across Assam, West Bengal and Bihar states, passing through the narrow (30 km) passage, known as the chicken neck between the borders of Nepal and Bangladesh before joining Link In.1 (and international route TAR-S1) at Mughalsarai about 35 km east of the ancient city of Varanasi on the Ganges River. Broad-gauging of the link was completed throughout in 1997 and its total length comprises 1074 km of single track, non-electrified line, 430 km of double track, non-electrified line and 325 km of double track, electrified line. Essentially, Link In.5a serves as a link between the underdeveloped north-eastern states and the industrialized states of northern India.

- Significant commercial centres served by Link In.5a include Tinsukhia, Dimapur, Lumding (junction with the northeastern metre gauge network), Guwahati (location of the only ICD in northeastern India), New Jalpaiguri, Katihar, Barauni, Patna and Danapur.

- Link followed is Lekhapani– –>Lumding– –>Siliguri– –>Patna– –>Mughalsarai, Sitarampur.

(vi) Link In.5b

The final TAR link in India, designated In.5b, has two components. The first is an existing metre gauge line of about 110 km connecting Lumding (located on Link In.5a) with Badarpur which lies on international Route TAR-S1. The second is part missing link and part existing metre gauge link joining the border towns of Tamu in Myanmar and Mahisasan on the border with Bangladesh (opposite the Bangladeshi border town of Shahbazpur), via Silchar and Badarpur and having an estimated length of 340 km, of which the existing section from Jiribam (just inside Manipur State) to Marisasan is about 160 km long.

14.8. Closing the Gaps in Network

Gaps or missing links (where there is currently an absence of physical linkages between the railway networks of neighbouring countries or an absence of continuous railway links within the countries themselves) exist at several points in the Southern Corridor network. The only missing link in India is the Jiribam to Moreh section.

The Government of India has started work on the 219-km Jiribam to Moreh line section. Although progress has been slow, the link is important for regional connectivity and falls under the plan of connecting South Asia with South-East Asia via Myanmar.

In addition, the Bangladesh Government plans to construct a 215-km line from Dhaka to Jessore as part of the Padma Bridge rail link project. The line will offer a rail connection to India that is 185 km shorter than the existing one via Darsana, Bangladesh, and which has added relevance in the context of the new 15-km rail connection that the Governments of Bangladesh and India plan to realize between Akhaura, Bangladesh, and Agartala, India. This short link will substantially improve rail connectivity between the north-eastern states of India and the ports of Kolkata, India, and Chittagong, Bangladesh.

14.9. Break of Gauge Points on TAR Southern Corridor

Break of gauge does not constitute a major problem to efficient services. Well-designed and well-organized facilities allow for trans-shipment to take place within the time allocated for other operations. A bulk of time-sensitive traffic is containerized cargo which, by nature, lend itself well to fast and efficient trans-shipment. Efficient trans-shipment often takes place within a few hours representing a fraction of the overall transit time over large distances. The construction of missing links and development of trans-shipment facilities on the TAR network will have to be developed by parties to the Inter-governmental agreement within the framework of their own national programme.

The following will be the break of gauge points/trans-shipment points on the Southern Corridor (TAR-S1) between Kunming in China to Kapikule in Bulgaria even after completion of respective missing links:

Table 14-2: Break of Gauge Points (TAR-S1)

Break of Gauge point	Between	Type of Gauge
Kachang in China	China and Myanmar	1435 mm (China) to 1000 mm (Myanmar)
Rueli in China	China and Myanmar	1435 mm (China) to 1000 mm (Myanmar)
Tamu in Myanmar	Myanmar and India	1000 mm (Myanmar) to 1676 mm (India)
Sahabazpur in Bangladesh	India and Bangladesh	1676 mm (India) to 1000 mm (Bangladesh)
Zahedan in Iran	Iran and Pakistan	1435 (Iran) mm to 1676 mm (Pakistan)

The following will be the break of gauge points/trans-shipment points on the Southern Corridor (TAR-S2) between Bangkok in Thailand and Kapikule in Bulgaria even after completion of respective missing links:

Table 14-3: Break of Gauge Points (TAR-S2)

Break of Gauge point	Between	Type of Gauge
Tamu in Myanmar	Myanmar and India	1000 mm (Myanmar) to 1676 mm (India)
Sahabazpur in Bangladesh	India and Bangladesh	1676 mm (India) to 1000 mm (Bangladesh)
Zahedan in Iran	Iran and Pakistan	1435 (Iran) mm to 1676 mm (Pakistan)

Table 14-4: Existing and Future rail gauges - India, Bangladesh, Myanmar and Nepal

Country	Existing rail gauge	Future rail gauge
India	1676 mm	1676 mm
Bangladesh	1676/1000 mm	1676 mm
Myanmar	1000 mm	1435 mm (except India links on BG)
Nepal	--	1435 mm (except India links on BG)

India must also be cautions against the influence of China in persuading the neighbours to go in for 1435 mm, Standard Gauge for all future rail project in the neighbourhood. It is to be noted that all other South East Asian countries, which were hitherto on MG are now executing new connectivity projects initiated in past two years only on 1,435 mm Standard Gauge, which provide for seamless rail connectivity to / from China, which operates on Standard Gauge (1435 mm).

Table 14-5: Some select Developments on Standard Gauge

Country	Existing Route Kilometer - Gauge	Current Plans
Myanmar	7942 Km - MG	Tamul-Kalay: MG Lashio-China Link 434 Km - SG
Thailand	4043 Km - MG	873 Km - China coop - SG 672 Km-Japan corp-SG
Laos	14 Km-MG	All future rail link on SG
Cambodia	652 Km - MG	4 Links - 874 Kms - SG
Vietnam	2524 Km	>1500 Km - SG

While India has little or no influence at this stage in the 'deep' South East Asian countries – Laos, Cambodia, Vietnam, Malaysia, Thailand - on the type of "Gauge", the two countries which India should proactively engage with on the issue are Nepal and Myanmar.

14.10. Ongoing activities and surveys

14.10.1.Connectivity to Nepal:

Indian Railway is currently executing 2 newline projects for connectivity to Nepal via its construction arm of IRCON and these projects would be intensively monitored for expeditious completion. Currently, both these projects are delayed due to issues of land acquisition in Nepal portion.

Table 14-6: Ongoing Connectivity Projects with Nepal

S. No.	Line	Length (Km)	Cost (cr)	Executing Agency
1	Jogbani-Biratnagar	18.6 Km	394	IRCON
2	Jaynagar-Bijalpura	69 Km	470	IRCON

Similarly, the 4 ongoing surveys for connectivity to Nepal shall also be expedited.

Sanctioned Surveys:

- Nepalganj - Nepalganj Road: 12 Km
- Nautanwa - Bhairahwa: 15 Km
- New Jalpaiguri - Kakarbhita: 46 Km
- Basti - Kapilavastu: 91 Km

On the issue of using mixed gauge for these connectivity lines, it is to be noted that providing for mixed gauge of Broad Gauge / Standard Gauge would open access to China, which is actively pursuing its connectivity from Lhasa to Kathmandu on Standard Gauge (SG).

In this context, it is desirable for Indian Railway to be involved in the new 950 Km East-West Corridor of Nepal, pursue Nepalese Government to execute this project on the Broad Gauge. India should demonstrate its keenness for accessing the Nepalese heartland through BG. Necessary facilitation be processed via the Ministry of External Affairs for the same. It is hereby reiterated that if India were to follow mixed gauge (BG/SG) for its connectivity projects with Nepal, then China would have clear access up to Indian Borders on its all Standard Gauge route from Mainland China. The better option for India is to gain access on BG to the 950 Km - proposed E-W Corridor and persuade Nepal therein.

14.10.2.Connectivity to Myanmar

It is to be diplomatically pursued with Myanmar that the Moreh-Tamu-Kalay (125 Km) link line be processed for Broad Gauge. M/S RITES have already submitted the DPR, which is pending with Ministry of External Affairs. Given that China is pursuing the 434 Km new line connectivity with Myanmar at Lashio point on Standard Gauge, it is imperative that Indian side finalize on the DPR of M/S RITES at the earliest.

14.10.3.Connectivity to Bangladesh

The ongoing two new line projects and ongoing surveys being executed should be expedited.

Table 14-7: Ongoing Connectivity Projects with Bangladesh

Agartala-Akhaura: 15 Km - BG	Cost: Rs. 887 cr
Haldibari - Chithia: 3 Km - BG	cost: Rs. 69 cr

Chapter 15 CONNECTIVITY WITH THE BACKWARD AREA AND INDUSTRIAL CORRIDORS

15.1. Background

Planned development in India has been based on the notion of ensuring balanced regional development. Given the enormity and diversity of the country this was an important objective in the planning exercise. The devolution of funds to States was based on a formula that gave weightage to population and income levels in order to build in equity in central assistance to the States. Over time, we find that inequality between regions has grown rather than diminished. Even today the problem of uneven development in the country is a cause for concern. Therefore, the objective of balanced regional development continues to have primacy.

15.1.1. Fifth Schedule Areas

In the Article 244(1) of the Constitution, expression Scheduled Areas means such areas as the President may by order declare to be Scheduled Areas.

15.1.1.1. Criteria for Declaring Schedule Areas

The criteria followed for declaring an area as Scheduled Area are
preponderance of tribal population;
compactness and reasonable size of the area;
under-developed nature of the area; and
marked disparity in economic standard of the people.

At present, 10 States namely Andhra Pradesh, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan and Telangana have Fifth Schedule Areas.

The Fifth Schedule of the Constitution deals with the administration and control of Scheduled Areas as well as of Scheduled Tribes residing in any State other than the States of Assam, Meghalaya, Tripura and Mizoram. Tribal habitations in the states of Kerala, Tamil Nadu, Karnataka, West Bengal, Uttar Pradesh and Jammu & Kashmir have not been brought under the Fifth or Sixth Schedule.

15.1.2. Connectivity of the 5th Schedule Districts

All the fifth schedule districts are connected to the Indian Railway system and it will have network upgradation in future years.

East Godavari, Prakasam, Srikakulam, Visakhapatnam, Vizianagaram, West Godavari, Bilaspur, Durg, Raigad, Bharauch, Vadodara, Surat, Valsad, Simdega, Betul, Amravati, Chandrapur, Nasik, Thane, Balasor, Ganjam, Sundargarh, Siroi will have DFC Connectivity.

Vadodara, Surat, Nasik, Pune and Udaipur will have HSR Connectivity.

Table 15-1: Rail Connectivity with the 5th Schedule Districts

State Name	District	Existing	Proposed	Proposed DFC	Proposed HSR
Andhra Pradesh	East Godavari	3L	4L+ABTS	DFC	-
	Mahboobnagar	2L	2L+ABTS	-	-
	Prakasam	3L	3L+ABTS	DFC	-
	Srikakulam	3L	3L+ABTS	DFC	-
	Visakhapatnam	4L	4L+ABTS	DFC	-
	Vizianagaram	4L	4L+ABTS	DFC	-
	West Godavari	3L	3L+ABTS	DFC	-
Chhattisgarh	Bastar	2L	2L+TC	-	-
	Bilaspur	4L	4L+ABTS	DFC	-
	Chindwada	2L	2L	-	-
	Durg	4L	4L+ABTS	DFC	-
	Kanker	1L	2L	-	-
	Raigad	2L	6L+TC	DFC	-
	Raipur	4L	4L+ABTS	-	-
	Rajnandgaon	4L	4L+ABTS	-	-
	Sarbhuja	1L	2L	-	-
	Sehdol	3L	3L+TC	-	-
Gujarat	Bharauch	2L	4L+ABTS	DFC	-
	Dangs	1L	1L	-	-
	Panchmahl	2L	3L+ABTS	-	-
	Sabarkanta	1L	2L	-	-
	Vadodara	2L	4L+ABTS	DFC	HSR
	Surat	2L	4L+ABTS	DFC	HSR
	Valsad	2L	4L+ABTS	DFC	-
Himachal Pradesh	Chamba	1L	2L	-	-
	Kinnaur	1L	2L	-	-
	Lahaul	1L	2L	-	-
	Spiti	1L	2L	-	-
Jharkhand	Devgarh	2L	4L+TC	-	-
	Dumka	1L	2L	-	-
	East Singhbhum	4L	4L+ABTS	-	-
	Garwa	2L	4L+TC	-	-
	Godda	1L	2L	-	-
	Gumla	2L	2L+TC	-	-
	Lohardaga	2L	2L+TC	-	-
	Pakur	2L	4L+TC	-	-
	Palamu	2L	2L+TC	-	-
	Ranchi	2L	2L+TC	-	-
	Sahabgunj	2L	4L+TC	-	-
	Simdega	4L	4L+ABTS	DFC	-
	West Singhbhum	4L	4L	-	-
Madhya Pradesh	Balaghat	1L	2L	-	-
	Betul	4L	4L+ABTS	DFC	-
	Dhar	1L	2L	-	-
	East Nimar (khandwa)	2L	3L+TC	-	-
	Jhabua	2L	3L+TC	-	-
	Khargone	2L	3L+TC	-	-
	Mandla	1L	2L+TC	-	-
	Morena	4L	4L+ABTS	-	-
	Ratlam	2L	3L+ABTS	-	-
	Seoni	1L	1L	-	-
Maharashtra	Ahmednagar	2L	3L+TC	-	-
	Amravati	4L	4L+ABTS	DFC	-
	Chandrapur	4L	4L+ABTS	DFC	-
	Dhule	2L	3L+TC	-	-
	Gadchiroli	2L	2L	-	-

State Name	District	Existing	Proposed	Proposed DFC	Proposed HSR
	Nanded	2L	2L+TC	-	-
	Nasik	4L	4L+ABTS	DFC	HSR
	Pune	4L	4L+ABTS	-	HSR
	Thane	6L	8L+ABTS	DFC	-
	Yavatmal	1L	2L	-	-
Orissa	Balasor	3L	3L+ABTS	DFC	-
	Bolangir	3L	4L+TC	-	-
	Boudhkondmals	1L	2L	-	-
	Ganjam	3L	3L+ABTS	DFC	-
	Kalahandi	3L	4L+TC	-	-
	Keonjhar	2L	2L+TC	-	-
	Koraput	2L	2L+TC	-	-
	Mayurbhanj	1L	1L	-	-
	Raigada	3L	4L+TC	-	-
	Sambalpur	2L	4L+TC	-	-
	Sundargarh	4L	4L+ABTS	DFC	-
Rajasthan	Banswara	1L	1L	-	-
	Chittaurgarh	3L	3L+TC	-	-
	Dungarpur	1L	2L	-	-
	Siroi	2L	2L+TC	DFC	-
	Udaipur	2L	2L+TC	-	HSR
Telangana	Adilabad	1L	1L	-	-

15.1.3. Sixth Schedule

The Sixth Schedule consists of provisions for the administration of tribal areas in Assam, Meghalaya, Tripura and Mizoram, according to Article 244 of the Indian Constitution.

15.1.3.1. Autonomous districts and regional councils

Along with ADCs, the Sixth Schedule also provides for separate Regional Councils for each area constituted as an autonomous region. In all, there are 10 areas in the Northeast that are registered as autonomous districts – three in Assam, Meghalaya and Mizoram and one in Tripura.

15.1.4. Connectivity of the 6th Schedule Districts

Most of the sixth schedule districts of Assam, West Bengal and Tripura are connected by Indian Railways. Kamrup District will have HSR connectivity (Guwahati), 6th Schedule areas of Ladakh, Manipur, Meghalaya and Mizoram will not have any proposed rail connectivity

Table 15-2: Rail Connectivity with the 6th Schedule Districts

State Name	District	Existing	Proposed	Proposed DFC	Proposed HSR
Assam	Baksa	-	-	-	-
	Chirang	-	-	-	-
	Kokrajhar	2L	4L+TC	-	-
	Udalguri	-	-	-	-
	Lakhimpur	1L	4L+TC	-	-
	Dima Hasao	1L	3L+TC	-	-
	Karbi Anglong	1L	3L+TC	-	-
	West Karbi Anglong	1L	3L+TC	-	-

State Name	District	Existing	Proposed	Proposed DFC	Proposed HSR
	Dhemaji	1L	3L+TC	-	-
	Kamrup Rural	4L	4L+TC	-	HSR
	Goalpara	1L	3L+TC	-	-
	Dibrugarh	1L	2L+TC	-	-
	Titabar	1L	2L+TC	-	-
	Morigaon	2L	4L+TC	-	-
Ladakh	Kargil	-	-	-	-
	Leh	-	-	-	-
Manipur	Chandel	-	-	-	-
	Churachandpur	-	-	-	-
	Kangpokpi	-	-	-	-
	Senapati	-	-	-	-
	Tamenglong	-	-	-	-
	Ukhrul	-	-	-	-
Meghalaya	East Garo Hills	-	-	-	-
	West Garo Hills	-	-	-	-
	South Garo Hills	-	-	-	-
	North Garo Hills	-	-	-	-
	South West Garo Hills	-	-	-	-
	East Jaintia Hills	-	-	-	-
	West Jaintia Hills	-	-	-	-
	West Khasi Hills	-	-	-	-
	East Khasi Hills	-	-	-	-
	Ri Bhoi	-	-	-	-
Mizoram	Tuichawng subdivision	-	-	-	-
	Lawngtlai subdivision	-	-	-	-
	Sangau subdivision	-	-	-	-
	Siaha subdivision	-	-	-	-
	Tipa subdivision	-	-	-	-
Tripura	Khumulwng	1L	2L+TC	-	-
West Bengal	Darjeeling	1L	2L+TC	-	-
	Kalimpong	1L	2L+TC	-	-

15.1.5. Aspirational Districts Programme

The 'Transformation of Aspirational Districts' Programme aims to expeditiously improve the socio-economic status of 117 districts from across 28 states. The three core principles of the programme are -Convergence (of Central & State Schemes), Collaboration (among citizens and functionaries of Central & State Governments including district teams), and Competition among districts. Driven primarily by the States, this initiative focuses on the strengths of each district, and prioritizes the attainable outcomes for immediate improvement.

Table 15-3: Rail Connectivity with Aspirational Districts

State Name	District	Existing	Proposed	Proposed DFC	Proposed HSR
	Kadapa	2L	3L+ABTS	-	-

State Name	District	Existing	Proposed	Proposed DFC	Proposed HSR
Andhra Pradesh	Visakhapatnam	4L	4L+ABTS	DFC	-
	Vizianagaram	4L	4L+ABTS	DFC	-
Arunachal Pradesh	Namsai	-	-	-	-
Assam	Baksa	2L	4L+TC	-	-
	Barpeta	2L	4L+TC	-	-
	Darrang	2L	4L+TC	-	-
	Dhubri	2L	2L	-	-
	Goalpara	1L	3L+TC	-	-
	Hailakandi	1L	1L	-	-
	Udalgudi	-	-	-	-
Bihar	Araria	1L	3L+TC	-	-
	Aurangabad	3L	4L+TC	DFC	-
	Banka	1L	2L	-	-
	Begusarai	2L	4L+TC	-	-
	Gaya	3L	3L+ABTS	-	-
	Jamui	2L	4L+TC	-	-
	Katihar	2L	4L+TC	-	HSR
	Khagaria	2L	4L+TC	-	-
	Muzaffarpur	2L	2L+TC	-	-
	Nawada	2L	2L+TC	-	-
	Purnea	1L	3L+TC	-	-
	Sheikhpura	2L	2L+TC	-	-
	Sitamarhi	1L	2L	-	-
Chhattisgarh	Baster	2L	2L+TC	-	-
	Bijapur	2L	2L	-	-
	Kondagaon	2L	2L+TC	-	-
	Korba	2L	3L+TC	-	-
	Mahasamund	1L	2L	-	-
	Naravanpur	2L	2L+TC	-	-
	Norh Bastar-Kanker	1L	2L	-	-
	Rajnandgaon	4L	4L+ABTS	-	-
	South Bastar-Dantewada	2L	2L	-	-
	Sukma	2L	2L	-	-
Gujarat	Morbi	2L	4L+TC	-	-
	Narmada	1L	1L	-	-
Haryana	Mewat	4L	4L+ABTS	-	-
Himachal Pradesh	Chamba	1L	2L+TC	-	-
Jammu And Kashmir	Baramula	1L	1L	-	-
	Kupwara	2L	2L+TC	-	-
Jharkhand	Bokaro	3L	3L	-	-
	Chatra	2L	4L+TC	-	-
	Dumka	1L	2L	-	-
	East Singhbhum	4L	4L+ABTS	-	-
	Garhwa	2L	4L+TC	-	-
	Giridih	3L	3L+ABTS	-	-
	Godda	1L	2L	-	-
	Gumla	2L	2L+TC	-	-
	Hazaribagh	1L	2L+TC	-	-
	Khunti	2L	2L+TC	-	-
	Latehar	2L	2L+TC	-	-
	Lohardaga	2L	2L+TC	-	-
	Pakaur	2L	4L+TC	-	-
	Palamu	2L	2L+TC	-	-
	Ramgarh	2L	2L+TC	-	-
	Ranchi	2L	2L+TC	-	-
	Sahibganj	2L	4L+TC	-	-

State Name	District	Existing	Proposed	Proposed DFC	Proposed HSR
	Simdega	4L	4L	-	-
	West Singhbhum	4L	4L	-	-
Karnataka	Gadag	2L	3L+TC	-	-
	Kalaburagi (Gulbarga)	2L	2L+ABTS	-	-
Kerala	Wayanand	2L	3L+TC	-	-
Madhya Pradesh	Barwani	1L	2L	-	-
	Chhatarpur	2L	2L	-	-
	Damoh	3L	4L+TC	-	-
	East Nimar	2L	3L+TC	-	-
	Guna	2L	3L+TC	-	-
	Rajgarh	1L	2L	-	-
	Singrauli	2L	3L+TC	-	-
	Vidisha	4L	4L+ABTS	-	-
Maharashtra	Gadchiroli	2L	2L	-	-
	Jalgaon	4L	4L+ABTS	DFC	-
	Nanded	2L	2L+TC	-	-
	Nandurbar	2L	3L+TC	-	-
Manipur	Chandel	-	-	-	-
Meghalaya	Ri Bhoi	-	-	-	-
Mizoram	Mamit	-	-	-	-
Nagaland	Kiphrie	-	-	-	-
Orissa	Balangir	3L	4L+TC	-	-
	Dhenkanal	4L	4L+TC	-	-
	Gajapati	1L	2L	-	-
	Kalahandi	3L	4L+TC	-	-
	Kandhamal	1L	2L	-	-
	Koraput	2L	2L+TC	-	-
	Malkangiri	2L	2L+TC	-	-
	Rayagada	3L	4L+TC	-	-
Punjab	Ferozepur	1L	2L	-	-
	Moga	1L	1L	-	-
Rajasthan	Barmer	1L	2L+TC	-	-
	Dhaulpur	4L	4L+ABTS	-	-
	Jaisalmer	2L	2L	-	-
	Karauli	2L	3L+TC	-	-
	Sirohi	2L	2L+TC	DFC	-
Sikkim	East Sikkim	-	-	-	-
Tamilnadu	Ramanathapuram	1L	1L	-	-
	Virudhunagar	2L	2L	-	-
Telengana	Adilabad	1L	1L	-	-
	Khammam	3L	3L+ABTS	-	-
	Warangal Rural	2L	6L+TC	-	-
Tripura	Dhalai	1L	2L+TC	-	-
Uttar Pradesh	Bahraich	3L	4L+TC	-	-
	Balrampur	1L	1L	-	-
	Chandauli	3L	4L+TC	DFC	-
	Chitrakoot	2L	3L+TC	-	-
	Fatehpur	2L	2L+ABTS	DFC	-
	Shravasti	3L	4L+TC	-	-
	Siddharthnagar	1L	1L	-	-
	Sonbhadra	2L	4L+TC	-	-
Uttarakhand	Haridwar	2L	2L+TC	-	-
	Udham Singh Nagar	1L	2L	-	-
West Bengal	Birbhum	3L	4L+TC	-	-
	Dakshin Dinajpur	1L	2L	-	-
	Malda	2L	4L+TC	-	-
	Murshidabad	2L	4L+TC	-	-
	Nadia	3L	4L+TC	-	-

15.2. Connectivity with Industrial Corridors

15.2.1. NICDC Projects

National Industrial Corridor Development Programme is India's most ambitious infrastructure programme aiming to develop new industrial cities as "Smart Cities" and converging next generation technologies across infrastructure sectors.

Govt. of India is developing various Industrial Corridor Projects as part of National Industrial Corridor programme which is aimed at development of futuristic industrial cities in India which can compete with the best manufacturing and investment destinations in the world. The same will create employment opportunities and economic growth leading to overall socio-economic development.

11 Industrial Corridors Projects are being taken up for development with 30 Projects to be developed in 04 phases up to 2024-25:
Delhi Mumbai Industrial Corridor (DMIC);
Chennai Bengaluru Industrial Corridor (CBIC);
Amritsar Kolkata Industrial Corridor (AKIC);
East Coast Industrial Corridor (ECIC) with Vizag Chennai Industrial Corridor (VCIC) as Phase 1;
Bengaluru Mumbai Industrial Corridor (BMIC);
Extension of CBIC to Kochi via Coimbatore;
Hyderabad Nagpur Industrial Corridor (HNIC);
Hyderabad Warangal Industrial Corridor (HWIC);
Hyderabad Bengaluru Industrial Corridor (HBIC);
Odisha Economic Corridor (OEC);
Delhi Nagpur Industrial Corridor (DNIC).

Table 15-4: NICDC Projects and Rail Proposals

Sl.	National Industrial Corridor	State	Phase	District Name	Existing	Proposed	DFC	HSR
1	**Dholera Special Investment Region (22.5 sq. kms)**	Gujarat	Phase 1	Ahmedabad	2L	4L+TC	DFC (2026)	HSR
2	**Shendra Bidkin Industrial Area (18.55 sq. kms)**	Maharashtra	Phase 1	Aurangabad	3L	4L+TC	DFC (2026)	-
3	**Integrated Industrial Township – Vikram Udyogpuri (1,100 acres)**	Madhya Pradesh	Phase 1	Ujjain	2L	3L+ABTS	-	-
4	**Integrated Industrial Township – Greater Noida (747.5 acres)**	Uttar Pradesh	Phase 1	Gautam Buddh Nagar	4L	4L+ABTS	DFC (2026)	-
5	**Integrated Multi-Modal Logistics Hub – Nangal**	Haryana	Phase 1	Mahendragarh	2L	2L	DFC (2026)	-

Sl.	National Industrial Corridor	State	Phase	District Name	Existing	Proposed	DFC	HSR
	Chaudhary (886 acres)							
6	Krishnapatnam Industrial Area (2,500 acres)	Andhra Pradesh	Phase 2	Nellore	4L	4L+ABTS	DFC (2031)	-
7	Tumakuru Industrial Area (1,736 acres)	Karnataka	Phase 2	Tumkur	1L	2L+TC	-	-
4	Multi Modal Logistics Hub & Multi Modal Transport Hub (MMLH & MMTH) (1,208 acres)	Uttar Pradesh	Phase 2	Ghaziabad	4L	4L+ABTS	DFC (2026)	-
8	Multi Modal Logistics Park, Sanand (500 acres)	Gujarat	Phase 2	Ahmedabad	2L	4L+TC	DFC (2026)	HSR
9	Dighi Port Industrial Area (7,413 acres)	Maharashtra	Phase 2	Pune	4L	4L+ABTS	-	HSR
10	Zaheerabad Phase 1 (3,500 acres)	Telangana	Phase 2	Sangareddy	2L	4L+TC	-	-
11	Hyderabad Pharma City Phase 1 (8,000 acres)	Telangana	Phase 2	Hyderabad	2L	4L+TC	-	-
12	Raghunathpur Industrial Park (2,483 acres)	West Bengal	Phase 2	Purulia	3L	3L	-	-
13	Ponneri Industrial Area (4,000 acres)	Tamil Nadu	Phase 3	Tiruvallur	4L	6L+ABTS	DFC (2031)	-
14	Salem (1,773 acres)	Tamil Nadu	Phase 3	Salem	2L	4L+TC	-	-
15	Palakkad Industrial Area (1,878 acres)	Kerala	Phase 3	Palakkad	3L	4L+TC	-	-
16	Koparthy Industrial Area (4,085 acres)	Andhra Pradesh	Phase 3	Srikakulam	3L	3L+ABTS	DFC (2031)	-
17	Chitoor Industrial Area (2,346 acres)	Andhra Pradesh	Phase 3	Chittoor	2L	3L+ABTS	DFC (2031)	-
18	Vishakhapatnam Industrial Area (1,100 acres)	Andhra Pradesh	Phase 3	Visakhapatnam	4L	4L+ABTS	DFC (2031)	-
19	Hisar Integrated Manufacturing Cluster (4,000 acres)	Haryana	Phase 3	Hisar	2L	3L+TC	-	-
20	Prag Khurpia Integrated Manufacturing Cluster (2,935 acres)	Uttarakhand	Phase 3	Udham Singh Nagar	1L	2L	-	-
21	Rajpura Patiala	Punjab	Phase 4	Patiala	2L	2L+TC	DFC (2026)	-
22	Kanpur	Uttar Pradesh	Phase 4	Kanpur Nagar	4L	6L+ABTS	DFC (2026)	HSR
23	Ghamariya	Bihar	Phase 4	Gaya	3L	3L+ABTS	DFC	-

Sl.	National Industrial Corridor	State	Phase	District Name	Existing	Proposed	DFC	HSR
							(2031)	
24	**Bahri**	Jharkhand	Phase 4	Hazaribagh	1L	2L+TC	-	-
25	**Sangli / Satara / Solapur**	Maharashtra	Phase 4	Sangli	2L	2L+TC	-	-
			Phase 4	Satara	2L	2L+TC	-	-
			Phase 4	Solapur	2L	2L+ABTS	-	-
26	**Dharwad**	Karnataka	Phase 4	Dharwad	2L	3L+TC	-	-
27	**Hyderabad Bengaluru Industrial Corridor**	Orvakal/ Anantapur/Hindupur	Phase 4	Kurnool	2L	2L+ABTS	-	HSR
				Anantapuramu	2L	4L+TC	-	-
28	**Odisha Economic Corridor**	Khurda-Cuttack-Jagatsinghpur/ Jajpur-Kendrapara-Bhadrak	Phase 4	Khordha	3L	3L+ABTS	DFC (2031)	-
				Cuttack	4L	4L+TC	DFC (2031)	-
				Jagatsinghpur	2L	4L+TC	-	-
				Jajpur	3L	4L+ABTS	DFC (2031)	-
				Kendrapara	1L	4L+TC	-	-
				Bhadrak	3L	3L+ABTS	DFC (2031)	-
29	**Delhi Nagpur Industrial Corridor**		Phase 4	Nagpur	4L	4L+ABTS	DFC (2031)	HSR
			Phase 4	Delhi	3L	4L+TC	DFC (2041/ 2051)	HSR

15.2.2. Connectivity with NICDC Projetcs

All projects are connected to Indian Railways very conveniently. Most of the projects are getting connected with DFC according to the DFC Phasing. Dholera Special Investment Region, Shendra Bidkin Industrial Area, Integrated Industrial Township – Greater Noida, Integrated Multi-Modal Logistics Hub – Nangal Chaudhary, Multi Modal Logistics Hub & Multi Modal Transport Hub (MMLH & MMTH), Multi Modal Logistics Park, Sanand, Rajpura Patiala and Kanpur will be connected to DFC by 2026 as per 1st phase of DFC Construction.

Krishnapatnam Industrial Area, Ponneri Industrial Area, Koparthy Industrial Area, Chitoor Industrial Area, Vishakhapatnam Industrial Area, Ghamariya and Odisha Economic Corridor will be connected by 2041 and others by 2041 or 2051

Dholera Special Investment Region, Multi Modal Logistics Park, Sanand, Dighi Port Industrial Area, Kanpur, Hyderabad Bengaluru Industrial Corridor, Delhi Nagpur Industrial Corridor will have HSR Connectivity.

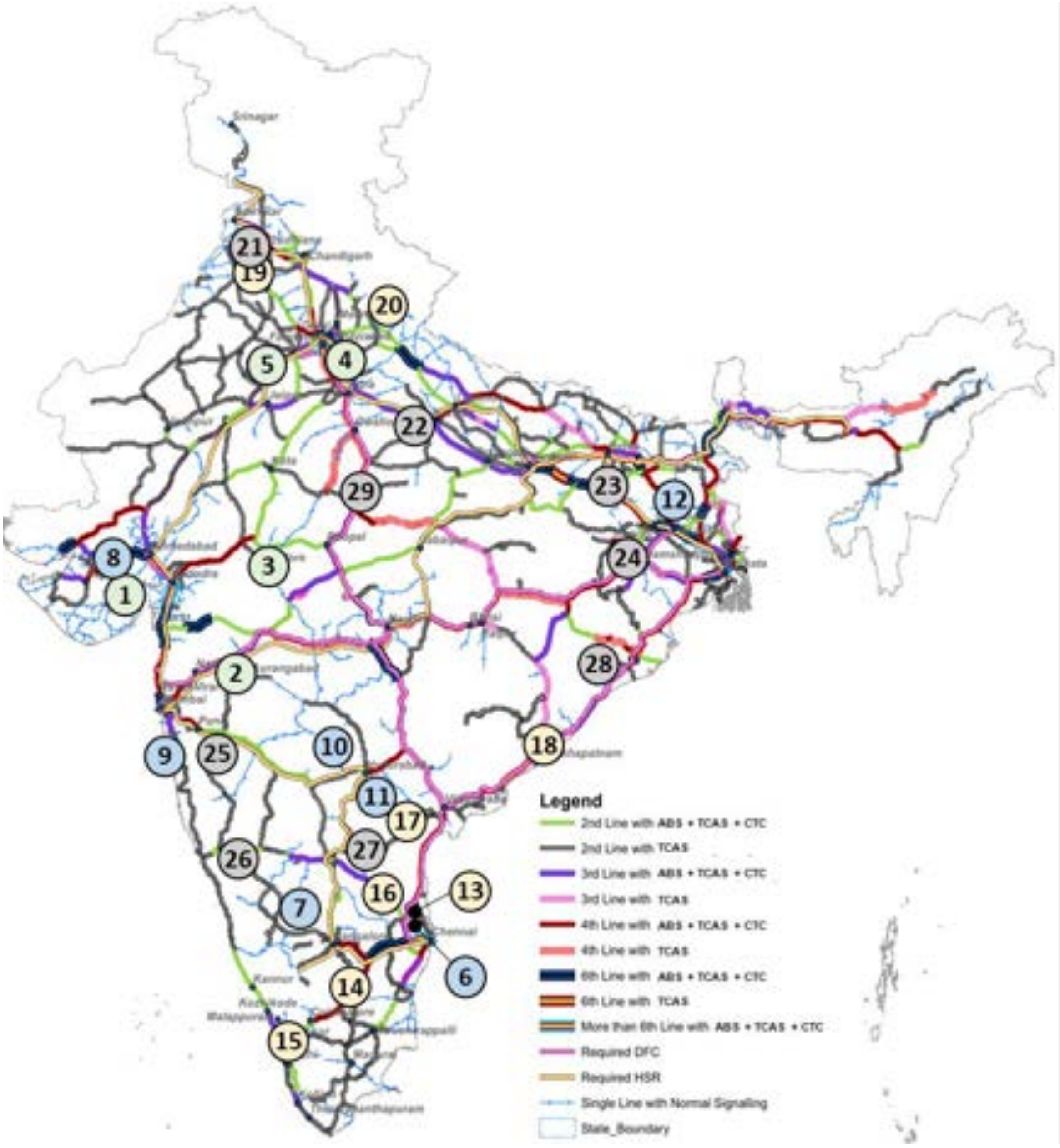


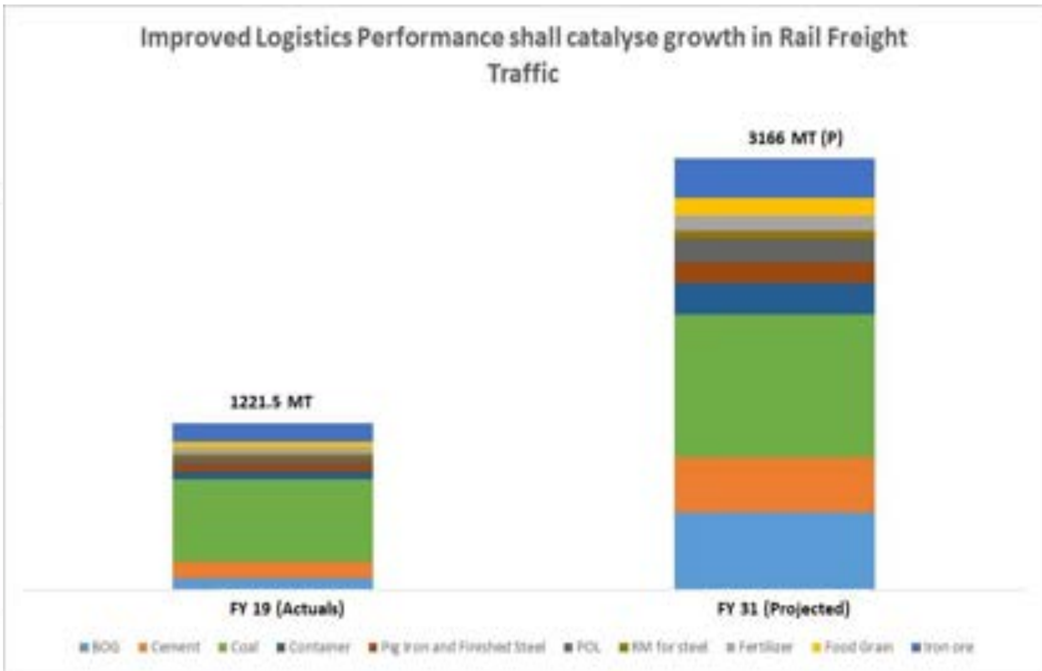
Figure 15-1 : Rail Connectivity with NICDC Projects

Chapter 16 MULTIMODAL FREIGHT TERMINALS

16.1. Background

Rail transportation inherently involves handling of cargo at terminals as part of the chain. Any rail-based cargo transportation chain therefore invariably involves both, terminal handling as well as first and last mile operations, as additional activities in comparison with road-based transportation, which in turn potentially adds to cost as well as time spent in the transit process, when compared to road-based movement of cargo alone.

The projected potential growth of freight traffic on rail, as discussed in the demand forecast report, indicates that rail traffic has a potential for almost 2.5x growth over the next decade subject to improved 'logistics performance' on rail. This additional demand will clearly throw up an inherent need for corresponding additional capacity for MMLPs/Freight Terminals to service the same.



Note: FY 19 Rail Traffic sourced from Indian Railways. FY 31 Rail Traffic Projections sourced from AECOM Logit Model

During the course of consultations with multiple Industry stakeholders, various issues were raised, ranging from lack of adequate terminal infrastructure capacity at desired locations, non-availability of facilities/mechanisms aligned with specific needs of different commodities, primitive nature of loading/unloading operations at existing terminals/good sheds, inefficiencies at terminals, etc. A summary of some of these issues and potential interventions for further terminal development is provided below.

In this context, IR needs to consider both expansion as well as upgradation of the current terminal network with the following basic objectives:

2. Development of new terminals or upgradation of existing terminals in districts which are expected to be underserved in reference to projected freight volumes over the next decade; and
2. Improvement in terminal quality at existing freight-handling terminals/good sheds to induce better service reliability, reduce time & cost of transportation and enable provision of value-added services.

16.2. Identification of Future MMLPs/Freight Terminals

16.2.1. Focus Commodities

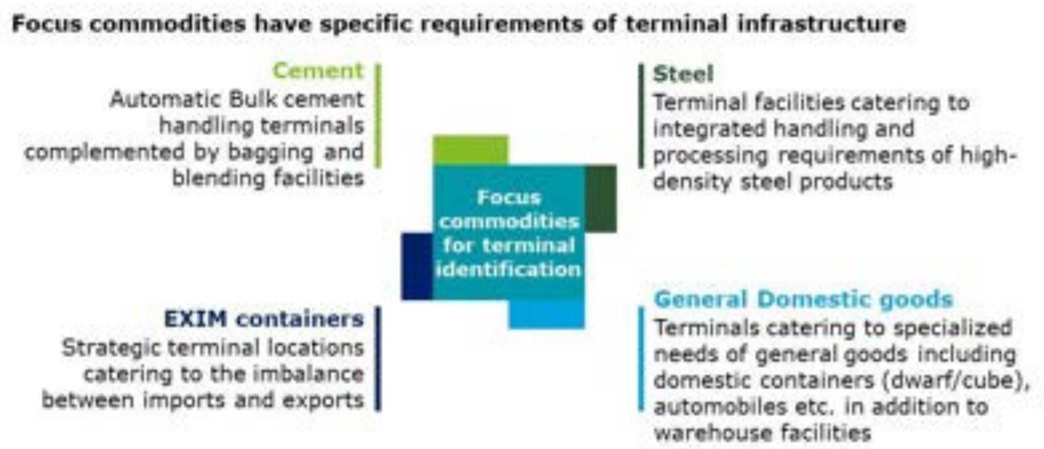
Each of the major commodity groups that have been identified for analysis in this study are typified by certain specific storage and handling requirements (based on underlying logistics needs and industry norms) at origin and destination points of cargo.

	Origin Handling Point	Destination Handling Point
Fertilizer	Plant	Good shed ■
Coal	Mine	Plant
Iron Ore	Mine	Plant
RM for Steel	Mine	Plant
Steel	Plant	Terminal ✓
Cement	Plant	Terminal ✓
EXIM Containers	Terminal ✓	Terminal ✓
POL	Refinery	Tank Farm
Food grains	FCI Siding	Terminal ■
Domestic Other Goods	Terminal ✓	Terminal ✓

✓ Requirement of new terminal infrastructure
■ Good shed upgradation will be adequate

It has been estimated[133] that certain high-potential commodities such as steel and cement, EXIM containers, and other non-conventional goods that are currently represented by a relatively low rail coefficient, are likely to be the main drivers for modal shift from road to rail. Each of these groups has specific terminal requirements. These requirements need to be addressed in planning the development of a terminal network that can support future growth in traffic.

For example, while the cement industry is moving towards bulk movement, and therefore needs terminals with bulk handling capabilities, the steel industry is realizing the need and advantages of setting up integrated logistics cum processing facilities (e.g. cutting, shaping of steel products) within the terminals, thereby adding final consumer value closer to the consumption points. The need for



[133] Refer Chapter 6: Optimum Modal Mix of Demand Forecast Report

terminals capable of handling containers at strategic locations across the IR network also necessitate the need for terminals with intermodal handling facilities, and similarly, potential for containerization of domestic other goods and specific facilities for Automotive handling are expected to require special handling infrastructure/facilities catering to the handling and rail transfer of such goods.

The following schematic identifies the focus commodities, and the nature of terminal development that is likely to be required to address model shift strategies for such commodities.

On the other hand, an analysis of terminal handling infrastructure required for certain bulk commodities like Coal, Iron Ore, RM for Steel and POL products indicates that such commodities tend to predominantly move from or to locations with integrated rail handling infrastructure in the form of private or industrial sidings. Such commodities therefore would not merit inclusion in assessment of demand for common user or multi-cargo rail terminals.

In addition, certain other generic commodities like food-grains and fertilizer move mostly in bagged form and a basic upgradation of existing goods sheds/rail terminal facilities will likely be adequate for sustaining the desired modal share for these commodities. In many cases, these commodities are also loaded from existing fertilizer plant sidings or FCI depot sidings which do not fall within the ambit of the Railways as far as development of multi-user handling facilities is required.

16.2.2. Identification of Locations (districts) with potential for terminal development

For identification of districts (lowest unit of analysis as discussed in our demand report, section **3.6.3, DEMAND FORECAST**, **Chapter 3**) with potential for development of terminals, an objective, multi-step approach has been adopted by the study team (exhibit alongside).

4. The first step involved looking at Commodity-wise projected volumes of potential rail cargo for the horizon year 2031[134] and the corresponding estimated rail modal share for each O-D pair (estimated using logit model[135]).

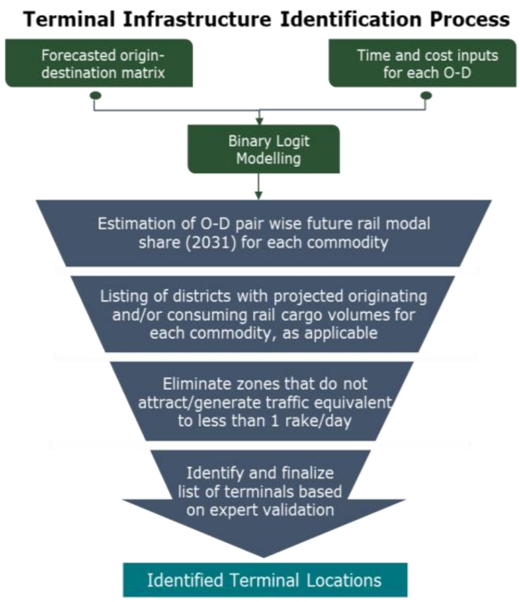


Figure 16-1: –Terminal Infrastrcutre Identification Process

[134] A typical terminal can be developed in around 2 to 3 years and accordingly, horizon year has been considered as 2031. Over the more long-term (2030-2050), variations in spread of production facilities/ consumption centres, commodity specific trends etc. are likely to continue to emerge with higher probability and impact. These, in turn, will directly impact the freight aggregation and distribution patterns and trade flows characteristics resulting in varying demand for terminal requirement as well as desired capacity levels over such period. It would be prudent to review and realign the terminal network, and its further development, about every 5 years.

[135] AECOM Logit Model, presented in Demand Forecast Report

5. Second, potential districts were identified which presented suitable addressable market for rail (i.e. at least 1 rake per day). This was done to ensure that each identified location was represented by volumes that would result in a basic viability for at least a medium sized terminal (see Exhibit 2).
6. Finally, the identified districts were assessed based on clustering of locations, stakeholder discussions and validation from a group of subject matter experts. At this stage, factors such as geographical parameters, rail connectivity, traditionally defined catchment areas etc. were also considered.

A medium sized terminal should ideally handle at least 1 rake per day for it to cover its monthly operating expenditure

Calculation of net revenue from setting up a medium sized terminal*
Expenditure

- Capital expenditure – INR 50 crores
- Monthly operating expenditure plus interests – INR 35-40 lacs

Revenue potential``

- Monthly revenue from access, handling and other sources – INR 45-50 Lacs
- 20% from Access ; 75% from handling; 5% from others
- 1 rake will yield ~ INR 50,000 so a daily rake will yield access revenue of ~15 Lacs per month. (20 Rs/Tonne x 2500 tonnes/train x 30 days)

Break Even / Profitability

These broad numbers yield a 20% EBITDA and 6-7-year break even period
It is important to note the numbers provided above can vary based on a number of factors including size of the terminal, type of commodities handled, mechanism of handling (i.e. mechanized or manual), among others
*Source: Deloitte Analysis

Based on the process defined above, the proposed districts identified as potential terminal locations (based on origin and destination demand) for each of the focus commodities, are presented in Sections below:

16.2.3. Cement

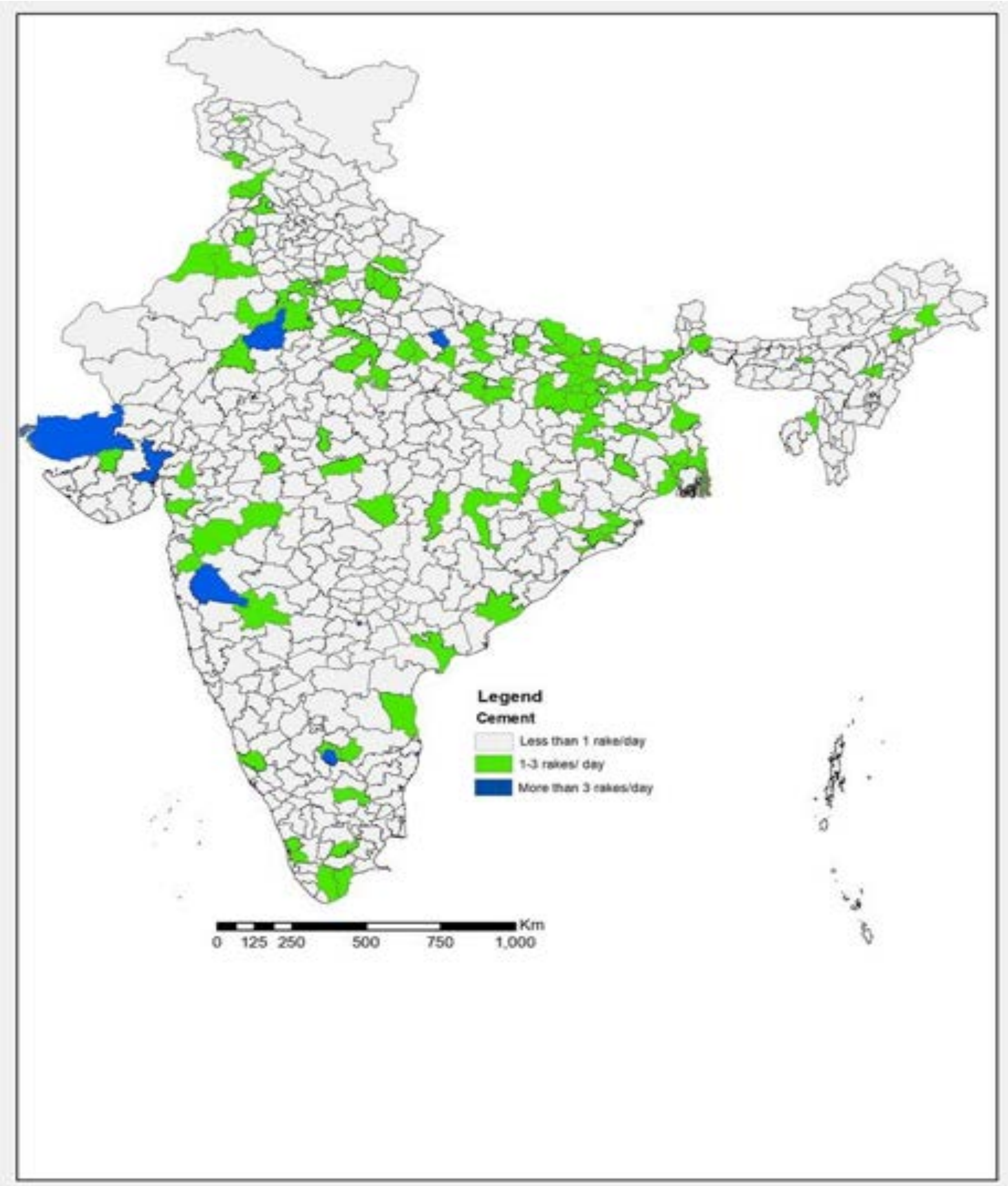


Figure 16-2: –Proposed Cement Terminal Locations

Table 16-1: Proposed Districts for Development of Cement Terminals

S.No.	Districts	Projected Rail Traffic, 2031 (MTs)
21.	Srinagar	1.4
22.	Jammu/ Gurdaspur/ Jalandhar	6.6
23.	Chandigarh	1.9
24.	Bhatinda/ Ganganagar/ Hanumangarh	3.6

S.No.	Districts	Projected Rail Traffic, 2031 (MTs)
25.	Meerut/ Jhajjar/ Aligarh/ Delhi	11.0
26.	Alwar/Sikar/ Jaipur/ Ajmer	10.4
27.	Nainital/ Bareilly/ Moradabad	5.7
28.	Agra/ Bhind/ Jhansi/ Gwalior	5.0
29.	Vadodara/ Ahmedabad	4.6
30.	Kachchh/ Morbi	4.8
31.	Vishakhapatnam/ Krishna	3.7
32.	Lucknow/ Kanpur Nagar/ Kanpur Dehat/ Raebareilly/ Gonda/ Faizabad/ Sultanpur	12.4
33.	Allahabad/ Mirzapur/ Varanasi	4.4
34.	Gorakhpur/ Gopal Ganj/ Purba Champaran/ Muzaffarpur/ Saran/ Vaishali	14.2
35.	Patna/ Nalanda/ Buxar/ Rohtas/ Aurangabad/ Gaya/ Nawada	12.5
36.	Ranchi/ Hazaribagh/ Dhanbad/ Purbi Singhbhum	6.9
37.	Bhagalpur/ Purnea/ Kishanganj/ Jalpaiguri	5.1
38.	Kamrup Metropolitan	1.2
39.	Tinsukia/ Shivsagar	2.2
40.	Madurai/ Tirunelvelli/ Kottayam/ Ernakulam	5.2
41.	Bangalore / Bangalore rural/ Kolar	11.0
42.	Kohima/ North Tripura	3.6
43.	Hugli/ Purba Medinipur/ North 24 Paraganas	9.6
44.	Jajpur/ Cuttack/ Khorda	4.1
45.	Raigarh/ Raipur/ Sambalpur/ Rajnandgaon	6.1
46.	Nagpur	1.7
47.	Hoshangabad/ Bhopal/ Indore	4.9
48.	Surat/ Nashik/ Jalgaon	4.6
49.	Mumbai/ Thane/ Pune/ Solapur	9.5
50.	Chennai/ Nellore	7.1
51.	Hyderabad	3.3
52.	Kottayam / Ernakulam	3.9
53.	Murshidabad / Paschim Bardhaman	4.7

16.2.4. Steel

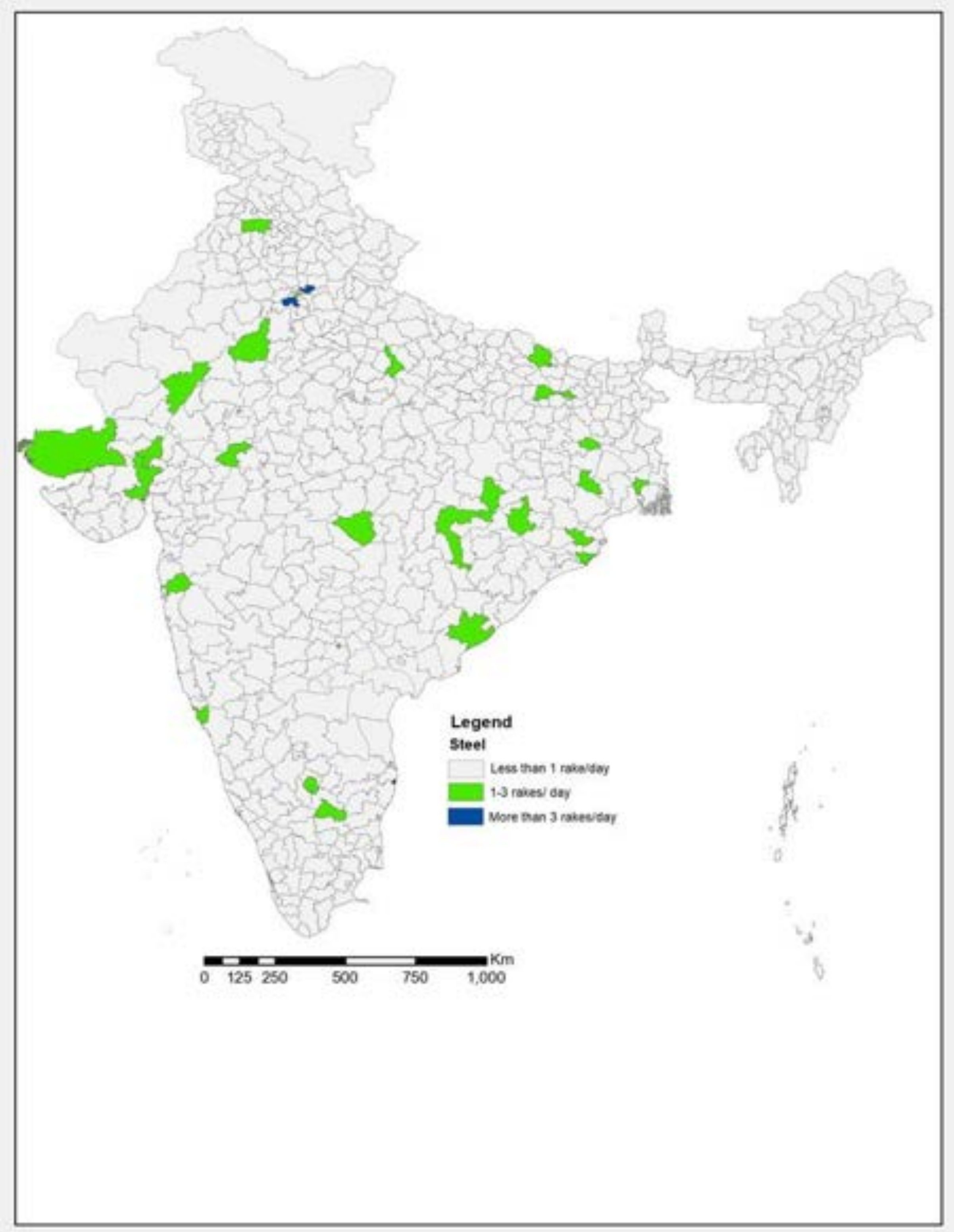


Figure 16-3: –Proposed Steel Terminal Locations

Table 16-2: Proposed Districts for Development of Steel Terminals

S.No.	Districts	Projected Rail Traffic, 2031 (MTs)
1.	Ludhiana	2.1
2.	Ghaziabad/ Gurgaon/ Delhi	7.8
3.	Jaipur	1.5
4.	Pali	2.4
5.	Kachchh	1.5
6.	Mehsana/Ahmedabad	4.2
7.	Thane	2.4
8.	Ratlam	1.9
9.	Nagpur	2.3
10.	Kanpur Nagar	1.0
11.	Purba Champaran/ Patna	2.7
12.	Dhanbad/ Purbi Singhbhum/ Howrah	4.6
13.	Jajpur/ Jagatsinghpur	2.1
14.	Raigarh/Sambalpur/ Raipur	4.7
15.	Vishakhapatnam	1.5
16.	Hyderabad	2.7
17.	Chennai	4.4
18.	Bangalore/ Dharmapuri	3.5
19.	South Goa	1.7
20.	Kamrup Metropolitan	4.4

16.2.5. EXIM Containers

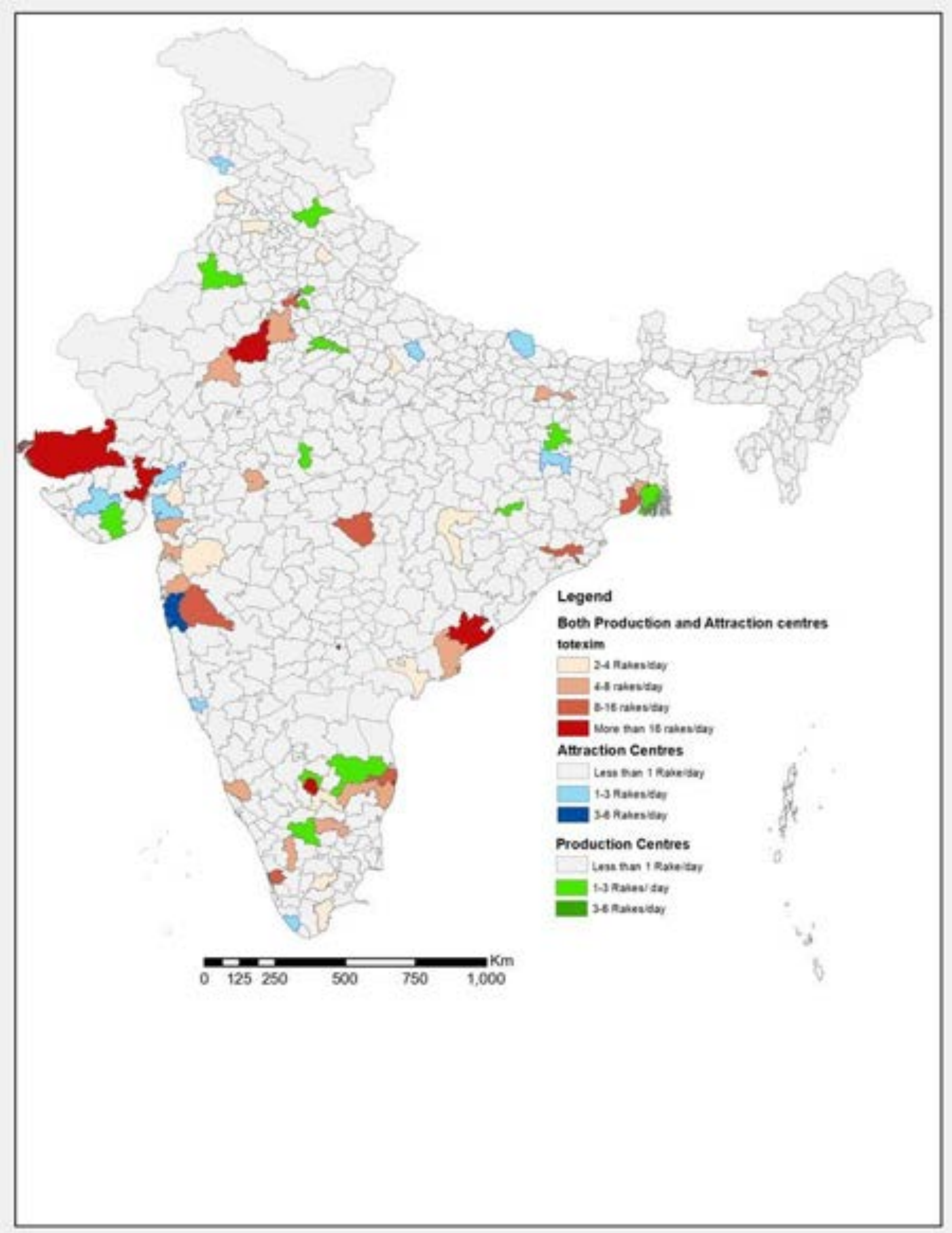


Figure 16-4: –Proposed Terminal Locations for Exim Containers

Table 16-3: Proposed Districts for Development of Exim Container Terminals

S.No.	Districts	Projected Rail Traffic, 2031 (MTs)
29.	Jammu/ Amritsar	5.1
30.	Ludhiana	2.3
31.	Shimla/ Haridwar	3.9
32.	Ghaziabad/ Gurugram/ New Delhi/ Faridabad	40.3
33.	Alwar/ Jaipur/ Ajmer	29.5
34.	Kachchh	33.1
35.	Rajkot/ Amreli	4.2
36.	Ahmedabad/ Kheda/ Bharuch/ Surat	52.6
37.	Valsad/ Nashik	7.4
38.	Thane/ Pune/ Raigarh/ Mumbai	102.5
39.	North Goa	2.5
40.	Dakshina Kannada	4.6
41.	Bangalore Rural/ Bangalore	32.8
42.	Chennai/ Thiruvallur/ Chittoor/ Vellore/ Kancheepuram	119.1
43.	Erode/ Salem/ Coimbatore/ Ernakulam	22.9
44.	Thiruvananthapuram/ Thoothukkudi	4.3
45.	Krishna/ East Godavari/ Vishakhapatnam	27.0
46.	Nagpur	8.1
47.	Raipur/ Jharsuguda	4.8
48.	Cuttack	9.7
49.	Howrah/ Kolkata/ Purba Medinipur/ South 24 Paraganas	116.2
50.	Ranchi/ Hazaribagh	4.1
51.	Patna	4.3
52.	Paschim Champaran	1.4
53.	Lucknow/ Kanpur	5.1
54.	Hyderabad	21.8
55.	Kamrup Metropolitan	9.7
56.	Bhopal/ Indore	7.3

16.2.6. Domestic General Goods/ Balance Other Goods

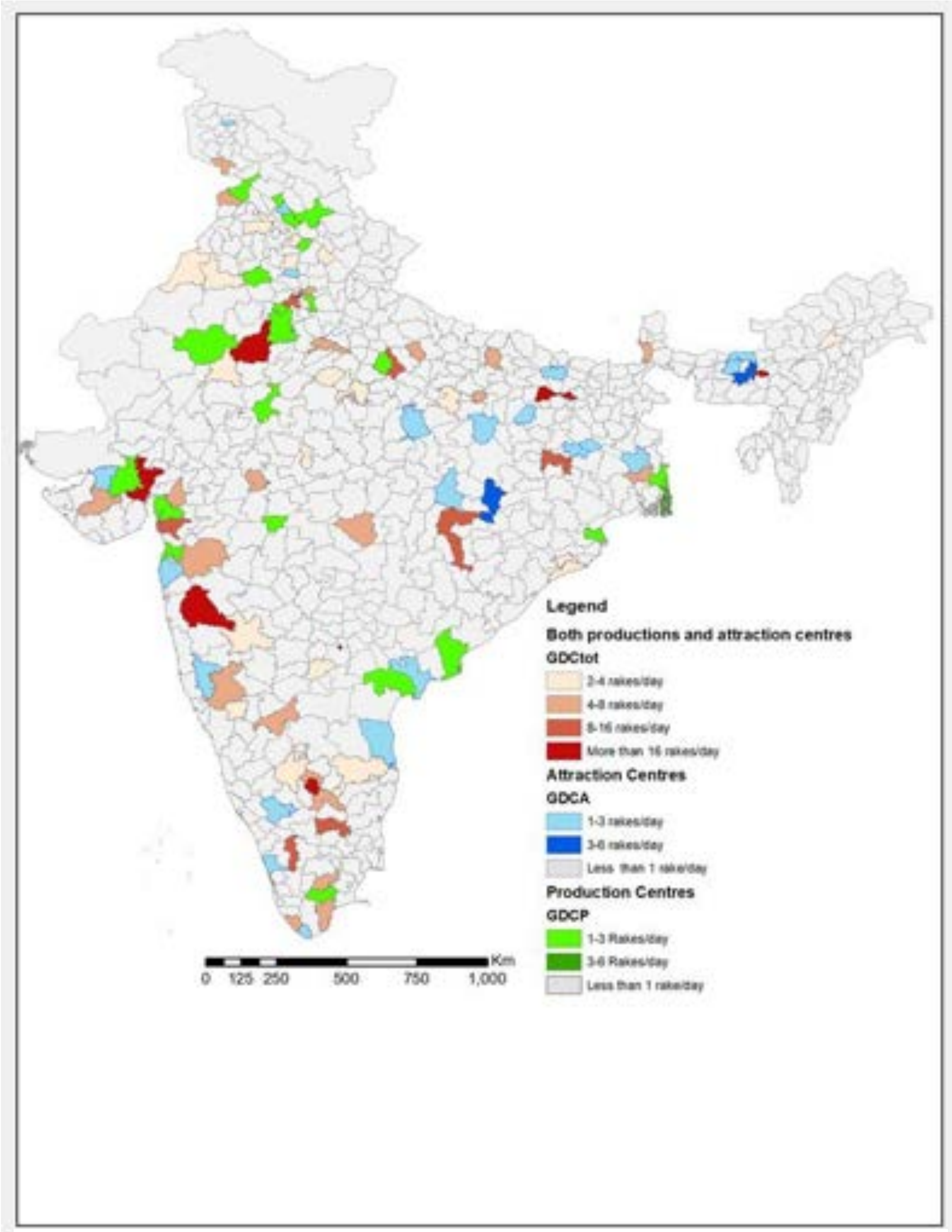


Figure 16-5: –Proposed Terminal Locations for Balance Other Goods

Table 16-4: Proposed Districts for Development of Terminals for Balance Other Goods

S.No.	Districts	Projected Rail Traffic, 2031 (MTs)
34.	Srinagar	2.1
35.	Jammu/ Gurdaspur/ Amritsar	11.4
36.	Ludhiana/ Shahid Bhagat Singh Nagar/ Solan/ Shimla/ Hamirpur/ Chandigarh	18.1
37.	Ambala/ Yamuna Nagar/ Karnal/ Panipat/ Haridwar	15.1
38.	Ganganagar/ Hanumangarh/ Hisar	8.9
39.	Jaipur/ Nagaur/ Ajmer	21.6
40.	Rajkot/ Surendranagar/ Ahmedabad/ Morbi	36.9
41.	Vadodara/Bharuch/ surat	18.5
42.	Valsad/ Nashik/Palghar	11.4
43.	Nagpur/Burhanpur	9.1
44.	Pune/ Solhapur	29.0
45.	Kolhapur/ Belgaum/ Bellary/ Dharwad	13.0
46.	Tumkur/ Bangalore/ Bangalore rural/ Krishnagiri/ Mysore/ Salem	81.5
47.	Coimbatore/Thrissur	10.6
48.	Thiruvananthapuram/Kanyakumari	6.9
49.	Hyderabad/ Mahabubnagar	27.0
50.	East Godavari/ West Godavari/ Guntur/ Krishna	6.9
51.	Raipur/ Bilaspur/ Raigarh	15.8
52.	Bhadrak/ Khorda / Puri	7.7
53.	Hugli/ North 24 Paraganas/ Purba Bardhaman	9.0
54.	Baksa/ Barpeta/ Kamrup Metropolitan	25.3
55.	Lakhimpur	2.5
56.	Gorakhpur	4.5
57.	Ranchi/ Bokaro/Dhanbad	14.1
58.	Aurangabad/ Patna/ Muzaffarpur	20.7
59.	Lucknow/ Kanpur Nagar/ Kanpur Dehat	18.0
60.	Varanasi/ Allahabad/ Sonebhadra/ Satna	12.7
61.	Gwalior/ Jhansi/ Agra	8.7
62.	Kota	1.9
63.	Bhopal/ Indore	9.8
64.	Madurai/ Virudhunagar/ Thoothukudi	10.2
65.	Ghaziabad/ Gautam Budh Nagar/ Faridabad/ Gurgaon/ Rewari/ Delhi/ Alwar	69.6
66.	Chitoor/ Nellore	4.0

16.3. Multi Commodity Terminals: Assessment of Co-location and Clustering Potential

> **Concept of co-locating terminals could attract terminal developers/ operators with its inherent advantages**
>
> **Co-locating two or more terminals can generate cost savings for the terminal operator with respect to investment in rail siding, connecting infrastructure, and equipment; facilities within the terminal; echnology for terminal operations, etc.**

Based on identification of the districts as potential terminal locations for the four focus commodities, a further assessment was undertaken to identify districts that are characterized by sizeable addressable freight volumes for more than one commodity. In order to extract maximum benefit of potential economies of scale in operations, it is accordingly proposed that multi-commodity terminals be considered for such locations. After identification of such locations, cargo potential in adjoining districts was also considered/ evaluated. Locations clusters (with more than one district) were accordingly identified such that a terminal(s) could potentially cater to traffic produced and/or consumed within the cluster.

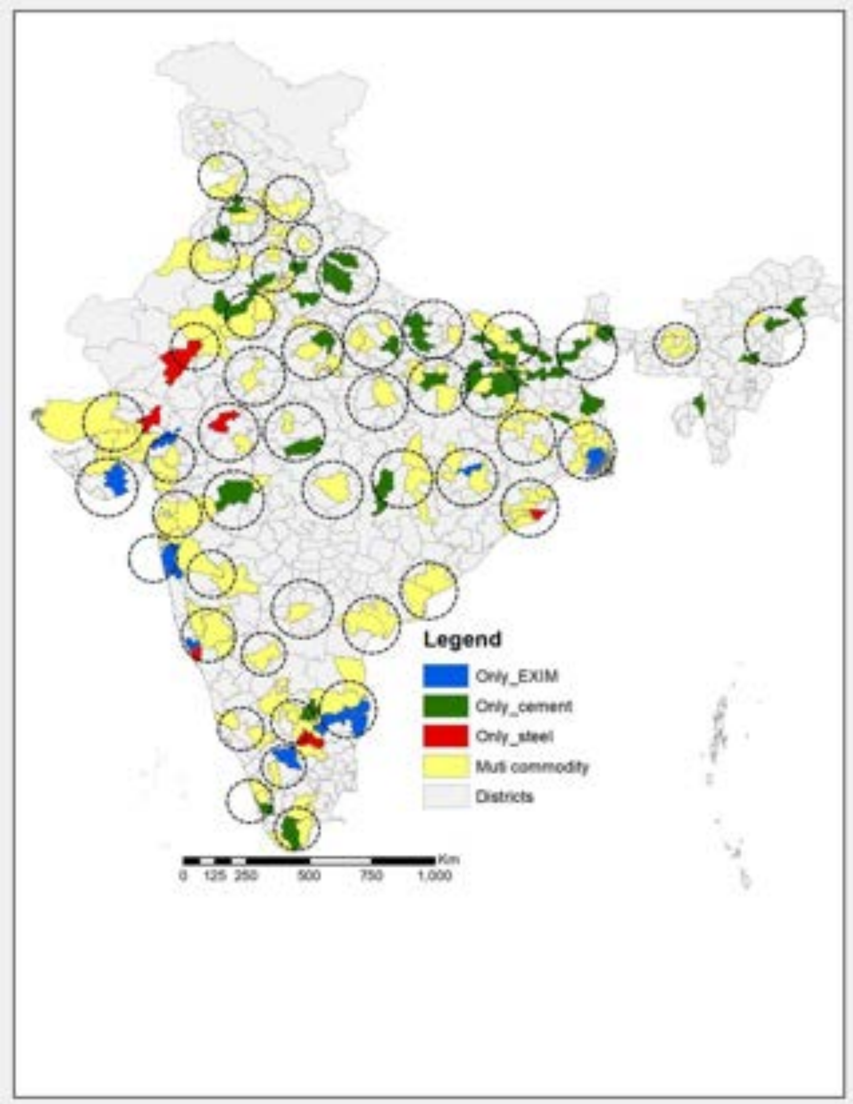


Figure 16-6: –Proposed Multi Commodity Terminal Clusters

The process of cluster identification in itself was based on multiple factors including location/number of urban centres, geographic characteristics such as natural hinterland formation, freight volumes spread across districts etc.

A map with a consolidated view of clusters having potential for development of multi-commodity terminals, with respect to overall cargo volumes, is presented below.

Finally, the list of identified clusters have been prioritized with reference to potential freight volumes produced/consumed within the cluster over the horizon period up to 2031.

Table 16-5: Priortised Clusters for Multi Commodity Terminals

S. No	Cluster	Potential Districts	Projected Rail Traffic, 2031 (MTs)	Existing MMLPs
43.	National Capital Region	Gurgaon/Hisar/Jhajjar/Karnal/Panipat/ Gautam Buddha Nagar/Ghaziabad/Meerut/ Faridabad/South West Delhi/New Delhi/ Central Delhi/	142.38	Yes
44.	Chennai	Chittoor/Nellore/Chennai/Kancheepuram/ Thiruvallur/Vellore	141.25	Yes
45.	Kolkata	Haora/Hugli/Kolkata/North 24 Parganas/Purba Medinipur/ South 24 Parganas/	139.53	Yes
46.	Bangalore	Bangalore Rural/Bangalore/Kolar/ Tumkur/Krishnagiri/	116.48	Yes
47.	Greater Mumbai	Mumbai/Raigarh/Thane	100.71	Yes
48.	Ahmedabad	Ahmedabad/Kheda/Mahesana/ Surendranagar/	82.67	Yes
49.	Rewari-Jaipur	Mahendragarh/Rewari/Alwar/Jaipur/ Sikar	60.99	Yes
50.	Hyderabad	Hyderabad/Mahbubnagar	55.61	Yes
51.	Patna	Arwal/Aurangabad/Buxar/Gaya/Jehanabad/Lakhisarai/Munger/Nalanda/Nawada/Patna/Rohtas/Saran/Vaishali	49.82	Yes
52.	Pune	Pune/Solapur/	45.87	Yes
53.	Morbi	Kachchh/Morbi	41.65	Yes
54.	Guwahati	Baksa/Barpeta/Kamrup Metropolitan/ Kamrup	40.68	Yes
55.	Kanpur	Kanpur Dehat/Kanpur Nagar/Lucknow/ Rae Bareli	35.67	Yes
56.	Surat-Vadodara	Bharuch/Surat/Vadodara	35.49	Yes
57.	Coimbatore	Ernakulam/Kottayam/Thrissur/ Coimbatore	34.08	Yes
58.	Vishakhapatnam	East Godavari/Vishakhapatnam	31.38	Yes
59.	Jajpur	Cuttack/Jagatsinghapur/Khordha/Puri/ Bhadrak/Jajapur/	29.42	Yes
60.	Jammu-Amritsar	Jammu /Srinagar /Amritsar /Gurdaspur	27.20	No
61.	Gorakhpur	Darbhanga/Gopalganj/Muzaffarpur/ Pashchim Champaran/Purba Champaran/Saharsa/Sitamarhi/ Gorakhpur/	25.72	Yes
62.	Nashik	Valsad/Nashik/Palghar	22.69	Yes
63.	Thiruvananthapuram	Thiruvananthapuram/Kanniyakumari/ Thoothukkudi/Tirunelveli/	22.53	Yes
64.	Chandigarh-Haridwar	Chandigarh/Ambala/Yamunanagar/ Haridwar	22.29	Yes
65.	Salem	Dharmapuri/Erode/Salem	21.91	Yes
66.	Raipur	Raipur/Rajnandgaon/Bilaspur	21.76	Yes

S. No	Cluster	Potential Districts	Projected Rail Traffic, 2031 (MTs)	Existing MMLPs
67.	Allahbad-Varanasi	Allahabad/Mirzapur/Sonbhadra/Varanasi	21.42	Yes
68.	Ranchi	Purbi Singhbhum/Ranchi	20.28	Yes
69.	Goa	North Goa/South Goa/Belgaum/ Dharwad/Kolhapur	19.73	Yes
70.	Nagpur	Nagpur	19.47	Yes
71.	Ajmer	Ajmer/Nagaur/Pali	17.83	Yes
72.	Indore	Indore/Ratlam	17.55	Yes
73.	Jharsuguda	Raigarh/Jharsuguda/Sambalpur	17.30	Yes
74.	Siliguri	Bhagalpur/Kishanganj/Purnia/Darjiling / Jalpaiguri	17.19	No
75.	Bilaspur	Bilaspur/Hamirpur/Shimla/Solan	16.76	Yes
76.	Ludhiana	Jalandhar/Ludhiana/ Shahid Bhagat Singh Nagar	16.06	Yes
77.	Bokaro-Dhanbad	Bokaro/Dhanbad/Hazaribagh	15.13	Yes
78.	Bhatinda	Bhatinda/Ganganagar/Hanumangarh	14.86	No
79.	Murshidabad	Purba Barddhaman/Murshidabad/ Paschim Barddhaman	12.02	Yes
80.	Rajkot	Amreli/Rajkot	11.17	No
81.	Bareilly	Bareilly/Moradabad/Rampur/Nainital	10.97	Yes
82.	Gwalior	Bhind/Gwalior/Jhansi	10.69	Yes
83.	Guntur	Guntur/Krishna	10.20	Yes
84.	Agra	Agra/Aligarh	10.16	Yes
85.	Madurai	Madurai/Virudunagar	9.95	No
86.	Mysore	Dakshina Kannada/Mysore	9.90	Yes
87.	Tinsukhia-Dimapur	Lakhimpur/Sivasagar/Tinsukia/Dimapur/ Kohima	9.83	No
88.	Bhopal	Bhopal/Hoshangabad	9.82	Yes
89.	Jalgaon	Burhanpur/Jalgaon	6.65	Yes
90.	Faizabad	Faizabad/Gonda/Sultanpur	5.84	No
91.	Bellary	Bellary	5.61	No
92.	Kota	Kota	4.11	Yes
93.	Satna	Satna	2.24	No

The above list was analysed against existing MMLP/Freight Terminal Network operated by CONCOR and private players in the country. This revealed a number of clusters in the above list where no Freight Terminals/MMLPs Capacity exists currently. In absence of any other facility, the comparative priority for terminal capacity development in these clusters could be higher and IR may take up development of MMLPs in these clusters accordingly.

16.4. Comparison with Locations Proposed by Other Agencies

The identified clusters/districts were also compared with various locations identified in other studies carried out by different government agencies. The following studies were evaluated:

- Study on Logistic Efficiency and Enhancement Program (LEEP) by Ministry of Road Transport and Highways, 25 locations
- Marketing Plan for Dedicated Freight Corridor Corporation Limited, 34 locations
- Integrated Logistics Plan by Department of Logistics, Ministry of Commerce, locations

Table 16-6: Proposed Terminal Locations by Other Agencies

Studies	DISTRICTS (not identified under NRP)	Identified Districts in Vicinity
DFC Marketing Plan	Banaskantha	Can be served by Kachchh
DFC Marketing Plan	Bulandshar	Can be served by Aligarh/ Ghaziabad
DFC Marketing Plan	Palwal	Can be served by Gurugram
DFC Marketing Plan	Patiala	Can be served by Ludhiana
DFC Marketing Plan	Firozabad	Can be served by Agra
DFC Marketing Plan	Koderma	Can be served by Gaya/ Hazaribagh
Integrated Logistics Plan	Akola	Can be served by Nagpur
Integrated Logistics Plan	Jasidih	Can be served by Dhanbad
Integrated Logistics Plan	Ratnagiri	Can be Served by Raigarh/Pune

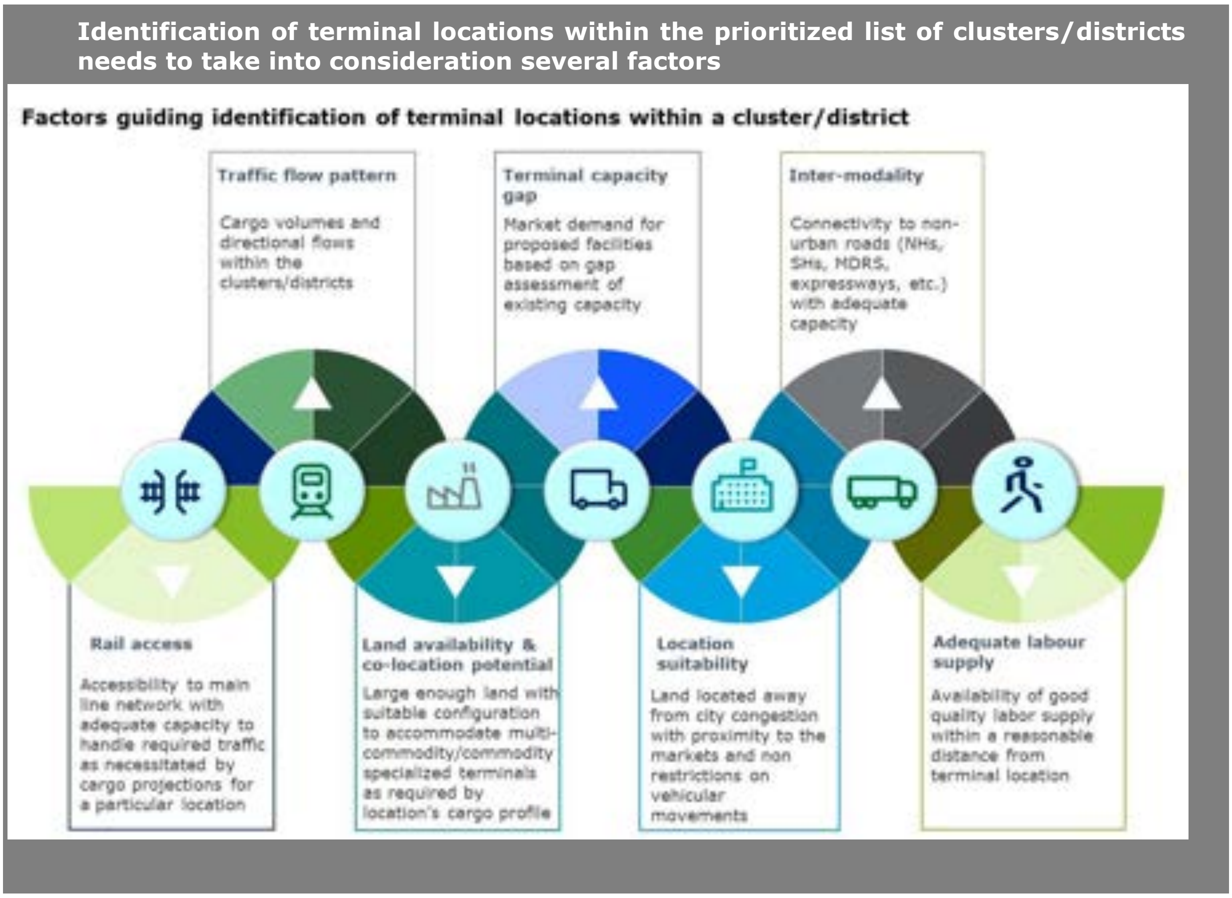
The proposed list of districts identified under this study for freight terminal capacity development broadly reconciles with locations identified in the above-mentioned studies barring a small number of exceptions. Upon further analysis, it was revealed that such terminals (identified in the above-mentioned studies) were proposed either in a neighboring district or within the same cargo cluster – as presented below.

16.5. Factors guiding identification of land parcels within Districts

It is important to note that identification of potential locations under this study is based on overall cargo O-D patterns including volumes which are already being handled on the existing IR network of goods sheds/terminals. Some of the identified locations will therefore have some terminal capacity that may or may not be adequate. As in case of development of all such projects, a specific exercise would need to be undertaken going forward for each terminal locations/clusters – focused on location specific feasibility assessment and identification of terminal features/ infrastructure requirements, in order to arrive at the final project structure for each terminal development.

A few factors governing the identification of suitable locations within each district and those which should form a part of detailed feasibility studies are presented in the exhibit below:

16.6. Improving Terminal Quality



Chapter 17 MULTIMODAL PASSENGER TERMINALS

17.1. Existing Situation

On the basis of the existing travel demand pattern which has been derived from the ticket sales data, total number of passengers from each of the railway terminal has been estimated for the base year (2018).

It may be noted here that district is the basic spatial unit or the Traffic Area Zone (TAZ) which has been explained earlier in the chapter on the "travel demand model". Each of the district is linked to the network through one station which is usually the major station. Thus, number of passengers handled at each station is the summation of the total demand of a district.

There are around 24 (no.) terminals (station clusters) that handle more than 2,00,000 passengers per day. The list of terminals along with the constituent stations and the total number passengers handled for the base year is compiled and given at Table below.

Table 17-1: List of Railway Terminal Cluster, and the total number of passengers handled in 2018

S. No	Railway terminal clusters	Passengers Handled
1.	Mumbai	1,03,55,456
2.	Thane	39,81,454
3.	Howrah	28,32,090
4.	Chennai	16,99,708
5.	North 24 Parganas	10,89,093
6.	New Delhi	10,41,749
7.	Hooghly	9,88,198
8.	South 24 Parganas	7,86,195
9.	Hyderabad	6,26,861
10.	Kanchipuram	4,51,716
11.	Pune	4,32,481
12.	Nadia	4,22,336
13.	Bangalore	3,87,721
14.	Patna	3,71,317
15.	Raigad	3,06,507
16.	Thiruvallur	2,81,786
17.	Paschim Medinipur	2,76,565
18.	Surat	2,68,521
19.	Lucknow	2,50,448
20.	Buldhana	2,28,094
21.	Ahmedabad	2,24,897
22.	Purba Barddhaman	2,21,785
23.	Paschim Bardhaman	2,12,887
24.	Varanasi	2,04,634

Source: compiled from the UTS and PRS data, CRIS

Mumbai Cluster of station handles the largest number of passengers in the country followed by Thane and Howrah cluster of stations.

17.2. Passenger Demand Forecast by Terminal Clusters

The passenger demand in terms of the footfall at the various Railway Stations has been forecasted using the results of the travel demand forecast model. This demand has been forecasted for all the cardinal years using the Passenger OD Matrices where the total number top 24 clusters (identified earlier which have a demand of more than 2,00,000 Passengers per day) is given at Table below.

Table 17-2: Base & Horizon Year Demand Forecast by Station Clusters (Footfalls > 2,00,000 passengers/ day)

S. No	Railway terminal clusters	Total Number of Passengers Handled in the Year				
		2018	2026	2031	2041	2051
1.	Mumbai City	1,03,55,456	11,592,463	13,709,937	16,232,817	19,719,808
2.	Thane	39,81,454	4,367,749	4,897,336	5,498,405	6,682,498
3.	Howrah	28,32,090	3,101,024	3,568,996	4,117,600	5,054,987
4.	Chennai	16,99,708	1,878,599	2,158,456	2,486,107	2,898,546
5.	North 24 Parganas	10,89,093	1,178,657	1,325,320	1,490,581	1,801,809
6.	New Delhi	10,41,749	1,192,061	1,423,777	1,712,042	2,388,011
7.	Hooghly	9,88,198	1,066,695	1,195,959	1,341,041	1,616,466
8.	South 24 Parganas	7,86,195	848,122	951,448	1,067,479	1,284,265
9.	Hyderabad	6,26,861	712,184	864,586	1,054,618	1,352,431
10.	Kanchipuram	4,51,716	486,894	537,047	592,960	674,277
11.	Pune	4,32,481	487,286	583,396	700,881	867,788
12.	Nadia	4,22,336	461,577	521,791	590,132	723,122
13.	Bangalore	3,87,721	440,965	522,012	622,269	799,485
14.	Patna	3,71,317	448,923	585,107	771,539	1,228,381
15.	Raigad	3,06,507	338,756	383,611	435,378	537,172
16.	Thiruvallur	2,81,786	302,576	331,190	362,820	412,899
17.	Paschim Medinipur	2,76,565	302,664	343,005	389,210	480,316
18.	Surat	2,68,521	303,697	356,102	418,939	567,155
19.	Lucknow	2,50,448	297,648	372,334	470,852	703,964
20.	Buldhana	2,28,094	252,259	286,203	325,532	404,445
21.	Ahmedabad	2,24,897	264,801	329,133	413,258	583,988
22.	Purba Barddhaman	2,21,785	243,001	275,903	313,529	385,570
23.	Paschim Bardhaman	2,12,887	234,840	268,460	307,407	386,894
24.	Varanasi	2,04,634	237,186	286,422	347,969	507,691

These 24 terminal/ station clusters are proposed to be taken up for upgradation immediately. The upgradation plan / interventions for each these clusters will have to be drawn up depending on the proposed footfall. As a first preference, the major station of these clusters will be taken up for upgradation so that the demand can be met. However, in case, there are physical, land or any other constraints to expand any station to meet the demand, directional terminals for the main station may be considered in the same district.

It is forecasted that with time more terminals /stations clusters will be added to this list which will handle more than 2,00,000 passengers/ day. Total number of such terminals along with the new terminals added with passengers handled more than 2,00,000 per day for each cardinal years is given at table below.

Table 17-3: Number of Terminal / Station Clusters (Footfalls > 2,00,000 Pax/ Day)

S. No	Cardinal Year	Number of Terminals	New Terminals
1	2018	24	-
2	2026	38	14
3	2031	50	12
4	2041	77	27
5	2051	96	19

The details of passenger footfalls for the cardinal years for these for is given at **ANNEXURE 17.1:** The list of these station is given at Table below.

Table 17-4: Phasing of Station Upgradation

S.No	2026	2031	2041	2051
1	Jaipur	Gaya	Allahabad	Gwalior
2	Rohtas	Saran	Dhanbad	Gonda
3	Munger	Vadodara	Bhagalpur	Saharanpur
4	Palghar	Chittoor	Purnia	Nashik
5	Kanpur Nagar	Bhopal	Bareilly	Ratlam
6	Ernakulam	Bilaspur	Raipur	Kheda
7	Guntur	Kollam	Jodhpur	Amritsar
8	Valsad	Muzaffarpur	Moradabad	Mysore
9	Darbhanga	Nagpur	Mathura	Sri Potti Sriramulu Nellore
10	Hazaribagh	Ranchi	Jalgaon	Bharuch
11	Gorakhpur	Ghaziabad	Vellore	Karnal
12	Krishna	Agra	Visakhapatnam	Birbhum
13	Gurgaon		Murshidabad	Dharwad
14	Kathgodam		Palakkad	Solapur
15			Khordha	Puruliya (Purulia)
16			Thanjavur	Rohtak
17			Kota	East Godavari
18			East Singhbhum	Ludhiana
19			Ambala	Gulbarga
20			Kannur	
21			Jhansi	
22			Jabalpur	
23			Meerut	
24			Kozhikode	
25			Coimbatore	
26			Sri Ganganagar	
27			Durg	

Thus, it is proposed that these stations should be taken up for the upgradation as per the schedule given at Table above. The sizing of these stations will be done as per the forecasted number of passengers to be handled by each station cluster.

17.3. Stations for Multimodal integration

As per the details given in the recommendation for network improvement, it is proposed that in addition to Indian Railway network, following modes are also taken up for development:

1. High-Speed Rail (HSR)
2. Semi High-Speed Rail (Thiruvananthapuram–Kasaragod Semi High-Speed Rail Corridor in Kerala)
3. Rapid Rail Transit System (RRTS)

Additional stations have been identified for upgradation where a multimodal integration will have to be carried out as per the details given below:

17.4. Integration with High Speed Rail (HSR)

As per the HSR master plan, 13 (no.) corridors have been identified for the implementation as a part of the National Rail Plan. The corridors along with their phasing are given in the table below.

Table 17-5: Phasing of HSR Corridors

SN	HSR Corridor	Proposed Year of Implementation
1	Mumbai Ahmedabad	2026
2	Delhi Varanasi via Ajodhya	2031
3	Delhi Ahmedabad	2031
4	Varanasi to Patna	2031
5	Patna to Kolkata	2031
6	Hyderabad Bangalore	2041
7	Nagpur Varanasi	2041
8	Mumbai Nagpur	2051
9	Mumbai Hyderabad	2051
10	Patna Guwahati	2051
11	Delhi Chandigarh Amritsar,	2051
12	Amritsar - Pathankot - Jammu	2051
13	Chennai to Mysuru via Bangalore	2051

The proposed stations for these HSR Corridors are given at Table 6. There are 13 (no.) stations that are do not appear in the list of stations to be upgraded have been highlighted. Similarly, three (no.) stations i.e. Bharauch, Vadodara, Jodhpur and Dhanbad stations which appear in the original list, but their upgradation has been preponed so that it is in line with the proposed corridor development.

17.5. Semi High-Speed Rail (Thiruvananthapuram–Kasaragod Semi High-Speed Rail Corridor in Kerala)

A high-speed railway connecting Thiruvananthapuram with Kasaragod with speed of 200 KMPH being implemented by K-Rail (Kerala Rail Development Corporation), a joint Venture Company between Ministry of Railways and Government of Kerala is proposed as the network proposals. The major stations include Thiruvanthpuram, Kollam, Kottayam, Ernakulam, Thrissur, Kozhikode, Kannur, Kasaragod. It is proposed that four (no.) stations will be added to the list that will require upgradation and upgradation of Kollam will have to preponed in order to meet the development phasing of the corridor.

17.6. Rapid Rail Transit System (RRTS)

National Capital Region Planning Board (NCRPB) has proposed eight (no.) RRTS corridors for commuter traffic travelling between Delhi in NCR. Three (no.) corridors are already under implementation by National Capital Region Transport Corporation (NCRTC) and are proposed to be implemented by 2026. The remaining corridors will be implemented by 2031. It is proposed that eight (no.) stations will be added to the list that will require upgradation and upgradation of three station i.e. Rohtak, Ghaziabad and Meerut will have to preponed in order to meet the development phasing of these corridors.

Table 17-6: Proposed Stations for Multimodal Integration with Other Modes

Year	Rail Corridor	Station Names								
HSR Corridors										
2026	Mumbai Ahmedabad	Mumbai	Thane	Vapi	Valsad	Surat	Bharuch	Vadodara	Anand	Ahmedabad
2031	Delhi Varanasi via Ajodhya	Delhi	Agra	Lucknow	Ajodhya	Varanasi				
2031	Delhi Ahmedabad	Delhi	Jaipur	Ajmer	Jodhpur	Ahmedabad				
2031	Varanasi to Patna	Varanasi	Patna							
2031	Patna to Kolkata	Patna	Gaya	Dhanbad	Kolkata					
2041	Hyderabad Bangalore	Hyderabad	Kurnool	Bangalore						
2041	Nagpur Varanasi	Nagpur	Jabalpur	Katni	Satna	Varanasi				
2051	Mumbai Nagpur	Mumbai	Nanded	Wardha	Nagpur					
2051	Mumbai Hyderabad	Mumbai	Pune	Solapur	Gulbarga	Hyderabad				
2051	Patna Guwahati	Patna	Begusarai (Barauni)	Katihar	New Jalpaiguri	New Bongaigaon	Guwahati			
2051	Delhi Chandigarh Amritsar,	Delhi	Karnal	Chandigarh	Ludhiana	Jalandhar	Amritsar			
2051	Amritsar - Pathankot - Jammu	Amritsar	Pathankot	Jammu						
2051	Chennai to Mysuru	Chennai	Bengaluru	Mysuru						
Semi High-Speed Rail										
2031	Semi High-Speed Rail	Thiruvanthpuram	Kollam	Kottayam	Ernakulam	Thrissur	Kozhikode	Kannur		
Rapid Rail Transit System (RRTS)										
2026	Delhi Ghaziabad Meerut	Delhi	Ghaziabad	Meerut						
2026	Delhi Sonipat Panipat	Delhi	Sonipat	Panipat						
2026	Delhi Gurgaon Rewari Alwar	Delhi	Gurgaon	Rewari	Alwar					
2031	Delhi Ghaziabad Khurja Aligarh	Delhi	Ghaziabad	Khurja	Aligarh					
2031	Delhi Ghaziabad Hapur	Delhi	Ghaziabad	Hapur						
2031	Delhi Rohtak	Delhi	Rohtak							
2031	Delhi Faridabad Mathura Agra	Delhi	Faridabad	Mathura	Agra					
Notes:										
	Stations which have to be added in the list of station to be upgraded									
	Stations which appear in the list of stations to be upgraded but their upgradation have to be preponed									

17.7. Updated List of Station to be upgraded

The list of stations to be upgraded has been revised to include the stations that will multi-modal integration. This revised is given at Table below.

Table 17-7: Updated List of Stations For Upgradation

S. No	New Stations to be taken up for upgradation in the year			
	2026	2031	2041	2051
1	Jaipur	Gaya	Allahabad	Gwalior
2	Rohtas	Saran	~~Dhanbad~~	Gonda
3	Munger	~~Vadodara~~	Bhagalpur	Saharanpur
4	Palghar	Chittoor	Purnia	Nashik
5	Kanpur Nagar	Bhopal	Bareilly	Ratlam
6	Ernakulam	Bilaspur	Raipur	Kheda
7	Guntur	Kollam	~~Jodhpur~~	Amritsar
8	Valsad	Muzaffarpur	Moradabad	Mysore
9	Darbhanga	Nagpur	Mathura	Sri Potti Sriramulu Nellore
10	Hazaribagh	Ranchi	Jalgaon	~~Bharuch~~
11	Gorakhpur	~~Ghaziabad~~	Vellore	Karnal
12	Krishna	Agra	Visakhapatnam	Birbhum
13	Gurgaon	Ajodhya	Murshidabad	Dharwad
14	Kathgodam	Ajmer	Palakkad	Solapur
15	Vapi	Jodhpur	Khordha	Puruliya (Purulia)
16	Vadodara	Dhanbad	Thanjavur	~~Rohtak~~
17	Bharuch	Thiruvananthpuram	Kota	East Godavari
18	Ghaziabad	Kannur	East Singhbhum	Ludhiana
19	Meerut	Hapur	Ambala	Gulbarga
20	Rohtak	Khurja	~~Kannur~~	Begusarai
21		Aligarh	Jhansi	Katihar
22		Faridabad	Jabalpur	New Jalpaiguri
23			~~Meerut~~	New Bongaigaon
24			Kozhikode	Pathankot
25			Coimbatore	Jammu
26			Sri Ganganagar	
27			Durg	
28			Kurnool	
29			Katni	
30			Satna	
No. of Stations	**20**	**20**	**27**	**23**

A total of 90 stations qualify for upgradation. This list may undergo slight modifications after the DPRs for the HSR and RRTS corridors are carried out and the location of new stations are finalised.

17.8. Existing Proposals

Out of these 90 stations, 14 stations have already been taken up for the Indian Railway Station Development Corporation (IRSDC). These stations are:

Chapter 1 Bhopal (Habibganj)
Chapter 2 New Delhi (Bijwasan and Anand Vihar)

Chapter 3 Chandigarh
Chapter 4 Nagpur
Chapter 5 Gwalior
Chapter 6 Amritsar
Chapter 7 Ahmedabad (Sabarmati)
Chapter 8 Mumbai (Shivaji Nagar)
Chapter 9 Surat
Chapter 10 Thane (Thakurali)
Chapter 11 Bangaluru (Baiyyappanahalli)
Chapter 12 Jaipur (Gandhinagar)
Chapter 13 Kanpur
Chapter 14 Chandigarh

The additional capacities being created at these stations may be considered while formulating the plans for expansion of these stations.

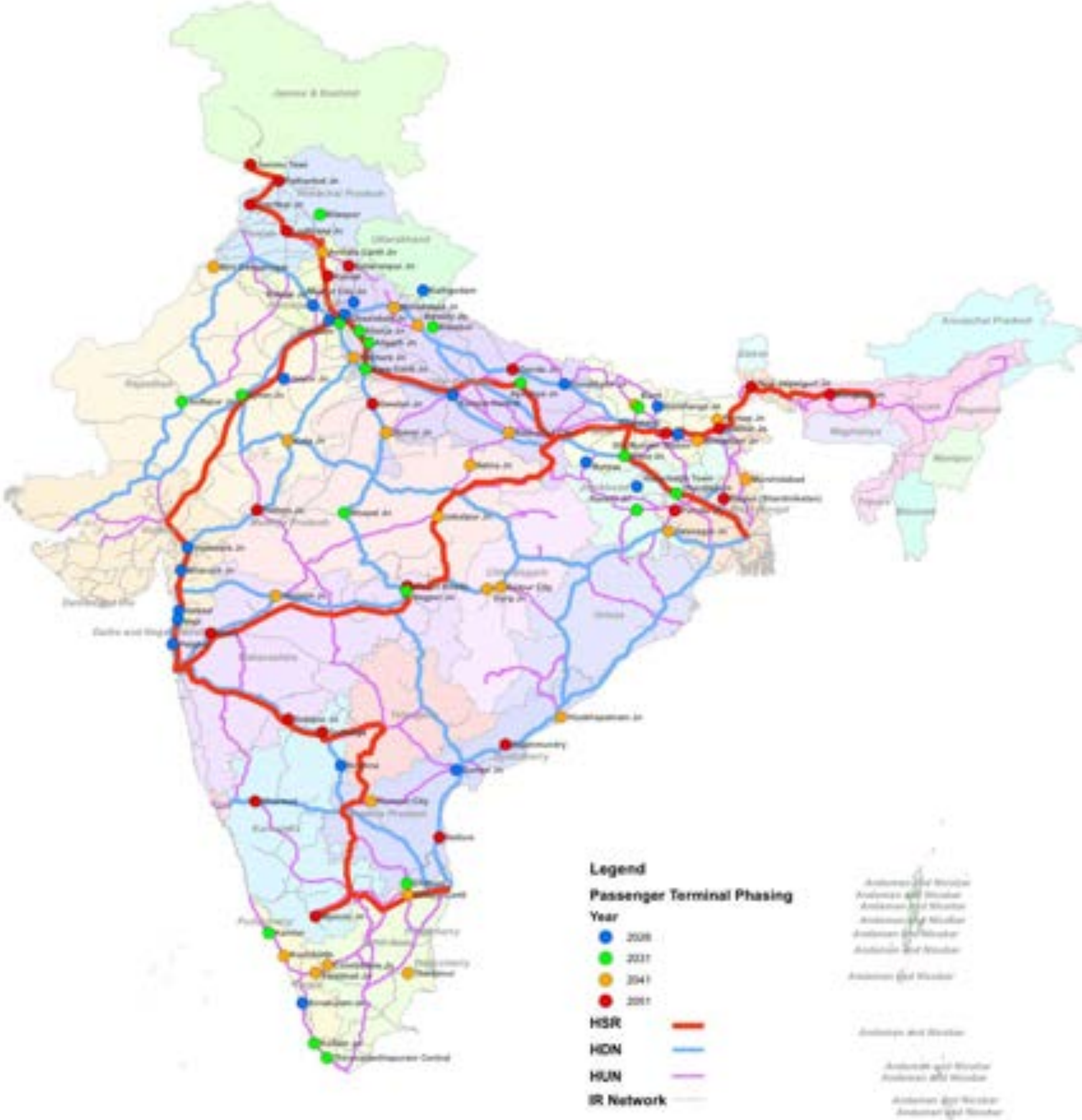


Figure 17-1: Passenger Terminal Phasing

Chapter 18 OTHER PROJECTS

18.1. Background

The Indian Railways has a route spread of nearly 67,378 km, out of this 22,021 km (33%) is either double or multiple lines. More than 50% of these double or multiple tracks are on the Golden Quadrilateral, connecting the 4 metropolises, along with the golden diagonals. Most of the railway network is still single line and there is a dire need to increase the double or multiple sections particularly of the congested network.

About 40% of the Indian Railways' network is congested, as both freight and passenger traffic move simultaneously on these sections. Out of 1,245 controlled sections, nearly 482 sections are having capacity utilization in excess of 100%.

In addition to network upgradation proposals for HDN and HUN, based on demand forecast, network improvement proposals have also been recommended for network other than HDN/ HUN.

Line Capacity charts of all the major sections in all divisions were provided by Ministry of Railways. Same were analysed in order to obtain the percentage utilisation of each section.

In addition, Chapter also details out the capacity analysis and provides other railway network development proposals such as Junctions Flyovers and Bypasses.

18.2. Summary of Upgradation Proposals on Network Other than HDN/ HUN

Other than, HDN, HUN, DFC and HSR 39,029 Network Km is present in Indian Railway. To comply with the demand of HDN, HUN, DFCs the upgradation is required in the others network also. These networks connect with the Class I, Class II and Class II cities and the villages. The improvement in these networks will provide efficiency on the main HDN and HUN Network also.

Table 18-1: Doubling Works in Other Network

	Network KM					Line KM				
Conversion	**2026**	**2031**	**2041**	**2051**	**Total**	**2026**	**2031**	**2041**	**2051**	**Total**
Single to Double Line	3185	809	5564	3916	**13474**	3185	809	5564	3916	**13474**
Single to Quadruple Line	141	0	0	0	**141**	424	0	0	0	**424**
Double to Triple Line	37	172	758	841	**1807**	37	172	758	841	**1807**
Double to Quadruple Line	68	7	387	137	**599**	136	14	775	273	**1198**
Double to 6 Lines	23	0	16	0	**39**	91	0	64	0	**155**
Triple to Quadruple Lines	36	5	34	37	**112**	36	5	34	37	**112**
Quadruple to 6 Lines	7	32	11	0	**50**	14	63	22	0	**99**
6 Lines to 8 Lines	0	0	19	9	**28**	0	0	38	18	**56**
Total	**3498**	**1024**	**6790**	**4939**	**16251**	**3924**	**1063**	**7255**	**5085**	**17326**

Majority of the proposals are Single to Double Lines and Double to Triple Lines. Extra Multiple Lines are required in Shorter sections as Bypasses and flyovers. 16,621 Network KM requires increase of 17,326 Line Km. Total 3,539 Network Km will require Automatic Signalling.

Table 18-2: Automatic Signalling in Others Network

	2026	2031	2041	2051
Single Line	0	0	0	0
Double Line	1286	490	1520	2456
Triple Line	76	184	932	900
Quadruple Line	277	16	423	173
6 Lines	30	32	27	0
8 Lines	0	0	19	9
Network KM	**1668**	**722**	**2921**	**3539**
Line KM	**4087**	**1786**	**7841**	**8379**

The Indian Railways has a route spread of nearly 67,378 km, out of this 22,021 km (33%) is either double or multiple lines. More than 50% of these double or multiple tracks are on the Golden Quadrilateral, connecting the 4 metropolises, along with the golden diagonals. Most of the railway network is still single line and there is a dire need to increase the double or multiple sections particularly of the congested network.

Detail list of improvement proposals for other network by LC sections are presented in detail in **ANNEXURE 18.1**:.

18.3. Line Capacity Utilization Analysis and Improvement Measures

The basic concept behind the capacity enhancement is to augment both the capacity of the tracks and decongest junctions. Doubling/tripling/quadrupling will create track capacity. This will help to segregate freight and passenger traffic which have different speeds and thus demand differential infrastructure and operational dynamics.

To understand the level of utilisation of the rail network, line capacity utilisation data of different division was analysed. The network which has a capacity utilisation of more than 80% was considered as the congested network or the network which need capacity augmentation in term of additional line or new line.

The division wise over utilisation analysis has been carried out and the same has been presented in the following table. After identifying the congested section, the improvement works proposed by railways were analysed. The capacity of the congested sections will be improved with the construction and development of all the planned projects.

The capacity and utilisation level of all the congested sections was again calculated to understand the impact of planned project. On some sections even after the improvement measures or the mitigation plan, the capacity utilisation with Maintenance Block (MB) was above 80%. Improvement proposals have been recommended for Sections, where even after carrying out, ongoing improvement works, percentage utilisation still remains higher than 80%.

Summary of capacity analysis and improvement proposals is presented in the tables below.

Table 18-3: Summary of Capacity Analysis and Interim Improvement Proposals

S. No	Zone	Total Sections	No. of Saturated Sections	No. of Sections improved after completion of Sanctioned works)	No. of Sections Saturated after improvements

1	CR	88	47	23	24
2	ECR	90	36	34	2
3	ER	98	60	11	49
4	NCR	54	34	18	16
5	NER	48	23	12	11
6	NFR	72	30	4	26
7	NR	207	96	23	73
8	NWR	69	17	10	7
9	ECOR	75	34	23	11
10	SR	123	23	14	9
11	SCR	104	57	17	40
12	SECR	40	23	7	16
13	SER	74	28	11	17
14	SWR	82	12	7	5
15	WCR	46	19	6	13
16	WR	142	45	15	30

Source: Line Capacity Utilisation Chart

The detail list of improvement proposals for each section by division is presented in subsequent tables.

Table 18-4: Summary of Capacity Analysis and Interim Improvement Proposals for Central Railway (CR) Zone																
S. No.	Section	Div.	Length (Km)	Line	Charted Capacity		Avg. No. of Trains Run each Way				% age Utilisation		Works in Progress	Capacity after work Completion	% Utilisation after Completion	Further Works Required to be done
					WOMB	WMB	P	Gds	Others	Total	WOMB	WMB				
1	CSTM - DR	BB	9	Th/DL	205	170	176	0.0	30.4	206	101	121	1)08-09: 5th & 6th line approved in MUTP in adv stage of approval. 2) 15-16 Extension of PF No.10, 11, 12&13 at CSTM.3) Parel Terminus Sub WIP	300	68.8	--
2	DR-CLA	BB	7	Th/DL	205	170	194	0.0	15.0	209	102	123	1)08-09: 5th & 6th line approved in MUTP II	300	70	--
3	CLA-TNA	BB	18	DL	205	170	194	0.0	15.8	210	102	123	LTT-Augmentation of coaching facilities Thane elevated station proposal by TMC in process.		102	3rd line is required
4	TNA-DW	BB	9	Th/DL	205	170	231	4.5	11.6	247	121	145	1) 08-09: 5th & 6th line approved in MUTP II. WIP	300	82	--
5	DW-KYN	BB	11	DL	205	170	217	4.5	11.2	233	114	137			114	3rd line is required
6	CSTM - VDLR	BB	9	DL	288	240	271	0.0	3.7	275	95	114			95	3rd line is required
7	VDLR - CLA	BB	6	DL	280	233	229	0.6	3.8	233	83	100			83	3rd line is required
8	CLA-MNKD	BB	7	DL	268	223	229	0.0	3.7	233	87	104			87	3rd line is required
9	MNKD-VSH	BB	9	DL	288	240	231	0.0	3.7	235	81	98			81	3rd line is required
10	VSH - BEPR	BB	10	DL	288	240	252	0.0	3.3	255	89	106			89	3rd line is required
11	KYN - TLA	BB	11	DL	144	120	142	6.6	4.6	153	106	128	11-12: Kalyan- Kasara third line WIP	216	71	--

Table 18-4: Summary of Capacity Analysis and Interim Improvement Proposals for Central Railway (CR) Zone

S. No.	Section	Div.	Length (Km)	Line	Charted Capacity		Avg. No. of Trains Run each Way				% age Utilisation		Works in Progress	Capacity after work Completion	% Utilisation after Completion	Further Works Required to be done
					WOMB	WMB	P	Gds	Others	Total	WOMB	WMB				
12	TLA-ASO	BB	21	DL	70	58	99	6.6	4.6	110	157	190	1)11-12: Kalyan- Kasara third line WIP	105	105	Automatic Signalling
13	ASO - KSRA	BB	35	DL	70	58	77	6.1	4.6	88	125	151	1)11-12: Kalyan- Kasara third line WIP	105	84	Automatic Signalling
14	KSRA - IGP	BB	16	TL	54	45	57	6.1	4.2	67	125	150	Ghat section. 1) 12-13: Igatpuri- Extension of PF's for dealing 24/26 coaches with banker.		125	Automatic Signalling
15	KYN-BUD	BB	14	DL	144	120	163	4.4	4.0	171	119	143			119	Automatic Signalling
16	KJT-LNL	BB	28	TL	48	40	49	8.6	5.0	63	130	157	1)10-11: Karjat- additional line from Karjat- Palasdhari(3kms), Ghat section 2) 08-09 Lonavala- Extension of Platforms to 24 coaches3) Lonavala-Pune 3/4th line by MRVC approved	64	98	Automatic Signalling
17	BSR -DW	BB	42	DL	48	40	25	19.1	2.8	47	98	118	1) 08-09: Provision of IBS in 1 section. Commissioned 2) 10-11 : Bhivandi road- New loop line to deal full rake parcel 3)12-13: Provision of Automatic signalling	60	78	--

Table 18-4: Summary of Capacity Analysis and Interim Improvement Proposals for Central Railway (CR) Zone																
S. No.	Section	Div.	Length (Km)	Line	Charted Capacity		Avg. No. of Trains Run each Way				% age Utilisation		Works in Progress	Capacity after work Completion	% Utilisation after Completion	Further Works Required to be done
					WOMB	WMB	P	Gds	Others	Total	WOMB	WMB				
18	DW-PNVL	BB	26	DL	56	46	38	25.4	4.2	68	121	147	1) 12-13: Provision of Automatic signalling 2)12-13 -Panvel-Kalamboli - New coaching terminal WIP	70	97	3rd line is required
19	KJT - KHPI	BB	14	SL	17	14	19	0.0	1.5	21	121	146			121	Doubling is required
20	PNVL - KJT	BB	28	SL	17	14	11	4.3	2.0	17	102	124			102	Doubling is required
21	IGP-MMR	BSL	124	DL	60	50	42	8.0	3.0	53	88	106	Igatpuri-Manmad - 3rd line (124 km)	90	59	--
22	MMR-NGN	BSL	25	DL	62	52	47	14.3	3.6	65	105	125	2016-17-3RD line MMR-JL sanctioned	90	72	--
23	NGN - JL	BSL	135	DL	62	52	47	16.7	2.8	67	107	128	2016-17-3RD line MMR-JL sanctioned	90	74	--
24	JL - BSL	BSL	24	DL	80	66	58	29.3	2.1	89	112	135	1) 11-12: Jalgaon - Bhusaval 3rd line 2) ABS sanctioned 3) 2016-17 4th line sanctioned.	160	56	--
25	BSL - KNW	BSL	123	DL	62	52	36	9.7	5.9	52	83	99			83	Automatic Signalling
26	BSL - BD	BSL	219	DL	62	52	25	29.8	3.3	58	94	112			94	Automatic Signalling
27	BD - WR	NGP	95	DL	62	52	27	32.2	3.1	62	101	120	2015-16 3rd line sanctioned 2.Wardha-Chitoda 2nd chord line 4.25 km sanction	90	69	--

Table 18-4: Summary of Capacity Analysis and Interim Improvement Proposals for Central Railway (CR) Zone

S. No.	Section	Div.	Length (Km)	Line	Charted Capacity		Avg. No. of Trains Run each Way				% age Utilisation		Works in Progress	Capacity after work Completion	% Utilisation after Completion	Further Works Required to be done
					WOMB	WMB	P	Gds	Others	Total	WOMB	WMB				
28	WR - NGP	NGP	79	DL	63	53	47	25.8	3.1	76	120	143	1) 12-13 - 3rd line between WR-NGP WIP. 2.Wardha-Nagpur 4th line sanction 3.Ajni-development as satellite terminal.	125	61	--
29	NGP-AMF	NGP	167	DL	44	37	29	19.6	2.1	51	115	137	1. 10-11Godhara-Kalumana doubling of chord line 4.8 km commissioned total13.7 ks 2 3rd line between AMF-NGP sanction.3.Teegaon-Chichoda 3rd Ghat line 16.53 km sanction.4.Godhra-NGP-Khapri Automatic Signalling in place of Absolute Block system.	90	56	--
30	AMF- ET	NGP	130	DL	42	36	32	19.4	3.2	55	130	152	Ghat section 1) 15-16, 3rd line between AMF-ET sanctioned.	70	78	--
31	WR - BPQ	NGP	132	DL	58	48	26	36.1	2	64	111	134	15-16, 3rd line between WR-BPQ sanctioned.	90	71	--
32	BTBR - URR	NGP	34	SL	8	7	0	6.6	0.0	7	83	94			83	Doubling is required
33	LNL - TGN	PUNE	30	DL	68	55	62	8.6	0.3	71	104	129	1)04-05: Automatic signalling LNL-Pune.(PH 33) commissioned upto	150	47	--

Table 18-4: Summary of Capacity Analysis and Interim Improvement Proposals for Central Railway (CR) Zone																
S. No.	Section	Div.	Length (Km)	Line	Charted Capacity		Avg. No. of Trains Run each Way				% age Utilisation		Works in Progress	Capacity after work Completion	% Utilisation after Completion	Further Works Required to be done
					WOMB	WMB	P	Gds	Others	Total	WOMB	WMB				
													KMST 2) 16-17:PA-LNL 3rd/4th line suburban corridor under MUTP execution by MRVC.			
34	TGN - PUNE	PUNE	35	DL	64	54	64	8.6	0.4	73	114	135	1)04-05 :Automatic signalling LNL-Pune (PH 33)commissioned upto KMST 2) 15-16:PA-LNL 3rd/ 4th line sanctioned (PH15)	150	49	--
35	PUNE - DD	PUNE	76	DL	65	55	48	9.1	0.7	58	89	105	1.Pune-Daund Chord line for connecting with Daund-Manmad Main line 2.Hadapsar- Development as Satellite terminal		89	Automatic Signalling
36	PA - STR	PUNE	145	SL	23	19	15	3.8	1.2	20	87	105	1)15-16:PA-MRJ-Londa Doubling (PH15) execution	50	40	--
37	STR - SLI	PUNE	126	SL	24	20	15	3.7	1.3	20	83	100	15-16:PA-MRJ-Londa Doubling (PH15)	50	40	--
38	SLI - MRJ	PUNE	7	SL	24	20	16	3.9	1.3	21	88	106	Miraj upgradation of interlocking Std II® approved.		88	Doubling is required
39	DD - BRMT	PUNE	44	SL	6	5	4	0.6	0.4	5	83	100	OHE work in progress.		83	Doubling is required
40	Daund-Bhigwan	SUR	28	DL	63	53	34	14.2	2.3	51	80	95			80	Automatic Signalling

Table 18-4: Summary of Capacity Analysis and Interim Improvement Proposals for Central Railway (CR) Zone

S. No.	Section	Div.	Length (Km)	Line	Charted Capacity		Avg. No. of Trains Run each Way				% age Utilisation		Works in Progress	Capacity after work Completion	% Utilisation after Completion	Further Works Required to be done
					WOMB	WMB	P	Gds	Others	Total	WOMB	WMB				
41	BGVN - KWV	SUR	81	SL	31	26	28	9.1	1.0	38	123	147	1)08-09: Doubling/Electrification of Doubling Bhigvan - Vakav section .WIP	60	64	--
42	KWV - MO	SUR	45	SL	31	26	26	9.2	1.0	36	117	139	08-09: Doubling/Electrification Solapur to Vakav Doubling 55.7 KMS commissioned, Balance section Engg, OHE WIP	60	60	--
43	Mohol - Solapur	SUR	34	DL	64	54	30	14.3	2.5	47	73	87	08-09: Electrification of Solapur - Mohol . Solapur to Vakav. OHE WIP		73	--
44	Solapur-Hotgi	SUR	16	DL	64	54	39	12.2	4.1	55	86	102	08-09: Electrification of Solpaur - Hotgi section Hotgi-Akalkot and Mohol-Vakav OHE work commissioned.		86	Automatic Signalling
45	HG - GR	SUR	98	SL	31	26	25	10.3	1.8	37	120	143	08-09: Doubling/Electrification of Hotgi-Gulbarga section .WIP	60	62	--
46	Gulbarga-Wadi	SUR	37	DL	63	53	32	14.9	3.6	51	80	95	08-09: Electrification of GR - Wadi section WIP		80	Automatic Signalling
47	DD - MMR	SUR	237	SL	26	22	17	5.5	2.2	25	95	112	16-17 Doubling work sanctioned.	60	41	--

Source: Line Capacity Utilisation Chart

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone

Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
1	Ranital Link Cabin - Bhadrak	KUR	5	DL	ABS	80	72	49	17.01	3.38	69.39	87%	96%	-	80	87	Automatic Signalling
2	Bhadrak - Jakhapura	KUR	51	DL	ABS	68	61	49	22.24	8.47	79.71	117%	131%	1. 3rd line between Bhadrak-Jakhapura sanctioned in 2012-13 & executed by CAO (C)/BBS; TDC- 2020-21. 2. Bhdrak - Vizianagram - 3rd line in balance section 525 kms	105	76	--
3	Haridaspur - Nergundi	KUR	30	DL	ABS	77	69	53	27.08	7.27	87.35	113%	127%	1. 3rd line between HDS-NRG sanctioned in 2012-13 & executed by CAO (C); TDC: 2020-21. 2. Haridaspur-Paradeep new B.G. line work is under progress; TDC: Dec'17(Revised TDC: Dec'18); TDC for Haridaspur-Kendrapara section: Mar'18	110	79	--
4	Nergundi - Cuttack	KUR	11	DL	A/M	93	84	61	37.80	4.78	103.58	111%	124%	1. Auto signaling between Nergundi-Cuttack section commissioned in	120	86	4th Line required

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone

Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
														Aug'16. 2. 3rd line between Nergundi - Barang sanctioned in 2015-16; TDC: Not fixed.			
5	Cuttack - Barang	KUR	12	DL	A/M	87	78	60	9.91	2.64	72.55	83%	93%	3rd line between Nergundi-Barang sanctioned in 2015-16; TDC: Not fixed.	120	60	--
6	Barang-Mancheswar	KUR	9	TL	A/M	103	93	74	23.01	2.64	99.65	97%	107%	1. 3rd line between Mancheswar-Bhubaneswar with one new crossing station is under progress; TDC: Oct'16 (Revised TDC: Mar'18). 2. 3rd line between Mancheswar - Barang commissioned in June'17. 3. 3rd line between Bhadrak-Vizianagaram balance section sanctioned; TDC: Not fixed.	120	83	4th Line required
7	Mancheswar-Bhubaneswar	KUR	7	TL	A/M	107	96	75	23.28	2.62	100.90	94.30%	105.10%	3rd line between Bhadrak - Vizianagaram balance section sanctioned; TDC: Not fixed.	120	84	4th Line required
8	Bhubaneswar - Khurda Road	KUR	19	TL	A/M	120	108	69	23.28	7.47	99.75	83%	92%	-	120	83	4th Line required

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone																		
Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
9	Khurda Road - Brahmapur	KUR	147	DL	ABS	66	59	47	23.83	5.37	76.20	115%	129%	1. 3rd line between Bhadrak-Vizianagaram balance section sanctioned; TDC : Not fixed. 2. IBS between Bhusandpur-Kaluparaghat sanctioned in 2016-17; TDC: Dec'17. 3. By pass line at Khurda Road sanctioned in 2015-16; TDC: Feb'18. iv) Khurda Road - Yard remodelling.	90	85	Automatic Signalling
10	Brahmapur - Palasa	KUR	74	DL	ABS	60	54	45	23.66	5.98	74.64	124%	138%	1. 3 IBSs in the section between Sompeta-Baruva- Mandasa Road and Surla Road-Ichhapuram sanctioned in 2016-17; TDC: Dec'17. 2. 3rd line between Bhadrak-Vizianagaram balance section sanctioned; TDC : Not fixed.	90	83	Automatic Signalling
11	Talcher - Budhapank	KUR	11	DL	ABS	66	59	22	41.81	9.99	73.80	112%	124%	1. Auto signalling is under progress;TDC: Oct'16 (Revised TDC: Mar'18).	120	62	--

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone

Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
														2.Budhapank - Salegaon via Rajatgarh 3rd & 4th line sanction 85.85 kms			
12	Talcher - Angul	KUR	19	SL	ABS	28	25	20	7.59	4.29	31.88	114%	127%	Talcher-Sambalpur doubling sanctioned ; TDC : Mar'21.	60	53	--
13	Angul - Budhapank	KUR	19	SL	ABS	27	24	20	7.73	6.40	34.13	126%	140%	1. 3rd & 4th line ex-Jarpada to Budhapank with fly over at Talcher Road sanctioned; TDC: Mar'21. 2. Angul-Sukinda Road new B.G. line work is under progress; TDC: June'18 (Baghuapal-Duburi-Sukinda section: Dec'17).	90	38	--
14	Budhapank - Rajathgarh	KUR	62	DL	ABS	71	64	22	43.89	7.76	73.65	104%	115%	1. Auto signalling is under progress;TDC : Oct'16 (Revised TDC: Mar'18). 2. 3rd & 4th line sanctioned between Budhapank-Salegaon via Rajathgarh section. TDC: Mar'21.	120	61	--

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone

Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
15	Cuttack - Paradeep	KUR	83	DL	ABS	55	50	6	33.28	10.53	49.81	91%	101%	Auto signalling is under progress;TDC: Dec'16 (Revised TDC: Not fixed).	75	66	--
16	Tomka-Chilikidara	KUR	35	SL	ABS	21	19	4	11.93	6.39	22.32	106%	118%	1. Doubling between Jakhpura- Banspani section sanctioned and work is being executed by M/s RVNL; 2. Doubling between Sitabinj-Chilikdara & Naranpur-Porjanpur sections commissioned in Apr'17; 3.TDC for balance Tomka-Banspani section:Feb.'17 (Revised TDC: June'19).	60	37	--
17	Sitibinj-Naranpur	KUR	23	SL	ABS	22	20	4	11.93	6.39	22.32	101%	113%	1. Doubling between Jakhpura- Banspani section sanctioned and work is being executed by M/s RVNL; 2. Doubling between Sitabinj-Chilikdara & Naranpur-Porjanpur sections commissioned in Apr'17; 3.TDC for balance Tomka-Banspani section: Feb.'17	60	37	--

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone																	
Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
														(Revised TDC: June'19).			
18	Porjanpur-Nayagarh	KUR	14	SL	ABS	19	17	3	13.28	6.39	22.67	119%	133%	1. Doubling between Jakhpura- Banspani section sanctioned and work is being executed by M/s RVNL; 2. Doubling between Sitabinj-Chilikdara & Naranpur-Porjanpur sections commissioned in Apr'17; 3.TDC for balance Tomka-Banspani section:Feb.'17 (Revised TDC: June'19).	60	38	--
19	Palasa - Naupada	WAT	26	DL	ABS	64	52	45	22.95	0.23	68.18	107%	131%	3rd line between Bhadrak-Vizianagaram balance section sanctioned; TDC: Not fixed.	90	76	--
20	Naupada - Vizianagaram	WAT	116.7	DL	ABS	61	50	43	23.19	0.23	66.42	109%	121%	i) 3rd line between Bhadrak-Vizianagaram balance section sanctioned; TDC: Not fixed. ii) 2 IBSs between Sigdam-Ponduru & Srikakulam-Urlam sanctioned in 2016-17; TDC: Mar'18.	90	74	--

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone

Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
														iii) By pass line at Vizianagaram sanctioned in 2015-16; TDC: Not fixed.			
21	Vizianagaram - Kottavalasa	WAT	35	TL	ABS	114	87	54	41.78	6.00	101.78	89%	117%	i) Second phase Vizianagaram yard remodelling in connection with 3rd line between Vizianagaram-Kottavalasa section; TDC- Dec'17 . ii) By pass line at Vizianagaram sanctioned in 2015-16; TDC: Not fixed. iii) 3rd line between Vizianagaram-Titlagarh-Sambalpur section sanctioned; TDC: Not fixed. iv) Auto Signalling between Gopalpatnam-Vizianagaram section sanctioned in 2017-18; TDC: Feb'19.	115	89	4th Line required
22	Kottavalasa - Simhachalam North	WAT	17	QL	ABS	128	94	56	50.62	10.25	116.87	91%	124%	Auto Signalling between Gopalpatnam-Vizianagaram section	155	75	--

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone

Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
														sanctioned in 2017-18; TDC: Feb'19.			
23	Simhachalam North - Gopalpatnam	WAT	3	DL	ABS	65	56	55	0.75	0.00	55.75	86%	100%	i) Simhachalam North-yard remodelling for removal of diamond crossings sanctioned in 2009-10. TDC: Mar'17 (Revised TDC: Sept'17). ii) Gopalpatnam yard remodelling commissioned. iii) Auto Signalling between Gopalpatnam-Vizianagaram section sanctioned in 2017-18; TDC: Feb'19.	85	66	--
24	Gopalpatnam - Visakhapatnam	WAT	7	DL	A/M	114	103	111	0.00	0.00	111.00	97%	108%	-	114	97	3rd Line required
25	Gopalpatnam - Duvvada	WAT	10	DL	A/M	77	65	62	2.46	3.15	67.61	88%	104%	Auto Signaling sanctioned in 2015-16; TDC-Mar'17(Revised TDC: Dec'17).	100	68	--
26	Koraput - Singapur Road	WAT	163.7	SL	ABS	18	13	7	6.71	4.85	18.56	103%	143%	i) Electrification has been sanctioned; TDC-Not fixed. ii) Doubling between Koraput-Singapuram Road sanctioned in 2015-16; TDC-Mar'22 (Koraput-	60	31	--

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone																	
Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
														Kakirigumma section: Mar'18).			
27	Singapur Road - Vizianagaram	WAT	133.5	DL	ABS	54	47	29	21.95	5.90	56.85	105%	121%	i) 3rd line between Vizianagaram-Titlagarh-Sambalpur section sanctioned; TDC: Not fixed. ii) 5 IBSs in the section between Donkinavalasa-Bobbili-Sitanagaram-Parvatipuram-Gumada and Rayagada-Singapur Road sanctioned in 2016-17; TDC- Dec'17.	90	63	--
28	Naupada - Gunupur	WAT	90	SL	OTOS	-	-	4	0.00	0.13	4.13	OTOS	OTOS	-			--
29	IB - Jharsuguda Road	SBP	9	SL	ABS	19	16	1	13.59	1.60	16.19	85%	101%	Fly over connection between IB - Jharsuguda Road sanctioned; TDC: Not fixed.	19	85	Doubling is required
30	Jharsuguda Road-Sambalpur	SBP	47	DL	ABS	51	48	23	27.15	2.00	52.15	102%	109%	i) Fly over between Jharsuguda - Brundamal sanctioned in 2008-09; Work is being executed by CAO(C) ; TDC: Mar'20. ii) Electrification of Lapanga-Sambalpur	51	102	Automatic Signalling

Table 18-5: Summary of Capacity Analysis and Interim Improvement Proposals for East Coast Railway (ECOR) Zone																	
Sl No.	Section	Div.	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Number of trains each way				% age Utilisation of Charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass	Goods	Others	Total	W/O MB	With MB				
														section is under execution;TDC: Oct'16 (Revised TDC: Oct'17)			
31	Sambalpur - Saragipalli	SBP	96	SL	ABS	27	24	16	10.61	1.45	28.06	104%	117%	Sambalpur- Talcher section doubling sanctioned. TDC: Mar/2021	54	52	--
32	Jarapada-Angul	SBP	24	SL	ABS	27	24	17	12.67	1.40	31.07	115%	129%	Doubling is in progress, TDC:Not fixed	54	58	--
33	Sambalpur - Hirakud	SBP	7	SL	ABS	25	22	17	10.83	1.43	29.26	117%	133%	Sambalpur-Titlagarh doubling work sanctioned; work is being executed by M/s RVNL.TDC-Mar/2019.	50	59	--
34	Deobahal-Titlagarh	SBP	151	SL	ABS	25	22	18	11.28	1.45	30.73	123%	140%	Sambalpur-Titlagarh doubling work sanctioned; work is being executed by M/s RVNL.TDC-Mar/2019.	50	61	--

Source: Line Capacity Utilisation Chart

Table 18-6: Summary of Capacity Analysis and Interim Improvement Proposals for East Central Railway (ECR) Zone

S. No.	Section	Division	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Coaching	Goods	Others	Total	W/O MB	WITH MB				
1	Gaya-Sonnagar	MGS	79.4	DL	ABS	66.0	56.1	28.9	26.8	3.0	58.7	88.94	104.63	1.Gomoh-Flyoverfor DN trains 2. Gaya -bypass line for Manpur.			--
2	Sonnagar - Dehri-on-Sone	MGS	5.76	DL	ABS	77.0	65.5	36.6	49.6	3.0	89.2	115.84	136.29	Nil			--
3	Dehri-on-Sone - Mughalsarai	MGS	117.15	TL	ABS	80.0	68.0	30.9	49.6	3.0	83.5	104.38	122.79	Nil			--
4	Valmikinagar Road-Narkatiaganj	SPJ	50.99	SL	ABS	19	16.15	19.00	12.00	2.00	33.00	173.68	204.33	Doubling & Electrification work under progress (Sanctioned year 2016-17).	50	66	--
5	Narkatiaganj-Sagauli	SPJ	58.54	SL	ABS	20	17.00	19.00	12.00	2.00	33.00	165.00	194.12				
6	Sagauli-Muzaffarpur	SPJ	100.58	SL	ABS	23	19.55	22.00	17.00	2.00	41.00	178.26	209.72				
7	Sagauli-Raxual	SPJ	29.19	SL	ABS	18	15.30	10.00	9.00	2.00	21.00	116.67	137.25				--
8	Samastipur-Darbhanga	SPJ	37.42	SL	ABS	24	20.40	34.00	11.00	4.00	49.00	204.17	240.20	Doubling under progress (Sanctioned year 2015-16).	50	98	Automatic Signalling
9	Darbhanga-Sakri	SPJ	19.31	SL	ABS	22	18.70	18.00	6.00	1.00	25.00	113.64	133.69	Electrification sanctioned in 2017-18.			--
10	Sakri-Jaynagar	SPJ	48.69	SL	ABS	19	16.15	16.00	6.00	1.00	23.00	121.05	142.41	Electrification sanctioned in 2017-18.			--
11	Samastipur-Khagaria	SPJ	85.88	SL	ABS	23	19.55	13.00	12.00	2.00	27.00	117.39	138.11	Electrification sanctioned in 2017-18.			--

Table 18-6: Summary of Capacity Analysis and Interim Improvement Proposals for East Central Railway (ECR) Zone

S. No.	Section	Division	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Coaching	Goods	Others	Total	W/O MB	WITH MB				
12	Mansi-Saharsa	SPJ	43.13	SL	ABS	24	20.40	18.00	8.00	2.00	28.00	116.67	137.25	Electrification sanctioned in 2014-15 & work under progress.			--
13	Chhapra Gramin-Sonpur	SEE	51.64	DL	ABS	50	42.50	29.00	12.00	3.00	44.00	88.00	103.53	NIL.			--
14	Sonpur-Hajipur	SEE	5.58	DL	ABS	50	42.50	39.00	16.50	3.00	58.50	117.00	137.65	NIL.			--
15	Hajipur-Ghoswar	SEE	5.33	DL	ABS	50	42.50	39.00	4.50	3.00	46.50	93.00	109.41	NIL.			--
16	Ghoswar-Ramdayalunagar	SEE	42.39	SL	ABS	30	25.50	25.00	4.50	3.00	32.50	108.33	127.45	Doubling between GWH-RD is a sanctioned work of PWP 2013-14.D/L section between RD-KHI opened on 18.04.2018.			--
17	Bachhwara-Barauni	SEE	16.52	DL	ABS	50	42.50	42.00	20.00	6.00	68.00	136.00	160.00	Yard remodelling work of BCA has been included in ongoing doubling project between HJP-BCA.			--
18	Barauni-Khagaria	SEE	55.54	DL	ABS	50	42.50	28.00	13.10	3.00	44.10	88.20	103.76	NIL.			--
19	Khagaria-Mansi	SEE	8.74	DL	ABS	50	42.50	34.00	15.50	3.00	52.50	105.00	123.53	NIL.			--
20	Koshi Block'Hut'-Kursela	SEE	3.82	SL	ABS	36	30.60	19.00	10.50	3.00	32.50	90.28	106.21	Doubling of Koshi Bridge is a	60	54	--

Table 18-6: Summary of Capacity Analysis and Interim Improvement Proposals for East Central Railway (ECR) Zone																		
S. No.	Section	Division	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Coaching	Goods	Others	Total	W/O MB	WITH MB				
														sanctioned work of 2012-13. TDC-2019.			
21	Hajipur-Bachhwara	SEE	71.31	SL	ABS	22	18.70	15.00	12.00	3.00	30.00	136.36	160.43	Doubling work sanctioned in 2015-16.ESP approved.Earth work is in progress.	44	68	--
22	Jhajha-Kiul	DNR	53	DL	ABS	54	45.90	42.00	18.00	5.00	65.00	120.37	141.61	RRI at Kiul & C/L at Bansipur. PI at Chaura BH & Bhalui sanctioned.			--
23	Kiul-Rampur Dumra	DNR	22	DL	ABS	54	45.90	54.00	18.00	5.00	77.00	142.59	167.76	PSR of 30Kmph at Kiul bridge.			--
24	Rampur Dumra-Tall	DNR	7	DL	ABS	48	40.80	38.00	10.00	5.00	53.00	110.42	129.90	PI at Hatidah.			--
25	Tall-Mokama	DNR	5	DL	ABS	54	45.90	50.00	10.00	5.00	65.00	120.37	141.61	NIL.			--
26	Mokama-Bakhtiyarpur	DNR	44	DL	ABS	63	53.55	48.00	10.00	5.00	63.00	100.00	117.65	NIL.			--
27	Bakhtiyarpur-Fatuha	DNR	24	DL	ABS	60	51.00	52.00	13.00	5.00	70.00	116.67	137.25	NIL.			--
28	Fatuha-Rajendra Nagar (T)	DNR	20	DL	ABS	59	50.15	57.00	13.00	5.00	75.00	127.12	149.55	NIL.			--
29	Rajendra Nagar (T)-Patna	DNR	2	DL	ABS	60	51.00	59.00	13.00	5.00	77.00	128.33	150.98	NIL.			--
30	Patna-Danapur	DNR	9	DL	ABS	60	51.00	59.00	13.00	5.00	77.00	128.33	150.98	PI at Block Hut 'A'(Sachiwalya Halt) sanctioned			--

Table 18-6: Summary of Capacity Analysis and Interim Improvement Proposals for East Central Railway (ECR) Zone																		
S. No.	Section	Division	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Coaching	Goods	Others	Total	W/O MB	WITH MB				
														& RRI/Danapur (2016 - 17).			
31	Danapur-Ara	DNR	39	DL	ABS	60	51.00	58.00	13.00	5.00	76.00	126.67	149.02	PI at Block Hut 'C' (In between Kulharia & Bihta) sanctioned (2016 - 17).			--
32	Ara-Buxar	DNR	69	DL	ABS	60	51.00	53.00	13.00	5.00	71.00	118.33	139.22	Critical Block section Baruna-Buxar.			--
33	Buxar-Mughalsarai	DNR	94	DL	ABS	60	51.00	52.00	13.00	5.00	70.00	116.67	137.25	NIL.			--
34	Patna-Gaya	DNR	92	DL	ABS	52	44.20	36.00	16.00	3.00	55.00	105.77	124.43	NIL.			--
35	Tall-Rajendrapul	DNR	13	SL	ABS	35	29.75	24.00	13.00	5.00	42.00	120.00	141.18	Doubling of Tall - Rajendrapul bridge already sanctioned (2016 - 17).	60	70	--
36	Rajendrapul-Rampur Dumra	DNR	7	SL	ABS	35	29.75	38.00	18.00	5.00	61.00	174.29	205.04	Doubling of Rampurdumra-Rajendrapur bridge already sanctioned (2016 - 17).	60	102	Automatic Signalling

Source: Line Capacity Utilisation Chart

Table 18-7: Summary of Capacity Analysis and Interim Improvement Proposals for Eastern Railway (ER) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Capacity each way		Average Nos. of Train Servcices Each way				% Utilisation of line Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WITH MB	W/O MB	Pass	Goods	Other	Total	WITH MB	W/O MB				
1	BARHARWA-SAHIBGANJ	MLDT	54.30	DL	ABS	32	35	19.0	7.0	4.5	30.5	95.3	87.1	OHE between Barharwa-Kiul work in progress.		87.1	Automatic Signalling
2	SAHIBGANJ - KAHALGAON	MLDT	43.88	DL	ABS	32	35	18.0	8.0	2.5	28.5	89.1	81.4	OHE between Barharwa-Kiul work in progress.		81.4	Automatic Signalling
3	KAHALGAON - BHAGALPUR	MLDT	30.37	SL	ABS	25	28	18.0	7.0	0.5	25.5	102.0	91.1	Doubling of Kahalgaon-Bhagalpur (10-11) work in progress.OHE between Barharwa-Kiul work in progress.	50	51	--
4	BHAGALPUR-RATANPUR	MLDT	46.64	DL	ABS	36	39	29.0	5.0	0.5	34.5	95.8	88.5	OHE between Barharwa-Kiul work in progress.		88.5	Automatic Signalling
5	RATANPUR-JAMALPUR	MLDT	6.35	SL	ABS	33	37	29.0	5.0	0.5	34.5	104.5	93.2	Doubling of Ratanpur-Jamalpur with Jamalpur yard remodelling.OHE between Barharwa-Kiul work in progress.	60		--
6	BONIDANGA LINK CABIN- BONIDANDA	MLDT	1.59	DL	ABS	41	45	22.0	22.0	0.5	44.5	108.5	98.9	OHE between Pakur-Maldatown work in progress.		98.9	Automatic Signalling
7	BONIDANGA-NEW FARAKKA	MLDT	12.05	DL	ABS	54	57	33.0	27.0	0.5	60.5	112.0	106.1	Conversion of line No.4 into common line & extn. of Up line No.1 to accommodate full length goods train at Tildanga(10-11).		106.1	3rd line is required

Table 18-7: Summary of Capacity Analysis and Interim Improvement Proposals for Eastern Railway (ER) Zone																	
S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Capacity each way		Average Nos. of Train Servcices Each way				% Utilisation of line Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WITH MB	W/O MB	Pass	Goods	Other	Total	WITH MB	W/O MB				
8	NEW FARAKKA-MALDA TOWN	MLDT	34.81	DL	ABS	53	57	39.0	22.0	0.5	61.5	116.0	107.9	OHE between Pakur-Malda Town in progress.Extension of down loop to accommodate full length goods train at Jamighata (11-12)		107.9	3rd line is required
9	MANIGRAM- NEW FARAKKA	MLDT	57.05	SL	ABS	21	23	17.0	3.0	1.0	21.0	100.0	91.3	Double line work between Manigram-New Farakka in progress.	42	50	--
10	KHANA-ANDAL	ASN	66.53	QL	ABS	123.0	131.0	81.0	31.0	21.5	133.5	108.5	101.9	Provision of cross over from Dn line 2 to Dn line 1 at Durgapur (09-10). Mankar addl. loop (10-11), Durgapur extn of Up & Dn loop (11-12). Andal conversion of DN line No.2 into common loop (12-13).		101.9	Automatic Signalling
11	ANDAL-ASANSOL	ASN	25.71	QL	ABS	117.0	123.0	76.0	46.0	16.5	138.5	118.4	112.6	Asansol stabling line MEMU rakes (08-09). Kalipahari re-arrangement of UP loops to accommodate full length trains (12-13).		112.6	Automatic Signalling
12	ASANSOL-SITARAMPUR	ASN	8.93	QL	ABS	114.0	118.0	85.0	36.0	9.0	130.0	114.0	110.2	Sitarampur remodelling of Yard (11-12).		110.2	Automatic Signalling

Table 18-7: Summary of Capacity Analysis and Interim Improvement Proposals for Eastern Railway (ER) Zone																		
S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Capacity each way		Average Nos. of Train Servcices Each way				% Utilisation of line Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WITH MB	W/O MB	Pass	Goods	Other	Total	WITH MB	W/O MB				
13	SITARAMPUR-CHOTAAMBONA	ASN	34.41	DL	AUT O	67.0	73.0	41.0	25.0	7.0	73.0	109.0	100.0			100.0	3rd line is required
14	CHOTAAMBANA-PRADHANKHANTA	ASN	5.55	DL	ABS	67.0	73.0	41.0	25.0	7.0	73.0	109.0	100.0			100.0	3rd line is required
15	SITARAMPUR-JASIDIH	ASN	101.45	DL	ABS	61.0	65.0	51.0	15.0	8.5	74.5	122.1	114.6			114.6	3rd line is required
16	JASIDIH-JHAJHA	ASN	43.93	DL	ABS	61.0	64.0	50.0	14.0	2.0	66.0	108.2	103.1	Jasidih extension of goods shed line (09-10)		103.1	3rd line is required
17	ANDAL-PANDABESWAR	ASN	20.34	TSL	ABS	36	39	13.0	12.0	17.5	42.5	118.1	109.0	Andal-Sainthia BG bypass line with direct connection from QL to Branch Line (12-13).		109.0	Automatic Signalling
18	HOWRAH-SORTING YARD RRI	HWH	3.11	6L	Auto	266	270	234.0	0.0	175.0	409.0	153.8	151.5	Howrah-extension of PF Nos.10,11,12 & 13 (13-14) . Tikiapara-Howrah removal of operational constraints by laying addl. track below Chandmari Bridge (11-12).		151.5	0
19	SORTING YARD RRI - BELUR	HWH	3.46	5L	Auto	244	248	234.0	4.0	32.0	270.0	110.7	108.9	Belur bypass connection for direct movement of EMU trains from Barddhaman/Bandel to Belur Math (10-11).		108.9	0
20	BELUR-SEORAPHULI	HWH	15.58	TL	Auto	167	171	159.0	0.5	5.0	164.5	98.5	96.2	Belur bypass connection for direct movement of EMU trains from		96.2	4th Line is required

Table 18-7: Summary of Capacity Analysis and Interim Improvement Proposals for Eastern Railway (ER) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Capacity each way		Average Nos. of Train Servcices Each way				% Utilisation of line Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WITH MB	W/O MB	Pass	Goods	Other	Total	WITH MB	W/O MB				
														Barddhaman/Bandel to Belur Math (10-11).			
21	SEORAPHULI-BANDEL	HWH	17.14	TL	Auto	123	128	109.0	0.5	3.0	112.5	91.5	87.9			87.9	4th Line is required
22	TARAKESWAR - ARAMBAGH	HWH	24.48	SL	ABS	15	17	13.0	0.0	1.0	14.0	93.3	82.4	New BG line between Goghat - Bishnupur (00-01).		82.4	Doubling required
23	ARAMBAGH - GOGHAT	HWH	9.57	SL	OTOS	8	10	6.0	0.0	1.0	7.0	87.5	70.0	New BG line between Goghat - Bishnupur (00-01).		70.0	--
24	BANDEL-SAKTIGARH	HWH	55.91	DL	ABS	79	83	70.0	7.0	2.0	79.0	100.0	95.2	3rd line between Bandel-Boinchi & Boinchi-Saktigarh (11-12).	105	75	--
25	BELUR-DANKUNI	HWH	8.24	DL	Auto	80	84	70	5.0	2.0	77.0	96.3	91.7				3rd line is required
26	DANKUNI-SAKTIGARH	HWH	68.07	TL	Auto/ABS	103	108	91	22.0	2.0	115.0	111.7	106.5	4th line between Dankuni-Chandanpur(10-11).Through renewal of turn outs on M/L & loop line 12 stations on Howrah-Barddhaman Chord section (10-11).	120	96	Automatic Signalling
27	SAKTIGARH-BARDDHAMAN	HWH	11.52	QL	ABS	160	165	140.0	28.0	2.0	170.0	106.3	103.0	Continuous track circuiting with Auto block Signalling in" A"to"C" route (03-04).	180	94	Automatic Signalling
28	BARDDHAMAN-KHANA	HWH	13.15	QL	ABS	130	135	108.0	29.0	2.0	139.0	106.9	103.0	Continuous track circuiting with	150	93	Automatic Signalling

Table 18-7: Summary of Capacity Analysis and Interim Improvement Proposals for Eastern Railway (ER) Zone																		
S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Capacity each way		Average Nos. of Train Servcices Each way				% Utilisation of line Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WITH MB	W/O MB	Pass	Goods	Other	Total	WITH MB	W/O MB				
														Automatic block Signalling in "A"to"C"route (03-04).			
29	KATWA-AZIMGANJ	HWH	72.74	SL	ABS	25	26	24.0	0.0	1.0	25.0	100.0	96.2	Doubling & Electrification between Katwa-Azimganj (10-11) & (12-13).	50	50	--
30	KHANA-SAINTHIA	HWH	70.93	DL	ABS	53	57	41.0	18.0	1.0	60.0	113.2	105.3			105.3	3rd line is required
31	SAINTHIA-GODADHARPUR	HWH	7.19	TL	ABS	61	65	45.0	25.0	1.5	71.5	117.2	110.0	3rd line between Sainthia-Godadharpur (11-12),(12-13).	90	79	--
32	GODADHARPUR-RAMPURHAT	HWH	14.10	TL	ABS	64	68	45.0	25.0	1.5	71.5	111.7	105.1			105.1	Automatic Signalling
33	RAMPURHAT-NALHATI	HWH	14.09	DL	ABS	59	63	42.0	25.0	1.0	68.0	115.3	107.9	3rd line between Rampurhat-Murarai (11-12).	90	76	--
34	NALHATI-GUMANI	HWH	57.79	DL	ABS	54	59	36.0	29.0	2.0	67.0	124.1	113.6	Pakur development of freight & pass. Train handling facilities (08-09). Electrification of Pakur - Bolidanga/LC - Malda Town (12-13).		113.6	3rd line is required
35	DUNKUNI CCLW - BHATTANAGAR	HWH	5.50	DL	ABS	18	20	3.0	15.0	1.0	19.0	105.6	95.0			95.0	Automatic Signalling
36	SEALDAH-KANKURGACHHI	SDAH	2.08	QL	Auto	237	238	234.0	0.02	43.5	277.5	117.1	116.6			116.6	0
37	KANKURGACHI-DUM DUM JN.	SDAH	4.78	QL	Auto	244	246	277.0	8.2	10.0	295.2	121.0	120.0	Dum Dum Jn.-Flyover to improve passage of goods &		120.0	0

Table 18-7: Summary of Capacity Analysis and Interim Improvement Proposals for Eastern Railway (ER) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Capacity each way		Average Nos. of Train Servcices Each way				% Utilisation of line Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WITH MB	W/O MB	Pass	Goods	Other	Total	WITH MB	W/O MB				
														Mail/Express trains (11-12).			
38	DUM DUM JN. - BARRACKPORE	SDAH	15.53	QL	Auto	166	170	151.0	3.0	8.0	162.0	97.6	95.3			95.3	0
39	BARRACKPORE - NAIHATI	SDAH	14.95	QL BP -KNR & TL KNR-NH	ABS	145	149	133.0	3.0	8.0	144.0	99.3	96.6	Barrackpore - Naihati - Automatic signalling system (07-08). Kankinara-Naihati 4th pass. Line by conversion of 1 Up goods line with provision of a PF at Kankinara (09-10).		96.6	Automatic Signalling
40	NAIHATI - KALYANI	SDAH	10.37	DL	ABS	90	93	87.0	5.0	9.5	101.5	112.8	109.1	3rd line between Naihati- Ranaghat (11-12). Provision of 12 coaches rake stabling facility at Naihati (11-12) for safety checking.	120	85	Automatic Signalling
41	KALYANI - RANAGHAT	SDAH	25.17	DL	ABS	73	76	71.0	4.0	9.5	84.5	115.8	111.2	3rd line between Naihati - Ranaghat (11-12) , Automatic signaling system (11-12) between Naihati-Ranaghat.	120	70	--
42	KALYANI - KALYANI SIMANTA	SDAH	4.78	SL	OTOS	18	20	17.0	0	0.5	17.5	97.2	87.5			87.5	--
43	RANAGHAT - KALINARAYANPUR	SDAH	4.05	DL	ABS	61	62	56.0	3.0	2.0	61.0	100.0	98.4			98.4	Automatic Signalling

Table 18-7: Summary of Capacity Analysis and Interim Improvement Proposals for Eastern Railway (ER) Zone																	
S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Capacity each way		Average Nos. of Train Servcices Each way				% Utilisation of line Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WITH MB	W/O MB	Pass	Goods	Other	Total	WITH MB	W/O MB				
44	KALINARAYANPUR-KRISHNANAGAR	SDAH	21.99	DL	ABS	40	42	36.0	3.0	2.0	41.0	102.5	97.6			97.6	Automatic Signalling
45	RANAGHAT-BONGAON	SDAH	32.93	SL	ABS	18	19	16.0	1.0	0.5	17.5	97.2	92.1	Stabling of 15 coaches EMU rake at Bongaon (12-13)		92.1	Doubling required
46	DUM DUM JN. - BARASAT	SDAH	15.24	DL	Auto	86	89	83.0	0.8	4.0	87.8	102.1	98.7			98.7	3rd line is required
47	BARASAT-BONGAON	SDAH	54.18	DL	ABS	68	72	58.0	0.4	3.0	61.4	90.3	85.3			85.3	Automatic Signalling
48	SONDALIA-LABUTALA	SDAH	6.58	SL	ABS	24	25	22.0	0	0.5	22.5	93.8	90.0	Double Line works is in progress.	48	47	--
49	CHAMPAPUKUR-HASNABAD	SDAH	16.54	SL	ABS	23	24	22.0	0	0.5	22.5	97.8	93.8			93.8	Doubling required
50	DUM DUM JN. - DANKUNI	SDAH	14.53	DL	Auto	57	61	45.0	12.5	4.0	61.5	107.9	100.8			100.8	3rd line is required
51	SEALDAH (SOUTH)-BALLYGUNGE	SDAH	5.07	DL	Auto	141	142	139.0	0	8.0	147.0	104.3	103.5	Extension of 4 stabling lines at Sealdah South for 12 coaches EMU rake stabling (10-11).		103.5	3rd line is required
52	BALLYGUNGE-MAJHERHAT(for passenger train)	SDAH	6.42	DL	Auto	44	45	42	0	0.5	42.5	96.6	94.4			94.4	3rd line is required
53	BALLYGUNGE-SONARPUR	SDAH	10.98	DL	Auto	112	114	111.0	0.03	0.5	111.5	99.6	97.8	Construction of new Terminal station at New Garia .		97.8	3rd line is required
54	SONARPUR-BARUIPUR	SDAH	8.59	DL	Auto	76	78	75.0	0.03	0.5	75.5	99.4	96.8			96.8	3rd line is required
55	SONARPUR-CANNING	SDAH	29.01	DL	ABS	32	34	31.0	0	0.5	31.5	98.4	92.6			92.6	Automatic Signalling

Table 18-7: Summary of Capacity Analysis and Interim Improvement Proposals for Eastern Railway (ER) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Capacity each way		Average Nos. of Train Servcices Each way				% Utilisation of line Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WITH MB	W/O MB	Pass	Goods	Other	Total	WITH MB	W/O MB				
56	BARUIPUR-DIAMONDHARBOUR	SDAH	34.76	DL	ABS	29	31	27.0	0	0.5	27.5	94.8	88.7			88.7	Automatic Signalling
57	BARUIPUR-LAKSHMIKANTAPUR	SDAH	36.72	DL	ABS	29	30	28.0	0	0.5	28.5	98.3	95.0			95.0	Automatic Signalling
58	LAKSHMIKANTAPUR-NAMKHANA	SDAH	46.56	SL	ABS	18	19	15.0	0	0.5	15.5	86.1	81.6			81.6	Doubling required
59	DUMDUM - KOLKATA	SDAH	3.92	TL	ABS	44	47	37.0	3.0	8	48.0	109.1	102.1			102.1	Automatic Signalling
60	KOLKATA-PRINCEP GHAT-MAJHERHAT	SDAH	14.48	SL	ABS	20	21	17.0	0	0.5	17.5	87.5	83.3	Extension of PFs for running of 12 coach EMU (10-11). Double line between Princepghat-Majerhat (11-12).		83.3	Doubling required

Source: Line Capacity Utilisation Chart

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
1	Mughalsarai-Jeonathpur	ALD	8	DL	A/M	91	81	48	39.45	10	97.45	107%	120%	1. Raising of speed to 160 KMPH/ 200 KMPH on existing NDLS-HWH route including CNB-LKO. (PWP 2017-18). 2. Extension of DN loop at Jeonathpur. (PWP 2011-12). 3.MGS-ALD 3rd line sanctioned. 4.MGS-bypass line.	140	70	--
2	Jeonathpur-Chunar	ALD	24	DL	A/M	91	81	54	42.00	10	106.00	116%	131%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18) 2. Construction of Fly over at Jeonathpur (PWP 2016-17). 3. Construction of DN longer loop at ARW. (PWP 2013-14) 4. MGS-ALD 3rd line sanctioned.	140	76	--
3	Chunar-Mirzapur	ALD	31	DL	A/M	91	81	57	41.55	10	108.55	119%	134%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-	140	78	--

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
														LKO.(PWP 2017-18) 2.Linking of Line No 8 of MZP to point No 213 towards E/End by providing track of about 200m. (Law Book 2015-16) 3. MGS-ALD 3rd line sanctioned.			
4	Mirzapur-Cheoki	ALD	81	DL	A/M	91	81	58	41.85	10	109.85	121%	136%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Provision of UP longer Loop at BEP & DN longer Loop at GAE. (WP 2013-14). 3. Cons. of Fly over between IDGJ-KCN (PWP 2016-17). 4. MGS-ALD 3rd line sanctioned.	140	78	--
5	Cheoki-Naini	ALD	1	DL	A/M	91	81	49	37.75	10	96.75	106%	119%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. 3rd Down line with	140	69	--

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
														additional platform at COI (PWP 2017-18). 3. Construction of Fly over between IDGJ-NYN (PWP 2016-17). 4. MGS-ALD 3rd line sanctioned.			
6	Naini-Allahabad	ALD	7	DL	A/M	91	81	66	42.65	10	118.65	130%	146%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Construction of Fly over between IDGJ-Kunwadih (PWP 2016-17). 3. MGS-ALD 3rd line sanctioned.	150	79	--
7	Allahabad-Subedarganj	ALD	4	TL	A/M	80	73	52	37.75	10	99.75	125%	137%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Provision of insertion of cross-over between R&D-I and Point No.-371 &376 at Allahabad Yard (Law Book 2016-17 Out-of-	135	74	--

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
														turn). 3.ALD-Bamrauli 4th line sanction (10Km) with flyover at Subearganj. 4.Allahabad-bypass line.			
8	Subedarganj-Fatehpur	ALD	108	DL	A/M	75	69	52	37.05	10	99.05	132%	144%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Upgradation of Subedarganj station. (14-15) 3.Extension of CSR of RUB UP Loop Line to make it 715m. (11-12)		132%	3rd Line required
9	Fatehpur-Chandari	ALD	74	DL	A/M	75	69	53	37.20	10	100.20	134%	145%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Extension of CSR of FTP L.No.5 by 45m to extend it from 670m to 715m. (PWP 2011-12). 3. Provision of DN longer loop at KKS.	100	100	3rd Line required

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
														(PWP 2013-14). 4.Rooma-Chakeri-Chandari 3rd line sanction.			
10	Chandari-kanpur	ALD	4	DL	A/M	55	45	52	0.00	10	62.00	113%	138%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB LKO.(PWP 2017-18). 2. construction of flyover at Kanpur.		113%	3rd Line required
12	Kanpur-Juhi/west	ALD	1	QL	A/M	97	90	90	50.50	10	150.50	155%	167%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Construction of CNB flyover (PWP 2017-18). 3. Modification in layout of track of PF No. 2 & 3 to accommodate 24 coach length trains. (Law Book 2016-17). 4.Coaching complex sanction at Kanpur (2.5Km)		155%	5th & 6th Line is required

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
13	Juhi/West-Panki	ALD	7	QL	A/M	91	81	73	41.10	10	124.10	136%	153%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Provision of additional loop at Govindpuri (PWP 2005-06).		136%	5th & 6th Line is required
14	Panki-Sikohabad	ALD	184	DL	A/M	91	81	72	41.60	10	123.60	136%	153%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Provision of Dn Loop at Maitha station with Sand Hump and Hot Axle Siding, extension of PF by 100 m and widening of PF by 2m. (PWP 2011-12). 3.Provision of DN longer loop at EKL,BDN & UP longer loop at AAP. (PWP 2013-14) 4.4th line between bhaupur-Panki (11 .38 kms. 5. Etawah-bypass line.		136%	3rd Line required

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
15	Sikohabad-Tundla	ALD	36	DL	A/M	91	81	73	42.00	10	125.00	137%	154%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Extention of PF No. 1 & 2 of SKB (PWP 2011-12).		137%	3rd Line required
16	Tundla-Tundla/West	ALD	1	DL	A/M	98	88	79	42.30	10	131.30	134%	149%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. EI & Yard remodelling work of TDL.		134%	3rd Line required
17	Tundla/West-Mitawali	ALD	6	DL	A/M	91	81	64	31.70	10	105.70	116%	130%			116%	3rd Line required
18	Mitawali-Barhan	ALD	3	DL	A/M	91	81	64	35.90	10	109.90	121%	136%	Mitawli-Etmadpur-link line bypassing Tundla.		121%	3rd Line required
19	Barhan-Aligarh Jn.	ALD	63	DL	A/M	91	81	63	35.60	10	108.60	119%	134%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Provision of DN longer loop at SNS. (PWP 2013-14).		119%	3rd Line required

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone																	
Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
														3.ALJN-Daudkhan 3rd line sanction (6.9Km) &construction of flyover at Daud Khan			
20	Aligarh Jn.-Khurja	ALD	43	TL	A/M	98	88	65	32.40	10	107.40	110%	122%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18), 2.3RD LINE A/M Signalling,SSI work and bidirectional middle line in ALJN-GZB .(08-09). 3. Fly-over ALJN-HGJ, PH-15, (16-17). 4.Automatic singling on 3rd line 5.Bidirectional Automatic signalling on UP main line		110%	4th Line is required
21	Khurja-Dankaur	ALD	28	TL	A/M	98	88	66	30.65	10	106.65	109%	121%	Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18).		109%	4th Line is required
22	Dankaur-Dadri	ALD	18	TL	A/M	98	88	68	30.65	10	108.65	111%	123%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route		111%	4th Line is required

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
														including CNB-LKO.(PWP 2017-18). 2. Provision of DN longer loop at DKDE. (PWP 2013-14)			
23	Dadri-Ghaziabad	ALD	17	TL	A/M	98	88	68	24.40	10	102.40	104%	116%	1. Raising of speed to 160 KMPH / 200 KMPH on existing NDLS-HWH route including CNB-LKO.(PWP 2017-18). 2. Provision of DN longer loop at MIU. (PWP 2013-14) 3.GZB-Dadri 4th line sanction (12 Km)	130	79	--
25	Chunar-Chopan	ALD	103	SL	A/M	12	11	6	3.50	1	10.50	88%	95%	Sanctioned work of Electrification of CAR-CPU Section (PWP 2016-17).			Doubling is required
1	Dhaulpur-AGRA	AGC	62.6	DL	ABS	74	66	44	27.5	2.0	73.49	99%	111%	1-Longer loop line at KXM and H/L PF entire section. 2- 3rd line between DHO-AGC 2015-16. 3-Coal rake movement of NR Power Houses planned in 2019-20. 4.AGC-connectivity with Bayana & Bandikui alignment.	110	67	--

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
2	AGRA-MATHURA	AGC	54.10	DL	Auto	90	81	46	26.3	2.0	74.26	83%	92%	1-Longer loop line at KXM and H/L PF entire section. 2- 3rd line between AGC-MTJ 2015-16. 3-Coal rake movement of NR Power Houses planned in 2019-20. 4.Mathura- Murhesi Rampur Flyoverfor avoiding surface crossing at Mathura. 5.Achnera-bypass line connecting Parkham to Chiksana.	130	57	--
3	MATHRA-PALWAL	AGC	83.40	TL	Auto	98	88	63	30.6	2.0	95.30	97%	108%	1- Mathura Yard remodeling with MTJ-BTSR 3rd line. 2- 4th line MTJ-PWL 2015-16 3.Mathura-Bhainsa-connectivity from bhaisa station to Bad yard and its electrification	130	73	--
5	JAMUNA BRIDGE-AGRA FORT-IDGAH	AGC	3.95	SL	ABS	29	22	15	10.2	1.0	26.24	90%	119%	1- JAB yard remodeling 2- Doubling between JAB-AF 150 kms. 3.Paprera halt to B-class station.	60	44	--

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
8	ACHNERA-BHARATPUR	AGC	27.31	SL	ABS	20	18	15	7.5	0.5	23.00	115%	128%	1-Electrification IDH-BTE 2. Doubling between Agra Fort-Bandikui 150 kms 3.Paprera halt to B-class station	40	58	--
9	BHARATPUR-BANDIKUI	AGC	97.00	SL	ABS	20	18	11	7.4	0.5	19.30	97%	107%	1-Conversion of 'D' class station Paprera & Ghasinagar halt in to 'B' class station. 2-Electrification AH-BTE & AH - IDH 3.Doubling between Agra Fort-Bandikui 150 kms.	40	48	--
12	MATHURA-ALWAR	AGC	123.35	SL	ABS	14	12	4	7.0	0.5	11.50	82%	96%	Upgradation of entire section with 6 new crossing station. 4 stations yet to be commissioned.	18	64	--
1	DHO-JHS	JHS	154.4	DL	ABS	70	64	46.40	36.1	1.6	84.1	120%	131%	1).Provision of New Goods Complex at RRU 2007-08 2) B class station between DAA -KRQ 2007-08 3) Prov. of 1500m loop line at SIKD, ARI, KTRA 2012-13 4) Prov. of 3rd line	140	60	--

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
														2016-17 5.Dholpur-JHS-Bina 4th line(321.81Km) 6) Datia-Karari-Jhansi & Jakhlaun-Dhaura- B-class station by converting IBH.			
2	JHS-BINA	JHS	152	DL	ABS	70	64	48.40	32.6	2.5	83.5	119%	130%	1) Prov. of cross over at DWA 2007-08 2) Extension of loop line a BJA 2012-13 3) Extension of loop line at KOA 2013-14 4) Prov. of 1500m loop line at BPW, MZX, JHA 2012-13 5) Prov. of 3rd line 2015- 16 6.Dholpur-Jhansi-Bina 4th line 321.80 kms 7. Lalitpur-Birari With flyover at Lalitpur 15.80 kms. 6) Rail fly over at Lalitpur to Birari line 2015-16 7) Provision of electrification of LAR-UDPR 2014-15 8).Dholpur-JHS-Bina 4th line(321.81Km)	140	60	--

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
3	BZM -JHS	JHS	220	SL	ABS	20	17	13.40	6.1	1.7	21.2	106%	125%	1) Splitting of longer block section by providing B Class station between- OR -ATA, ATA-KPI, 2006-07, 222- 2)CNB-JHS doubling by RVNL 2012-13 3.JHS-Khairar-Manickpur & Khairar-Bhimsen 411 kms 4.Paman-Bhimsen-new B-class station.	40	53	--
6	MKP-BNDA	JHS	100	SL	ABS	23	20	9.40	5.6	6.0	21.0	91%	105%	1).Prov. of 2nd loop line at KHOH 2012-13. 2).Prov. of token less block instrument in place of ball token instrument 2010 -11 3) Prov of PI at 3 Stn.KID,BNDA & ATE (PH 33) 2012-13 4).Prov of PI at KHOH station 2012-13 5) Additional loop line at KHOH 2007-08 6) .Prov. of 1500m loop line at KHOH 2012-13 7) provision of PI at BTKP		91%	Doubling is required

Table 18-8: Summary of Capacity Analysis and Interim Improvement Proposals for North Central Railway (NCR) Zone

Sr. No.	Section	Div	Length Km.	Line	System of working	Charted Line Capacity each way		Average Nos. Of train services each				%age utilisation of CC		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O M/B	WITH M/B	Pass	Goods	Others	Total	W/O M/B	WITH M/B				
														8) Doubling with electrification 2016-17			

Source: Line Capacity Utilisation Chart

Table 18-9: Summary of Capacity Analysis and Interim Improvement Proposals for North Eastern Railway (NER) Zone

S.No.	Section	Div.	Length (Kms.)	Line	System of working	Charted line capacity each way		Averager no. of train services each way				% utilisation of charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						Without Maint. Block	With Maint. Block	Pass	Gds.	Others	Total	Without Maint. Block	With Maint. Block				
1	KASHIPUR-RAMNAGAR	IZN	27.36	SL	ABS	11	10	10	0.00	0.00	10.00	90.91	100.00	-		91	Doubling is required
2	RAWATPUR-FARUKHABAD	IZN	132.37	SL	ABS	24	20	13	10.30	0.20	23.50	97.92	117.50	-		98	Doubling is required
3	FARUKHABAD-KASGANJ	IZN	107.84	SL	ABS	20	17	11	10.30	0.30	21.60	108.00	127.06	-		108	Doubling is required
4	KASGANJ-MATHURA	IZN	105	SL	ABS	25	20	10	13.60	0.10	23.70	94.80	118.50	-		95	Doubling is required
5	Barabanki-Burhwal	LJN	27.13	DL	ABS	43	36	34	10.19	0.76	44.95	104.53	124.86	-		105	Automatic Signalling
6	Sitapur City.-Burhwal	LJN	96.46	SL	ABS	24	20	10	11.06	0.98	22.04	91.83	110.20	Doubling work sanctioned in PWP 2015-16.	48	46	--

Table 18-9: Summary of Capacity Analysis and Interim Improvement Proposals for North Eastern Railway (NER) Zone

S.No.	Section	Div.	Length (Kms.)	Line	System of working	Charted line capacity each way		Averager no. of train services each way				% utilisation of charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						Without Maint. Block	With Maint. Block	Pass	Gds.	Others	Total	Without Maint. Block	With Maint. Block				
7	Burhwal-Gonda	LJN	61.72	DL	ABS	55	47	41	20.34	1.34	62.68	113.96	133.36	3rd line sanctioned in WP 2016-17	90	70	--
8	Gonda-Mankapur	LJN	27.94	DL	ABS	52	44	36	18.80	1.08	55.88	107.46	127.00	-		107	Automatic Signalling
9	Mankapur-Gorakhpur	LJN	125.16	DL	ABS	50	42	38	19.67	1.38	59.05	118.10	140.60	DMG-GKP-GKC-KHM 3rd line sanctioned in WP 2016-17	75	79	--
10	Gorakhpur-GorakhpurCantt.	LJN	3.22	TSL	ABS	52	44	46	19.98	0.57	66.55	127.98	151.25	DMG-GKP-GKC-KHM 3rd line sanctioned in WP 2016-17	75	89	Automatic Signalling
11	Mankapur-Ayodhya	LJN	37.65	SL	ABS	14	12	8	2.46	0.77	11.23	80.21	93.58	-		80	Doubling is required
12	Gorakhpur-Anandnagar	LJN	41.4	SL	ABS	21	17	19	2.25	1.04	22.29	106.14	131.12	Doubling sanctioned between GKP-JEA in WP 2016-17.	48	46	--
13	Gorakhpur Cantt.-Paniyahwa	BSB	82.84	SL	ABS	19	16	17	8.00	1.50	26.50	139.47	165.63	-		139	Doubling is required
14	Gorakhpur Cantt.-Chhapra	BSB	176.6	DL	ABS	54	45	30	12.00	3.00	45.00	83.33	100.00	DMG-GKP-GKC-KHM 3rd line	80	56	--

Table 18-9: Summary of Capacity Analysis and Interim Improvement Proposals for North Eastern Railway (NER) Zone

S.No.	Section	Div.	Length (Kms.)	Line	System of working	Charted line capacity each way		Averager no. of train services each way				% utilisation of charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						Without Maint. Block	With Maint. Block	Pass	Gds.	Others	Total	Without Maint. Block	With Maint. Block				
														sanctioned in WP 2016-17			
15	Chhapra-Chhapra Gramin	BSB	5.26	DL	ABS	60	50	34	15.00	2.00	51.00	85.00	102.00			85	Automatic Signalling
16	Chhapra-Phephna	BSB	75.05	SL	ABS	20	17	25	5.00	1.50	31.50	157.50	185.29	Doubling work between CPR-BUI sanctioned in PWP 2012-13 and work is in progress. Conversion of one Manjhi Halt station into crossing station is also sanctioned in PWP 2007-08	48	66	--
17	Phephana-Aunrihar	BSB	94.95	SL	ABS	23	20	22	4.00	1.50	27.50	119.57	137.50	Doubling sanctioned upto GCT in 2015-16 where as between GCT-ARJ in PWP 2014-15	48	57	--
18	Aunrihar-Varanasi City	BSB	31.20	DL	ABS	48	40	30	7.00	2.00	39.00	81.25	97.50		48	81	Automatic Signalling

Table 18-9: Summary of Capacity Analysis and Interim Improvement Proposals for North Eastern Railway (NER) Zone

S.No.	Section	Div.	Length (Kms.)	Line	System of working	Charted line capacity each way		Averager no. of train services each way				% utilisation of charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						Without Maint. Block	With Maint. Block	Pass	Gds.	Others	Total	Without Maint. Block	With Maint. Block				
19	Varanasi City-Varanasi	BSB	3.80	SL	ABS	20	17	18	7.00	2.50	27.50	137.50	161.76	Patch doubling sanctioned in PWP 2011-12	48	57	--
20	Varanasi-Allahabad	BSB	124	SL	ABS	24	20	21	7.00	4.00	32.00	133.33	160.00	Patch doubling sanctioned in PWP 2011-12 upto Manduadih and MUV-ALD doubling sanctioned in PWP 2015-16	48	67	--
21	Aunrihar-Mau	BSB	57.69	SL	ABS	22	19	16	4.00	1.50	21.50	97.73	113.16	Doubling sanctioned in WP 2016-17	48	45	--
22	Indara-Bhatni	BSB	59.61	SL	ABS	20	17	14	4.00	3.00	21.00	105.00	123.53	Provision of Bhatni-Peokol line on another alignment with conversion of Piokol halt into crossing station in PWP 2012-13 and Doubling sanctioned in WP 2016-17	48	44	--

Table 18-9: Summary of Capacity Analysis and Interim Improvement Proposals for North Eastern Railway (NER) Zone

S.No.	Section	Div.	Length (Kms.)	Line	System of working	Charted line capacity each way		Averager no. of train services each way				% utilisation of charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						Without Maint. Block	With Maint. Block	Pass	Gds.	Others	Total	Without Maint. Block	With Maint. Block				
23	Mau-Shahganj	BSB	99.75	SL	ABS	16	13	12	2.00	2.00	16.00	100.00	123.08	Doubling sanctioned in WP 2016-17	48	33	--

Source: Line Capacity Utilisation Chart

Table 18-10: Summary of Capacity Analysis and Interim Improvement Proposals for North Frontier Railway (NFR) Zone

S. No.	Section	Division	Length (Kms.)	SL/TSL/DL/TL/QL/QSL	Traction	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Remarks/ Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
							W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
1	MALDA TOWN-EKLAKHI	Katihar	19	DL	D	ABS	49	41	30.0	23.0	2.5	55.5	113%	135%			113%	Automatic Signalling
2	EKLAKHI-KUMEDPUR	Katihar	42	DL	D	ABS	49	41	31.0	22.0	2.5	55.5	113%	135%			113%	Automatic Signalling
3	KATIHAR-MUKURIA	Katihar	35	SL	D	ABS	18	15	16.0	12.0	2.0	30.0	167%	200%			167%	Doubling required
4	KATIHAR-KUMEDPUR	Katihar	30	SL	D	ABS	23	19	17.0	7.0	2.0	26.0	113%	137%			113%	Doubling required
5	KUMEDPUR - MUKURIA	Katihar	23	DL	D	ABS	49	41	28.0	20.0	2.0	50.0	102%	122%			102%	Automatic Signalling
6	MUKURIA - BARSOI	Katihar	5	DL	D	ABS	49	41	42.0	32.0	2.0	76.0	155%	185%			155%	Automatic Signalling
7	BARSOI - NEW JALPAIGURI	Katihar	145	DL	D	ABS	49	41	40.0	32.0	2.0	74.0	151%	180%			151%	Automatic Signalling
8	NEW JALPAIGURI - RANINAGAR JALPAIGURI	Katihar	26	DL	D	ABS	44	37	26.0	15.0	2.0	43.0	98%	116%			98%	Automatic Signalling
9	SILIGURI Jn.-NEW JALPAIGURI	Katihar	8	SL	D	ABS	16	12	16.0	7.0	3.0	26.0	163%	217%			163%	Doubling required
10	OLDMALDA - SINGHABAD	Katihar	25	SL	D	ABS	8	6	5.0	1.5	0.5	7.0	88%	117%			88%	Doubling required
11	KATIHAR - PURNEA	Katihar	28	SL	D	ABS	20	16	10.0	5.0	2.0	17.0	85%	106%			85%	Doubling required
12	RANINAGAR JALPAIGURI - SAMUKTALA ROAD	APDJ	129	SL	D	ABS	28	23	23	15.0	2.0	40.0	143%	174%	Work of doubling from Jalpaiguri Road to - Gumani Hat .	46	87	Automatic Signalling

Table 18-10: Summary of Capacity Analysis and Interim Improvement Proposals for North Frontier Railway (NFR) Zone

S. No.	Section	Division	Length (Kms.)	SL/TSL/DL/TL/ QL/QSL	Traction	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Remarks/ Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
							W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
13	SILIGURI JN - SAMUKTALA ROAD	APDJ	174	SL	D	ABS	23	19	13	7.0	2.0	22.0	96%	116%			96%	Doubling required
14	SAMUKTALA ROAD - NEW BONGAIGAON	APDJ	96	DL	D	ABS	49	45	24	22.0	2.0	48.0	98%	107%			98%	Automatic Signalling
15	NEW COOCHBEHAR -GOLAKGANJ	APDJ	55	SL	D	ABS	4	3	3	2.0	0.5	5.5	138%	183%			138%	Doubling required
16	Y' LEG OF MAYNAGURI ROAD-JALPAIGURI ROAD - NEW DOMOHANI-NEW COOCH BEHAR	APDJ	88	SL	D	ABS	14	12	3	8	0.5	11.5	82%	96%			82%	Doubling required
17	NEW BONGAIGAON-RANGIYA Jn.	Rangiya	109	SL	D	ABS	23	18	22	8.0	3.0	33.0	143%	183%	Doubling from New Bongaigaon to Kamakhya (142kms) sanctioned in 2013 - 14 .	46	72	--
18	RANGIYA JN.-AGTHORI	Rangiya	34	SL	D	ABS	23	18	24	7.0	2.5	33.5	146%	186%				Doubling required
19	NEW BONGAOGAON - GOALPARA TOWN - KAMAKHYA	Rangiya	176	SL	D	ABS	20	16	11	12.0	2.0	25.0	125%	156%	Doubling from New Bongaigaon to Kamakhya via Goalpara Town(176kms)	44	57	--

Table 18-10: Summary of Capacity Analysis and Interim Improvement Proposals for North Frontier Railway (NFR) Zone

S. No.	Section	Division	Length (Kms.)	SL/TSL/DL/TL/QL/QSL	Traction	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Remarks/ Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
							W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
20	AGTHORI - KAMAKHYA	Lumding	7	SL	D	ABS	24	20	23	4.0	2.5	29.5	123%	148%			123%	Doubling required
21	KAMAKHYA - GUWAHATI	Lumding	6	TSL	D	ABS	40	33	30	11.0	7.0	48.0	120%	145%			120%	Automatic Signalling
16	GUWAHATI- NEW GUWAHATI	Lumding	4	SL	D	ABS	37	31	22	11.0	8.5	41.5	112%	134%			112%	Doubling required
17	NEW GUWAHATI-DIGARU	Lumding	30	DL	D	ABS	40	34	22	7.0	3.0	32.0	80%	94%			80%	Automatic Signalling
18	DIGARU-LUMDING	Lumding	147	SL	D	ABS	22	20	22	6.5	2.5	31.0	141%	155%	Doubling from Hojai to Lumding (44.92 kms) & Digaru to Hojai (102 km) in progress.	44	70	--
19	LUMDING-FURKATING	Lumding	139	SL	D	ABS	17	15	15	4.0	2.0	21.0	124%	140%	2nd loop at Nailalung sanctioned in 2012 - 13. Work in progress.		124%	Doubling required
20	ARUNACHAL-SILCHAR	Lumding	6	SL	D	ABS	10	9	8	0.7	0.5	9.2	92%	102%			92%	Doubling required
21	ARUNACHAL-VANGAICHUNGPAO	Lumding	61	SL	D	OTOS	1	1	0.5	0.6	0.0	1.1	110%	110%	At present train runs OTOS		110%	--
22	FURKATING-MARIANI.	Tinsukia	38	SL	D	ABS	16	14	13	3.5	1.5	18.0	113%	129%			113%	Doubling required

Table 18-10: Summary of Capacity Analysis and Interim Improvement Proposals for North Frontier Railway (NFR) Zone

S. No.	Section	Division	Length (Kms.)	SL/TSL/DL/TL/QL/QSL	Traction	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Remarks/ Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
							W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
23	MARIANI-TINSUKIA	Tinsukia	157	SL	D	ABS	16	14	13	3.0	2.0	18.0	113%	129%			113%	Doubling required
24	TINSUKIA-DIBRUGARH TOWN	Tinsukia	47	SL	D	ABS	14	12	10	2.0	1.0	13.0	93%	108%			93%	Doubling required

Source: Line Capacity Utilisation Chart

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
1	Sanehwal - Ludhiana Jn	FZR	ABS	95	90	65	15	6	86	91%	96%			91%	Automatic Signalling
2	Ludhiana Jn - Phillaur Jn	FZR	ABS	77	65	72	9	4	85	110%	131%			110%	Automatic Signalling
3	Phillaur Jn - Phagwara Jn.	FZR	ABS	77	65	67	8	4	79	102%	121%			102%	Automatic Signalling
4	Phagwara Jn. - Jalandhar Cantt.	FZR	ABS	77	65	70	7	3	80	104%	123%			104%	Automatic Signalling
5	Jalandhar Cantt. - Jalandhar City	FZR	ABS	73	62	51	4	4	59	81%	95%			81%	Automatic Signalling

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
6	Jalandhar City - Suchi Pind	FZR	ABS	24	20	54	3	3	60	250%	300%			250%	Doubling is required
7	Bharoli Jn.- Jammu Tawi	FZR	ABS	51	43	35	6	4	45	89%	105%	1. PTKC - JAT doubling is in progress with 1block section (MDPB-KTHU 8.26km) still single line 2.Kathua-Madhopur Punjab Doubling across Ravi Bridge 3.Kathua-Madhopur Punjab Doubling across bridge no.16,18&19.	60	76	--
8	Nawanshahar - Doaba - Jaijon Doaba	FZR	ABS	3	3	3	0	1	4	133%	133%			133%	Doubling is required
9	Nawanshahar Doaba - Rohan	FZR	ABS	3	3	3	0	0	3	100%	100%			100%	Doubling is required
10	Khanalampura - Saharanpur Jn.	UMB	ABS	60	55	36	19	1	56	94%	108%			94%	Automatic Signalling
11	Saharanpur Jn. - Jagadhari	UMB	ABS	60	55	44	20	3	68	113%	123%			113%	Automatic Signalling
12	Jagadhari - Ambala Cantt.Jn	UMB	ABS	60	55	44	18	3	65	108%	117%			108%	Automatic Signalling
13	Ambala Cantt.Jn - Rajpura Jn.	UMB	A/M	80	74	72	30	4	106	133%	144%			133%	3rd line is required

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
14	Rajpura Jn. - Sirhind Jn.	UMB	A/M	80	74	62	21	3	87	109%	117%			109%	3rd line is required
15	Sirhind-Sanehwal	UMB	ABS	60	55	57	12	2	71	118%	129%			118%	3rd line is required
16	Rajpura Jn. - Patiala	UMB	ABS	22	19	10	8	1	19	87%	101%	1. Isolation and upgradation of signalling, 2. Electrification of RPJ-LHM, 3. DL of RPJ-BTI sec.	50	38	--
17	Patiala - Dhuri Jn.	UMB	ABS	22	19	9	7	1	18	80%	92%	Extn of running line no.1,2,3 at DBN, Electrification of RPJ-LHM section		80%	Doubling is required
18	Dhuri Jn. - Bathinda Jn.	UMB	ABS	22	19	12	6	1	20	89%	103%			89%	Doubling is required
19	Ludhiana Jn - Dhuri Jn.	UMB	ABS	24	21	14	4	1	19	80%	91%	1.Electrification of LDH-DUI-JHL section, 2. Replacement of signalling gear by electronic interlocking 3.Doubling between LDH-Kila Raipur.	50	38	--
20	Dhuri Jn. - Jakhal Jn.	UMB	ABS	24	21	15	4	1	21	86%	98%	At SFM additional traffic handling facilities		86%	Doubling is required
21	Delhi Jn, - Delhi Shahdra	DLI	A/M	85	78	80	11	12	104	123%	134%			123%	4th line is required
22	Delhi Shahdra-A Panel	DLI	A/M	85	78	67	10	12	89	105%	114%			105%	4th line is required
23	A Panel-Sahibabad	DLI	A/M	85	78	67	10	12	89	105%	114%			105%	4th line is required

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
24	Sahibabad - Ghaziabad Jn	DLI	A/M	160	146	162	35	24	221	138%	151%			138%	5th and 6th line is required
25	Khatauli- Tapri	DLI	ABS	29	26	26	2	6	34	117%	131%			117%	Doubling is required
26	Subzi Mandi - Adarsh Nagar Delhi	DLI	A/M	85	79	56	11	4	70	82%	88%	Auto matic Sig. Bet. SZM-PNP, PNP-UMB 99-00	100	70	--
27	Adarsh Nagar Delhi - Panipat Jn	DLI	AM/ABS	85	79	58	25	4	87	102%	110%	Auto matic Sig. Bet. SZM-PNP, PNP-UMB 99-00	100	87	Automatic Signalling
28	Panipat Jn - Kurukshetra	DLI	ABS	85	79	54	18	3	75	88%	95%	Auto matic Sig. Bet. SZM-PNP, PNP-UMB 99-00	100	75	--
29	Kurukshetra-Ambala	DLI	ABS	65	60	56	16	2	74	113%	123%	Auto matic Sig. Bet. SZM-PNP, PNP-UMB 99-00	100	74	--
30	Delhi Jn, - Subzi Mandi	DLI	ABS	25	20	22	7	3	32	127%	159%	Additional line between DLI-SZM sanc. in 2008-09	50	64	--
31	Delhi Jn, - Delhi Kishanganj	DLI	ABS	32	29	23	3	6	32	98%	109%			98%	Automatic Signalling
32	New Delhi - Delhi Kishanganj III	DLI	ABS	18	16	14	0	4	18	100%	113%			100%	Automatic Signalling
33	Delhi - Delhi - Subzimandi	DLI	ABS	25	21	34	4	3	41	164%	196%			164%	Automatic Signalling
34	Delhi Kishanganj - Daya Basti	DLI	ABS	45	41	50	8	11	69	154%	169%	Dayabasti - Grade separator		154%	Automatic Signalling

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
35	New Delhi - Subzi Mandi	DLI	ABS	36	33	34	8	3	45	124%	136%			124%	Automatic Signalling
36	Delhi Kishanganj - Daya Basti	DLI	ABS	45	41	49	8	11	68	152%	166%			152%	Automatic Signalling
37	Daya Basti - Rampur Jn.	DLI	ABS	45	41	48	8	8	64	142%	156%			142%	Automatic Signalling
38	Daya Basti - Shakurbasti	DLI	ABS	60	55	50	15	7	72	120%	131%			120%	Automatic Signalling
39	Patel Nagar - Rampura CABIN	DLI	ABS	38	35	8	22	6	36	94%	102%			94%	Automatic Signalling
40	Rampura CABIN - PATEL NAGAR	DLI	ABS	38	35	8	22	6	36	94%	102%			94%	Automatic Signalling
41	Delhi Jn. - New Delhi	DLI	ABS	40	37	18	0	21	39	98%	105%			98%	Automatic Signalling
42	New Delhi - Tilak Bridge	DLI	A/M	180	170	131	14	16	161	89%	95%	5th and 6th Line is in progress	240	67	--
43	Tilak Bridge - Nizamuddin	DLI	A/M	80	74	64	8	24	97	121%	131%			121%	3rd line is required
44	Nizamuddin - Tuglakabad M/L	DLI	ABS	80	74	92	8	11	111	139%	151%	Tughlakabad (Joint Cabin)-Palwal - 4th line (33.5 km)	120	93	Automatic Signalling
45	Tilak Bridge - B Panel	DLI	A/M	80	74	74	26	17	117	147%	159%	3rd and 4th line sanction between TKJ-ANVR	160	73	--
46	B panel-Sahibabad	DLI	A/M	80	74	76	25	13	114	143%	154%	3rd and 4th line bet. SBB-ANVR sanctioned	160	71	--

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
47	Tughlakabad - Palwal	DLI	AM/ABS	125	115	96	46	6	149	119%	129%	4th Line Between Jn. Cabin-Palwal WP 2005-06	170	87	Automatic Signalling
48	Lajpat Nagar - Patel Nagar	DLI	A/M	50	46	13	37	6	56	112%	121%			112%	3rd line is required
49	Delhi Sarai Rohilla-Garhi Harsaru Jn	DLI	ABS	65	60	41	15	5	61	94%	102%	Bijwasan-Coaching/Freight handling terminal		94%	Automatic Signalling
50	Garhi Harsaru Jn - Rewari	DLI	ABS	65	60	38	13	5	56	86%	93%			86%	Automatic Signalling
51	Lucknow - Rahimabad	MB	ABS	60	55	55	25	2	82	137%	149%	1. Additional loop line at DIL is sanctioned. 2. IBH between KKJ-MLD is sanctioned. 3. IBS between AMG-KKJ section is sanctioned.		137%	Automatic Signalling
52	Rahimabad - Balamau Jn.	MB	ABS	60	55	55	25	2	82	136%	148%	1. Additional loop line at UTA & DLQ is sanctioned, 2. IBH between RBD-SAN, 3. KAR-HRI is sanctioned. 4. IBS between DLQ-BLM section is sanctioned.		136%	Automatic Signalling
53	Balamau Jn. - Roza Jn.	MB	ABS	60	55	52	25	2	79	132%	144%	1. Additional loop line at MST is sanctioned 2. IBS between BLM-BGH, HRI-KUF and AIG-KH section is sanctioned.		132%	Automatic Signalling
54	Roza Jn. - Shahjahanpur Jn.	MB	ABS	60	55	67	23	2	91	152%	165%			152%	Automatic Signalling

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
55	Shahjahanpur Jn. - Bareilly Cantt.	MB	ABS	60	55	63	23	2	88	146%	159%	1.Additional loop lines at RYS, TSA & MK are sanctioned. 2. IBS bet. PMR-RYS section is sanctioned.		146%	Automatic Signalling
56	Bareilly Cantt-Bareilly Jn.	MB	ABS	60	55	58	23	2	83	138%	150%			138%	Automatic Signalling
57	Bareilly Jn.-Rampur Jn.	MB	ABS	60	55	55	23	2	80	133%	145%	IBS between NRS-MIL section is sanctioned.		133%	Automatic Signalling
58	Rampur Jn.-Katghar Left Bank	MB	ABS	60	55	57	23	2	82	136%	148%	IBS between NRS-MIL section is sanctioned		136%	Automatic Signalling
59	Katghar Left Bank-Moradabad	MB	ABS	60	55	68	23	2	93	154%	168%			154%	Automatic Signalling
60	Raja Ka Sahaspur-Moradabad	MB	ABS	22	20	16	3	1	20	89%	98%	SSI sanctioned with central panel		89%	Doubling is required
61	Moradabad-Najibabad Jn.	MB	ABS	60	55	32	25	2	59	98%	107%	1. Additional loop line at AWP,MTB,MWE,CAJ,HBW,PNI,is sanctioned, 2. IBH beween NGG-BEK is sanctioned		98%	Automatic Signalling
62	Najibabad Jn. - Muazzampur Narain Jn.	MB	ABS	60	55	37	25	2	64	107%	116%			107%	Automatic Signalling
63	Muazzampur Narain Jn.-Laksar	MB	ABS	60	55	34	25	2	61	102%	111%			102%	Automatic Signalling
64	Laksar Jn. - Khalaalampura	MB	ABS	60	55	44	25	2	71	118%	129%	IBH BETWEEN NGG - BEK SANCTIONED.		118%	Automatic Signalling

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone																
S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
65	Moradabad Jn. - Gajraula Jn.	MB	ABS	60	55	41	3	6	50	83%	91%	Additional loop line at AWP,MTB,MWE,CAJ,HBW,PNI is sanctioned		83%	Automatic Signalling
66	Gajraula Jn. - Hapur Jn.	MB	ABS	60	55	40	3	6	49	82%	89%	IBH BETWEEN KHE-GMS SANCTIONED.		82%	Automatic Signalling
67	Hapur Jn. - Ghaziabad Jn	MB	ABS	50	47	39	3	6	48	96%	102%			96%	Automatic Signalling
68	Roza Jn. - Sitapur City	MB	ABS	24	22	14	11	3	28	117%	127%			117%	Doubling is required
69	Laksar Jn. - Haridwar	MB	ABS	24	21	28	3	1	32	131%	150%	1. Doubling between LRJ-HW is sanctioned. 2. Electrification between LRJ-DDN is sanctioned	50	63	--
70	Haridwar - Raiwala Jn.	MB	ABS	24	21	22	3	1	26	106%	121%	Work for running of 18 coaches train between HW-DDN is sanctioned in WP 2007-08		106%	Doubling is required
71	Raiwala Jn. - Dehradun	MB	ABS	19	17	15	3	1	19	97%	109%			97%	Doubling is required
72	Mughalsarai-Block Hut B	LKO	ABS	65	60	41	20	0	61	94%	102%	MGS-BSB 3rd line sanction	100	61	--
73	Block Hut B-Varanasi Jn.	LKO	ABS	65	60	50	24	0	73	112%	122%	3rd line between MGS-BSB	100	73	--
74	Varanasi Jn. - Janghai Jn	LKO	ABS	26	24	21	11	1	35	136%	148%	1. Doubling between Lohta-Bhadoi sanctioned in 2009-10. Work yet to start. 2.Doubling between Bhadohi-Janghai sanctiion work yet to start.	60	59	--

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
												3. Varanasi-yard remodelling sanction			
75	Janghai Jn - Pratapgarh Jn.	LKO	ABS	26	24	14	4	1	24	92%	100%			92%	Doubling is required
76	Pratapgarh Jn. - Chilbila Jn.	LKO	ABS	26	24	29	4	0	38	146%	158%	Doubling between Lohta-Bhadoi sanctioned in 2009-1 0. Work yet to start.	60	63	--
77	Chilbila Jn. - Rae- Bareli Jn.	LKO	ABS	26	24	24	4	0	34	131%	142%	Raebareli-Amethi (60.1 kms) Doubling sanction	60	57	--
78	Rae- Bareli Jn. - Utratia Jn.	LKO	ABS	26	24	27	5	1	37	142%	154%	Alamnagar-Utretia 18.09 kms doubling sanction	60	62	--
79	Utratia Jn.- Dilkusha	LKO	ABS	60	55	49	3	2	54	90%	99%	Doubling sanction between Alamnagar-Utretia 18.09 kms.	60	90	Automatic Signalling
80	Dilkusha- Lucknow	LKO	ABS	60	55	87	20	3	110	183%	199%			183%	4th line is required
81	Varanasi - Zafrabad Jn.	LKO	ABS	62	57	39	13	1	52	84%	91%			84%	Automatic Signalling
82	Zafrabad - Jaunpur	LKO	ABS	25	23	31	4	0	35	141%	153%	Work of additional loops at RES, RDL, KS , MGWN & KTH is sanctioned in 2007-08, which is in progress Doubling - Jaunpur - Tanda (77.25 km	60	59	--
83	Jaunpur - Shahganj	LKO	ABS	25	23	23	4	0	27	107%	117%	Jaunpur-Jaunpur city chord line sanction		107%	Doubling is required
84	Shahganj - Akbarpur	LKO	ABS	25	23	24	5	0	28	114%	123%	Doubling Barabanki - Akbarpur (161 km)	60	47	--

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
85	Akbarpur - Ayodhya	LKO	ABS	25	23	24	3	0	26	106%	115%	Doubling Barabanki - Akbarpur (161 km)	60	44	--
86	Ayodhya - Faizabad	LKO	ABS	25	23	27	4	1	32	126%	137%	Doubling Barabanki - Akbarpur (161 km)	60	53	--
87	Faizabad - Barabanki	LKO	ABS	25	23	24	5	1	30	120%	130%	Doubling Barabanki - Akbarpur (161 km)	60	50	--
88	Barabanki - Malhaur	LKO	ABS	60	55	65	16	1	82	137%	149%	Doubling Barabanki-Malhaur - 3rd & 4th Line (32.84 km)	60	137	Doubling is required
89	Malhaur - Dilkusha	LKO	ABS	60	55	46	16	1	63	105%	115%	``Lucknow - 4-line entry & exit with yard remodelling	60	105	Doubling is required
90	Alambagh - Manaknagar	LKO	ABS	60	55	40	9	2	51	84%	92%	Section divided in to ALH-MKG-ON as traffic diverges/converges from/to NER at MKG		84%	Automatic Signalling
91	Manaknagar - Unnao	LKO	ABS	60	55	60	9	2	71	119%	129%	Section divided in to ALH-MKG-ON as traffic diverges/converges from/to NER at MKG		119%	Automatic Signalling
92	Unnao - Kanpur	LKO	ABS	60	55	68	12	1	81	135%	147%	Work of additional loops at Tharwai, Bariya Rampur, Pariwan Kalan (sanctioned in 2006-07) work in progress		135%	Automatic Signalling
93	Janghai - Phaphamau	LKO	ABS	24	22	15	7	1	22	93%	102%	Janghai-Phaphamau - Doubling with electrification (46.79 km)	60	37	--
94	Phaphamau - Prayag	LKO	ABS	31	28	34	0	0	34	111%	123%	Phaphamau-Allahabad (12.9 km) with new material modification for bypass line between Northern Railway and North Eastern Railway track		111%	Doubling is required

Table 18-11: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Railway (NR) Zone

S. No.	Section	Division	System of working	Charted Line Capacity each way		Average Nos. of train services each way				% utilisation of Charted Capacity LC		Works in Progress	Capacity after commissioning of work	%age Utilisation after Completion of Work	Further Works Required to be done
				W/O MB	WITH 2 MB	Pass	Goods	Others	Total	W/O MB	WITH 2 MB				
95	Lucknow - Alam Bagh	LKO	ABS	60	55	89	23	4	116	193%	210%			193%	Doubling is required
96	Alamnagar - Alam Bagh	LKO	ABS	60	55	55	13	2	70	117%	127%			117%	Automatic Signalling

Source: Line Capacity Utilisation Chart

Table 18-12: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Western Railway (NWR) Zone

S.No	Section	Division	Length (Km)	Line	System of working	Charted Line Capacity each way		Avg. no. of trains each way				% utilization of charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass.	Goods	others	Total	W/O MB	With MB				
1	PALANPUR-ABUROAD	Ajmer	52.64	SL	ABS	26	23	20.68	12.18	0.03	32.89	127	143	Doubling - Palanpur - Karjoda (2011-12), Karjoda- Sarotra Road- AbuRoad (2010-11) Electrification- Ajmer - Palanpur (2013-14)	60	55	--
2	ABUROAD-BHIMANA	Ajmer	16.77	SL	ABS	26	23	19.70	13.34	2.67	35.71	137	155	\Doubling - Aburoad - Swaroupganj (2010-11)	60	60	--

Table 18-12: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Western Railway (NWR) Zone

S.No	Section	Division	Length (Km)	Line	System of working	Charted Line Capacity each way		Avg. no. of trains each way				% utilization of charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass.	Goods	others	Total	W/O MB	With MB				
3	RANI-MARWAR	Ajmer	51.82	SL	ABS	26	23	19.70	13.34	2.67	35.71	137	155	Doubling- Rani - Marwar (2012-13)	60	60	--
4	GURIYA - BEAWAR	Ajmer	41.32	SL	ABS	26	23	15.76	10.86	2.23	28.85	111	125	Doubling- Guriya - Bangurgram (2012-13)	60	48	--
5	BEAWAR-DAURAI	Ajmer	45.07	SL	ABS	26	23	15.76	10.86	2.23	28.85	111	125	Doubling - Bangurgram - Ajmer (2011-12)	60	48	--
6	AJMER-CHANDERIA	Ajmer	178.28	SL	ABS	20	18	11.75	4.59	1.96	18.30	92	102			92	Doubling reuired
7	JHARLI-BHIWANI	Bikaner	40.87	SL	ABS	23	20	9.19	10.93	0.89	21.01	91	105	Doubling - Rewari - Manheru (2015-16)	50	42	--
8	BHIWANI-HISAR	Bikaner	60.00	SL	ABS	19	17	10.93	4.23	0.56	15.72	83	92			83	Doubling reuired
9	BATHINDA Jn-SURATGARH	Bikaner	142.33	SL	ABS	20	18	7.24	8.55	0.83	16.62	83	92	RE - Bathinda - Suratgarh (2015-16)		83	Doubling reuired
10	JAIPUR - PHULERA	Jaipur	54.75	DL	ABS	60	54	41.83	11.47	1.58	54.9	**91**	**102**			91	Automatic Signalling
11	ALWAR - BANDIKUI	Jaipur	60.37	SL	ABS	26	23	24.33	2.13	0.70	27.2	104	118	Doubling - Alwar - Bandikui (2013 - 14)	60	45	--
12	SAWAIMADHOPUR - JAIPUR	Jaipur	131.27	SL	ABS	20	18	14.23	1.90	1.12	17.3	86	96			86	Doubling reuired
13	REWARI - RINGAS	Jaipur	148.66	SL	ABS	26	23	6.60	18.85	2.09	27.5	106	120	RE - Rewari - Ringas - Phulera (2013-14) Rewari -	60	46	--

Table 18-12: Summary of Capacity Analysis and Interim Improvement Proposals for Northern Western Railway (NWR) Zone

S.No	Section	Division	Length (Km)	Line	System of working	Charted Line Capacity each way		Avg. no. of trains each way				% utilization of charted capacity		Works in progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	With MB	Pass.	Goods	others	Total	W/O MB	With MB				
														Khatuwas twin single line (2018-19)			
14	PHULERA - DEGANA	Jodhpur	108.75	SL	ABS	24	21	13.20	7.92	0.53	21.65	90	103	Doubling - Phulera - Degana (2015-16)	50	43	--
15	DEGANA - MERTAROAD	Jodhpur	44.24	SL	ABS	24	21	17.63	11.43	0.54	29.60	123	141	Doubling - Degana - Rai ka Bagh (2018-19)	50	59	--
16	MERTAROAD - RAI KA BAG	Jodhpur	104.13	SL	ABS	26	23	19.49	11.04	0.31	30.84	119	134			119	Doubling reuired
17	LUNI-SAMDARI	Jodhpur	48.54	SL	ABS	26	23	8.29	12.70	0.27	21.26	82	92			82	Doubling reuired

Source: Line Capacity Utilisation Chart

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
1	Wadi-Vikarabad	SC	112	DL	ABS	60	53	24	20	8	52	87%	99%	Wadi Bye -pass.		87%	Automatic Signalling
2	Lingampalli-Sanatnagar	SC	14	DL	A/M	94	82	82	15	9	106	113%	129%	Provision of locally operated motor points at SNF.		113%	3rd Line is required

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
3	Sanatnagar-Hussainsagar	SC	5	DL	A/M	94	82	82	6	5	93	99%	113%	Nil		99%	3rd Line is required
4	Hussainsagar-Hyderabad	SC	5	DL	A/M	65	57	51	0	7	58	89%	102%	Provision of locally operated motor points at HYB.		89%	3rd Line is required
5	Hussainsagar-Secunderabad	SC	4	DL	A/M	92	81	66	6	12	84	91%	104%	Provision of locally operated motor points at SC.		91%	3rd Line is required
6	Moulaali-Pagidipalli	SC	31	DL	ABS	84	74	52	19	5	76	90%	103%	MLY 'C'-GT quadrapling with auto signalling;GT-BN-Single line automatic; BN-PGDP-3rd line.	105	72	--
7	Pagidipalli-Kazipet	SC	94	DL	ABS	75	66	39	18	5	62	83%	94%	MMTS-Phase-III-PGDP-RAG- 3rd line.; Provision of Locally operated motor points at KZJ.	105	59	--
8	Balharshah-Bellampalli	SC	108	DL	ABS	63	55	32	26	5	63	100%	114%	3rd line between BPQ-KZJ; Provision of locally operated mottor points at BPA.	105	60	--
9	Bellampalli-Kazipet	SC	126	DL	ABS	65	57	32	33	5	70	108%	123%	3rd line between BPQ-KZJ; Provision of locally operated motor points at RDM.	105	67	--
10	Kazipet-Dornakal	SC	94	DL	ABS	69	60	43	18	4	65	94%	108%	3rd line between BZA-KZJ; Provision of Locally operated	105	62	--

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
														motor points at WL; Development of freight terminal at WL.			
11	Dornakal-Vijayawada	SC	125	DL	ABS	70	61	37	25	5	67	96%	109%	3rd line between BZA-KZJ.	105	64	--
12	BhadrachallamRd - Karepalli	SC	39	SL	ABS	21	18	7	8	2	17	81%	93%	Nil		81%	Doubling is required
13	Karepalli-Dornakal	SC	15	SL	ABS	21	18	7	9	2	18	86%	98%	Nil		86%	Doubling is required
14	BhadrachalamRd - Manuguru	SC	49	SL	ABS	18	16	4	13	2	19	106%	121%	Nil		106%	Doubling is required
15	Gudur- Nellore	BZA	38	DL	ABS	67	60	55.0	23.5	4.0	82.5	123%	138%	PB No.37 of 2015-16: BZA-GDR 3rd line. PB No.64 of 2010-11 GDR additional PF between Road 4 & 7	100	83	Automatic Signalling
16	Nellore-Bitragunta	BZA	34	DL	ABS	59	53	49.0	20.0	4.0	73.0	124%	138%	PB No.89 of 2015-16: Longer loop at BTTR		124%	3rd Line is required
17	Bitragunta-Ongole	BZA	82	DL	ABS	59	53	49.0	20.0	4.0	73.0	124%	138%			124%	3rd Line is required
18	Ongole-Tenali	BZA	107	DL	ABS	59	53	49.0	19.0	4.0	72.0	122%	136%	PB No. 89 of 2015-16: Longer loop at Ammanabrolu and Nidubrolu.		122%	3rd Line is required
19	Tenali-Krishnacanal	BZA	26	DL	ABS	62	56	47.0	19.0	4.0	70.0	113%	125%	PB No.95 of 2016-17: IB between Krishna Canal and Pedavadlapudi.		113%	3rd Line is required

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
20	Krishnacanal-Vijayawada	BZA	6	TL	A/M	80	72	55.0	27.0	4.0	86.0	108%	119%			108%	4th Line is required
21	Vijayawada-Nidadavolu	BZA	127	DL	ABS	58	52	43.0	24.6	7.0	74.6	129%	143%	PB No.83 of 2013-14: Vijayawada-Gannavaram Automatic Section. PB No.90 of 2015-16: Longer loop at Navabpalem.		129%	3rd Line is required
22	Nidadavolu-Rajamundry	BZA	22	DL	ABS	58	52	49.0	24.6	7.0	80.6	139%	155%	PB No.88 of 2015-16 RJY Yard Modification. PB No.95 of 2016-17: IB between Pulla-Chebrolu.		139%	3rd Line is required
23	Rajamundry-Samalkot	BZA	50	DL	ABS	58	52	50.0	22.8	8.0	80.8	139%	155%	PB No.90 of 2015-16: Bikkavolu Longer Loop.		139%	3rd Line is required
24	Samalkot-Duvvada	BZA	133	DL	ABS	58	52	44.0	22.8	7.0	73.8	127%	142%	PB No.90 of 2015-16: Elamanchili Longer Loop. PB No.49 of 2010-11: Narsingapalli extension of loop line to 720 Mts.		127%	3rd Line is required
25	Vijayawada-Gudivada	BZA	43	SL	ABS	20	18	19.6	1.2	2.0	22.8	114%	127%	PB No. 35 of 2012-13: BZA-GDV-BVRM-NS-GDV-MTM and BVRM-NDD	40	57	--

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
														Doubling with electrification.			
26	Gudivada-Machlipatnam	BZA	37	SL	ABS	17	15	12.0	0.1	2.0	14.1	83%	94%	PB No.69 of 2010-11: Extension of PF and stabling lines at MTM Stn.		83%	Doubling is required
27	Gudivada-Bhimavaram	BZA	66	SL	ABS	18	16	17.0	0.9	2.0	19.9	111%	124%	PB No. 35 of 2012-13: BZA-GDV-BVRM-NS-GDV-MTM and BVRM-NDD Doubling with electrification.	40	50	--
28	Bhimavaram-Nidadavolu	BZA	47	SL	ABS	16	14	14.0	0.7	2.0	16.7	104%	119%	PB No. 35 of 2012-13: BZA-GDV-BVRM-NS-GDV-MTM and BVRM-NDD Doubling with electrification.	40	42	--
29	Bhimavaram-Narsapur	BZA	29	SL	ABS	13	12	11.0	0.7	2.0	13.7	105%	114%	PB No. 35 of 2012-13: BZA-GDV-BVRM-NS-GDV-MTM and BVRM-NDD Doubling with electrification.	40	34	--
30	Vijayawada-Kondapalli	BZA	16	DL	ABS	45	41	33.7	24.6	5.0	63.3	141%	154%	PB No.82 of 2013-14: Modification to bulb & CR goods line. PB No.51 of 2013-14: Coaching fit for Bulb		141%	3rd Line is required

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone																	
S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
														lines between Vijayawada North East Cabin and Bulb Cabin			
31	Guntur-Nallapadu	GNT	5	DL	ABS	49	44	27.4	11.8	1.0	40.3	82%	91%			82%	Automatic Signalling
32	Nallapadu-Nandyal	GNT	252	SL	ABS	23	21	10.0	10.3	1.2	21.5	94%	103%			94%	Doubling is required
33	Guntur-Tenali	GNT	25	SL	ABS	17	15	17.4	0.7	0.0	18.1	107%	121%	Guntur-Tenali Doubling with electrification . PB.32 of 2015- 16.	40	45	--
34	Nandaluru - Gooty	GTL	194	DL	ABS	48	43	15.8	27.4	2.0	45.2	94%	105%			94%	Automatic Signalling
35	Gooty-Guntakal	GTL	29	DL	ABS	45	41	18.5	16.9	4.0	39.4	88%	96%			88%	Automatic Signalling
36	Guntakal - Raichur	GTL	121	DL	ABS	40	36	20.3	12.1	4.0	36.4	91%	101%			91%	Automatic Signalling
37	Raichur - Wadi	GTL	107	DL	ABS	47	42	22.0	13.9	3.0	38.9	83%	93%	2 +2 IBS sanctioned in 2016-17. PB No 92 of 2016-17.		83%	Automatic Signalling
38	Gooty-Dharmavaram	GTL	91	SL	ABS	29	26	23.2	5.6	2.0	30.8	106%	118%	i) Prasannayapalle: Standard Layout. PB 81 2016-17. ii) Gooty-Dharmavaram doubling with RE PB.40 of 2015-16. iii) Dharmavaram	60	51	--

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
														Bye-pass. PB 40 of 2016-17. iv) Dharmavaram cross-over connectivity from road No 6 for R&D of trains from and to Bangalore.PB 88 of 2016-17.			
39	Tirupati-Renigunta	GTL	10	DL	ABS	33	30	31.1	0.2	5.0	36.3	110%	121%	Tirupati: Development of entry from southern end. PB 86 2016-17. Tiruchanur-Conversion of class C' to B sanctioned in 2016-17 PB No 96 of 2016-17.		110%	Automatic Signalling
40	Nandyal-Dhone	GTL	76	SL	ABS	18	16	9.1	11.0	2.0	22.1	123%	138%			123%	Doubling is required
41	Dhone-Guntakal	GTL	69	SL	ABS	30	27	18.6	11.6	1.0	31.2	104%	116%			104%	Doubling is required
42	Gooty-Pendikallu	GTL	29	SL	ABS	17	15	9.1	3.0	2.0	14.1	83%	94%			83%	Doubling is required
43	Katpadi - Pakala - Tirupati	GTL	104	SL	ABS	24	22	19.3	0.3	1.0	20.6	86%	94%	Bommasamudram: Conversion of halt station to crossing station. PB 46 2013-14.		86%	Doubling is required

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
44	Secunderabad-Kacheguda	HYB	7	DL	A/M	100	90	68.0	6.0	9.0	83.0	83%	92%			83%	3rd Line is required
45	Kacheguda-Falaknuma	HYB	7	DL	A/M	100	90	68.0	6.0	6.0	80.0	80%	89%	1. Additonal Stabling line at Kachiguda sanctioned under LSWP 2014-15 (TFW).		80%	3rd Line is required
46	Falaknuma-Umdanagar	HYB	13	SL	ABS	42	37.8	28.0	6.0	5.0	39.0	93%	103%	MMTS Phase-II works of Doubling with electrification between Falaknuma-Umdanagar is in progress.	85	46	--
47	Umdanagar-Mahaboobnagar	HYB	85	SL	ABS	24	21.6	21.0	6.0	6.0	33.0	138%	153%	1. New crossing station at Peddashapur between Umdanagar-Timmapur sanctioned under PWP 2010-11. 2. Doubling with electrification between Umdanagar-Mahbubnagar sanctioned under PWP 2015-16.	48	69	--
48	Mahaboobnagar-Kurnool City	HYB	130	SL	ABS	24	21.6	17.0	6.0	5.0	28.0	117%	130%	New crossing station between Kaukuntla-Wanaparthi Road sanctioned under PWP 2017-18.		117%	Doubling is required

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
49	Kurnool City Dhone	HYB	54	SL	ABS	24	21.6	16.0	6.0	6.0	28.0	117%	130%	New crossing station between Manopad-Alampur Road, Itikyala-Manopad, Ulindakonda-Veldurthi sanctioned under PWP 2017-18.		117%	Doubling is required
50	Bolarum-Manoharabad	HYB	27	SL	ABS	24	21.6	22.0	5.0	3.0	30.0	125%	139%	MMTS Phase-II works of Doubling with electrification between Bollarum-Medchal section is in progress.	50	60	--
51	Manoharabad-Nizamabad	HYB	120	SL	ABS	24	21.6	20.0	5.0	3.0	28.0	117%	130%			117%	Doubling is required
52	Nizamabad - Mudkhed	HYB	88	SL	ABS	24	21.6	19.0	5.0	5.0	29.0	121%	134%	Nizamabad yard remodellig of yard arrangements for providing additional platforms and one full length dead end spur sanctioned 2018-19		121%	Doubling is required
53	Manmad-Aurangabad	NED	113	SL	ABS	24	22	16.00	3.20	1.90	21.1	88%	96%	NIL		88%	Doubling is required
54	Aurangabad-Jalna	NED	62	SL	ABS	24	22	16.00	2.60	2.30	20.9	87%	95%	NIL		87%	Doubling is required
55	Jalna-Parbhani	NED	115	SL	ABS	24	22	15.10	2.60	2.70	20.4	85%	93%	NIL		85%	Doubling is required

Table 18-13: Summary of Capacity Analysis and Interim Improvement Proposals for South Central Railway (SCR) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train servcices each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
56	Parbhani-Purna	NED	29	SL	ABS	24	22	22.90	3.70	2.50	29.1	121%	132%	Mudkhed-Parbani Doubling. PB.34 of 2015-16.	48	61	--
57	Purna-Mudkhed	NED	53	SL	ABS	24	22	23.10	5.30	4.30	32.7	136%	149%	Mudkhed-Parbani Doubling. PB.34 of 2015-16.	48	68	--

Source: Line Capacity Utilisation Chart

Table 18-14: Summary of Capacity Analysis and Interim Improvement Proposals for South East Central Railway (SECR) Zone

S.No	Section	Division	Length in (KMs)	Line	System of Working	Chartered Line capacity each way upto 31st Mar-18		Train service each way during the peak season in the year -2017-18(NOV-17-MAR-18)				%age of utilisation of Chartered Line Capacity		Work in Progress	Capacity after commissioning of the work	% Utilisation after Completion of Work	Further Works Required to be done
						WO MB	With MB	P	Goods	Others	TOTAL	WO MB	With MB				
1	DURG-GONDIA	NGP	134.9	DL	ABS	70	62	42	40.3	5.3	87.6	125.1	141.3	Provision of IBH between DKS-SKS sanctioned in FWP-2013-14; 3rd line between RJN-KAV sanctioned in PWP 2015-16. Automatic Signalling between Durg-Gondia	120	73	#N/A

Table 18-14: Summary of Capacity Analysis and Interim Improvement Proposals for South East Central Railway (SECR) Zone

S.No	Section	Division	Length in (KMs)	Line	System of Working	Chartered Line capacity each way upto 31st Mar-18		Train service each way during the peak season in the year -2017-18(NOV-17-MAR-18)				%age of utilisation of Chartered Line Capacity		Work in Progress	Capacity after commissioning of the work	% Utilisation after Completion of Work	Further Works Required to be done
						WO MB	With MB	P	Goods	Others	TOTAL	WO MB	With MB				
														defrozen in the year 2015-16; Shifting of Goods shed at RJN & Provision of Additional line, Extension of existing line for developement of New PFat DGG sanctioned under Umbrella works in 2018-19.			
2	GONDIA-TUMSAR ROAD	NGP	49.8	DL	ABS	67	59	38	40.3	3.3	81.6	122	138	3rd line between RJN-KAV sanctioned in PWP 2015-16.	100	81.6	Automatic Signalling
3	TUMSAR ROAD - KALUMNA-ITWARI-NAGPUR	NGP	73.8	DL/ SL	ABS	70	62	41	33	5	79	113	128	Provision of Long Haul Loop at Salwa sanctioned in FWP-2013-14; 3rd line between RJN-NGP sanctioned in PWP 2015-16. Connection of Shunting neck with Cross Over between KAV-ITR	100	79	#N/A
4	KANHAN-RAMTEK	NGP	23	SL	ABS	11	10	3	4	2	9	82	90	NIL		82	Doubling is required
5	GONDIA - BALAGHAT	NGP	40.8	SL	ABS	16	14	8	3	2	13	81	93	NIL		81	Doubling is required
6	BILASPUR-URKURA	R	105	TL	ABS	115	103	47	85.2	3	135.2	118	131	Automatic Signalling btween BSP-DPH-BYL sanction in PWP 2015-16; Provison of Long Haul Loop at Hathbandh sanctioned in		118	4th Line is required

Table 18-14: Summary of Capacity Analysis and Interim Improvement Proposals for South East Central Railway (SECR) Zone

S.No	Section	Division	Length in (KMs)	Line	System of Working	Chartered Line capacity each way upto 31st Mar-18		Train service each way during the peak season in the year -2017-18(NOV-17-MAR-18)				%age of utilisation of Chartered Line Capacity		Work in Progress	Capacity after commissioning of the work	% Utilisation after Completion of Work	Further Works Required to be done
						WO MB	With MB	P	Goods	Others	TOTAL	WO MB	With MB				
														FWP 2013-14; Conversin of BKTH(E) & (W) cabins into a single Block Station under Umbrella work in PWP 2018-19			
7	URKURA - SARONA	R	9.4	DL	ABS	45	40	1	57	2.5	60.5	134	151	Survery sanctioned for fly Over at Urkura & Sarona in 2018-19		134	3rd Line is required
8	URKURA - RAIPUR	R	5.6	DL	ABS	63	57	46	15.4	3	64.4	102	113	Shunt Signal facility at Raipur Station under Umbrella work in PWP 2018-19		102	3rd Line is required
9	RAIPUR - SARONA	R	6.0	DL	ABS	60	54	55	21.3	2	78.3	131	145	Extension of L/No.7 at Raipur with PF sactioned under Umbrella work in PWP 2018-19		131	3rd Line is required
10	SARONA-KUMHARI-BHILAI	R	17.3	TL	ABS	90	81	56	68.6	2	126.6	141	156			141	4th Line is required
11	BHILAI - DURG	R	13.6	TL	ABS	88	79	56	54	2	112	127	142	Construction of full length line at Durg Station sanctioned under Umbrella work in PWP 2018-19		127	4th Line is required
12	DURG - MARODA	R	11.2	SL	ABS	17	15	5	10.1	2	17.1	101	114	Maroda - New exchange yard for addl. Traffic of Bhilai Steel Plant sanctioned in FWP-10-11.		101	Doubling is required

Table 18-14: Summary of Capacity Analysis and Interim Improvement Proposals for South East Central Railway (SECR) Zone

S.No	Section	Division	Length in (KMs)	Line	System of Working	Chartered Line capacity each way upto 31st Mar-18		Train service each way during the peak season in the year -2017-18(NOV-17-MAR-18)				%age of utilisation of Chartered Line Capacity		Work in Progress	Capacity after commissioning of the work	% Utilisation after Completion of Work	Further Works Required to be done
						WO MB	With MB	P	Goods	Others	TOTAL	WO MB	With MB				
13	URKURA - RAIPUR STORE DEPOT-RAIPUR VIZAINAGRAM HUT	R	3.4	SL	ABS	24	22	0	20.8	4	24.8	103	113			103	Doubling is required
14	RAIPUR - RAIPUR VIZAINAGRAM HUT	R	4.6	SL	ABS	15	13	12	3.8	5	20.8	139	160	Provision of Double line between R-TIG sanctioned in FWP-07-08.	40	52	#N/A
15	LAKHOLI-RAIPUR - RAIPUR VIZAINAGRAM HUT	R	4.6	SL	ABS	22	19	12	17.8	2	31.8	145	167	Provision of Double line between R-TIG sanctioned in FWP-07-08.	45	71	#N/A
16	JHARSUGUDA - CHAMPA	BSP	151.7	DL	ABS	69	62	28	72.8	0.5	101.3	147	163	Provision of 3rd line between JSG-CPH, Remodelling of BEF station sanctioned in FWP-2008-09, Fly over at IB sanctioned in FWP-11-12. 4th line between BSP-JSG sanctioned in PWP 2015-16	90	113	4th Line is required
17	CHAMPA - BILASPUR	BSP	52.5	TL	ABS	90	81	40	75.7	1	116.7	130	144	4th line between BSP-JSG sanctioned in PWP 2015-16; Automatic Signalling between BSP-GTW-JRMG sanctioned in PWP 2016-17	120	97	Automatic Signalling and 4th line in full section is required

Table 18-14: Summary of Capacity Analysis and Interim Improvement Proposals for South East Central Railway (SECR) Zone

S.No	Section	Division	Length in (KMs)	Line	System of Working	Chartered Line capacity each way upto 31st Mar-18		Train service each way during the peak season in the year -2017-18(NOV-17-MAR-18)				%age of utilisation of Chartered Line Capacity		Work in Progress	Capacity after commissioning of the work	% Utilisation after Completion of Work	Further Works Required to be done
						WO MB	With MB	P	Goods	Others	TOTAL	WO MB	With MB				
18	CHAMPA - GEVRA ROAD	BSP	47.0	DL	ABS	50	45	11	38.4	1	50	101	112	Conversion of Goods shed line into running line at SRBA sanctioned in FWP-2009-10. ; Automatic Signalling between CPH-GAD sanctioned under Umbrella work in PWP 2018-19; Additioinal Loop lines at MRWN sanctioned under Umbrella work in PWP 2018-19;.	60	83	3rd Line is required
19	BILASPUR - ANUPPUR	BSP	150.9	DL/SL	ABS	30	27	23	22.0	1	46	153	170	Automatic Signalling between BSP-USL-GTK sanctioned in PWP 2015-16; Doubling between KOI and APR with Fly over at BSP sanctioned in FWP 2006-07. 3rd line between BSP-APR sanctioned in PWP 2015-16. Survery for Fly over at USL - DPH & APR sanctioned in 2018-19	60	77	#N/A
20	ANUPPUR - SAHDOL	BSP	41.0	DL	ABS	64	58	26	36.6	0.5	63.1	99	109	3rd line between APR-KTE sanctioned in PWP 2015-16.	90	70	#N/A
21	SAHDOL - KATNI	BSP	125.3	DL	ABS	60	54	24	37.1	0.5	61.6	103	114	Provision of Additional Up loop at RPD sanctioned in PWP 2008-09, 3rd line	90	68	#N/A

Table 18-14: Summary of Capacity Analysis and Interim Improvement Proposals for South East Central Railway (SECR) Zone

S.No	Section	Division	Length in (KMs)	Line	System of Working	Chartered Line capacity each way upto 31st Mar-18		Train service each way during the peak season in the year -2017-18(NOV-17-MAR-18)				%age of utilisation of Chartered Line Capacity		Work in Progress	Capacity after commissioning of the work	% Utilisation after Completion of Work	Further Works Required to be done
						WO MB	With MB	P	Goods	Others	TOTAL	WO MB	With MB				
														between APR-KTE sanctioned in PWP 2015-16.			
22	BORIDAND - AMBIKAPUR	BSP	118.8	SL	ABS	25	22	5	15.9	0.5	21.4	86	97	Spliting of Block section between KTO-SJQ into Two Block sections sanctioned under Umbrella work in PWP 2018-19;		86	Doubling is required
23	IB - JHARSUGUDA ROAD	BSP	8.5	SL	ABS	13	11	1	14.3	-	15.3	118	139	Provision of Fly-Over between IB - Brundamal		118	Doubling is required

Source: Line Capacity Utilisation Chart

Table 18-15: Summary of Capacity Analysis and Interim Improvement Proposals for South East Railway (SER) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
1	HOWRAH-TIKIAPARA	KGP	2	TL	A/M	167	139	108	0.00	50.00	158	95%	114%	Tikiapara-Santragachi direct connectivity for the 4th Line with Howrah end (PF No. 17 to 23)		95%	4th Line is required
2	TIKIAPARA-SANTRAGACHI	KGP	6	QL	A/M	161	134	108	4.90	42.00	155	96%	115%	Development of Santragachi Coaching Terminal 2 Shalimar-development of coaching terminal.		96%	5th & 6th line is required
3	SANTRAGACHI-ANDUL	KGP	5	TL	A/M	130	108	121	7.45	2.00	130	100%	120%	Sankrail-Santragachi lik line via flyover from Dn side to Up side. Development of Freight Terminal at Sankrail Goods Terminal Yard.		100%	4th Line is required
4	ANDUL-ULUBERIA	KGP	20	TL	A/M	155	129	121	25.10	1.50	148	95%	114%			95%	4th Line is required
5	ULUBERIA-MECHEDA	KGP	27	TL	A/M	152	127	117	25.35	1.50	144	95%	114%			95%	4th Line is required
6	MECHEDA-PANSKURA	KGP	12	TL	A/M	124	103	107	28.60	1.50	137	111%	133%			111%	4th Line is required
7	PANSKURA-KHARAGPUR	KGP	45	TL	A/M	124	103	75	32.55	1.50	109	88%	106%	Panskura-Kharagpur -3rd line 4.7 kms with new MM for Panskura-Ghatal 32.8 kms new line		88%	4th Line is required

Table 18-15: Summary of Capacity Analysis and Interim Improvement Proposals for South East Railway (SER) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
8	KHARAGPUR-TATANAGAR	KGP	134	DL	ABS	61	51	31	30.50	1.50	63	103%	124%	3rd Line between Kharagpur - Adityapur. IBS at Galudih-Rakha Mines.	85	74	--
9	KHARAGPUR/NIMPURA-BHADRAK	KGP	177	DL	ABS	63	52	42	24.30	1.50	68	108%	129%	3rd Line between Kharagpur-Bhadrak. Additional loops at Bhakrabad & Ranital. Improvement of mobility by remobval of PSR from 75 Kmph to 110 Kmph in Narayangarh-Bhakrabad, Haldipada-Balasore, Soroh-Markona sections.	90	75	--
10	PANSKURA-HALDIA	KGP	70	SL	ABS	27	22	13	13.15	1.50	28	102%	123%			102%	Doubling is required
11	ANDUL-BHATTANAGAR	KGP	16	SL	ABS	22	18	2	18.10	1.50	22	98%	118%	Doubling of Andul-BankraNayabaz.	50	43	--
12	SANTRAGACHI-AMTA	KGP	44.6	SL	ABS	13	11	10	0.00	0.50	11	81%	97%			81%	Doubling is required
13	MIDNAPUR-ADRA	ADRA	155.4	DL	ABS	40	33	23	10.39	0.5	34	85%	102%			85%	Automatic Signalling

Table 18-15: Summary of Capacity Analysis and Interim Improvement Proposals for South East Railway (SER) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
14	MOHUDA-GOMOH	ADRA	20.2	SL	ABS	23	19	7	7.80	4.0	19	82%	98%			82%	Doubling is required
15	ANARA-PURULIA	ADRA	25.7	DL	ABS	53	44	26	30.60	3.0	60	112%	135%	Chandil-Anara-Burnpur-3rd line with addl. Loop at four stns.	85	70	--
16	PURULIA-CHANDIL	ADRA	54.0	DL	ABS	66	55	23	36.20	3.0	62	94%	113%	Kantadih-Extension of loop & Biramdih-Additional loops.Chandil-Anara-Burnpur - 3rd line with addl.loop at 4 stns.	90	69	--
17	BURNPUR-ASANSOL	ADRA	5.6	SL	ABS	28	23	21	5.10	1.0	27	97%	116%			97%	Doubling is required
18	BOKARO STEEL CITY-KOTSHILA	ADRA	28.5	DL	ABS	49	41	26	12.70	1.5	40	82%	98%	two loops at Chas &Ispatnagri		82%	Automatic Signalling
19	PURULIA-KOTSHILA	ADRA	34.5	SL	ABS	14	12	11	1.90	1.0	14	99%	119%	Purulia Kotshila 36 kms doubling	30	46	--
20	CHANDIL-MURI	RNC	67	SL	ABS	18	14	7	8.70	1.0	17	93%	119%	Dn IBS between Gangaghat-Jona and between Jona-Kita		93%	Doubling is required
21	MURI-BARKAKANA	RNC	58	SL	ABS	14	12	7	9.40	1.0	17	124%	149%			124%	Doubling is required
22	KOTSHILA - MURI	RNC	24	DL	ABS	41	33	30	10.50	1.0	42	101%	126%			101%	Automatic

Table 18-15: Summary of Capacity Analysis and Interim Improvement Proposals for South East Railway (SER) Zone																	
S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
																	Signalling
23	MURI-HATIA	RNC	72	DL	ABS	43	35	29	12.40	1.0	42	99%	121%	Ranchi-Ttisilwai-Automatic signaling in both lines (UP/DN)		99%	Automatic Signalling
24	HATIA-NAWAGAON	RNC	136	SL	ABS	17	13	9	10.20	1.0	20	119%	155%	1. Doubling of Hatia-Bondamunda section Lodma -Piska- 2. Link line bypassing Hatia/Ranchi with Y connection 17.2 kms 3. Ranchi - Bondamunda 158.50 kms. Doubling	40	51	--
25	TATA-GAMHARIA	CKP	10.6	DL	A/M	113	94	42	60.80	2.0	105	93%	111%	1. Kharagpur-Adityapur 3rd Line 2. Sini -Aditypur 22.5 kms 3rd line	150	70	--
26	BONDAMUNDA-ROURKELA	CKP	9	TL	ABS	67	56	28	39.20	1.5	69	103%	123%	1. BNDM-ROU 4th Line. 2. Link C connectivity with Bisra sanctioned 3.Bimlagarh -Dumetra doubling 4.Champajharan-Bimlagarh 21 km. 5 Chakradharpur - goelkera 3rd line 6. Dumetra - Link C line connection with Bisra stn..	120	57	--

Table 18-15: Summary of Capacity Analysis and Interim Improvement Proposals for South East Railway (SER) Zone

S. No.	Section	Div	Length (Kms.)	Line	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
27	ROURKELA-JHARSUGUDA	CKP	101	DL	ABS	70	58	29	41.90	1.5	72	103%	124%	1.3rd Line Rourkela-Jharsuguda in progress 2.Goelkera -Monoharpur 3rd line 40 kms 3.Rajkharsawan -Sini 3rd line	100	72	--
28	RAJKHARSWAN-DANGOAPOSI	CKP	74.8	DL	ABS	45	37	6	44.30	1.5	52	115%	138%	1. Rajkharswan-Pendrasali -Jhinkpani 3rd line commissioned. 2. Jhinkpani-Dongoaposi 3rd line in progress	75	69	--

Source: Line Capacity Utilisation Chart

Table 18-16: Summary of Capacity Analysis and Interim Improvement Proposals for Southern Railway (SR) Zone

Sl. No.	SECTION	Division	Length (KMs)	SL/TSL /DL/TL/QL/QSL	System of working	Charted Line Capacity each way		Average No. of trains each way				%age of utilization of Charted Capacity		Works in progress in the section (No sanctioned DFC route in SR)	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/o MTCE	With MTCE	Pass	Goods	Others	Total	W/o MTCE	With MTCE				
1	**Vyasarpadi - Villivakkam**	**MAS**	6	Q/L	A/M	222	185	165.0	11.2	6.5	182.7	82%	99%			82%	5th & 6th line required
2	**Villivakkam - Avadi**	**MAS**	12	Q/L	A/M	222	185	165.0	11.2	6.0	182.2	82%	98%			82%	5th & 6th line required

Table 18-16: Summary of Capacity Analysis and Interim Improvement Proposals for Southern Railway (SR) Zone																	
Sl. No.	SECTION	Division	Length (KMs)	SL/TSL /DL/TL/QL/QSL	System of working	Charted Line Capacity each way		Average No. of trains each way				%age of utilization of Charted Capacity		Works in progress in the section (No sanctioned DFC route in SR)	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/o MTCE	With MTCE	Pass	Goods	Others	Total	W/o MTCE	With MTCE				
3	Katpadi Jn. - Jolarpettai Jn.	MAS	84	D/L	A/M	92	77	52.0	17.8	4.0	73.8	80%	96%			80%	3rd line required
4	Attipattu - Gummidipundi	MAS	25	D/L	A/M	94	78	70.0	5.3	2.0	77.3	82%	99%			82%	3rd line required
5	Chennai Beach - Royapuram	MAS	1	D/L	A/M	54	45	40.0	6.3	4.5	50.8	94%	113%	Third Line W.P.99 -2000 Fourth Line W.P. 03 - 04	110	46	--
6	Royapuram - Washermanpet.	MAS	2	D/L	A/M	54	45	40.0	6.4	4.5	50.9	94%	113%	Third Line W.P. 99 -2000 Fourth Line W.P. 03 - 04	110	46	--
7	Jolarpettai Jn - Magnesite Jn.	SA	117	D/L	ABS	62	52	36.0	13.1	4.0	53.1	86%	103%	IBS bet Bommidi-Lokur W.P.15-16.		86%	Automatic Signalling
8	Magnesite Jn. - Salem Jn.	SA	3	D/L	ABS	69	57	47.0	10.4	4.0	61.4	89%	107%			89%	Automatic Signalling
9	Salem Jn. - Erode Jn.	SA	59	D/L	ABS	66	55	41.0	7.9	4.0	52.9	80%	96%			80%	Automatic Signalling
10	Erode Jn. - Irugur Jn.	SA	83	D/L	ABS	62	52	42.0	6.5	4.0	52.5	85%	102%	IBS bet Vijayamangalam-Uttukuli & Vanjipalaiyam-Somanur W.P.15-16.		85%	Automatic Signalling
11	Magnesite Jn. - Omalur	SA	8	S/L	ABS	27	22	13.0	6.8	2.0	21.8	81%	97%	Doubling 2016-17 (Supplimentary)	54	40	--
12	Podanur Jn. - Palakkad Jn.	PGT	48	TSL	ABS	52	43	34.0	6.9	3.0	43.9	84%	101%			84%	Automatic Signalling

Table 18-16: Summary of Capacity Analysis and Interim Improvement Proposals for Southern Railway (SR) Zone

Sl. No.	SECTION	Division	Length (KMs)	SL/TSL /DL/TL/QL/QSL	System of working	Charted Line Capacity each way		Average No. of trains each way				%age of utilization of Charted Capacity		Works in progress in the section (No sanctioned DFC route in SR)	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/o MTCE	With MTCE	Pass	Goods	Others	Total	W/o MTCE	With MTCE				
13	**Mangaluru Jn. - Thokur**	**PGT**	16	S/L	ABS	25	21	17.0	5.8	2.0	24.8	99%	119%	Doubling MAJN-PNMB WP. 06-07. Electrification 10-11. Jokkate Xing stn com. 29.01.17.	52	48	--
14	**Shoranur Jn. - Punkunnam**	**TVC**	31	D/L	ABS	60	50	43.0	5.7	2.5	51.2	85%	102%	Third line sanctioned WP18-19	90	57	--
15	**Punkunnam - Thrisur**	**TVC**	2	D/L	ABS	72	60	50.0	5.7	2.5	58.2	81%	97%	Third line sanctioned WP18-19	105	55	--
16	**Thrisur - Ernakulam Town**	**TVC**	72	D/L	ABS	65	54	46.0	6.7	5.5	58.2	90%	107%	Third line sanctioned WP18-19	100	58	--
17	**Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)**	**TVC**	115	S/L	ABS	36	30	30.0	1.4	3.5	34.9	97%	116%	Doubling in progress	65	54	--
18	**Thiruvananthapuram Central - Nagercoil Jn.**	**TVC**	71	S/L	ABS	20	17	16.0	0.7	1.0	17.7	89%	106%	Crossing station at Nagercoil Town 99-2000 Doubling W.P.15-16.	40	44	--

Table 18-16: Summary of Capacity Analysis and Interim Improvement Proposals for Southern Railway (SR) Zone

Sl. No.	SECTION	Division	Length (KMs)	SL/TSL /DL/TL/QL/QSL	System of working	Charted Line Capacity each way		Average No. of trains each way				%age of utilization of Charted Capacity		Works in progress in the section (No sanctioned DFC route in SR)	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						W/o MTCE	With MTCE	Pass	Goods	Others	Total	W/o MTCE	With MTCE				
19	Nagercoil Jn. - Tirunelveli Jn.	TVC	73	S/L	ABS	20	17	14.0	0.8	1.5	16.3	82%	98%	X-ing stn Sengulam-Tirunelveli Jn. W.P.10-11. Doubling W.P.15-16.	40	41	--
20	Ernakulam Jn. - Alappuzha	TVC	57	S/L	ABS	27	22	22.0	0.4	2.0	24.4	90%	108%	Doubling in progress	54	45	--
21	Madurai Jn. - Virudunagar	MDU	43	S/L	ABS	28	23	23.0	1.4	1.5	25.9	93%	111%	Doubling W.P.15-16.	56	46	--
22	Virudunagar - Vanchi Maniyachchi Jn.	MDU	84	S/L	ABS	27	22	20.0	1.7	1.5	23.2	86%	103%	Doubling W.P.15-16.	54	43	--
23	Vanchi Maniyachchi Jn.-Tirunelveli Jn.	MDU	29	S/L	ABS	30	25	22.0	0.6	1.5	24.1	80%	96%	Doubling W.P.15-16.	60	40	--

Source: Line Capacity Utilisation Chart

Table 18-17: Summary of Capacity Analysis and Interim Improvement Proposals for South Western Railway (SWR) Zone

S. No.	Section	Division	Length (Kms.)	SL/TSL/DL/TL/QL/QSL	Traction	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Remarks/Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
							W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
1	Jolarpet-Bangarpet	SBC	70	DL	E	ABS	53	46	30	11	3	44	83%	96%			83%	Automatic Signalling
2	Whiteeifeld-Bangarpet	SBC	47.95	DL	E	ABS	61	54	40	10	5	55	90%	102%	Auto signalling work between WFD-BWT is in progress.	80	69	--
3	Baiyyappanahalli-Whitefield	SBC	13.50	DL	E	ABS	64	54	56	4	15	75	117%	139%			117%	Automatic Signalling
4	Bengaluru-Baiyyappanahallli	SBC	10.75	DL	E	ABS	64	54	55	2	15	72	113%	133%	1. Automatic signalling work between SBC-BNC-WFD section is in progress. 2.SBC Yard remodeling work sanction in 2018-19	80	90	3rd line is required
5	Penukonda-Yelahanka	SBC	120.53	SL	D	ABS	35	29	20	9	2	31	89%	107%			89%	Doubling is required
6	Penukonda-Dharmavaram via SSPN	SBC	53.12	SL	D	ABS	21	18	12	7	2	21	100%	117%	Doubling between YNK-DMM is in progress.	45	47	--
7	Baiyyappanahalli-Omalur	SBC	207.00	SL	D	ABS	18	17	12	1	3	16	89%	94%	Doubling between BYPL-HSRA is in progress.	45	36	--
8	Baiyyappanahalli-Yeshwantpur via BAND	SBC	19.67	SL	E	ABS	23	21	9	3	8	20	87%	95%	Doubling between YPR-BAND-BYPL is in progress.	45	44	--
9	Castle-Rock-Kulem	UBL	26	SL	D		17	12	4	9	2.5	16	91%	129%	Doubling is sanctioned	40	39	--

Table 18-17: Summary of Capacity Analysis and Interim Improvement Proposals for South Western Railway (SWR) Zone

S. No.	Section	Division	Length (Kms.)	SL/TSL/DL/TL/QL/QSL	Traction	System of working	Charted Line Capacity each way		Average Nos. of train services each way				%age utilisation of Charted Capacity		Remarks/Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
							W/O MB	WITH MB	Pass	Goods	Other	Total	W/O MB	WITH MB				
10	Tumkur - Arsikere	MYS	96	SL	D	ABS	23	20	19	1	2	22	96%	110%	Doubling work is in progress.	46	48	--
11	Harihar -Hubli	MYS	131	SL	D	ABS	23	20	16	1.7	1	19	81%	94%	Doubling work in progress	46	41	--
12	Sakaleshpur-Subramanyaroad	MYS	55	SL	D	ABS	6	4	2	3.2	3	8	137%	205%			137%	Doubling is required

Source: Line Capacity Utilisation Chart

Table 18-18: Summary of Capacity Analysis and Interim Improvement Proposals for Western Central Railway (WCR) Zone

S. No.	Section	Div	Length (Kms.)	System of working	Charted Line Capacity each way		Average Nos. of Train Servcices Each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
					W/O MB	WITH MB	Pass	Goods	Others	Total	W/O MB	WITH MB				
1	ITARSI-KHANDWA	BPL	183.42	ABS	76	63	57	11.7	8.0	76.7	100.9%	121.73%	Itarsi – North-South grade separator/fly over with yard remodelling (PB 17-18 Item No. 25) Mathela: Conversion of Mathela C class station into B class station with provision of 732 meters Up and Dn. loop lines with low level PF. (PB 17-18 Item No. 36) Masongaon & Bhaionpur - Conversion of C class station into IBSs (ET-KNW) (PB-17-18 Item No 48) KNW-ET- Provision of 6 IBS (PB 2017-18,item no 49)		100.9%	Automatic Signalling
2	BHOPAL-ITARSI	BPL	91.65	ABS	72	60	74	27.2	11.9	113	157%	188%	Bhopal : Yard remodelling & extension of shunting neck upto Nishatpura - D cabin. (17-18 Item No. 33) 3rd line between Budni-Barkhera section (33 kms). (PB 17-18 Item No. 6). Barkheda-Habibganj 3rd line (41.42 Kms). (17-18 Item No. 9) Powerkheda - Jujharpur-Single line flyover in up direction (12 Kms) (PB 17-18 Item No 18)	100	113	Automatic Signalling

Table 18-18: Summary of Capacity Analysis and Interim Improvement Proposals for Western Central Railway (WCR) Zone

S. No.	Section	Div	Length (Kms.)	System of working	Charted Line Capacity each way		Average Nos. of Train Servcices Each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
					W/O MB	WITH MB	Pass	Goods	Others	Total	W/O MB	WITH MB				
3	BHOPAL-BINA	BPL	138.38	ABS	70	58	65	23.5	8.3	96.8	138.2%	166.8%	3rd line between Bhopal-Bina (143 Kms). (PB-17-18 Item No. 4). Gulabganj-Pabai-Bareth & Sukhi Sevaniya-Dewanganj section commsioned. Sorai: Up loop line for shifting of goods shed from Vidisha (PB-17-18 Item No. 44)	100	97	Automatic Signalling
4	GUNA-BINA	BPL	118.37	ABS	30	25	16	16.8	3.3	36.1	120%	144.3%	Pipraigaon-Orr- New crossing station (PB 2017-18 item no 22) Kota-Bina (303 Kms)-Long Haul loops (Bhulon , Sundalak, Semerkhedi & Rahatwas) (PB-17-18 Item No 45) Malkhedi-Mahadeokhedi (8.7 kms) doubling PB-17-18 Item No.12 Bina - Kota (282.66 Kms) Doubling. (PB 17-18 Item No. 7) Ashok nagar-Orr- New crossing station (PB 2017-18 item no 23)	60	60	--
5	RUTHIYAI-GUNA	BPL	20.47	ABS	27	22	18	16.8	3.2	38.0	141%	173%	Guna-Ruthiyai (20.5 Kms): Doubling (PB-2017-18 Item No.5).	60	63	--
6	RUTHIYAI - MAKSI	BPL	192.7	ABS	14	12	9	1.9	1.0	11.9	85%	99.2%			85%	Doubling is required

Table 18-18: Summary of Capacity Analysis and Interim Improvement Proposals for Western Central Railway (WCR) Zone

S. No.	Section	Div	Length (Kms.)	System of working	Charted Line Capacity each way		Average Nos. of Train Servcices Each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
					W/O MB	WITH MB	Pass	Goods	Others	Total	W/O MB	WITH MB				
7	GUNA-GUWALIOR	BPL	227.46	ABS	8	7	7	1.5	0.3	8.8	109.6%	125%	Parakheda: Conversion of D-class station into B-class between Shivpuri (SVPI)-Mohana (MOH) (61.20 kms). (PB 17-18 Item No. 37) Miyana-Conversion of halt station into crossing station with addl. Loop, panel interlocking & simultaneous reception facility. (PB 17-18 Item No. 38)		109.6%	Doubling is required
8	KOTA-NAGDA	KOTA	224.98	ABS	72	60	40	26.8	2.6	69.4	96.4%	115.7%	Kota: Remodeling of passenger yard with RRI (PB 17-18 Item No. 27) Nagda-Mathura -8 nos. Long haul loops in 7 stations. (DN- Thuria, Shamgarh, Laban, Piloda. UP- Chhoti Odai, Laban, Ravtha Rd, Suvasra) PB-17-18 Item No.41 Provision of UP & DN IBS in DRF-KIW block section in Kota-Nagda section (LB 2017-18, item no 3)		96.4%	Automatic Signalling
9	GURLA-KOTA	KOTA	5.56	ABS	70	58	56	29.6	4.5	90	128.6%	155.3%	KOTA-GGC- IBS 10 no (PB 2017-18 item no 32) Gangapur city Mathura - removal of permanent speed restriction of 90kmph at 1093/1 to 1093/27		128.6%	Automatic Signalling

Table 18-18: Summary of Capacity Analysis and Interim Improvement Proposals for Western Central Railway (WCR) Zone

S. No.	Section	Div	Length (Kms.)	System of working	Charted Line Capacity each way		Average Nos. of Train Servcices Each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
					W/O MB	WITH MB	Pass	Goods	Others	Total	W/O MB	WITH MB				
10	SWAI MADHOPUR-GURLA	KOTA	102.2	ABS	75	62	50	26.0	3.7	79.7	106%	129%			106.3%	Automatic Signalling
11	BAYANA-SWAI MADHOPUR	KOTA	140.83	ABS	75	62	39	26.1	1.2	66	88%	107%			88.4%	Automatic Signalling
12	KOTA - RUTHIYAI	KOTA	164.26	ABS	26	22	11	16.0	2.7	29.7	114%	135%	Bina - Kota (282.66 Kms) doubling. (PB 2017-18 Item No. 7) KOTA-RTA section- Opening of 3 new X-ing station	60	50	--
13	ITARSI - JABALPUR	JBP	245.155	ABS	48	40	47	4.3	0.76	52.1	108.5%	130%	Jabalpur: Removal of 3 DDS and yard remodeling (PB 17-18 Item No. 19) ET-JBP section: Provision of 11 IBS(PB 17-18 Item No. 43) ET-JBP section: Provision of 13IBS (PB 17-18 Item No. 49) New work Sontalai-Bagratawa: Patch doubling (7.482 kms) (PB 17-18 Item No. 13) ET-ALD - Electrification 2012-13. Itarsi - Khandwa 6 IBS	52	100	Automatic Signalling
14	KATNI-JABALPUR	JBP	90.788	ABS	56	47	51	4.9	1.3	57.2	102%	122%	Katni: Yard remodeling of Katni yard in 'A' cabin area (PB 17-18 Item No.20) ET-ALD - Electrification 2012-13. JBP-KTE section: Provision		102%	Automatic Signalling

Table 18-18: Summary of Capacity Analysis and Interim Improvement Proposals for Western Central Railway (WCR) Zone

S. No.	Section	Div	Length (Kms.)	System of working	Charted Line Capacity each way		Average Nos. of Train Servcices Each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
					W/O MB	WITH MB	Pass	Goods	Others	Total	W/O MB	WITH MB				
													of 2 IBS (PB -17-18 Item No. 43) JBP-KTE section: Provision of 4 IBS (PB -17-18 Item No. 48) New works ET-ALD - Electrification 2012-13.			
15	SATNA-KATNI	JBP	98.202	ABS	77	65	46	12.0	2.6	60.6	79%	93%	ET-ALD - Electrification 2012-13.		79%	--
16	MANIKPUR-SATNA	JBP	77.449	ABS	56	47	45	17.6	1.8	64.4	115%	137%	Provision of IBS in Satna-Sagma section (PB 17-18 Item No.43) Provision of IBS in MJG-TKYR section (PB 17-18 Item No.29) ET-ALD - Electrification 2012-13.		115%	Automatic Signalling
17	BINA - NEW KATNI Jn.	JBP	264	ABS	54	45	28	33.5	1.8	63.3	117%	141%	KMZ: Removal of 3 DDS(double diamond slips) & development of up passenger platform. (PB 17-18 Item No. 26) Damoh: Yard remodelling for extension of PF. (PB 17-18 item no. 40) NKJ - Yard remodelling for improve-ment in traffic facilities (PB-17-18 Item No.42) KTE-BINA section: Provision of 3rd line (PB 17-18 Item No. 14) KTE: Grade	70	90	Automatic Signalling

Table 18-18: Summary of Capacity Analysis and Interim Improvement Proposals for Western Central Railway (WCR) Zone

S. No.	Section	Div	Length (Kms.)	System of working	Charted Line Capacity each way		Average Nos. of Train Servcices Each way				%age utilisation of Charted Capacity		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
					W/O MB	WITH MB	Pass	Goods	Others	Total	W/O MB	WITH MB				
													Separator/Bypass (21.50 km) (PB -17-18 Item No. 15)			
18	NEW KATNI Jn. - SINGRAULI	JBP	257	ABS	18	15	5	12.1	1.1	18.2	101.1%	121%	Marwasgram – Upgradation of interlocking (with PI) and Addl. Loops with sand humps at 8 stations (Katangikhurd, Salhana, Mahroi, Vijaysota, Chhateni, Dubrikalan & Joba) for simultaneous reception. (PB-17-18 Item No. 28) Doubling b/w katni - singrauli (261 km) Sursaraighat Jhara- Conversion of D class station into crossing station with 3 line layout. (PB 2017-18 item no 39) Majholi - Extension of line no. 3 & 4 for long haul trains (PB-17-18 Item No 47)	40	46	--
19	REWA-SATNA	JBP	48.6	ABS	22	18	9	11.7	2.2	22.9	104%	127%	Satna-Rewa Doubling (PB - 17-18 Item No. 16 of NCR)	45	51	--

Source: Line Capacity Utilisation Chart

Table 18-19: Summary of Capacity Analysis and Interim Improvement Proposals for Western Railway (WR) Zone

S. No.	Section	Div	Length (Kms.)	Lines	System of working	Charted Capacity		AVG. NO. OF TRAINS RUN EACH WAY				% AGE UTILISATION		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WOMB	WMB	P	Gds	Others	TOTAL	WOMB	WMB				
1	Virar-Dahanu Rd.	BCT	63.8	D/L	A/M	100	83	90.0	17.2	4.0	111.2	111.2%	133.9%	Quadrupling work of Virar - Dahanu sanction in MUTP-III (Executed by MRVC)	200	56%	--
2	Dahanu Rd.- Valsad	BCT	74.44	D/L	A/M	100	83	72.5	17.5	6.5	96.5	96.5%	116.3%			96.5%	3rd Line required
3	Valsad- Udhna	BCT	64.55	D/L	A/M	100	83	74.5	17.2	6.0	97.7	97.7%	117.7%	Work of additional loop line at Valsad is in progress. (PB 57)		97.7%	3rd Line required
4	Udhna- Surat	BCT	4.01	D/L	A/M	110	92	89.0	22.8	5.1	116.9	106.2%	127.0%			106.2%	3rd Line required
5	Udhna- Ukai Songarh	BCT	75.64	S/L	ABS	24	20	20.5	9.2	4.4	34.1	142.2%	170.7%	Doubling of Udhana - Jalgaon section is in progress (PB - 39)	60	57%	--
6	Ukai Songarh-Nandurbar	BCT	80.67	S/L	ABS	24	20	20.5	9.2	4.4	34.1	142.2%	170.7%	Doubling of Udhana - Jalgaon section is in progress (PB - 39)	60	57%	--
7	Nandurbar-Jalgaon	BCT	150.62	S/L	ABS	24	20	20.5	11.1	4.4	36.0	150.0%	180.0%	Doubling of Udhana - Jalgaon section is in progress (PB - 39)	60	60%	--
8	Bhesthan-Chalthan	BCT	5.62	S/L	ABS	24	20	19.5	11.1	4.4	35.0	145.9%	175.1%			145.9%	Doubling is required
1	Surat- Bharuch	BRC	58.94	D/L	A/M	110	92	84.0	22.9	2.7	109.6	99.6%	119.1%	Work of 3rd line between Surat -		99.6%	3rd Line required

Table 18-19: Summary of Capacity Analysis and Interim Improvement Proposals for Western Railway (WR) Zone

S. No.	Section	Div	Length (Kms.)	Lines	System of working	Charted Capacity		AVG. NO. OF TRAINS RUN EACH WAY				% AGE UTILISATION		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WOMB	WMB	P	Gds	Others	TOTAL	WOMB	WMB				
														Kosamba has been frozen (PB-37)			
2	Bharuch-Vadodara	BRC	70.12	D/L	A/M	110	92	85.0	24.6	2.8	112.4	102.2%	122.2%	Vadodara Yard :Segregation of Ahmedabad and Godhra lines (PB78)		102.2%	3rd Line required
3	Vadodara 'P'-Vadodara 'D'	BRC	4.58	D/L	ABS	120	100	112.0	24.6	16.0	152.5	127.1%	152.5%			127.1%	Automatic Signalling
4	Vadodara'D'-Bajwa	BRC	2.7	D/L	A/M	100	83	72.0	13.1	2.6	87.7	87.7%	105.7%			87.7%	3rd Line required
5	Bajwa- Vasad	BRC	12.96	D/L	A/M	100	83	70.0	17.9	2.2	90.1	90.1%	108.5%			90.1%	3rd Line required
6	Vasad- Anand	BRC	15.48	D/L	A/M	100	83	68.0	17.9	2.2	88.1	88.1%	106.1%			88.1%	3rd Line required
7	Anand- Kanjari Boriavi	BRC	7.54	D/L	A/M	100	83	73.0	22.2	2.3	97.5	97.5%	117.5%			97.5%	3rd Line required
8	Kanjari Boriavi-Geratpur	BRC	43	D/L	A/M	100	83	71.0	22.2	2.3	95.5	95.5%	115.1%			95.5%	3rd Line required
9	Sevaliya-Anand	BRC	51.76	S/L	ABS	24	20	7.0	7.7	1.7	16.4	68.3%	82.0%			68.3%	--
1	Godhra-Ratlam	RTM	185.21	D/L	ABS	68	57	47.50	25.21	4.69	77.40	113.8%	135.8%	Increase in CSR at Bajaranggarh and Bamnia is in progress (PB-62)		113.8%	Automatic Signalling
2	Ratlam- Nagda	RTM	41.35	D/L	ABS	75	63	49.50	31.76	4.74	86.00	114.7%	136.5%	Akodia-Mohamed Khera-Shujaipur-		114.7%	Automatic Signalling

Table 18-19: Summary of Capacity Analysis and Interim Improvement Proposals for Western Railway (WR) Zone

S. No.	Section	Div	Length (Kms.)	Lines	System of working	Charted Capacity		AVG. NO. OF TRAINS RUN EACH WAY				% AGE UTILISATION		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WOMB	WMB	P	Gds	Others	TOTAL	WOMB	WMB				
														Patch Doubling 13.15 kms sanction			
3	Maksi - Bairagargh	RTM	132.38	D/L	ABS	46	38	28.50	9.35	2.33	40.18	87.3%	105.7%			87.3%	Automatic Signalling
4	Bairagargh-Bhopal	RTM	10.2	T/S/L	ABS	46	38	28.50	9.35	2.33	40.18	87.3%	105.7%			87.3%	Automatic Signalling
5	Ujjain- Dewas	RTM	40.39	S/L	ABS	26	22	23.00	1.66	2.01	26.67	102.6%	121.2%	Work of new crossing station Binjana (between Dewas - Barlai) is in progress (PB-73) Doubling of Indore-Dewas- Ujjain is in progress (PB50)	60	44%	--
6	Dewas- Indore	RTM	38.84	S/L	ABS	30	25	31.50	2.05	2.09	35.64	118.8%	142.6%	Additional loop line & increase in CSR at Barayla & Harkia Khal is in progress (PB-70) 3. Ratlam -Yard remodelling Doubling of Indore-Dewas- Ujjain is in progress (PB50)	60	59%	--
7	Ratlam - Nimach	RTM	132	S/L	ABS	20	16	14.00	5.79	1.91	21.70	108.5%	135.6%	1.Additional loop line & increase in CSR at Bisalwas	60	36%	--

Table 18-19: Summary of Capacity Analysis and Interim Improvement Proposals for Western Railway (WR) Zone

S. No.	Section	Div	Length (Kms.)	Lines	System of working	Charted Capacity		AVG. NO. OF TRAINS RUN EACH WAY				% AGE UTILISATION		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WOMB	WMB	P	Gds	Others	TOTAL	WOMB	WMB				
														Kalan is in progress (PB-65) Dublling between Nimach-Ratlam senctioned (133 Km)			
8	Nimach - Chittaurgargh	RTM	55.73	S/L	ABS	20	16	15.00	6.14	2.16	23.30	116.5%	145.6%	2. Doubling of Nimach - Chittorgarh is in progress	60	39%	--
9	Chittaurgargh - Berach	RTM	2.5	T/S/L	ABS	40	33	35.50	5.01	1.97	42.48	106.2%	128.7%			106.2%	Automatic Signalling
10	Berach - Chanderia	RTM	4.9	S/L	ABS	27	23	21.50	5.00	3.05	29.55	109.4%	128.5%			109.4%	Doubling is required
1	Geratpur-Vatva	ADI	3.3	D/L	A/M	100	83	72.0	21.85	0.29	94.14	94.1%	113.4%	1. Work of providing 3rd line between VTA -ADI is in progress. (PB-44) 2.Work of providing 4th line between VTA -ADI is in progress. (PB-48) 3.ADI-Viramgam-IBS in 3 block section.	200	47%	--

Table 18-19: Summary of Capacity Analysis and Interim Improvement Proposals for Western Railway (WR) Zone																		
S. No.	Section	Div	Length (Kms.)	Lines	System of working	Charted Capacity		AVG. NO. OF TRAINS RUN EACH WAY				% AGE UTILISATION		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WOMB	WMB	P	Gds	Others	TOTAL	WOMB	WMB				
2	Vatva-Kankariya	ADI	6.14	D/L	A/M	100	83	72.0	21.85	11.71	105.56	105.6%	127.2%			105.6%	3rd Line required
3	Kankariya-Ahmedabad	ADI	1.76	D/L	ABS	95	79	72.0	21.85	6.38	100.23	105.5%	126.9%	Sabarmati- 2nd coaching terminal		105.5%	Automatic Signalling
4	Ahmedabad-SBT A	ADI	3.74	Twin S/L	ABS	90	75	71.0	23.78	3.05	97.83	108.7%	130.4%			108.7%	Automatic Signalling
5	Sabarmati-Khodiyar	ADI	11.23	S/L	ABS	42	35	31.5	4.08	0.00	35.58	84.7%	101.7%			84.7%	Doubling is required
6	Khodiyar-Kalol	ADI	10.75	S/L	ABS	36	30	32.0	3.83	0.00	35.83	99.5%	119.4%			99.5%	Doubling is required
7	Kalol - Mahesana	ADI	41.81	S/L	ABS	36	30	33.5	3.83	0.00	37.33	103.7%	124.4%	Doubling b/w mehsana-Palanpur (650 km) Sentioned		103.7%	Doubling is required
8	Mahesana-Palanpur	ADI	65.1	S/L	ABS	36	30	31.5	7.96	0.09	39.55	109.9%	131.8%	1. Doubling of VG-SIOB is in progress. (PB-43) 2. VG-GIM : Provision of additional loop line at Wadharva & Surbari is in progress (PB-55) 3. New crossing station between Dhanagadra -	60	66%	--

Table 18-19: Summary of Capacity Analysis and Interim Improvement Proposals for Western Railway (WR) Zone

S. No.	Section	Div	Length (Kms.)	Lines	System of working	Charted Capacity		AVG. NO. OF TRAINS RUN EACH WAY				% AGE UTILISATION		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WOMB	WMB	P	Gds	Others	TOTAL	WOMB	WMB				
														Vasadva is commissioned on 01.03.2017 (PB 56)			
9	Jhund- Maliya Miyana	ADI	129.09	S/L	ABS	27	23	11.0	13.07	0.02	24.09	89.2%	104.7%	Gauge Conversion of Kalol - Kadi - Katosan is in progress (PB15)		89.2%	Doubling is required
10	Katosan Road - Kalol	ADI	37.21	S/L	ABS	9	7.50	9.0	0.00	0.00	9.0	100.0%	120.0%			100.0%	Doubling is required
1	Surendranagar-Wankaner	RJT	74.44	S/L	ABS	27	23	26.00	6.04	0.25	32.29	119.6%	140.4%	Doubling of SUNR-RJT is in progress (PB-46)	60	54%	--
2	Wankaner - Rajkot	RJT	41.73	S/L	ABS	27	23	24.50	6.73	0.33	31.56	116.9%	137.2%	Rajkot - Kanalus 111..20 kms doubling sanction	60	53%	--
3	Rajkot - Hapa	RJT	76.13	S/L	ABS	27	23	23.00	6.74	0.41	30.15	111.7%	131.1%	Rajkot - Kanalus 111..20 kms doubling sanction	60	50%	--
4	Hapa - Jamnagar	RJT	8.64	S/L	ABS	24	20	22.50	6.88	0.73	30.11	125.5%	150.6%	Rajkot - Kanalus 111..20 kms doubling sanction	60	50%	--
5	Jamnagar - Kanalus	RJT	26.43	S/L	ABS	24	20	19.50	6.53	0.65	26.68	111.2%	133.4%	Okha : Conversion of non-running line 04 into running line.(LB10)		111.2%	Doubling is required

Table 18-19: Summary of Capacity Analysis and Interim Improvement Proposals for Western Railway (WR) Zone

S. No.	Section	Div	Length (Kms.)	Lines	System of working	Charted Capacity		AVG. NO. OF TRAINS RUN EACH WAY				% AGE UTILISATION		Works in Progress	Capacity after commissioning of the work	%age Utilisation after Completion of Work	Further Works Required to be done
						WOMB	WMB	P	Gds	Others	TOTAL	WOMB	WMB				
6	Kanalus - Okha	RJT	140.99	S/L	ABS	17	14	13.50	2.19	0.29	15.98	94.0%	114.1%			94.0%	Doubling is required
1	Surendra nagar- Botad	BVP	77.18	S/L	ABS	24	20	12.50	7.51	0.16	20.17	84.0%	100.9%			84.0%	Doubling is required
2	Botad- Dhola	BVP	42.88	S/L	ABS	24	20	12.50	7.51	0.16	20.17	84.0%	100.9%			84.0%	Doubling is required

Source: Line Capacity Utilisation Chart

18.4. Junction and Terminals Improvement Measures

Indian Railways has 709 junction stations/ terminals on its network. Junction's stations are defined as a railway station, which has 3 or more directions of rail movement merging at the station. Junction station adds to the complexity of railway operation due to cross movements. Management of conflicts and cross movements, without causing detention and delay, poses a challenge before the section controllers and the station operator.

Over the years, the conflicts have become intense due to growth of main line traffic, as well as the traffic on feeder route. This is leading to detention to trains in reception and dispatch operation. With growth of traffic on feeding corridors, the detentions to trains are increasing exponentially. Enhancing junction capacity has attracted attention of investment planners of Railway Infrastructure.

Out of 709 junction stations, 133 stations have connection with 4 routes, 29 stations have 5 routes, 6 stations have 6 routes and 1 station is connected with 7 routes. The balance 540 junctions have connection with 3 routes.

Calculation of junction capacity and its utilisation poses a challenge. The junction station may be catering to varied set of rail transportation facility, viz: loco maintenance shed, Coach Maintenance facility, coach and wagon sick line, goods shed etc. Broadly, a junction station, depending on the layout and design may be performing the following train/loco/shunting movement functions:

a) Reception and dispatch of trains
b) Local movement of locomotive from loco shed to station and vice-versa,
c) Shunting movement for reversal of engine and brakevan,
d) Attachment and detachment of locomotive on account of change of traction,
e) Movement of locomotive for link overlap period,
f) Shunting movement for placement and removal of coaching rake in washing line,
g) Detachment of sick wagons/coaches,
h) Placement/removal in sick line,
i) In case the station has a good shed, then additional movements for goods placement and removal.

These local movements may block path of trains being received and dispatched. Over the years, works in the nature of line capacity enhancement by way of construction of doubling, 3rd line, 4th line, automatic signalling has been taken up. This has increased the sectional capacity. Little has been done to increase capacity of the junction/terminal. As a result, the junctions have become bottleneck. Gains of capacity enhancement works have been significantly nullified due to heavy detentions at junctions and terminals. We have tried to workout junction capacity empirically. Assuming that the trains at the junction traverse a common point during reception/dispatch operation and the station does not have any other rail facility, which interfere with train operation, the station capacity will be 144 movements in 24 hours, with 10 minutes time allocated for each movement.

Broadly, if sum of all train movements from/to different directions is less than 144, the station can function reasonably well. In case of station having other facility, the capacity will reduce correspondingly. It is important that with every investment in line capacity, junction station capacity is reassessed and station yard is modified to remove the restrictive features. It could be achieved by creating more independent group of Reception and Dispatch lines with facility of simultaneous movement. This may also require construction of additional lines on the approach of station.

The junction capacity can be further enhanced by construction of Bye-pass lines and/or rail flyover. Bye-pass lines help in reduction in the train passing activity at the station. Goods trains can by-pass the station, thereby avoiding congestion. Rail flyover avoids surface crossing, thereby help in avoiding loss of sectional capacity lost due to surface movement.

Based on inputs from Zonal Railways a list of 222 rail flyovers and bye-passes is prepared, which is mentioned in table below.

Furthermore, 58 stations were identified for similar intervention as phase II of the programme by adopting the following approach.

a) Identification is done exclusively from the operational point of view. Other factors like availability of geographical space/ land etc. have not been considered.
b) Since line capacity utilisation of approach routes is not the sole criteria for determining the feasibility of such flyovers/ bypasses No. of directions at a junction and no. of trains running in each direction are more predominant factors for this identification.
c) If a junction station has 4 or more arms then bypasses should be constructed to avoid on surface cross movements depending upon no. of freight trains likely to use bye-pass, and also whether the said junction is a terminal or not because movements of rakes, engines, locos and sick line takes place frequently at such stations.
d) Grading should be done on branch line or avoiding main line or busy route to save energy, fuel and other abnormalities such as load stuck up cases etc.
e) Broadly speaking, the HDN rout and HUN routes should be designed as Expressways, without surface crossing from the trains coming from feeder routes. Prioritisation should be done based on intensity of activity. IR should gradually migrate to DFC type of un-interrupted movement at junctions.

The list of all Junctions and Terminals along with the proposals is described in Table below.

Table 18-20: List of Junctions and Terminals along with Additional Proposals of Bypasses and Flyovers

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
1	N.R	Firozepur	Pathankot		
2	N.R	Firozepur	Pathankot Cantt		
3	N.R	Firozepur	Bharoli		
4	N.R	Firozepur	Suchipind		
5	N.R	Firozepur	Jalandhar City		
6	N.R	Firozepur	Jalandhar Cantt		Jalandhar Cantt for Hoshiarpur line
7	N.R	Firozepur	Phagwara		
8	N.R	Firozepur	Phillaur		
9	N.R	Firozepur	Nawanshahar Doaba		
10	N.R	Firozepur	Ludhiana		Ludhiana for Dhuri and Moga lines
11	N.R	Firozepur	Firozepur Cantt		
12	N.R	Firozepur	Kotkapura		
13	N.R	Firozepur	Fazilka		
14	N.R	Firozepur	Firozepur City		
15	N.R	Firozepur	Beas		
16	N.R	Firozepur	Amritsar		Amritsar for Verka and Tarantaran
17	N.R	Firozepur	Verka		
18	N.R	Firozepur	Tarantaran		
19	N.R	Firozepur	Lohian Khas		
20	N.R	Firozepur	Batala		
21	N.R	Firozepur	Nakodar		
22	N.R	Firozepur	Sanehwal	Kila Raipur-Sanehwal by-pass	Sanewal-Gill-Baddowal byepass
23					
24	N.R	Ambala	Sirhind		
25	N.R	Ambala	Rajpura		
26	N.R	Ambala	Ambala Cantt	Ambala	
27	N.R	Ambala	Chandigarh		
28	N.R	Ambala	Morinda		
29	N.R	Ambala	Dhuri		Ludhiana Bathinda byepass line avoiding Dhuri
30	N.R	Ambala	Saharanpur	Saharanpur	
31	N.R	Ambala	Raipur Haryana		
32	N.R	Ambala	Bathinda	Bathinda	
33	N.R	Ambala	Hindon		
34					
35	N.R	Delhi	Katar Singh wala		
36	N.R	Delhi	Jakhal	Jakhal	
37	N.R	Delhi	Narwana		
38	N.R	Delhi	Jind Jn		
39	N.R	Delhi	Jind City		
40			Khukrana		
41	N.R	Delhi	Rohtak		
42	N.R	Delhi	Asthal Bohar	Asthal Bohar-for going to Rewari from SSB without reversal	
43	N.R	Delhi	Gohana		
44	N.R	Delhi	Kurukshetra		
45	N.R	Delhi	Panipat		Panipat byepass
46	N.R	Delhi	Sonipat	Holambikalan	
47	N.R	Delhi	Tapri		

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
48	N.R	Delhi	Meerut City		
49	N.R	Delhi	Garhi Harsaru	Farukhnagar-Rewari byepass	
50	N.R	Delhi	Ghaziabad		
51	N.R	Delhi	Delhi Cantt		
52	N.R	Delhi	Adarsh Nagar		Adarsh Nagar towards Rampura and Rampura to Shakurbasti
53	N.R	Delhi	Sahibabad	Anand Vihar-Ghaziabad ROR	
54	N.R	Delhi	Delhi Shahadra		
55	N.R	Delhi	B Panel		
56	N.R	Delhi	A Panel		
57	N.R	Delhi	Block Cabin		
58	N.R	Delhi	Tilakbridge		
59	N.R	Delhi	H.Nizamudin		
60	N.R	Delhi	Okhla		
61	N.R	Delhi	Lajpat Nagar		
62	N.R	Delhi	Tuglakabad		1)Palwal-Bahadurgarh-Sonipat byepass line 2)Tuglakabad-Dadri-Hapur line
63	N.R	Delhi	Patel Nagar	Brar Square towards Delhi Cantt	Flyover between Patel Nagar and Rampura to avoid surface crossing with SPR movement
64	N.R	Delhi	Dayabasti		
65	N.R	Delhi	Delhi Kishanganj		
66	N.R	Delhi	Delhi		Grade separater on densly congested triangle area to avoid surface crossings of trains between NDLS/DLI/DKZ/SZM /DEE
67	N.R	Delhi	New Delhi		
68	N.R	Delhi	Sabzimandi		
69	N.R	Delhi	Delhi Sarai Rohilla		
70					
71	N.R	Moradabad	Laksar		
72	N.R	Moradabad	Muazzampur Narain		
73	N.R	Moradabad	Najibabad		
74	N.R	Moradabad	Raiwala		
75	N.R	Moradabad	Hapur		
76	N.R	Moradabad	Gajraurla		
77	N.R	Moradabad	Moradabad	Moradabad	
78	N.R	Moradabad	Raja ka Sahaspur		
79	N.R	Moradabad	Chandausi		
80	N.R	Moradabad	Rampur		
81	N.R	Moradabad	Bareilly		
82	N.R	Moradabad	Bareilly Cantt		
83	N.R	Moradabad	Roza	Roza	
84	N.R	Moradabad	Balamau	Balamau-For direct movement from Unnao to Moradabad	
85	N.R	Moradabad	Sitapur City	Sitapur	
86	N.R	Moradabad	Shajahanpur		
87					
88	N.R	Lucknow	Alam Nagar		

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
89	N.R	Lucknow	Lucknow	1)Amausi- Transport Nagar chord, 2) LKO-Manak Nagar	
90	N.R	Lucknow	Malhaur		Malhaur byepass
91	N.R	Lucknow	Alambagh		
92	N.R	Lucknow	Barabanki		
93	N.R	Lucknow	Faizabad		
94	N.R	Lucknow	Ayodhya		
95	N.R	Lucknow	Akbarpur		
96	N.R	Lucknow	Shahganj	Shahganj	
97	N.R	Lucknow	Jaunpur	Jaunpur	
98	N.R	Lucknow	Zafrabad		
99	N.R	Lucknow	Utratia		
100	N.R	Lucknow	Sultanpur		
101	N.R	Lucknow	Raibareli		
102	N.R	Lucknow	Unnao		
103	N.R	Lucknow	Dalmau		
104	N.R	Lucknow	Daryapur		
105	N.R	Lucknow	Unchahar	Unchahar	
106	N.R	Lucknow	Chilbila		Chilbila to avoid surface crossing with Sultanpur side trains
107	N.R	Lucknow	Partapgarh		
108	N.R	Lucknow	Janghai		
109	N.R	Lucknow	Varanasi		Varanasi byepass lines
110	N.R	Lucknow	Block Hut B		
111	N.R	Lucknow	Phaphamau		
112	N.R	Lucknow	Prayag		
113					
114	N.E.R	Varanasi	Kaptanganj		
115	N.E.R	Varanasi	Bhatni		
116	N.E.R	Varanasi	Salempur		
117	N.E.R	Varanasi	Thawe		
118	N.E.R	Varanasi	Hathua		
119	N.E.R	Varanasi	Chapra Kacheri		
120	N.E.R	Varanasi	Chapra	Chapra	
121	N.E.R	Varanasi	Phephna	Phephna	
122	N.E.R	Varanasi	Aunrihar	Aunrihar	
123	N.E.R	Varanasi	Indara		
124	N.E.R	Varanasi	Mau		
125	N.E.R	Varanasi	Panihawa		
126	N.E.R	Varanasi	Gorakhpur Cantt		
127					
128	N.E.R	Izzat Nagar	Lalkuan		
129	N.E.R	Izzat Nagar	Kashipur		
130	N.E.R	Izzat Nagar	Bhojipura		
131	N.E.R	Izzat Nagar	Pilibhit		
132	N.E.R	Izzat Nagar	Kasganj	Kasganj	
133	N.E.R	Izzat Nagar	Mandhana		
134	N.E.R	Izzat Nagar	Izzat Nagar		
135	N.E.R	Izzat Nagar	Farukhabad		
136					
137	N.E.R	Lucknow Jn	Lucknow Jn		
138	N.E.R	Lucknow Jn	Bhurwal		Bhurwal
139	N.E.R	Lucknow Jn	Daliganj		
140	N.E.R	Lucknow Jn	Gonda	Gonda	
141	N.E.R	Lucknow Jn	Gorakhpur Jn	Gorakhpur	

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
142	N.E.R	Lucknow Jn	Anand Nagar		
143	N.E.R	Lucknow Jn	Mankapur		
144	N.E.R	Lucknow Jn	Gorakhpur City		
145	N.E.R	Lucknow Jn	Mailani		
146	N.E.R	Lucknow Jn	Nanpara		
147					
148	N.C.R	Allahabad	Khurja,		
149	N.C.R	Allahabad	Aligarh		Aligarh-Harduaganj
150	N.C.R	Allahabad	Hathras		
151	N.C.R	Allahabad	Barhan		
152	N.C.R	Allahabad	Tundla/Mitawali		
153	N.C.R	Allahabad	Shikohabad		
154	N.C.R	Allahabad	Etawah		
155	N.C.R	Allahabad	Kanpur		Kanpur byepass
156	N.C.R	Allahabad	Allahabad		Bamhrauli-Subedarganj
157	N.C.R	Allahabad	Naini/Chheoki	Naini	1) Naini-Iradatganj, 2) iradatganj-Kunwadih, 3)Karchana-Iradatganj
158	N.C.R	Allahabad	Chunar	1) Jeonathpur, 2) Chunar-for trains from Mughalsarai to Chopan	
159					
160	N.C.R	Agra	Mathura		Mathura byepass
161	N.C.R	Agra	Agra Cantt		Agra byepass
162	N.C.R	Agra	Achhnera		
163	N.C.R	Agra	Bhandai		
164					
165	N.C.R	Jhansi	Gwalior		
166	N.C.R	Jhansi	Jhansi	1)Jhansi Gwalior to Kanpur, 2) Byepass line from Bijauli-Orchha-Mustara-Karari-Datia to avoid reversal of trains from Gwalior to Banda	Doubling of chord line betwwen Ohan-Bansapahur
167	N.C.R	Jhansi	Ait		
168	N.C.R	Jhansi	Bhimsen		
169	N.C.R	Jhansi	Govindpuri		
170	N.C.R	Jhansi	Udi More		
171	N.C.R	Jhansi	Khairar		
172	N.C.R	Jhansi	Mahoba		
173	N.C.R	Jhansi	Manikpur		
174	N.C.R	Jhansi	Lalitpur		
175					
176	N.W.R	Jaipur	Rewari	New Rewari for DFC traffic to Delhi	Rewari Byepass
177	N.W.R	Jaipur	Alwar		
178	N.W.R	Jaipur	Bandikui	Bandikui-byepass	
179	N.W.R	Jaipur	Dausa	Dausa byepass	
180	N.W.R	Jaipur	Jaipur	Jaipur-byepass	
181	N.W.R	Jaipur	Phulera	Phulrea-for traffic from Degana to Ajmer	
182	N.W.R	Jaipur	Ringus		
183	N.W.R	Jaipur	Sikar		
184					
185	N.W.R	Ajmer	Ajmer	1) Ajmer- to avoid reversal of traffic between Chanderia and Marwar . 2) Byepass from DET to Ghosunda for direct connectivity between	

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
				Ajmer-DET and Ghosunda-Himmatnagar sections.	
186	N.W.R	Ajmer	Marwar	Marwar byepass	
187	N.W.R	Ajmer	Madar		
188	N.W.R	Ajmer	Mavli		
189	N.W.R	Ajmer	Bangurgram/Beawar	1)Bangurgram-for movements to and fro RAS siding towards Ajmer 2)RAS-for Chittorgarh side	
190	N.W.R	Ajmer	Durai		
191					
192	N.W.R	Jodhpur	Degana	Degana-for traffic from Ratangarh to Phulera avoiding reversal at Degana 2)	
193	N.W.R	Jodhpur	Merta Road		
194	N.W.R	Jodhpur	Pipar Road		
195	N.W.R	Jodhpur	Raikabagh Palace	Jodhpur byepass	
196	N.W.R	Jodhpur	Luni		Asaranada-Luni byepass line avoiding Jodhpur
197	N.W.R	Jodhpur	Samdari	Samdhari-for traffic from Barmer to Bhildi avoiding reversal at Samdhari for sanctioned HPCL and Rajasthan refinery	
198	N.W.R	Jodhpur	Phalodi		
199	N.W.R	Jodhpur	Makrana		
200					
201	N.W.R	Bikaner	Bhiwani		
202	N.W.R	Bikaner	Hisar	Hisar byepass	
203	N.W.R	Bikaner	Hanumangarh		
204	N.W.R	Bikaner	Sadalpur		
205	N.W.R	Bikaner	Sarupsar		
206	N.W.R	Bikaner	Bikaner		
207	N.W.R	Bikaner	Lalgarh		
208	N.W.R	Bikaner	Ratangarh		
209	N.W.R	Bikaner	Loharu	Loharu	
210	N.W.R	Bikaner	Churu		
211	N.W.R	Bikaner	Suratgarh		
212	N.W.R	Bikaner	Suratpura		
213	N.W.R	Bikaner	Satrod		
214	N.W.R	Bikaner	Sri Ganganagar		
215					
216	W.C.R	Bhopal	Bina	Bina	
217	W.C.R	Bhopal	Bhopal		Bhopal byepass
218	W.C.R	Bhopal	Itarsi	Itarsi	
219	W.C.R	Bhopal	Guna	Guna	Guna-Ruthayi
220	W.C.R	Bhopal	Ruthayi	Ruthayi	
221					
222	W.C.R	Kota	Bharatpur		
223	W.C.R	Kota	Bayana		
224	W.C.R	Kota	Gurla		
225	W.C.R	Kota	Swai Madhopur	Swai Madhopur	
226	W.C.R	Kota	Kota	Kota-for Thermal Power station	Kota byepass
227	W.C.R	Kota	Ramganj Mandi	Ramganj Mandi	
228					
229	W.C.R	Jabalpur	Katni		
230	W.C.R	Jabalpur	New Katni		
231	W.C.R	Jabalpur	Jabalpur	1) Jabalpur 2) Kachhpura	

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
232	W.C.R	Jabalpur	Satna		
233					
234	C.R	Bhusawal	Khandwa	Khandwa	
235	C.R	Bhusawal	Bhusawal		Bhusawal byepass
236	C.R	Bhusawal	Jalgaon		Jalgaon byepass
237	C.R	Bhusawal	Manmad	Manmad	
238	C.R	Bhusawal	Badnera		
239	C.R	Bhusawal	Pachora		
240	C.R	Bhusawal	Akola	Akola	
241	C.R	Bhusawal	Jalamb		
242	C.R	Bhusawal	Murtajpur		
243	C.R	Bhusawal	Chalisgaon		
244					
245	C.R	Nagpur	Amla		Amla byepass
246	C.R	Nagpur	Narkher		
247	C.R	Nagpur	Nagpur	Bhallarshah	Nagpur byepass
248	C.R	Nagpur	Wardha	Wardha-Katol NL bypassing NGP for traffic between Etarsi-Bhallarshah	
249	C.R	Nagpur	Majri	1) Majri 2)Tadali	
250	C.R	Nagpur	Chandarpur		
251	C.R	Nagpur	Pulgaon		
252	C.R	Nagpur	Ballaharshah		
253	C.R	Nagpur	Bhutori		
254	C.R	Nagpur	Tadali		
255	C.R	Nagpur	Wani		
256					
257	C.R	Mumbai	Thane		
258	C.R	Mumbai	Kalyan		
259	C.R	Mumbai	Diva		
260	C.R	Mumbai	Panvel	1) Panvel 2) Panvel Chord	
261	C.R	Mumbai	Pen		
262	C.R	Mumbai	Karjat		
263	C.R	Mumbai	Neral		
264	C.R	Mumbai	Ravli		
265	C.R	Mumbai	Vashi		
266	C.R	Mumbai	Kurla		
267					
268	C.R	Pune	Miraj		Kohlapur-Pandharpahar
269	C.R	Pune	Pune	Pune	
270	C.R	Pune	Lonard		
271	C.R	Pune	Daund	Daund-to avoid surface crossing for trains from Solapur towards Manmad	
272					
273	C.R	Solapur	Hotgi		
274	C.R	Solapur	Kurduwadi	1) Kurduwadi-for traffic from Pandharpur to Solapur 2) Kurduwadi-for Solapur side to Latur Road	
275	C.R	Solapur	Puntamba		
276	C.R	Solapur	Ahmednagar	Ahmednagar-for traffic from Parli Baijnath to Daund	
277	C.R	Solapur	Wadi	Gulbarga-for traffic from Bidar to Pune	
278					

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
279	K.R.C. L	Karwar	Majorda		Chandargaon-Cansuum byepassing Madgaon and Majorda sations
280	K.R.C. L	Karwar	Madgaon		
281	K.R.C. L	Karwar	Thokur		
282					
283	S.E.C.R	Nagpur	Nainpur		
284	S.E.C.R	Nagpur	Chhindwara	Chhindwara-for traffic from Nainpur to Nagpur	
285	S.E.C.R	Nagpur	Nagpur/Itwari	Flyover at Kalumna	
286	S.E.C.R	Nagpur	Nagbir		
287	S.E.C.R	Nagpur	Kanhan		
288	S.E.C.R	Nagpur	Tumsar Road		
289	S.E.C.R	Nagpur	Balaghat		
290	S.E.C.R	Nagpur	Gondia	Flyover at Gondia	
291					
292	S.E.C.R	Bilaspur	Anuppur	Flyover at Anuppur	
293	S.E.C.R	Bilaspur	Boridand		
294	S.E.C.R	Bilaspur	Darritola		
295	S.E.C.R	Bilaspur	Bilaspur	Flyover between Dadhpara-Uslapur	BSP-for CIC bound up trains
296	S.E.C.R	Bilaspur	Champa	Kirorimal Nagar-from up side traffic to down side (Jindal Plant)	
297					
298	S.E.C.R	Raipur	Raipur		Raipur byepass
299	S.E.C.R	Raipur	Bhilai		Bhilai byepass
300	S.E.C.R	Raipur	Marauda		
301	S.E.C.R	Raipur	Abhanpur		
302	S.E.C.R	Raipur	Durg		
303	S.E.C.R	Raipur	Urkura	Flyover at Urkura	
304	S.E.C.R	Raipur	Sarona	Flyover at Sarona	
305					
306	S.E.R	Ranchi	Muri	Byepass line between ILLU and SILLI avoiding Muri	
307	S.E.R	Ranchi	Ranchi		
308					
309	S.E.R	Adra	Kotshila		
310	S.E.R	Adra	Bokaro		
311	S.E.R	Adra	Talgoria	Flyover from Khanudih end to Gomoh	
312	S.E.R	Adra	Bhojudih	Flyover from Talgoria end to Bhojudih	
313	S.E.R	Adra	Rukni		
314	S.E.R	Adra	Adra		
315	S.E.R	Adra	Damodar	Flyover from Burnpur end to Asansol	
316	S.E.R	Adra	Bankura	Bankura-for trains from KGP side to Masagram side	
317	S.E.R	Adra	Bishnupur		
318	S.E.R	Adra	Purlia	Flyover from Gaurinathdham end to Purlia (Chandil end)	Byepass line Purlia-Gaurinathdham-Chharra
319	S.E.R	Adra	Anara	Flyover from Rukni end to Anara	
320	S.E.R	Adra	Sanka		

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
321	S.E.R	Adra	Joyachandipahar	Flyover from Adra end to Joyachandipahar	
322	S.E.R	Adra	Ramkanali		
323	S.E.R	Adra	Chandil	Flyover from Gundabihar end to Chandil	
324					
325	S.E.R	Kharagpur	Kharagpur		
326	S.E.R	Kharagpur	Rupsa	Rupsa- for trains from Kharagpur to Bharipada	
327	S.E.R	Kharagpur	Panshkura		
328	S.E.R	Kharagpur	Tamluk		
329	S.E.R	Kharagpur	Santragachi		Santragachi byepass
330	S.E.R	Kharagpur	Gokulpur		
331					
332	S.E.R	Chakradharpur	Gamharia	Flyover from UP grid of Adityapur-Ghamaria section to Birarajpur	
333	S.E.R	Chakradharpur	Tatanagar		
334	S.E.R	Chakradharpur	Rajkharswan		
335	S.E.R	Chakradharpur	Bondamunda	Flyover connectivity between joint line of DN grid and joint line of UP grid at A cabin Bondamunda	
336	S.E.R	Chakradharpur	Bimalgarh		
337	S.E.R	Chakradharpur	Padapahar	1) Flyover from Padapahar/Dongaposi DN grid to Dongaposi 3rd line/joint line. 2)Padapahar-for trains between Bolanki Khadan to Banspani to Dhamra Port	
338	S.E.R	Chakradharpur	Barajamda		
339	S.E.R	Chakradharpur	Jharsuguda		
340	S.E.R	Chakradharpur	Sini		
341	S.E.R	Chakradharpur	Birarajpur	Flyover from Birarajpur to Kandra (chandil end)	
342	S.E.R	Chakradharpur	Rourkela	Rourkela-for trains from Jharsuguda towards Birmitrapur	
343	S.E.R	Chakradharpur	Onlajhori		
344					
345	E.Co.R	Khurda Road	Bhadrak		
346	E.Co.R	Khurda Road	Jakhapura	1) Baghuapal flyover. 2) Jaijpur Keonjhar Road - to avoid surface crossing of trains coming from BHC side mainly Dharma Port towards Sukinda Road. 3) Haridaspur	
347	E.Co.R	Khurda Road	Talcher Road	Direct line from Talcher to Angul through the colliery to avoid reversal at Talcher	
348	E.Co.R	Khurda Road	Nergundi		
349	E.Co.R	Khurda Road	Machapur		
350	E.Co.R	Khurda Road	Barang		

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
351	E.Co.R	Khurda Road	Cuttack	A separate line with flyover at Cuttack for the traffic of M/s MCL	
352	E.Co.R	Khurda Road	Khurda Road	1) Gopalpur port flyover to avoid surface crossing for the traffic coming from port towards north and for trains from south towards port. 2) Machhapur	
353	E.Co.R	Khurda Road	Rajatpur	NL from Rajatgarh to Kaipadar Road to avoid Bhubaneshwar and Khurda Road busy route	
354	E.Co.R	Khurda Road	Ranital		
355	E.Co.R	Khurda Road	Radhakishorepur		
356	E.Co.R	Khurda Road	Tomka		
357					
358	E.Co.R	Sambalpur	Titlagarh	1) Titlagarh-Rahenbhata to Sikri from RV line to JT line 2)Titlagarh- for traffic SBP end towards Raipur end to avoid surface crossing from Vizianagram	
359	E.Co.R	Sambalpur	Lanjigarh Road		
360	E.Co.R	Sambalpur	Sambalpur	1) DL flyover between SBP and SBP City for the trains coming from Sambalpur end towards Angul and to avoid surface crossing. 2)sarla- to avoid surface crossing for the trains coming from SBP City and going towards Jharsuguda side. 3) Sambalpur-for traffic between Sambalpur -Angul	
361					
362	E.Co.R	Waltair	Naupada		
363	E.Co.R	Waltair	Vizianagram	Vizianagram flyover	
364	E.Co.R	Waltair	Kottavalasa		
365	E.Co.R	Waltair	Vishakhapatnam		
366	E.Co.R	Waltair	Singapur Road	1) Singapur Road flyover . 2)Singapur Road-B cabin to avoid surface crossing for the traffic coming from Titlagarh towards Koraput	
367	E.Co.R	Waltair	Bobbili		
368	E.Co.R	Waltair	Koraput	Koraput A cabin -to avoid surface crossing for the trains coming from Dhamanjodi towards Jharsuguda	
369	E.Co.R	Waltair	Simanchalam		
370	E.Co.R	Waltair	Gopalpatnam		
371	E.Co.R	Waltair	Jaggayyapalem		
372	E.Co.R	Waltair	Duwada		
373	E.Co.R	Waltair	Keutguda		
374					
375	W.R	Mumbai	Udhna	Udhna (on up line of Jalgaon-Udhna line towards Dn line of BCT- Surat)	
376	W.R	Mumbai	Basai Road	Naigaon-Basai Road	

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
377	W.R	Mumbai	Mahim		
378	W.R	Mumbai	Billimora		
379					
380	W.R	Vadodara	Godhra	Godhra-on up main line ex RTM towards Anand (to avoid surface crossing on dn main line of BRC-RTM)	
381	W.R	Vadodara	Vadodara	1) Vadodra 2) Vadodra-on dn M/L ex BCT to Godhra side (to avoid surface crossing on up main line of ADI-BCT)	
382	W.R	Vadodara	Vishwamitri		
383	W.R	Vadodara	Bharauch		
384	W.R	Vadodara	Petlad		
385	W.R	Vadodara	Vasad		
386	W.R	Vadodara	Ankleshwar		
387	W.R	Vadodara	Kosamba		
388	W.R	Vadodara	Nadiad		
389	W.R	Vadodara	Anand	Anand byepass for trains from Godhra to ADI side	
390	W.R	Vadodara	Samni		
391	W.R	Vadodara	Dabhoi		
392	W.R	Vadodara	Choranda		
393	W.R	Vadodara	Chuchhupura		
394	W.R	Vadodara	Miyagam Karjan		
395					
396	W.R	Ratlam	Nagda	1) Nagda 2) Nagda-up through line from Kota to Mumbai 3)Nagda- From up line ex BPL side to down line of Kota side traffic	
397	W.R	Ratlam	Ujjain	1) Ujjain 2) Ujjain-from up line ex Indore side towards BPL side	
398	W.R	Ratlam	Dewas		
399	W.R	Ratlam	Ratlam	Ratlam- for Neemach to Nagda	
400	W.R	Ratlam	Chanderia	Chittorgarh	
401	W.R	Ratlam	Berach		
402	W.R	Ratlam	Fatehabad Chandrawati Ganj		
403	W.R	Ratlam	Indore		
404	W.R	Ratlam	Maksi	Maksi Dewas to BPL	
405	W.R	Ratlam	RAU	RAU	
406					
407	W.R	Ahmedabad	Palanpur	Palanpur	
408	W.R	Ahmedabad	Bhildi	1) Bhildi 2) Bhildi to Patan to NWR	
409	W.R	Ahmedabad	Samkhyali	Samkhayali	
410	W.R	Ahmedabad	Viramgam	Viramagam	
411	W.R	Ahmedabad	Mahesana		
412	W.R	Ahmedabad	Ranuj		
413	W.R	Ahmedabad	Kalol		
414	W.R	Ahmedabad	Ahmedabad		1)Ahmedabad byepass 2) Geratpur -Sanand byepass to avoid Ahmedabad

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
415	W.R	Ahmedabad	Adipur		
416	W.R	Ahmedabad	Gandhidham		
417	W.R	Ahmedabad	Maliya Miyana		
418	W.R	Ahmedabad	Dhrangadhra		
419	W.R	Ahmedabad	Jhund		
420	W.R	Ahmedabad	Katosan Road		
421	W.R	Ahmedabad	Amblyasan		
422	W.R	Ahmedabad	Himatnagar		
423	W.R	Ahmedabad	Khodiyar		
424	W.R	Ahmedabad	Chandiodiya		
425					
426	W.R	Rajkot	Wankaner	Wankaner-Viramgram to Malliya Miyana	
427	W.R	Rajkot	Dahinsara		
428	W.R	Rajkot	Rajkot		
429	W.R	Rajkot	Surendernagar	Surendernagar	
430	W.R	Rajkot	Kanalus		
431	W.R	Rajkot	Jamnagar		
432					
433	W.R	Bhavnagar	Dhola		
434	W.R	Bhavnagar	Khijadya		
435	W.R	Bhavnagar	Junagarh		
436	W.R	Bhavnagar	Veraval		
437	W.R	Bhavnagar	Prachi Road		
438	W.R	Bhavnagar	Talala		
439	W.R	Bhavnagar	Botad		
440	W.R	Bhavnagar	Dhasa		
441	W.R	Bhavnagar	Jetalsar		
442	W.R	Bhavnagar	Wansjalya		
443	W.R	Bhavnagar	Sihor		
444	W.R	Bhavnagar	Rajula Road		
445	W.R	Bhavnagar	Visavadar		
446					
447	E.R	Howrah	Shaktigarh	Masagram flyover	
448	E.R	Howrah	Nalhati	Nalhati	
449	E.R	Howrah	Ahmadpur	Ahmadpur byepass for trains coming from Bolpur to Kirnahar	
450	E.R	Howrah	Katwa	Katwa for Azimganj bound trains from Ahmadpur	
451	E.R	Howrah	Barddhaman		
452	E.R	Howrah	Bandel		Bandel byepass
453	E.R	Howrah	Dankuni		
454	E.R	Howrah	Sheoraphuli		
455	E.R	Howrah	Santhia		Rampurhat-Khana line with Braddhaman-Asansol main line
456	E.R	Howrah	Rampurghat	Rampurghat	
457	E.R	Howrah	Khana		
458	E.R	Howrah	Azimganj		
459	E.R	Howrah	Arambagh		
460	E.R	Howrah	Belur		
461	E.R	Howrah	Lilua		
462					
463	E.R	Sealdah	Ranaghat		Ranaghat byepass
464	E.R	Sealdah	Dumdum		Dumdum byepass
465	E.R	Sealdah	Sonarpur		
466	E.R	Sealdah	Krishnanagar City		
467	E.R	Sealdah	Bangaon		

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
468	E.R	Sealdah	Bally Gunge		
469	E.R	Sealdah	Baruipur		
470	E.R	Sealdah	Barasat		
471	E.R	Sealdah	Kalyani		
472	E.R	Sealdah	Naihati		
473					
474	E.R	Asansol	Madhupur		Madhupur Bypass line to avoid engine reversal for KQR/GDH ex JSME.
475	E.R	Asansol	Sitarampur	Sitarampur link cabin ROR	
476	E.R	Asansol	Andal		Santhia-Andal branch line with Braddhaman-Asansol main line
477	E.R	Asansol	Asansol		Asansol – Sitarampur by pass connecting ASN-STN (Chord line to STN-JAJ Main line) and connecting Alidih of SER to STN – JAJ Main line
478	E.R	Asansol	Bhimgora		
479	E.R	Asansol	Jasidih		Jasidih Bypass to avoid engine reversal for Deogarh - Dumka.
480	E.R	Asansol	Deoghar		
481					
482	E.R	Malda Town	Bhagalpur	1) Bhagalpur 2) Pirpainti	
483	E.R	Malda Town	Banka	Hansdiha byepass to Godda	
484	E.R	Malda Town	New Farakka		
485	E.R	Malda Town	Barhat	Barhat byepass for traffic to Mandhar hill from Banka	
486	E.R	Malda Town	Bonidanga		
487	E.R	Malda Town	Jamalpur		
488	E.R	Malda Town	Tinapur		
489	E.R	Malda Town	Barharwa		
490					
491	E.C.R	Mughalsarai	Mughalsarai	1) Mughalsarai 2) Mughalsarai -B route flyover	
492	E.C.R	Mughalsarai	Sasaram	Sasaram	
493	E.C.R	Mughalsarai	Gaya	Ankorah	Gaya byepass
494	E.C.R	Mughalsarai	Son Nagar	1) Chiraila Pouthu 2) Flyover at Chiraila Pouthu (CPCB)	
495					
496	E.C.R	Dhanbad	Koderma	At Koderma towards Hirodih	
497	E.C.R	Dhanbad	Gomoh		Gomoh byepass
498	E.C.R	Dhanbad	Chandrapura		
499	E.C.R	Dhanbad	Hazaribagh		
500	E.C.R	Dhanbad	Barkakana/Arigada	Y connection at Arigada	
501	E.C.R	Dhanbad	Garhwa Road	Garhwa Road	
502	E.C.R	Dhanbad	Billi		
503	E.C.R	Dhanbad	Karaila		
504	E.C.R	Dhanbad	Dhanbad		
505	E.C.R	Dhanbad	Pradhankunta	Pradhankhanta	
506	E.C.R	Dhanbad	Rajabera		
507	E.C.R	Dhanbad	Tori		
508					

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
509	E.C.R	Danapur	Dildarnagar		
510	E.C.R	Danapur	Ara		
511	E.C.R	Danapur	Patna	ROR at Jatt Dhumri in Patna Gaya line	
512	E.C.R	Danapur	Fatuha		
513	E.C.R	Danapur	Bakhtiyarpur		
514	E.C.R	Danapur	Biharsharif		
515	E.C.R	Danapur	Daniawan		
516	E.C.R	Danapur	Kiul	Kiul	
517	E.C.R	Danapur	Tilaya		
518	E.C.R	Danapur	Hathidah/Tall		
519	E.C.R	Danapur	Danapur	1) Phulwarisharif(HWH end) 2) Patliputra-Danapur 3)ROR at Neora in Main Line	
520					
521	E.C.R	Samastipur	Narkatiaganj		
522	E.C.R	Samastipur	Raxual		
523	E.C.R	Samastipur	Sitamarhi	Sitamarhi	
524	E.C.R	Samastipur	Darbhanga	Darbhanga	
525	E.C.R	Samastipur	Sakri		
526	E.C.R	Samastipur	Jhajharpur	Saraighar & Nirmali	
527	E.C.R	Samastipur	Saharsa	Lalitgram byepass line between Pratapganj-Narpatganj to facilitate movement towards Forbesganj on account of reversal at Lalitgram bound for Forbesganj and onwards	
528	E.C.R	Samastipur	Banmakhi		
529	E.C.R	Samastipur	Samastipur	Bachhwara-Samastipur	
530	E.C.R	Samastipur	Sugauli	Sugauli	
531					
532	E.C.R	Sonpur	Hajipur	Hajipur	
533	E.C.R	Sonpur	Muzaffarpur	Muzaffarpur byepass(Turki-Silaut)	
534	E.C.R	Sonpur	Bachhwara		
535	E.C.R	Sonpur	Barauni	Barauni byepass(Teghra-Tilrath)	
536	E.C.R	Sonpur	Sahibpur Kamal/ Umaheshnagar		
537	E.C.R	Sonpur	Khagaria		
538	E.C.R	Sonpur	Mansi		
539	E.C.R	Sonpur	Sonpur		
540					
541	N.F.R	Katihar	Katihar		
542	N.F.R	Katihar	Kumedpur		
543	N.F.R	Katihar	Eklakhi		
544	N.F.R	Katihar	Old Malda		
545	N.F.R	Katihar	Mukuria		Mukuria byepass
546	N.F.R	Katihar	Aluabari Road		
547	N.F.R	Katihar	Siliguri		
548	N.F.R	Katihar	New Jalpaiguri	New Jalpaiguri - Y connection required between ABFC & SGUT stations byepassing NJP avoiding reversal	
549	N.F.R	Katihar	Raninagar Jalpaiguri		
550	N.F.R	Katihar	Purnia		
551	N.F.R	Katihar	Forbesganj		

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
552	N.F.R	Katihar	Barsoi	Barsoi- for trains between NJP-SGUT to RDP	
553					
554	N.F.R	Alipur Duar	New Mal		
555	N.F.R	Alipur Duar	New Changrabandha		
556	N.F.R	Alipur Duar	New Cooch Behar		
557	N.F.R	Alipur Duar	Alipur Duar	Alipur Duar (PQZ-SJRR to NBS-NOQ byepassing APDJ)	
558	N.F.R	Alipur Duar	Samuktala Road		
559	N.F.R	Alipur Duar	Fakiragram		
560	N.F.R	Alipur Duar	Golak Ganj		
561					
562					
563	N.F.R	Rangiya	Rangiya		Rangiya byepass for trains from GHY to Rangapara
564	N.F.R	Rangiya	Dudhnoi		
565	N.F.R	Rangiya	Rangapara		
566	N.F.R	Rangiya	Balipara		
567	N.F.R	Rangiya	Harmuty	Sripani	
568	N.F.R	Rangiya	Bogibeel Bridge		
569	N.F.R	Rangiya	New Bongaigaon		
570					
571	N.F.R	Lumding	Kamakhya		
572	N.F.R	Lumding	Chaparmukh		
573	N.F.R	Lumding	Senchoa		
574	N.F.R	Lumding	Lumding	1) Lumding 2) Rangapara North	
575	N.F.R	Lumding	Badarpur	Badarpur	
576	N.F.R	Lumding	Kathakal		
577	N.F.R	Lumding	Karimganj		
578	N.F.R	Lumding	Baraigram		
579	N.F.R	Lumding	Arunachal		
580					
581	N.F.R	Tinsukia	Mariani	Mariani	
582	N.F.R	Tinsukia	Selenghat/Amguri		
583	N.F.R	Tinsukia	Simaluguri		
584	N.F.R	Tinsukia	Tinsukia		
585	N.F.R	Tinsukia	Makum		
586	N.F.R	Tinsukia	Dibrugarh Jn.		Sripani byepass for trains from Dibrugarh to Mukongselek
587	N.F.R	Lumding	Furkating		
588					
589	S.W.R	Hubballi	Londa	1) flyover connecting Chandargoa to Consaulim 2) Provision of direct connectivity from Chandargoa to Consaulim byepassing Mudgaon-Majorda stations of KRCL	
590	S.W.R	Hubballi	Alnavar		
591	S.W.R	Hubballi	Hubballi	Dharwad	
592	S.W.R	Hubballi	Gadag		
593	S.W.R	Hubballi	Hosapete		
594	S.W.R	Hubballi	Ballari		
595	S.W.R	Hubballi	Vayas Colony		

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
596	S.W.R	Hubballi	Toranagallu		
597	S.W.R	Hubballi	Gingeria		
598					
599	S.W.R	Bengaluru	Penukonda		
600	S.W.R	Bengaluru	Bengaluru	Flyover rail line arrangement connecting Salem line to Channasandra	
601	S.W.R	Bengaluru	Yeshvantpur	Yeshvantpur	
602	S.W.R	Bengaluru	Yelahanka		
603	S.W.R	Bengaluru	Bangerpet		
604	S.W.R	Bengaluru	Baiyyappanahalli	Flyover rail line arrangement connecting Salem line to BYPL	
605	S.W.R	Bengaluru	Chikbanavar	Flyover rail line arrangement connecting Krishnarajapuram to Channasandra	
606					
607	S.W.R	Mysuru	Amarvathi Colony		
608	S.W.R	Mysuru	Chikjajpur	Chikjajpur byepass line connecting Sasalu-Chikjajpur main line to Chikjajpur-Rayadurga line to avoid reversal of trains coming from UBL and going to Rayadurga	
609	S.W.R	Mysuru	Birur	Birur byepass line connecting Nagavangala-Birur M/L to Birur-Shivamoga town line to avoid reversal of trains coming from UBL / RDG and going to Birur / Telguppa side	
610	S.W.R	Mysuru	Kadur		
611	S.W.R	Mysuru	Arsikere	Arsikere	
612	S.W.R	Mysuru	Hassan	1) Hassan 2) Sakleshpur	
613	S.W.R	Mysuru	Mysuru		
614					
615	S.R	Chennai	Chennai		
616	S.R	Chennai	Arakkonam	Melapakkam-between Tirutanni to Chitteri	
617	S.R	Chennai	Chengalpattu		
618	S.R	Chennai	Gudur		
619	S.R	Chennai	Katpadi	Katpadi	
620					
621	S.R	Salem	Jolarpettai		
622	S.R	Salem	Salem		
623	S.R	Salem	Karur		
624	S.R	Salem	Erode	Erode byepass between Cauvery to Totiyapalaiyam	
625	S.R	Salem	Coimbatore		
626	S.R	Salem	Podanur		
627	S.R	Salem	Magnesite		
628					
629	S.R	Palakkad	Shoranur	Shoranur	
630	S.R	Palakkad	Palakkad	Palakkad-required from Palghat Town towards SRR	
631	S.R	Palakkad	Mangaluru Jn		
632	S.R	Palakkad	Pollachi		
633					
634	S.R	Madurai	Dindigul	Dindigul	

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
635	S.R	Madurai	Karaikkudi		
636	S.R	Madurai	Manmudrai		
637	S.R	Madurai	Virudunagar	Virudunagar	
638	S.R	Madurai	Vanchi Maniyachhi		
639	S.R	Madurai	Tirunelveli		
640	S.R	Madurai	Tenkasi		
641	S.R	Madurai	Madurai		
642					
643	S.R	Tiruchhirappalli	Villupuram	1) Villupuram-to be connected to proposed 3rd line at Sevur end byepassingKatpadi 2)Villupuram- from chengalpattu end towards Vriddhachalam	
644	S.R	Tiruchhirappalli	Vriddhachalam	Vriddhachalam	
645	S.R	Tiruchhirappalli	Cuddalore Port		
646	S.R	Tiruchhirappalli	Mayiladuturai		
647	S.R	Tiruchhirappalli	Thiruvarur		
648	S.R	Tiruchhirappalli	Nagappattinam		
649	S.R	Tiruchhirappalli	Tiruturaipundi		
650	S.R	Tiruchhirappalli	Tiruchhirappalli		Tiruchhirappalli byepass
651	S.R	Tiruchhirappalli	Thanjavur		
652					
653	S.R	Thiruvananthapuram	Nagercoil		
654	S.R	Thiruvananthapuram	Kollam		
655	S.R	Thiruvananthapuram	Kayankulan		
656	S.R	Thiruvananthapuram	Ernakulam Jn.		
657	S.R	Thiruvananthapuram	Ernakulam Town		
658	S.R	Thiruvananthapuram	Thrisur		
659					
660	S.C.R	Secunderabad	Manikgarh		
661	S.C.R	Secunderabad	Peddapalli	Peddapalli-Kazipet byepass	
662	S.C.R	Secunderabad	Warangal		
663	S.C.R	Secunderabad	Dornakal		
664	S.C.R	Secunderabad	Motumari		Motumari byepass
665	S.C.R	Secunderabad	Karepalli		
666	S.C.R	Secunderabad	Kazipet		Kazipet byepass
667	S.C.R	Secunderabad	Bibinagar	Pagidipalli-Bhongir end byepass	
668	S.C.R	Secunderabad	Vikarabad	Vikarabad-Wadi end byepass	
669	S.C.R	Secunderabad	Khanapur	1) Parli Vaijnath-Ghatnandur byepass 2)Latur Road-Parli Vaijnath end byepass 3) Khanapur-Parli Vaijnath end byepass	

S. No.	Rly	Division	Name of Junction	Locations of Proposed Flyovers	More Probable Locations
670	S.C.R	Secunderabad	Maula Ali		
671	S.C.R	Secunderabad	Hussain Sagar		
672	S.C.R	Secunderabad	Secunderabad		
673	S.C.R	Secunderabad	Santnagar		Santnagar byepass
674					
675	S.C.R	Nanded	Parbhani	Parbhani byepass line	
676	S.C.R	Nanded	Purna	Purna byepuss	
677	S.C.R	Nanded	Mudkhed	Provision of new BG line byepassing Mudkhed station	
678					
679	S.C.R	Hyderabad	Jankampet		
680	S.C.R	Hyderabad	Nizamabad	Nizamabad byepass	
681	S.C.R	Hyderabad	Devarkadra		
682	S.C.R	Hyderabad	Gadwal		
683					
684	S.C.R	Guntur	Nandyal		
685	S.C.R	Guntur	Guntur	Guntur	
686	S.C.R	Guntur	Nadikudi		
687	S.C.R	Guntur	Vishnupuram	Provision of byepass line at Vishnupuram connecting Janphad line at SC end	
688	S.C.R	Guntur	Nallapadu		
689					
690	S.C.R	Guntakal	Renigunta		1) Renigunta byepasas 2)Tirupati-Renigunta-Chennai byepass line
691	S.C.R	Guntakal	Pakala		
692	S.C.R	Guntakal	Dharmavaram		
693	S.C.R	Guntakal	Kalluru		
694	S.C.R	Guntakal	Gooty		Gooty byepass
695	S.C.R	Guntakal	Gutakal	1) Guntakal west- Mallappa gate 2)Guntakal(west) station in GTL -BAY section to Nancherla station in GTL-WD section	
696	S.C.R	Guntakal	Dhone		
697	S.C.R	Guntakal	Yerraguntla		
698	S.C.R	Guntakal	Cuddapah	Cuddapah byepass line	
699	S.C.R	Guntakal	Raichur		
700	S.C.R	Guntakal	Pendekallu		
701					
702	S.C.R	Vijayawada	Vijayawada	1) Byepass line at BZA to connect BZA-RJY line with BZA-KI section (19.5 km) with flyover between MBD-KI byepass line 2)Vijayawada byepass (BZA-Motumari line to BZA-Gudur line) for traffic from Vishakhapatnam side to Chennai side	
703	S.C.R	Vijayawada	Gudivada		
704	S.C.R	Vijayawada	Bhimavaram		
705	S.C.R	Vijayawada	Samalkot		
706	S.C.R	Vijayawada	Tenali		Tenali byepass
707	S.C.R	Vijayawada	Venkatachalam		
708	S.C.R	Vijayawada	Kakinada		
709	S.C.R	Vijayawada	Nidadavolli		

Source: Pink Book (2018-19), Ministry of Railways

Chapter 19 ROLLING STOCK REQUIREMENTS

19.1. Introduction

The projections for the rolling stock have been made met the forecasted demand for passenger and freight in the travel demand model that has been made for the study. This chapter covers the following rolling stock components:

- Electric Locomotives
    a. Freight
    b. Passenger
- Freight Wagons
    a. Open Wagons
    b. Closed Wagons
    c. Container Wagons
    d. Flat Wagons
    e. Tank Wagons
    f. Other special purpose wagons for the Automobiles
- Passenger Coaches
    a. Air Conditioned (AC) Coaches
    b. Non-AC Coaches
- Mainline Electric Multiple Units (MEMUs)
- Train Sets

The projections made in the plan for different components of the Rolling stocks are based on the characteristics of the existing operations, Emerging trends in Freight and passenger movement, Plans of Indian Railway and results of the travel demand model

19.2. Demand for Locomotives

Demand for locomotives has been assessed in four steps:

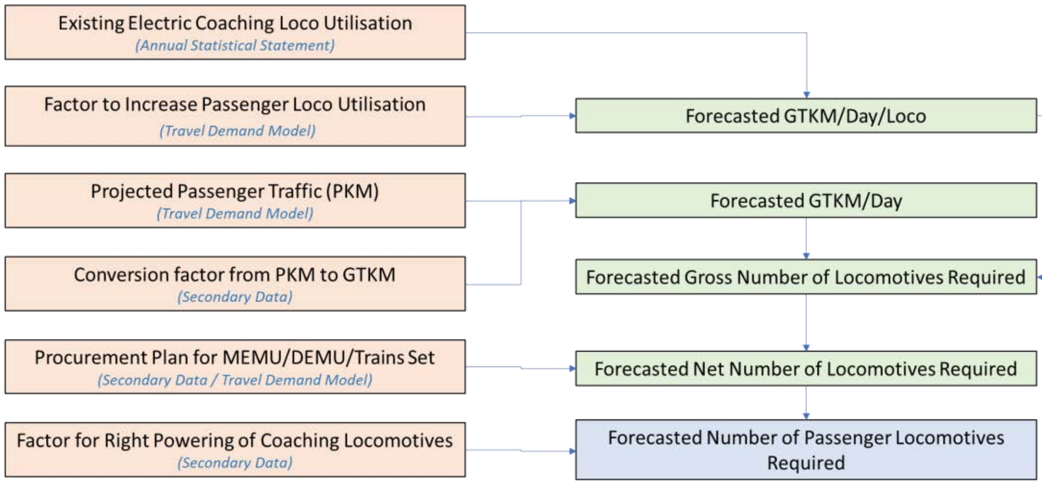
5. Assessment of total demand for locomotives for passenger operations
6. Assessment of total demand for locomotives for freight traffic operations
7. Condemnation Plan of Existing fleet based on the age profile
8. Procurement plan to meet total demand and supply

19.2.1. Locomotives for Passenger Operations

The total demand for locomotives has been derived on the basis of the forecasted total passenger Km as per the travel demand model. The detailed methodology and working has been given in the section

19.2.1.1. Methodology

The methodology for forecasting the demand for locomotives the locomotives for the passenger movement for each of the cardinal years is presented in the figure given below:



19.2.1.2. Projected Locomotive Utilisation for Passenger Operations

It is projected that the entire IR network will be electrified by 2023-24. With 100% Electrification of all BG routes, share of electric traction on all coaching services has been assumed as 100% respectively by FY 2025-26. In line with this, only electric locos are proposed to be procured in future.

For the base year, Electric passenger loco utilisation (GTKM/day/loco) has been calculated for the current operations. It is projected that the electric passenger loco utilisation will increase by 2026 due to various reason, which include:

– projected better utilisation of line capacity
– higher mobility due to uni-traction,
– commencement of freight traffic on DFC,
– increasing of GQ and Diagonal routes
– maximum speed upto 160kmph on GQ & GD and other routes upto 130kmph by 2024-25.

Considering the above assumptions, projected locomotive utilisation has been worked for the cardinal years. This is summarised in the table given below:

Table 19-1: Locomotive utilisation for cardinal years

Item	Unit	Year			
		2026	2031	2041	2051
Ratio of GTKM/PKM	Number	0.8	0.8	0.8	0.8
Share of Electric		100.00%	100.00%	100.00%	100.00%
Passenger Loco Utilisation (existing)	GTKM/day/loco	5,92,766			
Factor to increase Loco Utilisation	Number	2.00	2.00	2.00	2.00
Passenger Loco Utilisation (Forecast)	GTKM/day/loco	11,85,533	11,85,533	11,85,533	11,85,533

19.2.1.3. Projected Passenger Traffic

From the travel demand model, Passenger Kilometre (PKM) have been forecasted for the cardinal years to forecast the demand for Locomotives for the passenger use.

Table 19-2: Passenger Kilometre (PKM)

Item	Unit	Year			
		2026	2031	2041	2051
Projected NTKM	billion PKM per year	1850	2398	3880	5711

19.2.1.4. Number of Locomotives required for Passenger Operations

19.2.1.4.1.*Gross Number of Locomotives required*

Table 19-3: Gross Number of Locomotives required

Item	Unit	2026	2031	2041	2051
Passenger Traffic	Billion Passenger Km	1850	2398	3880	5711
Ratio of GTKM /PKM	No.	0.8	0.8	0.8	0.8
Projected Traffic	Billion Gross Tonne Km	1480	1919	3104	4569
Electric Share	Billion Gross Tonne Km	1480	1919	3104	4569
Gross Number of Locomotives required	No.	3421	4434	7174	10559

19.2.1.4.2.*Locomotives' demand to be met by Train Sets and MEMU*

It is projected that part of the passenger demand will be met through Mainline EMU (MEMUs) and train set. The criteria and the detailed working of these are given in later section of this chapter. The total MEMU and train sets which have been projected based on the demand for these services is given in the table given below:

Table 19-4: Locomotives' demand to be met by Train Sets and MEMU

Projected Demand for	2026	2031	2041	2051
Gross Number of Locomotives for passengers	3421	4434	7174	10559
MEMUs	1154	1324	1572	1882
Train Set	100	144	214	306
Net Number of Locomotives for passengers	2167	2966	5388	8371

This demand has been subtracted from the total demand of locomotives for the passenger operations.

19.2.1.4.3.*Factor for Right Powering*

It is planned to have additional locomotives to ensure that the average speed of the passenger train is increased. It is proposed to run the premium passenger trains at the speed of 160 KMPH on Golden Quadrilateral and Golden Diagonal (GQ & GD) and at the speed of 130 KMPH on other routes. All necessary track infrastructure in terms of lines and signalling is already proposed. To run the trains on the proposed speeds, it is imperative that the trains are run on the push-pull mode. A factor of 50% has been taken for increase in additional requirement for locomotives to be used in passenger trains running on the GQ & GD network.

19.2.1.4.4.*Factor for Maintenance*

It is proposed that an additional 7.5% of locomotives will be required for the maintenance. A provision for this is also kept in the overall calculations

19.2.1.4.5.*Net Number of Locomotives required for Passenger Operations*

Table 19-5: Net Number of Locomotives required for Passenger Operations

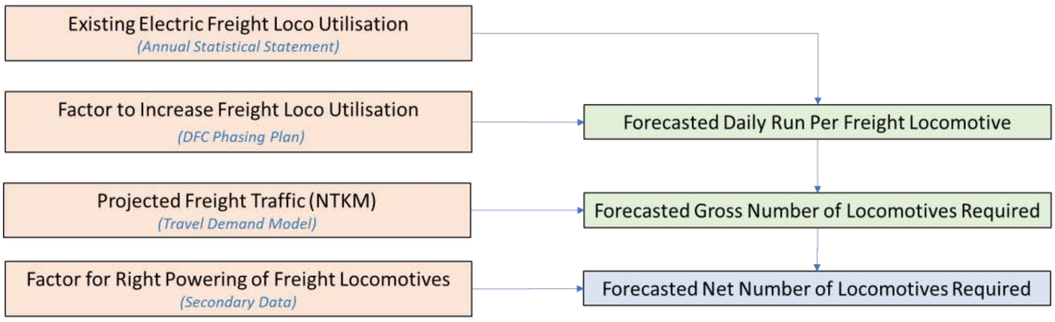
Item	2026	2031	2041	2051
Net Coaching Locomotives Required	2167	2966	5388	8371
Right Powering of Coaching Locomotives	1.50	1.50	1.50	1.50
Net Coaching Loco Required	3251	4449	8081	12557
Additional Locomotives Required for Maintenance (7.50%)	244	334	606	942
TOTAL COACHING LOCOMOTIVES REQUIRED	3494	4782	8687	13498

19.2.2. Locomotives of Freight Operations

The total demand for locomotives for freight operation has been derived on the basis of the forecasted total Net Tonne Km (NTKM) as per the travel demand model. The detailed methodology and working is given in the section

19.2.2.1. Methodology

The methodology for forecasting the demand for locomotives the locomotives for the passenger movement for each of the cardinal years is presented in the figure given below:



19.2.2.2. Projected Locomotive Utilisation for Freight Operations

It is projected that the entire IR network will be electrified by 2023-24. With 100% Electrification of all BG routes, share of electric traction on all coaching services has been assumed as 100% respectively by FY 2025-26. In line with this, only electric locos are proposed to be procured for freight traffic movement in future.

For the base year, Electric passenger loco utilisation (NTKM/day/loco) has been calculated for the current operations from the Annual Statistical Statement issued by Indian Railways. It is projected that the electric passenger loco utilisation will increase I future by a factor which will be derived from by considering the higher speed due to freight Operations on DFC Corridors and 100% electrification.

Considering the above assumptions, projected locomotive utilisation has been worked for the cardinal years. This is summarised in the table given below:

Table 19-6: Projected locomotive utilisation

Item	Units	2026	2031	2041	2051
Projected Traffic in 2029-30	Billion NTKM	1491	2453	3910	5554
Electric Freight Traction Share	%	100%	100%	100%	100%
Existing Electric Freight Utilisation Norm	NTKM/day /loco	3,71,664	3,71,664	3,71,664	3,71,664
Factor to increase utilisation	ratio	1.39	1.91	2.12	2.12
Proposed Electric Freight Utilisation Norm	NTKM/day /loco	5,16,795	7,08,716	7,87,463	7,87,463

19.2.2.3. Projected Freight Traffic

From the travel demand model, Net Tonne Kilometre (NTKM) have been forecasted for the cardinal years to forecast the demand for Locomotives for the freight use. This is presented in the table given below:

Table 19-7: Projected Net Tonne Kilometre (NTKM)

Item	Unit	Year			
		2026	2031	2041	2051
Projected NTKM	Billion NTKM per year	1491	2453	3910	5554

19.2.2.4. Number of Locomotives required for Freight Operations

19.2.2.4.1.*Gross Number of Locomotives required*

Table 19-8: Number of Locomotives required for Freight Operations

Item	Unit	2026	2031	2041	2051
Forecasted Traffic	Billion NTKM	1491	2453	3910	5554
Electric Share	Billion NTKM	1491	2453	3910	5554
Gross Number of Locomotives required	No.	7,906	9,481	13,603	19,322

19.2.2.4.2.*Factor for Right Powering*

During assessment of electric locomotives by Mobility Directorate, Railway Board for right powering under Mission Raftaar, it has been observed that HP to TL ratio is hovering between 0.94 to 1.15 over IR as against international norms of 2 to 2.25 Tonne. Further, Mobility Directorate has recommended that IR need to achieve Horsepower to Trailing Load Ratio between 1.5 to 2.0. An increase in HP requirement by 53% would be needed to bring HP to TL ratio at 2.0 Factor for Maintenance.

19.2.2.4.3.*Factor for Maintenance*

It is proposed that an additional 10% of locomotives for freight operations will be required for the maintenance. A provision for this is also kept in the overall calculations

19.2.2.4.4.*Net Number of Locomotives required for Freight Operations*

Table 19-9: Net Number of Locomotives required for Freight Operations

Item	2026	2031	2041	2051
Gross Freight Locomotives Required	7,906	9,481	13,603	19,322
Additional Locomotives Required for Maintenance (10%)	791	948	1,360	1,932
Net Freight Loco Required	8,696	10,429	14,963	21,254
Factor for Right Powering of Coaching Locomotives	1.53	1.53	1.53	1.53
TOTAL FREIGHT LOCOMOTIVES REQUIRED	13,305	15,957	22,894	32,519

19.2.3. Procurement Plan for Locomotives

The next step is to work out the procurement plan for the locomotives for next 30 years. This done in the following steps:

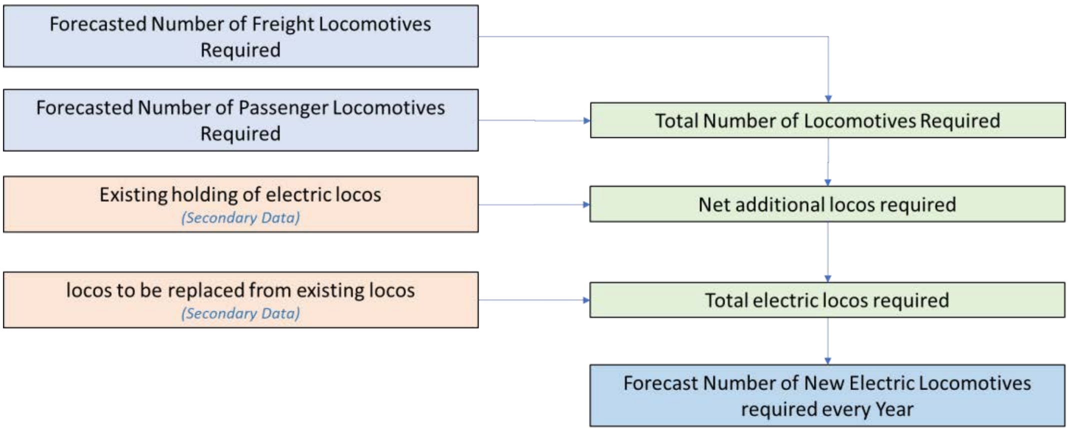
Total demand for locomotives is calculated by adding the locomotive demand for Passenger and freight operations, which is derived on the basis of forecasted demand.

Existing fleet of electric locos is worked out and the replacement plan is derived on the basis of the age profile of the existing fleet

Demand for the new locomotives is worked out on the basis of the above for each cardinal year.

19.2.3.1. Methodology

The methodology for the deriving the procurement plan is presented at the following figure



19.2.3.2. Existing Holding of Electric Locomotives and replacement Plan

As of 1st April 2020, IR has a holding of 6,436 mainline Electric Locomotive. The replacement plan for these 6,436 locomotives is given in the table below:

Table 19-10: Existing Holding of Electric Locomotives and replacement Plan

Item	2026	2031	2041	2051
Holding of Electric Locos on 01.04.2020	6,436	6,436	6,436	6,436
Locos Required for Replacement (from 01.04.2020)	660	1,367	4,035	6,436
Remaining existing stock available	5,776	5,069	2,401	-

19.2.3.3. Procurement Plan of Locomotive (Net additional Locomotives required) for each cardinal Year

The additional locomotives are required due to two reasons:

1. Net Incremental Demand due to passenger and freight
2. Replacement of existing fleet

This is presented at table given below

Table 19-11: Procurement Plan of Locomotive

Item	2026	2031	2041	2051
Locos Required due to Replacement	660	1,367	4,035	6,436
Net Incremental Locos Required	10,364	14,303	25,145	39,581
Total additional Electric Locos Required	11,024	15,670	29,180	46,017

Procurement plan is number of wagons that will have to be procured every year in each category. It is calculated by dividing the total demand in any period between two cardinal years by the total number of years. The procurement plan per year for all categories of wagons is as given below:

19.2.3.4. Procurement Plan for Each year

Procurement plan is number of electric locomotives that will have to be procured every year in each category. It is calculated by dividing the total demand in any period between two cardinal years by the total number of years. The procurement plan per year for Locomotives is as given below:

Table 19-12: Procurement Plan of Locomotives for Each year

Duration	Total Main Line Electric Locos Required	Total Electric Locos Required Per Year
2018-26	16,800	1,837
2026-31	20,739	929
2031-41	31,581	1,351
2041-51	46,017	1,684

It is learnt that a separate exercise to forecast the number of locomotives required is being carried out in the Railway Board. The assumptions made in this report are aligned with the except growth rate of Passenger Traffic.

19.3. Demand for Wagons

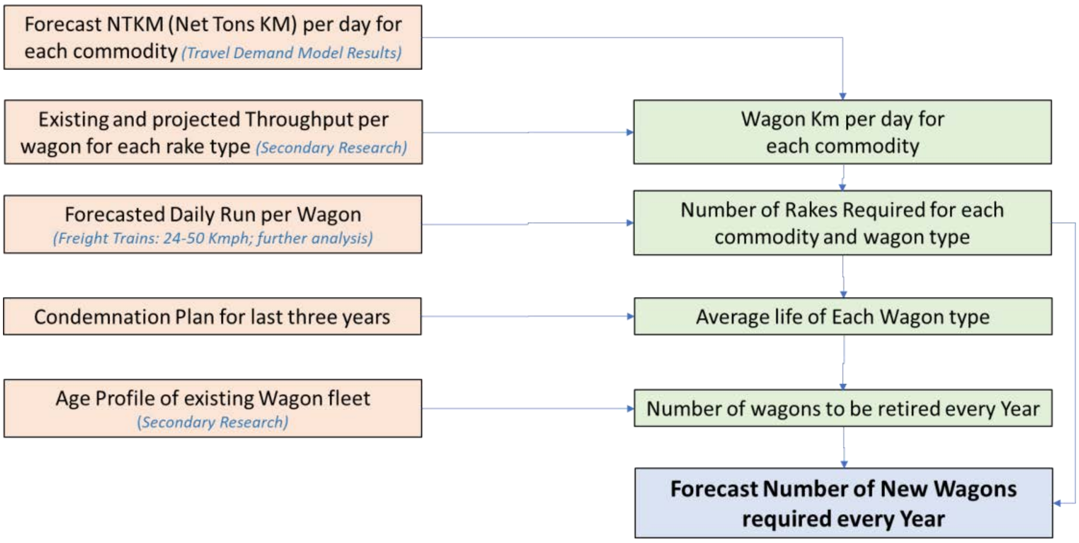
The demand for wagons has been calculated separately for the following five broad categories and two special purpose wagons:

a. Open Wagons (including Hooper wagons)
b. Covered Wagons
c. Container Wagons
d. Flat Wagons
e. Tank Wagons
f. Other special purpose wagons
    i. Automobiles
    ii. Bulk Cement

The number of each of these different types of wagons have been calculated based on the total NTKM for all the commodities that each of these wagons currently carries and is proposed to carry in future.

19.3.1. Methodology for forecast

The methodology for forecasting the demand for different wagon for each of the cardinal years is presented in the figure given below:



19.3.2. Existing and Forecasted Daily Net Tonne Km (NTKM) and Wagon Km

As discussed earlier, all the commodities carried by Railways are broadly classified in ten categories. On the basis of the Logit Model, OD Matrices for each of these commodities is prepared and assigned on the Railway network. On the basis of the assignment model, Net Tonne Km for each of these commodities has been worked out for each of the cardinal year. These NTKMs for each of the commodities are presented in table given below:

Table 19-13: Million NTKM per day

Year	BOG	Cement	Coal	Container	Fertilizer	Food Grains	Iron Ore	Pig Iron	POL	RM for Steel	Total
2018	145	181	783	150	120	186	107	139	85	46	1,896*
2026	1,074	517	1,221	142	177	332	155	279	121	69	4,017
2031	2,226	771	1,658	285	244	406	255	392	391	92	6,627
2041	3,528	1,307	2,287	510	378	540	425	579	1,013	143	10,568
2051	5,000	2,061	2,571	787	553	712	614	835	1,877	206	15,009

* Annual NTKM works out to be 692 Billion NTKM. This is in line with figure given in the Indian Railway Annual Report – 2018-19 for the figure given for 2017-18 i.e. 692Billion NTKM.

It is proposed that in future all commodities will continue to use the existing wagon types except part of the BOG and Cement will move on the different types of wagons as per the detail below:

Balance Other Goods

1. Covered
2. Automobiles
3. ISO Containers and Dwarf Containers

Cement

1. Covered
2. Special Purpose Wagon for Bulk movement

The shares of BOG and Cement NTKMs on different Wagons is as given below:

Table 19-14: Shares of BOG and Cement NTKMs on different Wagons

Year	BOG (Total)	BOG (Covered)	BOG (Automobile)	BOG (Container)	Cement (total)	Cement (Covered)	Cement (Bulk)
2018	145	145	-	-	181	179	2
2026	1,074	733	12	330	517	488	29
2031	2,226	1,434	21	770	771	705	66
2041	3,528	1,999	32	1,497	1,307	1,118	189
2051	5,000	2,433	45	2,512	2,061	1,546	515

In this analysis following assumptions have been made for the year 2051.

- Automobile is worked out based on actual forecast
- Container traffic is assumed to be capped at 50% of the total BOG traffic
- Bulk movement of Cement is capped at 25% of Rail Cement share
- For the intervening years, the shares are linearly interpolated

19.3.3. Characteristics of Different Wagons type

It is proposed that as a policy decision regarding the design and procurement of new wagons, only 25 Tonne Axle load wagons should be manufactured in future. Depending on the availability of design, all new procurements shall be done for 25 Tonne axle load for all the wagon categories. This is also in line with the decisions taken in the Railway Board meeting held on 22nd July 2020. It is important that the Maximum Moving Dimensions of different routes are examined from the perspective of vertical clearances. In order to get volume for different type of wagons need for additional vertical clearance is identified. Railways need to identify the route wise infringements and feasibility of removing them.

The most common type of existing and new type of wagons for each of these categories is given in Table below:

Table 19-15: New type of wagons

SN	Broad Category of wagon	Code for common type of wagon	
		Existing Wagons Type	New Wagons Type
1	Open Wagons	BOXN	BOXNS
2	Closed Wagons	BCN	BCNS
3	Container Wagons	BLC	BLCSA
4	Flat Wagons	BRNA	BRN25
5	Tank Wagons	BTPN	BTFLN
6	Automobiles Wagons	BCACBM	BCACBM
7	Special Purpose Bulk Cement	BCFC	BCFC

19.3.3.1. Wagon Capacity

The specifications for the existing and new type of wagons are given in the section.

19.3.3.1.1. *Existing Wagons type*

The specifications including the wagon capacity for existing wagon in each category are summarised below:

Table 19-16: Existing Wagons type

SN	Description of wagon	Covered (BCN)	Open (BOXN)	Container (BLC)	Flat (BRNA)	Tank (BTPN)
1	Length over Hd. Stock (mm)	14500	9784	13625	13716	11491
2	Length over Buffer / Couplers (mm)	15429	10713	14566	14645	12420
3	Length inside (mm)	14494	9784	NA	13716	11434 (inside Barrel length.)
4	Width Inside / Overall ()	2944/3100	2950/3200	2100/2200	2845	2850 (inside Barrel Diameter)
5	Height Inside / From Rail ()	2446/3788	1950 / 3233	1009.	2544 from R.L.	4265 (overall Height)
6	Bogie Centres ()	10000	6524	9675/8812	9144	8391
7	Journal Centres ()	2260	2260	2260	2260	2260
8	Wheel dia. on Tread ()	1000	1000	840	1000	1000
9	Nominal Max. Axle load (Tonnes)	22.82	20.32	20.32t	20.32	20.32
10	Tare (Tonnes)	27.2	22.48	15.1/18 t	23.543	27
11	Pay Load (Tonnes)	64.08	58.8	61	57.737	54.28
12	Ratio Pay Load / Tare (Tonnes)	2.36	2.61	3.194/3.39	2.452	2.01
13	Gross Load (Tonnes)	91.28	81.28	80.1/79	81.28	81.28
14	No. of wagons / Rake (no.)	41	58	45(18+27)	42	51 *
15	Through - Put / Rake (Tonnes)	2627	3410	1098/1647	2425 t.	2768.28
16	Track Load Density (Tonnes/meter)	5.92	7.59	5.5/6.0	5.55 t./m	6.54
17	Cubic Capacity (m^3)	104	56.28	NA	NA	70.4
18	Speed (Empty / Loaded) (KMPH)	80/60	80/75	100/100	80 / 75	80 / 75 MW /
19	Type of Coupler	CBC	CBC	CBC/SDB	CBC	CBC
20	Type of Bearing	CTRB	CTRB	CTRB	CTRB	CTRB

19.3.3.1.2. *New Wagons type*

Currently, design exist for the 25 Tonne axle load wagons for Open, Covered and Container type of wagons. In the analysis, assumptions relating to a proto Flat and proto Tank Wagons with 25 Tonne axle load have been made.

Table 19-17: New Wagons types

S. N.	Description of wagon	Covered BCNS	Open BOXNS	Container BLCSA	Flat Proto BRN 25	Tank Proto BTFLN
1	Length over Hd. Stock	10678	9784	13625		
2	Length over Buffer / Couplers	11478	10713	14554		
3	Length inside	10500	9808	12192		
4	Width Inside / Overall	3328	3111/3135	2200/2100		
5	Height Inside / From Rail	4174	2300/3581	1009		
6	Bogie Centres	7426	6524	9675		
7	Journal Centres	2222	2260	2260		
8	Wheel dia. on Tread	1000	840	840		
9	Nominal Max. Axle load	25 T	25 T	25 t	25	25
10	Tare	22.7 T	19.85 T	19.2	23.3	23.3
11	Pay Load	77.3 T	80.15 T	80.8	76.7	76.7
12	Ratio Pay Load / Tare	3.4 T	4.04	4.21		
13	Gross Load	100 T	100 T	100		
14	No. of wagons / Rake	55	59	18	42	51
15	Through - Put / Rake	4251	4729	2181.6	3221.4	3911.7
16	Track Load Density	9.33 T/M	9.33 t./m	6.87 t/m		
17	Cubic Capacity	9.87 m³	69.36 m³			
18	Speed (Empty / Loaded)	100 / 100	85 / 65	65		
19	Type of Coupler	CBC	CBC	CBC		
20	Type of Bearing	CTRB	CTRB	CTRB K-Class		

19.3.3.2. Projection of Daily run per wagon

Base Year

Projections relating to the daily run per wagon have been carried out. Considering that the average lead of freight traffic is ~600 Km, a freight train must run for about 1200 Km in one round trip. As per the Indian Railways Annual Statistical Statement 2018-19 for the year 2017-18, the turnaround time is 5 days for a rake. This can be expressed as

$LT_1 + TT_1 + UT_1 + IT_1 \quad = 5$ DAYS

Where,

LT = Loading Time

TT = Travel Time

UT = Unloading Time
IT = Inspection Time

The average speed of wagon can be deduced as ~ 10 kmph (1200 Km / (5 days x 24 Hrs/day))

Design Years

If the running speed of the rake increases, corresponding decrease in travel time will not be proportionate as the time required for the Loading, unloading and Inspection will not reduce proportionately. It is targeted that total turnaround time will be around 3 days for the any rake.

$LT_2 + TT_2 + UT_2 + IT_2$ = 3 Days, (target)

If the speed is doubled from existing 25 Kmph to 50 Kmph, the travel time will be reduced by 50%. However corresponding decrease in time of other activities will be only 20%. Future average Speed of Wagon can be deduced as 16.67 Kmph (1200 Km / (3days x 24 Hrs./day)). Thus, the daily run in future can be deduced as 400km per day, (16.67 Kmph * 24 Hrs.). Thus, on an average Daily Run per Wagon is assumed as 400 Km per Day

19.3.3.3. Daily Run per Wagon type

On the basis of the data received from FOIS, daily run for the different type of wagons is worked out and compiled for the base year. Daily run for different wagons has forecasted for cardinal years on the basis of the existing daily run, projected increase in the daily Run (which incorporates the increase in the effective speed and terminal detention time). The existing and the projected daily run for each type of wagon is given below:

Table 19-18: Daily Run per Wagon type

Year	BCN	BOXN	BCAC BM	BLC	BRN	BCFC	BTPN
2018	260	244	283	271	233	271	249
2026	328	308	357	341	294	341	314
2031	386	363	420	402	346	402	370
2041	417	391	453	434	373	434	398
2051	417	391	453	434	373	434	398

19.3.3.4. Percentage of loaded run for each Wagon type

Data on the percentage of the loaded run has been compiled on the basis of the actual FOIS data for the base year. This data has been assumed to be same for the cardinal years. This data has also been verified with the professionals who have industry and operations experience. The details are given at table below:

Table 19-19: Percentage of loaded run for each Wagon type

Type of wagon	Percentage of loaded run
Covered	65%
Open	60%
Automobile	50%

Type of wagon	Percentage of loaded run
Container	85%
Flat	65%
Bulk Cement	50%
Tank	60%

19.3.3.5. Seasonal Variation Correction Factor

There is a seasonal variation in freight flows for different commodities. It is important to plan the capacity for the peak demand period. So, a seasonal variation correction factor has been worked out so that there is always enough capacity to meet the demand. The seasonal variation correction factor has been worked by dividing peak month demand with the average monthly demand (annual demand divided by 12). The data on the monthly flows for different commodities is provided by CRIS, which has been clubbed in wagon type. The seasonal variation correction factor for different wagons is given below:

Table 19-20: Seasonal Variation Correction Factor

Type of wagon	Seasonal Variation Factor Correction
Covered	1.08
Open	1.19
Automobile	1.15
Container	1.14
Flat	1.17
Bulk Cement	1.26
Tank	1.07

19.3.3.6. Fleet Utilisation for each Wagon type

Fleet utilisation is the ratio of number of wagons that are under usage to the total fleet size. It may be noted that the entire fleet is never under full utilisation due to various major reasons like part of the fleet is under maintenance, private fleet owners use there fleet only when required and other temporal and spatial variations in the demand, supply and types of wagons.

The fleet utilisation has been calculated for the base year for all as 85% which covers all wagon types. Out of this around 5% of fleet is under maintenance. It is expected that with technological improvements, demand management and policy interventions, fleet utilisation may improve over time. However, for this analysis, current 85% fleet utilisation has been assumed for the cardinal years.

19.3.4. Profile of Existing Wagon Fleet

19.3.4.1. Age profile of existing fleet

In order to work out the demand for replacement of the existing wagon fleet, its age profile has been studied. The detail number of wagons for each year are given at **ANNEXURE 19.1:**. The average age of different type of wagons is as given below:

Table 19-21: Age profile of existing fleet

Type of wagon	Average Age (in years)
Open wagon	15.85
Covered wagon	12.28
Tank wagon	16.78
Container wagon	12.11
Flat wagon	14.27

19.3.4.2. Life of Different type of wagons

Indian Railway Finance code (Volume I, Chapter 2) has recommended normal life of the various classes of railway assets including different type of wagons. These are given at table below:

Table 19-22: Life of Different type of wagons

SN	Type of Wagons	Age (in years)
1	Open wagon	30
2	Covered wagon	35
3	Tank wagon	40
4	Container wagon	35
5	Flat wagon	35

19.3.4.3. Condemnation plan for of existing fleet

Based on the average age of condemnation and the age profile of existing fleet, condemnation plan for the existing fleet is worked for different cardinal years and is presented below:

Table 19-23: Condemnation plan for of existing fleet

	BCN	BOXN	BCACBM	BLC	BRN	BCFC	BTPN	Total
2026	5,973	26,563	0	2,702	1,357	0	1,111	37,705
2031	1,991	53,127	0	5,404	2,713	0	2,222	65,456
2041	23,980	89,074	0	8,692	6,936	0	4,443	1,33,124
2051	70,281	1,58,652	0	23,178	14,164	0	8,540	2,74,814

19.3.4.4. Net existing Fleet Available

On the basis of the existing fleet size and the condemnation plane, availability of the existing wagon in different cardinal years is calculated and presented at table below:

Table 19-24: Net existing Fleet Available

Year	BCN	BOXN	BCACBM	BLC	BRN	BCFC	BTPN	Total
2018	81,237	1,58,652		32,894	16,515		11,999	3,01,296
2026	75,265	1,32,089	-	30,192	15,158	-	10,888	2,63,591
2031	79,246	1,05,526	-	27,490	13,802	-	9,778	2,35,841
2041	57,257	69,578	-	24,202	9,579	-	7,556	1,68,172
2051	10,956	-	-	9,716	2,351	-	3,459	26,482

19.3.5. Procurement for Wagons

19.3.5.1. Gross number of Wagons Required

19.3.5.1.1. *Gross Number of wagons required for each wagon type for all the cardinal years has been worked considering the following factors:*

- Total NTKM for each wagon type
- Daily Wagon Run Km
- Empty return flow; and
- Fleet utilisation

The gross number of wagons in cardinal years required for all categories including the Special Purpose Wagons is given at the table below:

Table 19-25: Gross number of Wagons Required

Year	BCN	BOXN	BCACBM	BLC	BRN	BCFC	BTPN	Total
2018	84,128	1,31,573	-	30,073	20,622	290	13,189	2,79,876
2026	1,57,456	1,47,738	6,523	48,162	29,671	4,158	14,062	4,07,769
2031	2,12,727	1,71,242	10,221	73,525	35,243	7,979	34,288	5,45,225
2041	2,79,539	2,22,115	14,293	1,15,135	47,895	21,074	79,020	7,79,071
2051	3,54,684	2,59,050	19,754	1,65,333	68,413	57,413	1,43,483	10,68,130

19.3.5.2. Net new Wagons required

Net new wagons required have been calculated by considering the gross requirements and the availability of the existing stock for each category of wagon and in each cardinal year. The net number of wagons required are given at table below:

Table 19-26: Net new Wagons required

Year	BCN	BOXN	BCACBM	BLC	BRN	BCFC	BTPN	Total
2026	82,191	15,650	6,523	17,970	14,513	4,158	3,173	1,44,178
2031	1,33,480	65,717	10,221	46,035	21,442	7,979	24,511	3,09,384
2041	2,22,282	1,52,537	14,293	90,933	38,316	21,074	71,464	6,10,899
2051	3,43,728	2,59,050	19,754	1,55,617	66,062	57,413	1,40,024	10,41,648

19.3.5.3. Procurement Plan for cardinal years

The additional wagons are required due to:

9. Net Incremental Demand due higher freight movement; and
10. Replacement of existing fleet of wagons

This is presented at table given below

Table 19-27: Wagon Procurement Plan for cardinal years

Year	BCN	BOXN	BCACBM	BLC	BRN	BCFC	BTPN	Total
2026	82,191	15,650	6,523	17,970	14,513	4,158	3,173	1,44,178
2031	51,289	50,067	3,698	28,065	6,929	3,821	21,337	1,65,206
2041	88,802	86,820	4,072	44,898	16,874	13,095	46,953	3,01,514
2051	1,21,445	1,06,514	5,461	64,684	27,746	36,339	68,561	4,30,750
Total	3,43,728	2,59,050	19,754	1,55,617	66,062	57,413	1,40,024	10,41,648

19.3.5.4. Procurement Plan per year

Procurement plan is number of wagons that will have to be procured every year in each category. It is calculated by dividing the total demand in any period between two cardinal years by the total number of years. The procurement plan per year for all categories of wagons is as given below:

Table 19-28: Wagon Procurement Plan per year

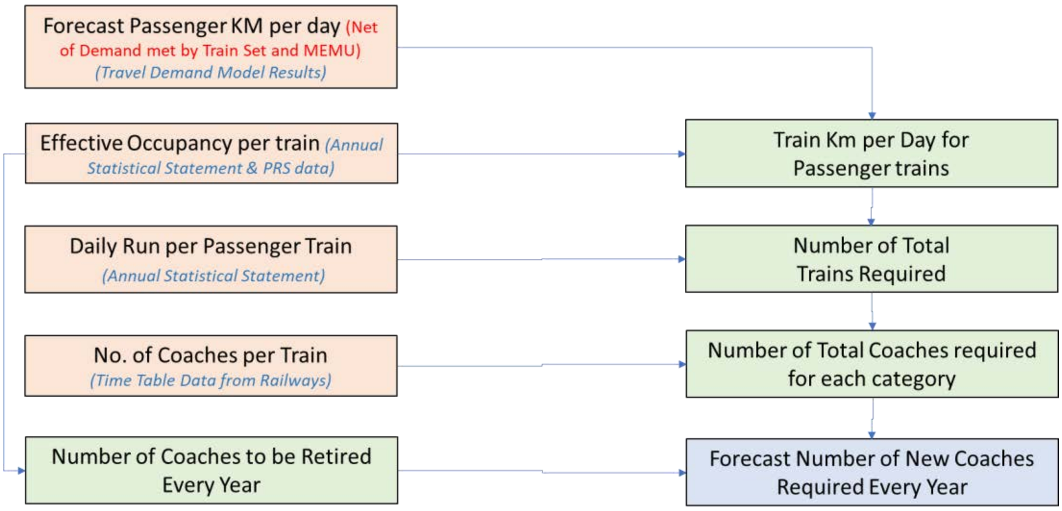
Year	BCN	BOXN	BCACBM	BLC	BRN	BCFC	BTPN	Total
2018-26	10,274	1,956	815	2,246	1,814	520	397	18,022
2026-31	10,258	10,013	740	5,613	1,386	764	4,267	33,041
2031-41	8,880	8,682	407	4,490	1,687	1,310	4,695	30,151
2041-51	12,145	10,651	546	6,468	2,775	3,634	6,856	43,075

It is understood that the current production capacity is around 20,000 Wagons per year. Thus, it may be enough to meet the demand till 2026. The production capacity will have to be enhanced to meet the demand beyond 2026. The BLC wagon demand includes EXIM traffic being loaded in ISO containers and ISO Dwarf containers for domestic container traffic

19.4. Demand for Passenger Trains

19.4.1. Methodology for forecast

The methodology for forecasting the demand for Coaches and Train for each of the cardinal years is presented in the figure given below:



19.4.2. Characteristics of Passenger Train Operations

19.4.2.1. Effective Occupancy on AC and Non-AC Trains

Passenger service on Indian Railways usually has mix of AC and Non-AC coaches. it is estimated that on an average, a passenger train has a capacity of about 1800 passenger in a train. Thus, for this analysis, capacity has been taken as 1800 passenger capacity per train.

A load factor of 85% and fleet utilisation of 95% has been worked out from Indian Railways Annual Statistical Statement. Thus, the effective occupancy of an average train works out to be 1453 persons per train.

Table 19-29: Effective Occupancy on AC and Non-AC Trains

Item	Value
Capacity per train	1800
Load Factor	85%
Fleet Utilization	95%
Effective Occupancy	1453.5

A further check of the above number of "Effective Occupancy" has been done by dividing the average daily total passengers (with the average total number of intercity trains per day (. This is

19.4.3. Demand for AC and Non- AC Coaches

19.4.3.1. Forecasted Total PKM

As discussed earlier, intercity passengers carried by Railways are broadly classified into AC and Non-AC categories. Using the demographic projection and the Frater Model, OD Matrices for passenger in both these categories are prepared and assigned on the Railway network. On the basis of the assignment model, Passenger Km (PKM) for both the categories have been prepared for each of the cardinal year.

It is proposed that part of the AC demand will be met by the Train Sets and a part of the Non-AC Demand will be met by the MEMUs that will be run on the system. The criteria for working out the demand for Trains Sets and MEMUs has detailed in the sections of Train Sets and MEMUs respectively. The cardinal Year wise demand for the AC passengers, Non-AC Passengers, Train Sets and MEMUs is summarised in the table given below:

Table 19-30: Forecasted Total PKM

Year	Daily Passenger KM (in Million)			
	AC (including Train Set)	Non-AC (including MEMU)	Train Set	MEMU
2018	314	3095	24	303
2026	750	4913	56	537
2031	1133	6134	81	616
2041	2025	9458	120	731
2051	3317	13374	169	875

19.4.3.2. Forecasted PKM less demand met by MEMUs and Trains sets

Net Forecasted Passenger Km for the cardinal years for the intercity AC and Non-AC passengers has been derived by subtracting the train Set demand from the Total AC and MEMU demand from the Non-AC demand. This is summarised in the table given below:

Table 19-31: Forecasted PKM less demand met by MEMUs and Trains sets

Year	Passenger KM daily (million)		
	Net AC (excluding Train Set)	Net Non-AC (excluding MEMU)	Total
2018	289	2792	3081
2026	694	4376	5070
2031	1052	5519	6571
2041	1905	8727	10631
2051	3148	12499	15647

19.4.3.3. Forecasted Train Km for passenger operations

Forecast of train Km for the passenger trains is derived by dividing the Passenger KM by the effective occupancy for these trains. It is summarised in the table given below:

Table 19-32: Forecasted Train Km for passenger operations

Year	Daily Train Km (Million)		
	Net AC (excluding Train Set)	Net Non-AC (excluding MEMU)	Total
2018	0.20	1.92	2.12
2026	0.48	3.01	3.49
2031	0.72	3.80	4.52
2041	1.31	6.00	7.31
2051	2.17	8.60	10.77

19.4.3.4. Daily Passenger Train Km run per day

Daily run for the passenger trains for the base year has been derived from the Indian Railway Annual Statistical Survey (2017-18). This has been forecasted on the basis of the proposed increase in the speed of the passenger train operations and is summarised in the table given below:

Table 19-33: Daily Passenger Train Km run per day

Year	Daily Passenger Train Km per day
2018	651
2026	765
2031	836
2041	916
2051	941

19.4.3.5. Total Coach Requirement

On the basis of the daily demand in terms of Net PKM, and Daily Passenger train Km run per day, total Train and Coach Requirement have been worked out and presented at table given below:

Table 19-34: Total Coach Requirement

Year	Train Requirement			Coach Requirement		
	AC	Non-AC	Total	AC	Non-AC	Total
2018	306	2,952	3,257	4,074	39,343	43,417
2026	624	3,934	4,557	8,311	52,430	60,741
2031	866	4,544	5,411	11,546	60,569	72,115
2041	1,431	6,554	7,985	19,067	87,360	1,06,427
2051	2,302	9,140	11,442	30,685	1,21,824	1,52,509

19.4.3.6. Age Profile of Existing Fleet

In order to work out the demand for replacement of the existing coach fleet, its age profile has been studied and is as given below:

Table 19-35: Age Profile of Existing Passenger Fleet

Range of the age (Years)	No. of Coaches
0-5	11521
5-10	10217
10-15	8854
15-20	9434
20-25	7142
Total	47168

19.4.4. Replacement of existing Fleet

On the basis of the age profile of the existing fleet, and considering the life of an ICF coach as 12 years, total coach requirement on account of replacement is as per table given below:

Table 19-36: Replacement of existing Passenger Fleet

Year	Total Coach Requirement		
	AC	Non-AC	Total
2018	4,074	39,343	43,417
2026	8,311	52,430	60,741
2031	11,546	60,569	72,115
2041	19,067	87,360	1,06,427
2051	30,685	1,21,824	1,52,509

19.4.4.1. Procurement Plan (New AC and Non-AC coaches required) for each cardinal Year

Procurement plans for the new AC and Non-AC coaches required to meet the demand has been worked out and is given in the table given below:

Table 19-37: Procurement Plan (New AC and Non-AC coaches required)

Year	AC			Non-AC		
	Existing Coaches	Coaches required	Coaches to be procured	Existing Coaches	Coaches require	Coaches to be procured
2018	4,074			39,343		
2026	3,121	11,865	7,230	19,698	29,797	29,797
2031	-	11,546	4,316	10,440	41,990	12,193
2041	-	19,067	7,521	-	60,569	18,579

Year	AC			Non-AC		
	Existing Coaches	Coaches required	Coaches to be procured	Existing Coaches	Coaches require	Coaches to be procured
2051	-	30,685	11,618	-	87,360	26,790

19.4.4.2. Procurement Plan (New AC and Non-AC coaches required) for each Year

Procurement plan is number of coaches that will have to be procured every year for both AC and non-AC category. It is calculated by dividing the total demand in any period between two cardinal years by the total number of years. The procurement plan per year is as given below:

Table 19-38: Procurement Plan (New AC and Non-AC coaches required) for each Year

Year	Procurement plan per year		
	AC	Non-AC	Total
2018	-	-	-
2026	904	5,249	6,153
2031	863	3,716	4,579
2041	752	2,679	3,431
2051	1,162	3,446	4,608

19.5. Demand for Mainline Electric Multiple Units (MEMUs)

19.5.1. MEMU Corridors

19.5.1.1. Criteria for delineating MEMUs Corridors

It is proposed that the MEMUs operations will carry around 50% of the total Non-AC passenger demand on the entire network. Considering that MEMUs shall have a provision only for the seating, it is further proposed that the Passenger demand for non-AC on these corridors with the Average Trip Length less than 200 Km shall be carried through MEMUs.

19.5.1.2. Demand on identified MEMU routes

Table 19-39: PKM Demand on identified MEMU routes

Year	Daily PKM (in million)		% of total non-AC passenger demand met by MEMU
	Total Non-AC Passenger	MEMU PKM	
2018	3095	303	9.80%
2021	3976	464	11.66%
2026	4913	537	10.92%
2031	6134	616	10.04%
2041	9458	731	7.73%
2051	13374	875	6.54%

19.5.2. Characteristics of MEMU operations

The characteristics of the MEMU operations in terms of the Average Occupancy, Run per day, and Fleet Utilisation is as per the table given below:

Table 19-40: Characteristics of MEMU operations

Operation Parameter	Value
Average Occupancy	2000
Run per Day	310
Efficiency	75%

19.5.3. Procurement Plan

19.5.3.1. Net Demand for new MEMUs

Net demand total MEMUs that will have to be required to meet the demand by that particular cardinal year. The demand of MEMU is due to two reasons:

1. Net Incremental Demand due to passenger and freight
2. Replacement of existing fleet

This is presented at table given below

Table 19-41: Net Demand for new MEMUs

Year	2018	2026	2031	2041	2051
PKM per day (Million)	303	537	616	731	875
Incremental demand	653	1154	1324	1572	1882
Replacement demand		130	163	195	163
Total EMUs Required	653	1284	1487	1767	2045

19.5.3.2. Procurement Plan (New MEMUs required) for each cardinal Year

Procurement plan is number of MEMU that will have to be procured every year. It is calculated by dividing the total demand in any period between two cardinal years by the total number of years. The procurement plan per year is as given below:

Table 19-42: Procurement Plan (New MEMUs required) for each cardinal Year

Year	2018	2026	2031	2041	2051
Total MEMUs required	1303	1284	1487	1767	2045
Demand for new MEMUs (Procurement Plan)		631	203	280	277

19.5.3.3. Procurement Plan (New MEMUs required) for each Year

Procurement plan for each year refers to the number of MEMUs that will have to be procured every year. It is calculated by dividing the total demand in any period between two cardinal years by the total number of years. The procurement plan per year for the MEMUs is as given below:

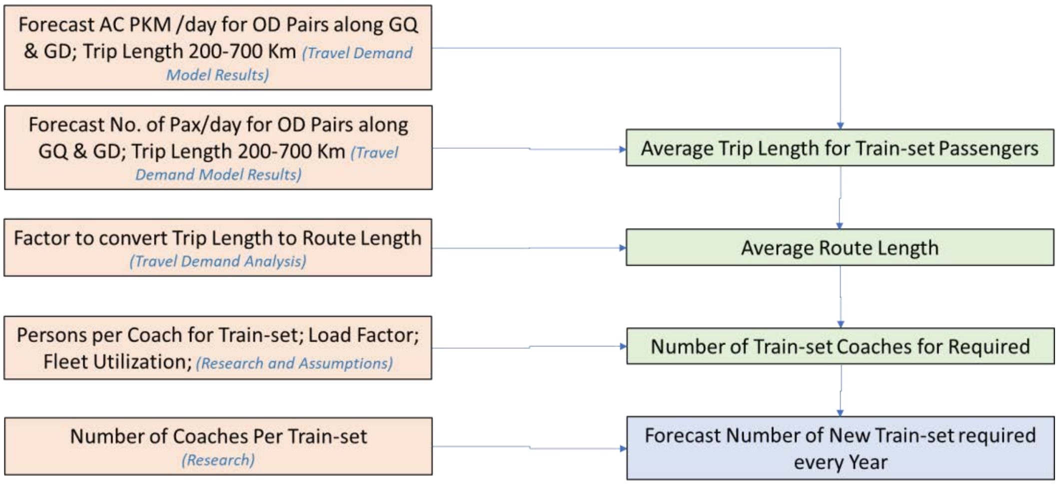
Table 19-43: Procurement Plan (New MEMUs required) for each Year

Year	2018-26	2026-31	2031-41	2041-51
Demand for new MEMUs (Procurement Plan)	631	203	280	277

Annual Procurement Plan	79	41	28	28

19.6. Demand for Train Sets

19.6.1. Methodology for forecast



19.6.2. Train Set Corridors

19.6.2.1. Criteria for delineating Train Sets Corridors

Golden Quadrilateral and Golden Diagonal shall be developed with an infrastructure which will allow the train sets to operate at speed of 160 KMPH. Thus, it is proposed that the Train Sets will run on these corridors. Considering that Train Set shall have a provision for car chairs, it is further proposed that the Passenger demand for AC on these corridors with the Average Trip Length between 200 to 700 Km shall be carried through Trains Sets.

19.6.2.2. Demand on identified Train Set routes

The demand for the total AC Passenger and the demand on these delineated corridors in the terms of PKM for different cardinal years, along the percentage of total AC passenger demand which will be met from Train Sets is as given below:

Table 19-44: Demand on identified Train Set routes

Year	Total annual PKM (in million)		% of total AC passenger demand met by Trains Set
	Total AC	Train Set	
2018	314	24	7.8%
2021	514	40	7.9%
2026	750	56	7.5%
2031	1133	81	7.2%
2041	2025	120	5.9%
2051	3317	169	5.1%

19.6.3. Characteristics of Train set operations

The characteristics of the train set operations in terms of the Average Occupancy, Load Factor, Fleet Utilisation and number coaches per train is as per the table given below:

Table 19-45: Characteristics of Train set operations

Item	Value
Average Occupancy per coach	75
Coaches in a Train	16
Load Factor	80%
Fleet Utilization	95%

19.6.4. Procurement Plan

19.6.4.1. Demand for Train Sets to meet additional Demand

Table 19-46: Demand for Train Sets to meet additional Demand

Year	PKM / Day	No. of Pax / day	Average Trip Length	Average Route Length	Coaches Required	Trains Required
	(Million)	(Thousand)	(Km)	(Km)	(No.)	(No.)
2018	24	59	413	619	693	42
2021	40	97	415	623	1137	70
2026	56	136	414	621	1595	100*
2031	81	197	413	620	2301	144
2041	120	293	411	616	3427	214
2051	169	417	405	607	4883	306
*100 Train set are to be procured upto 2030 as per the *****. Based on the capacity of the train sets, route length and potential OD pairs that could be passenger						

19.6.4.2. Procurement Plan (New Train Sets required) for each cardinal Year

Procurement plan is the number of incremental trains sets that will have to be procured by that particular cardinal year after the previous cardinal year. It is calculated by subtracting the total demand in given cardinal year from the demand of the previous cardinal. The procurement plan for trains sets for cardinal years is as given below:

Table 19-47: Procurement Plan (New Train Sets required) for each cardinal Year

Year	Train sets Required	Train sets to be procured for each Cardinal Year
	(No.)	(No.)
2018-21	70	70
2021-26	100*	30
2021-31	144	44
2031-41	214	70
2041-51	306	92

19.6.4.3. Procurement Plan (New Train Sets required) for each Year

Procurement plan for each year refers to the trains sets that will have to be procured every year. It is calculated by dividing the total demand in any period between two cardinal years by the total number of years. The procurement plan per year for trains sets is as given below:

Table 19-48: Procurement Plan (New Train Sets required) for each Year

Year	Train sets to be procured	Train sets to be procured per year
	(No.)	No.)
2018	-	
2021	70	23
2026	30	6
2031	44	9
2041	70	7
2051	92	9

Chapter 20 COSTING AND PHASING

20.1. Background

Indian Railways must invest on the capacity augmentation of the railways carrying capacity to serve the huge upcoming demand on its network. Passengers will increase and the freight will be increased as well. To serve the multi-fold demand, a lot of projects to be taken up and finished as per the timeline suggested in the National Rail Plan. This includes the dedicated freight service in terms of DFC, Dedicated world class Passenger service as High Speed Rail, Semi-Highspeed Rail. Doubling works of the existing network, Improvement of the existing signalling system, flyovers and bypasses for the decongestion of the bottlenecks, Passenger terminals, Freight Terminals. In addition to that procurement of Rolling stock coaches, MEMU, Train Sets for passengers and Wagons for Freight and Locomotives to run the trains.

20.2. Cost Estimates for Dedicated Freight Corridor (DFC)

Western DFC and Eastern DFC upto Sonenagar are under construction. The additional requirements of the Dedicated Freight Corridors are phased as per the **Table 20-1: DFC Phasing and Costing.** The block cost of 40 crore rupees per km is considered as the construction cost of the DFCs. This includes the interchanges points with the Indian Railways.

Table 20-1: DFC Phasing and Costing

Period	DFC Corridor	Length in KM	Cost in Crore Rupees
2026-31	East Cost DFC, Kharagpur to Vijayawada	1265 km	50,600
	East West DFC, Palghar to Dankuni and EDFC Connectors	2013 km	80,520
	Eastern DFC, Sonnagar to Dankuni	515 km	20,600
	Total	**3793 km**	**1,51,720**
2031-41	North South DFC, Itarsi to Chennai via Nagpur and Vijayawada	**1206 km**	**48,240**
2041-51	North South DFC, Palwal to Itarsi	**751 km**	**30,040**
Grand Total		**5750 km**	**2,30,000**

20.3. Cost Estimates for High Speed Rail (HSR)

Other than the Mumbai-Ahmedabad High Speed rail corridor, the other HSR corridors are phased under the national rail plan as per the **Table 20-2: HSR Phasing and Costing**. The cost of HSR is considered as 200 crore rupees per km as block cost. This includes the rolling stock, station development cost for HSR corridor.

Table 20-2: HSR Phasing and Costing

Period	HSR Corridor	Length in KM	Cost in Crore Rupees
2026-31	Delhi Varanasi via Ajodhya	855 km	1,71,000
	Varanasi to Patna	250 km	50,000
	Patna to Kolkata	530 km	1,06,000
	Delhi Udaipur Ahmedabad	886 km	1,77,200
	Total	**2,521 km**	**5,04,200**
2031-41	Hyderabad to Bangalore	618 km	1,23,600
	Nagpur to Varanasi	855 km	1,71,000
	Total	**1,473 km**	**2,94,600**
2041-51	Mumbai to Nagpur	789 km	1,57,800
	Mumbai to Hyderabad	709 km	1,41,800
	Patna to Guwahati	850 km	1,70,000
	Delhi to Amritsar via Chandigarh	485 km	97,000
	Amritsar - Pathankot - Jammu	190 km	38,000
	Chennai to Mysuru via Bangalore	462 km	92,400
	Total	**3,485 km**	**6,97,000**
Grand Total		**7,479 km**	**14,95,800**

20.4. Cost Estimates for Network Augmentation Proposals

20.4.1. Doubling and Signalling Cost

Indian railways will require to augment its network by introducing advanced signalling and additional number of Lines. Refer **Table 20-3: Corridor wise Total Doubling + Signalling Cost in Crore Rupees.** Block cost of 15 cr per line km, 40 lakhs for TCAS Signalling, Additional 40 Lakhs for Automatic Block Signalling (ABS) and Computerised Train Control (CTC) is included. For AI Based maintenance 20 lakhs per km is included for GQ GD corridors. 50 lakhs per km of network is considered for additional instruments required for centralised systems.

Table 20-3: Corridor wise Total Doubling + Signalling Cost in Crore Rupees

Corridor Name	Network KM	Total Doubling + Signalling Cost in Crore Rupees				
		2026	2031	2041	2051	Total
HDN 1	1,463	2,698	0	349	2,852	**5,898**
HDN 2	1,889	4,014	2,540	188	257	**6,999**
HDN 3	1,387	2,373	3,325	2,069	8,663	**16,429**
HDN 4	1,845	1,729	19,000	12,394	7,141	**40,265**
HDN 5	2,048	4,257	0	0	0	**4,257**
HDN 6	1,113	2,119	0	0	2,418	**4,537**
HDN 7	1,224	2,054	980	3,488	2,493	**9,015**
All HDN	**10,969**	**19,244**	**25,846**	**18,487**	**23,825**	**87,402**
HUN 1	3,671	5,155	5,467	12,273	20,156	**43,051**
HUN 2	3,507	2,278	4,684	15,233	4,514	**26,708**
HUN 3	1,688	1,935	2,522	6,350	5,268	**16,075**
HUN 4	1,527	9,102	960	6,922	4,086	**21,071**
HUN 5	1,847	3,000	2,046	1,631	5,401	**12,078**

Corridor Name	Network KM	Total Doubling + Signalling Cost in Crore Rupees				
		2026	2031	2041	2051	Total
HUN 6	1,693	3,242	10,026	17,957	2,927	**34,152**
HUN 7	3,212	2,297	2,175	13,839	8,643	**26,953**
HUN 8	1,451	636	123	10,267	4,490	**15,516**
HUN 9	2,240	12,717	3,143	923	6,660	**23,443**
HUN 10	3,028	5,607	2,687	4,078	7,833	**20,204**
HUN 11	1,050	383	4,078	4,185	8,052	**16,697**
All HUN	**24,266**	**43,717**	**37,797**	**87,583**	**76,703**	**245,800**
Other than HDN/HUN Network	**40,944**	65,813	17,254	117,960	82,647	**283,673**
Port Connectivity	**2,680**	11,858	1,978	4,923	14,351	**33,110**
Overall	**75,194**	**126,914**	**71,358**	**221,456**	**181,967**	**601,696**

Table 20-4: State-wise costing for Network Augmentation Proposals

State Name	Network KM	Total cost in Crore Rupees			
		Total Cost	Doubling Cost	TCAS Signalling Cost	ABS+ TCAS+ CTC Cost
Bihar	4,095	**53,692**	51,333	1,989	370
Nagaland	73	**2,250**	2,181	69	0
Tripura	218	**3,447**	3,272	175	0
Assam	2,614	**53,849**	52,198	1,652	0
West Bengal	4,537	**30,855**	28,337	1,594	923
Jharkhand	2,210	**13,443**	12,190	584	668
Odisha	3,582	**25,088**	22,275	1,257	1,556
Chhattisgarh	1,631	**16,561**	15,682	202	677
Madhya Pradesh	5,937	**43,559**	39,619	2,120	1,820
Gujarat	5,641	**49,315**	47,397	1,216	703
Maharashtra	7,047	**67,878**	61,907	1,604	4,367
Andhra Pradesh	4,291	**30,999**	27,265	900	2,834
Karnataka	4,111	**24,502**	23,561	849	93
Goa	161	**1,602**	1,518	84	0
Kerala	1,103	**7,239**	6,736	503	0
Tamil Nadu	4,362	**37,599**	36,293	957	349
Puducherry	138	**940**	884	56	0
Telangana	2,398	**23,599**	22,033	629	937
Jammu and Kashmir	425	**2,413**	2,257	157	0
Himachal Pradesh	322	**3,456**	3,391	65	0
Punjab	2,627	**21,640**	20,911	729	0
Chandigarh	68	**412**	357	55	0
Uttarakhand	638	**2,187**	2,149	38	0
Haryana	1,598	**13,234**	12,455	692	87
Delhi	171	**816**	695	43	78
Rajasthan	6,293	**22,574**	20,539	1,403	632
Uttar Pradesh	8,774	**49,220**	44,778	2,386	2,056

State Name	Network KM	Total cost in Crore Rupees			
		Total Cost	Doubling Cost	TCAS Signalling Cost	ABS+ TCAS+ CTC Cost
All India	**75,194**	**601,696**	**561,539**	**22,008**	**18,149**

20.4.2. Flyovers and By-passes

Block Cost of flyovers are taken 400 crore rupees and by-passes are taken 150 crore rupees.

Table 20-5: Flyovers and By-passes Costing

Sl. No.	Infrastructure intervention project	Number	Cost in Crore Rupees
1	Flyovers	178	71,200
2	By-passes	58	8,700

20.5. Cost Estimates for Passenger Terminals

Based on the demand projected, the development of Passenger Terminals is required. The cluster of Terminals (major cities may require directional Terminal) are proposed and the cost are estimated as per the projected footfall.

Table 20-6: Passenger Terminal Development Cost

	Investment Required in Crore Rupees				
	2021- 26	2026- 31	2031- 41	2041- 51	Total
Passenger Terminal Development Cost	**54,316**	**16,175**	**9,325**	**4,041**	**83,857**

20.6. Cost Estimates for Freight Terminals

As per the distribution of trip ends of projected demand of freight, freight terminals are proposed.

Table 20-7: Freight Terminal Development Cost

	Investment Required (INR Crores)		
	2021- 26	2026- 31	Total
Freight Terminal Development Cost	**6,241**	**4,161**	**10,402**

20.7. Cost Estimates for Rolling Stock

Procurement of Rolling Stock is required to meet the demand of freight as well as the passenger in future years. This procurement plan includes the replacement of older rolling stock also.

Table 20-8: Rolling Stock Procurement Cost

Item	Cost per Unit (Rs. In crore)	Number of new Rolling Stock to be procure in the Year				
		2026	**2031**	**2041**	**2051**	**Total**
Locomotives	14	11,024	4,646	13,510	16,837	46,017
Wagons*		1,43,762	1,64,824	3,00,205	4,27,116	10,35,907
- BOXN	0.24	15,650	50,067	86,820	1,06,514	2,59,050
- BCN	0.22	82,191	51,289	88,802	1,21,445	3,43,728

Item	Cost per Unit (Rs. In crore)	Number of new Rolling Stock to be procure in the Year				
		2026	2031	2041	2051	Total
- BTPN	0.41	3,173	21,337	46,953	68,561	1,40,024
- BLC	0.31	17,970	28,065	44,898	64,684	1,55,617
- BRN	0.39	14,513	6,929	16,874	27,746	66,062
- BCACBM	0.51	6,523	3,698	4,072	5,461	19,754
- BCFC	0.39	3,742	3,439	11,786	32,705	51,672
Coaches		49,220	22,895	34,311	46,082	1,52,509
- NAC	1.8	41,990	18,579	26,790	34,464	1,21,824
- AC	2.15	7,230	4,316	7,521	11,618	30,685
MEMU	8	631	333	443	471	1,879
Train Sets	250	100	44	70	92	306
Broad Cost Estimates (Rs in Crore)		**3,14,450**	**1,67,918**	**3,60,924**	**4,75,570**	**13,18,862**

20.8. Comprehensive NRP Cost

Total implementation cost of Proposals of cost of NRP will be more than 38 Lakh Crore.

Table 20-9: Comprehensive Cost Table

Head		2021-26	2026-31	2031-41	2041-51	Grand Total
DFC						
DFC Corridors	1		East Cost DFC Kharagpur to Vijayawada	North South DFC Itarsi to Chennai via Nagpur and Vijayawada	North South DFC Palwal to Itarsi	
			1265 km	1206 km	751 km	
			50,600	48,240	30,040	
	2		East West DFC Palghar to Dankuni and EDFC Connectors			
			2013 km			
			80,520			
	3		Eastern DFC Sonnagar to Dankuni			
			515 km			
			20,600			
	DFC Corridor Total					
	Length in KM		**3793 km**	**1206 km**	**751 km**	**5750 km**
	Cost in Crore Rupees		**151,720**	**48,240**	**30,040**	**230,000**
HSR						
HSR Corridor	1		Delhi Varanasi via Ajodhya	Hyderabad to Bangalore	Mumbai to Nagpur	
			855 km	618 km	789 km	
			171,000	123,600	157,800	
	2		Varanasi to Patna	Nagpur to Varanasi	Mumbai to Hyderabad	
			250 km	855 km	709 km	
			50,000	171,000	141,800	
	3		Patna to Kolkata		Patna to Guwahati	
			530 km		850 km	
			106,000		170,000	

Head		2021-26	2026-31	2031-41	2041-51	Grand Total
	4		Delhi Udaipur Ahmedabad		Delhi to Amritsar via Chandigarh	
			886 km		485 km	
			177,200		97,000	
	5				Amritsar - Pathankot - Jammu	
					190 km	
					38,000	
	6				Chennai to Mysuru via Bangalore	
					462 km	
					92,400	
	HSR Corridor Total					
	Length in KM		**2521 km**	**1473 km**	**3485 km**	**7479 km**
	Cost in Crore Rupees		**504,200**	**294,600**	**697,000**	**1,495,800**
IR Network						
HDNs	HDN 1	2,698	0	349	2,852	5,898
	HDN 2	4,014	2,540	188	257	6,999
	HDN 3	2,373	3,325	2,069	8,663	16,429
	HDN 4	1,729	19,000	12,394	7,141	40,265
	HDN 5	4,257	0	0	0	4,257
	HDN 6	2,119	0	0	2,418	4,537
	HDN 7	2,054	980	3,488	2,493	9,015
	All HDN	**19,244**	**25,846**	**18,487**	**23,825**	**87,402**
HUNs	HUN 1	5,155	5,467	12,273	20,156	43,051
	HUN 2	2,278	4,684	15,233	4,514	26,708
	HUN 3	1,935	2,522	6,350	5,268	16,075
	HUN 4	9,102	960	6,922	4,086	21,071
	HUN 5	3,000	2,046	1,631	5,401	12,078
	HUN 6	3,242	10,026	17,957	2,927	34,152
	HUN 7	2,297	2,175	13,839	8,643	26,953
	HUN 8	636	123	10,267	4,490	15,516
	HUN 9	12,717	3,143	923	6,660	23,443
	HUN 10	5,607	2,687	4,078	7,833	20,204
	HUN 11	383	4,078	4,185	8,052	16,697
	All HUN	**43,717**	**37,797**	**87,583**	**76,703**	**245,800**
Others	**Other than HDN/HUN Network**	**65,813**	**17,254**	**117,960**	**82,647**	**283,673**
Ports	**Port Connectivity**	**11,858**	**1,978**	**4,923**	**14,351**	**33,110**
Total Network	**Overall**	**126,914**	**71,358**	**221,456**	**181,967**	**601,696**
Flyovers and By-Passes						
Flyovers	178 No.	71,200				71,200
By-passes	58 No.	8,700				8,700
	Total	**79,900**	**0**	**0**	**0**	**79,900**
Terminal						
Terminal Development Cost	Passenger Terminal Development Cost	54,316	16,175	9,325	4,041	83,857
	Freight Terminal Development Cost	6,241	4,161			10,402
	Terminal Total	**60,557**	**20,336**	**9,325**	**4,041**	**94,259**
Rolling Stock						
Rolling Stock	**Locomotives**					
	Electric Locomotives	**154,336**	**65,044**	**189,140**	**235,718**	**644,238**
	Wagons					

Head		2021-26	2026-31	2031-41	2041-51	Grand Total
	- BOXN	3,749	11,992	20,795	25,513	62,049
	- BCN	17,820	11,120	19,253	26,330	74,523
	- BTPN	1,290	8,677	19,094	27,881	56,943
	- BLC	5,603	8,751	14,000	20,169	48,523
	- BRN	5,595	2,671	6,505	10,697	25,468
	- BCACBM	3,339	1,893	2,084	2,795	10,111
	- BCFC	1,442	1,325	4,543	12,605	19,916
	Wagon Total	**38,838**	**46,430**	**86,274**	**125,990**	**297,532**
	Coaches					
	- NAC	75,582	33,442	48,222	62,035	219,283
	- AC	15,545	9,279	16,170	24,979	65,973
	MEMU	5,150	2,718	3,615	3,844	15,335
	Train Sets	25,000	11,000	17,500	23,000	76,500
	Coach Total	**121,276**	**56,439**	**85,508**	**113,858**	**377,091**
	Broad Cost Estimates	**314,450**	**167,913**	**360,922**	**475,566**	**1,318,861**
Grand Total in Crore Rupees		**581,821**	**915,527**	**934,543**	**1,388,614**	**3,820,516**

Chapter 21 FUNDING REQUIREMENTS IDENTIFIED UNDER NRP AND POTENTIAL FINANCING STRATEGIES

21.1. Coverage of this Section

The scope for this module of the study on National Rail Plan was enunciated as follows:

- *Assess funding requirement for above capacity enhancement plans*
- *Conduct Sensitivity Analysis under critical assumptions and by identifying key risks*
- *Evolve a detailed financing strategy plan including budgetary support, PPPs, enabling financing environment*

This section presents analyses of these scope elements based on inputs from earlier sections of the report on identified capacity augmentation works and required projects/ investments.

21.2. Estimated funding requirements for capacity enhancement plans under NRP (2022-2051)

With IR's focus on augmenting railway infrastructure to facilitate movement of freight and passengers, as discussed earlier under this study, investments will be needed over 2022 to 2051 to address capacity constraints and make multi-modal transportation more efficient for users – dovetailing with existing and planned transport infrastructure in the country.

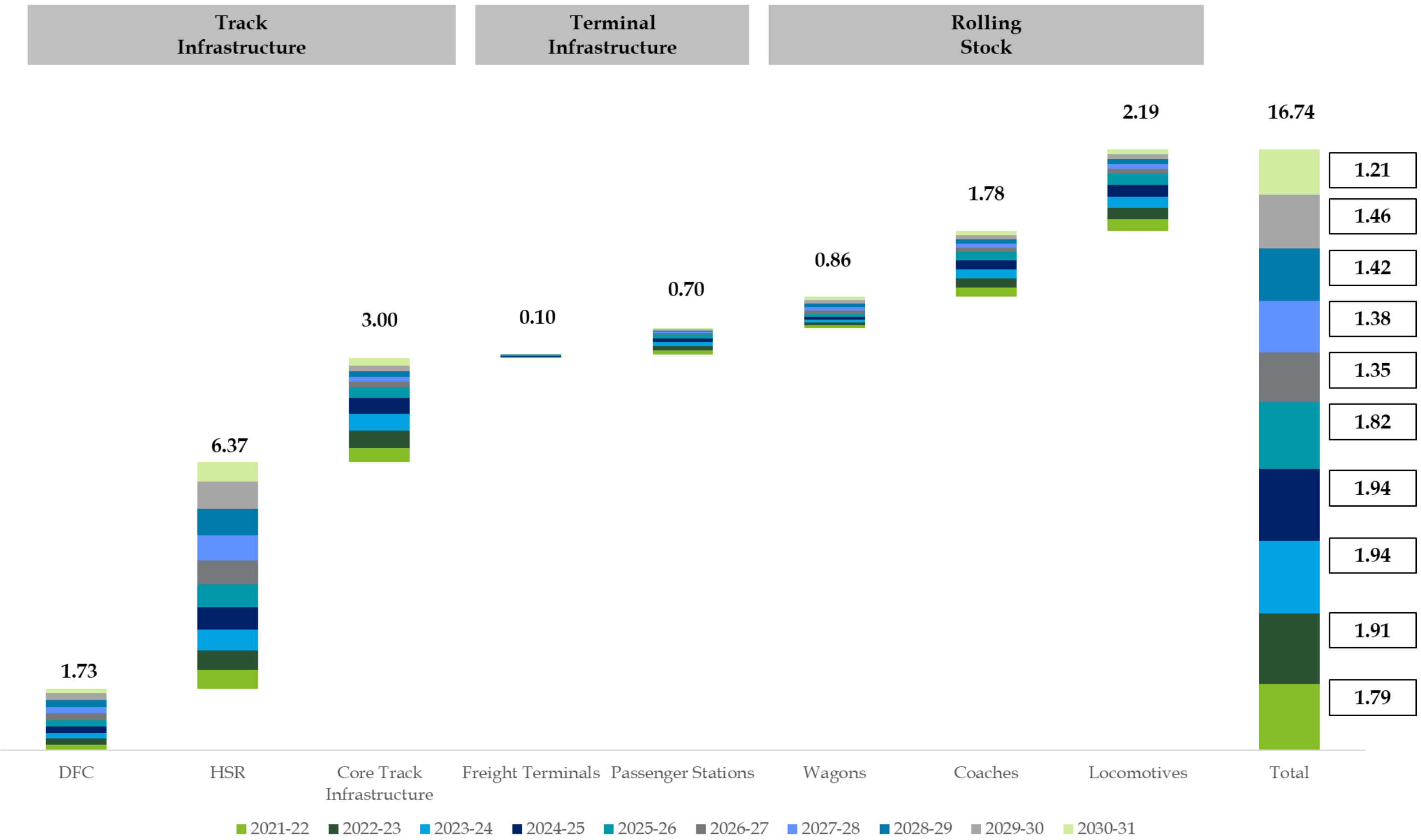
Such investments/ capital expenditure requirements have been estimated under earlier modules of NRP for three major asset categories viz. tracks, terminals and rolling stock, and are presented in the following exhibits.

As can be observed, till 2031, capital expenditure requirements in track infrastructure (including investments in DFC, HSR and Core Track Infrastructure i.e. doubling and signalling works across HDN, HUN and other networks) along with construction of flyovers and bypasses) account for a majority of the total capital expenditure requirements i.e. ~66% - with a year-on-year increase in investment requirements for DFC as well as HSR. Capital expenditure requirements for rolling stock (wagons, coaches and locomotives) account for ~29% of the total capital expenditure requirements with the balance ~5% of the total capital expenditure requirements pertaining to development of terminal infrastructure (including both passenger and freight terminals).

This trend continues in the future. Of the total capital expenditure requirements estimated beyond 2031 under this study - i.e. till 2051, capital expenditure requirements in track infrastructure are estimated to constitute ~60% of the total capital expenditure requirements, that for rolling stock are estimated to constitute

~39% of the total capital expenditure requirements with the balance pertaining to development of terminal infrastructure.

Figure 21-1: Annual Capital Expenditure Requirements till 2031*[136] (Figures in INR lakh crore)

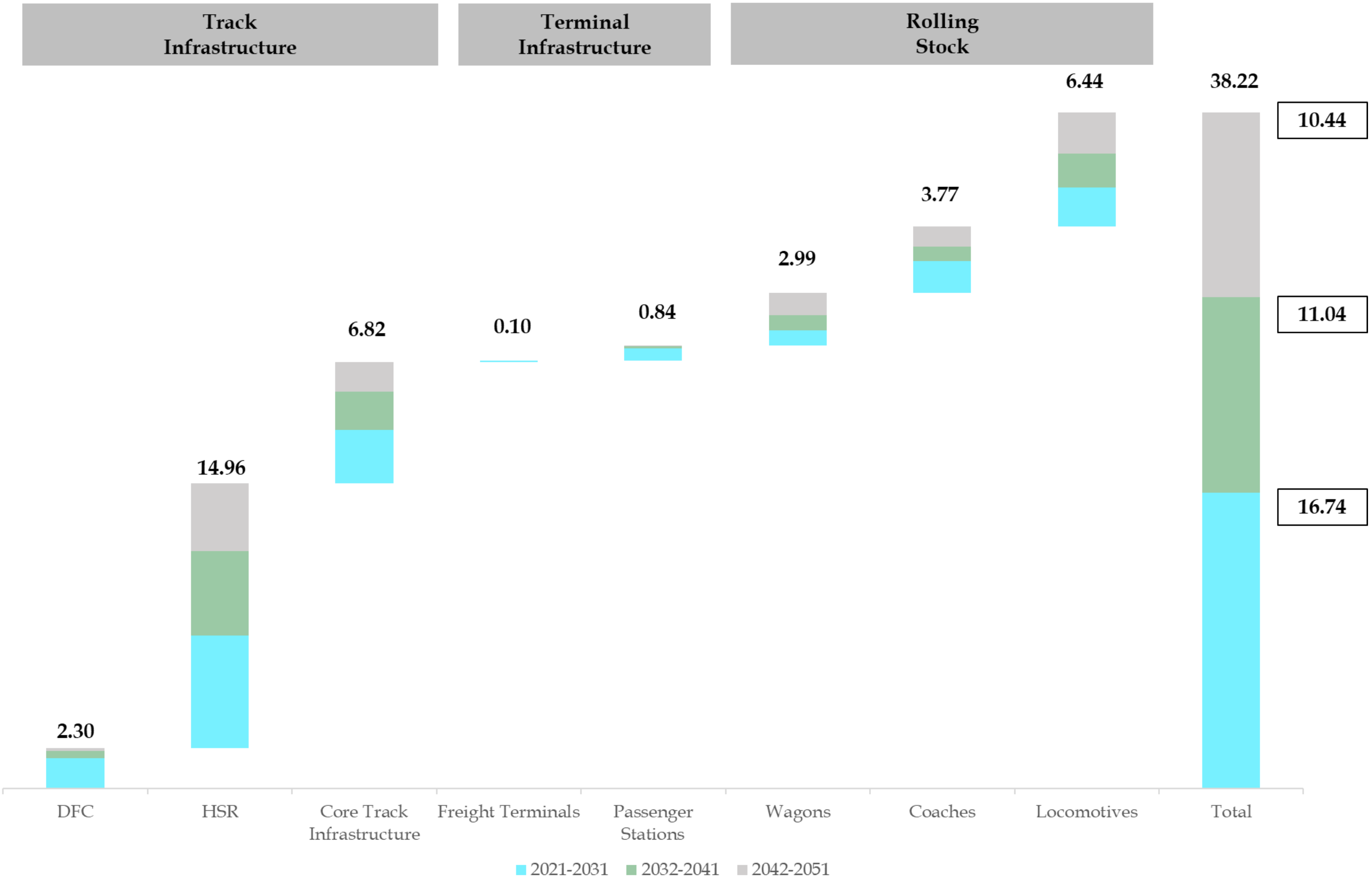


*Technical consultants have assumed some investment in FY2021. The figure is summation of investments required for the period FY21-FY31

Source: Technical Experts' Estimates

136 Year wise details have been presented in Error! Reference source not found.

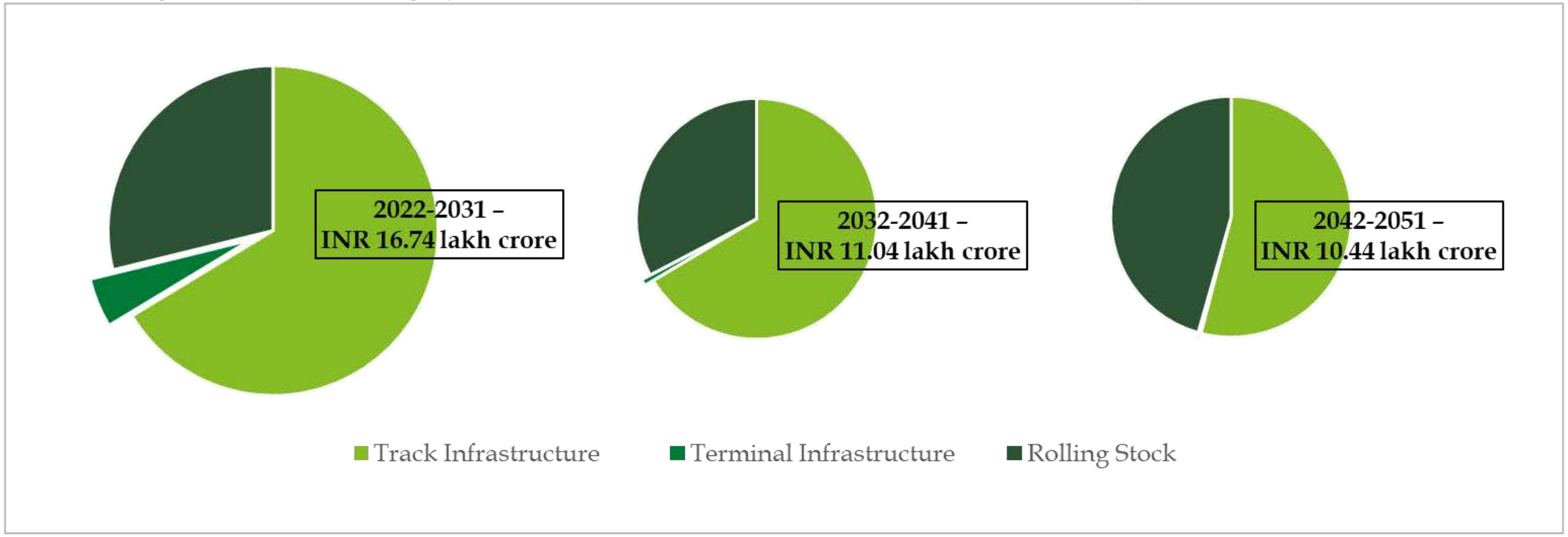
Figure 21-2: Decadal Capital Expenditure Requirements till 2031, 2041 and 2051[137] (Figures in INR lakh crore)



Source: Technical Experts' Estimates

[137] Details have been provided in Error! Reference source not found.

Figure 21-3: Asset Category-wise Capital Expenditure Requirement across horizon years 2031, 3041 and 2051



21.2.1. Capital expenditure requirements under NRP vis-à-vis IR's Pink Book

The 'Pink Book' is a document prepared by IR that presents IR's annual capital expenditure plan for works-in-progress as well as new projects to be taken up in the year along with fund allocation. Such works cover construction as well as replacement/ renewal of different assets and are included after obtaining approval of the proposed works programme from the Parliament.

The capital expenditure requirements identified under the National Rail Plan, on the other hand, pertain to acquisition/ development of assets over a longer-term horizon (2051) such that capacity can be developed ahead of demand over such horizon.

Capital expenditure requirements/ projects have been included under the NRP based on analyses of capacity required for handling projected passenger and freight traffic, network capacity, potential infrastructure bottlenecks, etc. Some of the projects being considered/ already proposed to be taken up by Indian Railways have been included under the NRP based on relevance to the above-mentioned analyses and solution identification.

In this context, it may be noted that such analyses have assumed completion of works proposed under Pink Book for 2019-2020 along with consequent capacity creation.

Furthermore, it is pertinent to note that certain categories of works/ projects for which expenditure is indicated in the Pink Book have not been included under the National Rail Plan by the technical team. These include electrification and gauge conversion projects of existing network that are needed for seamless end to end operation. Since gauge conversion and electrification of most of the traffic bearing key routes have already been done or are works in progress, it is expected that capital expenditure on these two activities for the remaining routes would be prioritized/ planned after assessing the progress made, through the annual exercise of Works Programme. Additionally, capital investment requirements for production units have not been considered as it is understood that the Ministry of Railways is undertaking an initiative for corporatization of Production Units. Besides these, asset categories such as workshops, computerization, railway research projects, road safety works, bridge and tunnel works, machinery and plant, metropolitan transport projects etc. constitute a smaller proportion of the total annual capital expenditure requirements identified and therefore, may need only be considered year-on-year based on specific short-term requirements and priorities.

Consequently, IR would need to account for capital expenditure corresponding to the afore-mentioned asset categories while undertaking its annual budgeting exercise.

21.2.2. Capital expenditure requirements under NRP vis-à-vis National Infrastructure Pipeline

A High-Level Task Force of the Government of India was constituted to draw up a National Infrastructure Pipeline (NIP) for FY 20-25. The final report of the Task Force was released by the Union Minister for Finance & Corporate Affairs on 29th April, 2020[138] - and was based on information provided by various stakeholders including line ministries on projects under conceptualization or under implementation or under development, with project cost greater than Rs. 100 crore per project.

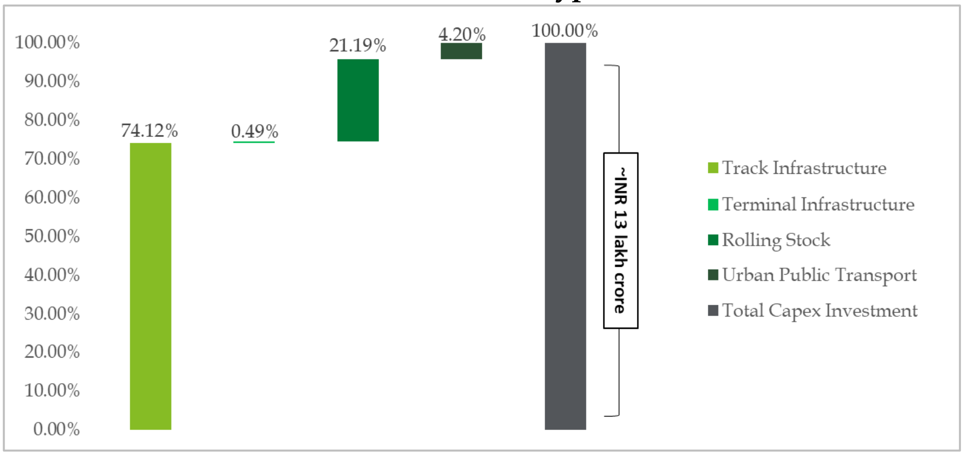
The exhibit below presents the capital expenditure requirements considered for Railways in the NIP – covering projects pertaining to track infrastructure, terminal infrastructure, rolling stock and urban public transport.

Table 21-1: Capital Expenditure Requirements for Railways under NIP (Figures in INR crore)

	FY20	FY21	FY22	FY23	FY24	FY25	Total
Railways	133,387	262,465	308,800	273,831	221,209	167,870	**13,67,563**

Source: National Infrastructure Pipeline Volume I[139]

Figure 21-4: Capital Expenditure requirements for Railways under NIP for different asset types



Source: National Infrastructure Pipeline

Based on data received from the Ministry of Railways for this study, it is understood that sources of financing have been broadly identified for projects under the NIP – comprising Gross Budgetary Support (GBS i.e. support for meeting planned outlays of the Central Government during the financial year) to the extent of ~35%, Extra Budgetary Resources (i.e. EBR includes market borrowings such as financing from banks, institutional financing, and external investments – where

[138] https://indiainvestmentgrid.gov.in/national-infrastructure-pipeline

[139] (2020), Report of the Task Force Volume I (National Infrastructure Pipeline), Department of Economic Affairs Ministry of Finance Government of India, https://indiainvestmentgrid.gov.in/assets/iigNew2/pdf/Report_of_the_Task_Force_Volume_I.pdf

external investments could be in the form of public private partnerships (PPPs), joint ventures, or market financing from private investors) to the extent of ~63% of the total investment requirement with the balance being met by Internal Accruals.

As the National Rail Plan has considered required capital expenditure/ investments for augmenting railway infrastructure vis-à-vis future demand/ requirements, there could be some overlap with capacity creation projects included under the NIP (as projects under conceptualization or under development).

Furthermore, as the capital expenditure/ investments proposed under the National Rail Plan are evaluated and considered further (through preparation of Pre-feasibility/ Feasibility Studies and Detailed Project Reports), they can be added to the project database under the NIP – so that the same is maintained as a 'living repository' as envisaged by the Government - providing visibility to potential investors/ developers.

21.3. Identification of key risks and sensitivity analyses of capital expenditure requirements

Given the nature of long-term planning for capacity addition involved in a study of this nature, variations in such capacity addition projects in terms of specifications/ project contours and associated capital expenditure requirements are possible, in the future, with respect to certain risks/ assumptions involved in such estimation.

Key risks that could impact such capacity enhancement plans/ project contours and/ or associated capital expenditure requirements in future could pertain to:

- **Technical Risks** – with respect to changes in requirements, technology, interface issues, performance, quality, etc.
- **External Risks** – with respect to customers, market (capital providers as well as players), suppliers, etc.
- **Organization Risks** – with respect to dependencies, resources, etc.
- **Project Management** – with respect to planning, scheduling, estimation, controlling, etc.

To undertake sensitivity analyses of capital expenditure requirements, potential risks that could impact capacity enhancement plans and/ or associated capital expenditure requirements were considered for the asset categories along with assessment of probability of their occurrence and potential extent of impact in future.

While assessment of probability has reference to track record/ experiences of such events in a wider context, assessment of potential impact has reference to variations that can be expected across dimensions like cost, schedule, scope, scope and quality.

Tables below present a discussion on potential risks that could impact capacity enhancement plans and associated capital expenditure requirements for the key asset categories.

Table 21-2: Potential risks that can impact capital expenditure estimates for rail track/ line projects under NRP

Risk Category and generic description	Potential Risks	Probability of occurrence	Potential extent of impact	Exposure (Combination of Probability and Impact)
Technical Risks - Requirements, technology, interface issues, performance, quality, etc.	Advent of new technologies/ research outputs (construction, components such as signalling, etc.) can result in optimization of cost/ schedule sometimes creating a justification for changes in projects under planning/ implementation as well	L	M	LM
	Interface issues (e.g. axle load or systems technology) between new and existing lines can lead to sub-optimal asset utilization and revenue realization	L	M	LM
	Introduction of new technology (e.g. HSR) can have a higher upfront cost of asset acquisition/ operationalization impacting project implementation viability/ financing costs/ timelines with progressive optimization/ localisation needing time	L	M	LM
External Risks - Customers, market (capital providers as well as players), suppliers, etc.	Inability to market/ charge appropriate tariffs to users/ customers to ensure financial viability of new projects can impact overall system viability as well as investment/ financing of new projects	M	H	MH
	Changes in demand-supply requirements/ usage/ transportation patterns over the national transport system can impact traffic over IR network/ new lines in absence of integrated response in terms of development/ optimization of overall service offerings from time to time	M	H	MH
	Variation in estimated time for obtaining necessary land, rights of way, permits, easements, etc. impacting project alignment, timelines and cost	M	H	MH
	Force majeure risk due to adverse natural/ industrial/ other events impacting project implementation/ viability	L	L	LL

Risk Category and generic description	Potential Risks	Probability of occurrence	Potential extent of impact	Exposure (Combination of Probability and Impact)
	Changes in legal and regulatory environment (localization or change in taxes) can increase/ decrease time and cost of projects	L	L	LL
	Changes in macro-economic aspects like inflation, exchange rate, commodity prices (steel), etc. can impact project costs	l	M	LM
Organization Risks - Dependencies, resources, etc.	Inadequate maintenance/ practices (including historical trend based rather than based on monitoring of asset quality/ usage/ wear) impacting the life-cycle cost of the asset	M	M	MM
	Inability to maintain appropriate environmental or social safeguards during construction or operation impacting further financing from multinational financial institutions (MFIs)/ agencies	M	M	MM
	Inadequate availability/ allocation of funds over time can constrain project execution in a timely manner - impacting timelines as well as final project costs	H	M	HM
Project Management - Planning, scheduling, estimation, controlling, etc.	Traffic projections not materializing as projected - under/ over (inadequate project study & preparation), can impact network and line utilization and viability impacting overall system viability as well as investment/ financing of new projects	M	H	MH
	While railway construction and maintenance organisation (including PSUs under MoR) are fairly well established and experienced, works are now being commissioned on EPC basis as well; Efficacy of undertaking substantial works in future would depend upon enhancement in overall productivity/ utilization of such resources by IR as well as appropriate monitoring and contract management of EPC works; inefficiencies here can impact time and cost of execution of works	M	H	MH

Risk Category and generic description	Potential Risks	Probability of occurrence	Potential extent of impact	Exposure (Combination of Probability and Impact)
	Unrealistic timelines/ scheduling (of project preparation and/ or construction activities) can impact project execution efficacy - timelines as well as costs	H	H	HH

Table 21-3: Potential risks that can impact capital expenditure estimates for terminal projects under NRP

Risk Category and generic description	Potential Risks	Probability of occurrence	Potential extent of impact	Exposure (Combination of Probability and Impact)
Technical Risks - Requirements, technology, interface issues, performance, quality, etc.	New technologies in rolling stock and/ or handling equipment/ processes can impact handling requirements at terminals (passengers as well as freight) - leading to need for modifications/ capital expenditure	M	M	MM
	Interface of terminals with local areas in terms of key transport links/ corridors can have an impact on efficiency of operations/ congestion/ utilization	H	M	HM
	Inadequate planning/ designing and resultant KPIs from use of such terminals could lead to suboptimal operational and financial performance	M	M	MM
External Risks - Customers, market (capital providers as well as players), suppliers, etc.	Evolution in transportation patterns of passengers/ freight and handling requirements can change leading to issues of capacity utilization & viability of terminals or requirements of modifications/ additional capital expenditure	M	M	MM
	Inability to market/ charge appropriate user fees/ charges to ensure financial viability of terminals can impact viability, investments and financing of new projects	M	H	MH
	Variation in estimated time for obtaining necessary land, rights of way, permits, easements, etc. impacting project development, traffic realisation, timelines and cost	M	H	MH
	Force majeure risk due to adverse natural/ industrial/ other events impacting project implementation/ viability	L	L	LL
	Changes in legal and regulatory environment (taxes, land lease, etc.) can increase/ decrease time and cost of projects	L	L	LL
	Changes in macro-economic aspects like inflation, exchange rate, commodity prices (steel, cement), etc. can impact project costs	M	M	MM

Risk Category and generic description	Potential Risks	Probability of occurrence	Potential extent of impact	Exposure (Combination of Probability and Impact)
Organization Risks - Dependencies, resources, etc.	Service provision at terminals not receiving due focus leading to lower of customer experience/ quality, can impact traffic and viability for the larger network (including infrastructure utilization)	H	M	HM
	Development of terminals being linked to monetization/ revenue realization from land (needing delineation and provision) due to fund constraints can be impacted by performance of real estate sector/ developers at various points of time	H	H	HH
Project Management - Planning, scheduling, estimation, controlling, etc.	Inability to undertake required network planning of inter-modal movement of passengers/ freight and location/ development of terminals with reference to overall economics and customer experience can impact traffic realisation/ terminal utilization and viability as well as overall operational/ financial performance of the network	M	H	MH
	Sub-optimal project preparation (process flows, estimation of timelines/ scheduling) can impact project execution efficacy - traffic, timelines as well as costs	H	H	HH

Table 21-4: Potential risks that can impact capital expenditure estimates for rolling stock under NRP

Risk Category and generic description	Potential Risks	Probability of occurrence	Potential extent of impact	Exposure (Combination of Probability and Impact)
Technical Risks - Requirements, technology, interface issues, performance, quality, etc.	Advent of new technologies and products can result in better payload: tare ratio creating an economic justification for shifting away from/ premature replacement of existing rolling stock assets; this can impact utilization depending on ownership pattern of rolling stock in future (lessors, etc.) and higher capital expenditure while improving economics of usage of newer rolling stock	M	M	MM
	Interface issues with respect to lines with different axle loads/ maximum moving dimensions (DFC/ feeder routes) can result in sub-optimal capacity utilization resulting in need for upgrade/ premature replacement of rolling stock (especially wagons))	M	M	MM
External Risks - Customers, market (capital providers as well as players), suppliers, etc.	Development and scaling of different products and offerings (e.g. HSR) may depend on customers' acceptance and absorption vis-à-vis competing modes given potential price points - impacting demand for different rolling stock types differently	M	M	MM
	Suppliers in India lacking technical capacity (or taking more time) for technology upgradation/ development can result in lower efficiency of utilization/ requirement for premature replacements in future	L	M	LM
	Outturn in terms of lower traffic may result in postponement of deliveries of ordered rolling stock by private players resulting in cost escalation (contractual penalties, time delays)	M	M	MM
	Force Majeure risk due to adverse industrial and other events impacting manufacturers can impact costs and lead to time delays	L	L	LL

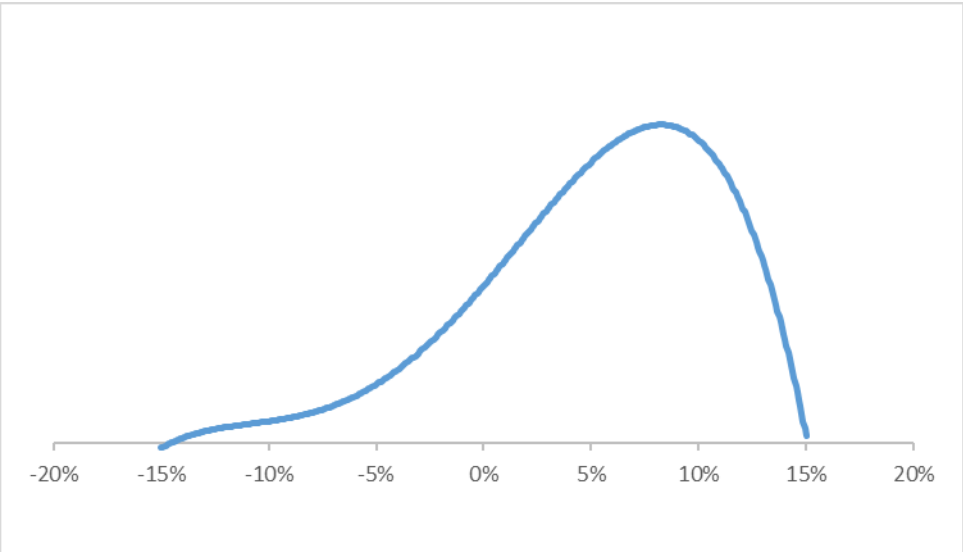
Risk Category and generic description	Potential Risks	Probability of occurrence	Potential extent of impact	Exposure (Combination of Probability and Impact)
	Changes in legal and regulatory environment can increase/ decrease time and cost of manufacturing due to need for upgradation or localization requirement or change in taxes	L	L	LL
	Changes in macro-economic aspects like inflation, exchange rate, commodity prices (steel), etc. can impact manufacturing costs	M	M	MM
Organization Risks - Dependencies, resources, etc.	Inadequate maintenance/ practices can lead to lowering of asset quality and performance issues (time delays) creating a need for asset upgrade/ premature replacement	L	M	LM
	Even with superior quality rolling stock, congestion on routes/ network could impact performance for users and further traffic realization impacting future requirements	L	M	LM
Project Management - Planning, scheduling, estimation, controlling, etc.	Mismatch between demand (rolling stock requirements) and supply capacity (manufacturing capacity of vendors) in different time periods can result in price variations (premium/ discounts) by vendors	L	L	LL
	Inefficiency in technology upgrade/ selection and/ or procurement (delay in driving containerization) can result in inefficient utilization of existing rolling stock and impact traffic as well as demand-supply mismatch in future	M	M	MM

As can be seen from the above, the impact of potential risk events would tend to predominantly be in terms of cost variation (mostly escalation in project costs) and time variation (mostly extension of project timelines).

While variations in cost and time estimates cannot be ruled out on the lower side (lower project costs and shorter project timelines than those estimated under earlier modules of NRP) on account of potential optimization of project contours/ specifications, development of new technology/ engineering practices in future, etc., data for infrastructure projects/ experiences over time indicate that mostly such risk events/ uncertainties in outcomes have resulted in escalation in project costs and extension of project timelines.

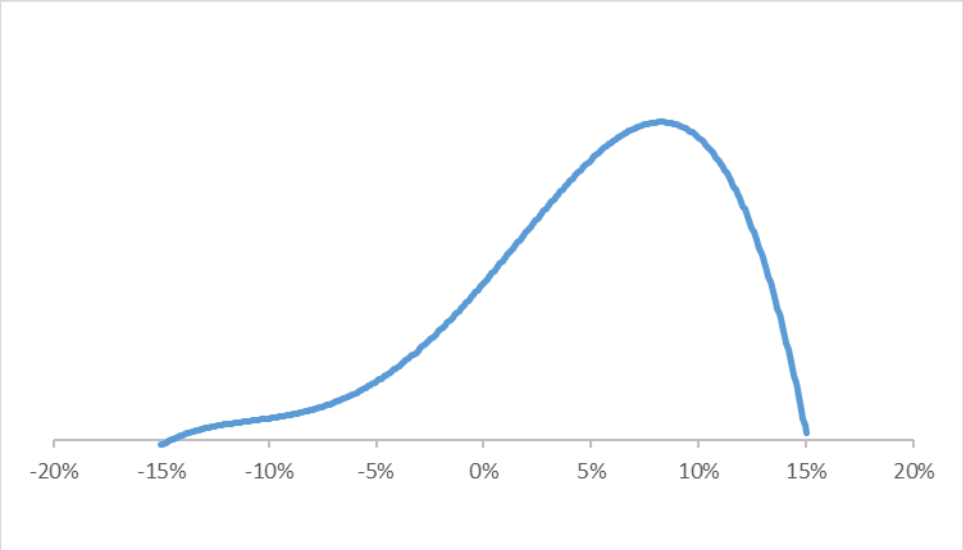
Technical experts in the team indicated that potential variation in capital expenditure requirements on account of such risks could be considered in a range of +/- 15%. Based on assessment and discussion of risks for each of the asset categories presented above, sensitivity analyses were undertaken for the potential variation in capital expenditure estimates (based on assumptions around unit costs for such projects considered under the study) using Monte Carlo simulation. Triangular distribution curves presented below were considered to model the variation in capital expenditures for the three asset categories of track/ lines, terminals and rolling stock. As discussed above, variation on account of risks/ uncertainties is expected to be asymmetric with respect to the mean/ base values of capital expenditure estimates considered and presented in earlier modules of this study.

Exhibit 1: Variation in capital expenditure estimates considered for track / line projects for sensitivity analyses



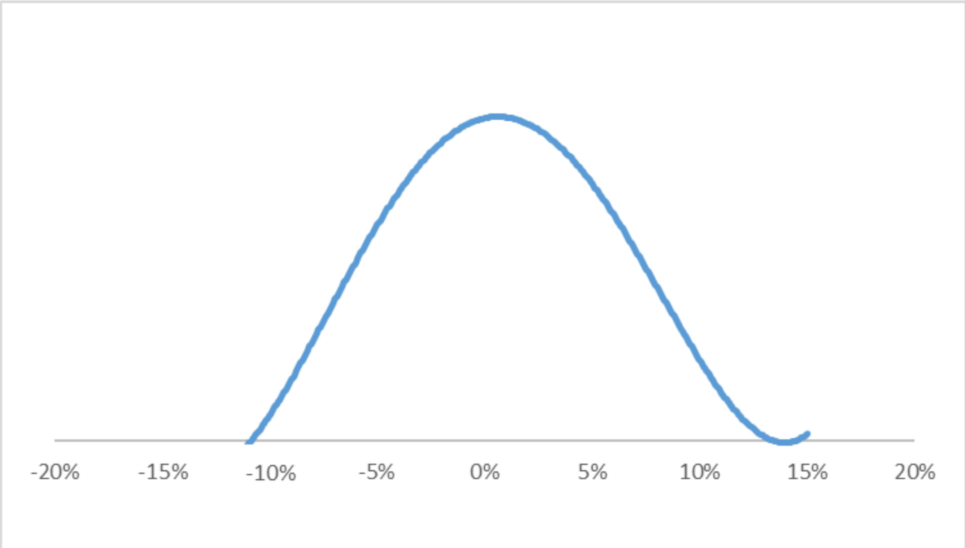
Source: Consultant's Estimation

Exhibit 2: Variation in capital expenditure estimates considered for terminal infrastructure development projects for sensitivity analyses



Source: Consultant's Estimation

Exhibit 3: Variation in capital expenditure estimates considered for rolling stock for sensitivity analyses



Source: Consultant's Estimation

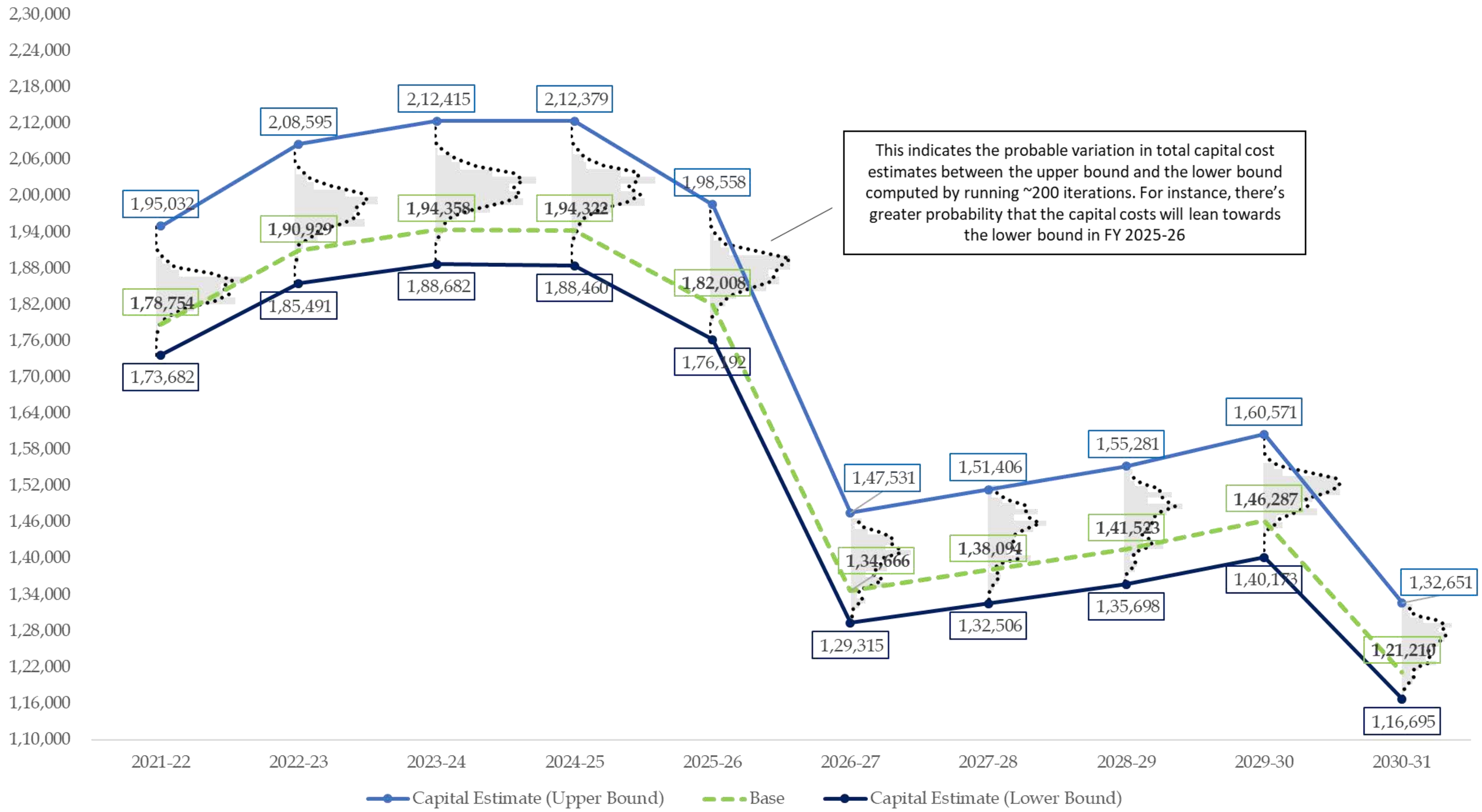
Compared to potential variation in capital expenditure estimates considered for line/ track projects and terminal infrastructure development projects, the risk of expenditure towards sub-optimal rolling stock (technology/capacity) or deferred expenditure due to poor demand is considered less likely to impact capital expenditure requirements in rolling stock significantly. While some of the risks could lead to higher operations and maintenance costs, suboptimal capacity utilization (wagons during transition), or deferred acquisition (due to lower demand), are unlikely to translate into major variations/ increases in the capital expenditure estimates. In fact, with some initiatives like corporatization of

Production Units (as distinct from single buyer/ captive production), development of competition (leasing), etc. already underway, resulting localization and economies of scale could keep rolling stock prices stable in India over the coming years.

The following figure illustrates the potential variation in capital expenditure requirements across years based on the sensitivity analyses discussed above. It may be noted that probability of variation would tend to be different across years based on the relative mix of capital expenditure requirements across the three broad asset categories being different across the years.

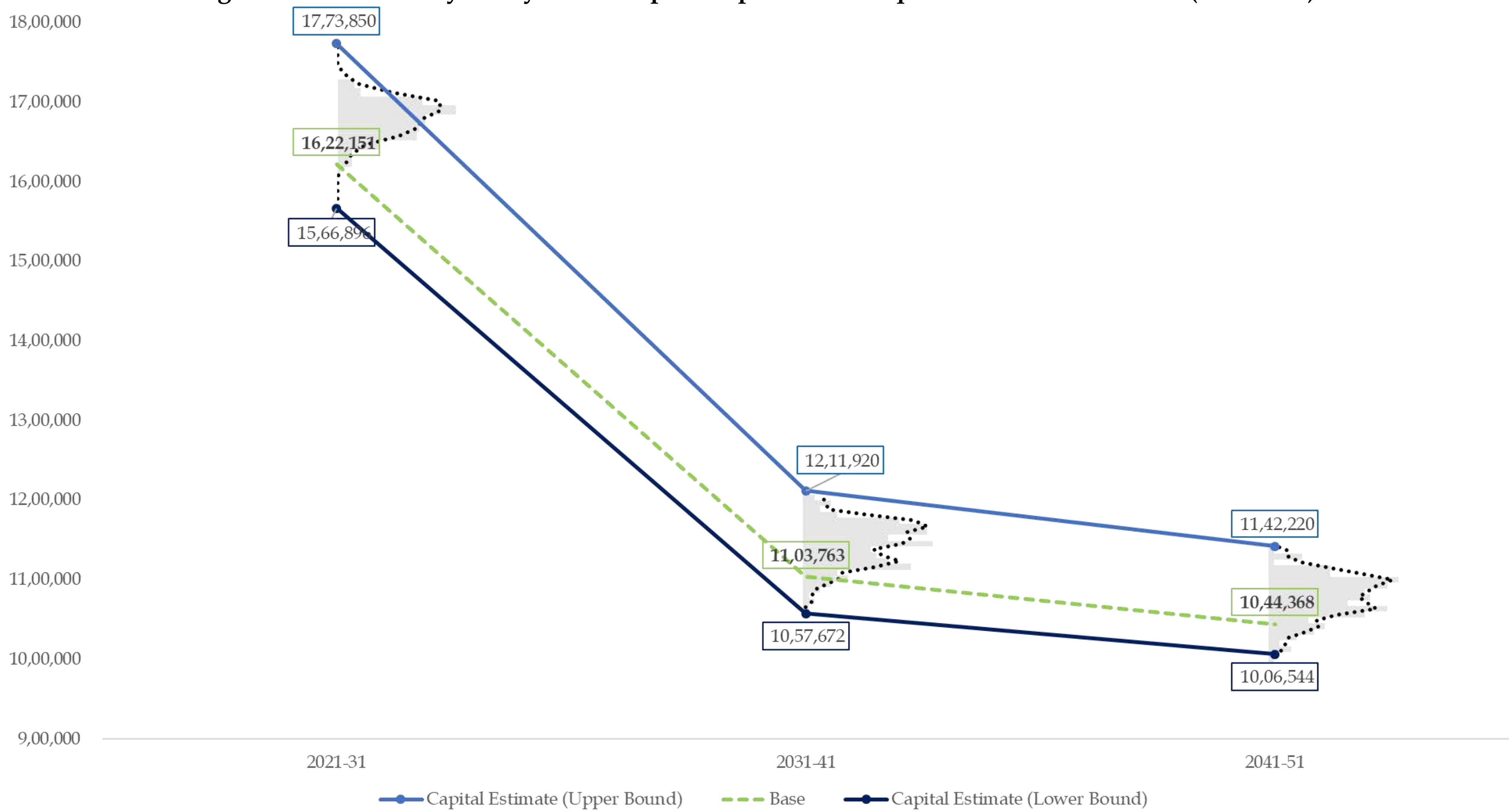
This can inform the budgeting exercise in future for programs/ projects as well as annual budgeting of capital expenditure program of Indian Railways.

Figure 21-5: Sensitivity Analyses for Capital Expenditure Requirements in INR crores (2021-2031)



Source: Consultant's Analyses

Figure 21-6: Sensitivity Analyses for Capital Expenditure Requirements in INR crores (2031-2051)



Source: Consultant's Analyses

21.4. Strategic framework for prioritizing and financing projects under NRP

As mentioned earlier, given the nature of long-term planning for capacity addition involved in a study of this nature, as well as variations possible in future in terms of specifications/ project contours (and associated capital expenditure requirements) on account of risks – including those pertain to changes in requirements, technology, customers, markets, resources, planning controlling, etc., projects/ investment areas identified under NRP would need to be studied, updated, prioritized, and monitored under a systematic and robust framework over time.

The following exhibit presents such a framework. It would be important for IR to ensure that the:

- project pipeline is periodically reviewed and updated based on evolving priorities and objectives of the government, changes in market/ external environment as well as development of IR's network;
- individual projects are studied in detailed and analysed so that appropriate financing options can be leveraged; and
- implementation of projects is monitored and reviewed so that market response and success of initiatives can be leveraged for customising the financing structures/ strategies for projects in future.

While the pipeline of projects under the National Rail Plan has presently been prepared based on modelling of the extant network and future requirements, timing of these projects (in terms of year of implementation) would need to be updated based on modelling of IR's network over time as well as evolution of priorities and objectives given changes in market/ external environment. This would ensure that the pipeline is kept current and relevant for consideration of projects as part of an annual budgeting exercise.

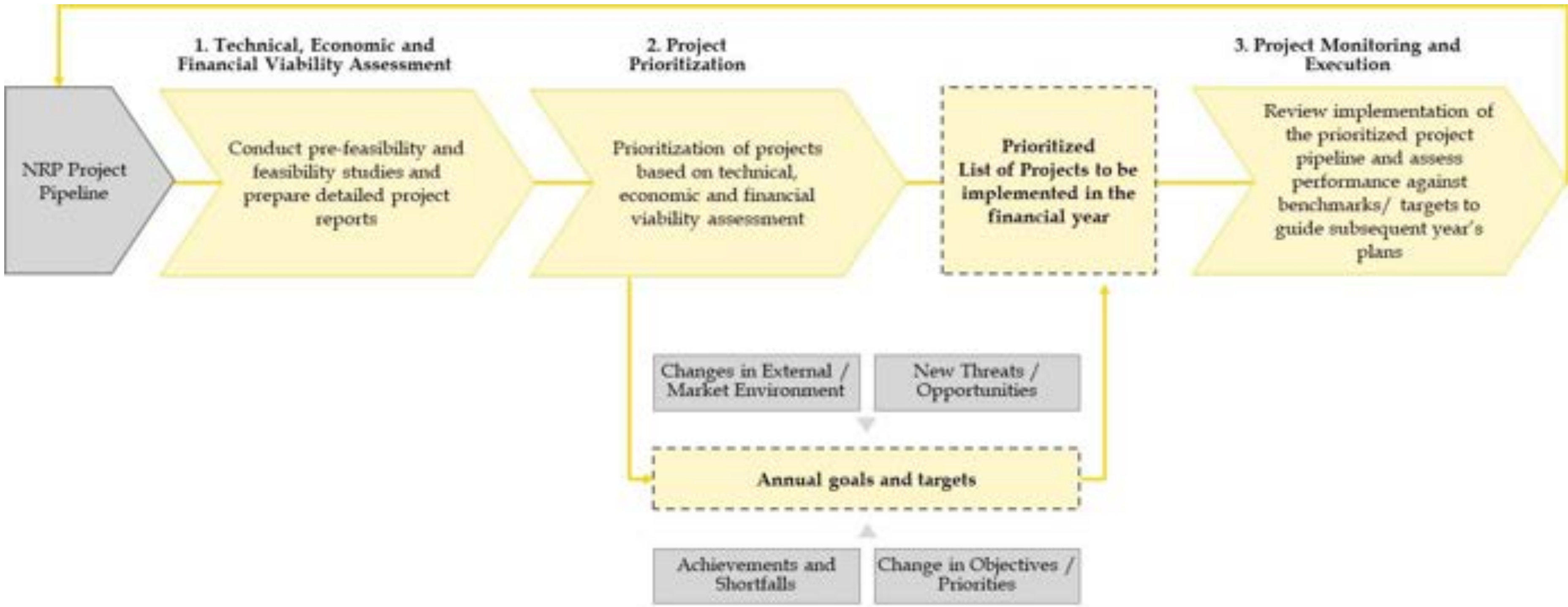
21.5. Evaluation of technical, economic and financial viability of the proposed projects

To appropriately structure execution and financing of projects proposed under the NRP, IR would need to undertake robust project detailing – thereby mitigating the risks of time and cost overruns during execution stage, as well as evaluation of social/environmental impact, and technical, economic and financial viability.

The process would need to ensure that:

1. The contours of the project(s) (designs/ specifications) meets the system requirements/ desired **objectives**;
2. All **costs** are accounted for while preparing capex estimates, with reference to required surveys, detailed traffic assessments/ user consultations, potential cost escalations/ contingencies, etc.;

Exhibit 4: Framework for project preparation, prioritization, and monitoring for financing and implementation



Source: Consultants' Analyses

3. **Viability** of the projects is holistically reviewed with respect to technical, social, environmental, economic and financial aspects; such an assessment would not impede but instead transparently identify projects that may need to be undertaken for strategic reasons (ensuring social and economic cohesion, balanced regional growth, etc.) to ensure that the financing and implementation mechanisms are accordingly identified; and
4. All **risks** associated with the project – technical, commercial, legal, regulatory, etc., are considered and accounted for.

IR may consider establishing a separate – centralized and specialized unit for project preparation and evaluation to ensure consistency in preparation and evaluation of projects across asset categories and incorporation of learnings over time.

Such a unit could also take up an enhanced role in future - of identifying projects for potential private sector participation and undertaking consultations with relevant stakeholders for marketing and better leveraging financing from potential investors.

21.6. Project prioritization and identification of annual targets

Presently, investment decisions involving creation, acquisition and replacement of assets in the Indian Railways are processed through the annual 'Work, Machinery and Rolling Stock Programme'. The selection and prioritization of these projects is a dynamic process beginning at the divisional level as part of preparation of the Preliminary Works Programme (PWP), which is initially reviewed at the zonal level and then submitted to the Railway Board. Projects are then deliberated at the Railway Board with General Managers for inclusion in the Final Works Programme[140].

It is expected that the pipeline of projects identified under the NRP, would feed into the annual budgeting process of IR. Based on results of technical, economic and financial viability assessments of these projects, prioritization would be required with respect to sources/ nature of potential finances and their available quantum vis-à-vis threshold economic and financial viability estimates of projects.

Indian Railways considers sources of finances under three (3) key categories:

- Gross Budgetary Support – covering support for meeting planned outlay of the Central Government during a financial year (including under heads like the Railway Safety Fund);
- Internal Accruals from operations; and

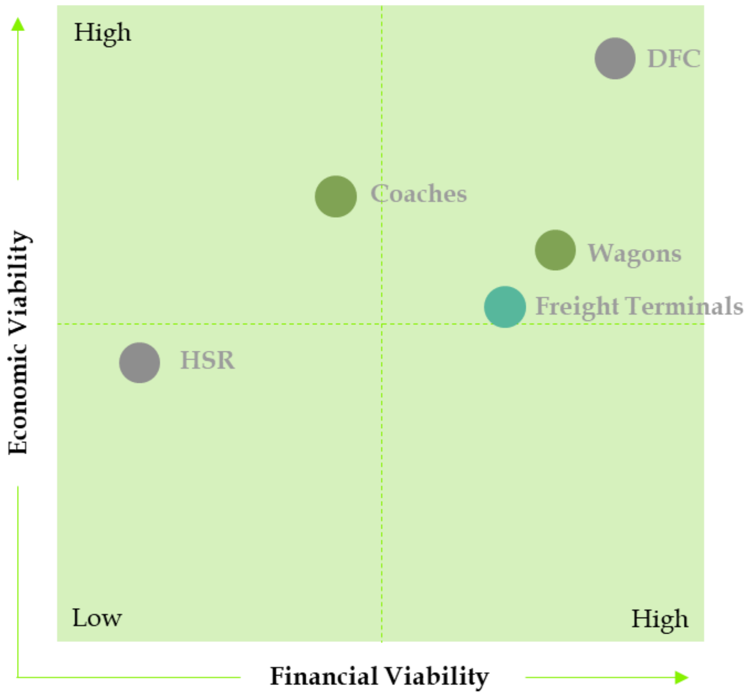
[140] Chapter VI: Investment Planning and Works Budget, Investment Planning and Works Programme Section, Indian Railways Code for the Engineering Department

- Extra-Budgetary Resources – including bank borrowings, institutional financing, and external investments in the form of public private partnerships (PPPs), joint ventures, or market financing from private investors.

In many countries, a framework built on Social Cost Benefit Analysis (SCBA) is used extensively to prioritise alternative infrastructure investments. Given the nature of financing requirements, IR would also need to define an objective framework to allocate limited resources for infrastructure development.

As discussed above, IR may create a framework that considers proposed projects along the dimensions of economic and financial viability as illustrated in the exhibit below.

Exhibit 5: Illustrative matrix to identify potential projects along dimensions of economic and financial viability



Note: This is only an illustrative based on study of case examples corresponding to similar projects across the globe. The financial and economic viability of each project might differ on a case-by-case basis.

In order to reduce subjectivity and potential bias/ sentiments in selection of projects, IR may consider identifying thresholds for economic and financial viability\, or even a weightage system to assign values to various projects along these dimensions and based on a composite score and other policy objectives, prioritise the projects for investments meeting pre-specified thresholds. Such a process would enable an evidence-based view to approve projects.

Some additional parameters IR may consider while creating such framework could *inter alia* include,

- Direct benefits from the project in terms of financial returns, enhancement in modal share etc.
- Indirect benefits covering strategic factors such as contribution to objectives of improved connectivity, balanced regional growth etc.
- Existing status of the project - For instance, ongoing projects which can be completed in a short period of time with a little push through financing or resolving some approval issues may be given a higher weightage as compared to a greenfield project which may just be in planning stages.
- Potential for Private Sector Participation – Projects which score high in terms of financial viability and are likely to attract private sector investments could be given a higher weightage as such projects do not compete for fund allocation from internal sources or Gross Budgetary Support or borrowings of IR.
- Readiness of the project in terms of aspects like land acquisition, desired approvals, detailed appraisal document etc.

The results/data from project preparation and appraisal exercise, as explained earlier, could be used to inform the prioritisation decisions and calculating composite scores. Based on the composite score which could be generated from the framework, the projects could be classified as High, Medium or Low priority.

IR may also have reference to tools developed by institutions like The World Bank to develop/review its prioritisation framework. For instance, The World Bank Group has developed a tool (Infrastructure Prioritisation Framework (IPF) – refer **ANNEXURE 21.3:**) to help governments systematically prioritise infrastructure investments to achieve their development goals, taking into account capacity and public resource constraints.

However, for long-term financial viability of the system as well as to allow leveraging of Extra Budgetary Resources in future, it would be important that financial viability of projects – as a criteria in itself, is given due importance. For instance, in a situation similar to the one profiled in the past in the Report of the Committee on 'Creative Financing for Indian Railways'[141] (data is admittedly dated; example being referred in absence of data on recent projects in similar context/ format), where a majority of the on-going railway projects as on 1st April 2011 seemed to have rate of return below financeable thresholds, financing of capital expenditure would have substantial dependence on constrained Gross Budgetary Resources.

Table 21-5: Synopsis of data on on-going Railway Projects on the basis of Profitability (as on 1st April 2011)

[141] April 2014, "Report of the Committee on Creative Financing for Indian Railways"; Planning Commission, Government of India, New Delhi

Sl. No.	On-going New Rail Line, Gauge Conversion and Line-Doubling Projects	No. of Projects	Cost of Projects (INR crores)
1	Projects having ROR of 14% & above	76	27,867.08
2	Projects having ROR between 1% to 14%	62	38,492.21
3	Projects having a negative ROR	202	1,06,575.06
	Total	**340**	**1,72,934.35**

Source: Report of the Committee on Creative Financing for Indian Railways, Planning Commission, Government of India; April 2014

21.6.1. Project Monitoring and Execution

Time delays and cost overruns have been witnessed in India's infrastructure sector. Nearly 432 infrastructure projects – each worth Rs 150 crore or more, have been hit by cost overruns of over Rs 4.29 lakh crore owing to delays and other reasons during project implementation[142].

In this context, project monitoring and establishing robust controls can help ensure timely completion of projects and provide comfort to providers of finance (including the Government) that expected outcomes and (economic/ financial) returns would materialize.

Such project monitoring through appropriate institutional oversight and use of information for proactive decision making and taking corrective actions can greatly contribute to timely implementation of projects within budgeted resources.

Indian Railways has already undertaken initial steps towards developing institutional capacity through Indian Railways Projects Sanctions and Management (IRPSM) application. This web-based application, apart from enabling coordination for new work proposals between IR's zonal and apex level, also provides periodic reporting of status of various activities associated with execution of sanctioned works. **ANNEXURE 21.4**:presents certain interventions that can be considered by IR for better project monitoring and control.

21.7. Financing of Capital Expenditure

21.7.1. Past trends and future outlook

As mentioned earlier, Indian Railways finances capital expenditure using (1) Gross Budgetary Support (GBS i.e. support for meeting planned outlays of the Central Government during the financial year), (2) Internal Accruals, and (3) Extra Budgetary Resources (including market/ bank borrowings, institutional financing, and external investments in the form of public private partnerships (PPPs), joint ventures, or market financing from private investors).

[142] July 2020, Ministry of Statistics and program Implementation, Flash Report by Infrastructure and projects monitoring Division

Based on data received from the Ministry of Railways, GBS including funds available from the Railway Safety Fund and the Rastriya Rail Sanraksha Kosh, averaged just over INR 50,000 crores per annum over the last five (5) financial years (topping at just under INR 70,000 crores in financial year 2019-20). IR expects funds to available under this head at an average of just over INR 60,000 crores per annum over the next five financial years.

Internal resources of IR - operated through the Depreciation Reserve Fund (DRF), the Development Fund (DF) and the Capital Fund (CF), averaged about INR 6,800 crores per annum over the last five years (and only about INR 1,700 crores per annum over the last three financial years). As per present situation and estimates, funds may only be available to a similar extent over the next five years as well.

Over the last five financial years, Extra Budgetary Resources were leveraged to the extent of an average of INR 60,000 crores per annum (topping at just under INR 80,000 crores in financial year 2019-20). With a number of new initiatives involving private sector participation, IR expects leverage such resources to the extent over INR 130,000 crores per annum over the next five financial years. While this number itself (at more than twice the annual average of EBR over the last five years) looks significantly high, IR could still be left with a financing gap of over INR 200,000 crores over the next five years with reference to capital expenditure for projects identified prior to the NRP (including ones included in the NIP).

21.7.2. Key Enablers

Given the context of the fiscal situation of the Government and fund requirements for various schemes and initiatives, GBS allocation to Railways may remain at the current levels. Accordingly, to sustain capital expenditure requirements, there is an urgent need for IR to increasingly leverage Extra Budgetary Resources while enhancing its 'operating ratio' and internal accruals.

Over the last few financial years, IR's operating ratio has been just under 1 (or 100%) implying that IR has been spending close to every Rupee earned in each of the recent financial years – leaving a negligible surplus for financing expansion and growth.

An improvement in the operating ratio – including through incremental revenue from additional freight movement over the system based on successful implementation of the modal shift strategies profiled/ recommended under this study, would therefore be a key enabler for successfully financing capital expenditure requirements in future. This would especially be true for capital expenditure on projects/ areas that are not amenable to ring fencing as standalone projects with economic and financial viability beyond thresholds required for raising of project-specific resources.

21.8. Operating Ratio & internal accruals/ resource generation

In 2018-19, IR's operating ratio stood at 98.4%[143]. Multiple reasons have been enunciated, and recommendations made to address this aspect across various studies/ expert committee reports. Some of the key recommendations with respect to improvement in operations that emerge from many studies in the past are indicated below[144]:

Recommendation	Report
Divest Non-Core Activities ; Outsource activities	Rakesh Mohan (2001) ; NTDPC (2014) ; Debroy (2015)
Set up Rail Regulatory Authority	Rakesh Mohan (2001); NTDPC (2014); Debroy (2015)
Government to provide capital subsidy for social obligations	Rakesh Mohan (2001)
Promote Private Sector participation in Railway Operations	Rakesh Mohan (2001)
Increase Freight Revenues through customer coordination	Rakesh Mohan (2001) ; DK Mittal (2014)
JV with Cargo Operators	Rakesh Mohan (2001)
Freight related management and information systems	Rakesh Mohan (2001)
Commodity specific freight strategies	Rakesh Mohan (2001)
Increase average speed/reduce speed differentials	DK Mittal (2014)
Passenger business should not be cross subsidised by Freight	Rakesh Mohan (2001); Kakodkar (2012); DK Mittal (2014)
Recalibrate Passenger and Freight Tariffs	RK Mohan (2001)
Dynamic Pricing in Freight	DK Mittal (2014)
Focus on capturing share of fast growing FMCG, Consumer Durable, IT, Containerised traffic etc.	NTDPC 92014) ; Debroy (2015)
Responsive and transparent accounting and cost system	Debroy (2015)
Increase Payload/Tare Ratio on Wagons	Pitroda (2012)
Time tabling/scheduling Goods Trains	Kunzru (1978)

Source : Debroy Committee Report, **ANNEXURE 21.1: and ANNEXURE 21.2:**

The need for IR to streamline its operations through efficiency improvements, improving revenue earnings (especially from the freight – which is the engine for growth), focusing on core activities, and promoting private participation emerge as key/ common themes from various earlier studies and continue to remain relevant for IR.

One of the objectives of the NRP is to create capacity ahead of demand, and in the process address one of the key issues relating to IR's financial health. If the average

[143] Sourced from IR Annual Report, 2018-19
[144] 2015, Debroy, Bibek et al; Report of the Committee for Mobilization of Resources for Major Railway Projects and Restructuring of Railway Ministry and Railway Board; Ministry of Railways, New Delhi

capacity in the system is higher than peak demand, the system would be able to accommodate cyclical fluctuations, and also have the ability to accommodate year on year increases in demand ahead of capacity additions. This in turn would greatly help in arresting and addressing the ongoing loss in rail modal share on account of inability to service demand at the right price and with required service levels/ quality.

As mentioned above, an improvement in the operating ratio would be a key enabler for successfully financing capital expenditure requirements in future. Besides generating additional resources for financing a part of the required capital expenditure, it would also be a critical enabler for more effectively leveraging EBR in terms of market borrowings and external investments in the form of public private partnerships (PPPs), or market financing from private investors – given the comfort it would provide to such players on returns they could make from a financially viable network/ sector.

With specific reference to this study on preparation of the National Rail Plan, under an earlier module, suggestions have been made to facilitate an increase in modal share of freight transportation over the railway system. **ANNEXURE 21.5**: (Illustrative scenario analyses of potential revenue unlock through increase in rail modal share of freight transportation) presents an illustrative analysis of revenue potential that can be unlocked through a successful increase in rail modal share of freight. As can be seen, successful implementation of modal shift strategies over a period of time could lead to generation of incremental rail revenue that is proportionately higher than the incremental tonnage transported over the system – and in turn contribute to improving the operating ratio as well.

21.9. EBR – through Indian Railway Finance Corporation (IRFC) and Institutional Financing (IF)

IR accesses Extra Budgetary Resources through its dedicated financing arm, viz. the Indian Railway Finance Corporation (IRFC) which was set up on 12th December 1986 for mobilizing funds from domestic as well as overseas Capital Markets.

While IRFC primarily focused on financing acquisition of rolling stock assets, it also diversified into financing viable railway infrastructure assets and national projects of the Government of India and lending to other entities under the Ministry of Railways, Government of India.

IRFC has a cost-plus based 'Standard Lease Agreement' with the Ministry of Railways, allowing it to borrow at low cost, while obtaining a margin over its weight average cost of borrowing from MoR. Its relationship (its lease payments form part of the annual railway budget in the Union Budget of India) and agreement contours with the Ministry of Railways have allowed it to maintain a low risk profile.

As of September 30, 2019, IRFC's total borrowings were INR 1,84,631.65 crores[145] against an overall borrowing limit presently set out by the Government of India of INR 4,00,000 crores. As of September 30, 2019, of their total Assets Under Management of INR 2,21,910.25 crores, 60.80% pertained to lease receivables against Rolling Stock Assets, 2.56% pertained to loans to PSU Entities, and 36.64% pertained to leasing of viable railway infrastructure assets and national projects of the Government of India.

Additionally, to overcome shortage of funds, the Ministry of Railways decided to borrow funds from 'institutions' to ensure completion of crucial railway projects - such as New Lines, Gauge Conversion, Doubling, Traffic Facilities, Railway Electrification, S&T etc. – projects deemed important for enhancing throughput on congested corridors and generation of revenue. In relation to such funding of viable railway infrastructure assets and national projects of the Government of India under Extra Budgetary Resources – Institutional Financing (EBR-IF), IRFC took up an intermediary role by issuing bonds to Life Insurance Corporation (LIC) for such funding in the first instance – on similar lines as funding of Rolling Stock by IRFC by issuing bonds to the public/institutions and leasing to IR.

EBR through IRFC (including Institutional Financing in future), would be an important source of financing given the low cost of borrowing. However, as noted in the Draft Red Herring Prospectus of IRFC, after completion of their 'issue', their borrowing costs may increase due to potential changes in risk perception of investors and rating agencies. The same may bring back reference to improvement in operating ratio of IR, as well as more stringent selection of projects based on financial viability considerations.

21.9.1. Leveraging State JVs and MFIs

21.9.2. Reinvigorating JVs/ SPVs with State Governments and other entities

One of the potential avenues for financing railway infrastructure in the country could be through joint ventures between IR and State Governments. IR already has experience in forming JVs with a variety of partners to finance railway infrastructure projects. For instance, IR has formed JVs with at least eight States to serve their core sector industries, ports, mines, industrial corridors etc., and undertake project development, resource mobilization and monitoring of mutually identified rail infrastructure projects[146]. JVs have also been explored with the State Governments for redevelopment of passenger stations where other state transport entities have also extended a portion of the equity for projects being conceived as multi-modal transportation hub.

Internationally, in Japan, since 1996, regional and central governments together finance non-commercial railway projects with a regional development objective in

[145] Figures and facts in this section have reference to the Draft Red Herring Prospectus of Indian Railway Finance Corporation Limited dated January 16, 2020
[146] https://pib.gov.in/Pressreleaseshare.aspx?PRID=1595889

a ratio of 1:2. Similarly, in China, provincial governments extend significant support towards financing rail infrastructure. Railway lines have been constructed through joint ventures between provincial and central governments which are in the form of asset construction and management companies. Such JVs have also been leveraged for building HSR infrastructure with the provincial government often contributing through land. Several provinces in China have even set up Provincial Railway Investment Corporations to invest in railway infrastructure in their respective provinces.

Framework for collaboration with State Governments and other entities

Regional development and economic growth are key focus areas for the State Governments. While railways is a subject under List I—Union List, there is a growing need for State Governments to complement the efforts of IR to boost rail connectivity in their respective efforts. Just as IR is best positioned to manage the overall rail network in the country, State Governments can provide significant contribution towards rail infrastructure development by contributing in areas like financing, land acquisition and addressing the problems and barriers specific to their states.

It is therefore suggested that collaboration with State Governments should continue to be explored and rather scaled up. Such collaboration could especially be relevant for projects which are financially unviable but service a strategic need (economic or social) of the state.

In this context, a few guiding principles for developing an effective partnership with the State Governments and key areas of focus could be as follows:

Establishing MoUs with State governments – IR and State Governments could put in place long-term MOUs for collaborative development of mutually beneficial railway infrastructure projects. Such MOUs would need to clearly lay down the premise for such partnerships including the objectives being targeted both from IR and State Government's perspectives, role and responsibilities of IR and State Governments, nature of projects being targeted, concessions being provided by respective entities, procurement process for developing infrastructure etc. For instance, the roles and responsibilities could, among others, be with respect to aspects such as land acquisition, sharing of project costs, proper risk allocation (for instance, how to address the risk of cost overruns), project monitoring and governance mechanisms, and manpower deployment etc. Similarly, it is understood that State Governments typically express that their contributions such as land should be considered as equity/investment. There should be an agreement on such aspects which could help in saving valuable time while evaluating and implementing projects in future.

Mechanism for identification and implementation of suitable projects – Project preparation and prioritisation frameworks presented earlier may be used while identifying projects for financing under such MOUs. The framework could have specific reference to the objectives and roles defined under respective MOUs. Clearly communicating the prioritization and phasing of various projects would help the states and other agencies to have a clear view on prioritisation of projects. Certain considerations which should be kept in mind for identification of projects include:

- State Governments are potentially more likely to fund projects which visibly lead to a social benefit (e.g. enhanced connectivity to a backwards/ remote area connectivity) or those that are economically viable (e.g. enhanced connectivity to an industrial region).
- A railway project may not directly generate sufficient revenues from the project. However, projects for port, mine or industrial corridor connectivity, may have indirect benefits such as revenue enhancement and efficiency improvements for the industries, port or mine operators by helping with, say, evacuation of goods. Therefore, while considering the viability of such projects, any indirect benefits must also be taken into consideration.

Developing Institutional Mechanism for continuous engagement with State Government – IR and State Governments would need to develop an institutional mechanism to expedite implementation of identified railway infrastructure projects as well as address any other aspects requiring immediate addressal. This could also help in resolving any situations where potentially conflicting priorities of States and IR may appear. Such institutional mechanism could probably be created by forming a JV with the State Government where IR could be represented by officials from zones/divisions.

21.9.3. Leveraging Multilateral Financial Institutions (MFIs) for financing rail infrastructure

Onboarding Multilateral Financing Institutions (MFIs) can yield significant benefits for IR while implementing infrastructure projects. MFIs provide financing through grants/subsidies which can improve project viability and also through debt or equity – often on terms more favourable to the project than terms that would be associated with commercial financing arrangements. Typically, MFIs have specific working groups to create and implement programs for promoting sustainable and clean transport systems.

The World Bank supports developing country governments in tackling three key challenges with respect to rail systems:

- Reforms in the way railroads are organized and financed, including better governance and more competition, which will provide better service at lower prices.
- Integrating railways into a country's transportation network. This often requires both new investments in terminals and a new way of thinking about how railroads mesh with roads, ports and businesses in general.
- Research into rail's impact on poverty. With a better understanding of rail's potential to address poverty, transport ministries and urban planners can make more informed decisions on policies and investments.

Source: https://www.worldbank.org/en/topic/transport/brief/railways

In India, MFIs such as The World Bank and ADB are playing a key role in funding some large rail initiatives like DFC, Railway Electrification program etc. For instance, ADB had focussed on capacity augmentation of high-density corridors in parallel with institutional strengthening support to overall railway operations as part of a railway sector reform in India. Even railway entities like IRFC are looking to leverage infrastructure and development funding targets of MFIs to explore additional fund-raising options at cost effective rates. For instance, in May 2019, IRFC entered into a facility agreement with Asian Development Bank and MoR for an amount of US $ 750 million, primarily for contributing to the railway electrification initiative of IR.

The Logistics Division of the Ministry of Commerce and Industry (MoCI), Government of India and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) India, are jointly implementing the Climate Friendly Freight Transport in India (Green Freight) project. As part of this initiative, one of the strategies being explored by GIZ is around modal shift from road to rail and identifying carbon intensity reduction measures.

As mentioned earlier in this report, IR expects to substantially leverage Extra Budgetary Resources involving market borrowings and institutional financing to meet its capital expenditure requirements. Given the focus of MFIs on railway sector, there are potentially several areas where IR can seek collaboration with MFIs and create programs for financing rail infrastructure. MFIs could also support projects through provision of contingent support mechanisms such as credit guarantees.

As can be seen in a subsequent section in this Report, given the significant investments required in greenfield project and constraints on Gross Budgetary sources of Government of India, one important area for MFI involvement in financing projects under this study could be track infrastructure including future DFC projects, HSR and Core Rail Infrastructure.

Further, associating with MFIs can unlock the following benefits for railway infrastructure projects:

Leveraging Multilateral Financial Institutions (MFIs) in state specific projects: Several MFIs, as part of their regional strategy run state level initiatives, such as Comprehensive Mobility Plans, aimed at funding infrastructure programs focused on catalyzing societal development. The Indian Railways should seek active collaboration with the State Governments to make use of such programs and attract investments by creating / planning projects in a manner that it satisfies the objectives of such programs.

Successful examples of such collaboration have been seen in various infrastructure sectors. For instance:

- Jharkhand Power System Improvement Project which is aimed at increasing the transmission capacity of electricity network in the state of Jharkhand and strengthening the institutional capacity of state-owned power transmission and distribution utilities. IBRD has committed USD 310 million to the aforesaid project.
- The World Bank has recently approved a $105 million project to improve the inland water transport infrastructure in Kolkata in West Bengal.
- In Railways, the Kerala Rail Development Corporation Ltd. has initiated steps to mobilise INR 33,700 crore from external funding agencies as loan for semi high-speed rail corridor. This joint venture of Railways and the State has initiated steps to mobilise funds from international financial institutions for the Kochuveli-Kasaragod semi high-speed rail corridor, Silver Line, estimated to cost INR 63,941 crore. The State has approached the Asian Development Bank (ADB), Japan International Cooperation Agency (JICA), German Development Bank KfW, and Asian Infrastructure Investment Bank (AIIB) for mobilising the loan.

Project identification and appraisal – MFIs have specific requirements for financing projects and ascertaining whether projects are in line with these requirements through pre-feasibility studies, Value for Money analysis and economic analysis. Insights gained through such structured and focused studies, not only help in better project preparation but may also help IR in refining its own processes and lead to better prioritization and execution of other projects in the future.

Project preparation and execution – MFIs often lend technical aid which can be crucial in the project design & implementation phase. For instance, the French Development Agency (AFD), through the French National Railways (SNCF), has agreed to provide technical assistance to IRSDC to support the station redevelopment program. Further, MFIs also have frameworks for project structuring and monitoring which can be leveraged for better project governance. For instance, World Bank has a 'Program for Results' mechanism which links disbursement of funds to the achievement of specific project outcomes.

Access to other financing sources - The involvement of an MFI can lend credibility to the projects and thus improve access to other sources of finance, such as banks and pension funds. MFI involvement is also perceived by private sector as an indicator for the project being safer and improving the likelihood of their interests being protected. Therefore, MFI involvement can also be beneficial for projects to be executed through PPP.

21.9.4. Conducive regulatory environment

Indian Railway is vertically-integrated in terms of it being the (predominant) owner of track infrastructure as well as (predominant) provider of freight and passenger train operations/ services accessing and utilizing such infrastructure.

As discussed further in this section, private investment has either (1) already been, (2) is proposed to be, or (3) could be, leveraged for creation of infrastructure as well as provision of services in discrete market segments. Such potential market segments/ opportunities can be identified as a combination across certain key dimensions:

- Asset category (lines; terminals; or rolling stock);
- Geographic (defined origin-destination pairs; or network-wide); and/or
- Business type (freight – container/ bulk; or passenger – inter-city/ suburban).

In any progressive rollout of projects/ initiatives and involvement of private sector/ industry players for provision of infrastructure/ services in such a context, an enabling regulatory environment becomes essential at two levels:

1. **Commercial elements** impacting players taking a view on project economics and long-term viability of operations/ returns from project investments; and
2. Given the inevitable interaction with Indian Railways – including potentially as a counter-party in many projects/ contracts, **dispute resolution and contract administration**.

Internationally, across infrastructure sectors seeking investments from private sector/ industry players, wherever there is an involvement of a monopoly infrastructure or service provider, there is extensive experience of a regulatory mechanism being put in place to determine/ specify relevant commercial and operational aspects in a manner that:

- creates a **level playing field** for multiple operators to access and use such infrastructure or service;
- is **transparently determined** (with adequate stakeholder consultation) and publicised;
- is **consistent and predictable** for users/ investors in terms of the regulatory philosophy over time;
- is **fair** and conducive to the market context in terms of being cost reflective/ enabling customization and provision of services – essentially **mimicking a competitive environment** between parties.

Presently, IR simultaneously functions as the infrastructure developer and owner, provider of freight and passenger transport services, policy maker, and regulator.

This can/ has potentially led to 'conflict of interest' and situations where key issues relating to maintenance of a "level playing field", and investment returns for private investors remain unaddressed.

Various expert committees in the past have recommended establishing a suitable regulatory environment – with potential variations in terms of institutional options.

21.9.5. Independent Regulatory Mechanism for commercial aspects

Given the monopolistic nature of certain functions of IR, such as provision of track infrastructure, there is a need for mimicking/ facilitating competition and bringing in predictability and consistency in areas like non-discriminatory access, access charges levied to service providers, commonality/ similarity of service levels for users etc.

In this context, a few guiding principles for developing an independent regulatory mechanism and key areas of focus could be as follows:

1. **Independence** - It is imperative that any institution performing a regulatory role is independent of the working ministry for it to be effective in discharging its functions and should be able to create an environment for effecting real change and not be limited to recommendatory functions alone.
2. **Flexibility** - It is critical to ensure that the regulatory framework provides adequate agility and flexibility to adapt to the evolving market scenario over time. To facilitate the same, a best practice is to consultatively outline the overarching policy/ principles that are relatively stable and allow operating procedures to be periodically reviewed and updated over time through guidelines.
3. **Focus on creating a level playing field** - With increased private participation, there may emerge various categories of service providers/ users. Focus on creation of a level playing field would require fair access to enabling infrastructure as well as creating conditions for fair competition between different service providers. This could be achieved, for instance, by enforcing a non-discriminatory track access and terminal access regime.

Exhibit 6: Examples requiring focus for creation of level playing field in railways sector in India

Track - As the two DFC corridors (Western and Eastern) get operationalized, it will be important to set track access charge (TAC) which are fair and transparent. The TAC setting mechanism should be such that it creates a level playing field in the market, for both private as well as IR trains.

Terminals - Access to pre-existing goods sheds has been an area of resistance by IR. The ramifications of this have been high levels of terminal access charges for container rail terminals (CRTs) or restricting access to many privately owned wagons (such as those under SFTO, LWIS etc. in railway goods sheds). Access to railway good sheds, which are facilities developed on public land should ideally be provided to all users and for all types of traffic on a common user basis, and terms and conditions of access

4. **Service / KPI setting up and monitoring** - Setting up and monitoring of service levels / KPIs pertaining to quality of service offered by IR and private sector service providers and ensuring that the same yardsticks / mechanisms for addressing deviation in KPIs are applicable on both private and public sector.
5. **Fair and transparent price discovery** - Fair and transparent price discovery is best achieved through market forces. Accordingly, any regulatory mechanism should ideally steer away from regulating prices for end users such as passengers or freight customers who have the choice of multiple service modes/ providers.
   - However, wherever benchmarking is not possible with market – for example, tariffs on haulage or access charges levied on private concessionaires, they could be transparently set through broad stakeholder consultations (including Indian Railways as well as Ministry of requirements of cross-subsidy as a systemic level) and indexed for growth parameters, creating a transparent and predictable escalation regime.
   - The same mechanism may also be used to define principles (and not actual tariffs) for determination of tariffs for use of IR network assets, IR owned terminals and terminals built on IR land, and passenger and freight train operations by IR.

21.9.6. Independent Regulatory Mechanism for contract administration and dispute resolution

As mentioned earlier, interaction with Indian Railways – including potentially as a counter-party would be inevitable in many projects where IR is seeking involvement of private sector/ industry players. To ensure that private sector players are comfortable investing in existing/ new projects with IR, it would be important to ensure that contracts and disputes between IR and the private players, are administered and decided upon in a fair and transparent manner.

In this context, a few guiding principles for developing an independent regulatory mechanism and key areas of focus could be as follows:

1. **Providing independent and expeditious dispute resolution** – IR itself cannot be expected to play the role of deciding on disputes potentially created out of its own actions. An independent and expeditious mechanism to amicably resolve commercial, and contractual issues/ disputes without government interference will work strongly to incentivise private participation in the rail sector.

   In this context, the Sam Pitroda Committee had recommended appointing a 'PPP Ombudsman' to help resolve disputes that may arise between the private sector and government agencies with regard to interpretation and enforcement of provisions of the agreements. The committee also proposed that the Ombudsman to be a quasi-judicial authority having the authority to issue directions which are binding on the parties.

2. **PPP contract revision and development** – In the context where private sector/ industry players are expected to contribute across multiple segments and projects, it is important to continuously review, revise and develop contracts/ project structures and agreements. An independent entity can review and recommend changes/ required evolution in the terms of partnership between public and private stakeholders such that lessons are learnt from prior experiences, private sector participation is suitably incentivised, (evolving) public objectives are better served, and contractual clauses that are one-sided or that create a conflict of interest are avoided.

   Ideally such guidelines should be developed through a mechanism independent of IR as an interested party in such public-private engagements.

21.10. Attracting & facilitating private investment/ participation

As mentioned earlier in this report, IR expects to substantially leverage Extra Budgetary Resources involving market borrowings, institutional financing, and external investments in the form of public private partnerships (PPPs), and market financing from private investors, to meet its capital expenditure requirements – to the extent over INR 130,000 crores per annum over the next five financial years.

IR has identified a number of areas where work has been undertaken to prepare projects structures amenable to private sector/ industry players, like for instance – private (passenger) train operations, annuity projects for track/ line sections, redevelopment of passenger stations, etc.

Given the total capital expenditure requirements already identified by IR combined with ones additionally identified under the National Rail Plan, private sector participation may need to be leveraged even further in order to meet the overall investment requirements in the network. Such private sector participation opportunities could be identified across segments (1) with the direct requirement for investments and creation of infrastructure, as well as in (2) provision of services, and (3) unlocking of investment (monetization) through transfer of operating assets to private sector for operations and maintenance[147].

While the second category of projects mentioned above could supplement private sector resources in relevant asset acquisition (like for instance rolling stock) as well as enhancement in revenues, the third category of projects could make funds available for capital expenditure requirements elsewhere in the system.

While identification of such other areas and preparation of detailed project partnership structures would need to be separately taken up, in terms of creation of an enabling environment to leverage private participation, in addition to creation of a conducive regulatory and contract administration environment (discussed above), the following aspects may be considered. These recommendations have been informed by stakeholder consultations and experiences from other infrastructure sectors/ countries.

1. **PPP unit** – While IR already has a PPP unit, the same needs to have a multi-disciplinary team of senior officials identified for longer tenure postings (for continuity over life cycle of such initiatives) and empowered to coordinate and resolve inter-departmental issues, while reporting directly to the Board.

   Coordinating various Public Private Partnership initiatives through a central/ empowered unit can help IR leverage learnings over time, speed up preparation of project structures & contract documents, and effectively navigate various required approval processes of the Government.

   Such a unit should also engage with private/ industry players to share information on potential initiatives, seek feedback & inputs, and address issues/ queries of market participants over the structuring and approval life cycle.

   In fact, Debroy Committee report mentions that there has been a tendency in private sector participation schemes in railways to have strict conditions which subsequently have to be relaxed to align with private sector interests/goals.[148] Taking an active consultative approach can help avoid these issues and ensure that private sector requirements/ interests are reflected in structure of the initiatives/ projects.

2. **Review and selection of PPP (models) should be based on 'Value for Money' (VfM) analyses and not just based on IR's borrowing cost** – It is sometimes stated that IR's borrowing cost is the lowest possible – especially when compared with potential costs for private players. Review of the efficacy of project/ service

[147] In Roads, NHAI's Toll-Operate-Transfer (TOT) scheme monetizes existing infrastructure by giving tolling rights to private developers on operational road assets against an upfront fee. IR can similarly explore monetization of operational assets (with identified revenue streams, clear regulatory regime, etc.) to unlock resources for financing other capital expenditure requirements.

[148] Debroy,B.(2015)."Report of the Committee for Mobilization of Resources for Major Railway Projects and Restructuring of Railway Ministry and Railway Board". Ministry of Railways, New Delhi.
https://indianrailways.gov.in/railwayboard/uploads/directorate/HLSRC/FINAL_FILE_Final.pdf

delivery through PPP must be considered more broadly. Value for Money (VfM) is an approach adopted extensively in this context – one that denotes optimum combination of benefits and costs in delivering services users want. This can be undertaken in qualitative terms, quantitative terms (comparing against 'Public Sector Comparator (PSC)' or even in terms of comparison of economic benefits of a PPP option over traditional procurement against its additional costs.

A broader analysis should also take into consideration other constraints and objectives of IR in terms of capacity to deliver projects simultaneously, upgradation of technology, provision of service, etc. through private sector participation.

3. **Creation of a pipeline of projects in identified areas/ segments –** Creating and publishing a pipeline of projects for private sector participation under defined programs could greatly facilitate in attracting prospective private sector/ industry participants. As in other infrastructure sectors, creation of such pipeline(s) can indicate that IR is focused and serious about private sector participation in such areas/ segments and that the opportunities for private players would tend to be substantial and sustained.

   This would enable players to take a decision to invest (often substantial) resources in exploring and participating in such projects over time rather than seeing such participation as risky in one-off projects.

   This could also unlock and facilitate financing support from institutional investors to players who look to create portfolios of such projects to build scale and diversify risks.

   Project preparation of projects through pre/feasibility studies could focus on identification of such project structures based on specific reference to project details and viability assessments.

   For instance, in China, the scale of MLPT plan (Mid and Long-Term Plan adopted in early 2000's for development of railways infrastructure) created a program effect which led to significant capacity increase in implementing projects with private sector participation.

4. **Flexibility in responding to evolving market conditions** – Development of an enabling and successful framework for private sector participation is a dynamic and iterative process that requires active participation of the government, private sector and other stakeholders in the ecosystem over time to ensure success of the program.

   As can be seen from the experience of the Roads & Highways sector in India (profiled in the following exhibit), PPP models may need updating from time to time to address market issues, variations in subsequent project contours & viability, as well as incorporate learnings from operation of PPP contracts/ projects over time.

   It would be critical to proactively address such issues and continue to update and evolve PPP models to sustain and enhance/ broaden private sector interest and participation in relevant areas/ segments. This would ensure that developments and maturity of the sector is adequately reflected while implementing future projects and PPP continues to be relevant for IR as well as private sector.

Exhibit 7: Measures taken by MoRTH and NHAI to create an enabling PPP environment over time

MoRTH and NHAI have been at the forefront of creating an enabling environment for bringing in private sector investments in the Roads and Highways sector. The sector, which initially started with the Annuity form of PPPs, has evolved significantly over the past 20 years – developing and implementing projects on DBFOT (Design-Build-Finance-Operate-Transfer), Hybrid Annuity Model (HAM), OMT (Operate Maintain and Transfer) and TOT (Toll Operate and Transfer). It is also at the fore-front of creation of InVITs.

The sector witnessed a period (until 2012) wherein private sector showed lot of enthusiasm and sometimes, players bid very aggressively. Several issues came up and led to a period of subdued private sector investment.

MoRTH/ NHAI were instrumental in rekindling the interest of private investors and lenders by bringing in several measures such as:

- Policy of one-time fund infusion to complete projects
- Policy of deferment of premium for financial stressed projects not able to meet subsistence revenue requirements
- Policy of harmonious substitution for substitution of Special Purpose Vehicle (SPV) in consultation with lenders and concessionaire subject to certain conditions
- 100% equity disinvestment in projects 2 years after completion for BOT projects awarded before 2009

Further, MoRTH/ NHAI also introduced a new PPP model - "Hybrid Annuity Model (HAM)" to address private sector's concerns of traffic risk sharing. This was followed by TOT which enabled the authority to monetize certain brownfield assets. TOT helped in derisking for greenfield construction risks and allowed a special class of investors (PE funds) to re-finance these projects. After the success of the TOT model, NHAI has now been focusing on setting up InVITs for its existing brownfield assets to generate capital.

Further, NHAI has also been working on amendments to revive the BOT Model by bring in several measures[149] such as (a) flexibility in concession period, (b) 90% land acquisition at the start, and (c) inclusion of a dispute resolution board and timely redressal within 90 days[150].

MoRTH/ NHAI have been taking several measures at regular intervals to respond to the changing market situation and create a conducive environment for private sector investments in the roads and highways sector.

5. **Ring fencing of project resources** - Experiences from infrastructure projects – nationally as well as internationally, suggest a number of projects suffer delays (and consequent cost escalations) due to lack of/ delay in availability of funds. To be able to complete large projects in a time bound manner, dedicated technical and financial resources would need to be allocated, and financial disbursements synchronised at timely intervals with project progress/ milestones.

[149] https://www.thehindubusinessline.com/economy/logistics/inter-ministerial-group-clears-overhaul-of-model-concession-pact-for-bot-toll-roads/article32056766.ece
[150] https://economictimes.indiatimes.com/news/economy/indicators/proposed-concession-changes-inadequate-to-revive-private-sector-participation-in-toll-road-projects-ind-ra/articleshow/73224718.cms

While this aspect would be relevant for projects IR undertakes on its own as well, it would be important to create confidence in, and attract participation from, private sector/ industry players, as well as mitigate risk perception and thereby reduce the cost of capital for private sector project. This could mean that required resourcing on the part of IR for such under-implementation projects (land acquisition/ milestone-based contract payments/ etc.) takes precedence in future – informing and dove-tailing with the annual budgeting exercise.

The above should be accompanied with empowerment and clear accountability of implementation units for time project execution and delivery

6. **Capacity to monitor and manage PPP projects** – A project with private sector participation only commences with signing of the concession agreement/ contract. IR would need to identify resources to coordinate and ensure that such projects are well managed during implementation. The zonal teams must have access to such resources with adequate competencies and technical capacities to monitor and manage the contract and project execution/ delivery.

   The following section (on asset category specific review of financing option) includes private sector participation models that IR may consider given its context and keeping in view considerations specific to individual asset types (lines, rolling stock, stations and terminals).

21.11. Asset category specific review of financing options

The next section discusses various options for financing investments proposed under NRP for three asset categories viz. tracks, terminals and rolling stock, based on investments/ capital expenditure requirements estimated under earlier modules of NRP. The section covers:

1. Existing financing patters of various asset categories;
2. Key features of various asset categories impacting their financing options;
3. Key takeaways from select international countries, including the variation in context of rail systems in such countries vis-à-vis Indian Railways; and
4. Potential financing strategies for each of the asset category.

While arriving at potential financing options for various asset categories, apart from undertaking literature review and a study of international practices/scenarios, the study team also held consultations with stakeholders including representatives from wagon leasing companies, automobile freight train operators, container train operators, developers, railway PSUs like IRSDC, DFCCIL, NHSRCL, MOR officials, international experts, and Multilateral Financial Institutions.

Key takeaways for IR in terms of financing options for each of the asset category is presented below:

1. Rolling Stock: Wagons

a. As of March 2020, there were approximately 2,95,000 wagons as part of the Indian rail network. More than 81% of these are financed by IRFC. Given a potential requirement of INR 85,603 crores of investments over the next 10 years till 2031 and another ~INR 2,13,053 crores till 2051, there is a need and potential of much higher private participation in wagon ownership.

b. While investment in wagons by private sector in India has seen limited spread so far, where it has been attempted, it has led to clear benefits to stakeholders involved. Global experience also shows us that in many mature, and freight dominated, rail markets such as Australia, USA, and Russia, wagons are completely owned by the private sector (up to 80-90% in case of Russia). In Russia, within a span of 10-12 years, wagon ownership was transferred to private hands.

c. Approximately 35% of the existing wagon fleet in IR is also older than 15 years. As more and more wagons become due for replacement, there is an opportunity to further promote private sector participation in wagon ownership. Additionally, IR may also consider possible monetization of existing wagons. This could be achieved by transferring the existing stock of wagons owned or leased by IR to the private sector over a period. This along with certain policy measures like consolidation of policies for wagon ownership, could enable operation of rakes with multiple types of wagons, helping with consolidating commodities and inviting interest from industry, especially the LSPs.

2. Rolling Stock: Coaches

a. As of March 2020, there were approximately 76,000 passenger coaches in service on the IR network with ~85% being financed through IRFC. There is a potential requirement of INR 1,77,560 crores of investments over the next 10 years till 2031 another ~INR 1,99,218 crores till 2051. About half of this amount is expected to be needed for purchase of Non-AC coaches, and the balance for mainly AC coaches and train sets.

b. Given the potential viability issues of passenger operations, especially for Non-AC coaches and MEMU/DEMU coaches, and a scenario where the market consists of a single buyer and operator, i.e. IR, and there is a reduction in incremental demand for coaching stock, the circumstances would not be conducive for creation of a leasing market with private sector involvement. Therefore, financing for Non-AC coaches and MEMU/DEMU coaches could continue with the existing mechanism, i.e., a finance lease with IRFC.

c. At present, no passenger coaches are owned by the private sector. A concession for India's first private passenger train operator (based on trainsets with service offerings entirely focused on AC coaches) is currently under the bidding process where the operator would be responsible for financing, i.e., owning or leasing, the requisite rolling stock. In case the private train operations model gathers momentum, and more routes are awarded to the private sector, a private leasing market for coaches may also develop. In this scenario, should IR require trainsets for transforming a part of its passenger operations (for competing with PTOs and catering to premium passenger segment), it could opt to procure such rolling stock for 10-15 year-leases with option to renew the lease or purchase outright at a predetermined discounted price.

3. Rolling Stock: Locomotives

a. As of March 2020, there were approximately 12,500 locomotives in service on the IR network with ~91% being financed through IRFC and balanced owned by IR directly. There is a potential requirement of INR 2,19,380 crores of investments over the next 10 years till 2031 another ~ INR 4,24,858 crores till 2051 for locomotives. Similar to coaches, in a scenario where the market consists of a single buyer and operator, i.e. IR, and there is a reduction in incremental demand for locomotives, the circumstances would not be conducive for creation of a leasing market with private sector involvement. The existing financing mechanism, i.e., finance leases through IRFC, may continue for such operations.

b. No locomotives (except for a few used for captive purposes in ports or large industrial units) are owned by the private sector. The model for private PTOs is expected to work with trainsets, rather than separate coaches and locomotives. As trainsets are self-powered, increase in demand for these would correspondingly mean a lower locomotive demand for passenger services. A high-level estimate suggests that ~150-200 locomotives pertaining to passenger coaches could be subsumed with investments in trainsets through PTO model. Similarly, in the freight space, a case can be made for some wagon owners (especially those with large operations to warrant captive locomotives), to invest in locomotives to increase operational efficiency of their own assets and help improve asset productivity and 'turnaround time' (TAT) by ensuring captive locomotive availability.

c. A more effective incentive for private investment in locomotives could come if IR were to consider shifting the responsibility of locomotive operations and maintenance to the private sector as well. As discussed in this study, locomotives and wagons are treated in a similar way in most mature international rail markets, with respect to their financing, ownership, and maintenance.

4. Freight Terminals

a. As mentioned in the earlier sections of this report, capital investment of ~INR 10,402 crore will be required to develop the necessary freight terminal infrastructure at the identified clusters / locations in a phased manner for the horizon year 2031. There is, at present, no capex requirement from IR as far as the greenfield aspect of freight terminal development is concerned. For investment needed to upgrade goods sheds, which have generally been in the domain of IR's own financing plans, there have been policy initiatives of late, where private participation has been invited with potential reimbursement on investments through a revenue share from rail freight.

b. Investments in freight terminals is typically recovered through revenues from terminal access, handling and storage revenues, revenues from value added services and revenues from exploitation of land or airspace to develop ancillary facilities. Attracting desired levels of private sector participation into the development of freight terminals would require certain critical policy modifications and choosing the appropriate model/structure based on factors such as ownership of land (whether with IR or private party) and type of project (greenfield or brownfield).

c. In order to create a more enabling environment to encourage greater private investment in terminal infrastructure, it is recommended to have a consolidated terminal ownership policy that shall cover specific aspects like greater flexibility on use of railway land, appropriate fee structure with 'zero' entry fee, efficient approval process and improved access to railway good sheds. Similarly, the Goods Shed Development Policy should have provision of preferential access rights, ensuring minimum returns on investment for a longer time frame and revenue share to incentivize marketing and increase in cargo volumes.

d. It is also recommended that utilizing the DBFOT PPP model by leveraging the use of Railway or publicly owned land be considered. IR can also encourage state governments (under an MOU/JV model) to provide vacant land parcels for undertaking development of necessary infrastructure.

5. Passenger Terminals

a. There are currently about 8,000 passenger stations on the IR network. These stations have been developed over time by IR using its own finances. As mentioned in the earlier sections of this Report, about 96 districts have been identified for station redevelopment projects over the course of the study period requiring ~INR 70,490 crores till 2031. Beyond 2031, another ~INR 13,365 crores of investment may be needed till 2051. Since project size for a station redevelopment project can vary significantly, the cost of development shall depend upon factors such as station area, number, length and area of platforms, passenger footfall, quality of service offering required, area of land available etc.

b. The overall station redevelopment program of IR is expected to be commercially remunerative at a program/portfolio level, i.e. while some of the individual projects may not be commercially viable, the program as a whole may not need support from the government apart from provision of land for commercial development. If this premise holds true in future, majority of capital expenditure requirements for passenger stations could be financed through private sector.

c. Potential sources for generating funds for station development could include revenues from land monetisation as part of the redevelopment project, revenues from user fee and non-fare box revenues generated from the station premises (including vertical developments, if feasible). Opportunities may also be explored with state governments and regional authorities such as road transport corporations that may be willing to collaborate for redeveloping stations for various strategic or economic interests such as promoting local economies, tourism, integration with other transport modes etc. IR may also consider programs of various MFIs with the State Governments such as Comprehensive Mobility Plans and explore possible financing under such programs for station redevelopment projects serving the objectives of passenger convenience. Any deficit of funds for non-viable station redevelopment projects after accounting for the above sources would need to be financed by IR, either from GBS or from its internal resources.

6. Track Infrastructure – Dedicated Freight Corridors

a. As mentioned in the earlier sections of this Report, five new DFCs have been identified in addition to the two under-construction DFCs (Eastern and Western

DFC). There is an estimated requirement of INR 1,73,428 crores of investments for construction of 3 proposed DFCs over the next 10 years till 2031 and another ~INR 56,572 crores till 2051. As currently envisaged, the sole customer of DFCCIL would be the Indian Railways with revenue generation taking place for DFCCIL through a Track Access Charge (TAC) mechanism. It is evident from the budgetary allocations over the past few years to IR that Gross Budgetary Support is limited and may not be available to fund large projects such as DFCs.

b. Given the capital-intensive and greenfield nature of DFC projects and lack of precedence around traffic allocation etc., it is also understood from various consultations that it would be difficult to tap in private sector investments upfront for construction of these projects unless PPP models such as Annuity or Hybrid Annuity models are considered. The recommended financing options would, therefore, need to be a combination of leveraging private capital and external borrowings. Although the private capital may be more expensive than public capital, larger projects are inherently complex and private players can add value by bringing in efficiencies in construction as well as operations and maintenance. The higher cost of funds of private players can also be partially offset by economic gains brought through ability of IR to undertake multiple projects in parallel (and therefore avoiding time loss in preparing key projects that gets delayed because direct fiscal support is unavailable), ring fencing of financing through concepts like financial close, and better project management capabilities etc.

c. Also, based on information available with the study team, RITES had submitted a Preliminary Engineering and Traffic Survey report for three DFCs – East-West DFC, North-South DFC and East Coast DFC. As per the report, while the financial IRR for North-South DFC is above 21%, the same for other corridors are estimated to be more than 34%, indicating a preliminary viability of these corridors. Therefore, given that the projects may have a potential to attract private sector interest, certain measures like off-balance sheet financing, or asset monetisation for existing DFCs could be considered once the assets are operational. This can further help in repaying the debt and freeing up equity which can then be used to fund additional such projects.

7. Track Infrastructure – High Speed Rail

a. As mentioned in the earlier sections of this Report, twelve High Speed Rail (HSR) projects have been identified as part of NRP, which are in addition to the ongoing HSR project (Mumbai - Ahmedabad). There is a potential requirement INR 6,36,770 crore of investments for construction of proposed HSRs over the next 10 years till 2031 and another INR 8,59,030 crore of investments would be needed for construction of remaining HSRs.

b. HSR projects are capital intensive and require significant fiscal support due to high cost of construction. Given high upfront capital requirement and likely low IRRs, private sector may not be amenable to financing the HSR projects and these projects would need to be financed through direct contribution from the Central Government by either imposing direct or indirect levies or tapping into resources of MFIs and collaborating with the State Governments.

c. Globally also, financing of HSR projects has been a challenge for government authorities requiring significant grant support in order to make the project viable.

In many projects, even economic returns have been in a medium-low range. Once HSR infrastructure is created, train operations can potentially be provided by private players on PPP basis, as has been the case in other countries.

8. **Track Infrastructure – Core Rail Infrastructure**

a. A number of capacity creation/expansion projects for core track infrastructure, High Density Network (HDN), Highly Utilized Network (HUN) and other lines, have been identified as part of this study across three categories – (a) doubling/ 3rd line/ 4th line projects; (b) signalling upgradation projects and (c) Construction of flyover/ bypasses. As mentioned in the earlier sections of this Report, INR 3,00,244 crores of investments would be required for construction of core track infrastructure over the next 10 years till 2031. Beyond 2031, it is expected that another INR 3,82,029 crore of investments would be needed. Compared to DFC and HSR, the average project size in this category is comparatively lower. Each asset category has several projects with varying project size depending upon the length of the project section.

b. Currently, construction of new/ additional lines, signalling upgradation projects and flyovers/ bypasses is primarily financed through a combination of internal accruals, Gross Budgetary Support and Extra-budgetary Resources (EBR) generated through various sources. While a number of PPPs have been attempted in this space, the success has been limited and mainly concentrated in port connectivity and mine (coal/iron ore) connectivity projects mostly on account of strategic importance of such connectivity projects to the investment partners.

c. Projects proposed under core track infrastructure, as part of NRP, would result in capacity expansion and thus would indirectly lead to higher revenues. Project IRRs would be contingent on specific variables such as construction cost and the resultant traffic on the section. It would be pertinent to prioritise projects which are economically viable, i.e. where the economic benefits outweigh the economic costs. Given the nature of assets and lack of delineable revenue sources, financing such assets would require a combination of public and private investment leveraging annuity-based PPP models and PPPs for port and mine connectivity, Gross Budgetary Support and MFI financing for economically viable projects, leveraging IRFC balance sheet and a passenger surcharge (similar to user fee being envisaged for station development) on certain specific classes of passengers, only on trains which get direct benefit from such capacity increase.

Detailed discussions on each of these asset categories are presented in the next section and summarized in the tables below.

Table 21-6: Potential financing options for various asset categories.

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
Wagons	Approx. 81.5% of existing wagons are financed by IRFC and leased to IR. About 6.9% of existing wagons are owned by IR. Remaining 11.5% of the wagons are owned by private sector including captive users, the predominant share comes from wagons procured under the Container Train Operator Scheme.	Ownership of wagons are closely linked to the structure of rail systems in various countries. • In Australia, the government owns all network, and the private sector owns the rest of the infrastructure. Operations and maintenance of Wagons are handled by private sector. • In Russia, whose rail system was similar to IR, the wagon ownership has been transferred to private hands over the last 10-12 years. This was done through transfer of wagons to government owned subsidiaries, the shares of which were then transferred to private entities.	To finance the rolling stock investments, potential recommendations that may be considered by IR for simultaneous implementation include: • Private sector investment in all future requirements of wagons • Transfer of ownership or corporatization of management of the existing IR/IRFC owned fleet • Development of a diversified private ownership market structure, with a strong leasing market • Consolidated policy for wagon ownership: This could enable operation of rakes with multiple types of wagons, helping with consolidating commodities and inviting interest from industry, especially the LSPs.
Coaches	A majority of coaches on Indian Railways system, ~85% , are financed and owned by the IRFC and leased to the IR, while the balance ~15% of coaches are owned by the Indian Railways directly.	In some key international rail markets, most aspects pertaining to passenger rail operations have been privatized. This contrasts with the structure of passenger rail transportation in India, where	• As per estimates by the technical consultant, the requirement of incremental coaching stock is expected to reduce over time. • In a scenario where the market consists of a single buyer and operator, i.e. IR, and there is a reduction in incremental demand for coaching stock, the circumstances would not be conducive

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
	At present, no passenger coaches are owned by the private sector. A concession for India's first private passenger train operator is currently under the bidding process.	most aspects continue to be controlled by the Government. • For example, in UK, passenger operations have been shifted completely to the private sector. The duration of franchise (7-10 years) is less than life of asset (30-35 years), favouring lease over purchase for Train Operating Companies. Further, it also ensures a market for coaches after the franchise expires. • In Japan, the coaches are outrightly purchased by train operators. The 6 major operators are divided based on geography, and own rail assets - stations, land, rolling stock, and network.	for creation of a leasing market with private sector involvement. The existing financing mechanism, i.e., finance leases through IRFC, may continue for such operations. • In case the private train operations model gathers momentum, AC coaches and trainsets can be procured/ financed largely by the private sector. With such private ownership of rolling stock, maintenance of such rolling stock could also be shifted to the private sector. With investments in coaches financed from the private sector, IR would not be required to finance capital required for coaches. These savings could be used by IR to invest in other core rail assets, such as track infrastructure, signaling and communication.
Locomotives	A majority of locomotives on Indian Railways system, ~91%, are financed and owned by the IRFC and are leased to the IR, similar to wagons and coaches. The balance ~9% of locomotives are owned by the Indian Railways directly.	Unlike India, in most international markets, the financing model for locomotives is similar to the financing model of corresponding coaches and wagons. An exception to this is Russia, where the locomotives are still the	• In a scenario where the market consists of a single buyer and operator, i.e. IR, and there is a reduction in incremental demand for locomotives, the circumstances would not be conducive for creation of a leasing market with private sector involvement. The existing financing mechanism, i.e., finance leases through IRFC, may continue for such operations.

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
	No locomotives (except for a few used for captive purposes in ports or large industrial units) are owned by the private sector. Even where the private sector is involved in investment of wagons, the associated locomotives are still owned by IR.	responsibility of RZD (100% Government-owned entity).	However, there are three potential scenarios in which greater investment in locomotive from private sources can be envisaged or requirement from IR for financing may be reduced. • The first relates to greater proliferation of the PTO scheme. With most PTO based passenger services based on trainset operations, there will be no need for separate locomotives to be owned by IR for such operations, and motive-power investments would accordingly get subsumed with PTO investments. • In the freight space, a case can be made for some wagon owners (especially those with large operations to warrant captive locomotives), to invest in locomotives. • Finally, should IR require higher horsepower/new technology locomotives which cannot be manufactured in existing units, it could opt for 10-15 year leasing from private sector with an option to renew the lease or go in for outright purchase at the end of the lease period.
Freight Terminals	• Approximately 53% of the freight terminals on IR's network, out of a total ~2,350, are financed, developed, operated	Similar to other infrastructure sectors, IR has taken several policy steps to attract greater private investment in terminal	The following options could be considered by IR to attract private investment in freight terminal infrastructure:

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
	and are maintained by IR. Private sidings, developed as part of the IR network, are ~44% for which, IR only provides land for connectivity for which a commercial lease charge is levied. All investments for acquisition of land, development of terminal infrastructure, equipment etc. is borne directly by private sector.	infrastructure and going forward, it envisions to augment the capacity and quality of its terminal infrastructure by adopting suitable models for private sector participation as the primary mode of financing and development of terminals infrastructure.	• **Create a more enabling environment by undertaking critical policy modifications** - It is important to simplify the existing terminal policy framework and introduce provisions that help in increasing access and in incentivizing private investment in order to improve service quality that in turn will promote modal shift from road to rail. To achieve this, it is recommended that the policy for Private Sidings, ICDs and PFTs should be merged into a single policy. The key components of a common consolidated policy for terminals could pertain to greater flexibility on use of railway land, fees, approval process, access and freight haulage rebates. • **Adopting DBFOT variant of PPP model** - To attract requisite investment required for creating additional capacity in the terminal network by way of developing greenfield terminals, the DBFOT model may be considered by leveraging the use of Railway or publicly owned land. Under the existing scheme, license from railways is only available for connectivity. Adequate land parcels can be provided to private parties either as an equity investment or under a lease by undertaking land monetization.

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
Passenger Terminals	• Conventionally, passenger stations in India have been financed and operated as a part of the overall system of railway operations. All works, including upgradation, maintenance, and development of stations have generally been met through various budgetary heads as part of IR's overall internal resources. In the years FY17 to FY19 the budgetary allocations under the Passenger Amenities head ranged from INR ~918 crore to INR ~2411 crore • In recent years, IR has started exploring the concept of developing passenger stations as standalone projects with PPP or State JVs as an option for financing the redevelopment of these stations. Various models have been considered by IR and its PSUs such as IRSDC and RLDA including Modified swiss challenge method, Single stage	In mature markets such as USA, UK and Japan, station redevelopment efforts have often been executed as individual business units and financed through a variety of ways, including through multilateral banks, government funding as well as private sector involvement. A few key takeaways from the international case studies include: • **Transportation hubs -** Many stations across the globe are developed as transportation hubs integrated with other urban transport systems resulting in enhanced viability through improving footfall and business for the commercial developments at and around the station. • **Benefits of PPP** – Station redevelopments through PPP models have resulted in	• Minor standalone upgrades for maintaining the station and quality of passenger amenities without warranting a full-fledged redevelopment of the station could continue to be financed by IR through its budgetary allocation. • Large scale station redevelopment projects to be undertaken through a combination of public capital from both central government and state governments (either through provision of land for monetization or through direct provision of funds) supported by private capital under appropriate partnership models. • Given the high variability in station redevelopment projects in terms of both cost of redevelopment and potential of return due to the various factors, projects may be categorised into 3 categories and tailored models of execution may be adopted for each. ○ **Category 1:** Station development projects which are commercially viable through exploitation of the three revenue sources, i.e. land monetisation, fare box revenues (user fees and passenger tickets) and on station non-fare box revenues to be taken through DBFOT PPP model.

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
	model used for Habibganj station redevelopment and the new DBFOT model under which the bidding is ongoing for various stations such as New Delhi, Dehradun, Nagpur and Sabarmati.	significant Value for Money benefits for the government as well as business opportunities for the private partner. However, station development projects are not homogenous and may need tailored solutions for financing depending upon project characteristics. • **Land and airspace monetization** - Land and airspace monetization can be an effective tool for generating revenue to fund the station development irrespective of whether the project is being financed by a government entity or a private party through PPP.	○ **Category 2:** Station development projects which are not commercially viable on an overall level but has potential of generating surplus through land monetization. ▪ Using consolidated surplus from land monetization and surplus from Category 1 stations, development through IR, EPC or BOT (Annuity/HAM) models. ▪ PPP with Viability Gap Funding (VGF) support either under the government's VGF scheme or directly provided by IR. ○ **Category 3:** Station development projects which are not commercially viable and land monetization is also not feasible. ▪ Financed by IR through the surplus raised from Category 1 stations or if there is a deficit, through GBS or internal resources. ▪ Joint development with state governments ▪ Asset bundling with Category 1 stations
Dedicated Freight Corridor (DFC)	• The two existing DFCs in India under implementation, Eastern and Western DFCs are being funded through a mix of equity from MoR and loan from multilateral development banks	Internationally, there are limited examples of a similar DFC like infrastructure development wherein only freight operations are permitted. However, a few	Financing options for proposed DFC corridors include a combination of leveraging private capital as well as government borrowings and is discussed as follows:

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
	(viz. World Bank and JICA). These two DFCs, with a project cost of INR 81,459 crore are being funded through (a) 47 percent from JICA loans (b) 17 percent from World Bank loans, and (c) 36 percent from MoR's equity contribution. • DFCCIL has been contemplating to develop a section of Eastern DFC (Sonnagar – Dankuni) on PPP mode. After several deliberations and discussions within the MoR, it is envisaged that the given section would be developed on DBFMT-Annuity model with traffic risk being allocated to DFCCIL.	takeaways from some of the similar large-scale projects include: • **Financing of Australia's Inland Rail through combination of public investments and PPPs:** Australian government is funding an Inland Rail project (a USD 10 billion project & 1700 km long) to provide better freight logistics services and increase rail freight share. Given the huge capital investment required, and the positive macroeconomic benefit associated, the Australian government is funding majority of the project on its own with a small section (128 kms) on availability-based PPPs to leverage private sector's innovation and experience. • **Off balance sheet financing mechanism for Delhi-Mumbai Expressway:** Due to the already stretched position of NHAI's balance sheet and over reliance	• **PPP (Annuity based) to fund DFCs:** As per the preliminary economic and financial analysis, the upcoming corridors appear to be financially viable. However, it is understood that investors could be wary of investing in such large greenfield projects in Indian rail sector due to high risk perceptions. Given the nature of the project, the investors will need certainty on traffic before making investment decisions. In light of this, a DBFMT-Annuity model which addresses the traffic risk issue could be a more feasible option. • **Off balance sheet financing:** Off-balance sheet financing could be leveraged to fund commercially viable greenfield projects such as DFCs. Institutional investors can fund the initial construction cost (potentially by passing on the construction risk to the government entity) and once the assets are operational, they can then be monetized to repay the investors. • **Asset monetization:** Another option which can be explored by IR and DFCCIL is to monetise the

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
		on borrowings in the past, NHAI is envisaging an off-balance sheet financing mechanism to finance Delhi-Mumbai Expressway (a green-field project with cost of INR 90,000 Cr). With off-balance sheet financing, institutional investors can fund such greenfield projects in return of defined annuity payments. The investor is also de-risked from construction risks. Further, once the asset gets operational and there are steady cashflows, the asset can be monetized to repay the investors.	existing DFC networks once they become operational and start generating a steady stream of revenues. This is because once key risks such as traffic allocation, TAC regime etc. are addressed, given the potential viability of DFC networks, the private sector may be interested to invest in such assets for long term. IR and DFCCIL could use such opportunity to explore options like InvITs to bring in large institutional investors. As the asset gets monetized, the debt of projects could be repaid, and the freed-up equity can be used to fund additional such projects.
High Speed Rail (HSR)	• The first HSR project in the country, the Mumbai-Ahmedabad High Speed Rail (HSR) Corridor with estimated project cost of INR 1,08,000 Cr, is being executed by National High-Speed Rail Corporation Limited. The project is predominantly funded by a loan	• Internationally, financing of HSR projects has been a challenge for government authorities. Given the scale of investments and low IRRs, HSR projects typically does not attract financing from the private sector players. Even economic returns	Potential financing options that may be considered for HSR project, include: • **Public capital or borrowings:** Given high financing requirements and typical budgetary constraints, financing of HSR projects solely from GBS may not be possible. Hence the likely source of funds could include: o **Extra-budgetary resources** (institutional financing) through MFIs.

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
	(81% of the project cost) from Government of Japan and equity contributions from Central Government through Ministry of Railways and two State Governments viz. Government of Gujarat and Government of Maharashtra.	have been in a medium-low range. • Globally, a majority of the HSR corridors have been funded through government/ public support with very few precedence of PPPs in such projects. Even in the PPP projects, there has been significant reliance on public investments (the PPP structure of an HSR project in France needed to be supported with a significant grant support (~50 percent of project cost) to the concessionaire in order to make the project viable).	○ **Support from GoI and States:** The projects may be considered as a separate business unit (like an SPV) from financing perspective and potentially funded through central government support. This may be done through direct/ indirect levies. Also, since the benefits of High-Speed Rail would trickle down to the participating states, the state governments should be encouraged to provide financial support in financing these projects by way of equity contribution and/ or financing land acquisition. There are examples from China and Japan wherein provincial governments have supported the financing of High-Speed Rail Projects. • **Private capital to fund rolling stock:** Once the HSR infrastructure is created, train operations can be provided by private players on PPP basis, as has been the case in other countries. • **Revenue enhancement measures**: Apart from initial financing requirements, it is also important to look at measures which could increase the financial sustainability of HSR projects. Some of the key revenue enhancement measures could be

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
			(a) land value capture and (b) augmenting non-farebox revenues.
Core Track Infrastructure	• Currently, construction of new/ additional lines, signaling upgradation projects and flyovers/ bypasses are generally financed by IR through a combination of sources: ○ Internal accruals, ○ Gross-budgetary support, ○ Extra-budgetary Resource (EBR) • There is significant reliance on gross-budgetary support and extra-budgetary resources (predominantly through IRFC borrowings) for financing of such core track infrastructure projects. • Several PPP models were formulated for financing of track infrastructure projects such as new lines construction and doubling, including through policies like R3I, R2CI and various Participative Policies.	• Internationally, the ownership and management for rail infrastructure and rail operations are divided into two segments (a) Below the rail (track infrastructure management), and (b) Above the rail (train operations/ rolling stock management). • Countries such as the UK, USA and Australia have models where an infrastructure manager (could be public or private) is responsible for development and maintenance of track infrastructure. Above the rail services are provided by various service providers and the infrastructure manager charges a fee, or a "track access charge". This track access charge is used to recover the cost of development and maintenance of track infrastructure.	• Given the vertically integrated structure of Indian Railways and revenues are not segregated across individual, cost recovery of track development and maintenance is typically undertaken through revenues generated from the passenger and freight charges. However, with the high operating ratio being experienced by IR, it would be challenging to fund such track infrastructure projects through internal accruals. • Given the nature of assets and lack of delineable revenue sources, private sector investments may not be amenable for financing of core track infrastructure unless the chosen PPP mode is annuity based. Possible financing options for such projects could include: ○ **Private capital (through Annuity/ Hybrid annuity-based models) for larger projects:** Since GBS funding is expected to be limited, it becomes pertinent to use it sparingly, and only where no alternatives are available. Although the private capital may be more expensive than public capital, it could still be relevant to fund larger projects through private capital by leveraging PPP instruments such as Annuity

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
	• On the whole, there has been limited success in getting private sector capital for rail line projects, and PPPs in rail have been mostly concentrated in port connectivity and mine (coal/iron ore) connectivity projects.		or Hybrid Annuity models. Such funding decisions could be taken by leveraging Value-for-money (VFM) analysis at appraisal stage. ○ **Leveraging IRFC to fund projects:** In line with proposed financing options for financing rolling stock through private sector, IRFC could be leveraged to play a larger role in financing core track and signalling projects. ○ **PPPs to fund port/ mine connectivity projects:** Projects having strategic business interests such as port and mine connectivity should be funded through PPPs by leveraging various forms of participative models. ○ **Gross budgetary support and MFI financing to fund economically viable projects:** Projects which are economically viable but financially unviable could be funded through gross-budgetary support and financing from MFIs, including projects such as flyovers/ bypasses, which do not have a delineable revenue stream but are important from a capacity expansion perspective. • **Revenue enhancement measures through levy of surcharge on select passengers:** The financial sustainability of IR hinges upon the passenger

Asset Category	Existing financing pattern	Key takeaway from international / other sector case studies	Potential financing options
			segment, as the passenger business is currently loss making and cross-subsidized by the freight business. IR may consider levying a surcharge in the form of Development Fee (current being envisaged for station development) on trains which get direct benefit from such capacity expansion.

21.12. Financing Rolling Stock

As mentioned in the earlier sections of this Report, capital investment in rolling stock (categorized into Wagons, Coaches and Locomotives) over the next 10 years, till 2031, is estimated to be approximately INR 4,82,543 crore. Beyond 2031, further investments of INR 8,37,129 crore are expected in rolling stock.

A summary of the expected rolling stock investment requirements is presented in the **Table 21-7** below.

Table 21-7: Total financing requirements for Rolling Stock (Figures in INR crores)

Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032 - 2041	2042 - 2051	Total
Wagons	7,813	7,813	7,813	7,813	7,813	9,307	9,307	9,307	9,307	9,307	86,572	1,26,481	**2,98,656**
Coaches	24,235	24,235	24,235	24,235	24,235	11,277	11,277	11,277	11,277	11,277	85,436	1,13,782	**3,76,778**
Locomotives	30,867	30,867	30,867	30,867	30,867	13,009	13,009	13,009	13,009	13,009	1,89,140	2,35,718	**6,44,238**
Total	**62,915**	**62,915**	**62,915**	**62,915**	**62,915**	**33,593**	**33,593**	**33,593**	**33,593**	**33,593**	**3,61,148**	**4,75,981**	**13,19,672**

There may be variations in the above-mentioned numbers, based on how various factors impacting the investments may turn out over a period. Such factors could include inter alia capacity related with rail network expansion, operating performances impacting average speeds and asset turnaround, and demand variations based on economic growth, and performance of competing modes.

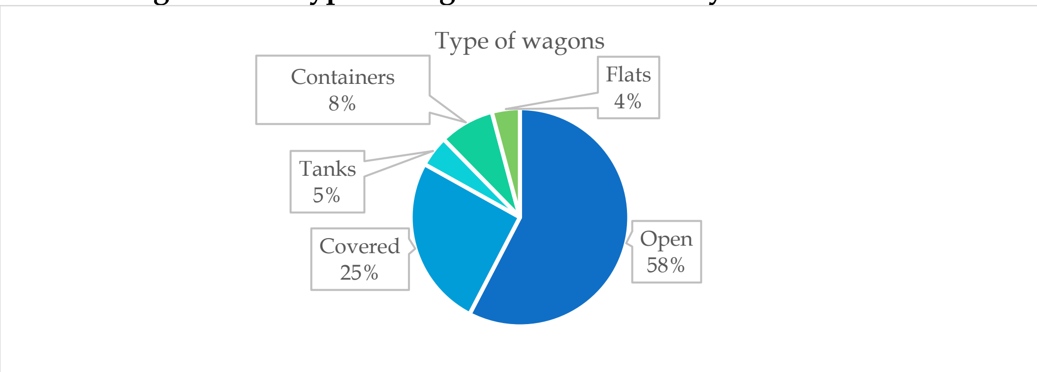
The sub-sections below discuss in brief about the existing financing pattern of each category of rolling stock, features of different categories which impact the financing of such infrastructure, examples from international rail markets and discussion on potential sources of financing for each category of rolling stock.

21.12.1.Wagons

21.12.1.1. Existing Financing Pattern

As of March 2020, there were approximately 2,95,000[151] wagons as part of the Indian rail network. Over the past 5 years, since March 2015, the fleet has grown annually by ~3%. About 60%[152] of these are open wagons (predominantly variants of BOXN wagons), which carry bulk commodities like coal, iron ore, cement clinker, and other raw materials for steel (dolomite and limestone).

Figure 21-7: Type of wagons in Indian rail system



Source: Consultant's analysis based on data in IR Yearbook

Another 25% are covered wagons (variants of BCN wagons), used for transportation of bagged commodities like cement, fertilizer and food grains. About 8% are container wagons (variants of BLC wagons), used for transportation of containers. Tank wagons (variants of BTPN wagons), constituting about 5% of the existing wagons are used mainly for transportation of POL products and some liquid chemicals, and the rest are variants of flat wagons (for example, BRN wagons), used primarily to carry steel, railway materials etc.

As stated earlier in this report, over the next decade and beyond, IR will need to concentrate on expanding its commodity portfolio and focusing on much greater containerization to increase its modal share. This is expected to result in higher demand for Container flats as well as new and innovative rolling stock to attract greater modal share in various commodities. This is, therefore, likely to create opportunities for further investment in wagons by the private sector.

Currently, a majority of wagons, ~81.5% (refer **Table 21-8** below), are financed and owned by the IRFC and are leased to the IR on a finance lease basis for a term of 30

[151] Source: Fleet size as on March 2019 and previous years has been sourced from IR website. Fleet size as on March 2020 is estimated based on growth trends. Growth of past 5 years has been computed based on data as on March 2015, sourced from IR website.
[152] Source: Consultant's analysis based on data received from IR

years, i.e., close to the useful life of wagons. Given the Government of India control over both IR and IRFC, this financing mechanism can be considered as notional leasing between internal railway divisions. Further, considering that these are finance leases, and not operating leases, these are very similar to financing an outright purchase through debt.

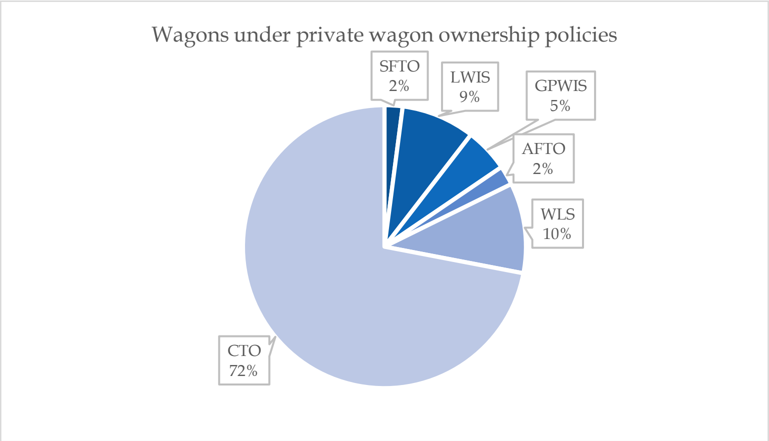
Table 21-8: Ownership of existing wagon fleet

Owner	Percentage of fleet owned	Remarks
IR	6.9%	
IRFC	81.5%	Apart from container wagons, almost all wagons are owned by IRFC, and leased to IR through a finance lease.
Private	11.5%	About 78% of these are container wagons, facilitated through CTO and WLS policies. All other categories (open, covered, tanks, and flats) comprise about 4-5% each.

Source: Consultants' analysis based on data received from IR

Of the approximately 11.5% of the wagons owned by the private sector[153], the predominant share comes from wagons procured under the Container Train Operator Scheme, which has been in place since 2006, and the rest are accounted for through freight marketing policies, such as SFTO/LSFTO, LWIS, GPWIS etc.

Figure 21-8: Wagons under private wagon ownership policies



Source: Consultant's analysis based on data received from IR

A mere 10% of private wagons i.e., ~1.15% of the total fleet are accounted for by Wagon Leasing companies that have procured wagons through the wagon leasing

[153] **Note:** For the purposes of this chapter, the private sector is assumed to include Public Sector Enterprises such as CONCOR, NTPC, IOCL, BPCL, HPCL, etc.

policy (WLS) for onward lease to End Users or Logistics Service providers. End users / cargo owners have shown the most interest in LWIS, GPWIS, and SFTO policies, while Logistics companies have invested through CTO, AFTO and recently through the GPWIS policies.

Box 16: Overview of investments through wagon investment and leasing policies

Table 21-9: Overview of investments through wagon investment and leasing policies

Policy	No. of rakes approved (FY20)	No. of rakes inducted (FY20)	Key players
CTO	534	534	A total of 19 operators were granted permission to operate container trains. With some mergers, there are now 17 registered operators, with 14 having ownership of trains. Out of 534, 321 rakes (~60%) are owned by CONCOR. Others own the balance rakes, ranging from 2-30 rakes each.
LSFTO	37	16	This scheme which was started as SFTO and has now been modified to LSFTO, has seen participation from just 3 players: 1. TM International (a subsidiary of Tata Steel (LSP/Captive, flat wagons, ~70% of approved rakes under scheme, to be used for movement of steel products) 2. Jindal Steel and Power (Captive, flat wagons, ~20% of approved rakes under scheme, to be used for movement of steel products) 3. NTPC (captive, tank wagons, 10% of approved rakes under scheme, used for movement of flyash).
LWIS	133	54	This scheme, which has now been merged with the LSFTO policy, has attracted participation from 21 players. These are mostly large end user companies who have invested in these rakes for their captive use. About 60% of the approved rakes are accounted for by 3 companies: 1. Food Corporation of India (FCI) - 30% of approved rakes, covered wagons, to be used for movement of food grains 2. Ultratech Cement - 18% of approved rakes, covered wagons, to be used for movement of cement 3. Vedanta Aluminium Ltd - 11% of approved rakes, tank wagons, to be used for movement of aluminum products Balance 40% of the rakes are taken up by 18 companies, ranging from 1-6 rakes each. Majority of these are used for movement of cement and aluminium, with some used for POL and fertilizers.

Note 1: SFTO policy significantly revised and replaced with LSFTO vide circular number 2020/TC(FM)/4/02 dated 16/03/2020.
Note 2: The LWIS policy has now been discontinued vide IR circular number 2020/TC(FM)/4/4 dated 25/06/2020, after the introduction of the revised LSFTO policy. Existing permissions under the policy will continue, but all fresh approvals will be covered by LSFTO policy.

Policy	No. of rakes approved (FY20)	No. of rakes inducted (FY20)	Key players
GPWIS	215	29	This scheme, which allows investments in conventional general-purpose wagons, has attracted participation from 14 players. These are both LSPs and end user companies who have invested in these rakes for their captive use. About 76% of the approved rakes are taken by 4 companies: 1.Adani Logistics - 25% of approved rakes, open wagons, to be used for movement of bulk cargo - coal, iron ore, limestone 2.Coal India Ltd - 19% of approved rakes, open wagons, to be used for movement of coal 3.TM International - 18% of approved rakes, open wagons, to be used for movement of RM for steel. 4.Rungta Mines Ltd - 14% of approved rakes, open wagons, to be used for movement of raw materials for steel. Balance 24% of the rakes are taken up by 10 companies, ranging from 1-4 rakes each. These are used for movement of coal, cement, and raw materials for steel.
AFTO	59	27	6 companies have participated in the scheme; 5 of these are LSPs (90% of rakes) and 1 is an end user (Maruti Suzuki, 10% of rakes). Among LSPs, APL Logistics Vascor Automotive is the clear market leader with 70% of current fleet operating capacity. Based on investment plans, APLL Vascor and Joshi Konoike Transport & Infrastructure would become the two leading investors, with 42% and 22% rakes each. Rail share in movement of automobile freight has grown significantly with opening of wagon ownership to the private sector - from 1% in FY13 to ~7% in FY20.
WLS	191	75	The scheme has seen participation from 3 companies: 1. GATX - Wagon Leasing Company, 66% of approved rakes, with about 60% container wagons 2. Adani Logistics – LSP, 25% of approved rakes (yet to be inducted), mostly open and container wagons to be used by Adani group's captive needs. 3. Touax Texmaco - Wagon Leasing Company, 8% of approved rakes, a mix of flat, container, tank and open wagons.

Source: Consultant's analysis based on data received from IR

The idea of private ownership of wagons has been in place for almost 3 decades. The Own your own Wagon scheme was introduced as early as 1992 to tap the private sector for enhancing wagon supply. A number of other schemes were introduced later but have so far met with limited success in terms of numbers of participants. There are now schemes in operation that allow for almost all wagon types to be owned by private investors, and going forward, the private sector can be expected to play an ever-increasing role in the ownership of wagons if enabled through the right policy framework. In the past, it has been observed that the private sector does bring additional benefits that favor transportation of commodities through rail, as compared to road.

Box 17: Private sector participation in wagon ownership – impact on rail share in automobile freight

Context: Low rail share of automobile freight in India

Rail has 3 key inherent advantages over road for automobile freight movement:

1. With lower CO^2 emissions as compared to road, rail is better for the environment
2. For long distances over ~1,000 km, rail is typically found to be cheaper
3. OEMs looking to move on rail to de-risk dependence on road create a demand pull for the sector

In mature international rail markets, rail's share in automobile movement is high – USA 75%, Europe 40%, and China 16%. However, despite rail's advantages, IR's share till 2013 was just ~1%. Therefore, IR introduced AFTO scheme in 2010, opening private participation in automobile wagon ownership, with an objective to increase rail's share.

Overview of AFTO Scheme

Key features of policy:

- Permits private ownership of wagons
- In-built freight rebate, charged on per wagon basis, and not on actual load basis
- Tariff recovery from end user has not been regulated
- IR to take responsibility of wagon maintenance
- Chargeable empty movements to encourage two-way balanced flows and 3rd party LSPs

Interest from private players

- The policy drew interest in 2013 from 2 key players:
  - APLL Vascor (LSP), and
  - Maruti Suzuki (captive use)
- Later, more players applied to be AFTOs - IVC Logistics, TCI, Adani NYK and Joshi Konoike.
- Currently, there are 29 such private rakes in operation, with 18 owned by APLL Vascor.
- In addition to these, IR's own NMG rakes (non double-decker) are also in operation for moving automobile freight

Benefits brought in by the private sector

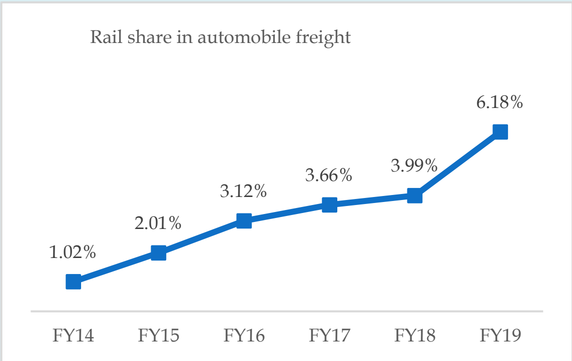
1. Design improvements: Double (and adjustable) decks, increased height, and other changes for more robustness, better functionality, and ease of use. For instance, the configuration of two compact SUVs, one over the other, is now possible with 2 decks and increased wagon height. Further, a side- opening variant of the wagon to assist in loading of 2 Wheelers is also under trial.

2. Change in perception: When Maruti Suzuki bought 3 rakes and announced plans to move 30% of its movements by mid 2020s, the industry perception regarding automobile movement shifted in favor of rail. This helped more OEMs joining hands with 3PL players for rail movement.

3. End-to-end logistics solutions: 3PL players introduced end-to-end multi-modal solutions for movement of vehicles from OEM plants to dealer stockyards, presenting a single window service for OEMs, who otherwise dealt with multiple players. Other value added services - vehicle pick-ups, stocking at 3PL players' stockyards, loading/unloading at terminals, and tracking and tracing - further increased attractiveness of the rail option.

4. De-risking of freight by reducing dependence on road: Involvement of private sector in movement of automobiles on rail has encouraged OEMs already looking to de-risk their dependence on road. This helps in locking in committed demand, creating a demand pull for rail.

Results – significant growth in rail share



Further improvements for IR to consider

- **Design approval process:** The approval process of new wagon designs may include a definite timeline for approvals and enable protection of IPR.
- **Consolidated policy for wagon ownership:** This could enable operation of rakes with multiple types of wagons, helping with consolidating commodities and inviting interest from industry, especially the LSPs.
- **Changes in wagon design:** Changes in design could expand rail's scope to movement of vehicle categories not currently targeted (2 wheelers, LCVs, trucks). Focus on increasing volumetric capacity can lead to greater rail share.

21.12.1.2. Project features and financing requirements

As mentioned in the earlier sections of this Report, INR 85,603 crores of investments could be required in acquisition of wagons over the next 10 years till 2031. Beyond 2031, ~INR 2,13,053 crores of investment may be needed till 2051. As previously discussed, these requirements would be subject to change based on various developments.

Table 21-11: Summary of investments required in wagons

Type of wagon	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-2041	2042-2051	Total
No. of wagons													
Open	3,130	3,130	3,130	3,130	3,130	10,013	10,013	10,013	10,013	10,013	86,820	106,514	2,59,051
Covered	16,438	16,438	16,438	16,438	16,438	10,258	10,258	10,258	10,258	10,258	88,802	121,445	3,43,727
Tanks	635	635	635	635	635	4,267	4,267	4,267	4,267	4,267	46,953	68,561	1,40,024
Container	3,594	3,594	3,594	3,594	3,594	5,613	5,613	5,613	5,613	5,613	44,898	64,684	1,55,617
Flats	2,903	2,903	2,903	2,903	2,903	1,386	1,386	1,386	1,386	1,386	16,874	27,746	66,062
SP-BCACBM	1,305	1,305	1,305	1,305	1,305	740	740	740	740	740	4,072	5,461	19,754
SP-BCFC	748	748	748	748	748	688	688	688	688	688	11,786	32,705	51,672
Total	**28,752**	**28,752**	**28,752**	**28,752**	**28,752**	**32,965**	**32,965**	**32,965**	**32,965**	**32,965**	**300,205**	**427,116**	**10,35,907**
Investments required (INR crore)													
Open	751	751	751	751	751	2,403	2,403	2,403	2,403	2,403	20,837	25,563	62,172
Covered	3,616	3,616	3,616	3,616	3,616	2,257	2,257	2,257	2,257	2,257	19,536	26,718	75,620
Tanks	260	260	260	260	260	1,750	1,750	1,750	1,750	1,750	19,251	28,110	57,410
Container	1,096	1,096	1,096	1,096	1,096	1,712	1,712	1,712	1,712	1,712	13,694	19,729	47,463
Flats	1,132	1,132	1,132	1,132	1,132	540	540	540	540	540	6,581	10,821	25,764
SP-BCACBM	665	665	665	665	665	377	377	377	377	377	2,077	2,785	10,075
SP-BCFC	292	292	292	292	292	268	268	268	268	268	4,597	12,755	20,152
Total	**7,813**	**7,813**	**7,813**	**7,813**	**7,813**	**9,307**	**9,307**	**9,307**	**9,307**	**9,307**	**86,572**	**126,481**	**2,98,656**

SP: Special Purpose Wagons

21.12.1.3. Examples from international rail markets

Private participation in wagon ownership is at a mature stage in many rail markets. Some of these include Australia, USA, and Russia, all of which have freight as a predominant segment of the rail system. In all these markets, the private participation models and the role of the Government varies. An overview of these models has been discussed in this section.

Table 21-12: Overview of wagon ownership models in key international markets

Country	Type of market	Wagon responsibilities			Key System Features
		Manufacturing	Ownership	Maintenance	
Australia	Freight market (dominated by bulk commodities over long distances intended for exports), with very low passenger movements. Freight rail is privatized, with about 600 freight train operators, with 7 largest players controlling 94% market share.	Private manufacturers	Most freight train operators own the wagons outright. However, a small leasing market also exists with the proportion of ownership vs leasing skewed in favor of ownership.	By the private sector - by wagon owner, either end user, or lessor.	• The government owns all network, and the private sector owns the rest of the infrastructure. • Network leased to train operators on payment of network access fee. • Operations are handled by private sector.
USA	Freight market, with low passenger movements. Freight rail is completely privatized, with ~25 operators; 3 largest players control ~97% market.	Private manufacturers	Three ownership models exist: 1. Owned by private freight operators directly 2. Lease (typically operating leases) 3. Equipment trust certificate - this used to	Private sector-by wagon owner, either end user, or lessor.	• Network ownership - by the private freight train operators themselves. • Operations are handled by private sector.

Country	Type of market	Wagon responsibilities			Key System Features
		Manufacturing	Ownership	Maintenance	
			be common before leasing became more prevalent.		
Russia	Predominantly a freight market with movements across very long distances. The rail network is owned by RZD, a fully government-owned entity. Until early 2000s, the entire system was under Government control. This was moved to the private hands in a gradual manner, with focus on freight segment.	Private manufacturers	Various structures exist, similar to the situation in India: 1. ~10-15% wagons are owned by RZD, and the balance 85-90% are owned / leased by the private sector. 2. Leasing market has been growing with entry of new players like GATX.	Earlier RZD owned depots; now all these have been privatized.	• While the system has some features similar to Indian market in terms of ownership structures, the key difference is in operations, which are taken up by private players in Russia. • In a span of 10-12 years, Russia transferred ownership in almost all its wagons to private hands. This was done through transfer of wagons to government owned subsidiaries, the shares of which were then transferred to private entities interested in freight operations.

Source: Consultant's analysis based on various sources – articles and reports on public domain and stakeholder consultations

21.12.1.4. Potential sources of financing

The study team held consultations with stakeholders including representatives from wagon leasing companies, automobile freight train operators, container train operators, MOR officials, international rolling stock experts, and Multilateral Financial Institutions. Further, specific to rolling stock financing strategies, a literature review and a study of international practices/scenarios was also undertaken.

As discussed earlier, a majority of wagons in operation today are either owned or leased by IR. The leased wagons are financed by IRFC primarily through bonds which are backed by a sovereign guarantee. Leasing rolling stock from IRFC blocks potential capital that could be used by IR to finance other rail assets like lines and related line infrastructure such as signaling and communication.

Privatization of wagons:

While investment in wagons by the private sector in India has seen limited spread so far, where it has been attempted, it has led to clear benefits to stakeholders involved. An earlier case study has already highlighted the increase in modal share witnessed in the automobile sector after the introduction of the AFTO scheme. Growth in containerization of various commodities has also been similarly driven by the competition and resultant price and operating efficiencies introduced through the CTO scheme. Stakeholder consultation during the study have also indicated that the private sector would be further interested in wagon investments, with some key changes in existing wagon investment and leasing policies. The global experience also shows us that in all mature freight dominated rail markets such as Australia, USA, and Russia, wagons are now completely owned by the private sector (up to 80-90% in case of Russia).

The existing wagon ownership and leasing policies of IR now permit private ownership by either end-users, logistics service providers or leasing companies across almost all types of wagons.

Table 21-13: Ownership categories across wagon types in India

Wagon Type	Policy Under which Ownership is permitted
Open-BOXN type and other open wagons	GPWIS
Covered-All BCN type wagons	GPWIS
Flat – BRN and BFNS type wagons	GPWIS, LSFTO
Tank – BTPN and other specialized Tanks	GPWIS, LSFTO
Containers-All BLC type wagons	CTO
Automobiles, Loose Bulk Cement etc.	AFTO, LSFTO

Source: Consultants' analyses

Approximately 35% of the existing wagon fleet in IR is also older than 15 years[154]. As more and more wagons become due for replacement (codal life of most wagons is 30 years), there is an opportunity to further promote private sector participation in wagon ownership. Increased private sector participation can also bring in newer technologies in wagon design based on lighter and stronger materials, better volumetric utilization of space, improved safety systems such as breaks and riggings, etc. Newer technologies would bring accordant benefits, such as a higher pay-to-tare ratios, less maintenance requirements, and even higher speeds over time.

With the existing policies already in place for investment in almost all types of wagons, and given the budgetary constraints being faced by IR, it would be ideal for future investments in wagons to come from the private sector.

Additionally, IR may also consider possible monetization of existing wagons to a certain extent. This could be achieved by transferring the existing stock of wagons currently owned or leased by IR to the private sector over a period. Considering, however that ~90% of the current wagon stock is either owned or leased by IR through IRFC, such a transition would require concerted efforts and potentially several enablers related to IR's operating and marketing policies.

Financing recommendations:
To finance the rolling stock investments, three options have been considered by the study team for simultaneous implementation:

1. Private sector investment in all future requirements of wagons
2. Transfer of ownership or corporatization of management of the existing IR/IRFC owned fleet
3. Development of a diversified private ownership market structure, with a strong leasing market

Each of these is discussed in further detail below:

1. Private sector investment in all future requirement of wagons

In order to ensure that all future investment in wagons is taken up through the private sector, there is a requirement to undertake some key changes in the existing policy framework for private wagon ownership. The first and foremost change would require a consolidation of various policies currently in place into a single policy for ownership of wagons, and the second change would require some key changes in the policy framework to enable greater private investment.

Going forward, as part of the process to prioritise capital investments, IR should move to a regime where all wagon ownership is in the private space either with direct users, or with Logistics service providers and wagon leasing companies. At present, there are 5 different policies (GPWIS, AFTO, LSFTO (LWIS is now discontinued and merged with LSFTO) and CTO) that cover the private owner ship

[154] Source: A broad estimate based on wagon production data received from IR

of wagons. Having undertaken a detailed comparative review on various policies related to private ownership of wagons (Refer **ANNEXURE 21.6:**), it is proposed that a consolidated policy be framed with several factors considered. This is discussed in the box below.

Box 18: Key Components of a Consolidated Wagon Ownership Policy

1. **Type of Wagons to be covered:** At present almost all types of wagons operating on the IR fleet are covered, ranging from general purpose wagons (open and covered), high capacity wagons, special purpose wagons, automobile wagons and container flats. Accordingly, in a combined policy, all wagon types should be covered.
2. **Ownership Criteria:** Existing policies have considerable overlap in ownership conditions, with end users, LSPs and companies meeting certain criteria being covered. In a combined policy, ownership should be kept open to all, with some minimum requirements on fleet size, so that non-serious and small-scale operators are avoided. To achieve this, it is suggested that any wagon owner must acquire at least 10 rakes over the first three years of operations. It is also suggested that the clause for change of ownership be eased, with change permitted at any time, on an automatic process as long as the new owners satisfy the original ownership criteria.
3. **Wagon Maintenance:** Currently, maintenance is carried out mostly by IR, with some formula for compensation to be made by wagon owners. Going forward, private maintenance of wagons, with some provision for safety certification by IR should be the way forward. This will likely reduce not only the cost of maintenance, but also likely improve overall asset quality and up-time for rolling stock. Considering that the maintenance of wagons and ownership of their maintenance facilities is currently with IR, change management, including co-sharing or even eventual transfer of maintenance facilities to private hands will have to be managed in a calibrated manner.
4. **Commodities:** With almost all wagons now covered under private ownership schemes, almost all commodities are also part of the group that can be loaded on such private wagons. However, there are different commodity restrictions for special wagons under SFTO, a different commodity class rate for certain notified commodities in the case of containers etc. It is recommended that all commodities subject to the suitability of the wagons be permitted for loading on private wagons. Any restrictions on commodities in order to protect railway traffic carried in IR owned wagons should be done away as these tend to work as market disrupters. Opening up the commodity basket and keeping essential parity between loading in private or rail owned wagons is essential to let the market work to attract the highest possibly commodity basket for rail-based movement.
5. **Fees:** This is one area where there is considerable difference between existing policies, with 50 crore. being required for a category I container license to no charges being levied for GPWIS or LSFTO policies. Going forward, participation in wagon ownership should not be linked with any license fee, as the investment made by private sector in wagon ownership is in-itself adequate incentive to attract cargo volumes on to rail. Some mechanism may still be needed to compensate those who have already paid fees or some sort, and this could be done through a forward based

freight discount (an additional 2% can be offered till the original fees have been paid off), which also will work as an incentive for attracting yet more traffic to rail.

6. **Freight/Haulage Charges:** At present, two formulae exist for levy of freight to private wagon owners. For some, such as Automobiles and Containers, there is a separate haulage charge table based on distance slabs and weight carried, and for others, such as SFTO, LWIS, GPWIS etc. there is a pre-determined discount from existing rail freight (from 10% up to 15%), levied up to a period of 15 to 20 years, or till the capital value of the wagon has been recovered. Going forward, it is suggested to have a single percentage-based freight discount for private wagon ownership.
   a. Since discounts from 10% up to 15% (even 20% for coils) have been permitted, it is recommended that for any private wagon, a discount of 12.5% on IR freight be considered.
   b. For High Capacity wagons that allow for more than 10% extra loading compared to a standard design, an incentivized rebate of 15% can be offered. For double stack loading of containers on wagons, a discount of 25% be offered for each of the lower and higher stack containers.
   c. The time limitation for such discounts should be up to the codal life of the wagon, and not restricted in any other way.
   d. Even for Containers and Automobiles, instead of a separate freight rate, it is recommended to benchmark these with a 'commodity class' and then offer the same 12% discount against IR freight for that particular class.
   e. For empty moves, following the existing framework, where an empty move, if it is less than or equal to the previous loaded move can be free, and a 50% freight on incremental distance can be levied if the empty move is more than the previous loaded move.
   f. Finally, flexibility in the rake size for movement is an important requirement for trade to opt for rail. The policy can address this aspect by looking at the pricing mechanism, differentially for congested and non-congested routes, as also in the empty direction of movement. This can be managed through specific instructions issued based on customer/user requests that justify such rating based on incremental volumes for the system as a whole.
7. **Terminal Access:** While a separate policy is being recommended for terminal development, there is no possible justification for restricting access to any kind of terminal. Restrictions on co-user permissions, limits to hub-spoke locations, time frames to reconsider route permissions etc. should be done away with. As terminals are the access points to any network, access should be freely permitted on all terminals irrespective of their status as rail goods sheds, PFT, private siding etc. Commercial levies for such access should be determined by terminal owners, and where IR is itself the owner, it should restrict such levies to levels (as prescribed in the separate terminal policy), so as to create a wide network of locations from which cargo can be brought on to or transferred from the IR network.
8. **Approval Process:** An automatic approval process, with a defined time frame subject to acceptance of Railway commercial, safety and wagon design norms, should be in place.

9. **Operations:** The principal of FIFO movements for private wagons should be followed for all rail operations.
    a. Where wagon owners wish to prioritise movements of their owned wagons, a provision for transit commitments upon payment of a freight premium should also be put in place. Failure to meet such commitments once a premium freight has been collected should result in not only a refund for the premium, but also for payment of certain penalties so that the idea so service quality can be commercially embedded in the system of private rail operations.
    b. Issue or Rail Receipts in the name of end users, even where wagons are being provided by LSPs should be permitted, and issue of multiple RRs for multiple customers with cargo on a single train should also be permitted. This will encourage movement of smaller parcel sizes from road to rail through the medium of cargo consolidators such as LSPs.

Additional policy directions related to Wagons that could be incorporated in the consolidated policy:

10. **Focus on Special Commodity Wagons & Innovation in Wagon Design:** Any technology improvement in rolling stock that brings about higher payload-tare ratio, or simply helps in diverting road traffic to rail should be encouraged with incremental freight rebates between 2 to 5%.
11. **Private Rakes with Locomotives:** Private Ownership of full rakes including locos can be encouraged to catalyse fleet expansion and private ownership and reallocation of IR's limited financial resource for core area of capital investments in fixed track infrastructure.

2. **Transfer of ownership/Corporatize management of existing IR/IRFC owned wagon fleet:**

   In addition to incremental investments coming from the private sector, another option which may be considered by IR relates to the gradual transfer of the existing wagon fleet of IR – both leased through IRFC and owned by IR –to the private sector. IR may consider transferring its existing stock of wagons to the private sector through two mechanisms.

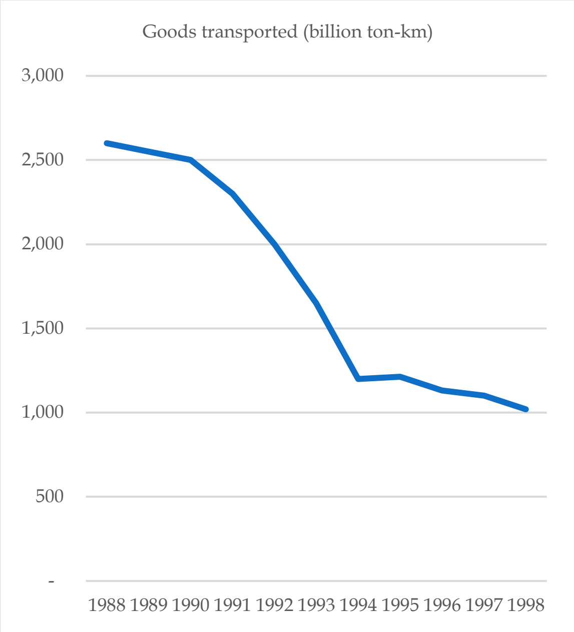
i. **Direct transfer:** This could be through an invitation to bid or private negotiations. The receiving entities could comprise all types of wagon owners – Wagon Leasing Companies, logistics companies, and end users.

ii. **Transfer through a Special Purpose Vehicle (SPV):** IR could create a separate entity, or entities, and transfer its existing wagon fleet to these entities. In order to ensure competition, each entity should ideally hold multiple wagons types so that no single monopoly element is created. Once this transfer has taken place, these entities may be listed and equity in these entities may be placed through market investment over a defined time frame. The case study of RZD in Russia, where a significant portion of government-owned wagons were transferred to the private sector using this approach can be looked at to better understand the mechanics and validity of such an approach. Different leasing scenarios have been observed in different markets, and based on understanding of global examples, and, stakeholder consultations, and given a large Indian wagon fleet, about 4-5 such SPVs could be potentially created. These would result in 4-5 wagon leasing companies, all competing for varied customers with varying wagon type needs.

Box 19: Reform in Russian Rail Freight Sector through Privatization of Rolling Stock

Context: Falling freight traffic with disintegration of the Soviet Union

- When the Soviet Union got disintegrated in early 1990s, Russian rail freight sector witnessed a steep decline in traffic.
- At this time, the system was completely controlled by the Government.
- The Government, in late 1990s, introduced a reform program to revive the sector, reduce costs, improve traffic levels, and increase the quality and safety of rail services.
- Privatization of rolling stock was one of the key aspects of this program.



Legal basis for privatization

- The Federal Law 153 was introduced in 1995, and a number of government decrees in late 1990s and early 2000s defined what the reform program entailed.
- In 2003, the Ministry of Railways was segregated into Federal Railway Transport Agency (FRTA, regulator of rail) and RZD (a fully state-owned monopoly joint stock company that owned and operated rail services)

Private Operators and Carriers

- The news laws and decrees set the path for creation of non-RZD railway operators and carriers.
- **Operator** - owner and provider of wagons. These are typically either Rolling Stock Leasing Companies or LSPs.
- **Carrier** - owner and provider of wagons and locomotives, and also liable for operations of rail services. However, currently, RZD and an RZD JV are the only two carriers as of now.

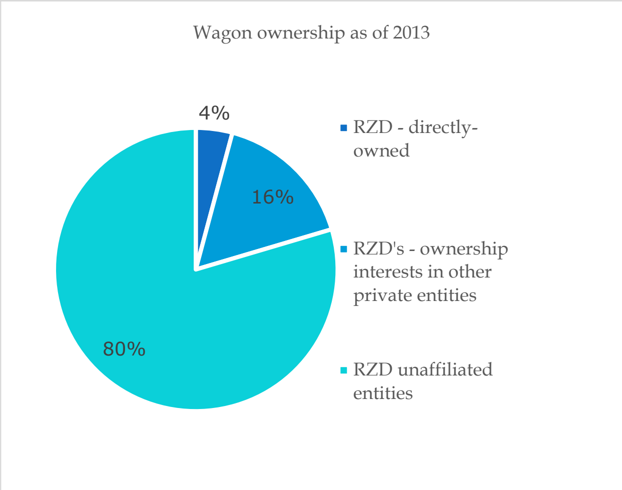
Privatization of wagons

- RZD, the owner of all wagons before privatization, created separate business units that owned wagons.
- Stake in these entities were later sold to private sector (Transcontainer, First Freight Company)

Reform program

Impact of reforms on rail freight:

- Rolling stock leasing companies emerged, and logistics service providers entered the rail freight space and provided freight forwarding services, handling their customers' logistics.
- By 2005, one-third of all wagons were privatized. By 2013, this jumped to 80%.
- This attracted investment of more than US$ 50bn by the private sector towards Russian rail sector.
- Over time, rail freight traffic revived from its lows in late 1990s.



Key takeaways for IR:

- Significant capital can be released for investment in core rail assets - lines, signaling, and communication.
- A healthy wagon leasing market can be developed with requisite enablers.
- The private sector can undertake maintenance of rolling stock, releasing the state from this signficant burden.
- The private sector can undertake maintenance of rolling stock, releasing the state from this signficant burden.

Based on the potential demand, as well as constraints such as age of fleet, and other social obligations of IR, it may need to use both these mechanisms to ensure all its wagons are transferred in a timely and phased manner. For most of the wagons, transfer through SPV should be the preferred route. Also, while this mechanism would be ideally suited for transfer to Wagon Leasing Companies, other users such as Logistics companies and end users should not be prevented from participation.

The transfer of existing fleet would also be driven by the age of wagons. From industry interactions, it is understood that a minimum life of 15 years should be remaining in a wagon for it to be transferred. A life lower than this may not be a worthwhile investment, as the economic benefits would be derived for a much shorter period. Therefore, IR would need to assess the age of its existing fleet, and accordingly start with privatization of those wagons that have a longer life span (more than 15 years), while gradually replaced existing fleet that reaches the end of codal life through a fresh inductions process.

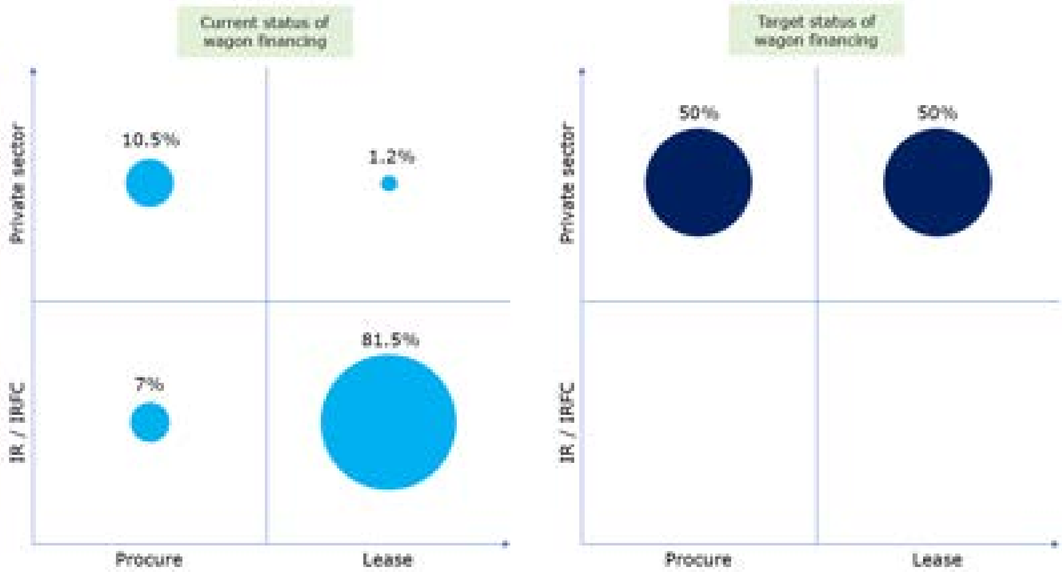
3. Enable development of a diversified private ownership market structure, with a strong leasing market

Another option which may be considered by IR is to promote diversification of privately-owned wagon market, with sufficient ownership by all 3 segments of the private sector – wagon leasing companies, logistics companies, and end users. Primarily, this would require enabling development of a leasing market, which is at a nascent stage in India.

The primary driver of an operating lease is the de-risking of asset ownership by avoidance of a long-term commitment by the end user of the asset. The ownership split between the logistics companies and the end users would depend on the size of end users. Large users such as integrated steel plants, cement conglomerates, or others, may consider purchasing the wagons outright for long term use. The other users who work at relatively smaller scale would need the services of logistics companies, as direct ownership for such users may not be viable. At the same time, both end users and logistics service providers may need to work with Wagon Leasing companies in order to hedge their investment risks and create a mix of owned versus leased fleet of wagons.

As an example, in the steel sector, approximately 50% of the production comes from small and medium enterprises, and the balance 50% from large integrated players. In this scenario, the small and medium enterprises would prefer to either use logistics companies or lease the wagons for their rail transportation needs. The large integrated players may prefer to own their wagons. Therefore, the private ownership of wagons in this case would ideally be in a ratio of 50:50, with ownership by leasing companies on one hand, and ownership by logistics companies and end users on the other. The actual ownership ratio would vary across commodity classes based on industry structures and logistics needs, and Figure 3 below shows one instance of how the ownership of wagons may look compared to today.

Figure 21-9: Current and target status of wagon financing



Source: Current status sourced from Consultant's analysis based on data received from IR

Operating and finance lease

Currently, the arrangements for leasing of wagons through IRFC is a finance lease model. The duration of contract extends to the useful life of wagons, i.e., 30 years, with an EMI equivalent payment taking place over the first 15 years and a notional 1 Re lease thereafter. Going forward, for a private leasing market to develop, promotion of operating leases would be needed. This would enable leasing of wagons for much shorter durations. Logistics companies and end users with only short-term visibility on certain commodities could lease the requisite wagons from leasing companies for a period as per their business requirements. This could be as low as 2-3 years. Once such leases are over, the wagons would have a further market, and could be leased out to other entities. Therefore, while finance leases discourage leasing by forcing the lessee into a much longer-term operating commitment, the operating lease encourages greater flexibility and may work as a driver to encourage greater adoption of rail as a transport mode. The existing wagon leasing policy or IR has evolved into a stable document over time and does not need significant changes at present. However, as has been suggested earlier, allowing private maintenance by wagon leasing company as the wagon owner, and encouraging design innovation and adoption of new technology by simplification of the design approval process will help strengthen the leasing market as well.

Savings for IR if further investments in wagons are invited from private sector:

In an event when above recommendations are implemented, certain capital may get freed up for investment into other infrastructure / projects of IR. There would be two sources of additional capital available with IR.

i. Funds invested by private sector in new wagons

ii. Transfer of existing IR owned wagons to private sector

With all investments in new wagons financed from the private sector, IR would not be required to finance ~INR 2,98,000 crore of capital, that it would otherwise need to finance on its own. Additionally, IR could generate funds by transferring its existing wagon fleet to the private sector. An illustrative phasing of this transfer is explained in the **Table 21-14**. These savings and additional funds could be used by IR to invest in other core rail assets, such as track infrastructure, signaling and communication. Apart from this, further capital could be freed up for IR if investments in locomotives associated with freight are also invited from the private sector. This has been discussed in subsequent sections.

Table 21-14: Illustrative phasing of privatization of existing wagon fleet of IR

Particulars	2020	2026	2031	2041	2051
Estimated Phasing of transfer of existing wagons	0%	33%	67%	100%	100%
Total wagons in system	2,95,729	4,13,194	5,18,884	7,00,384	10,57,748
Wagons owned by IR	2,61,606	1,56,873	1,43,595	49,173	0
Wagons owned by private sector	34,123	2,56,321	3,75,288	6,51,211	10,57,748
Privatization levels	***12%***	***62%***	***72%***	***93%***	***100%***

Source: Consultant's Analysis. Phasing of transfer of existing fleet has been assumed.

21.12.2.Coaches

21.12.2.1. Existing Financing Pattern for Coaches

As of March 2020, there were approximately 76,000[155] passenger coaches in service on the IR network. Over the past 5 years, since March 2015, the fleet has grown annually by ~4%.

Currently, a majority of these coaches, ~85%[156], are financed and owned by the IRFC and leased to the IR, while the balance ~15% of coaches are owned by the Indian Railways directly. The IRFC coaches are on finance leases, with the period of lease extending up to 30 years, i.e., close to the useful life of the coaches. With Government of India exercising control over both IR and IRFC, this financing mechanism can be considered as a notional leasing arrangement between internal railway divisions. Further, considering that these are finance leases, and not operating leases, these are very similar to financing an outright purchase through debt.

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155 Source: Fleet size as on March 2019 and previous years has been sourced from IR website. Fleet size as on March 2020 is estimated based on growth trends. Growth of past 5 years has been computed based on data as on March 2015, sourced from IR website.
156 Source: Consultant's analysis based on existing fleet size owned by IRFC

At present, no passenger coaches are owned by the private sector. A concession for

Box 20: Passenger Train Operator (PTO) model

Currently, India's first PTO model is in progress, with 109 routes being awarded for operations by the private sector. Some key tenets of this model are presented below.

PPP Concession

- Private train operator (PTO) would be selected through a competitive bidding process for operation of passenger trains.
- Under the Project, MoR has identified 109 routes, which have been bundled into 12 clusters
- 35 Year long concession period
- Concession proposed to be awarded to the bidder quoting the highest share of gross revenues payable to Indian Railways.

PTO Responsibilities

- Procurement of rolling stock (all trainsets)
- Maintenance of rolling stock
- Strategic management functions such as determination and collection of fares, marketing and demand generation.
- Fulfilment of various KPIs listed in the concession (punctuality, reliability, upkeep of trains, etc.)

IR Responsibilities

- Provide access to its infrastructure (tracks, overhead equipment, signaling network, terminals, access to maintenance depot site/shed etc.)
- Facilitate transmission of electric power and recover cost of the same at actuals
- Provide loco pilot and guard
- Train movement control

India's first private passenger train operator is currently under the bidding process. As per the model adopted, the private operator would be awarded a concession to operate passenger trains on limited routes for a period of 35 years. The operator would be responsible for financing, i.e., owning or leasing, the requisite rolling stock. This would be the first time that passenger coaches would be owned by the private sector in India. While the ownership would shift to the private sector, actual operation of trains, i.e., provision of loco pilot/guard, and train movement control, is expected to remain with IR.

21.12.2.2. Project features and financing requirements for Coaches

As mentioned in the earlier sections of this Report, INR 1,77,560 crores of investments could be required for the acquisition of coaches over the next 10 years till 2031. About 61% of this is estimated to be required for purchase of Non-AC coaches. About 20% is expected for purchase of train sets, and the balance for AC/MEMU/DEMU coaches.

Beyond 2031, it is expected that another INR 1,99,218 crore of investments may be needed for acquisition of coaches up to 2051. While these requirements would be subject to change based on various developments, about half of this amount is expected to be needed for purchase of Non-AC coaches, and the balance for mainly AC coaches and train sets.

An overview of total number of coaches, and the associated costs is presented in **Table 21-15** below.

Table 21-15: Summary of investments required in coaches

Type of coach	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2041	2051	Total
No. of coaches													
Non-AC	8,398	8,398	8,398	8,398	8,398	3,716	3,716	3,716	3,716	3,716	26,790	34,464	1,21,823
AC	1,446	1,446	1,446	1,446	1,446	863	863	863	863	863	7,521	11,618	30,685
MEMU/DEMU	126	126	126	126	126	67	67	67	67	67	443	471	1,878
Train sets	20	20	20	20	20	9	9	9	9	9	70	92	306
Total	**9,990**	**9,990**	**9,990**	**9,990**	**9,990**	**4,654**	**4,654**	**4,654**	**4,654**	**4,654**	**34,824**	**46,645**	**1,54,692**
Investments required (INR crore)													
Non-AC	15,116	15,116	15,116	15,116	15,116	6,688	6,688	6,688	6,688	6,688	48,222	62,035	2,19,281
AC	3,109	3,109	3,109	3,109	3,109	1,856	1,856	1,856	1,856	1,856	16,170	24,979	65,973
MEMU/DEMU	1,010	1,010	1,010	1,010	1,010	533	533	533	533	533	3,544	3,768	15,024
Train sets	5,000	5,000	5,000	5,000	5,000	2,200	2,200	2,200	2,200	2,200	17,500	23,000	76,500
Total	**24,235**	**24,235**	**24,235**	**24,235**	**24,235**	**11,277**	**11,277**	**11,277**	**11,277**	**11,277**	**85,436**	**1,13,782**	**3,76,778**

21.12.2.3. Examples from international rail markets

In some key international rail markets, most aspects pertaining to passenger rail transportation have been privatized. This is in contrast to the structure of passenger rail transportation in India, where most aspects continue to be controlled by the Government.

An overview of passenger rail structures in two key international markets – UK and Japan - is discussed below.

Table 21-16: Overview of passenger coaches ownership models in UK and Japan

Country	Type of market	Coaches responsibilities			Key System Features
		Manufacturing	Ownership	Maintenance	
United Kingdom	Predominantly, a passenger market, with very low freight rail movements. The system is predominantly privatized. Rail Network is owned by the Government and leased to private train operators, or Train Operating Companies (TOCs), on payment of a network access fee. A franchise agreement is entered between Government and a TOC	Private manufacturers	All passenger coaches are owned by Rolling Stock Companies (ROSCOs). These are all private entities. ROSCOs lease out coaches to TOCs for the period of franchise, which is considerably less than the life of asset, enabling the facilitation of a leasing market.	Handled by the private sector. This is undertaken either by the TOCs or the ROSCOs, depending on the lease arrangement between the parties.	There are a number of reasons why the leasing model works in UK. Two key reasons are as follows: • Passenger train operations have been shifted completely to the private sector, leading to a number of TOCs. • The duration of franchise (7-10 years) is less than life of asset (30-35 years), favoring lease over purchase for TOCs. • Further, it also ensures a market for coaches after the franchise expires.

Country	Type of market	Coaches responsibilities			Key System Features
		Manufacturing	Ownership	Maintenance	
	for a defined period of 7-10 years.				
Japan	Japan is also a predominantly passenger market, with limited freight movement. The market is completely privatized. The entire rail network is owned by private operators.	Private manufacturers	Coaches are owned outright by train operators. Leasing is almost non-existent.	Private train operators	• The 6 major operators are divided based on geography, and own all rail related assets - stations, land, rolling stock, and the network. • There are another 100 very small operators performing very specialized services.

Source: Consultant's analysis based on various sources – articles and reports on public domain and stakeholder consultations

21.12.2.4. Potential sources of financing

The study team held consultations with various stakeholders including representatives from rolling stock leasing companies, MOR officials, international rolling stock experts, and Multilateral Financial Institutions. Further, specific to rolling stock financing strategies, a literature review and a study of international practices/ scenarios was also undertaken.

From the point of view of IR, financing options for coaches could depend on how private participation in passenger train operations materializes. Financing options have been considered for the two operational scenarios that could play out simultaneously:

i. **IR controlled passenger train operations:**

As per estimates indicated in **Table 21-15** above, requirement of incremental coaching stock is expected to reduce over time.

In a scenario where the market consists of a single buyer and operator, i.e. IR, and there is a reduction in incremental demand for coaching stock, the circumstances would not be conducive for creation of a leasing market with private sector involvement. The existing financing mechanism, i.e., finance leases through IRFC, may continue for such operations.

ii. **Private train operations:**

In case the private train operations model gathers momentum, and more routes are awarded to the private sector, a private leasing market for coaches may also develop.

With multiple operators (as against only IR) looking to purchase rolling stock, competitive supply from manufacturers could happen through leasing companies. Accordingly, in such a scenario, AC coaches and trainsets can be procured/ financed largely by the private sector. With such private ownership of rolling stock, maintenance of such rolling stock could also be shifted to the private sector. In this scenario, should IR require trainsets for transforming a part of its passenger operations (for competing with PTOs and catering to premium passenger segment), it could opt to procure such rolling stock for 10-15 year-leases with option to renew the lease or purchase outright. Further, the purchase option should have a predetermined, discounted capped price. In such leases, the actual payable price can be determined at the end of the lease periods by independent valuers or an experts' body.

In this scenario, as the PTO model is based on trainsets with service offerings entirely focused on AC coaches, it is essentially for premium inter-city travel. Therefore, financing for additional Non-AC (sleeper/GS) coaches and MEMU/DEMU coaches could continue with the existing mechanism, i.e., a finance lease with IRFC.

Savings for IR if further investments in coaches are invited from private sector

Given the early days of PTO initiative, accurate forecasts pertaining to the coverage of rail network with the PTO model could not be made as a part of this study.

Therefore, for the purposes of this Report, two assumptions were made to assess the potential capital that could be attracted from the private sector for financing passenger coaches:

i. PTO potential as a proportion of total passenger rail network: ~16.7%[157]

ii. Phasing of this potential being realized:
- By 2026: 25%
- By 2031: 50%
- By 2041: 75%
- By 2051: 100%

Both these assumptions would be subject to change based on actual market developments - the response of the private sector to invest in these models, the reaction of the customers, and benefits accrued to IR, among others.

With investments in coaches financed from the private sector, IR would not be required to finance ~INR 15,000 crore of capital, that it would otherwise need to finance on its own. These savings could be used by IR to invest in other core rail assets, such as track infrastructure, signaling and communication.

This is further detailed in **Table 21-17** below.

Table 21-17: Illustration on potential capital from private investment in passenger coaches (Figures in INR crore)

Particulars	2026	2031	2041	2051	Total
Total financing needed:					
AC coaches	15,545	9,279	16,170	24,979	**65,973**
Train Sets	25,000	11,000	17,500	23,000	**76,500**
Private financing:					
AC coaches	649	775	2,025	4,171	**7,619**
Train Sets	1,044	918	2,191	3,840	**7,994**
Total	**1,692**	**1,693**	**4,216**	**8,011**	**15,613**

Source: Consultant's Analysis

In case IR intends to shift investments in coaches to private sector, certain enablers would however be required in the way passenger operations are privatized going forward. Some key ones are discussed below.

1. Implications of concession period

With private passenger train operators in place, a key component of the concession agreements that would impact the financing of rolling stock would be the

157 Source: An approximation was made for a proportion of total trains that are fully AC trains. This was based on Consultant's analysis from data sourced from IR website, through a document titled "Trains at a Glance, June 2019-June 2020; *http://indianrailways.gov.in/railwayboard/view_section.jsp?id=0,1,304,366,537*. This was computed as ~7%. To this, another 10% was added for additional potential that may lie for PTO model.

concession period. In the first model being implemented, the concession period has been kept in line with the life of asset. This would have two key implications:

a. **Lease market:** Given the proposed length of concession for PTO model, for the train operator, it would make sense to purchase the asset, rather than obtain access through an operating lease. Such a model would not require a leasing market of coaches to develop in India. Going forward, in case there is a demand for shorter concession periods, less than the life of asset, say 10-15 years such as in UK, a leasing market may subsequently develop as operating leases would start to make more sense as compared to outright purchase of coaches.
b. **Implications on risk:** A long concession period locks in a concessionaire to operate on a business model that has not been tested before. The concessionaire may face several challenges for which planning at this stage may be difficult. These may include emergence of better coaching and other railway technologies, competition from IR, and competition from upcoming HSR projects, among others.

2. Requirement of an independent regulatory mechanism

As mentioned in a previous section of this Report, an independent regulatory mechanism may be required to facilitate several aspects pertaining to the private sector participation in coaches.

21.12.3. Locomotives

21.12.3.1. Existing Financing Pattern for Locomotives

As of March 2020, there were approximately 12,500[158] locomotives on the IR network. About half of these are diesel, and the other half are electric. Over the past 5 years, since March 2015, the fleet has grown annually by ~3%.

Currently, majority of these locomotives, ~91%[159], are financed and owned by the IRFC and are leased to the IR, similar to wagons and coaches. The balance ~9% of locomotives are owned by the Indian Railways directly.

No locomotives (except for a few used for captive purposes in ports or large industrial units) are owned by the private sector. Even where the private sector is involved in investment of wagons, the associated locomotives are still owned by IR. As previously discussed, a concession for India's first private passenger train operator is currently under process. The model for PTOs is expected to work with trainsets, rather than separate coaches and locomotives. As trainsets are self-powered, increase in demand for these would correspondingly mean a lower locomotive demand for passenger services.

Currently, IR is in process to electrify the entire rail network. This would imply a gradual phase out of diesel locomotives. Going forward, all new locomotives are proposed to be electric. An exception would be a few diesel units that IR would need to procure to satisfy its contractual obligations. These units could be expected to be used during the transition from a mix of diesel and electric to fully electric.

[158] Source: Fleet size as on March 2019 and previous years has been sourced from IR website. Fleet size as on March 2020 is estimated based on growth trends. Growth of past 5 years has been computed based on data as on March 2015, sourced from IR website.
[159] Source: Consultant's analysis based on existing fleet size owned by IRFC

21.12.3.2. Project features and financing requirements for locomotives

As mentioned in the earlier sections of this Report, INR 2,19,380 crores of investments could be required for the acquisition of locomotives over the next 10 years till 2031. Beyond 2031, it is expected that another INR 4,24,858 crore of investments may be needed for acquisition of locomotives up to 2051. These requirements would however be subject to change based on various market and system developments such as demand variations, increased capacity, better speeds, heavier and longer trains etc.

An overview of total number of locomotives, as estimated earlier in the report, and the associated costs for procurement are presented in **Table 21-18** below.

Table 21-18: Summary of investments in locomotives

Particulars	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2041	2051	Total
No. of locomotives	2,205	2,205	2,205	2,205	2,205	929	929	929	929	929	13,510	16,837	46,017
Investments required (INR crore)	30,867	30,867	30,867	30,867	30,867	13,009	13,009	13,009	13,009	13,009	1,89,140	2,35,718	6,44,238

21.12.3.3. Examples from international rail markets

Unlike India, in most international markets, the financing model for locomotives is similar to the financing model of corresponding coaches and wagons. An exception to this is Russia, where the locomotives are still the responsibility of RZD (100% Government-owned entity).

An overview of financing structure of locomotives in key international markets is discussed below.

Table 21-19: Overview of locomotive ownership models in key international markets

Country	Segment concentration	Locomotives responsibilities			Key takeaways for IR
		Manufacturing	Ownership	Maintenance	
United Kingdom	Passenger	In UK, most of the coaches are manufactured as train sets. Therefore, there is no separate model for locomotives.			• A shift towards trainsets for viable routes must be explored
Australia	Freight	Private manufacturers	Similar model as wagons.	Similar model as wagons	• IR may consider consolidating locomotives' ownership with wagon investment and leasing policies to shift the burden of ownership and maintenance to the private sector.
USA	Freight	Private manufacturers	Similar model as wagons.	Similar model as wagons.	• IR may consider consolidating locomotives' ownership with wagon investment and leasing policies to shift the burden of

Country	Segment concentration	Locomotives responsibilities			Key takeaways for IR
		Manufacturing	Ownership	Maintenance	
					ownership and maintenance to the private sector.
Japan	Passenger	Private manufacturers	Private train operators	Private train operators	• With respect to passenger operations, the first PTO model has kept the responsibility of locomotives on the private sector. IR may continue to do so for further PTO concessions as well.
Russia	Freight	Private manufacturers	RZD	RZD	• The locomotives ownership model in Russia is similar to that in India.

Source: Consultant's analysis based on various sources – articles and reports on public domain and stakeholder consultations

Most international rail markets with mature rail operations, have locomotive ownership in the private sector, with an exception of Russia. However, these markets operate under a very different rail structure as compared to India. The key difference is that while these markets have privatized train operations (i.e., train movement control and provision of loco driver), the Indian system works with IR as the operator, even when the wagons or coaches are owned by the private sector.

21.12.3.4. Potential sources of financing

As per the estimates indicated in **Table 21-19** above, requirement of incremental locomotives is expected to reduce over time.

The rail structure in India with respect to operations of trains, i.e., train movement control and provision of loco driver/crew, is the responsibility of IR. In this scenario, where the market consists of a single buyer and operator, i.e. IR, and there is a reduction in incremental demand for locomotives, the circumstances would not be conducive for creation of a leasing market with private sector involvement. The existing financing mechanism, i.e., finance leases through IRFC, may continue for such operations.

However, there are three potential scenarios in which either greater investment in locomotive from private sources can be envisaged or requirement from IR for financing may be reduced.

1. The first relates to greater proliferation of the PTO scheme. With most PTO based passenger services based on trainset operations, there will be no need for separate locomotives to be owned by IR for such operations, and motive-power investments would accordingly get subsumed with PTO investments. A high-level estimate suggests that ~150-200 locomotives[160] pertaining to passenger coaches could be subsumed with investments in trainsets through PTO model.
2. In the freight space, while it would be difficult to develop a stand-alone model for private locomotive ownership, a case can be made for some wagon owners (especially those with large enough operations to warrant captive locomotives), to invest in locomotives to increase operational control over their own assets, and help improve asset productivity and TAT by ensuring captive locomotive availability. As per high-level estimates, investments in ~800-900[161] locomotives pertaining to wagons could come from the private sector, if such option of private locomotive ownership is offered. These estimates are based on the wagon-owning private entities that exist today. Going forward, this estimate may increase with more entities investing in wagon ownership.
3. Finally, should IR require higher horsepower/new technology locomotives which cannot be manufactured in existing units, it could opt for 10-15 year leasing from private sector with an option to renew the lease or go in for outright purchase at the end of the lease period. The purchase option should have a predetermined, discounted price, which should be capped. Actual payable price can be determined at the end of leasing period by independent valuers or an experts' body.

   A more effective incentive for investment in locomotives and a better proliferation of investments under above scenarios could come if IR were to consider shifting the responsibility of locomotive operations and maintenance to the private sector as well. As discussed earlier in this study, locomotives and

[160] Source: This is computed based on an assumption of a PTO potential of 17% as a proportion of total passenger rail network as mentioned in earlier section of this Report
[161] Source: This estimate is based on an assumption that large private entities that own more than 20 rakes would find it viable to invest in their own locomotives. The data pertaining to this was sourced from IR.

wagons are treated in a similar way in most mature international rail markets, with respect to their financing, ownership, and maintenance. For instance, even if a small proportion of total rail freight operations, equating to ~5% of total number of trains (including passenger trains), are operated by the private sector through its own locomotives, investments in ~2,300 locomotives[162] pertaining to wagons could come from the private sector till 2051.

21.12.4. Enablers needed for recommended financing sources

Specific enablers for each rolling stock category have been previously discussed. A summary of these is discussed below.

- Formulation of separate SPVs to facilitate corporatization of existing wagon fleet and creating a robust leasing market in India
- Consolidation and rationalization of existing wagon ownership and leasing policies
- Development of a mature private wagon leasing market by encouraging diversified ownership
- Continual development of PTO model to shift investments in passenger coaches from IR to private sector
- Changes in PTO model pertaining to contractual provisions to enable development of a private leasing market in passenger coaches
- For large scale investment in locomotives by the private sector, a structural change in the Indian rail system may be needed – i.e. for the IR to shift the responsibility of locomotive operations and maintenance to the private sector as well.

[162] Calculated based on total locomotives requirement proposed in this Report x 5%

21.13. Financing Terminal Infrastructure

As mentioned in the earlier sections of this Report, a capital investment of ~INR 80,893 crore (from FY2021-FY2031) could be required to create the requisite network of passenger and freight terminals to service the projected demand growth estimated in the NRP. Beyond 2031, till 2051, an additional investment of ~INR 13,365 crore may be required, which is primarily for passenger terminals, as it has been proposed that projections beyond 2031 for freight terminals should be made at a subsequent stage on the basis of actual development of demand and requisite infrastructure over time.

A summary of the expected investment requirements in terminal infrastructure is presented in **Table 21-20** below:

Table 21-20: Total Capex Requirements for Terminal Infrastructure (Figures in INR crores)

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-2041	2042-2051	Total[163]
Freight Terminals	1,061	1,560	1,560	1,352	1,040	832	832	832	541	291	-	-	10,402
Passenger Terminals	10,863	10,863	10,863	10,863	10,863	3,235	3,235	3,235	3,235	3,235	9,324	4,041	83,855
Total Cost	11,924	12,423	12,423	12,215	11,903	4,067	4,067	4,067	3,776	3,526	9,324	4,041	94,257

The sub-sections below discuss in brief about the existing financing pattern of freight terminals and passenger stations, features of such assets which impact their financing, examples from international rail markets and discussion on potential sources of financing.

[163] Technical consultants have assumed some investment in FY2021. The figure is summation of investments required for the period FY21-FY51

21.13.1.Freight Terminals

21.13.1.1. Existing Financing Pattern

Indian Railways currently provides its users access to its network via ~2350[164] freight terminals. Based on nature of use, these freight terminals can be classified into the following three categories:

1. Private Sidings, including Inland Container Depots (ICDs) developed by CONCOR on Railway Land, terminals developed by public sector undertakings (PSUs), essentially as captive cargo facilities for single commodity, customers or industrial units.
2. Private Terminals included those developed by PSUs, as ICDs, Private Freight Terminals (PFTs) etc. on non-Railway land, which are essentially developed for handing third party cargo for single or multiple commodity classes.
3. Railway Owned Terminals / Good sheds (including container rail terminals (CRTs))

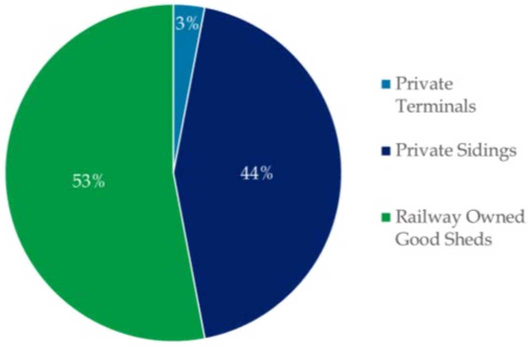
On current count, ~53% of the freight terminals on IR's network have been financed, developed, operated and are maintained by IR itself. These are mostly common user facilities, with general public access and multi-commodity use. Other than the IR's own goods sheds, a number of private sidings have also been developed as part of the IR network. These, on current count represent ~44% of the terminal network. These are mostly developed by end users and are meant for captive cargo use. They include facilities at cement plants, mines, steel plants etc.[165]

With the introduction of the CTO policy in 2006, and subsequent policies for other private freight train operations as well as Government initiatives toward development of MMLPs, IR has also generated a greater thrust on private sector participation in terminal development. IR has accordingly introduced several policies to attract private investments in rail freight terminals. Broadly, the policies developed by IR can be categorised into (a) those for encouraging greenfield developments and new terminal developments, and (b) those for bringing about improvements and upgradation of existing facilities. **ANNEXURE 21.7:** provides a snapshot of the nature and basic features of these policies.

[164] Based on data received from IR

[165] This list of terminals also includes around 27 container terminals developed on railway land by CONCOR in which containers containing third party cargo are handled, though train services have been mostly restricted to CONCOR.

Figure 21-10: Classification of Rail Freight Terminal's on IR's Network



Source: Consultant's Analysis

In terms of financing pattern, for PFTs and private sidings, IR only provides land for connectivity for which a commercial lease charge is levied. All investments for acquisition of land, development of terminal infrastructure, handling equipment etc. is expected to be borne directly by the private sector-either as end-users of cargo, or as logistics service providers who have entered the ICD or PFT space. There is therefore at present no capex requirement from IR as far as this greenfield aspect of freight terminal development is concerned. For investment needed to upgrade goods sheds, which have generally been in the domain of IR's own financing plans, there have been some policy initiatives of late, where private participation has been invited with potential reimbursement on investments made through a revenue share from rail freight.

21.13.1.2. Financing Requirements and Key Project Features

As mentioned in the earlier sections of this report, capital investment of ~INR 10,402 crore will be required to develop the necessary freight terminal infrastructure at the identified clusters / locations in a phased manner for the horizon year 2031. Details of locations, as well as estimated capex requirement for the same have already been provided in **ANNEXURE 21.8**: along with an earlier section on demand and modal shift strategies.

A typical investment in any rail freight terminal is based upon examination of the following key features:

1. **Sources of Revenue**: There are primarily three sources of revenue for a rail freight terminal –
    a. Terminal Access – these are usually paid for by rail operators or cargo owners who access the facility and are mostly in the form of a recovery of train access charges for development of specific rail infrastructure.
    b. Handling and Storage Revenue – these are service-related charges usually earned by a terminal against provision of specific cargo related services like stevedoring, warehousing etc.
    c. Revenue from additional services like transport, weighments, value addition etc.
    d. To further earn incremental returns on investments, terminal owners / operators can undertake commercial property development by developing ancillary facilities or by commercially exploiting the available air space.

With increased competition on clusters with multiple terminals, the potential revenue and the chargeable rate for terminal access is beginning to reduce. The primary viability of the terminal will therefore usually depend upon handling and storage, or through value-add services basis the cargo being handled and the terminal developers' business model.

2. **Traffic Potential**: Given the growth in projected freight volumes over the next decade, terminals developed at premium and strategic locations, especially with connectivity established to more than a single mode of transport, hold potential to attract considerable cargo volumes. The larger the hinterland from which a terminal can attract cargo, and the more efficient the cargo consolidation, arrival and dispatch facilities, the greater will be the overall traffic potential, and in turn the overall viability of a terminal project.

3. **Other Risks and Challenges:** Besides the demand and market risk associated with traffic potential and revenue potential, investors in terminal infrastructure also need to consider some other aspects for success in such investments. Long payback periods coupled with high construction costs and time delays (due to difficulty in acquiring suitable land parcels, approval delays, etc.), and associated risk related to rail operators being able to provide suitable service quality and reliability of service to meet the potential demand also pose challenges than can sometimes discourage private sector investment. These and other risks have been elaborated upon in an earlier section.

21.13.1.3. Potential Sources of Financing

As already indicated, IR has taken several policy related steps to attract greater private investment in terminal infrastructure and going forward, it envisions to augment the capacity and quality of its terminal infrastructure by adopting suitable models for private sector participation as the primary mode of financing and development of terminals infrastructure. While the former can be achieved by undertaking critical policy modifications, the choice of suitable models/structures for private sector participation is dependent on various project components and characteristics along with the risk allocation levels (as already mentioned above) between public and private components:

1. **Ownership of land**: Rail freight terminals can either be built on railway land/ state-owned land, or land owned / leased / licensed by a private party. Depending upon the land ownership, the choice of private sector participation models will vary. For instance, if the ultimate ownership of land rests with the railways / state, either O&M concession agreements (in case of brownfield terminals) or Design-Build-Finance-Operate-Transfer (DBFOT) model and its variants (in case of greenfield terminals) can be adopted.
2. **Capex or Opex based projects**: Considering the extent of private participation required for undertaking either construction / development of the terminal facility or operations and maintenance of the terminal facility or both, the appropriate modal for private sector participation can be determined. For brownfield terminals developed by IR, further upgradation / development works along with certain

specified operations of the terminal can be undertaken by the private party by entering into a concession agreement with IR. Since attractiveness to the project in such a case is governed by its potential to generate adequate cash flows to compensate for additional investments made, a hybrid revenue sharing model can be developed, where IR finds a mechanism to provide a return in real or strategic terms to the investing agency.

On the other hand, for greenfield terminals, considering the capital-intensive nature of financing terminal infrastructure and the resource constraints being currently experienced by IR, private investors might be encouraged to generate financing. Consequently, the most suitable model for implementation would be one where the responsibility of project finance rests with the private proponent such as in case of DBFO or DBFOT. This however would be dependent upon a fair and risk addressed model for investment in terminals to be maintained by IR.

Financing Recommendations

In view of the above, the following financing options could be considered by IR to create freight terminal infrastructure:

1. Create a more enabling environment to encourage greater private investment in terminal infrastructure by undertaking critical policy modifications
2. Consider adopting DBFOT variant of PPP model

Each of these recommendations has further been elaborated below:

1. Create a more enabling environment to encourage greater private investment in terminal infrastructure by undertaking critical policy modifications

In order to invite greater private participation to expand the terminal infrastructure facilities, it is important to simplify the existing terminal policy framework and introduce provisions that help in increasing access and in incentivizing private investment in order to improve service quality that in turn will promote modal shift from road to rail.

To achieve this, considering the similarities in the provisions of policies governing the development of new terminals (as defined in **ANNEXURE 21.7:**), it is recommended that the policy for Private Sidings, ICDs and PFTs should be merged into a single policy. The key components of a common consolidated policy for terminals have been elaborated in the following box. Furthermore, certain modifications in the Goods Shed Development Policy that has been announced recently have also been recommended.

Box 21: Key Components of a Common Terminal Ownership Policy

1. **Greater flexibility on use of Railway land -** Within the framework of the existing land licencing policy, Railway land should be made more easily available to supplement private land for new terminals, to permit storage and stacking of cargo and to improve access to the rail network. Examples of an Auto-Hub policy and a Development of Goods sheds Policy dated October 2020 that permits private users to develop and improve railway land for handling of goods already exist. Since such land is public in nature, any terminal infrastructure created thereby will be deemed as a 'common user' facility.
   Furthermore, the restrictions on such policies such as the high risk of forced exits (owing to the facility being operationally / financially unsustainable) or inability of the private investor to leverage any investments made to improve upon rail facilities need to be eased. Hence, it is suggested that viability assessments are carried out before inviting private investments.
2. **Fees –** Fees for permission to develop terminals are already either nil or negligible. Ideally there should be 'zero' entry fee, though a security deposit of 1% of expected railway construction cost can be retained for all type of terminal works. Further, a simplification of charges in private siding policy is also suggested. Railways should not get directly involved in the construction work of new terminals or even with improvement works. This work should be done by the terminal developers directly or through approved vendors. Railways can then levy a single supervision charge fixed at mutually accepted estimates of project cost instead multiple levies for codal charges, development costs, staff recovery, inspection or maintenance charges. Levying a separate lease charge for connectivity when freight is already charged till the siding end, amounts to a double charging, and could be considered with withdrawal altogether.
3. **Approval Process –** An automatic approval process, with a defined time frame subject to acceptance of Railway commercial, safety, engineering and facility design norms, should be put in place. A single approving body, with representation from IR, Department of Logistics, State Governments, and other compliance agencies needs to be constituted for all types of terminals. While terminals on private land and being developed by private investors should not ideally be restricted in terms of permissions, those that are on public land or being developed by public/government agencies should also be examined from the point of view of overlapping hinterlands, creation of duplicate capacity etc.
4. **Access -** Access to already existing goods sheds has been an area of considerable resistance on part of the Railways. This has been manifested in the form of restrictions on use and high levels of terminal access charges for container rail terminals (CRTs), or restricting access of many privately owned wagons (such as those under LSFTO, LWIS etc. in railway goods sheds). Another manifestation has been in terms of restricting use of such locations as hubs for hub-spoke operations. Access to railway good sheds should be provided to all users (including CTOs) and for all types of traffic. Terms and conditions of access should be same for all users (including rail and private users). Other than retaining a terminal cost of 20Rs/Tonne within the haulage charge, and a framework of free time rules for use of space, the Railways should not differentiate between Rail and Private users, and a create a common user regime for all railway goods terminals

(refer **Annexure 5***)*. At the same time, some incentives and operational preference needs to be considered for those who are investing private capital for improving or adding value to idle rail land, or existing rail facilities. This may take the form of priority / preference accorded to movement of terminal owners' rakes over the rakes of other users. Where terminal owners wish to prioritise movements of other users' trains, a provision for transit commitments upon payment of a freight premium can also be put in place. Failure to meet such commitments once a premium freight has been collected should result in not only a refund for the premium, but also for payment of certain penalties so that the idea so service quality can be commercially embedded in the system of private rail operations. Similarly, provisions related to exclusivity of operations can also be considered to provide guarantee on commodity volumes to be handled at each such facility. Any improvement in terminal access increases the number of nodes in the network and creates potential increase in the rail share of goods transported.

5. **Freight/ Haulage Rebates -** In the costing of its services, IR already incorporates a cost of terminals and just as the cost of wagon provision is reduced from freight in the case of private wagon ownership, 20 Rs/Tonne (with an escalation factor) rebate from freight should also flow to terminal owners who are reducing the IR's own need to develop terminal networks. This is already in place under the PFT policy. Providing a revenue incentive through a freight rebate will also incentivise terminal operators to market for additional cargo volumes for transportation on the rail network. The existing 10% rebate provided to those who agree to bear the capital expenditure on common traffic facility works should be continued for all private terminal operators.

Modification of Goods Shed Development Policy

While the essential concept of allowing private investment for upgradations of goods sheds facilities is a step in the right direction, the terms for attracting investments need modification in order to incentivise investments and create a fair return scenario for private investors. Recommended changes in the policy would require the following issues to be addressed:

1. Provide some preferential access rights to those who invest in goods sheds
2. Ensure that returns on investment are benchmarked against a minimum value, for a longer time frame than the 5-year period currently provided.
3. Consider providing revenue share from freight income generated at the terminal to incentivise terminal developers from marketing for and attracting fresh cargo instead of merely seeking to gain rental incomes on existing cargo volumes.

2. Consider adopting DBFOT variant of PPP model

To attract the requisite investment required for creating additional capacity in the terminal network by way of developing greenfield terminals, the DBFOT model (as discussed before) may be considered by leveraging the use of Railway or publicly owned land.

Under the existing scheme, the private investor acquires land by owning / leasing / licensing land. License from railways is only available for connectivity. It has been observed that private investments in terminal infrastructure have been restricted / discouraged owing to the challenges and delays experienced by private parties in acquiring land for construction of terminals at suitable locations.

To resolve this, since the most suitable locations for terminals often require proximity to exiting rail lines and stations, IR can extend support by permitting the use of rail land which will result in identification of better locations as well as layouts for new terminals. Adequate land parcels can be provided to private parties either as an equity investment or under a lease by undertaking land monetization. This will also help protect idle railway land parcels from encroachments etc. Similarly, IR can also help establish a tri-party agreement by encouraging state governments (under an MOU/JV model as discussed earlier in this Report) to provide vacant land parcels for undertaking development of necessary infrastructure. In such cases, provisions for transfer of ownership after the end of the concession period will have to be in place as part of the contractual agreements.

Having adequate cash flows to compensate for investments in a terminal project is fundamentally dependent on the revenue model being considered for the project. Where IR provides land or some form of preferential access rights to existing facilities in exchange for investment from the private sector, a couple of revenue sharing models between IR and the private party can be considered for incentivizing private sector participation (especially for attracting investments in strategically important locations for terminals which have comparatively less potential of cash flows).

These include:

a. *IR providing revenue guarantee through a long-term contract* – In this case, IR could ensure that cargo being generated for transportation via rail within a defined range / radius of a terminal in which investment is sought is routed through the same terminal, thereby, extending provision of preferential access to the cargo hinterland for the terminal developer / operator.

b. *Performance / availability-based payments* – In this case, payments could be made by IR to the private party based on provision of a minimum level of service thereby ensuring that the private sector doesn't face any risk related to traffic/demand.

Other development and financing modalities as per DBFOT model have been presented in Figure 5.

Figure 21-11: Development and Financing Modalities of DBFOT model

		DBFOT Model
Responsibility	Ownership of Land	IR / State Government
	Capital Expenditure and Operational Expenditure	Private Party
	Project Finance	Private Party
	Revenue Model	IR provides revenue guarantee / performance-based payments to private party
Risks	Land Acquisition Risk	IR / State Government
	Financing Risk	Private Party
	Design, Construction and Operating Risk	Private Party
	Approvals	IR
	Traffic Risk	Shared between Private Party and IR

Source: Consultant's Analysis

21.13.2. Passenger Terminals

21.13.2.1. Existing Financing Patterns

There are currently about 8000 passenger stations on the IR network. These stations have been developed over time by IR using its own finances. Conventionally, passenger stations in India have not been viewed as segregated business units but instead as a part of the overall system of railway operations. Therefore, the minor maintenance, upgradation and development requirements of railway stations have generally been met through various budgetary heads as part of IR's overall internal resources. For instance, upgradation of about 1149 stations (from 2009-10 till Nov 2019) has been undertaken as part of the 'Adarsh Station Scheme'[166]. These upgradation projects have focused on modernizing/upgrading amenities such as retiring rooms, waiting rooms, landscaping, parking, signages, washrooms etc. These works were financed from the budgetary resources of IR funds under plan head "Passenger Amenities". In the years FY17 to FY19 the budgetary allocations under the Passenger Amenities head ranged from INR ~918 crore to INR ~2411 crore.[167]

21.13.2.2. Existing models used by IR for Passenger Terminal Development:

In mature markets such as USA, UK and Japan, station redevelopment efforts have often been executed as segregated projects, treating the stations as a stand-alone individual business unit. As part of these projects, station development/ redevelopment has been financed through a variety of ways, including through multilateral banks, government funding as well as private sector involvement.

In recent years, IR has also started exploring the concept of developing passenger stations as standalone projects. With this change in development strategy, Indian Railways began exploring PPP as an option for financing the redevelopment of these stations. There are broadly three PPP models which have been explored by IR to finance the redevelopment of passenger stations through the private sector. These models have included the modified swiss-challenge method, the single stage model under which Habibganj station was awarded by IRSDC earlier, and the DBFOT model now being utilized by IRSDC and RLDA. A brief overview of these models is provided in **Table 21-21** below.

State and local authority participation:

Apart from the PPP models presented in the table below, two stations in Gujarat, i.e., Gandhinagar and Surat, are also being developed through JVs that IRSDC has entered with state and local government bodies, which are providing a proportion of the financing for these stations.[168]

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166. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1593143

167 https://pib.gov.in/PressReleseDetailm.aspx?PRID=159314

168 Gandhinagar Railway and Urban Development Corporation Ltd (GARUD) – with Govt. of Gujarat's equity at 74% and (SITCO) – in which the Gujarat State Road Transport Corporation

(GSRTC) and the Surat Municipal Corporation (SMC) together have equity ownership of 37%; with the rest from IRSDC.

Table 21-21: Comparison of current PPP models

Models	Modified Swiss Challenge Model	Single stage PPP model	New DBFOT Model
Specific Examples	• 23 stations were envisioned under this model	• Habibganj station	• New Delhi and Puducherry (RLDA) • Gwalior, Amritsar, Nagpur and Sabarmati (IRSDC)
CAPEX Responsibility	• Private sector	• Private sector	• Private Sector
OPEX Responsibility	• Private sector	• Private sector	• Private Sector
Traffic Risk	• Private sector	• Private sector	• Private Sector
Concession Period	• 45 years	• 5 years (Station Development) • 45 years (Commercial/Real Estate Development)	• 60 years commercial real estate and station development • 99 years residential real estate
Bid Parameter	• Bid was structured as a combination of lease premium and revenue share	• Upfront lease premium	• Annual Concession Fee (For New Delhi) • Annual Concession Fee or Upfront Premium for IRSDC stations (will be shared at RFP stage)
Current status/ remarks	• The modified Swiss challenge method was not taken forward due to lukewarm response from private sector. The primary issues of contention were private participants having the responsibility of getting necessary approvals and land related clearances	• It is the only station redevelopment project successfully awarded on PPP basis. • Habibganj project is nearing completion (over 98% civil work	• RLDA is planning to develop 62 stations as part of smart city projects • Stations like New Delhi, Puducherry, Tirupati and Dehradun are in the bidding stage • IRSDC is developing ~60 stations under this model • The RFQ stage has recently been completed for the 4 IRSDC stations listed above

Models	Modified Swiss Challenge Model	Single stage PPP model	New DBFOT Model
	etc. and the concession period being relatively short, among others.	completed as of 30th June 2020).	

Source: Consultant's analysis based on various sources – articles and reports on public domain and stakeholder consultations

21.13.2.3. Project Features for Passenger Terminals

As mentioned earlier in this report, the identification of station redevelopment projects has been based on using 'districts' as the basic spatial unit or Traffic Area Zone (TAZ). Accordingly, there are 96 districts which have been identified for station redevelopment projects over the course of the study period i.e. up to 2051[169].

Development priorities

As the entry and exit points of a passenger's railway journey, stations are an integral part of the overall passenger experience. Modernized/upgraded stations, developed to a certain standard with adequate passenger facilities and retail/ commercial offerings can thus help in turning more passengers towards rail as a comfortable mode of transport and therefore, help in competing with air and other transport modes in the future.

Special focus on the redevelopment of stations which are in state capitals, have high passenger footfall, are associated with profitable passenger categories such as AC trains which include Rajdhani/Shatabdi services would be integral to this effort. A potential indicator for identifying such stations could be in terms of linkages with IR's recent initiative of private participation in passenger train operations (PTO). For instance, some of the TAZs identified under the study that have also been identified as Origin/Destination stations for private train operations are in cities such as Hyderabad, Ahmedabad and Chennai.

Projects that fit with location types so described would also be best executed by the private sector due to the potential for innovation in design/construction, efficient management and a higher focus on exploring non-core revenue streams/services.

General characteristics

1. **Project Size:**

The project size for a station redevelopment project can vary significantly. The cost of station development depends upon several factors such as station area, number, length and area of platforms, passenger footfall, quality of service offering required, area of land available etc.

The cost of station redevelopment projects in a TAZ for the 96 TAZs considered under the study ranges from INR 168 crore to INR 20,789 crore. The average cost for a TAZ is INR ~874 crore and the median cost is INR ~411 crore. The average cost is affected by a few TAZs with relatively high cost of development. The 96 TAZs may be segmented in terms of cost of development as follows.

[169] For each district, the station redevelopment effort may entail the redevelopment of one or more of the stations in that district. In this section of the Report, a 'station redevelopment project' or simply 'project' refers to the redevelopment of an individual station which may be the only station being redeveloped in a district or among multiple stations being redeveloped.

Table 21-22: Cost of station redevelopment project(s) in a TAZ

S.no	Cost of development range	Number of TAZs
1.	Greater than or equal to INR 1000 crore	12
2.	Greater than or equal to INR 500 crore but less than INR 1000 crore	21
3.	Greater than or equal to INR 250 crore but less than INR 500 crore	41
4.	Less than INR 250 crore	22
	Total	**96**

Apart from cost of development, another key metric for project size is size of the associated land parcel available.[170]

2. **Sources of Revenue:**

There are primarily three sources of revenue associated with a passenger station.

a. **Fare box revenues/User Fees:** These include the fee charged from rail users for use of the station facilities, either through inclusion in the rail ticket fare or through the sale of platform tickets. IR has approved user fee as an additional source of revenue for station redevelopment projects and this has also been explicitly included in relevant RFQs such as New Delhi and in IR's Model Concession Agreement for station redevelopment. Given these developments and based on consultations, the study team has considered user fee as an integral revenue source for funding station redevelopment projects.

b. **Non fare box revenues (through utilizing station space):** These include revenues from commercial activities on the station premises such as rental of space for retail, food and beverage, advertising, parking, branding/ naming rights etc. These sources have been well utilized to fund railway and metro stations development in many countries. For instance, Amtrak in the USA has effectively leveraged in-station retail concessions at several railway stations such as those in Chicago and Philadelphia to raise additional revenues.

c. **Utilization of land and air space for commercial development:** Utilizing land parcels around stations or undertaking vertical developments above stations can be another mechanism to generate additional revenue. This space can be utilized for real estate for commercial (retail/malls/offices), hospitality or even residential developments. Lease rentals from such developments can be a major source of revenue for passenger stations.

[170] Data was actively sought by the study team in this regard but could not be acquired in detail. RLDA provided data for 8 specific stations (not all of which are in the identified TAZs), for which the size of the land parcel including station and commercial area ranged from 1 to 88 hectares with an average of ~26 hectares. However, among these stations, New Delhi is an outlier for which 88 hectares of land is available. For the rest of the 7 stations, on an average, land to the tune of ~17 hectares is available.

For passenger stations, all these sources of revenue are easily delineable from the larger rail system and can accordingly be allocated to each specific asset (station). This strengthens the case for treating stations as individual business units and executing the projects on standalone basis.

3. **Traffic Potential:**

The identification of the TAZs is based on traffic projections, as presented earlier in the report. As per the passenger demand forecasts, each TAZ is expected to have crossed the threshold of 2,00,000 (2 lac) passengers per day by the time development project(s) in that TAZ would be completed. Therefore, the station redevelopment efforts can be linked to significant revenue potential through passenger footfall numbers.

4. **Rate of Returns:**

Based on limited data being available pertaining to the rates of return for existing station redevelopment projects (data was received for 7 stations from RLDA), the project Internal Rate of Return (IRR) for such projects is ~18%. A Project IRR at about this value is generally considered viable for private investment in infrastructure sector in India.

21.13.2.4. Financing Requirements for Passenger Terminals

As mentioned in the earlier sections of this Report, INR 70,490 crores of investments could be required for station redevelopment projects over the next 10 years till 2031. Beyond 2031, ~INR 13,365 crores of investment may be needed till 2051. As previously discussed, these requirements would be subject to change based on various developments.

The total investment requirements for station redevelopment projects is about 2.19 percent of the total planned capital expenditure outlay under the NRP. While in practice, it is likely that individual projects may be executed in varying time frames within the same phase of development, technical experts have illustrated the capital costs as presented in **Table 21-23** below.

The individual cost estimates for each TAZ identified for the relevant phase of development have been presented in **ANNEXURE 21.9:**

Table 21-23: Financing requirements for station redevelopment (Figures in INR crores)

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-2041	2042-2051
Total Cost (INR cr)	10,863	10,863	10,863	10,863	10,863	3,235	3,235	3,235	3,235	3,235	9,324	4,041
No. of TAZs identified	20					30					27	19

The high average cost in the first 5 years is due to a few outlier TAZs requiring significant amounts of capital for development. TAZs such as Mumbai, Chennai, Howrah, Thane and Patna would each require investments over INR 2,000 crore with Mumbai alone requiring investment of over INR 20,000 crore.

21.13.2.5. International Cases and learnings for Passenger terminal development

Some of the international examples reviewed for this Report are presented in **Table 21-24** below:

Table 21-24: Summary of international case studies[171]

Station Name	Country	Station Ownership	Execution Year	Project Features	Project Cost	Financing	Remarks
Atocha Railway Station	Spain	Spanish Government	2010	• Station enlargement • New tunnel for high speed use	$265.8 Mn	European Investment Bank	• Financing undertaken as part of larger high-speed rail project
St. Pancras Rail Station	England	London and Continental Railways (LCR) (property development company which was private at the time of project execution but was later nationalized)	2001	• Station redevelopment and expansion as part of High Speed 1 project • Integration with several transport modes (regional, national and international) • Construction of terminal and platforms • Shopping center and mixed-use development, including a hotel	$1.33 Bn	Primarily from LCR with $73 million from UK's Department for Transport	• Focus on sustainable development with a long-term horizon (structures have design life of 120 years) • Revenue generation from 9,000 sqm of retail space in line with flow of passengers.

[171] Wikibooks."Rail Reinvented - Examining Railway Station Redevelopment Abroad". https://en.wikibooks.org/wiki/Rail_Reinvented_-_Examining_Railway_Station_Redevelopment_Abroad#CASE_STUDY:_Atocha_Railway_Station,_Madrid,_Spain
East Japan Railway Company.(2012)."Transforming Shinjuku Station and Surrounds Into a Hub of Interaction with Easy Accessibility". https://www.jreast.co.jp/e/press/2012/pdf/20120902.pdf
Nakono, R.(2016)."Case Study on Station Redevelopment in Japanese Railways". http://irsdc.in/sites/default/files/ryoko-nakano.pdf
WSP Parsons Brinckerhoff."CASE STUDY SOUTHERN CROSS STATION". http://irsdc.in/sites/default/files/paul-holmes.pdf

Station Name	Country	Station Ownership	Execution Year	Project Features	Project Cost	Financing	Remarks
Poznań Główny Railway Station	Poland	Polish National Railways (before project execution)	2007	• Multimodal transportation hub • Station building above railway tracks • Large retail and shopping center	$170 Mn (excluding land cost)	Project execution through PPP Financing raised by TriGranit, a private property developer through debt and equity	• Project funded through monetization of 58,000 sqm of leasable space as well as a number of shops, restaurants, bars and cafes. • Station development also funded through revenues from operations of station
Southern Cross Railway Station	Australia	Government	2002	• Redevelopment of station • Public transportation hub • Commercial development comprising car parking, retail and office space	$350 Mn	Project execution through and annuity-based PPP model Financing raised by Civic Nexus, a private consortium through debt and equity	• Project financed through real estate development and annuity payments from government
Union Station	USA	Union Station Redevelopment Corporation (Government entity)	1980s	• Intermodal transportation center • Renovation of station • Development of Amtrak's corporate headquarters	$150 Mn	About 46% from Amtrak (government owned railway); 27% from regional government,	• USRC doesn't receive any federal funds and generates revenues from car parking and management of developers' lease

Station Name	Country	Station Ownership	Execution Year	Project Features	Project Cost	Financing	Remarks
				• Retail and entertainment center		27% from commercial development	
Shinjuku Station	Japan	JR East (Privately owned regional railway entity)	2012	• Transportation hub and cultural exchange facilities above station and train tracks • Multipurpose building with offices and retail facilities • Public access passage	Over $1 Bn	Financed by JR East	• Significant reliance on land and airspace monetization (approximately 111,000 sqm of floor space) to generate revenue

A few key takeaways for IR from these case studies are presented below:

1. **Transportation hubs**

   Many stations redevelopment projects across the globe have had the concept of development of a transport hub as a key component. For instance, the transportation hub above the Shinjuku station in Japan houses a taxi stand and bus terminal. These integrated transportation hubs can have multiple benefits – reducing road traffic congestion and accidents in the area surrounding the station; improving footfall and business for the commercial developments at and around the station, thereby also contributing to an indirect increase in overall revenues. For instance, Anand Vihar in New Delhi is one such railway station on the IR network with multimodal connectivity through railway, metro and bus transport in proximity. A transportation hub is also part of the Surat station redevelopment project and is additionally being explored for stations such as Tirupati and Nellore [172].

2. **Benefits of PPP**

   Adequately structured and well executed PPP projects can yield Value for Money (VFM) benefits for the government as well as business opportunities for the private partner. For instance, a VFM analysis of Australia's Southern Cross Station project revealed that the government was able to develop the station at a reduced overall cost while also providing the public with the benefits of better facilities and a redeveloped station.

3. **Land and airspace monetization**

   Generating funds through monetization of land and airspace around the station as a concept has been widely explored internationally. This can be an effective tool for generating revenue to fund the station development irrespective of whether the project is being financed by the government entity or a private party through PPP.

4. **Appropriate selection of model**

   Station redevelopment projects have been implemented by government and private agencies using various models and financed through a reliance on project revenues (fare box and non-fare box), land and airspace monetization as well as through government funds. This variety in project types indicates that station development projects are not homogenous and may need tailored solutions for financing depending upon project characteristics.

[172] https://www.financialexpress.com/infrastructure/railways/surat-railway-station-set-for-makeover-indian-railways-to-invite-rfq-for-world-class-hub/2003860/
https://www.livemint.com/news/india/indian-railways-tirupati-and-nellore-railway-stations-to-get-a-makeover-soon-pre-bid-meetings-held-with-prominent-infra-firms-11589465608473.html

21.13.2.6. Financing strategies and sources of funds for Passenger Terminals

Minor upgrades and redevelopment efforts

Over the horizon of the NRP study, there may continue to be requirements to upgrade the passenger facilities/amenities apart from the larger overall station redevelopment projects. These requirements could arise either at the stations within the identified TAZs but well before the station redevelopment projects are planned or at other stations of IR. These are expected to be minor standalone upgrades for maintaining the station and quality of passenger amenities such as – installation of lifts/escalators, expanding passenger seating areas, construction/repairs to building structures etc. without warranting a full-fledged redevelopment of the station. Since these works are likely to be too small to separately attract financing from any other source, they would require to be financed from within the railway budget under the Passenger Amenities head discussed earlier or through other appropriate budget heads.

Station redevelopment projects

These projects would typically require significant amounts of capital expenditure for aspects such as large-scale construction works of new terminals, platforms, and access roads and large-scale modernization/upgradation of passenger facilities. Potential financing options for station redevelopment projects include a combination of public capital from both central government and state governments (either through provision of land for monetization or through direct provision of funds) supported by private capital, wherever feasible. The potential financing sources for such projects are listed below:

Private capital (without land monetization) – Private capital would be a feasible option for station redevelopment projects which are viable even without provision of land for commercial development. This would be a suitable source of financing station redevelopment projects where the revenues from user fee, non-fare box revenues generated from the station premises (including vertical developments, if feasible) are expected to be sufficient to cover the cost of station redevelopment. The primary basis for the identification of such stations would be passenger footfall, passenger mix (general vs reserved tickets, AC vs non-AC etc.) and availability of commercial space at the station. High footfall stations such as New Delhi and Mumbai could fit into this category, depending upon the possible quantum of user fee.

Monetization of land available with public authorities – For certain stations, where the revenues from user fee or non-fare box revenues generated from the station premises may not be sufficient to fund station redevelopment cost, monetisation of land could be explored to attract private sector investment and make the projects viable. The quantum of funds that can be raised through this approach would depend upon the quantum of land that can be monetized. IR could consider land monetisation through private players both as an integrated project with station redevelopment project or as a standalone project, in case the land available for monetisation is not near the station.

The projects suitable to be financed through this approach would typically be stations in metro and large cities such as New Delhi, Pune and Ahmedabad with appropriate demographic and economic profile for such developments and where there is demand for development of such commercial facilities. Depending upon the model adopted by IR, the funds raised can then be used for the redevelopment of associated stations and the surplus, if any can also be channelled towards the redevelopment of other stations.

Funds from State governments and regional authorities – State governments and regional authorities such as road transport corporations may be willing to provide a proportion of the funds required for redeveloping stations associated with strategic or economic interests such as promoting local economies, tourism, integration with other transport modes etc. For instance, for the Surat station redevelopment project which is being developed as a multi modal transportation hub, a part of the financing is in the form of equity infusion from Surat Municipal Corporation and Gujarat Road Transport Corporation. IR may also consider programs of various MFIs with the State Governments and explore possible funding under such programs for station redevelopment projects serving the objectives of passenger convenience.

Funds from Indian Railways – Any deficit of funds for the station redevelopment projects after accounting for the above sources would need to be financed by IR, either from GBS or from its internal resources. These funds, if required, would primarily be needed to finance the non-viable station redevelopment projects.

21.13.2.7. Categorization of stations and selection of appropriate project structures/models

Given the high variability in station redevelopment projects in terms of both cost of redevelopment and potential of return due to the various factors discussed earlier, appropriate categorization of projects and tailoring models of execution according to specifics of each category becomes imperative.

For an accurate categorization exercise, data pertaining to aspects such as IRRs of individual station, size of land parcels, passenger footfall etc. would be necessary. In the absence of availability of such data however, qualitative factors for the categorization exercise, the broad categories and specific project structures/options for each category have been provided below.

At the first level, the station redevelopment projects can be categorized into station redevelopment projects which are commercially viable and those that are not:

Station redevelopment projects which are commercially viable

The stations where the revenue to be generated from the three sources, i.e. fare box revenues (user fees and passenger tickets), on station non-fare box revenues (advertising, station retail etc.) and land and airspace monetisation, are expected to be sufficient to cover the cost of station development after accounting for developer margins would fall under this category.

Based on a high-level analysis, some of the TAZs under the study that are also origin/destination stations under private train operations and are associated with Category Z (Tier 1) cities as per central government categorization include – New Delhi, Mumbai, Pune, and Bangalore. Some of the stations in these cities might fall under this category. A number of these stations in and around these cities are either already being executed under such a model (for instance New Delhi) or are expected to be high potential stations by IRSDC (such as Dadar, Bangalore City, Bandra Terminus, Adarsh Nagar Delhi etc.).[173]

Stations redevelopment projects which are not commercially viable
This category includes stations where the revenues from sources cited above may not be sufficient to cover the costs of station development. This could be on account of various factors such as less than threshold footfall to generate required returns, low commercial revenue generation potential at the stations etc.

Such stations can be further categorized into:

1. Stations where land is available for commercial exploitation and land monetization (in isolation) may be viable. However, even with the land monetisation, the revenues may not be sufficient to cover the cost of station development. This could be the case due to low/marginal revenue surplus or due to high cost of station development at some of the stations.
2. Stations where profitable monetization of land is not feasible. This could be the case either due to non-availability of sufficient land or due to low commercial viability.

Based on the broad categorisation above, the stations can be categorized under the following heads:

1. **Category 1:** Station development projects which are commercially viable through exploitation of the three revenue sources, i.e. land and airspace monetisation, fare box revenues (user fees and platform tickets) and on station non-fare box revenues (advertising, station retail etc.)
2. **Category 2:** Station development projects which are not commercially viable on an overall level, but potential of generating surplus through land monetization.
3. **Category 3:** Station development projects which are not commercially viable and land monetization is also not feasible.

As per considerable secondary research, and stakeholder consultations, the overall station redevelopment program of IR is expected to be commercially remunerative, i.e. while some of the individual projects may not be commercially viable, the program as a whole is likely to be financially rewarding/self-sufficient and is not likely to need support from the government apart from provision of land for

[173] IRSDC. "Draft Invitation for Proposal (Invitation Document) – Selection of Development Partner for Development of High Potential Railway Stations under Station Redevelopment Program". https://drive.google.com/file/d/1nC30UHk5WZuAJtrI25n7vQ-B0I8zoTz_/view

commercial development. If this assessment holds true in the future, the entire capital expenditure requirements for passenger stations could be financed through private sector financing. However, any project specific deficit may need to be financed through state and central government funds.

Category wise project models/structures:
Table 21-25 below presents potential options for category-wise development models which may be explored by relevant agencies like IR, IRSDC and RLDA.

Table 21-25: Category wise modular recommendations

Category of Station	Option 1	Option 2	Option 3
Category 1	DBFOT PPP		
Category 2	PPP with VGF support	Carve out commercial development and separately execute the station redevelopment project	
Category 3	Development by railways or private involvement through EPC/BOT-Annuity/ HAM	Joint development with State governments	Asset bundling with Category 1 projects

1. **Category 1 stations:**
These stations can be developed through the DBFOT PPP model wherein a developer would be invited to redevelop the station and commercially develop real estate at the land parcel proposed to be provided as part of the agreement, if any. The developer would be able to earn revenues from the station and land monetisation for a pre-defined concession period. The developer would be required to pay a concession fee to the project authority, which would be determined based on competitive bidding. This model is similar to the one currently being explored by IRSDC/RLDA for stations such as Nagpur, Gwalior, Sabarmati, and Pondicherry etc.

There could be different choices of transaction structures by considering different options for bid parameter/concession fee. Given the context of IR and potential requirement to arrange funding for Category 2 and Category 3 stations, a potential model to be explored could involve an upfront lease premium. The upfront lease premium could be pre-fixed for the Category 1 projects to generate funds for developing less remunerative stations (Categories 2 and 3) in future and some other bid variables (such as revenue share/annual lease rent/ per passenger fee) could then be left to be determined through competitive bidding.

2. **Category 2 stations:**
At the Category 2 stations, while there may be a surplus for IR from the land monetisation at such stations, such surplus may not be sufficient to cover the costs of station development and therefore a simple PPP mechanism may not work. There could be two ways to finance the redevelopment of these stations:

Carved out commercial development and station development funded partly through surplus from category 1 stations: One of the options to fund development of Category 2 stations is to combine the surplus generated from land monetization associated with these stations (by leasing out the land parcels to be commercially developed and utilized for a pre-defined concession period) and from upfront lease premium generated from transactions carried out for Category 1 stations. The consolidated surplus from these projects as well as from Category 1 projects could then be used in part to finance the station development aspects of these stations through:

- Development by Indian Railways
- Engineering Procurement Construction (EPC) contracts
- BOT-Annuity/Hybrid Annuity Models (HAM) – The BOT-annuity model, which has been widely used to finance infrastructure in roads sector, could also be utilized to redevelop Category 2 stations. Under this model, the private sector would develop the station at its own cost and operate and maintain it for a pre-defined concession period against annual payments from the project authority. Another option could be the HAM in which the IR could finance a part of initial capital expenditure along with providing annual payments to the concessionaire. The benefit of using these models over a simple EPC is that the government does not have to pay the entire development cost upfront and private sector efficiencies are brought into the operations and maintenance through a single transaction. This might help bring in efficiencies into station operations and may help generate additional station based non-fare box revenues for the concessionaire and IR.

a. PPP with VGF support: IR could consider arranging for financial support to developers either under the government's Viability Gap Funding scheme or directly provided by IR to enhance the viability of these station redevelopment projects. The developers could be selected based on least VGF required. This method would be especially suitable for projects where the surplus from commercial development is only marginally lesser than the station development cost. Careful structuring of the transaction to ensure that VGF support is only provided for the station development component would be helpful – for example by having the cost of station development as the bid cap.

3. **Category 3 stations:** These stations are the ones where the station development projects are not commercially viable and land monetisation is also not feasible in isolation.

a. IR funding: These stations could be financed by IR through the surplus raised from the execution of Category 1 stations or if there is a deficit, through GBS or internal resources.

b. Joint development in association with state governments/regional bodies: Another way of financing a part of the station development cost for Category 3 stations could be through equity contributions from state governments into the projects. This mechanism would be suitable for stations with strategic or economic interests of the states such as integration with other transport modes, facilitating tourism, promoting regional economy etc.

c. Asset bundling: Another mechanism to finance the development of these stations could be to bundle some of them in a single transaction along with Category 1 stations with enough expected surplus to finance the station development of the Category 3 stations within the bundle as well. The bundling could be based on parameters like geographical proximity to facilitate a network effect and enable better project management and coordination between different administrative units (railway zones or states). Based on preliminary consultations with private sector players, asset-bundling may be a viable mechanism and would be suitable as long as the bundle is remunerative.

21.13.2.8. Key Considerations/Enablers to enhance funding options:

Certain interventions at a policy level could further help improve the viability of station redevelopment projects. Some of these are based on previous attempts of IR to engage private sector financing for station redevelopment projects.

1. **Shorter lease period:** Several of the potential developers were not satisfied with the 45-year lease period for commercial development that was being offered initially. Now, the lease period has already been extended to 60 years for commercial and 99 years for residential developments, which is expected to be attractive for the private sector.
2. **Land related regulatory issues and clearances:** Under the earlier model, the development was proposed to be on as as-is where is basis with the private developer being required to obtain all approvals, land use and associated clearances required for the development process. These tasks and risks are better managed by government authorities. These issues have also been addressed in the new models with no change in land use required for railway station redevelopment and IRSDC acting as the single window for approval of master plan and building plans in consultation with local authorities.
3. **Allowing multiple sub-leases and residential development –** These were the other two concerns expressed by developers in the Swiss-challenge model. These have also now been addressed by IRSDC in the new model under which station redevelopment projects are being executed.
4. **User Fee** - As per the study team's consultations with developers, depending upon the quantum and structuring, user fee could form an integral part of project revenues and therefore, funding. For instance, for New Delhi station, even a

nominal average fee of INR 10 per passenger would result in revenues of over INR 164 crore per annum[174]. While affordability for passengers would be one of the primary considerations affecting the quantum and structure/grading of user fee, some form of predictability and transparency in the process would help increase developer confidence towards user fee as a reliable source of revenue. For instance, in the airports context, aeronautical revenues including User Development Fee (UDF) are regulated by the Airports Economic Regulatory Authority (an independent regulator) to help ensure reasonable returns for private airport operators.

5. **Centralized fund for station development program** - It is important to have efficient mechanisms in place to make the overall station redevelopment program viable for IR. This would involve channelling any surplus generated from Category 1 stations and land monetisation at Category 2 stations towards other station redevelopment projects. One mechanism could be setting up of a centralized fund within IR wherein the surplus revenue from these projects is collected, after accounting for management fee, if any, from all organization managing these projects such as IRSDC, RLDA, and other PSUs etc.
6. **Cash flow management** - Another key success factor would be to ensure that enough surplus is available in each year to finance the station development projects of that year. The levers to ensure this could include appropriate phasing of projects selected for redevelopment. Cash flow mismatches could occur if some of the remunerative/surplus generating projects are inadvertently delayed due to unforeseen circumstances or if the less remunerative stations need to be developed earlier due to strategic reasons. These delays could happen due to factors such as delays in securing regulatory approvals/clearances or delays related to land or other market factors. To cover such scenarios, there should be mechanisms in place to secure bridge financing.[175]
7. **Efficient coordination among stakeholders at various levels** - Station redevelopment is a complex project involving a variety of stakeholders – implementing agency, zonal railways, state government and local urban development authorities. Through its consultations on the subject, the study team was informed that coordination with local bodies for aspects such as the approval of master plan, building plans, FAR related norms etc. is an important facet for timely completion of the projects and to avoid any time and cost overruns. Some of the ways of smoothening this process could be to involve the local authorities in the planning process from the initial stages itself and to ensure that the development plans are harmonious with the nearby architecture and city profile.

[174] Consultant’s analysis based on data from the New Delhi station redevelopment project’s RFQ

[175] For instance, IRSDC is currently in the process of raising an INR ~541 loan from IRFC to fund the EPC construction of stations such as Anand Vihar, Bijwasan and Chandigarh on EPC basis. The loan is intended to be eventually serviced from the future surplus from remunerative projects.

21.14. Financing Rail Track Infrastructure

As part of the future network requirement section of this Report, capacity expansion proposals with respect to track infrastructure have been identified. The track infrastructure projects can be classified into three distinguishable components:

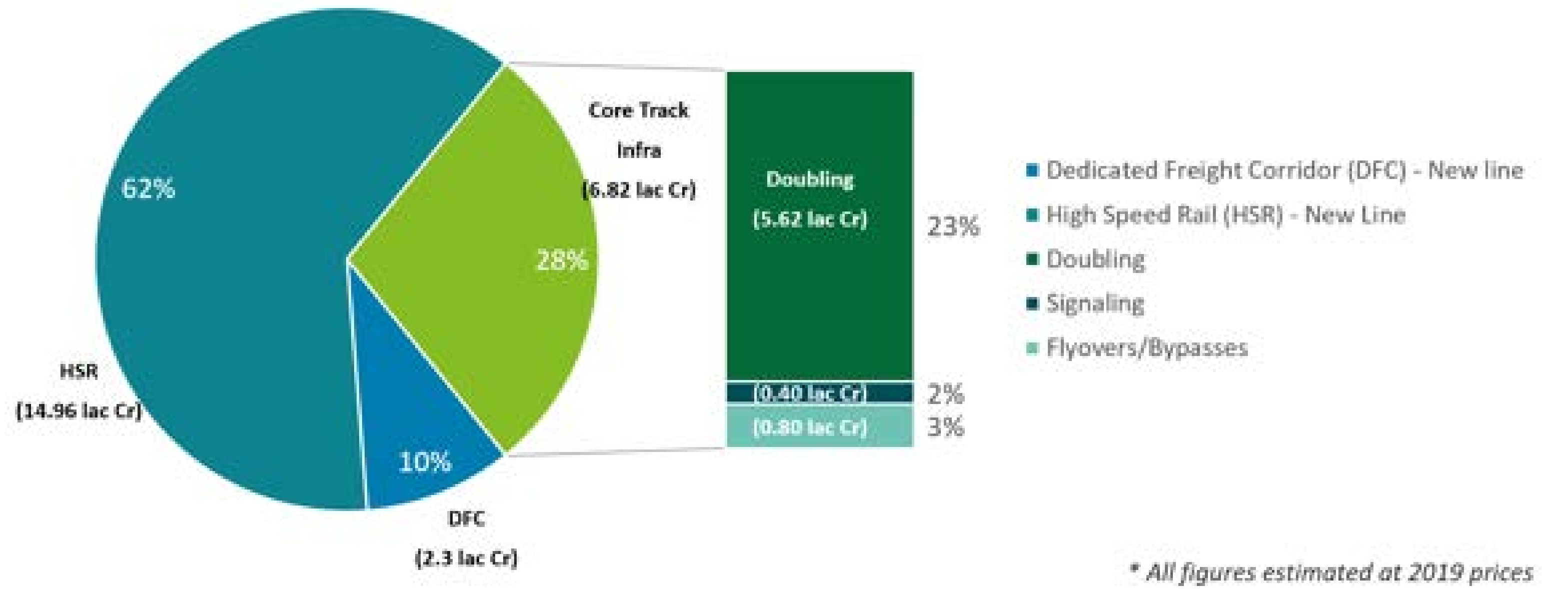
a. Core track infrastructure (including HDN, HUN and other lines)

b. Dedicated freight corridor (DFC)

c. High Speed Rail (HSR)

As mentioned in the earlier sections of this Report, capital investment in rail track infrastructure, is estimated to be approximately INR 24.08 lakh Crore (till the year 2051); 28 percent of which is marked for core track infrastructure, 10 percent for Dedicated Freight Corridor (DFC) and 62 percent for High Speed Rail (HSR). This is illustrated in Figure 6 below.

Figure 21-12: Capex estimation for track infrastructure (till 2051)



Source: Consultants' Analyses

Out of the total INR 24.08 lakh crore for track infrastructure requirements, approximately 25.6 percent is estimated to be needed by the year 2026, another 20.5 percent by the year 2031 and remaining 53.9 percent between the years 2031 and 2051. This is shown in the **Table 21-26** below.

Table 21-26: Phasing of capex for track infrastructure (Figures in INR crores)

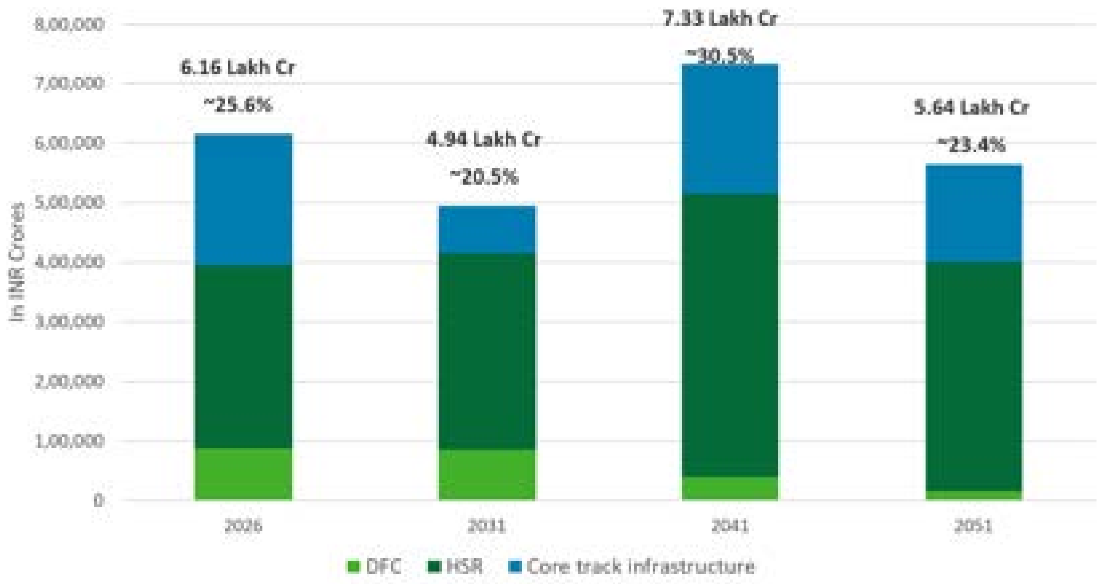
Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032 - 2041	2042 - 2051	Total[176]
DFC	15,172	15,654	16,137	16,619	17,102	17,584	18,066	18,549	19,031	11,928	40,050	16,522	2,30,000
HSR	50,420	53,366	56,312	59,258	62,204	65,150	68,096	71,042	73,988	51,724	4,75,680	3,83,350	14,95,800
Core Track Infrastructure	38,323	46,571	46,571	43,135	27,844	14,272	14,272	14,272	15,899	20,439	2,17,557	1,64,472	6,82,272
Total	**1,03,915**	**1,15,592**	**1,19,020**	**1,19,012**	**1,07,149**	**97,006**	**1,00,434**	**1,03,862**	**1,08,918**	**84,091**	**7,33,287**	**5,64,344**	**24,08,072**

Source: Consultants' Analyses[177]

The capex requirements, in decadal terms, have been shown in the figure below.

[176] Technical consultants have assumed some investment in FY2021. The figure is summation of investments required for the period FY21-FY51
[177] The phasing of investments over the years has been considered based on technical inputs

Figure 21-13: Phasing - Track infrastructure capex



Source: Consultants' Analyses

The following sub-sections discuss the financing options for the three track infrastructure components.

21.14.1.Dedicated Freight Corridors (DFCs)

21.14.1.1. Financing Requirements for DFCs

As mentioned in the earlier sections of this Report, five new DFCs have been identified in addition to the two under-construction DFCs (Eastern and Western DFC). The capital requirements and the phasing assumptions of these DFCs are given in **ANNEXURE 21.10:** The investment required for the proposed DFC corridors is presented below:

Table 21-27: Year-wise capital requirement for DFCs (Figures in INR crores)

Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032 - 2041	2042 - 2051	Total[178]
Eastern DFC – II	2,060	2,060	2,060	2,060	2,060	2,060	2,060	2,060	2,060	1,030	0	0	20,600
East Coast DFC	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	5,060	2,530	0	0	50,600
East West DFC (and EDFC connectors)	8,052	8,052	8,052	8,052	8,052	8,052	8,052	8,052	8,052	4,026	0	0	80,520
North South DFC - I	0	482	965	1,447	1,930	2,412	2,894	3,377	3,859	4,342	26,532	0	48,240
North South DFC – II	0	0	0	0	0	0	0	0	0	0	13,518	16,522	30,040
Total	**15,172**	**15,654**	**16,137**	**16,619**	**17,102**	**17,584**	**18,066**	**18,549**	**19,031**	**11,928**	**40,050**	**16,522**	**2,30,000**

Source: Consultants' Analyses

178 Technical consultants have assumed some investment in FY2021. The figure is summation of investments required for the period FY21-FY51

21.14.1.2. Existing financing pattern for DFCs

The concept of DFC was conceptualized in 2006 with an objective to create dedicated freight corridors to increase rail freight share. The Dedicated Freight Corridor Corporation of India (DFCCIL), an SPV, was set up in 2006 under the control of the MoR to "undertake planning & development, mobilization of financial resources and construction, maintenance and operation of the dedicated freight corridors"[179].

The two DFCs under implementation, Eastern and Western DFCs are being funded through a mix of equity from MoR and loan from multilateral development banks viz. World Bank and JICA. These two DFCs, with a project cost of INR 81,459 crore (as per figures available) are being funded through (a) 47 percent from JICA loans (b) 17 percent from World Bank loans, and (c) 36 percent from MoR's equity contribution. This is shown in the adjoining figure[180]. The Western DFC is majorly funded through loans from Japan International Cooperation Agency (JICA) and equity from MoR, whereas the Eastern DFC is being funded through loans from the World Bank and equity from MoR. These loans from World Bank and JICA have a condition that these are tied-up loans.

DFCCIL has been contemplating to develop a section of Eastern DFC (Sonnagar – Dankuni) on PPP mode. After several deliberations and discussions within the MoR, on the basis of likely financeability, it is envisaged that the given section would be developed on DBFMT-Annuity model with traffic risk being allocated to DFCCIL. The model concession agreement for the same is being drafted.

21.14.1.3. Project Features of DFCs

From an investment perspective, the key features of DFC projects are as follows:

1. **Project Size:** The project size of various DFCs would typically be in the range of INR 20,000 Crs – 80,000 Crs with project lengths varying from 500kms to 2,000kms. The individual DFCs can further be broken down into smaller sub-sections when it comes to project structuring for an investment perspective.

2. **Customer and revenue:** As currently envisaged, the sole customer of DFCCIL[181] would be the Indian Railways with revenue generation taking place for DFCCIL

[179] Source: DFCCIL website accessed from the URL: https://dfccil.com/Home/DynemicPages?MenuId=3
[180] Source: Consultant's analysis based on data accessed from the report "Raghuram. G. (2019). "Dedicated Freight Corridor: Current Challenges". Indian Institute of Management Banaglore, Bangalore, accessed from the URL: https://www.iimb.ac.in/sites/default/files/inline-files/Transportation%20Research%20Procedia_WCTR.pdf
[181] Source: Credit Rating Report, DFCCIL https://dfccil.com/upload/Dedicated_Freight_Corridor_CRR_080914_-_Report.pdf

through a Track Access Charge (TAC) mechanism. IR would decide the trains which would run on the DFC network. The freight booking would be done through IR, which would then assign traffic to the DFCs.

The track access charge would be determined by DFCCIL in a way that it covers fixed and variable components of providing and maintaining track infrastructure. Fixed components would comprise costs such as financing cost, staff, and depreciation. The variable components would include traction power and materials.

3. **Financial and Economic Returns of proposed DFCs:** Based on information available with the study team, RITES had submitted a PETS (Preliminary Engineering and Traffic Survey) report for three DFCs – East-West DFC, North-South DFC and East Coast DFC. Based on preliminary cost and traffic estimation on these three proposed DFCs, the economic and financial returns are shown in the **Table 21-28** below:

Table 21-28: Return summary - Future proposed DFCs

DFC Name	Project Length (km)	Estimated Project Cost (INR Cr)[182]	Economic IRR	Financial IRR
East-West DFC	2,328	1,60,959	34.4%	34.7%
North-South DFC	2,327	1,67,062	23.4%	21.1%
East Coast DFC	1,114	74,750	37.5%	34.7%

Source: Appreciation report of 3-Dedicated Freight Corridors (East-west, North-South & East-Coast), RITES, Dec 2018

Given this preliminary analysis, the above three proposed DFCs are expected to be economically and financially viable. The detailed project reports (DPRs) for these three corridors are currently being prepared by DFCCIL and the financial estimates would get validated and become more granular once these studies are completed.

4. **Project Risks:** Large Infrastructure projects, such as the DFCs, are often posed with varied nature of risks. A detailed evaluation of risks and impact from the same has already been provided in an earlier section of this report.

21.14.1.4. International/ Other Sector Financing Examples

The study team has examined a few relevant case studies which could provide key takeaways vis-à-vis financing of DFCs. These include (a) Financing of Australia's Inland Rail, and (b) Exploring off-balance sheet financing for funding expressways in India.

1. **Financing of Australia's Inland Rail**

[182] Project completion costs have been estimated at current prices by taking annual inflation @ 5%; insurance and working capital @1% and Interest During Construction (IDC) @7%

The Australian government funded its Inland Rail project (a USD 10 billion project) through its own resources and a small section through availability based[183] PPP.

Box 22: Financing of Australia's Inland Rail

Australia's Inland Rail Project draws substantial similarities from the DFC project. The route length of the Inland Rail project is approximately 1700 km, including 1100 km of major upgrades of existing rail tracks and 600 km of new track.

The existing rail line between Melbourne and Brisbane is heavily congested due to which 74 percent of all inter-capital freight between the two cities moves by road. The Inland Rail project, connecting Melbourne and Brisbane, is being developed as a solution to provide better freight logistics services in the East Coast region of Australia and increase the rail freight share.

Key technical characteristics[184] of Inland Rail are:

- Train length - 1800 m with future proofing for ultimately 3600 m
- Axle Load / Max Speed - 21 tonnes @ 115 km/h, 25 tonnes @ 80 km/h, with future proofing for 30 tonnes @ 80 km/h
- Double Stacking - 7.1 m clearances for double stack operation
- Interoperability - Full interoperability with the interstate mainline standard gauge network

Funding: The estimated capital investment is approximately USD 10 billion over a 10-year period. The economic benefits accruing to the country outweigh the cost of the project with a benefit cost ratio of 2.62. As per the financial analysis, it is envisaged that the project would not be able to generate enough revenue to help recover the full construction cost. However, the project will be cash positive once it is operational and should be able to cover the cost of operations and maintenance.

Given the huge capital investment required, and the positive macroeconomic benefit associated, the Australian government is funding majority of the project on its own[185]. However, a section of about 128 kilometers (including three tunnels and numerous viaducts, bridges and crossing loops) is envisaged to be developed on Availability Based PPP[186] mode. It has been envisaged that the PPP process will bring in private sector's innovation and experience to deliver a world class engineering solution. In this Availability Based PPP, Australian Rail Track Corporation (ARTC) will make a capital contribution of 50 percent of the upfront cost. By way of using this PPP structure, Government will also be able to manage risk by withholding availability payments[187] to private players until the construction is completed.

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183 https://www.inframationgroup.com/third-group-forming-inland-rail-ppp

184 Inland Rail, Summary of Business Case, accessed from URL: https://1worpv3xudfc4dl40l1hi7fz-wpengine.netdna-ssl.com/wp-content/uploads/2020/07/case-for-inland-rail-2015.pdf

185 Inland Rail Implementation Group Report To The Australian Government, https://1worpv3xudfc4dl40l1hi7fz-wpengine.netdna-ssl.com/wp-content/uploads/2020/07/business-case-2015.pdf

186 https://inlandrail.artc.com.au/inland-rail-public-private-partnership-one-step-closer/

187 Gowrie to Kagaru Public Private Partnership (PPP) Project Fact Sheet https://1worpv3xudfc4dl40l1hi7fz-wpengine.netdna-ssl.com/wp-content/uploads/2020/07/ppp-fact-sheet.pdf

Source: Report "The Case for Inland Rail – Summary of the 2015 Business Case" accessed from the URL: https://1worpv3xudfc4dl4011hi7fz-wpengine.netdna-ssl.com/wp-content/uploads/2020/07/case-for-inland-rail-2015.pdf

2. **Exploring off-balance sheet financing for funding expressways in India**
   National Highways Authority of India (NHAI) is envisaging an innovative way of financing greenfield expressways by leveraging institutional financing coupled with asset monetization.

Box 23: Exploring off-balance sheet financing

The Delhi-Vadodara-Mumbai Expressway is conceived as a 1320 km[188] greenfield project under the *Bharatmala Pariyojna*. The existing Delhi-Mumbai National Corridor (NH-8 section of the Golden Quadrilateral) is one of the busiest and most critical routes of the national highways network, witnessing an average traffic of more than 80,000 PCUs per day. Considering the present traffic scenario, it was decided to develop the expressway which would create seamless connectivity between Delhi and Mumbai and improve the efficiency of this highly trafficked National Corridor.

This would be the longest expressway in the country once constructed. The estimated project cost of the expressway is pegged at INR 90,000 crore and is one of the largest linear infrastructure projects in the country. The project is primarily being developed through EPC mode wherein NHAI, the implementing agency, is arranging funds through various sources. Given the already stretched position of NHAI's balance sheet and over reliance on borrowings in the past, NHAI is envisaging off-balance sheet financing. This is illustrated in the figure below.

Figure 21-14: Off balance sheet financing mechanism

Given the greenfield nature of projects, many investors shy away from investing in such projects. This problem is being addressed by a creative financing mechanism[189]. During the construction phase, institutional investors can fund such projects in return of defined annuity payments. Further, once the asset gets operational and there are steady cashflows, the asset can be monetized to repay the investors. This innovative means of financing can

[188] Source: PIB Note, Ministry of Road Transport & Highways, 08 MAR 2019 accessed from the URL: https://pib.gov.in/PressReleasePage.aspx?PRID=1568385
[189] https://www.livemint.com/news/india/nhai-seeks-to-raise-85-000-crore-via-asset-monetization-by-fy25-1567704201940.html

be used to fund large scale greenfield projects which are commercially viable over a longer time horizon.

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21.14.1.5. Potential Sources of Funding for DFCs

Given the considerations discussed in the previous sub-section, potential sources of funds for DFC projects that may be explored by IR are presented in the **Table 21-29** below.

Table 21-29: Potential Funding sources: Dedicated Freight Corridor

Parameter	Rank (High, Medium, Low)	Remarks	Potential Sources of financing
Private sector investments			
Commercial viability	Medium to High	• IRRs as per the preliminary studies indicate viable projects	PPP Annuity/ Hybrid Annuity Model
Environment conduciveness	Low	• Greenfield construction risk • Traffic risk • Regulatory risk	
Precedence	Low	• In India, there have been fewer PPPs in rail track infrastructure. However, there have been significant number of PPPs in other sectors such as roads, power, etc. • Globally, there are examples of asset creation by private	

Parameter	Rank (High, Medium, Low)	Remarks	Potential Sources of financing
		players (e.g. USA) wherein majority of freight track infrastructure is developed and operated by private players	
Monetization potential	Medium to High	• DFCs would have a good monetization potential once the track access regime is put in place	Off-balance sheet financing to fund upfront cost and then asset monetization
Public sector investments			
Capital requirement	High	• Upfront capital requirement is high and hence government's ability to fund these projects though GBS would be low	MFI financing
Economic benefits (social and environment)	Medium to High	• As per the preliminary studies, DFCs would be economically viable by way of bringing in logistics efficiency, reducing environmental externalities and economic development. Hence, DFC projects would be amenable to strategic investors or MFIs. • Economic analysis would need to be carried out to ascertain if the economic benefits outweigh the economic costs.	

Given the capital-intensive and greenfield nature of DFC projects and lack of precedence, it is understood from various stakeholder consultations, that it would be difficult to tap in private sector investments upfront for construction of these projects. The recommended financing options would, therefore, be a combination of leveraging private capital as well as borrowings and is discussed as follows:

PPP (Annuity based) to fund DFCs: PPPs for funding DFC network is at very nascent stage and is currently being explored wherein a part of Eastern DFC, Sonnagar to Dankuni, is envisaged to be developed on PPP Annuity Mode. As per the economic and financial analysis given in the PETS report, the upcoming corridors appear to be financially viable. The two possible options for developing DFC projects on PPPs are: (a) DBFMT, and (b) DBFMT-Annuity (discussed in **ANNEXURE 21.11:**).

One key input from various stakeholder consultations carried out by the study team is that investors could be wary of investing in such large greenfield projects in Indian rail sector due to high risk perceptions. A DBFMT Model would generally pass on the traffic risk to the concessionaire. Given the nature of the project, of a dedicated freight only line, the investors will need certainty on traffic before making investment decisions.

In light of this, a DBFMT-Annuity model which addresses the traffic risk issue could be a more feasible option.

It is evident from the budgetary allocations, over the past few years, that gross budgetary support is limited, and may not be available to fund large investment projects such as DFCs. Although the private capital may be more expensive than public capital, it could be relevant to fund DFCs through private capital by leveraging PPP instruments such as Annuity or Hybrid Annuity models. Larger projects are inherently complex and private players can add value by bringing in efficiencies in construction as well as operations and maintenance. The higher funding cost of private players can also be partially offset by the efficiency gains brought in by them.

Off-balance sheet financing: Off-balance sheet financing, as explained earlier, could also be leveraged to fund commercially viable greenfield projects such as DFCs. Institutional investors can fund the initial construction cost (potentially by passing on the construction risk to the government entity) and once the assets are operational, they can be monetized to repay the investors.

Asset monetization: Another option which can be explored by IR and DFCCIL is to monetise the existing DFC networks once they become operational and start generating a steady stream of revenues. This is because once key risks such as traffic allocation, TAC regime etc. are addressed, given the potential viability of DFC networks, the private sector may be interested to invest in such assets. IR and DFCCIL could use such opportunity to explore options like InvITs to bring in large institutional investors. As the asset gets monetized, the debt of projects could be repaid, and the freed-up equity can be used to fund additional such projects.

21.14.2.High Speed Rail (HSR)

21.14.2.1. Financing Requirements for HSRs

As mentioned in the earlier sections of this Report, twelve High Speed Rail (HSR) projects have been identified as part of NRP, which are in addition to the ongoing HSR project (Mumbai - Ahmedabad). The project details and the phasing assumptions of these HSRs are given in **ANNEXURE 21.12:**. The investments required for the proposed HSR corridors are presented in the **Table 21-30** below:

Table 21-30: HSR Financing Requirement as per NRP (Figures in INR crores)

Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032 - 2041	2042 – 2051	Total [190]
Delhi Varanasi via Ayodhya	17,100	17,100	17,100	17,100	17,100	17,100	17,100	17,100	17,100	8,550	0	0	1,71,00 0
Varanasi to Patna	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	2,500	0	0	50,000
Patna to Kolkata	10,600	10,600	10,600	10,600	10,600	10,600	10,600	10,600	10,600	5,300	0	0	1,06,00 0
Delhi Udaipur Ahmedabad	17,720	17,720	17,720	17,720	17,720	17,720	17,720	17,720	17,720	8,860	0	0	1,77,20 0
Hyderabad to Bangalore	0	1,236	2,472	3,708	4,944	6,180	7,416	8,652	9,888	11,124	67,980	0	1,23,60 0
Nagpur to Varanasi	0	1,710	3,420	5,130	6,840	8,550	10,260	11,970	13,680	15,390	94,050	0	1,71,00 0
Mumbai to Nagpur	0	0	0	0	0	0	0	0	0	0	71,010	86,790	1,57,80 0
Mumbai to Hyderabad	0	0	0	0	0	0	0	0	0	0	63,810	77,990	1,41,80 0
Patna to Guwahati	0	0	0	0	0	0	0	0	0	0	76,500	93,500	1,70,00 0

190 Technical consultants have assumed some investment in FY2021 of INR 25,210 crore. The figure is summation of investments required for the period FY21-FY51

Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032 - 2041	2042 – 2051	Total [190]
Delhi to Amritsar via Chandigarh	0	0	0	0	0	0	0	0	0	0	43,650	53,350	97,000
Amritsar - Pathankot - Jammu	0	0	0	0	0	0	0	0	0	0	17,100	20,900	38,000
Chennai to Mysuru via Bangalore	0	0	0	0	0	0	0	0	0	0	41,580	50,820	92,400
Total	**50,420**	**53,366**	**56,312**	**59,258**	**62,204**	**65,150**	**68,096**	**71,042**	**73,988**	**51,724**	**4,75,680**	**3,83,350**	**14,95,800**

Source: Consultants' Analyses[191]

The above cost is inclusive of all cost elements of HSR development such as track infrastructure, passenger stations, systems and rolling stock.

21.14.2.2. Existing financing pattern for HSRs

The first HSR project[192] in the country, the Mumbai-Ahmedabad High Speed Rail (HSR) Corridor, is being executed by National High-Speed Rail Corporation Limited (NHSRCL), an SPV set up with an objective to finance, construct, maintain and manage the High Speed Rail Corridor in India. NHSRCL has equity participation[193] from Central Government through Ministry of Railways and two State Governments viz. Government of Gujarat and Government of Maharashtra. The estimated project cost of Mumbai-Ahmedabad HSR Corridor is INR 1,08,000[194] crore which includes the cost of track infrastructure, depot and the rolling stock. The project is predominantly funded by a loan from Government of Japan, details[195] of which are given below:

[191] The phasing of investments over the years is as per the inputs received from technical consultant
[192] https://pib.gov.in/PressReleseDetailm.aspx?PRID=1605231
[193] https://www.nhsrcl.in/en/about-us/about-nhsrcls
[194] https://pib.gov.in/PressReleseDetail.aspx?PRID=1513314
[195] https://www.thehindubusinessline.com/economy/logistics/japan-hands-out-sweet-deal-for-bullet-trainbeats-expectations-on-soft-loan-terms/article7980794.ece

- Loan Amount = 81 percent of the project cost
- Rate of interest = 0.1 percent per annum. The given loan is a tied loan with certain pre-conditions on mandatory procurement of certain goods and works from Japan. Further, it is envisaged that the effective rate of borrowing would be in the range of 4-5 percent per annum including the cost of hedging[196].
- Repayment period = 50 years

Given the tail ended revenue profile, a moratorium of 15 years has been provided. It is envisaged that there will be enough ridership by the time debt repayment starts[197]. Other than the loan, the remaining cost for the HSR project would be borne by the states of Gujarat and Maharashtra in the form of land acquisitions for the project.[198]

Funding of HSR projects: Internationally, funding of HSR projects has been a major challenge[199] for government authorities. Given the scale of investments, HSR projects are not self-funding for the private sector players. Revenue from operations may be able to cover the cost of operations and maintenance but generally would not be able to fully cover the cost of construction of the HSR network. In China, where 38,000 km length of HSR network has been constructed, majority of the lines are barely[200] able to cover the cost of operations and maintenance.

Internationally, a majority of the HSR corridors have been funded through government/ public support with very few precedence of PPPs in such projects. The **Table 21-31** below captures the nature of funding sources for HSR projects across various countries.

Table 21-31: Funding pattern of HSR projects

Country	Nature of Funding	Remarks
China	Public	China's HSR has been funded through public investment from a combination of the equity contribution from MOR/CRC and local governments, bank loans taken by the JVs (mostly from

[196] https://www.livemint.com/Politics/AXIyUTEJaxNtX0Yv7npPiO/Is-Japans-bullet-train-loan-the-best-deal-India-has-ever-ha.html
[197] https://www.thehindubusinessline.com/economy/logistics/japan-hands-out-sweet-deal-for-bullet-trainbeats-expectations-on-soft-loan-terms/article7980794.ece
[198] https://www.financialexpress.com/infrastructure/railways/ahmedabad-mumbai-bullet-train-project-a-new-hurdle-for-the-countrys-first-high-speed-rail-corridor-details/2011317/
[199] Source: Preston J. (2013). "The Economics of Investment in High Speed Rail". OECD. United Kingdom. https://www.itf-oecd.org/sites/default/files/docs/dp201330.pdf
[200] Source: Lawrence, Martha, Richard Bullock, and Ziming Liu. 2019. China's High-Speed Rail Development. International Development in Focus. Washington, DC: World Bank. doi:10.1596/978-1-4648-1425-9, http://documents1.worldbank.org/curated/en/933411559841476316/pdf/Chinas-High-Speed-Rail-Development.pdf

Country	Nature of Funding	Remarks
		the major national and provincial development banks), and the central budget.[201]
Spain	Public	One of the earliest adopters of HSR projects in the world, Spain has invested over 60 USD[202] billion in its network. Further, Spain has received contribution from EU of about 17 billion USD in the form of grants and interest free loans to improve the network.
Japan	Initial Public funding	Japan was the first nation to develop HSR project in the world with borrowings by the National Government and Japan National Railway (JNR)[203] along with contributions from the World Bank. Historically, the HSR networks have been funded through (a) JNR funds by Japanese state (66.7 percent) and (b) local governments (33.3 percent). Since the privatization of HSR in 1987, a construction company "Japan Railway Construction Company" has been created to develop additional HSR lines. These lines are then given to private operating companies on usage fee basis.
France	Public + Some PPPs	HSR projects, till 1997, had primarily been funded by the National Government through bank borrowings. Over the years, funding pattern has evolved and now the HSR projects are funded through a variety of sources[203] including national government, regional governments, RFF (Réseau Ferré de France – the infrastructure manager), SNCF (French National Railway Company) and the European Union. France is the first European country to use PPPs as a mode of financing the HSR projects. There are two PPP models[204] for HSR development: (a) the partnership model and (b) the concession model. Even in the PPP projects, there has been significant reliance on public investments.

[201] Source: Lawrence, Martha, Richard Bullock, and Ziming Liu. 2019. China's High-Speed Rail Development. International Development in Focus. Washington, DC: World Bank. doi:10.1596/978-1-4648-1425-9, http://documents1.worldbank.org/curated/en/933411559841476316/pdf/Chinas-High-Speed-Rail-Development.pdf

[202] https://www.fresnobee.com/news/local/high-speed-rail/article36319920.html

[203] Rutzen B & Walton C. (2011). "High Speed Rail: A Study of International Best Practices and Identification of Opportunities in the U.S. Center for Transportation Research. Austin. https://static.tti.tamu.edu/swutc.tamu.edu/publications/technicalreports/476660-00071-1.pdf

[204] Lawrence, Martha; Ollivier, Gerald. 2015. Attracting Capital for Railway Development in China. World Bank, Washington, DC. © World Bank. URL: https://ppiaf.org/sites/ppiaf.org/files/documents/toolkits/railways_toolkit/PDFs/RR%20Toolkit%20EN%20New%202017%2012%2027%20CASE14%20SNCF.pdf

21.14.2.3. Project Features of HSR projects

From an investment perspective, the key features of HSR projects are as follows:

1. **Project Size:** HSR investments are capital intensive and the average size of the HSR projects proposed under NRP is INR ~62,000 crore with project size varying between INR ~20,000 crore and INR ~90,000 crore. An HSR system involves different cost elements including infrastructure and construction cost, rolling stock cost and operations and maintenance cost. Given the fact that the proposed HSR system would be a standalone system and bifurcated from the existing rail network, the project would require greenfield construction often requiring elements such as elevated structures and tunnels.
2. **Customers:** It is envisaged that HSRs would provide distinct and premium service offerings and the customer profile could be very much similar to the airline sector. It has been observed worldwide that business travelers appear to be the main beneficiaries of HSR given the time savings offered by HSR services.
   The sources of HSR traffic may vary from route to route and would depend on a variety of factors such as commercial profile of the regions being connected, population density, passengers' ability to pay, and competition from other modes on various grounds such as fare, journey time and quality of service, etc.[205]
   Data from the existing HSR corridors in Europe suggests that around 30 percent of HSR traffic is derived from the existing air market, 30 percent from conventional rail, 15 percent from road (mainly car) and 25 percent is assumed to be generated traffic[206]. From India's perspective, abstraction of traffic from modes such as conventional rail and road would be necessitated because the bulk of passenger traffic lies in these segments.
3. **Revenue:** The two main sources of revenues for the HSR project would be (a) farebox revenue; and (b) non-farebox revenue.

- **Farebox revenue** would be a function of the ticket prices and the ridership. Setting the optimal ticket prices would be crucial to the financial sustainability of the HSR project. Pricing would in turn be influenced by cost of operations, competing mode price structure, perceived value of HSR service and the ability and willingness to pay by passengers.

Box 24: Potential Pricing Strategies for HSR

Some of the potential pricing strategies for HSR passenger offerings include:

[205] The most successful HSR routes share some common characteristics in that they: • Connect large cities • Have stations located close to population and economic centers • Are the optimal distance apart to be competitive against road and air travel • Deliver a fast average speed (fewer intermediate stops, clear paths) • Have commercial freedom to maximize profit rather than passenger volume https://www.lek.com/sites/default/files/insights/pdf-attachments/2109-High-Speed-Rail-Profitability.pdf

[206] Source: Preston J. (2013). "The Economics of Investment in High Speed Rail". OECD. United Kingdom. https://www.itf-oecd.org/sites/default/files/docs/dp201330.pdf

- **Volume maximisation strategy:** A low cost service offering resulting in high volume of passengers and augmenting revenues through non-farebox sources (catering, advertisement, value added services, etc.)
- **Volume driven differentiated offering strategy:** A high-capacity and a multi class service offering and the economy class priced in a manner to drive the volume.
- **Price maximization strategy:** A premium and low capacity offering aimed at time-sensitive customers (mostly business travelers) at higher prices
- **Price driven differentiated offering strategy** – A premium multi class offering with differentiated services and aimed at premium customers (both business and leisure travelers)

- **Non-farebox revenue:** Non-farebox revenue comprises revenues accruing from allied activities such as real estate development, leasing and advertising. Given the huge initial capital outlay, non-fare box revenues would be critical to create supplementary revenue potential for HSR projects.

4. **Financial and Economic Returns of HSR:** Upfront financing costs are extremely important for HSR, owing to the vast amounts of construction capital required compared to operating costs. The pre-feasibility study conducted for Mumbai-Ahmedabad HSR project indicated an initial traffic estimate of 12 million passengers per annum (in year 2021) and a financial rate of return (FIRR) of 12.8 percent[207]. However, it has been evaluated that this estimation of 12.8 percent of FIRR could be affected by an appraisal optimism[208].
HSR projects, being capital intensive in nature, take years to recover the initial investment from operations. For commercial viability of the project, the two most important levers are (a) ridership level, and (b) fare structure.

   Globally, it is difficult to find an example of a successful self-funding HSR project. Most of the HSR lines require public subsidy in the form of grants or availability

[207] (Systra, RITES, & Italferr, 2010); Accessed from article -Dedicated High Speed Rail Network in India: Issues in Development, G Raghuram, Prashanth D Udayakumar, W.P. No. 2016-03-58, March 2016, URL: https://web.iima.ac.in/assets/snippets/workingpaperpdf/10701585992016-03-58.pdf
[208] Preston's Paper: https://www.itf-oecd.org/sites/default/files/docs/dp201330.pdf

payments for financial sustainability. The **Table 21-32**[209] below presents the economic and financial returns of some HSR projects:

Table 21-32: Economic and Financial Returns of HSR projects globally

Country/ Region	Economic IRR	Financial IRR
China High Speed Rail	8%	6%[210]
France High Speed Rail[211]	10.14% (average)	5.42% (average)
Atlantic	*12.0%*	*7.0%*
North Europe	*5.0%*	*3.0%*
Paris Interconnection	*15.0%*	*6.9%*
Rhone Alps	*10.6%*	*6.1%*
Mediterannean	*8.1%*	*4.1%*

Evidence from China High Speed Rail projects indicates that except few HSR lines, majority of the HSR lines are unable to even pay for debt servicing[212]. This is further illustrated in the figure below.

Figure 21-15: Sustainability of China's High-Speed Rail

Majority of the HSR projects have been funded on principles of adding economic benefit to the society in the form of (a) time savings, (b) low carbon emission benefits, (c) employment generation, and (b) regional benefits.

5. **Project Risks:** Risks pertaining to the line projects tend to be common and have been discussed earlier in this report.

[209] Due to limited availability of data, the list is not an exhaustive list
[210] http://documents1.worldbank.org/curated/en/933411559841476316/pdf/Chinas-High-Speed-Rail-Development.pdf ; Page 20/ 101
[211] Ex-post returns. Source: Crozet, Yves (2013) High Speed Rail Performance in France accessed from the article "The Economics of Investment in High Speed Rail", URL: https://www.itf-oecd.org/sites/default/files/docs/dp201330.pdf
[212] Source: Lawrence, Martha, Richard Bullock, and Ziming Liu. 2019. China's High-Speed Rail Development. International Development in Focus. Washington, DC: World Bank. doi:10.1596/978-1-4648-1425-9, http://documents1.worldbank.org/curated/en/933411559841476316/pdf/Chinas-High-Speed-Rail-Development.pdf

21.14.2.4. International/ Other Sector Financing Examples for HSR

The origin of HSR dates to 1964 with the Tokaido Shinkansen in Japan with first high speed rail train operations at operating speed of 250 kmph. This was followed by European countries such as Italy (1977), France (1981), Germany (1991) and Spain (1992). China, which had its first line opened in 2007, has expanded its network rapidly and has the largest HSR network in the world. The list of top 10 countries with the longest HSR network in the world is shown in **Table 21-33** below.

Table 21-33: High Speed Rail Corridor - Top 10 countries

Country	Operations (km)	Lines under construction (km)	Approved (km)	Total length (km)	Max speed (km/h)
China	26,869	10,738	1,268	38,875	350
Spain	3,100	1,800	0	4,900	310
Japan	3,041	402	194	3,637	320
France	3,220	125	0	3,345	320
Germany	3,038	330	0	3,368	300
Sweden	1,706	11	0	1,717	205
UK	1,377	230	320	1,927	300
South Korea	1,104	376	49	1,529	305
Italy	999	116	0	1,115	300
Turkey	802	1,208	1,127	3,137	300

Source: Fact Sheet, High Speed Rail Development Worldwide[213]

The study team has examined a few relevant case studies which could provide key takeways vis-à-vis financing of HSR. These include (a) China's experience of financing HSR projects, (b) Financing of Barcelona-Madrid High Speed Rail Line, and (c) Financing of HSR project through PPP in France.

1. **China's experience of financing HSR projects**

China has used public sector investments such as equity from budgetary resources, borrowings and construction bonds to finance HSR projects.

Box 25: China's story of financing HSR projects

China has expanded its HSR network rapidly over the last fifteen years due to generous funding from the Chinese government. A massive sum of 370 billion USD was invested in the HSR network between 2005 and 2015. This was financed from a combination of the equity contribution from MOR/CRC and local governments, bank loans taken by the JVs (mostly from the major national and provincial development banks), central budget, and construction bonds of various types to finance the MOR/ CRC equity contribution. Local provincial government also play a key role as they contribute land acquisition and resettlement, provide support for material supply, facilities, and relief from local taxes.

[213] (2018), Fact Sheet, High Speed Rail Development Worldwide, EESI, https://www.eesi.org/files/FactSheet_High_Speed_Rail_Worldwide.pdf

The financial rate of return for the network at the end of 2015 is estimated at 6 percent while the economic rate of return is estimated at 8 percent. Financial sustainability of HSR lines differ significantly as few lines can cover for their cost of operations, maintenance and debt servicing and many lines are barely able to cover for their cost of operations.

Given the extensive reliance on public investments for funding of HSR, the focus is shifting towards tapping private sector investments through promoting structures such as sole proprietorship and joint ventures, as well as the ownership and management rights. There have been few success stories – (1) Hangzhou to Taizhou is the first HSR line financed over 51 percent by private capital, and (2) Jinan to Qingdao is the first HSR line based on local government capital.

Source: China's High Speed Rail Development, World Bank, accessed from http://documents1.worldbank.org/curated/en/933411559841476316/pdf/Chinas-High-Speed-Rail-Development.pdf

2. **Financing of Barcelona-Madrid High Speed Rail Line**

The Barcelona-Madrid High Speed Rail line has been funded through contributions from Spanish Government and Regional Transport Funds (EU Cohesion and TEN-T).

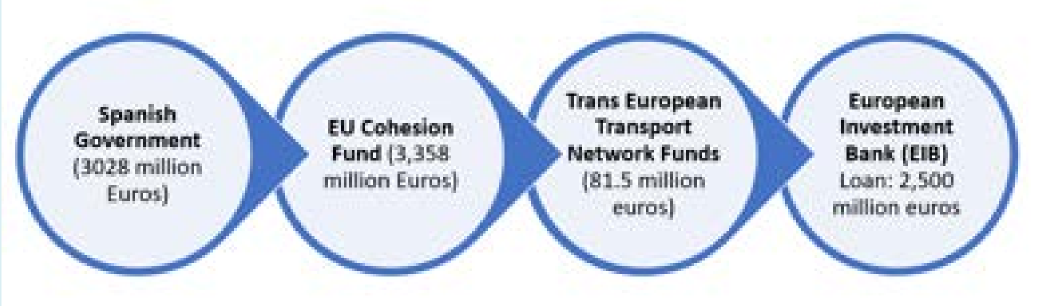
Box 26: Financing of Barcelona-Madrid High Speed Rail Line

The Barcelona-Madrid line is 804 km long and is the busiest route in Spain. The purpose of this project was to strengthen the connection between two main cities in Spain (Madrid and Barcelona) and to improve the connections with France and Europe.

Key features of the project are:

- Type – High Speed Rail
- Length – 804 km
- Speed – 350 kmph
- Authority – RENFE (Infrastructure owner – ADIF AV, Train operations – RENFE Operator. (*RENFE, ADIF AV and RENFE OPERATOR are state-owned companies controlled by the Ministry of Development*)
- Completed – Jan 2013
- Estimated investment – Euro 8,967 million

The project has been sponsored by Spanish Government with additional support from transport funding programs available within the EU region.



The contractual framework of the project is a public funded project executed through specialized contractors for construction and implementation of the HSR project. The project was divided into several sections (~100) wherein more than 40 companies provided their services.

Source: Compilation from http://www.adifaltavelocidad.es/es_ES/infraestructuras/lineas_de_alta_velocidad/madrid_barcelona_frontera_francesa/madrid_barcelona_frontera_francesa.shtml & http://www.mega-project.eu/assets/exp/resources/High_Speed_Rail-Madrid-Barcelona-French-frontier.pdf

3. **Financing of HSR project on PPP in France**

The PPP structure of an HSR project in France needed to be supported with a significant grant support (~50 percent of project cost) to the concessionaire in order to make the project viable.

Box 27: Financing of HSR project on PPP in France.

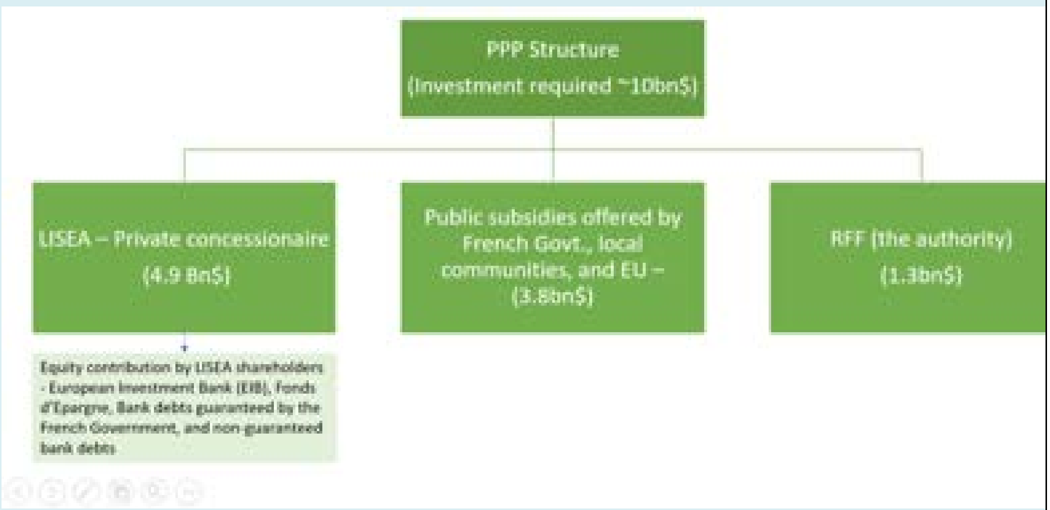
The Tours-Bordeaux High-Speed Rail line was built through a 50-year concession contract, the largest of its kind. The concession contract includes financing, design, construction, operation, and maintenance of the project for 50 years.

Key features of the project are:

- Type – High Speed Rail
- Length – 302 km high-speed line and 38km connecting lines to the existing rail network along the corridor
- Speed – 320 kmph
- Authority - Réseau Ferré de France (RFF)
- Concession Contractor - LISEA (A company promoted by VINCI). LISEA is owned by VINCI (33.4 percent), CDC Infrastructure (25.4 percent), SOJAS (22 percent), and AXA Private Equity (19.2 percent).
- Award – 2011
- Completed – Early 2017
- Estimated investment - $10.06 bn
- The new HSR line was envisaged to free up the existing Tours-Bordeaux line for more freight and regional express train traffic.

The Tours-Bordeaux High-Speed Rail Project (Estimated project cost – $10.06 bn) is funded through a public-private partnership (PPP). LISEA, the Concessionaire, was responsible for financing USD 4.9bn) of the project cost. Sources for LISEA's financing include equity contribution by LISEA shareholders, the European Investment Bank (EIB), Fonds d'Epargne, bank debts guaranteed by the French Government, and non-guaranteed bank debts.

Public subsidies offered by the French Government, local communities, and the EU amount to nearly €3bn ($3.8bn), and RFF, the French Rail authority, invested €1bn ($1.3bn) in the project



Approximately, 50 percent of the total project cost has been borne through public subsidies and grants from the sponsoring authority (RFF).

Source: Compilation from https://www.railway-technology.com/projects/toursbordeaux-high-speed-rail/ & "The Economics of Investment in High Speed Rail by John Preston, OECD, 2013" https://ppiaf.org/ppiaf/sites/ppiaf.org/files/documents/toolkits/railways_toolkit/PDFs/RR%20Toolkit%20EN%20New%202017%2012%2027%20CASE14%20SNCF.pdf

21.14.2.5. Potential Sources of Funding for HSRs

Given the considerations discussed in relation to HSR financing, potential sources of funds that may be explored by IR are presented in the **Table 21-34** below.

Table 21-34: Funding sources: High Speed Rail

Parameter	Rank (High, Medium, Low)	Remarks	Potential Sources of funds
Private sector investments			
Commercial viability	Low	• High upfront capital requirement, private sector may not be amenable to fund • IRRs – typically low	Private sector funding can be explored during post-construction period through PPPs in train operations including Rolling Stock ownership
Environment conduciveness	Low	• In India, High speed rail is in nascent stage and the business model is yet to be seen. • Greenfield construction risk	

Parameter	Rank (High, Medium, Low)	Remarks	Potential Sources of funds
		• Traffic risk • Regulatory risk	and operations and station operations
Precedence	Low	• Globally, there are very limited examples of PPPs in High Speed Rail. Even the projects which are funded through PPPs have significant contributions from the government in the form of grants/ subsidies/ loans	
Monetization potential	Medium to low	• To be ascertained once the assets are operational. However, it is possible that infrastructure (track as well as stations) could be monetized (Instruments such as Toll Operate Transfer (TOTs) have been used in roads sector to monetize highway assets and secure upfront capital)	Could be explored based on viability of the project
Public sector investments			
Capital requirement	High	• Upfront capital requirement is high	MFI financing with favorable terms (i.e. low interest rates, longer moratorium periods) Support from GoI and States Revenue enhancement measures – (a) Station monetization, and (b) Land Value Capture
Economic benefits (social and environment)	Medium	• International examples suggest that majority of the HSR projects have been funded on grounds of economic viability rather than purely on financial viability • Economic analysis would need to be carried out to ascertain if the economic benefits outweigh the economic costs • It is envisaged that the benefits of High-Speed Rail would trickle down to the participating states in the form of economic and social development.	

HSR projects, world over, are capital intensive and require fiscal support due to high capital cost of construction and rolling stock. Given the considerations discussed above, possible financing options for such projects are discussed as follows:

- **Private capital to fund rolling stock:** Given the high upfront capital requirement and the likely low IRRs, private sector may not be amenable to funding the complete HSR project. However, once the infrastructure is created, train operations can be provided by private players on PPP basis, as has been the case in other countries.
- **Public capital or borrowings to fund infrastructure (track infrastructure + depot + stations):** It may not be feasible to fund these projects solely from GBS as the financing requirements are very high and hence the likely source of funds could include:
  - **Extra-budgetary resources** (institutional financing) through MFIs need to be explored to fund HSR projects. As the revenue profile of HSR projects are tail ended, it is also important that the financing comes at favorable terms (i.e. low interest rates, longer moratorium periods), else the financing costs will be extremely high and may become a financial burden. Also, apart from providing capital, MFIs add significant value to the project by means of bringing in compliance measures in project appraisal as well as project execution.
  - **Support from GoI and States:** The projects may be considered as a separate business unit (like an SPV) from financing perspective and potentially funded through central government support. This may be done through direct/ indirect levies.

  It is also envisaged that the benefits of High-Speed Rail would trickle down to the participating states. Hence, states should be encouraged to provide financial support in funding these projects by way of equity contribution and/ or financing land acquisition. There are examples from China[214] and Japan wherein provincial governments have supported the central government in financing High Speed Rail Projects.

- **Revenue enhancement measures:** Apart from funding requirements, it is also important to look at measures which could increase the financial sustainability of HSR projects. Some of the key revenue enhancement measures are as follows:
  - **Land Value Capture:** As HSR lines are developed, it would bring development in the vicinity of key HSR stations. Globally, there are examples[215] of

[214] Source: Lawrence, Martha, Richard Bullock, and Ziming Liu. 2019. China's High-Speed Rail Development. International Development in Focus. Washington, DC: World Bank. doi:10.1596/978-1-4648-1425-9, (Page 35/101) http://documents1.worldbank.org/curated/en/933411559841476316/pdf/Chinas-High-Speed-Rail-Development.pdf

[215] Case Study (Tokyu Corporation), Japan: https://ppiaf.org/ppiaf/sites/ppiaf.org/files/documents/toolkits/railways_toolkit/PDFs/RR%20Toolkit%20EN%20New%202017%2012%2027%20CASE16%20TOKYU.pdf
Case Study (London King's Cross), UK: https://ppiaf.org/ppiaf/sites/ppiaf.org/files/documents/toolkits/railways_toolkit/PDFs/RR%20Toolkit%20EN%20New%202017%2012%2027%20CASE16%20TOKYU.pdf

development of megaregions around the HSR stations with emergence of key commercial, residential, institutional or cultural centres. Investment in HSR is likely to bring in an appreciation in value of the property prices around the HSR stations. Ministry of Housing and Urban Affairs (MoHUA) has already released a Value Capture Policy Framework (VCPF). Various land value capture tools (Property tax, Betterment charges, Tax increment financing, etc.) are available and should be leveraged to help augment the revenues of HSR projects.

- **Non-farebox revenues:** Similar to airports, HSR stations could have a high non-farebox revenue potential. Focus should be given on deriving maximum non-farebox revenues from the stations by way of commercial development, advertisements and value-added services.

21.14.3. Core Track Infrastructure

21.14.3.1. Financing Requirements

Improvement proposals for core track infrastructure (High Density Network (HDN), Highly Utilized Network (HUN) and other lines) have also been identified as a part of this study. There are three categories of projects – (a) doubling/ 3rd line/ 4th line projects; (b) signalling upgradation projects ; and (c) Construction of flyover/ bypasses. The investment required is presented in the **Table 21-35** below:

Table 21-35: Core track infrastructure financing requirement (Figures in INR crores)

Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032 - 2041	2042 - 2051	Total[216]
Doubling	17,528	25,776	25,776	22,339	17,184	13,747	13,747	13,747	15,375	19,836	2,10,746	1,58,166	5,62,216
Signalling	4,815	4,815	4,815	4,815	2,670	524	524	524	524	603	6,811	6,306	40,157
Flyover/ Bypasses	15,980	15,980	15,980	15,980	7,990	0	0	0	0	0	0	0	79,900
Total	**38,323**	**46,571**	**46,571**	**43,135**	**27,844**	**14,272**	**14,272**	**14,272**	**15,899**	**20,439**	**2,17,557**	**1,64,472**	**6,82,272**

Source: Consultant's Analyses, Future Network Requirements Report

[216] Technical consultants have assumed some investment in FY2021 of INR18,646 crore. The figure is summation of investments required for the period FY21-FY51

21.14.3.2. Existing financing pattern for core track infrastructure

Construction of new/ additional lines, signalling upgradation projects and flyovers/ bypasses are generally financed through a combination of sources:

- Internal accruals,
- Gross-budgetary support,
- Extra-budgetary Resource (EBR)
  - EBR – Bonds
  - EBR – Institutional financing (EBR-IF)
  - EBR – Public Private Partnership

While it is understood that a clear mapping of funding sources to the expenditure heads does not exist, given the low proportion of internal resource generation of IR, it can be inferred that there is significant reliance on gross-budgetary support and extra-budgetary resources (predominantly through IRFC borrowings) for funding of such core track infrastructure projects. The contribution of the three sources of funds to IR's capital outlay is shown in the **Table 21-36** below.

Table 21-36: IR's Capital Outlay (Figures in INR crores)

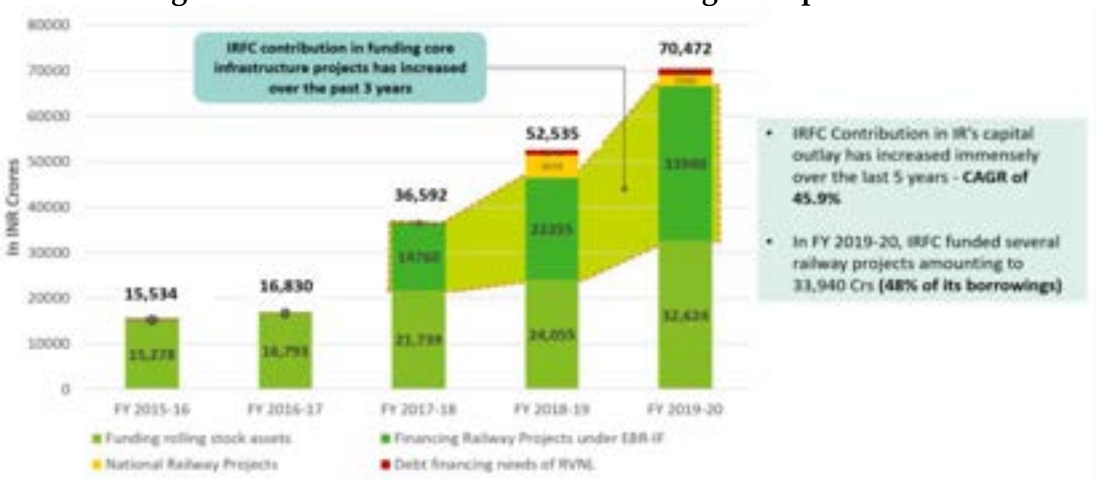
Source	2016-17	2017-18	2018-19	2019-20 (Revised Estimates)
Gross Budgetary Support	45,232 (41.14%)	43,418 (42.6%)	52,838 (39.6%)	68,105 (43.6%)
Extra Budgetary Resources	52,578 (47.83%)	55,498 (54.4%)	75,876 (56.9%)	83,247 (53.2%)
Internal Resources	12,125 (11.03%)	3,070 (3.01%)	4,663 (3.5%)	5,000 (3.2%)
Total Capex	**1,09,935**	**1,01,986**	**1,33,377**	**1,56,352**

Source: Demands for grants (2020-21), Standing committee on Railways, (2020), Railway Board[217]

IRFC, which initially began as a rolling stock investment vehicle of IR, has evolved over time, and is now being leveraged to fund core track infrastructure projects as well.

[217] Accessed from the URL: http://164.100.47.193/lsscommittee/Railways/17_Railways_3.pdf

Figure 21-16: IRFC contribution to funding IR Capex



Source: Consultant's analyses, IRFC Annual Reports

The criteria for the use of EBR-(IF) for core track infrastructure projects requires that the projects have minimum of 10 percent IRR and are approved by a committee headed by AM(Works)[218].

PPPs in Core Track Infrastructure:

Several PPP models have been formulated for funding of track infrastructure projects such as new lines construction and doubling. A policy called "R3I" (Railway's Infrastructure for Industry Initiative - 2010) was introduced to attract private sector participation in rail connectivity projects. Subsequently, "R2CI" Policy (Rail Connectivity to Coal and Iron Ore Mines – 2011) was brought in to bring in private sector investment and improve rail connectivity to coal/ iron ore mines. In 2014, a participative policy replaced the earlier policies and provided for five models as follows:

- Non- govt railway (NGR) private line model;
- Joint venture model;
- BOT model;
- Capacity augmentation with customer funding;
- Capacity augmentation through annuity model

Amongst these five models, only three models have been used for funding rail track infrastructure - (a) Joint-Venture model, (b) NGR model, and (c) Capacity augmentation with customer funding. On the whole, there has been limited success in getting private sector capital for rail line projects, and PPPs in rail have been mostly concentrated in port connectivity and mine (coal/iron ore) connectivity projects mostly on account of strategic importance of such connectivity projects to the investment partners.

218 https://www.indianrailways.gov.in/railwayboard/uploads/directorate/finance_budget/FSCell/guideline%20EBR-IF_7201.pdf

About 3000 km of track infrastructure, with project cost of INR 41,695 Crore, has been created using PPPs. A summary of PPP projects in various stages of implementation is presented in the **Table 21-37** below (details of PPP projects is provided in **ANNEXURE 21.13:**).

Table 21-37: PPPs in Track Infrastructure in India

PPP Models	Length (Kms)	Cost (in INR Cr)
JV	**2,196**	**35,196**
Completed	1,013	6,285
In principal approval	392	10,692
Under implementation	791	18,219
NGR	**369**	**4,031**
Completed	189	1,302
In principal approval	180	2,729
Customer funded	**399**	**2,468**
Completed	241	1,270
Under implementation	158	1,198
Grand Total	**2,964**	**41,695**

Source: Consultants' Analyses, Data received from Railway Board

21.14.3.3. International Experience

Internationally, it has been observed that the ownership and management arrangements for rail infrastructure and rail operations are divided into two segments:

- Below the rail (track infrastructure management)
- Above the rail (train operations/ rolling stock management)

Countries such as the UK, USA and Australia have models where an infrastructure manager (could be public or private) is responsible for development and maintenance of track infrastructure. Above the rail services are provided by various service providers and the infrastructure manager charges a fee, or a "track access charge". This track access charge is used to recover the cost of development and maintenance of track infrastructure.

21.14.3.4. Project Features for Core Track Infrastructure projects

The key features of such projects are as follows:

1. **Project Size:** Compared to DFC and HSR, the average project size in this category is comparatively lower. Each asset category (HDN, HUN, Other lines and Port connectivity projects) has several projects with varying project size depending upon the length of the project section.
2. **Customers:** Given the current structure of IR, both "below the rail" and "above the rail" services are provided by IR. In this arrangement, IR is the customer of the track infrastructure. Private sector players are now being allowed limited participation through ownership of rolling stock, while core train operations continue to remain with IR.

3. **Revenue:** Indian Railways is a vertically integrated rail system wherein the infrastructure management and train operations are both by Indian Railways. There is no direct revenue stream which is currently charged for the core track infrastructure. The revenue can be indirectly attributed to (a) Revenue from passenger services, and (b) Revenue from freight services. With the advent of private train operations, the cost could be compensated directly in the form of "track access charge (TAC)" or "haulage charge for operating private trains". In geographies, where there is a vertical separation, the investment in infrastructure is recovered though the TAC.
4. **Financial and Economic Returns:** Based on the data provided to the study team, the IRRs and revenue features of some of the projects have been presented in the **Table 21-38** below.

Table 21-38: Return profile for core track infrastructure projects

Project Category	Revenue Features	IRR Ranges and Examples
Capacity expansion (doubling/ 3rd line/ 4th line)	• Project IRRs typically in the range of 12-16% • Capacity expansion resulting in improved train operations and cost reduction (by way of avoidance of train detention) • Allowing additional trains to ply, resulting in higher revenues	• Samakhiali Palanpur Section Doubling[219]: **IRR 15.24%** • Raipur – Titlagarh Double Tracking: **FIRR -11.9%, EIRR - 19.5%**[220] • Sambalpur-Titlagarh Double Tracking: **FIRR -13.6%, EIRR - 17.2%**[221] • Angul-Sukhinda New Line Construction – 104 km (PPP project under JV Model): **IRR 13.04%**[222] • Rowghat-Jagdalpur New Line – 140 km (PPP project under JV model): **IRR 13.96%**[222] • Angul-Balram-Jarapada – 64 km (PPP project under JV model): **IRR 13.04%**[222]

[219] (2016), Bankability Study for Doubling, (with RE) of Palanpur – Samakhiali Section, http://www.kutchrail.org/Troma/UploadDocuments/9E8A0QBANKABILITY%20STUDY%20FOR%20RE%20PALANPUR-%20SIOB.pdf
[220] https://www.adb.org/sites/default/files/project-document/64222/36330-02-ind-tacr-01.pdf
[221] (2009), INDIA: Railway Sector Investment Program, Project Number: 36330-02 (Technical Assistance No. 4998), https://www.adb.org/sites/default/files/project-document/64222/36330-02-ind-tacr-01.pdf
[222] Data received from Railway Board

Project Category	Revenue Features	IRR Ranges and Examples
		• Shivpur-Kathautia – 49 km (PPP project under JV model): **IRR 13.47%**[222]
Signalling project (Automatic signaling/ ETCS)	• Enhancing line capacity by facilitating train operations at higher speed and thus resulting in higher revenues. • Reduction in accident costs by way of improving safety	• No reference IRRs available • However, as per the Creative Financing for Indian Railways[223], "signaling projects are viable and would pay for itself given that it will lead to an increase in line capacity"
Flyovers/ Bypasses	• Enhancing line capacity and safety	• No reference IRRs available

Projects proposed under core track infrastructure, as part of NRP, would result in capacity expansion and thus would indirectly lead to higher revenues. Project IRRs would be contingent on specific variables such as construction cost and the resultant traffic on the section. It would be pertinent to take up only those projects which are economically viable, i.e. where the economic benefits outweigh the economic costs.

5. **Project Risks:** Risks pertaining to the line projects tend to be common and have been discussed earlier in this report.

21.14.3.5. Potential sources of funding for Core Track Infrastructure

As mentioned above, India follows a state-owned monopoly model for Railway track infrastructure where both the segments ("Above the rail" and "Below the rail") are provided by a single entity, i.e. Indian Railways. Since it is difficult in such a scenario to segregate revenue from individual projects or even to asses returns for such projects which are part of a larger network, the ideal option for cost recovery of track development and maintenance is through internal accruals generated from the passenger and freight services. However, with the high operating ratio being experienced by IR, it would be challenging to fund such track infrastructure projects through internal accruals.

Given these considerations, some possible sources of funds for such projects that may be explored by IR are presented in the **Table 21-39** below.

[223] (2014), Report of the Committee Creative Financing for Indian Railways, PPP & Infrastructure Division, http://www.gajendrahaldea.in/download/Report-of-the-Committee-on-Creative-Financing-of-Railways.pdf

Table 21-39: Funding sources: Core Track Infrastructure

Parameter	Rank (High, Medium, Low)	Remarks	Potential Sources of funds
Private sector investments			
Commercial viability	Medium	• IRRs in the range of 12-16 percent for doubling projects	PPP (Annuity)/ HAM for doubling projects (HDN, HUN and other lines) PPP (JV/NGR/BOT / Customer funded) for Port Connectivity Projects
Environment conduciveness	Low	• No delineable revenue source: Infrastructure and train operations both with Indian Railways (IR) • Absence of track access regime • Regulatory risk	
Precedence	Low	• Very few PPPs and majority of these are in port connectivity projects	
Monetization potential	Low	• No delineable revenue source	
Public sector investments			
Capital requirement	Medium	• Upfront capital requirement is medium	IRFC Borrowings, Gross Budgetary Support, IDO Support
Economic benefits (social and environment)	Medium to High	• Projects are most likely to be economically viable as these are capacity expansion projects. The current capacity on most of the lines is already saturated and hence these projects would free up the capacity on existing lines and allow more trains to ply • Projects would also have to be looked from an economic point of view as these projects are likely to result in social and economic development • Amenable to strategic investors such as IDOs	

Given the nature of assets and lack of delineable revenue sources, private sector investments may not be amenable for funding of core track infrastructure unless the chosen PPP mode is annuity based. The possible financing options for such projects are discussed as follows:

- **Private capital (through Annuity/ Hybrid annuity-based models) for larger projects:** Since GBS funding is expected to be limited, it becomes pertinent to use it sparingly, and only where no alternatives are available. Although the private capital may be more expensive than public capital, it could still be relevant to fund larger projects through private capital by leveraging PPP instruments such as Annuity or Hybrid Annuity models. Larger projects are inherently complex and private players can add value by bringing in efficiencies in construction as well as operations and maintenance. The higher funding cost of private players can be partially offset by efficiency gains brought in by them. Such funding decisions could be taken by leveraging Value-for-money (VFM) analysis at the project appraisal stage.

- **Leveraging IRFC to fund projects:** It has earlier been suggested in this report that rolling stock can be potentially financed by private players. The rolling stock on the books of IRFC can be then disinvested and proceeds from the disinvestment can be used to fund core track infrastructure projects. Also, once IRFC is freed up from raising capital for leasing of rolling stock, it can be better leveraged to fund necessary track infrastructure. As a measure of fiscal prudence, only those projects should be taken up which are financially viable and can generate enough revenues to repay the borrowings.
- **PPPs to fund port/ mine connectivity projects:** Projects having strategic business interests such as port and mine connectivity projects should be funded through PPPs by leveraging various forms of participative models.
- **Gross budgetary support and MFI financing to fund economically viable projects:** Projects which are economically viable but financially unviable could be funded through gross-budgetary support. Projects with lower investment size could be ideal candidates for GBS financing as these projects would help eliminate several capacity bottlenecks while the burden on government resources would be lower. Projects such as flyovers/ bypasses, which do not have a delineable revenue stream but are important from a capacity expansion perspective, could also be funded through GBS. In addition to GBS, financing from MFIs could be leveraged to fund economically viable projects.
- **Revenue enhancement measures through levy of surcharge on select passengers:** The financial sustainability of IR hinges upon the passenger segment, as the passenger business is currently loss making and cross-subsidized by the freight business. Rationalisation of tariff structure has been highlighted in several committee reports in the past. Cost of freight is already considered high and any further increase will only lead to reduction in traffic numbers. Hence, the only way to reduce the funding deficit would be by rationalizing passenger fares.
    - Drawing parallels from the roads sector, where users are charged a toll fee in lieu of better road conditions, a similar fee or a surcharge can be levied on passengers. On similar lines, concept of station development fee (levy of a usage fee on passengers) is being formulated within Indian Railways to help fund station development projects by way of increasing commercial viability. The said station development fee would be applicable to only those stations which are proposed to be developed.
    - The rationale for such surcharge would be to ensure adequate capital investments are made in track infrastructure projects which are critical for

providing better services by way of improved reliability, better punctuality and reduced journey time. Therefore, wherever such investments are made, a surcharge or "development fee" could be levied on passengers till a period where such investments are recovered. It is understood that increasing passenger fares would require multiple approvals at various levels and may find resistance from various parts of the general public. Accordingly, till the time IR adopts an alternative approach to review passenger fares, in order to ensure minimum burden on passengers and funding for track infrastructure, such surcharge should only be levied on certain specific classes of passengers and only on trains which get direct benefit from such capacity increase.

Chapter 22 WAY FORWARD

22.1. Study Execution Framework

Since, preparation of National Rail Plan (NRP) has commenced and is reaching its logical conclusion. Going forward, action needs to be taken at all levels of governance in Ministry of Railways, other Ministries for playing an important role to advocate the National Rail Plan at all levels of decision making and activate the stakeholders to avail the opportunities and discharge their responsibilities by participating in all Stakeholders' Consultations.

Based on the Traffic Survey Data, Traffic Demand has been forecasted, it has been assigned on the available Rail Network, congested sections have been identified along with potential demand corridors.

Based on the above, Rail Infrastructure Development Proposals along with their respective Phasing have been listed out in detail in the present report.

Cost Estimates have been worked out and total Project Outlay requirement by each of the cardinal years has been listed in **0**.

Based on Cost Estimates, possible funding sources and financing strategies have been listed in **Chapter 21**

For the purpose of giving a logical end to this exercise, Following tasks are required to be organised:

- Draft NRP to be publicised at various Government Levels and discussed with Key Stakeholders for obtaining their observations for Finalisation.
- NRP is dynamic, therefore requires constant updation of data for tweaking the priorities. For this purpose, a dedicated self-sustained cell is required to be established within Railway Board.
- Railway Board Staff is required to be trained for carrying out such updation.
- In the last approval shall be required from Government of India on the Financial Outlays of NRP.

Ministry of Railways
Government of India

National Rail Plan (NRP)-India

Draft Final Report
Volume 2: Annexure
December 2020

ANNEXURE

LIST OF ANNEXURES

ANNEXURE 3.1: Input Data for Commodity Projections

Table A.3.1: GDP growth forecasts

2018	6.98%
2019	7.59%
2020	7.72%
2021	7.30%
2022	6.92%
2023	6.59%
2024	6.32%
2025	6.10%
2026	5.91%
2027	5.74%
2028	5.58%
2029	5.44%
2030	5.30%
2031	5.16%
2032	5.03%
2033	4.91%
2034	4.79%
2035	4.68%
2036	4.56%
2037	4.46%
2038	4.36%
2039	4.26%
2040	4.17%
2041	4.08%
2042	3.99%
2043	3.92%
2044	3.84%
2045	3.77%
2046	3.70%
2047	3.63%
2048	3.56%
2049	3.50%
2050	3.43%

Source: OECD GDP forecasts

Table A.3.2: Population growth forecasts

2018	1.16%
2019	1.14%
2020	1.11%
2021	1.08%
2022	1.05%
2023	1.03%
2024	1.00%
2025	0.97%
2026	0.94%
2027	0.92%
2028	0.89%
2029	0.86%
2030	0.60%
2031	0.23%
2032	0.47%
2033	0.67%
2034	0.64%
2035	0.61%
2036	0.58%
2037	0.54%
2038	0.51%
2039	0.49%
2040	0.46%
2041	0.43%
2042	0.41%
2043	0.38%
2044	0.36%
2045	0.34%
2046	0.32%
2047	0.29%
2048	0.27%
2049	0.25%
2050	0.23%

Source: Food and Agriculture Organisation of United Nations

Table A.3.3: Cement and Lime Index

2006	102.34
2007	118.88
2008	137.66
2009	138.64
2010	149.02
2011	150.84
2012	156.97
2013	168.63
2014	166.98
2015	169.6
2016	173.63
2017	175.48

Source: Office of Economic Advisor, Ministry of Commerce and Industry

Table A.3.4: Coke Price Index

2006	152.7
2007	152.7
2008	155.43
2009	234.4
2010	234.4
2011	233.14
2012	219.3
2013	219.3
2014	219.3
2015	219.3
2016	219.3
2017	219.3

Source: Office of Economic Advisor, Ministry of Commerce and Industry

Table A.3.5: Iron and Steel Index

2006	102.23
2007	111.72
2008	123.22
2009	137.96
2010	129.51
2011	140.73
2012	156.29
2013	166.07
2014	164.53
2015	165.56
2016	154.58
2017	156.27

Source: Office of Economic Advisor, Ministry of Commerce and Industry

Table A.3.6: Merchandise trade as a % of GDP

1961	16.80
1962	16.24
1963	16.49
1964	16.86
1965	16.85
1966	17.11
1967	16.96
1968	17.50
1969	18.04
1970	19.71
1971	19.90
1972	20.31
1973	23.04
1974	29.24
1975	27.33
1976	28.56
1977	28.80
1978	28.37
1979	30.94
1980	34.02
1981	32.67
1982	30.72
1983	29.24
1984	30.18
1985	29.00
1986	26.89
1987	27.95
1988	28.74
1989	29.77
1990	30.09
1991	29.40
1992	29.38
1993	28.96
1994	30.73
1995	32.95
1996	33.84
1997	35.16
1998	34.73
1999	35.62
2000	39.07
2001	37.81
2002	38.03
2003	39.59
2004	42.79
2005	44.98

2006	47.75
2007	48.92
2008	51.44
2009	41.96
2010	46.66
2011	50.25
2012	49.66
2013	49.26
2014	48.08
2015	44.62
2016	42.69
2017	44.48
2018	46.24

Source: World Bank Data Bank

Table A.3.7: Private Final Consumption Expenditure (USD Trillion)

1960	0.12
1961	0.12
1962	0.12
1963	0.13
1964	0.14
1965	0.14
1966	0.14
1967	0.15
1968	0.15
1969	0.16
1970	0.16
1971	0.16
1972	0.17
1973	0.17
1974	0.17
1975	0.18
1976	0.18
1977	0.20
1978	0.21
1979	0.20
1980	0.22
1981	0.23
1982	0.24
1983	0.25
1984	0.26
1985	0.27
1986	0.28
1987	0.29
1988	0.31
1989	0.32
1990	0.34
1991	0.35
1992	0.35
1993	0.37
1994	0.39
1995	0.41
1996	0.44
1997	0.46
1998	0.49
1999	0.52
2000	0.53
2001	0.57
2002	0.58
2003	0.62
2004	0.65

2005	0.70
2006	0.73
2007	0.78
2008	0.82
2009	0.86
2010	0.92
2011	0.99
2012	1.04
2013	1.12
2014	1.19
2015	1.28
2016	1.39
2017	1.49
2018	1.61

Source: World Bank Data Bank

Table A.3.8: Real Interest Rate

1978	10.77
1979	-1.06
1980	4.48
1981	5.12
1982	7.77
1983	7.32
1984	7.95
1985	8.68
1986	9.09
1987	6.56
1988	7.64
1989	7.44
1990	5.27
1991	3.62
1992	9.13
1993	5.81
1994	4.34
1995	5.86
1996	7.79
1997	6.91
1998	5.12
1999	9.19
2000	8.34
2001	8.59
2002	7.91
2003	7.31
2004	4.91
2005	4.86
2006	2.57
2007	5.68
2008	3.77
2009	4.81
2010	-1.98
2011	1.32
2012	2.47
2013	3.87
2014	6.70
2015	7.56
2016	6.35
2017	5.46
2018	5.06

Source: World Bank Data Bank

ANNEXURE 3.2: District wise Commodity

Table A.3.9: District wise coal dispatch data for FY 2018

S. No.	District	State	Production (MTPA)
1	Tinsukia	Assam	0.62
2	Bilaspur	Chhattisgarh	0.07
3	Raigarh	Chhattisgarh	17.07
4	Surguja	Chhattisgarh	10.72
5	Korba	Chhattisgarh	5.62
6	Korba	Chhattisgarh	111.46
7	Surguja	Chhattisgarh	1.27
8	Deoghar	Jharkhand	3.39
9	Dhanbad	Jharkhand	39.43
10	Giridih	Jharkhand	0.78
11	Godda	Jharkhand	15.70
12	Hazaribagh	Jharkhand	16.74
13	Palamu	Jharkhand	2.61
14	Ranchi	Jharkhand	12.25
15	Sahibganj	Jharkhand	0.00
16	Bokaro	Jharkhand	18.76
17	Pakur	Jharkhand	0.41
18	Chatra	Jharkhand	22.44
19	Latehar	Jharkhand	0.28
20	Ramgarh	Jharkhand	1.04
21	Rajouri	J&K	0.01
22	Narsimhapur	Madhya Pradesh	0.00
23	Betul	Madhya Pradesh	3.47
24	Chhindwara	Madhya Pradesh	2.81
25	Shahdol	Madhya Pradesh	15.25
26	Sidhi	Madhya Pradesh	46.01
27	Umaria	Madhya Pradesh	3.10
28	Anuppur	Madhya Pradesh	1.60
29	Singrauli	Madhya Pradesh	22.61
30	Chandrapur	Maharashtra	21.05
31	Nagpur	Maharashtra	14.00
32	Yavatmal	Maharashtra	14.91
33	Anugul	Odisha	87.22
34	Sambalpur	Odisha	0.21
35	Sundargarh	Odisha	17.50
36	Jharsuguda	Odisha	49.76
37	Adilabad	Telangana	16.63
38	Karimnagar	Telangana	22.37
39	Khammam	Telangana	29.83
40	Warangal Rural	Telangana	2.66
41	Sonbhadra	Uttar Pradesh	30.81
42	Bankura	West Bengal	2.31
43	Birbhum	West Bengal	0.44
44	Purba Barddhaman	West Bengal	27.79
45	Puruliya	West Bengal	0.17

Table A.3.10: Coal imports for FY 2018

S. No.	Port	State	Production (MTPA)
1	Appiic Multi Prod Sez Vizag Dc	Andhra Pradesh	0.085
3	Bedi Sea	Gujarat	4.055
4	Bhavnagar	Gujarat	0.599
6	Chennai sea	Tamil Nadu	0.022
7	Cochin sea	Kerala	0.044
8	Dehej sea	Gujarat	6.184
10	Dhamra (Chandbali)	Odisha	12.734
11	Dharmatar sea	Maharashtra	2.029
12	Ennore sea	Tamil Nadu	8.803
13	Gangavaram port	Andhra Pradesh	11.237
14	Hazira port	Gujarat	3.943
15	Hetero infra, nakkapalli	Andhra Pradesh	0.015
20	ICD nagpur	Maharashtra	0.002
23	Jabilant, Kandla Port	Gujarat	0.035
24	Jaigad	Maharashtra	3.057
25	Jakhau	Gujarat	0.054
26	Kakinada sea	Andhra Pradesh	1.041
27	Kandla sea	Gujarat	11.336
28	Karikal	Puducherry	5.154
30	Kolkata sea	West Bengal	9.356
31	Krishnapatnam	Andhra Pradesh	16.21
32	Magdalla port	Gujarat	5.421
33	Marmagoa sea	Goa	10.737
34	Muldwarka	Gujarat	0.102
36	Mumbai sea	Maharashtra	2.458
37	Mundra	Gujarat	14.893
38	Naliya, Bhuj	Gujarat	0.224
39	Navlakhi	Gujarat	2.84
40	New Mangalore sea	Karnataka	5.752
42	Okha	Gujarat	0.696
43	Opgs Gandhidham	Gujarat	0.355
44	Paradip sea	Odisha	15.998
45	Pipavab(Vicyor)	Gujarat	1.105
46	Porbandar	Gujarat	0.085
47	Ramki pharma city india	Andhra Pradesh	0.01
48	Revdanda	Maharashtra	0.31
49	Sez Dahej	Gujarat	0.025
50	Sez Mundra	Gujarat	15.855
51	Tuticorin sea	Tamil Nadu	9.439
52	Visakhapatnam sea	Andhra Pradesh	8.651

Origin	Import (in MT)
Appiic Multi Prod Sez Vizag Dc	0.085
Bangalore Airport	0
Bedi Sea	4.055
Bhavnagar	0.599
Chennai air	0
Chennai sea	0.022
Cochin sea	0.044
Dehej sea	6.184
Delhi air	0
Dhamra(Chandbali)	12.734
Dharmatar sea	2.029
Ennore sea	8.803
Gangavaram port	11.237
Hazira port	3.943
Hetero infra, nakkapalli	0.015
Hyderabad Airport	0
ICD bangalore	0
ICD Bhusawal	0
ICD Garhiharsaru	0
ICD nagpur	0.002
ICD Patli	0
ICD Sabarmati	0
Jabilant , KANDLA	0.035
Jaigad	3.057
Jakhav	0.054
Kakinada sea	1.041
Kandla sea	11.336
Karikal	5.154
Kolkata Air	0
Kolkata sea	9.356
Krishnapatnam	16.21
Magdalla port	5.421
Marmagoa sea	10.737
Muldwarka	0.102
Mumbai air	0
Mumbai sea	2.458
Mundra	14.893
Naliya, Bhuj	0.224
Navlakhi	2.84
Newmangalore sea	5.752
Nhava sheva	0
Okha	0.696
Opgs Gandhidham	0.355
Paradip sea	15.998

Pipavab(Vicyor)	1.105
Porbandar	0.085
Ramki pharma city india	0.01
Revdanda	0.31
Sez Dahej	0.025
Sez Mundra	15.855
Tuticorin sea	9.439
Visakhapatnam sea	8.651

Table A.3.11: Existing and Under- Construction thermal power plants

S.No	Plant	TYPE	DISTRICT	Capacity
1	ANPARA C TPS	Existing	Sonbhadra	1200
2	ANPARA TPS	Existing	Sonbhadra	2630
3	BADARPUR TPS	Existing	Delhi	705
4	BARKHERA TPS	Existing	Pilibhit	90
5	CHHABRA TPP	Existing	Baran	1660
6	DADRI (NCTPP)	Existing	Gautam Buddha Nagar	1820
7	GH TPS (LEH.MOH.)	Existing	Bathinda	920
8	GND TPS(BHATINDA)	Existing	Bathinda	440
9	GOINDWAL SAHIB TPP	Existing	Tarn Taran district	540
10	HARDUAGANJ TPS	Existing	Aligarh	605
11	INDIRA GANDHI STPP	Existing	Jhajjar	1500
12	KALISINDH TPS	Existing	Jhalawar	1200
13	KAWAI TPS	Existing	Baran	1320
14	KHAMBARKHERA TPS	Existing	Aligarh	90
15	KOTA TPS	Existing	Kota	1240
16	KUNDARKI TPS	Existing	Moradabad	90
17	LALITPUR TPS	Existing	Lalitpur	1980
18	MAHATMA GANDHI TPS	Existing	Jhajjar	1320
19	MAQSOODPUR TPS	Existing	Kapurthala	90
20	OBRA TPS	Existing	Sonbhadra	1188
21	PANIPAT TPS	Existing	Panipat	920
22	PANKI TPS	Existing	Kanpur Nagar	210
23	PARICHHA TPS	Existing	Jhansi	1140
24	PRAYAGRAJ TPP	Existing	Allahabad	1980
25	RAJGHAT TPS	Existing	Delhi	135
26	RAJIV GANDHI TPS	Existing	Hisar	1200
27	RAJPURA TPP	Existing	Patiala	1400
28	RIHAND STPS	Existing	Sonbhadra	3000
29	ROPAR TPS	Existing	Rupnagar	1260
30	ROSA TPP Ph-I	Existing	Shahjahanpur	1200
31	SINGRAULI STPS	Existing	Sonbhadra	2000
32	SURATGARH TPS	Existing	Ganganagar	1500
33	TALWANDI SABO TPP	Existing	Mansa	1980
34	TANDA TPS	Existing	Ambedkar Nagar district	440
35	UNCHAHAR TPS	Existing	Rae bareli	1550
36	UTRAULA TPS	Existing	Balrampur	90
37	YAMUNA NAGAR TPS	Existing	Yamunanagar	600
38	AKALTARA TPS	Existing	Janjgir-Champa	1200
39	AMARAVATI TPS	Existing	Amaravati	1350
40	AMARKANTAK EXT TPS	Existing	Anuppur	210
41	ANUPPUR TPP	Existing	Anuppur	1200
42	AVANTHA BHANDAR	Existing	Raigarh	600
43	BALCO TPS	Existing	Korba	600
44	BANDAKHAR TPP	Existing	Korba	300
45	BARADARHA TPS	Existing	Janjgir-Champa	1200
46	BHILAI TPS	Existing	Durg	500
47	BHUSAWAL TPS	Existing	Jalgaon	1210
48	BINA TPS	Existing	Sagar	500
49	BUTIBORI TPP	Existing	Nagpur	600
50	CHANDRAPUR (MAHARASHTRA) STPS	Existing	Chandrapur	2920

S.No	Plant	TYPE	DISTRICT	Capacity
51	DAHANU TPS	Existing	Palghar	500
52	DHARIWAL TPP	Existing	Chandrapur	600
53	DSPM TPS	Existing	Korba	500
54	GANDHI NAGAR TPS	Existing	Gandhi Nagar	630
55	GMR WARORA TPS	Existing	Chandrapur	600
56	JSW RATNAGIRI TPP	Existing	Ratnagiri	1200
57	KHAPARKHEDA TPS	Existing	Nagpur	1340
58	KORADI TPS	Existing	Nagpur	2400
59	KORBA-II	Existing	Korba	440
60	KORBA STPS	Existing	Korba	2600
61	KORBA-WEST TPS	Existing	Korba	1340
62	MAHAN TPP	Existing	Singrauli	600
63	MARWA TPS	Existing	Janjgir-Champa	1000
64	MAUDA TPS	Existing	Nagpur	2320
65	MUNDRA TPS	Existing	Kachchh	4620
66	MUNDRA UMTPP	Existing	Kachchh	4000
67	NASIK TPS	Existing	Nashik	630
68	NAWAPARA TPP	Existing	Raigarh	600
69	NIGRI TPP	Existing	Singrauli	1320
70	OP JINDAL TPS	Existing	Raigarh	1000
71	PARAS TPS	Existing	Aloka	500
72	PARLI TPS	Existing	Beed	1170
73	PATHADI TPP	Existing	Korba	600
74	RAIKHEDA TPP	Existing	Raipur	1370
75	SABARMATI (C STATION)	Existing	Ahmedabad	422
76	SALAYA TPP	Existing	Jamnagar	1200
77	SANJAY GANDHI TPS	Existing	Umaria	1340
78	SASAN UMTPP	Existing	Singrauli	3960
79	SATPURA TPS	Existing	Betul	1330
80	SEIONI TPP	Existing	Seoni	600
81	SHRI SINGHAJI TPP	Existing	Mundi Khandwa	1200
82	SIKKA REP. TPS	Existing	Jamnagar	500
83	SIPAT STPS	Existing	Bilaspur	2980
84	SOLAPUR	Existing	Solapur	660
85	TAMNAR TPP	Existing	RAIGARH	2400
86	TIRORA TPS	Existing	Gondia	3300
87	TROMBAY TPS	Existing	Mumbai city	1250
88	UCHPINDA TPP	Existing	Janjgir Champa	1080
89	UKAI TPS	Existing	Tapi	1110
90	VINDHYACHAL STPS	Existing	Singrauli	4760
91	WANAKBORI TPS	Existing	Kheda	1470
92	WARDHA WARORA TPP	Existing	Chandrapur	540
93	BAKRESWAR TPS	Existing	Birbhum	1050
94	BANDEL TPS	Existing	Hoogly	450
95	BARAUNI TPS	Existing	Begusarai	210
96	BARH II	Existing	Patna	1320
97	BOKARO `B` TPS	Existing	Bokaro	710
98	BUDGE BUDGE TPS	Existing	South 24 Parganas	750
99	CHANDRAPURA(DVC) TPS	Existing	Chandrapura	630
100	DERANG TPP	Existing	Anugul	1200
101	D.P.L. TPS	Existing	Durgapur	660
102	DURGAPUR STEEL TPS	Existing	Durgapur	1000

S.No	Plant	TYPE	DISTRICT	Capacity
103	DURGAPUR TPS	Existing	Durgapur	210
104	FARAKKA STPS	Existing	Murshidabad	2100
105	HALDIA TPP	Existing	Purba Mednipur	600
106	IB VALLEY TPS	Existing	Jharsuguda	420
107	JOJOBERA TPS	Existing	Purbi Singbhum	240
108	KAHALGAON TPS	Existing	Kahalgaon	2340
109	KAMALANGA TPS	Existing	Dhenkanal	1050
110	KODARMA TPP	Existing	Koderma	1000
111	KOLAGHAT TPS	Existing	Purba Mednipur	1260
112	MAHADEV PRASAD STPP	Existing	Purba Singbhum	540
113	MAITHON RB TPP	Existing	Dhanbad	1050
114	MEJIA TPS	Existing	Bankura	2340
115	MUZAFFARPUR TPS	Existing	Muzaffarpur	610
116	PATRATU TPS	Existing	Ramgarh	770
117	NABI NAGAR TPP	Existing	Aurangabad	500
118	RAGHUNATHPUR TPP	Existing	Purulia	1200
119	SAGARDIGHI TPS	Existing	Murshidabad	1600
120	SANTALDIH TPS	Existing	Purulia	500
121	SOUTHERN REPL. TPS	Existing	Kolkata	135
122	STERLITE TPP	Existing	Jharsuguda	1200
123	TALCHER (OLD) TPS	Existing	Anugul	460
124	TALCHER STPS	Existing	Anugul	3000
125	TENUGHAT TPS	Existing	Bokaro	420
126	TITAGARH TPS	Existing	Titagarh	240
127	Bongaigaon TPP/NTPC	Under_const/Planned	Chirang	250
128	Barh STPP-I /NTPC	Under_const/Planned	Patna	660
129	Barh STPP-I /NTPC	Under_const/Planned	Patna	660
130	Barh STPP-I /NTPC	Under_const/Planned	Patna	660
131	Nabi Nagar TPP / JV of NTPC & Rly.	Under_const/Planned	Aurangabad	250
132	Nabi Nagar TPP / JV of NTPC & Rly.	Under_const/Planned	Aurangabad	250
133	Nabi Nagar TPP / JV of NTPC & Rly.	Under_const/Planned	Aurangabad	250
134	New Nabi Nagar TPP /JV of NTPC & BSPGCL	Under_const/Planned	Aurangabad	660
135	New Nabi Nagar TPP /JV of NTPC & BSPGCL	Under_const/Planned	Aurangabad	660
136	New Nabi Nagar TPP /JV of NTPC & BSPGCL	Under_const/Planned	Aurangabad	660
137	North Karanpura TPP/ NTPC	Under_const/Planned	Chatra	660
138	North Karanpura TPP/ NTPC	Under_const/Planned	Chatra	660
139	North Karanpura TPP/ NTPC	Under_const/Planned	Chatra	660
140	Kudgi STPP Ph-I/ NTPC	Under_const/Planned	Bijapur	800
141	Solapur STPP/ NTPC	Under_const/Planned	Solapur	660
142	Solapur STPP/ NTPC	Under_const/Planned	Solapur	660
143	Gadarwara TPP/ NTPC	Under_const/Planned	Narsinghpur	800
144	Gadarwara TPP/ NTPC	Under_const/Planned	Narsinghpur	800
145	Khargone TPP/ NTPC	Under_const/Planned	Khargone	660
146	Khargone TPP/ NTPC	Under_const/Planned	Khargone	660
147	Darlipalli STPP/ NTPC	Under_const/Planned	Sundargarh	800
148	Darlipalli STPP/ NTPC	Under_const/Planned	Sundargarh	800
149	Neyveli New TPP/ NLC	Under_const/Planned	Cuddalore	500

S.No	Plant	TYPE	DISTRICT	Capacity
150	Neyveli New TPP/ NLC	Under_const/Planned	Cuddalore	500
151	Telangana Ph-I/NTPC	Under_const/Planned	Peddapalli	800
152	Telangana Ph-I/NTPC	Under_const/Planned	Peddapalli	800
153	Lara STPP / NTPC	Under_const/Planned	Raigarh	800
154	Lara STPP / NTPC	Under_const/Planned	Raigarh	800
155	Meja STPP/ JV of NTPC & UPRVUNL	Under_const/Planned	Allahabad	660
156	Meja STPP/ JV of NTPC & UPRVUNL	Under_const/Planned	Allahabad	660
157	Tanda TPP/ NTPC	Under_const/Planned	Ambedkar Nagar	660
158	Tanda TPP/ NTPC	Under_const/Planned	Ambedkar Nagar	660
159	Ghatampur TPP/ NLC JV	Under_const/Planned	Kanpur Nagar	660
160	Ghatampur TPP/ NLC JV	Under_const/Planned	Kanpur Nagar	660
161	Ghatampur TPP/ NLC JV	Under_const/Planned	Kanpur Nagar	660
162	Barsingsar TPP ext/NLC	Under_const/Planned	Bikaner	250
163	Bithnok TPP /NLC	Under_const/Planned	Bikaner	250
164	Rayalaseema TPP St-IV / APGENCO	Under_const/Planned	Kadapa	600
165	Dr N T Rao TPS St-V/APGENCO	Under_const/Planned	Vijaywada	800
166	Sri Damodaram TPS St-II/APGENCO	Under_const/Planned	Nellore	800
167	Barauni TPS Extn./ BSEB	Under_const/Planned	Begusarai	250
168	Barauni TPS Extn./ BSEB	Under_const/Planned	Begusarai	250
169	Wanakbori TPS Extn. / GSECL	Under_const/Planned	Wanakbori	800
170	Shri Singhaji TPP-II / MPGENCO	Under_const/Planned	Khandwa	660
171	Shri Singhaji TPP-II / MPGENCO	Under_const/Planned	Khandwa	660
172	Ib valley TPP / OPGCL	Under_const/Planned	Jharsuguda	660
173	Ib valley TPP / OPGCL	Under_const/Planned	Jharsuguda	660
174	Chhabra TPP Extn. / RRVUNL	Under_const/Planned	Baran	660
175	Chhabra TPP Extn. / RRVUNL	Under_const/Planned	Baran	660
176	Suratgarh TPS/ RRVUNL	Under_const/Planned	Suratgarh	660
177	Suratgarh TPS/ RRVUNL	Under_const/Planned	Suratgarh	660
178	Kothagudem TPS St-VII / TSGENCO	Under_const/Planned	Bhadradri Kothagudem	800
179	Bhadradri TPP / TSGENCO	Under_const/Planned	Bhadradri Kothagudem	270
180	Bhadradri TPP / TSGENCO	Under_const/Planned	Bhadradri Kothagudem	270
181	Bhadradri TPP / TSGENCO	Under_const/Planned	Bhadradri Kothagudem	270
182	Bhadradri TPP / TSGENCO	Under_const/Planned	Bhadradri Kothagudem	270
183	Ennore exp. SCTPP(Lanco) / TANGEDCO	Under_const/Planned	Chennai	660
184	Ennore SCTPP / TANGEDCO	Under_const/Planned	Chennai	660
185	Ennore SCTPP / TANGEDCO	Under_const/Planned	Chennai	660
186	North Chennai TPP St-III/TANGEDCO	Under_const/Planned	Chennai	800
187	Uppur SCTPP/TANGEDCO	Under_const/Planned	Ramanathapuram	800
188	Uppur SCTPP/TANGEDCO	Under_const/Planned	Ramanathapuram	800

S.No	Plant	TYPE	DISTRICT	Capacity
189	Harduaganj Exp.-II TPP / UPRVUNL	Under_const/Planned	Aligarh	660
190	Jawaharpur STPP/ UPRVUNL	Under_const/Planned	Etah	660
191	Jawaharpur STPP/ UPRVUNL	Under_const/Planned	Etah	660
192	Obra-C STPP/ UPRVUNL	Under_const/Planned	Sonbhadra	660
193	Obra-C STPP/ UPRVUNL	Under_const/Planned	Sonbhadra	660
194	Thamminapatnam TPP stage -II / Meenakshi Energy Pvt. Ltd.	Under_const/Planned	Nellore	350
195	Thamminapatnam TPP stage -II / Meenakshi Energy Pvt. Ltd.	Under_const/Planned	Nellore	350
196	Akaltara TPP (Naiyara) / KSK Mahandi Power Company Ltd.	Under_const/Planned	Janjgir-Champa	600
197	Akaltara TPP (Naiyara) / KSK Mahandi Power Company Ltd.	Under_const/Planned	Janjgir-Champa	600
198	Nawapara TPP / TRN Energy Pvt Ltd	Under_const/Planned	Raipur	300
199	Binjkote TPP/ SKS Power Generation (Chhattisgarh) Ltd.	Under_const/Planned	Raigarh	300
200	Binjkote TPP/ SKS Power Generation (Chhattisgarh) Ltd.	Under_const/Planned	Raigarh	300
201	Nasik TPP Ph-I / Ratan India Nasik Power Pvt. Ltd.	Under_const/Planned	Nashik	270
202	Nasik TPP Ph-I / Ratan India Nasik Power Pvt. Ltd.	Under_const/Planned	Nashik	270
203	Nasik TPP Ph-I / Ratan India Nasik Power Pvt. Ltd.	Under_const/Planned	Nashik	270
204	Shirpur TPP/ Shirpur Power Pvt Ltd	Under_const/Planned	Dhule	150
205	Shirpur TPP/ Shirpur Power Pvt Ltd	Under_const/Planned	Dhule	150
206	Uchpinda TPP/ RKM Powergen. Pvt. Ltd.	Under_const/Planned	Janjgir –Champa	360
207	Uchpinda TPP/ RKM Powergen. Pvt. Ltd.	Under_const/Planned	Janjgir –Champa	360
208	Tuticorin TPP St-IV / SEPC	Under_const/Planned	Thoothukudi	525
209	Prayagraj (Bara) TPP / PPGENCO	Under_const/Planned	Allahabad	660
210	India Power TPP / Haldia Energy Ltd.	Under_const/Planned	Purba Mednipur	150
211	India Power TPP / Haldia Energy Ltd.	Under_const/Planned	Purba Mednipur	150
212	India Power TPP / Haldia Energy Ltd.	Under_const/Planned	Purba Mednipur	150
213	Utkal TPP/Ind Bharat	Under_const/Planned	Jharsuguda	350
214	Patratu /NTPC	Under_const/Planned	Ramgarh	800

S.No	Plant	TYPE	DISTRICT	Capacity
215	Patratu /NTPC	Under_const/Planned	Ramgarh	800
216	Patratu /NTPC	Under_const/Planned	Ramgarh	800
217	Raghunathpur St-II/DVC	Under_const/Planned	Purulia	660
218	Raghunathpur St-II/DVC	Under_const/Planned	Purulia	660
219	Katwa/ NTPC	Under_const/Planned	Purba Bardhaman	800
220	Katwa/ NTPC	Under_const/Planned	Purba Bardhaman	800
221	Barethi/NTPC	Under_const/Planned	Chattarpur	800
222	Barethi/NTPC	Under_const/Planned	Chattarpur	800
223	Pudimdaka/NTPC	Under_const/Planned	Visakhapatnam	1000
224	Pudimdaka/NTPC	Under_const/Planned	Visakhapatnam	1000
225	Pudimdaka/NTPC	Under_const/Planned	Visakhapatnam	1000
226	Pudimdaka/NTPC	Under_const/Planned	Visakhapatnam	1000
227	Bhilur/NTPC	Under_const/Planned	Udaipur	660
228	Bhilur/NTPC	Under_const/Planned	Udaipur	660
229	Teiangana St II/ NTPC	Under_const/Planned	Peddapalli	800
230	Teiangana St II/ NTPC	Under_const/Planned	Peddapalli	800
231	Teiangana St II/ NTPC	Under_const/Planned	Peddapalli	800
232	Lara StI/ NTPC	Under_const/Planned	Raigarh	800
233	Lara StI/ NTPC	Under_const/Planned	Raigarh	800
234	Lara StI/ NTPC	Under_const/Planned	Raigarh	800
235	Buxar/ SJVN	Under_const/Planned	Buxar	660
236	Buxar/ SJVN	Under_const/Planned	Buxar	660
237	THDC	Under_const/Planned	Ghaziabad	660
238	THDC	Under_const/Planned	Ghaziabad	660
239	Sirkali/ NLC	Under_const/Planned	Nagapattinam	660
240	Sirkali/ NLC	Under_const/Planned	Nagapattinam	660
241	Sirkali/ NLC	Under_const/Planned	Nagapattinam	660
242	Pirpainti/ PBCPL	Under_const/Planned	Bhagalpur	660
243	Pirpainti/ PBCPL	Under_const/Planned	Bhagalpur	660
244	Lakhisarai/LBCPL	Under_const/Planned	Lakhisarai	660
245	Lakhisarai/LBCPL	Under_const/Planned	Lakhisarai	660
246	Bhaiathan/ ICPL	Under_const/Planned	Surajpur	660
247	Bhaiathan/ ICPL	Under_const/Planned	Surajpur	660
248	Pench/NTPC	Under_const/Planned	Seoni	660
249	Pench/NTPC	Under_const/Planned	Seoni	660
250	Margerhita/NEEPCO	Under_const/Planned	Tinsukia	660
251	Obra "C/"UPRVUNL	Under_const/Planned	Sonbhadra	660
252	Obra "C/"UPRVUNL	Under_const/Planned	Sonbhadra	660
253	Jawaharpur/ UPRVUNL	Under_const/Planned	Etah	660
254	Jawaharpur/ UPRVUNL	Under_const/Planned	Etah	660
255	Panki Extr/ UPRVUNL	Under_const/Planned	Kanpur Nagar	660
256	Hazipur/ PSPCL	Under_const/Planned	Vaishali	660
257	Hazipur/ PSPCL	Under_const/Planned	Vaishali	660
258	Edlapur/ KPCL	Under_const/Planned	Akola	660
259	DCRTPP (Yamunanagar)/ HPGCL	Under_const/Planned	Yamunanagar	660
260	Panipat / HPGCL	Under_const/Planned	Panipat	800
261	Korba South	Under_const/Planned	Korba	660
262	Satpura/ MPPGCL	Under_const/Planned	Hoshangabad	800
263	Nasik / MSPGCL	Under_const/Planned	Nashik	1000
264	Bhusawal / MSPGCL	Under_const/Planned	Bhusawal	660
265	Duwasan/ GSECL	Under_const/Planned	Korba	660

S.No	Plant	TYPE	DISTRICT	Capacity
266	Duwasan/ GSECL	Under_const/Planned	Korba	660
267	Sinor/ GSECL	Under_const/Planned	Vadodara	660
268	Udangudi St-I/ TANGEDCO	Under_const/Planned	Thoothukudi	660
269	Udangudi St-I/ TANGEDCO	Under_const/Planned	Thoothukudi	660
270	Srikakulam/ APGENCO	Under_const/Planned	Srikakulam	660
271	Srikakulam/ APGENCO	Under_const/Planned	Srikakulam	660
272	Srikakulam/ APGENCO	Under_const/Planned	Srikakulam	800
273	Tenughat/ TVNL	Under_const/Planned	Bokaro	800
274	Tenughat/ TVNL	Under_const/Planned	Bokaro	800
275	Kamakhyanagar/OTPCL	Under_const/Planned	Dhenkanal	660
276	Kamakhyanagar/OTPCL	Under_const/Planned	Dhenkanal	660
277	Kamakhyanagar/OTPCL	Under_const/Planned	Dhenkanal	800
278	Bakreshwar/ WBPDCL	Under_const/Planned	Birbhum	800
279	Santaldih/ WBPDCL	Under_const/Planned	Purulia	800
280	Binjkote TPP/ SKS Power Generation (Chhattisgarh) Ltd.	Under_const/Planned	Raigarh	660
281	KVK Nilanchal TPP/ KVK Nilanchal	Under_const/Planned	Cuttack	660
282	KVK Nilanchal TPP/ KVK Nilanchal	Under_const/Planned	Cuttack	300
283	Nasik TPP Ph-II / Ratan India Nasik Power Pvt. Ltd.	Under_const/Planned	Nashik	350
284	Nasik TPP Ph-II / Ratan India Nasik Power Pvt. Ltd.	Under_const/Planned	Nashik	350
285	Nasik TPP Ph-II / Ratan India Nasik Power Pvt. Ltd.	Under_const/Planned	Nashik	270
286	Nasik TPP Ph-II / Ratan India Nasik Power Pvt. Ltd.	Under_const/Planned	Nashik	270
287	Nasik TPP Ph-II / Ratan India Nasik Power Pvt. Ltd.	Under_const/Planned	Nashik	270
288	Amravati TPP Ph-II / Ratan India Power Pvt. Ltd.	Under_const/Planned	Amravati	270
289	Amravati TPP Ph-II / Ratan India Power Pvt. Ltd.	Under_const/Planned	Amravati	270
290	Amravati TPP Ph-II / Ratan India Power Pvt. Ltd.	Under_const/Planned	Amravati	270
291	Amravati TPP Ph-II / Ratan India Power Pvt. Ltd.	Under_const/Planned	Amravati	270
292	Amravati TPP Ph-II / Ratan India Power Pvt. Ltd.	Under_const/Planned	Amravati	270
293	Tori / Essar Power	Under_const/Planned	Latehar	270
294	Visa / Visa Power	Under_const/Planned	Raigarh	270
295	Dhenkanal/ CESC	Under_const/Planned	Dhenkanal	600
296	Dhenkanal/ CESC	Under_const/Planned	Dhenkanal	660
297	Matrishri Usha Ph-I / Corporate Power Ltd.	Under_const/Planned	Latehar	660
298	Matrishri Usha Ph-I / Corporate Power Ltd.	Under_const/Planned	Latehar	660
299	Kawai Ext	Under_const/Planned	Baran	800
300	Kawai Ext	Under_const/Planned	Baran	800
301	Udipi Ext	Under_const/Planned	Udupi	800
302	Udipi Ext	Under_const/Planned	Udupi	800

S.No	Plant	TYPE	DISTRICT	Capacity
303	Pench	Under_const/Planned	Seoni	800
304	Pench	Under_const/Planned	Seoni	660
305	Dahej	Under_const/Planned	Bharuch	660
306	Dahej	Under_const/Planned	Bharuch	660
307	Dahej	Under_const/Planned	Bharuch	660
308	Dahej	Under_const/Planned	Bharuch	660
309	Badreshwar	Under_const/Planned	Hoogly	660
310	Badreshwar	Under_const/Planned	Hoogly	660
311	Badreshwar	Under_const/Planned	Hoogly	660
312	Badreshwar	Under_const/Planned	Hoogly	660
313	Badreshwar	Under_const/Planned	Hoogly	660

Note: Duplicate entries represent separate units within same TPP.
Source: CEA, Deloitte Analysis

Table A.3.12: List of Retiring Thermal Power Plants

Name of the Utility	Name of the Station	Unit No.	Capacity (MW)	Year of termination
DPL	DPL TPS	3	70	2017
DPL	DPL TPS	4	75	2017
DPL	DPL TPS	5	75	2017
ASEB	Chandrapur TPS	1	30	2017
ASEB	Chandrapur TPS	2	30	2018
GSECL	Sikka TPS	1	120	2017
GSECL	Ukai TPS	1	120	2017
GSECL	Ukai TPS	2	120	2017
IPGCL	Rajghat TPS	1	67.5	2017
IPGCL	Rajghat TPS	2	67.5	2017
MPPGCL	Satpura TPS	6	200	2017
MPPGCL	Satpura TPS	7	210	2017
UPRVUNL	Harduaganj	5	60	2017
UPRVUNL	Obra TPS	8	94	2018
NLC	Nevyeli LigniteTPS-I	1	50	2018
NLC	Nevyeli LigniteTPS-I	2	50	2018
NLC	Nevyeli LigniteTPS-I	3	50	2018
NLC	Nevyeli LigniteTPS-I	4	50	2018
NLC	Nevyeli LigniteTPS-I	5	50	2018
NLC	Nevyeli LigniteTPS-I	6	50	2018
NLC	Nevyeli LigniteTPS-I	7	100	2019
NLC	Nevyeli LigniteTPS-I	8	100	2019
NLC	Nevyeli LigniteTPS-I	9	100	2019
TSPGCL	Kothadudem TPS	1	60	2019
TSPGCL	Kothadudem TPS	2	60	2019
TSPGCL	Kothadudem TPS	3	60	2019
TSPGCL	Kothadudem TPS	4	60	2019
PSPCL	GND (Bathinda) TPS	1	110	2018
PSPCL	GND (Bathinda) TPS	2	110	2018
CSPGCL	DSPM Korba TPS	1	50	2018
CSPGCL	DSPM Korba TPS	2	50	2018
CSPGCL	DSPM Korba TPS	3	50	2018
CSPGCL	DSPM Korba TPS	4	50	2018
MPPGCL	Satpura TPS	8	210	2018
MPPGCL	Satpura TPS	9	210	2018
UPRVUNL	Obra TPS	1	40	2017
UPRVUNL	Obra TPS	2	50	2017
UPRVUNL	Panki TPS	3	105	2018
UPRVUNL	Panki TPS	4	105	2018
TSPGCL	Kothadudem TPS	5	120	2019
TSPGCL	Kothadudem TPS	6	120	2019
TSPGCL	Kothadudem TPS	7	120	2019

Name of the Utility	Name of the Station	Unit No.	Capacity (MW)	Year of termination
TSPGCL	Kothadudem TPS	8	120	2019
TSPGCL	Ramagundem-B TPS	1	62.5	2019
PSPCL	Ropar TPS	1	210	2018
PSPCL	Ropar TPS	2	210	2018
PSPCL	Ropar TPS	3	210	2018
PSPCL	Ropar TPS	4	210	2018
MSPGCL	Koradi TPS	5	200	2017
PVUNL	Patratu TPS	4	50	2017
PVUNL	Patratu TPS	6	100	2017
PVUNL	Patratu TPS	9	110	2017
PVUNL	Patratu TPS	10	110	2017
PVUNL	Patratu TPS	7	110	2017
NTPC LTD.	Badarpur TPS	1	95	2018
NTPC LTD.	Badarpur TPS	2	95	2018
NTPC LTD.	Badarpur TPS	3	95	2018
DVC	Chandrapur TPS	2	130	2017
DVC	Chandrapur TPS	3	130	2017
BSEB	BARAUNI TPS	6	105	2043
BSEB	BARAUNI TPS	7	105	2043
NTPC & Bihar	MUZAFFARPUR TPS	1	110	2020
NTPC & Bihar	MUZAFFARPUR TPS	2	110	2020
D.V.C	BOKARO `B` TPS	1	210	2020
D.V.C	BOKARO `B` TPS	2	210	2020
D.V.C	BOKARO `B` TPS	3	210	2018
TenughatVN Ltd	TENUGHAT TPS	1	210	2019
TenughatVN Ltd	TENUGHAT TPS	2	210	2021
Ind barath	IND BARATH TPP	1	350	2041
C.E.S.C. Pvt.	TITAGARH TPS	1	60	2020
C.E.S.C. Pvt.	TITAGARH TPS	2	60	2020
C.E.S.C. Pvt.	TITAGARH TPS	3	60	2020
C.E.S.C. Pvt.	TITAGARH TPS	4	60	2020
D.V.C	DURGAPUR TPS	4	210	2020
WBPDC	BAKRESWAR TPS	1	210	2024
WBPDC	BAKRESWAR TPS	2	210	2026
WBPDC	BAKRESWAR TPS	3	210	2033
WBPDC	BAKRESWAR TPS	4	210	2035
WBPDC	BAKRESWAR TPS	5	210	2035
WBPDC	BANDEL TPS	1	60	2020
WBPDC	BANDEL TPS	2	60	2020
WBPDC	BANDEL TPS	3	60	2020
WBPDC	BANDEL TPS	4	60	2020
WBPDC	BANDEL TPS	5	210	2020
HGP Corpn	PANIPAT TPS	5	210	2020
PSEB	GND TPS (BHATINDA)	3	110	2020

Name of the Utility	Name of the Station	Unit No.	Capacity (MW)	Year of termination
PSEB	GND TPS (BHATINDA)	4	110	2020
PSEB	ROPAR TPS	5	210	2020
PSEB	ROPAR TPS	6	210	2018
RRVUNL	KOTA TPS	1	110	2020
RRVUNL	KOTA TPS	2	110	2020
RRVUNL	KOTA TPS	3	210	2020
RRVUNL	KOTA TPS	4	210	2020
RRVUNL	KOTA TPS	5	210	2020
NTPC	TANDA TPS	1	110	2020
NTPC	TANDA TPS	2	110	2020
NTPC	TANDA TPS	3	110	2020
NTPC	TANDA TPS	4	110	2023
UPRVUNL	HARDUAGANJ TPS	7	105	2020
UPRVUNL	OBRA TPS	7	94	2020
UPRVUNL	PARICHHA TPS	1	110	2020
UPRVUNL	PARICHHA TPS	2	110	2020
APGENCO	Dr. N.TATA RAO TPS	1	210	2020
APGENCO	Dr. N.TATA RAO TPS	2	210	2020
APGENCO	Dr. N.TATA RAO TPS	3	210	2020
APGENCO	Dr. N.TATA RAO TPS	4	210	2020
APGENCO	Dr. N.TATA RAO TPS	5	210	2019
APGENCO	Dr. N.TATA RAO TPS	6	210	2020
KPCL	RAICHUR TPS	1	210	2020
KPCL	RAICHUR TPS	2	210	2020
KPCL	RAICHUR TPS	3	210	2019
KPCL	RAICHUR TPS	4	210	2019
KPCL	RAICHUR TPS	5	210	2024
KPCL	RAICHUR TPS	6	210	2024
KPCL	RAICHUR TPS	7	210	2027
KPCL	RAICHUR TPS	8	250	2038
Ind barath	TUTICORIN (P) TPP	1	150	2037
Ind barath	TUTICORIN (P) TPP	2	150	2037
NEYVELI LIGNITE	NEYVELI (EXT) TPS	1	210	2020
NEYVELI LIGNITE	NEYVELI (EXT) TPS	2	210	2020
NEYVELI LIGNITE	NEYVELI (EXT) TPS	1	210	2020
NEYVELI LIGNITE	NEYVELI (EXT) TPS	2	210	2020
NEYVELI LIGNITE	NEYVELI (EXT) TPS	3	210	2020
NEYVELI LIGNITE	NEYVELI (EXT) TPS	4	210	2020
NEYVELI LIGNITE	NEYVELI (EXT) TPS	5	210	2020
NEYVELI LIGNITE	NEYVELI (EXT) TPS	6	210	2020
NEYVELI LIGNITE	NEYVELI (EXT) TPS	7	210	2018
TNEB	METTUR TPS	1	210	2020
TNEB	METTUR TPS	2	210	2020
TNEB	METTUR TPS	3	210	2020

Name of the Utility	Name of the Station	Unit No.	Capacity (MW)	Year of termination
TNEB	METTUR TPS	4	210	2020
TNEB	NORTH CHENNAI TPS	1	210	2019
TNEB	NORTH CHENNAI TPS	2	210	2020
TNEB	NORTH CHENNAI TPS	3	210	2021
TNEB	TUTICORIN TPS	1	210	2020
TNEB	TUTICORIN TPS	2	210	2020
TNEB	TUTICORIN TPS	3	210	2020
TNEB	TUTICORIN TPS	4	210	2020
TNEB	TUTICORIN TPS	5	210	2020
TSGENCO	KOTHAGUDEM TPS (NEW)	9	250	2022
TSGENCO	KOTHAGUDEM TPS (NEW)	10	250	2023
CSPGCL	KORBA-III	1	120	2020
CSPGCL	KORBA-III	2	120	2020
CSPGCL	KORBA-WEST TPS	1	210	2020
CSPGCL	KORBA-WEST TPS	2	210	2020
CSPGCL	KORBA-WEST TPS	3	210	2020
CSPGCL	KORBA-WEST TPS	4	210	2020
GSECL	SIKKA REP. TPS	2	120	2018
Gupta Energy P L	GEPL TPP Ph-I	1	60	2032
Gupta Energy P L	GEPL TPP Ph-I	2	60	2032
NTPC	KAHALGAON TPS	1	210	2022
NTPC	KAHALGAON TPS	2	210	2022
NTPC	KAHALGAON TPS	3	210	2022
NTPC	KAHALGAON TPS	4	210	2022
NTPC	TALCHER STPS	1	500	2022
NTPC	TALCHER STPS	2	500	2022
OPGCLtd	IB VALLEY TPS	1	210	2022
OPGCLtd	IB VALLEY TPS	2	210	2022
E.S.C. Pvt.	SOUTHERN REPL.	1	68	2022
E.S.C. Pvt.	SOUTHERN REPL.	2	68	2022
D.P.L.	D.P.L. TPS	6	110	2022
D.V.C	MEJIA TPS	1	210	2022
D.V.C	MEJIA TPS	2	210	2023
NTPC	FARAKKA STPS	1	200	2022
NTPC	FARAKKA STPS	2	200	2022
NTPC	FARAKKA STPS	3	200	2022
NTPC	FARAKKA STPS	4	500	2022
NTPC	FARAKKA STPS	5	500	2022
WBPDC	KOLAGHAT TPS	1	210	2022
WBPDC	KOLAGHAT TPS	2	210	2022
WBPDC	KOLAGHAT TPS	3	210	2022
WBPDC	KOLAGHAT TPS	4	210	2022
WBPDC	KOLAGHAT TPS	5	210	2022

Name of the Utility	Name of the Station	Unit No.	Capacity (MW)	Year of termination
WBPDC	KOLAGHAT TPS	6	210	2022
NTPC	DADRI (NCTPP)	1	210	2022
NTPC	DADRI (NCTPP)	2	210	2022
NTPC	DADRI (NCTPP)	3	210	2022
NTPC	DADRI (NCTPP)	4	210	2022
NTPC	RIHAND STPS	1	500	2022
NTPC	RIHAND STPS	2	500	2022
NTPC	SINGRAULI STPS	1	200	2022
NTPC	SINGRAULI STPS	2	200	2022
NTPC	SINGRAULI STPS	3	200	2022
NTPC	SINGRAULI STPS	4	200	2022
NTPC	SINGRAULI STPS	5	200	2022
NTPC	SINGRAULI STPS	6	500	2022
NTPC	SINGRAULI STPS	7	500	2022
NTPC	UNCHAHAR TPS	1	210	2022
NTPC	UNCHAHAR TPS	2	210	2022
UPRVUNL	ANPARA TPS	1	210	2027
UPRVUNL	ANPARA TPS	2	210	2022
UPRVUNL	ANPARA TPS	3	210	2022
UPRVUNL	ANPARA TPS	4	500	2022
UPRVUNL	ANPARA TPS	5	500	2022
UPRVUNL	OBRA TPS	9	200	2022
UPRVUNL	OBRA TPS	10	200	2022
UPRVUNL	OBRA TPS	11	200	2022
UPRVUNL	OBRA TPS	12	200	2022
UPRVUNL	OBRA TPS	13	200	2022
APGENCO	RAYALASEEMA TPS	1	210	2022
APGENCO	RAYALASEEMA TPS	2	210	2022
NTPC	RAMAGUNDEM STPS	1	200	2022
NTPC	RAMAGUNDEM STPS	2	200	2022
NTPC	RAMAGUNDEM STPS	3	200	2022
NTPC	RAMAGUNDEM STPS	4	500	2022
NTPC	RAMAGUNDEM STPS	5	500	2022
NTPC	RAMAGUNDEM STPS	6	500	2022
NTPC	KORBA STPS	1	200	2022
NTPC	KORBA STPS	2	200	2022
NTPC	KORBA STPS	3	200	2022
NTPC	KORBA STPS	4	500	2022
NTPC	KORBA STPS	5	500	2022
NTPC	KORBA STPS	6	500	2022
GSECL	GANDHI NAGAR TPS	3	210	2022
GSECL	GANDHI NAGAR TPS	4	210	2022
GSECL	KUTCH LIG. TPS	1	70	2022
GSECL	KUTCH LIG. TPS	2	70	2022

Name of the Utility	Name of the Station	Unit No.	Capacity (MW)	Year of termination
GSECL	KUTCH LIG. TPS	3	75	2022
GSECL	UKAI TPS	3	200	2022
GSECL	UKAI TPS	4	200	2022
GSECL	UKAI TPS	5	210	2022
GSECL	WANAKBORI TPS	1	210	2022
GSECL	WANAKBORI TPS	2	210	2022
GSECL	WANAKBORI TPS	3	210	2022
GSECL	WANAKBORI TPS	4	210	2022
GSECL	WANAKBORI TPS	5	210	2022
GSECL	WANAKBORI TPS	6	210	2022
Torrent	SABARMATI	1	120	2022
Torrent	SABARMATI	2	121	2022
Torrent	SABARMATI	3	121	2022
MPPGCL	SANJAY GANDHI TPS	1	210	2022
MPPGCL	SANJAY GANDHI TPS	2	210	2022
NTPC	VINDHYACHAL STPS	1	210	2022
NTPC	VINDHYACHAL STPS	2	210	2022
NTPC	VINDHYACHAL STPS	3	210	2022
NTPC	VINDHYACHAL STPS	4	210	2022
NTPC	VINDHYACHAL STPS	5	210	2022
NTPC	VINDHYACHAL STPS	6	210	2022
MAHAGENCO	BHUSAWAL TPS	2	210	2022
MAHAGENCO	BHUSAWAL TPS	3	210	2022
MAHAGENCO	CHANDRAPUR STPS	3	210	2022
MAHAGENCO	CHANDRAPUR STPS	4	210	2022
MAHAGENCO	CHANDRAPUR STPS	5	500	2022
MAHAGENCO	CHANDRAPUR STPS	6	500	2022
MAHAGENCO	KHAPARKHEDA TPS	1	210	2022
MAHAGENCO	KHAPARKHEDA TPS	2	210	2022
MAHAGENCO	KORADI TPS	6	210	2022
MAHAGENCO	KORADI TPS	7	210	2022
MAHAGENCO	NASIK TPS	3	210	2022
MAHAGENCO	NASIK TPS	4	210	2022
MAHAGENCO	NASIK TPS	5	210	2022
MAHAGENCO	PARLI TPS	4	210	2022
MAHAGENCO	PARLI TPS	5	210	2022

Source: CEA, Deloitte Analysis

Table A.3.13: Plant wise (District-wise) cement dispatches, FY 2018

S. No.	Company	Plant	District	State	Production Capacity (in MT)	Actual Production (in MT)
1	Prism Cement Ltd	Prism Cement-I & II	Satna	Madhya Pradesh	6.6	5.6
2	Shree Cements	Ras	Pali	Rajasthan	7.0	5.52
3	Chettinad Cement	Ariyalur	Ariyalur	Tamil Nadu	5.5	5.5
4	UltraTech Cement Ltd	Gujarat Cement Works	Amreli	Gujarat	6.4	5.3
5	Ambuja Cement Ltd	Ambujanagar I & II	Junagadh	Gujarat	5.5	5.19
6	ACC ltd	Gagal-I & II	Bilaspur	Himachal Pradesh	4.4	4.64
7	Kesoram Industries	Vasvadatta Cement	Gulbarga	Karnataka	9.1	4.52
8	Chettinad Cement	Karikkali	Dindigul	Tamil Nadu	4.5	4.5
9	Wonder Cement	Wonder Cement	Chittorgarh	Rajasthan	6.8	4.23
10	Birla Corp. Ltd	Chanderia	Chittorgarh	Rajasthan	4.0	4
11	Century Textiles and Industries Ltd	Maihar Cement I & II	Satna	Madhya Pradesh	4.2	3.72
12	UltraTech Cement Ltd	Rajashree	Gulbarga	Karnataka	6.1	3.55
13	UltraTech Cement Ltd	Aditya	Chittorgarh	Rajasthan	5.2	3.55
14	Dalmia Cement (Bharat) Ltd	Dalmiapuram	Trichy	Tamil Nadu	3.4	3.5
15	Lafarge Cement	Sonadih	Raipur	Chhattisgarh	1.5	3.41
16	Lafarge Cement	Jojobera(G)	Singhbhum	Jharkhand	4.6	3.4
17	ACC ltd	Wadi & Wadi New	Wadi	Karnataka	6.1	3.37
18	Ambuja Cement Ltd	Maratha Cement	Chandrapur	Maharashtra	4.5	3.32
19	UltraTech Cement Ltd	Nagpur	Nagpur	Maharashtra	2.0	3.3
20	JAL Jaypee group	Rewa	Rewa	Madhya Pradesh	2.5	3.21
21	UltraTech Cement Ltd	Anantapur	Anantpur	Andhra Pradesh	6.5	3.2
22	Murli Industries	Murli Cement	Chandrapur	Maharashtra	3.0	3
23	Orient Cement	Jalgaon (G)	Jalgaon	Maharashtra	2.0	3
24	JK Lakshmi Cement Ltd	Sirohi	Sirohi	Rajasthan	4.7	2.93
25	Binani Cement	Sirohi	Sirohi	Rajasthan	4.9	2.91
26	UltraTech Cement Ltd	Kotputli	Jaipur	Rajasthan	3.0	2.77
27	ACC ltd	Kymore	Katni	Madhya Pradesh	2.7	2.7
28	OCL India Ltd	Kapilas (G)	Cuttack	Odisha	1.4	2.7
29	UltraTech Cement Ltd	Awarpur	Chandrapur	Maharashtra	3.6	2.67
30	ACC ltd	Chanda	Chandrapur	Maharashtra	3.8	2.65
31	Lafarge Cement	Chittorgarh	Chittorgarh	Rajasthan	2.6	2.6
32	OCL India Ltd	Rajgangpur	Sundargarh	Odisha	4.0	2.56
33	Century Textiles and Industries Ltd	Manikgarh Cement I & II	Chandrapur	Maharashtra	5.0	2.55

S. No.	Company	Plant	District	State	Production Capacity (in MT)	Actual Production (in MT)
34	UltraTech Cement Ltd (erstwhile Jaypee Group)	Baga	Solan	Himachal Pradesh	1.7	1.7
35	Sanghi Industries Ltd	Sanghi Cement	Kutch	Gujarat	4.1	2.52
36	Dalmia Cement (Bharat) Ltd	Ariyalur	Ariyalur	Tamil Nadu	3.0	2.5
37	JAL Jaypee group	Chunar (G)	Mirzapur	Uttar Pradesh	2.5	2.5
38	UltraTech Cement Ltd (erstwhile Jaypee Group)	Bagheri (G & B)	Solan	Himachal Pradesh	2.0	2.5
39	Bharathi Cement	Kadapa	Kadapa	Andhra Pradesh	5.0	2.49
40	Shree Cements	Bangur Cement (G)	Aurangabad	Bihar	3.6	2.45
41	Shree Cements	Khushkhera (G)	Alwar	Rajasthan	3.0	2.45
42	UltraTech Cement Ltd	Vikram	Neemuch	Madhya Pradesh	3.0	2.45
43	Orient Cement	Devapur	Adilabad	Telangana	3.0	2.4
44	UltraTech Cement Ltd (erstwhile Jaypee Group)	Bela	Rewa	Madhya Pradesh	2.6	2.4
45	JSW Cement	Salboni	P Medinipur	West Bengal	2.4	2.4
46	UltraTech Cement Ltd	Wanakbori (G)	Kheda	Gujarat	2.4	2.4
47	UltraTech Cement Ltd	Hotgi	Solapur	Maharashtra	4.0	2.35
48	Sagar Cements	Mattampally	Nalgonda	Telangana	2.7	2.35
49	J.K. Cement Ltd	Mangrol	Chittorgarh	Rajasthan	2.3	2.35
50	Ambuja Cement Ltd	Bhatapara	Raipur	Chhattisgarh	3.5	2.34
51	Zuari Cement Ltd	Yeraguntla	Kadapa	Andhra Pradesh	3.8	2.31
52	Mangalam Cement Ltd	Mangalam Cement I & II	Kota	Rajasthan	3.3	2.26
53	UltraTech Cement Ltd	Hirmi	Raipur	Chhattisgarh	2.8	2.23
54	UltraTech Cement Ltd	Sewagram	Kutch	Gujarat	2.4	2.18
55	Durgapur and Durga Hitech Cement (G)	Satna	Satna	Madhya Pradesh	2.2	2.15
56	Century Textiles and Industries Ltd	Century Cement	Raipur	Chhattisgarh	2.1	2.1
57	Dalmia Cement (Bharat) Ltd (erstwhile Jaypee Group)	Bokaro (G)	Bokaro	Jharkhand	2.1	2.1
58	Calcom Cement India Ltd	Calcom Cement India Ltd	Noagoan	Assam	1.7	2.1
59	Ambuja Cement Ltd	Rabriyawas	Pali	Rajasthan	2.6	2.03

S. No.	Company	Plant	District	State	Production Capacity (in MT)	Actual Production (in MT)
60	Birla Corp. Ltd (erstwhile Reliance Cement)	Maihar	Satna	Madhya Pradesh	3.0	2
61	UltraTech Cement Ltd	Rawan	Raipur	Chhattisgarh	2.5	2
62	UltraTech Cement Ltd (erstwhile Jaypee Group)	Sidhi	Sidhi	Madhya Pradesh	2.3	2
63	Heidelberg Cement	Imlai (G)	Damoh	Madhya Pradesh	2.0	2
64	Penna Cement Industries Ltd	Boyareddypalli	Anantpur	Andhra Pradesh	2.0	2
65	JSW Cement	Nandyal	Kurnool	Andhra Pradesh	4.8	1.93
66	Shree Cements	Baloda Bazar	Raipur	Chhattisgarh	2.6	1.92
67	J.K. Cement Ltd	Muddapur	Bagalkot	Karnataka	3.0	1.86
68	Shree Cements	Roorkee (G)	Haridwar	Uttrakhand	1.8	1.85
69	Sri JayaJothi Cements Pvt. Ltd	Sri JayaJothi Cement Plant	Kurnool	Andhra Pradesh	3.2	1.82
70	Orient Cement	Chittapur	Gulbarga	Karnataka	3.0	1.77
71	Ramco Cements Ltd	Ariyalur	Perambalur	Tamil Nadu	3.5	1.71
72	Chettinad Cement	Puliyur	Karur	Tamil Nadu	1.7	1.7
73	Shree Cements	Suratgarh (G)	Sriganganagar	Rajasthan	1.2	1.64
74	India Cements Ltd	Vishnupuram	Nalgonda	Telangana	2.5	1.61
75	ACC ltd	Thondebhavi (G)	Chikballapur	Karnataka	1.7	1.6
76	My Home Industries Ltd	Mellacheruvu	Nalgonda	Telangana	3.3	1.58
77	ACC ltd	Jamul	Durg	Chhattisgarh	2.4	1.58
78	Nirma Ltd.	Nirma Cement	Pali	Rajasthan	2.3	1.57
79	Shree Cements	Beawar I & II	Ajmer	Rajasthan	3.0	1.52
80	The K.C.P. Ltd	Muktyala	Krishna	Andhra Pradesh	1.9	1.52
81	J.K. Cement Ltd	Nimbahera	Chittorgarh	Rajasthan	3.3	1.51
82	My Home Industries Ltd	Mulakalapalli (G)	Vizag	Andhra Pradesh	2.0	1.5
83	Ramco Cements Ltd	Ramasamyraja Nagar	Virudhnagar	Tamil Nadu	2.0	1.5
84	ACC ltd	Lakheri	Bundi	Rajasthan	1.5	1.5
85	UltraTech Cement Ltd	Ginigera (G)	Koppal	Karnataka	1.3	1.5
86	Chettinad Cement	Kallur	Gulbarga	Karnataka	2.5	1.45
87	Ramco Cements Ltd	Alathiyur Works I & II	Perambalur	Tamil Nadu	3.1	1.43
88	Dalmia Cement (Bharat) Ltd	Cuddapah	Kadapa	Andhra Pradesh	2.5	1.43
89	Mehta Group	Saurashtra Cement	Porbandar	Gujarat	1.5	1.43
90	Bhavya Cement	Bhavya Cement	Guntur	Andhra Pradesh	1.4	1.4

S. No.	Company	Plant	District	State	Production Capacity (in MT)	Actual Production (in MT)
91	Binani Cement	Sikar (G)	Sikar	Rajasthan	1.4	1.4
92	KJS Cement	KJS Cement	Satna	Madhya Pradesh	2.1	1.39
93	Lafarge Cement	Arasmeta	Janjgir	Chhattisgarh	1.8	1.39
94	India Cements Ltd	Trinetra Cement	Banswara	Rajasthan	1.5	1.38
95	India Cements Ltd	Sankarnagar	Tirunelveli	Tamil Nadu	2.1	1.37
96	Deccan Cement	Nalgonda	Nalgonda	Telangana	2.3	1.33
97	India Cements Ltd	Dalavoi	Ariyalur	Tamil Nadu	1.9	1.3
98	UltraTech Cement Ltd	Reddipalayam	Ariyalur	Tamil Nadu	1.6	1.3
99	India Cements Ltd	Chilamkur Works	Kadapa	Andhra Pradesh	1.5	1.3
100	Rain Cements Ltd	Kurnool Cem Plant	Kurnool	Andhra Pradesh	2.2	1.29
101	Shree Cements	Bulandsahar (G)	Sikandrabad	Uttar Pradesh	2.0	1.29
102	UltraTech Cement Ltd (erstwhile Jaypee Group)	Balaji Cement	Krishna	Andhra Pradesh	5.0	1.2
103	India Cements Ltd	Malkapur	Rangareddy	Telangana	2.4	1.2
104	ACC ltd	Kudithini (G)	Ballari	Karnataka	1.1	1.2
105	UltraTech Cement Ltd	Arakkonam (G)	Vellore	Tamil Nadu	1.1	1.2
106	ACC ltd	Chaibasa	Singhbhum	Jharkhand	0.9	1.2
107	ACC ltd	Madukkarai	Coimbatore	Tamil Nadu	1.1	1.18
108	India Cements Ltd	Vallur (G)	Chennai	Tamil Nadu	1.1	1.1
109	Ambuja Cement Ltd	Farakka (G)	Murshidaba d	West Bengal	1.3	1.04
110	Zuari Cement Ltd	Sitapuram	Nalgonda	Telangana	1.2	1.04
111	ACC ltd	Bargarh	Bargarh	Odisha	2.5	1.03
112	Kesoram Industries	Kesoram Cement	Karimnagar	Telangana	1.8	1.01
113	JSW Cement	Vijayanagar	Bellary	Karnataka	3.2	1
114	Amrit Cement	Jaintia Hills	Jaintia Hills	Meghalaya	3.0	1
115	UltraTech Cement Ltd	Jharsuguda (G)	Jharsuguda	Odisha	2.6	1
116	Lafarge Cement	Mejia (G)	Bankura	West Bengal	1.5	1
117	India Cements Ltd	Parli (G)	Beed	Maharashtra	1.1	1
118	Hills Cement Company	Hills Cement	Jaintia Hills	Meghalaya	1.0	
119	JSW (erstwhile Heidelberg Cement (I) Ltd)	Dolvi (G)	Raigad	Maharashtra	1.0	1
120	Kalyanpur Cement	Kalyanpur Cement	Rohtas	Bihar	1.0	1
121	Sri Lalita	Matampally	Nalgonda	Telangana	1.0	1
122	UltraTech Cement Ltd (erstwhile Jaypee Group)	Ayodhya (G)	Ambedkar Nagar	Uttar Pradesh	1.0	1
123	Zuari Cement Ltd	Chennai (G)	Chennai	Tamil Nadu	0.9	1
124	ACC ltd	Damodar (G)	Purulia	West Bengal	0.8	1

S. No.	Company	Plant	District	State	Production Capacity (in MT)	Actual Production (in MT)
125	Penna Cement Industries Ltd	Ganeshpahad	Nalgonda	Telangana	1.2	0.98
126	Ramco Cements Ltd	Jayantipuram	Krishna	Andhra Pradesh	3.7	0.95
127	Ambuja Cement Ltd	Dadri- (G)	G B Nagar	Uttar Pradesh	1.8	0.95
128	Penna Cement Industries Ltd	Talaricheruvu	Anantpur	Andhra Pradesh	1.8	0.95
129	Ramco Cements Ltd	Kolaghat (G)	P Medinipur	West Bengal	1.0	0.95
130	Ambuja Cement Ltd	Nalagargh	Solan	Himachal Pradesh	1.5	0.93
131	ACC ltd	Sindri (G)	Dhanbad	Jharkhand	2.4	0.91
132	Bheema Cement (Earlier Coromandel Cements)	Bheema Cement	Nalgonda	Telangana	0.9	0.9
133	Parasakti Cement	Parasakti Cement	Guntur	Andhra Pradesh	1.7	0.86
134	Ambuja Cement Ltd	Darlaghat	Solan	Himachal Pradesh	1.6	0.85
135	Anjani Portland Cements	Anjani Portland Cements	Nalgonda	Telangana	1.2	0.85
136	Shree Digvijay Cement Co.	Shree Digvijay-Sikka	Sikka	Gujarat	1.2	0.85
137	Topcem	Gauripur	Kamrup	Assam	0.7	0.85
138	Shree Cements (erstwhile Jaypee Group)	Panipat (G)	Panipat	Haryana	1.5	0.84
139	Birla Corp. Ltd (erstwhile Reliance Cement)	Kundanganj (G)	Raebareli	Uttar Pradesh	1.2	0.8
140	Panyam Cement	Panyam Cement	Kurnool	Andhra Pradesh	1.0	0.8
141	Rain Cements Ltd	Ramapuram Cem Plant	Nalgonda	Telangana	1.5	0.78
142	Shree Cements	Jaipur (G)	Jaipur	Rajasthan	1.5	0.78
143	NCL Industries	Simhapuri	Nalgonda	Telangana	1.0	0.78
144	India Cements Ltd	Sankaridurg	Salem	Tamil Nadu	0.9	0.77
145	Penna Cement Industries Ltd	Tandur	Rangareddy	Telangana	2.0	0.75
146	UltraTech Cement Ltd	Magdalla (G)	Surat	Gujarat	0.8	0.7
147	Dalmia Cement (Bharat) Ltd	Belagavi	Belagavi	Karnataka	4.0	0.69
148	Adhunik Cement Ltd	Adhunik Cement Ltd	Jaintia Hills	Meghalaya	1.5	0.69
149	Keerthi Industries (Formerly Suvarna Cement)	Keerthi Industries	Nalgonda	Telangana	0.6	0.69
150	Sagar Cement Ltd.	BMM Cement	Anantpur	Andhra Pradesh	1.0	0.67

S. No.	Company	Plant	District	State	Production Capacity (in MT)	Actual Production (in MT)
151	Emami Ltd.	Risda	Baloda Bazaar	Chhattisgarh	2.4	0.63
152	JK Lakshmi Cement Ltd	Kalol (G)	Gandhinagar	Gujarat	1.0	0.6
153	J.K. Cement Ltd	Jharli(G)	Jhajjar	Haryana	1.5	0.55
154	JK Lakshmi Cement Ltd	Jhajjar (G)	Jhajjar	Haryana	1.3	0.55
155	The K.C.P. Ltd	Macherla	Guntur	Andhra Pradesh	0.8	0.49
156	UltraTech Cement Ltd	Jafrabad	Amreli	Gujarat	0.5	0.44
157	Malabar Cements	Walayar	palakkad	Kerala	0.7	0.42
158	Meghalaya Cements Ltd	Jaintia Hills	Jaintia Hills	Meghalaya	0.5	0.4
159	India Cements Ltd	Yerraguntla	Kadapa	Andhra Pradesh	0.7	0.35
160	Ambuja Cement Ltd	Bathinda (G)	Bhatinda	Punjab	0.8	0.34
161	Bagalkot Cement & Ind Ltd	Bagalkot Cement	Bijapur	Karnataka	0.6	0.29
162	Udaipur Cement	Udaipur Cement	Udaipur	Rajasthan	1.6	0.28
163	BJCL	Bhilai Jaypee (G)	Durg	Chhattisgarh	2.2	0.25
164	Star Cement . Ltd	CMCL-Lumshong	Jaintia Hills	Meghalaya	1.0	0.18
165	C.C.I. Ltd	Rajban	Sirmaur	Himachal Pradesh	0.3	0.17
166	Mehta Group	Gujarat Sidhee Cement	Junagadh	Gujarat	1.4	0.14
167	Ambuja Cement Ltd	Roorkee (G)	Haridwar	Uttrakhand	1.0	0.12
168	Grey gold Cement	Grey gold Cement	Nalgonda	Telangana	0.1	0.09
169	Vijay Cements	Vijay Cements	Trichy	Tamil Nadu	0.1	0.06
170	Mancherial Cement	Mancherial Cement	Adilabad	Telangana	0.3	0.02
171	Vadraj Cement	Mora	Surat	Gujarat	6.0	-
172	UltraTech Cement Ltd	Bara	Allahabad	Uttar Pradesh	4.0	-
173	ACC ltd	Tikaria (G)	Sultanpur	Uttar Pradesh	3.0	-
174	Kalburgi Cement	Gulbarga	Gulbarga	Karnataka	2.8	-
175	Heidelberg Cement	Jhansi (G)	Jhansi	Uttar Pradesh	2.7	-
176	JK Lakshmi Cement Ltd	Durg	Durg	Chhattisgarh	2.7	-
177	Ambuja Cement Ltd	Ropar (G)	Ropar	Punjab	2.5	-
178	Ambuja Cement Ltd	Sankrail (G)	Howrah	West Bengal	2.4	-
179	ACL	Durga Cement Works	Guntur	Andhra Pradesh	2.3	-
180	Emami Ltd.	Panagarh	Burdwan	West Bengal	2.0	-
181	JPVL	Jayprakash Power Ventures (G)	Singrauli	Madhya Pradesh	2.0	-
182	Mancherial Cement	Jalgaon (G)	Jalgaon	Maharashtra	2.0	-
183	Star Cement . Ltd	CMCL-Sonapur (G)	Guwahati	Assam	2.0	-
184	UltraTech Cement Ltd	Patliputra	Patna	Bihar	1.9	-

S. No.	Company	Plant	District	State	Production Capacity (in MT)	Actual Production (in MT)
185	UltraTech Cement Ltd	Bhatinda (G)	Bhatinda	Punjab	1.8	-
186	Ramco Cements Ltd	Salem (G)	Salem	Tamil Nadu	1.6	-
187	UltraTech Cement Ltd	Dankuni	Hooghly	West Bengal	1.6	-
188	UltraTech Cement Ltd	Jhajjar (G)	Jhajjar	Haryana	1.6	-
189	Ambuja Cement Ltd	Magdalla (G)	Surat	Gujarat	1.6	-
190	Asian FCPL	Asian Cement	Patiala	Punjab	1.5	-
191	Century Textiles and Industries Ltd	Sonar Bangla (G)	Murshidabad	West Bengal	1.5	-
192	JAL Jaypee group	Churk	Mirzapur	Uttar Pradesh	1.5	-
193	My Home Industries Ltd	Tuticorin	Tuticorin	Tamil Nadu	1.5	-
194	Swasata Cements Ltd	Swasata Cements	Purulia	West Bengal	1.5	-
195	UltraTech Cement Ltd	WBCW (G)	Burdwan	West Bengal	1.4	-
196	JK Lakshmi Cement Ltd	Surat	Surat	Gujarat	1.4	-
197	OCL India Ltd	Bengal Works	Midnapore	West Bengal	1.4	-
198	Asian CCPL	Asian Cement	Solan	Himachal Pradesh	1.3	-
199	Durgapur and Durga Hitech Cement (G)	Raebareli (G)	Raebareli	Uttar Pradesh	1.3	-
200	UltraTech Cement Ltd	Aligarh(G)	Aligarh	Uttar Pradesh	1.3	-
201	UltraTech Cement Ltd	Dadri (G)	G B Nagar	Uttar Pradesh	1.3	-
202	UltraTech Cement Ltd	Panipat(G)	Panipat	Haryana	1.3	-
203	Hi-Bond cement	Hi-Bond cement	Gondal	Gujarat	1.2	-
204	Kanodia Cement	Kanodia Infra	Bhabhua	Bihar	1.2	-
205	Zuari Cement Ltd	Solapur	Solapur	Maharashtra	1.2	-
206	UltraTech Cement Ltd (erstwhile Jaypee Group)	Roorkee (G)	Haridwar	Uttrakhand	1.1	-
207	ECO Cement	Durgawati	Bhabhua	Bihar	1.0	-
208	Green Valley Industries	Green Valley Industries	Jowai	Meghalaya	1.0	-
209	UltraTech Cement Ltd (erstwhile Jaypee Group)	Sikandrabad	Bulandsahar	Uttar Pradesh	1.0	-
210	NCL Industries	Kondapalli (G)	Krishna	Andhra Pradesh	1.0	-
211	Ramco Cements Ltd	Vizag (G)	Vizag	Andhra Pradesh	1.0	-
212	JPVL	Raigarh	Raigarh	Chhattisgarh	0.9	-

S. No.	Company	Plant	District	State	Production Capacity (in MT)	Actual Production (in MT)
213	Mangalam Cement Ltd	Aligarh(G)	Aligarh	Uttar Pradesh	0.8	-
214	Megha Techhnical & Engineers Pvt. Ltd	MTEPL-Lumshong	Jaintia Hills	Meghalaya	0.7	-
215	JAL Jaypee group	Sadva Khurd (Blending)	Allahabad	Uttar Pradesh	0.6	-
216	ACL	Vishaka Cement Works	Vizag	Andhra Pradesh	0.5	-
217	Heidelberg Cement	Ammasandra	Tumkur	Karnataka	0.5	-
218	Birla Corp. Ltd (erstwhile Reliance Cement)	Butibori (G)	Nagpur	Maharashtra	0.5	-
219	J.K. Cement Ltd	Gotan White	Nagaur	Rajasthan	0.5	-
220	JUD Cements	Jaintia Hills	Jaintia Hills	Meghalaya	0.5	-
221	Ramco Cements Ltd	Changelpet(G)	Kancheepuram	Tamil Nadu	0.5	-
222	Tamil Nadu Cement	Ariyalur	Ariyalur	Tamil Nadu	0.5	-
223	Tata Chemicals Limited	Tata Chemicals Cement Division	Mithapur	Gujarat	0.5	-
224	UltraTech Cement Ltd (erstwhile Jaypee Group)	Dalla	Sonebhadra	Uttar Pradesh	0.5	-
225	UltraTech Cement Ltd	Ratnagiri (G)	Ratnagiri	Maharashtra	0.5	-
226	DCM Shriram Cement	Shriram Cement Works	Kota	Rajasthan	0.4	-
227	J&K Cement Ltd	Khrew	Pulwama	J & K	0.4	-
228	RNB Cement	East Khasi Hills	East Khasi	Meghalaya	0.4	-
229	Purbanchal Cement	Kamrup	Kamrup	Assam	0.4	-
230	Shristi Cement	Mangalpur	Burdwan	West Bengal	0.4	-
231	Sagar Cements	Pedaveedu	Nalgonda	Telangana	0.4	-
232	Barak Valley Cement	Karimganj	Karimganj	Assam	0.3	-
233	Kanodia Cement	Kanodia Cement	Bulandsahar	Uttar Pradesh	0.3	-
234	Khyber Industries (P) Ltd	Khyber Cement	Srinagar	J & K	0.3	-
235	Maa Chandi Cement	Bamunara	Burdwan	West Bengal	0.3	-
236	Sparta Cements & Infra Ltd.	Narasimhapuri Cement Unit	Guntur	Andhra Pradesh	0.3	-
237	ACC ltd	Vizag (G)	Vizag	Andhra Pradesh	0.3	-
238	Burnpur Cement	Asansol	Burdwan	West Bengal	0.3	-
239	Burnpur Cement	Patratu	Ramgargh	Jharkhand	0.3	-
240	Ramco Cements Ltd	Mathodu	Chitradurga	Karnataka	0.3	-
241	Tamil Nadu Cement	Alangulam	Virudhnagar	Tamil Nadu	0.3	-
242	C.C.I. Ltd	Bokajan	Karbi	Assam	0.2	-

S. No.	Company	Plant	District	State	Production Capacity (in MT)	Actual Production (in MT)
243	Malabar Cements	Cherthala (G)	alappuzha	Kerala	0.2	-
244	Sagar Cements	Bayyavaram	Vizag	Andhra Pradesh	0.2	-
245	J&K Cement Ltd	Samba	Jammu	J & K	0.1	-

Source: Indian Bureau of Mines and secondary research

Table A.3.14: Expansion plans of cement plants

S. No	Company	District	State	Increase capacity in future (MTPA)	Expected Production	Expected Date of completion
1	Upcoming cement plants					
2	UltraTech Cement Ltd	Kurnool	Andhra Pradesh	6	4.8	2020
3	ACC ltd	Kadapa	Andhra Pradesh	5	4	
4	Birla Corp. Ltd	Yavatmal	Maharashtra	3.9	3.12	
5	Ramco Cements Ltd	Kurnool	Andhra Pradesh	3.16	2.528	
6	Shree Cements	Cuttack	Odisha	3	2.4	
7	Dalima Cement (Bharat)	Cuttack	Odisha	2.5	2	
8	Dalmia Cement (Bharat)	Sundergarh	Odisha	2.25	1.8	
9	Star Cement . Ltd	Jalpaiguri	West Bengal	2	1.6	
10	ACL	Rajpura	Punjab	1.5	1.2	2020-2025
11	ACL	Solan	Himachal Pradesh	1.2	0.96	
12	Integrated Cement Plant	Katni	Madhya Pradesh	1.1	0.88	
13	ACC ltd	Amethi	Uttar Pradesh	1	0.8	
14	Wonder Cement	Dhule	Maharashtra	2	1.6	
	Expansion plans of existing plants					
1	Lafarge Cement	Singhbhum	Jharkhand	6.6	5.28	All prior to 2023
2	Sanghi Industries Ltd	Kutch	Gujarat	8.6	6.88	
3	Birla Corp. Ltd	Chittorgarh	Rajasthan	5.5	4.4	
4	Ramco Cements Ltd	Krishna	Andhra Pradesh	4.6	3.68	
5	J.K. Cement Ltd	Chittorgarh	Rajasthan	4.25	3.4	
6	Orient Cement	Adilabad	Telangana	7.45	5.96	
7	JSW Cement	PMedinipur	West Bengal	4.8	3.84	
8	ACC ltd	Dhanbad	Jharkhand	3.45	2.76	
9	J.K. Cement Ltd	Chittorgarh	Rajasthan	3.25	2.6	
10	Chettinad Cement	Karur	Tamil Nadu	5.1	4.08	
11	Lafarge Cement	Raipur	Chhattisgarh	3.5	2.8	
12	Birla Corp. Ltd (erstwhile Reliance Cement)	Raebareli	Uttar Pradesh	3.6	2.88	
13	Anjani Portland Cements	Nalgonda	Telangana	2.35	1.88	
14	Ramco Cements Ltd	Vizag	Andhra Pradesh	2	1.6	

Source: Secondary Research

Table A.3.15: Plant-wise (District-wise) steel dispatches for FY 2018

S. No.	Name of the Steel Plant	District	State	Production Capacity (MTPA)	Production (MTPA)
1	SAIL - RSP - Rourkela	Sundergarh	Odisha	4.2	5.082
2	SAIL - BSL - Bokaro	Bokaro	Jharkhand	4.36	3.7932
3	SAIL - DSP - Durgapur	Paschim Bardhaman	West Bengal	1.8	2.016
4	Tata - Kalinganagar	Jajpur	Odisha	3	2.94
5	Tata - Jamshedpur	East Singbhum	Jharkhand	9.6	9.408
6	JSW - Tornagalne/ Vijaynagar	Bellary	Karnataka	18	16.74
7	JSW Dolvi	Raigarh	Maharashtra	6	4.8
8	JSPL - Raigarh	Raigarh, Chattisgarh	Chattisgarh	2.5	2
9	JSPL - Angul	Angul	Odisha	6	3.54
10	Monnet Ispat - Raigarh	Raigarh, Chattisgarh	Chattisgarh	2	1.6
11	Jai Balaji Group - ChattisgarH, Jharkhan	Durg	Chattisgarh	1	0.8
12	Adunik Group - Odisha, WB, Odishan	SUndergarh	Odisha	0.5	0.21
13	Usha Martin - Jamshedpur	East Singbhum	Jharkhand	0.5	0.465
14	Vizag steel plant	Visakhapatna m	Andhraprades h	7.3	6.059
15	IISCO, Burnpur	Paschim Bardhaman	West Bengal	2.5	0.625
16	SAIL- BHILAI	Durg	Chattisgarh	3.93	5.1483
17	Essar Steel Ltd. Hazira	Surat	Gujarat	10	6.8
18	Electro-steel- Bokaro	Bokaro	Jharkhand	2.51	1.3805
19	Bhusan Power & Steel Ltd.	Jharsuguda	Odisha	2.3	1.311

Source: Indian Bureau of Mines (IBM) and Secondary Research

Table A.3.16: Expansion plans of steel plants

S. No	Name of the Steel Plant	District	State	Capacity expansion by 2021	Capacity expansion by 2026	Capacity expansion by 2031
	Upcoming steel plants					
1	BPSL - Bilaspur, Chattisgarh	Bilaspur	Chattisgarh		3	3
2	NMDC - SPV Chartra	Durg	Chattisgarh		6	6
3	Vedanta - Sasikela	Surat	Gujarat		1	1
4	Posco-Jagatsingpur	Jagatsinghpur	Odisha		6	6
5	JSPL-Asanboni	East Singbhum	Jharkhand		3	3
6	Arcelor Mittal - Essar Steel	Jagatsinghpur	Odisha		8.5	8.5
7	Tata - Saraikela	Seraikela Kharsawan	Jharkhand		6	6
8	JSW - Salboni	West Medinipur	West Bengal		6	6
9	KNK corp- kotegal	Kolar	Karnataka		1.2	1.2
	Expansion plans of existing plants					
1	SAIL - RSP - Rourkela	Sundergarh	Odisha	4.2	7.5	10.3
2	SAIL - BSL - Bokaro	Bokaro	Jharkhand	4.6	9.4	13.4
3	SAIL - DSP - Durgapur	Paschim Bardhaman	West Bengal	2.2	6.8	8.8
4	Tata - Kalinganagar	Jajpur	Odisha	6	6	6
5	Tata - Jamshedpur	East Singbhum	Jharkhand	11	14	14
6	JSW - Tornagalne/ Vijaynagar	Bellary	Karnataka	22	26	30
7	JSW Dolvi	Raigarh	Maharashtra	10	10	12
8	JSPL - Raigarh	Raigarh, Chattisgarh	Chattisgarh	5	5	7
9	JSPL - Angul	Angul	Odisha	6	6	20
10	Monnet Ispat - Raigarh	Raigarh, Chattisgarh	Chattisgarh	1.5	1.5	2.5
11	Jai Balaji Group - ChattisgarH, Jharkhan	Durg	Chattisgarh	1.8	2.5	4
12	Adunik Group - Odisha, WB, Odishan	SUndergarh	Odisha	1	2	2
13	Usha Martin - Jamshedpur	East Singbhum	Jharkhand	2	2	2
14	Vizag steel plant	Visakhapatnam	Andhra Pradesh	9	7.3	12
15	IISCO, Burnpur	Paschim Bardhaman	West Bengal	2.5	2.5	2.5
16	SAIL- BHILAI	Durg	Chhattisgar h	3.93	3.93	3.93
17	Essar Steel Ltd. Hazira	Surat	Gujarat	10	10	10
18	Electro-steel- Bokaro	Bokaro	Jharkhand	2.51	6	6
19	Bhusan Power & Steel Ltd.	Jharsuguda	Odisha	2.3	4.6	4.6

Source: Secondary Research

Table A.3.17: Iron Ore production for FY 2018

S.No.	District	State	Production (in million tonnes)
1	Anantapur	Andhra Pradesh	0.01
2	Kadapa	Andhra Pradesh	0.43
3	Krishna	Andhra Pradesh	0.00
4	Kurnool	Andhra Pradesh	0.23
5	Nellore	Andhra Pradesh	0.01
6	Prakasam	Andhra Pradesh	0.00
7	Dantewara	Chhattisgarh	23.90
8	Durg	Chhattisgarh	7.56
9	Kanker	Chhattisgarh	2.22
10	Narayanpur	Chhattisgarh	0.00
11	Rajnandgaon	Chhattisgarh	0.86
12	North Goa	Goa	4.04
13	South Goa	Goa	4.00
14	Singhbhum	Jharkhand	21.85
15	Begalkot	Karnataka	0.44
16	Ballari	Karnataka	24.56
17	Chitradurga	Karnataka	3.72
18	Tumakuru	Karnataka	0.00
19	Gwalior	Madhya Pradesh	0.02
20	Jabalpur	Madhya Pradesh	2.60
21	Chhatarpur	Madhya Pradesh	0.05
22	Sagar	Madhya Pradesh	0.01
23	Chandrapur	Maharashtra	0.04
24	Gadchiroli	Maharashtra	0.18
25	Gondia	Maharashtra	0.01
26	Kolhapur	Maharashtra	0.00
27	Sindhudurg	Maharashtra	0.71
28	Keonjhar	Odisha	70.68
29	Mayurbhanj	Odisha	1.27
30	Sundargarh	Odisha	30.23
31	Bhilwara	Rajasthan	0.00
32	Jaipur	Rajasthan	0.08
33	Jhunjhunu	Rajasthan	0.00
34	Sikar	Rajasthan	1.24
35	Khammam	Telangana	0.00
36	Warangal	Telangan	0.00

Source: Indian Bureau of Mines

Table A.3.18: Iron Ore imports for FY 2019

S.No.	District	State	Production (in million tonnes)
1	Krishnapatnam	Andhra Pradesh	2.75
2	Jaigarh	Maharashtra	2.38
3	Kandla	Gujarat	1.04
4	Hazira	Gujarat	0.00
5	Mundra	Gujarat	0.49
6	Paradeep	Odisha	0.37
7	Mangalore	Karnataka	0.33
8	Mormugao	Goa	0.31
9	Karaikal	Puducherry	0.06

Source: Secondary Research

Table A.3.19: Plant Wise (District-Wise) Dispatches of Fertilizers for FY 2018

S. No.	Plant	District	State	Installed capacity	Production in Lakh Metric Tonnes
1	PPL:Paradeep	Jagatsinghpur	Odisha	7.4	13.14
2	GSFC:Vadodara	Vadodara	Gujarat	7.99	9.68
3	GSFC:Sikka-I	Jamnagar	Gujarat	3.26	4.92
4	TCL:Babrala	Sambhal	Uttar Pradesh	8.65	12.14
5	KRIBHCO:Hazira	Surat	Gujarat	17.29	23.53
6	Grasim/IGFL:Jagdishpur	Amethi	Uttar Pradesh	8.65	11.61
7	NFCL:Kakinada	East Godavari	Andhra Pradesh	5.97	7.88
8	NFL:VijaipurExpn.	Guna	Madhya Pradesh	8.65	11.39
9	RCF:Thal	Mumbai city	Maharashtra	17.07	21.44
10	IFFCO:Aonla	Bareilly	Uttar Pradesh	8.65	10.69
11	NFL:Vijaipur	Guna	Madhya Pradesh	8.65	10.58
12	MCFL:Mangalore	Dakshina Kannada	Karnataka	6.4	6.42
13	CFCL:Gadepan-II	Kota	Rajasthan	8.65	10.36
14	IFFCO:Aonla-II	Bareilly	Uttar Pradesh	8.65	10.34
15	NFCL:Kakinada 2	East Godavari	Andhra Pradesh	5.97	7.1
16	GNFC:Bharuch	Bharuch	Gujarat	7.8	9.11
17	IFFCO:Phulpur-I	Allahabad	Uttar Pradesh	5.51	6.32
18	IFFCO:Phulpur-II	Allahabad	Uttar Pradesh	8.65	9.92
19	CFCL:Gadepan-I	Kota	Rajasthan	8.65	9.66
20	CIL:Vizag	Visakhapatnam	Andhra Pradesh	10	11.12
21	NFL:Bhatinda	Bathinda	Punjab	5.12	5.68
22	RCF:TrombayV	Mumbai	Maharashtra	4.2	4.65
23	IFFCO:Kalol	Gandhinagar	Gujarat	5.45	6.02
24	KFL/KSFL:Shahjahanpur	Shahjahanpur	Uttar Pradesh	8.65	9.32
25	NFL:Panipat	Panipat	Haryana	5.12	5.43
26	NFL:Nangal-II	Rupnagar	Punjab	4.79	5.02
27	IFFCO:Kandla	Kachchh	Gujarat	24.15	25.05
28	SFC:Kota	Kota	Rajasthan	3.8	3.94
29	FACT:Cochin-II	Ernakulam	Kerala	4.85	4.93
30	KFCL:Kanpur	Kanpur Nagar	Uttar Pradesh	7.23	7.23
31	ZACL:Goa	South Goa	Goa	10.59	10.49
32	Greenstar Fert.Ltd.	Thoothukkudi	Tamil Nadu	6.06	5.52
33	SPIC:Tuticorin	Thoothukkudi	Tamil Nadu	6.2	5.63
34	FACT:Udyogamandal	Ernakulam	Kerala	3.74	3.18
35	IFFCO:Paradeep	Jagatsinghapur	Odisha	19.2	16.32
36	BVFCL:Namrup-III	Dibrugarh	Assam	3.15	2.5
37	Hindalc:Dahej	Bharuch	Gujarat	4	3
38	RCF:Trombay-V	Mumbai	Maharashtra	6	4.08
39	CIL:Kakinada	East Godavari	Andhra Pradesh	19.25	11.47
40	TCL:Haldia	Purba Medinipur	West Bengal	6.7	3.57

S. No.	Plant	District	State	Installed capacity	Production in Lakh Metric Tonnes
41	CIL:Ennore	Chennai	Tamil Nadu	3.3	1.43
42	MFL:Chennai	Chennai	Tamil Nadu	13.27	5.17
43	Smartchem/DFCLTaloja	Raigarh	Chhattisgarh	6.7	2.54
44	Matix Group.Cor.	Kolkata	West Bengal	120	44
45	BVFCL:Namrup-II	Dibrugarh	Assam	2.4	0.6
46	GSFC: Sikka-II	Jamnagar	Gujarat	3.96	-

Source: Department of Fertilizers, Ministry of Chemical and Fertilizers, Government of India

Table A.3.20: District-wise imports of fertilizers for FY 2018

S. No.	Port	District	State	Total Import (Lakh Metric Tonnes)
1	Mundra	Kutch	Gujarat	35.82
2	Kandla	Kutch	Gujarat	28.72
3	East Godavari	Kakinada	Andhra Pradesh	21.84
4	Visakhapatnam	Visakhapatnam	Andhra Pradesh	14.09
5	Pipavav	Amreli	Gujarat	9.94
6	Visakhapatnam	Visakhapatnam	Andhra Pradesh	6.74
7	Surat	Surat	Gujarat	5.83
8	Dakshina Kannada	Dakshina Kannada	Karnataka	5.3
9	Kachchh	Kutch	Gujarat	5.19
10	Nellore	Nellore	Andhra Pradesh	5.19
11	Jamnagar	Jamnagar	Gujarat	3.27
12	Tuticorin	Thoothukudi	Tamil Nadu	3.23
13	Haldia	Purba Medinipur	West Bengal	1.46
14	Paradip	Jagatsinghpur	Odisha	1.21
15	Mumbai	Mumbai	Maharashtra	1.05
16	South Goa	South Goa	Goa	0.92
17	Ratnagiri	Ratnagiri	Maharashtra	0.9
18	Wardha	Wardha	Maharashtra	0.84
19	South Goa	South Goa	Goa	0.77
20	Karaikal	karaikal	Puducherry	0.62
21	Raigarh	Raigarh	Maharashtra	0.55
22	Ganjam	Ganjam	Odisha	0.44
23	Ernakulam	Ernakulam	Kerala	0.35
24	Bhavnagar	Bhavnagar	Gujarat	0
25	Chennai	Chennai	Tamil Nadu	0
26	Mumbai	Mumbai	Maharashtra	0
27	JNPT	Mumbai	Maharashtra	0

Source: Department of Fertilizers, Ministry of Chemical and Fertilizers, Government of India

Table A.3.21: Expansion plans of Fertilizers Plants

S.No	Name of the Steel Plant	District	State	Capacity expansion (in LMT)	Year of completion
	Upcoming steel plants				
1	HURL (revival)	Gorakhpur	Uttar Pradesh	12.7	2021
2	Talcher Fertilizer project (revival)	Angul	Odisha	12.7	2022
3	RFCL	Karim Nagar	Telangana	12.7	2019
4	HURL (revival)	Begusarai	Bihar	12.7	2021
5	HURL (revival)	Dhanbad	Jharkhand	12.7	2021
6	HURL (revival)	Peddapalli	Andhra Pradesh	12.7	NA
7	KRIBHCO	Nellore	Andhra Pradesh	12	NA
	Expansion plans of existing plants				
1	PPL:Paradeep	Jagatsinghpur	Odisha	10	2020
2	GSFC:Vadodara	Vadodara	Gujarat	1.4	2021
3	MCFL:Mangalore	Dakshina Kannada	Karnataka	1	NA

Source: Secondary Research

Table A.3.22: Existing refineries of POL for FY 2018

S. No	Refinery	District	State	Production (in MT)
1	IOC, Guwahati	Kamrup Metropolitan district	Assam	1.12
2	IOC, Barauni	Begusarai	Bihar	5.88
3	IOC, Koyali	Vadodara	Gujarat	13.10
4	IOC, Haldia	Purba Mednipur	West Bengal	6.98
5	IOC, Mathura	Mathura	Uttar Pradesh	8.91
6	IOC, Digboi	Tinsukia	Assam	0.54
7	IOC, Panipat	Panipat	Haryana	15.83
8	IOCL,Bongaigoan, Assam	Bongaigaon	Assam	2.27
9	IOCL, Paradip,	Jagatsinghpur	Odisha	6.91
10	BPCL, Mumbai	Mumbai	Maharashtra	13.01
11	BPCL, Kochi	Ernakulam	Kerala	11.19
12	HPCL, Mumbai	Mumbai	Maharashtra	7.95
13	HPCL, Vishakhapatnam	Visakhapatnam	Andhra Pradesh	8.65
14	CPCL(MRL), Manali	Kullu	Himachal Pradesh	8.96
15	CPCL(MRL), Narimanam	Nagapattinam	Tamil Nadu	0.53
16	NRL, Numaligarh	Golaghat	Assam	2.65
17	MRPL, Mangalore	Dakhshina Kannada	Karanataka	14.62
18	ONGC, Tatipaka	East Godavari	Andhra Pradesh	0.082
19	RPL, Jamnagar	Jamnagar	Gujarat	32.92
20	RPL,SEZ	Jamnagar	Gujarat	41.26
21	EOL, Vadinar	Dwarka	Gujarat	20.09
22	BORL,Bina	Sagar	Madhya Pradesh	5.76
23	HMEL,Bathinda	Bhatinda	Punjab	9.96

Source: Petroleum Planning and Analysis Cell

Table A.3.23: Expansion plans of POL

S. No	Company	Location	District	2018 (in MT)	2020 (in MT)	2025 (in MT)	2030 (in MT)
1	IOCL	Guwahati	Kamrup, Metropolitan	1	2	1.7	1.7
2	IOCL	Barauni	Begusarai	6	6	9	9
3	IOCL	Gujarat	Vadodara	13.7	13.7	18	18
4	IOCL	Haldia	Purba Medinipur	7.5	8	8	8
5	IOCL	Mathura	Mathura	8	8	9.2	9.2
6	IOCL	Digboi	Tinsukia	0.65	0.65	0.65	0.65
7	IOCL	Panipat	Panipat	15	15	25	25
8	IOCL	Bongaigaon	Bongaigaon	2.35	2.7	2.7	4.5
9	IOCL	Paradip	JagatsinghApur	15	15	21	21
10	IOCL	CPCL-Manali	Kullu	10.5	10.5	10.5	10.5
11	IOCL	CPCL-CBR	Nagapattinam	1	1	9	9
12	HPCL & ONGC	Mumbai	Mumbai City	7.5	9.5	9.5	9.5
13	HPCL & ONGC	Visakh	Visakhapatnam	8.3	15	15	15
14	HPCL & ONGC	HMEL-Bathinda	BatHinda	11.3	11.3	11.3	11.3
15	HPCL & ONGC	Rajasthan	Jaipur	-	-	9	9
16	HPCL & ONGC	MRPL	Dakshina Kannada	15	15	18	18
17	HPCL & ONGC	Tatipaka	East Godavari	0.1	0.1	0.1	0.1
18	BPCL	Mumbai	Mumbai City	12	12	12	12
19	BPCL	Kochi	Ernakulam	15.5	15.5	20	20
20	BPCL	Bina	Sagar	6	7.8	15	15
21	BPCL	Numaligarh	Golaghat	3	3	9	9
22	Other refiners	Essar	Devbhoomi Dwarka	20	20	45	45
23	Other refiners	RIL- DTA	Jamnagar	33	33	40.5	63
24	Other refiners	RIL-SEZ	Jamnagar	35.2	35.2	35.2	35.2
25	IOCL, HPCL & BPCL	Ratnagiri Greenfield Refinery	Ratnagiri	0	0	60	60

Source: CHT Bulletin, Ministry of Petroleum and Natural Gas, Government of India

ANNEXURE 5.1: Consolidated Commodity groups based on Review of Select National Databases

Agriculture and Allied Sectors	Mining & Quarrying	Manufacturing & Capital Goods	Utilities & Fuels	Other Industrial Products
• Crops & Food Grains o Pulses & Cereals o Grains o Oilseeds o Commercial and Fiber Crops • Allied Sectors o Dairy o Animal Husbandry and products o Fisheries o Food Processing • Fruits & Vegetables	• Coal • Iron Ore • Stones • Other Ores & Minerals • Non Ferrous Metals	• Automotive • Electronic Goods and appliances • Engineering Products • Machinery & Equipment • Cotton, Textile, Leather & related products • Rubber & Plastics • Paper & Paper Products • Chemical and Chemical Products including Pharma • Fertilizers	• POL • Water • Gas • Others	• Building Products • Wood & Wood Products • Steel & Pig Iron • Cement & Clinker • Metals and metal products • Others

ANNEXURE 5.2: Indian Railway's Classification of Goods

#	Commodity	Remarks	Commodity Head	Broad Category
1	Absolute Alcohols		Acid and Alcohols	Balance Other Goods
2	Acetic Acid		Acid and Alcohols	Balance Other Goods
3	Benzoic Acid		Acid and Alcohols	Balance Other Goods
4	Benzyl alcohols		Acid and Alcohols	Balance Other Goods
5	Boric Acid		Acid and Alcohols	Balance Other Goods
6	Butyl alcohol		Acid and Alcohols	Balance Other Goods
7	Citric Acid		Acid and Alcohols	Balance Other Goods
8	Hydrochloric acid		Acid and Alcohols	Balance Other Goods
9	Nitric acid		Acid and Alcohols	Balance Other Goods
10	Phosphoric acid		Acid and Alcohols	Balance Other Goods
11	Spirit		Acid and Alcohols	Balance Other Goods
12	Sulphuric Acid		Acid and Alcohols	Balance Other Goods
13	Alloy pipes		Alloys and Metals	Pig Iron and Finished Steel
14	Alloy Steel		Alloys and Metals	Pig Iron and Finished Steel
15	Alumina		Alloys and Metals	Pig Iron and Finished Steel
16	Aluminimum Ingots & Billets		Alloys and Metals	Pig Iron and Finished Steel
17	Aluminium Powder		Alloys and Metals	Pig Iron and Finished Steel
18	Brass		Alloys and Metals	Pig Iron and Finished Steel
19	Copper Anode & Cathods		Alloys and Metals	Pig Iron and Finished Steel
20	Copper concentrates		Alloys and Metals	Pig Iron and Finished Steel
21	Copper Ingot & Slab		Alloys and Metals	Pig Iron and Finished Steel
22	Ferro Chrome		Alloys and Metals	Pig Iron and Finished Steel
23	Ferro Manganese		Alloys and Metals	Pig Iron and Finished Steel
24	Ferro Silicon		Alloys and Metals	Pig Iron and Finished Steel
25	Kansa		Alloys and Metals	Pig Iron and Finished Steel
26	Lead		Alloys and Metals	Pig Iron and Finished Steel
27	Silico Chrome		Alloys and Metals	Pig Iron and Finished Steel
28	Silicon		Alloys and Metals	Pig Iron and Finished Steel
29	Silicon Manganese		Alloys and Metals	Pig Iron and Finished Steel
30	Tin plate		Alloys and Metals	Pig Iron and Finished Steel

#	Commodity	Remarks	Commodity Head	Broad Category
31	Zinc		Alloys and Metals	Pig Iron and Finished Steel
32	Ballast		Bricks and Stones	RM for Steel
33	Ballast chips		Bricks and Stones	RM for Steel
34	*Bricks broken		Bricks and Stones	RM for Steel
35	Ceramic tiles		Bricks and Stones	RM for Steel
36	Chakkees		Bricks and Stones	RM for Steel
37	*Fire bricks		Bricks and Stones	RM for Steel
38	Flooring tiles		Bricks and Stones	RM for Steel
39	Floring Stone		Bricks and Stones	RM for Steel
40	Glass Stone		Bricks and Stones	RM for Steel
41	Granite		Bricks and Stones	RM for Steel
42	Gravel		Bricks and Stones	RM for Steel
43	Kunker		Bricks and Stones	RM for Steel
44	Marble chips		Bricks and Stones	RM for Steel
45	Marble dressed		Bricks and Stones	RM for Steel
46	Marble un-dressed		Bricks and Stones	RM for Steel
47	Mill Stone		Bricks and Stones	RM for Steel
48	Roller Stone		Bricks and Stones	RM for Steel
49	Sanitory wares		Bricks and Stones	RM for Steel
50	Slate		Bricks and Stones	RM for Steel
51	Slate Stone		Bricks and Stones	RM for Steel
52	Stone Dust		Bricks and Stones	RM for Steel
53	Stone Grit		Bricks and Stones	RM for Steel
54	Stone Pillars		Bricks and Stones	RM for Steel
55	Stone Ware		Bricks and Stones	RM for Steel
56	Stone, Cut or Engraved		Bricks and Stones	RM for Steel
57	Caustic potash liquor		Caustic Potash and Soda	Balance Other Goods
58	Caustic potash solid		Caustic Potash and Soda	Balance Other Goods
59	Caustic soda		Caustic Potash and Soda	Balance Other Goods
60	Caustic soda liquor		Caustic Potash and Soda	Balance Other Goods
61	Caustic soda lye		Caustic Potash and Soda	Balance Other Goods
62	Chlorate of Soda		Caustic Potash and Soda	Balance Other Goods
63	Soda ash		Caustic Potash and Soda	Balance Other Goods
64	Soda Bicarbonate		Caustic Potash and Soda	Balance Other Goods
65	Sulphur		Caustic Potash and Soda	Balance Other Goods

#	Commodity	Remarks	Commodity Head	Broad Category
66	Washing soda		Caustic Potash and Soda	Balance Other Goods
67	Acid resisting Cement		Cement	Cement
68	Asbestos		Cement	Cement
69	Cement Blocks		Cement	Cement
70	Cement Clinker		Cement	Cement
71	Cement manufactured		Cement	Cement
72	Cement Pipes		Cement	Cement
73	Cement sheets		Cement	Cement
74	Cement Tiles		Cement	Cement
75	Coloured Cement		Cement	Cement
76	**Fly ash		Cement	Cement
77	Superfine Cement		Cement	Cement
78	White Cement		Cement	Cement
79	Ammonium Nitrophosphate		Chemical manures	Fertilizers
80	Ammonium Phosphate		Chemical manures	Fertilizers
81	Ammonium Sulphate Nitrate		Chemical manures	Fertilizers
82	Bentonite Sulphur Pastilles (straight sulphur fertilizer)		Chemical manures	Fertilizers
83	Calcium Ammonium Nitrate		Chemical manures	Fertilizers
84	Calcium Nitrate		Chemical manures	Fertilizers
85	Calcium Sulphate		Chemical manures	Fertilizers
86	Complex Fertilizers		Chemical manures	Fertilizers
87	Cynamide		Chemical manures	Fertilizers
88	Di-Ammonium Phosphate		Chemical manures	Fertilizers
89	Ground Phosphate		Chemical manures	Fertilizers
90	Lime Nitrogen		Chemical manures	Fertilizers
91	Manure mixture		Chemical manures	Fertilizers
92	Mineral Phosphate		Chemical manures	Fertilizers
93	Muriate of Ammonia (Ammonia Chloride)		Chemical manures	Fertilizers
94	Muriate of Potash		Chemical manures	Fertilizers
95	Mycelium		Chemical manures	Fertilizers
96	N.P.K.Fertilizer		Chemical manures	Fertilizers
97	Nitrolim		Chemical manures	Fertilizers
98	Nitrophoska		Chemical manures	Fertilizers
99	Rock Phosphate (in Bag)		Chemical manures	Fertilizers
100	Rock Phosphate (in Loose)		Chemical manures	Fertilizers

#	Commodity	Remarks	Commodity Head	Broad Category
101	Single Super Phosphate		Chemical manures	Fertilizers
102	Sulphate of Ammonia		Chemical manures	Fertilizers
103	Sulphate of Zinc		Chemical manures	Fertilizers
104	Super Phosphate		Chemical manures	Fertilizers
105	Triple Super Phosphate		Chemical manures	Fertilizers
106	Urea		Chemical manures	Fertilizers
107	Urvara		Chemical manures	Fertilizers
108	Water Soluble fertilizer		Chemical manures	Fertilizers
109	*Bentonite powder		Clay and Sand	Balance Other Goods
110	*China Clay		Clay and Sand	Balance Other Goods
111	*Fire Clay		Clay and Sand	Balance Other Goods
112	Ground silica		Clay and Sand	Balance Other Goods
113	Luting sand		Clay and Sand	Balance Other Goods
114	Red Mud		Clay and Sand	Balance Other Goods
115	Calcined Petroleum coke		Coal and Coke	Coal and Coke
116	Coal Dust		Coal and Coke	Coal and Coke
117	Coal Shale		Coal and Coke	Coal and Coke
118	Coke hard		Coal and Coke	Coal and Coke
119	Coke soft		Coal and Coke	Coal and Coke
120	Cooking coal		Coal and Coke	Coal and Coke
121	Coke		Coal and Coke	Coal and Coke
122	Lignite		Coal and Coke	Coal and Coke
123	Metallurgical coke		Coal and Coke	Coal and Coke
124	Patent Fuel (as coal)		Coal and Coke	Coal and Coke
125	Petroleum coke		Coal and Coke	Coal and Coke
126	Raw Petroleum coke		Coal and Coke	Coal and Coke
127	Middling		Coal and Coke	Coal and Coke
128	Run off Mines Coal (ROM)		Coal and Coke	Coal and Coke
129	Steam coal		Coal and Coke	Coal and Coke
130	Washed Coal		Coal and Coke	Coal and Coke
131	Coal for Steel Plants		Coal and Coke	Coal and Coke
132	Atta		Foodgrain, Flour and Pulses	Foodgrain
133	Bajra		Foodgrain, Flour and Pulses	Foodgrain
134	Besan		Foodgrain, Flour and Pulses	Foodgrain
135	Chana Dal		Foodgrain, Flour and Pulses	Foodgrain
136	Gram		Foodgrain, Flour and Pulses	Foodgrain

#	Commodity	Remarks	Commodity Head	Broad Category
137	Jowar		Foodgrain, Flour and Pulses	Foodgrain
138	Maida		Foodgrain, Flour and Pulses	Foodgrain
139	Maize		Foodgrain, Flour and Pulses	Foodgrain
140	Moong Dal		Foodgrain, Flour and Pulses	Foodgrain
141	Musoor Dal		Foodgrain, Flour and Pulses	Foodgrain
142	Paddy		Foodgrain, Flour and Pulses	Foodgrain
143	Rice		Foodgrain, Flour and Pulses	Foodgrain
144	Suji		Foodgrain, Flour and Pulses	Foodgrain
145	Toor Dal		Foodgrain, Flour and Pulses	Foodgrain
146	Urad Dal		Foodgrain, Flour and Pulses	Foodgrain
147	Wheat		Foodgrain, Flour and Pulses	Foodgrain
148	Floating Fish Feed		Fish Meal	Foodgrain
149	All refined & non-refined edible oils		Hydrogenerated and other Edible Oils	Foodgrain
150	Castor oil		Hydrogenerated and other Edible Oils	Foodgrain
151	Groundnut Oil		Hydrogenerated and other Edible Oils	Foodgrain
152	Mustard Oil		Hydrogenerated and other Edible Oils	Foodgrain
153	Palm Oil		Hydrogenerated and other Edible Oils	Foodgrain
154	Sunflower oil		Hydrogenerated and other Edible Oils	Foodgrain
155	Vanaspati Ghee		Hydrogenerated and other Edible Oils	Foodgrain
156	Angles		Iron and Steel	Pig Iron and Finished Steel
157	Billets		Iron and Steel	Pig Iron and Finished Steel
158	Blooms		Iron and Steel	Pig Iron and Finished Steel
159	Cold Rolled Sheets / Coils		Iron and Steel	Pig Iron and Finished Steel
160	Colliery Arch & Z-Pilling		Iron and Steel	Pig Iron and Finished Steel

#	Commodity	Remarks	Commodity Head	Broad Category
161	Flat, iron or steel		Iron and Steel	Pig Iron and Finished Steel
162	Girders		Iron and Steel	Pig Iron and Finished Steel
163	Hot Rolled Sheets / Coils		Iron and Steel	Pig Iron and Finished Steel
164	Ingots		Iron and Steel	Pig Iron and Finished Steel
165	Stainless steel		Iron and Steel	Pig Iron and Finished Steel
166	*Steel Pipes		Iron and Steel	Pig Iron and Finished Steel
167	*Wire rod coils		Iron and Steel	Pig Iron and Finished Steel
168	Hides & Skins		Leather, Rubber and Plastic	Balance Other Goods
169	Leather cloth		Leather, Rubber and Plastic	Balance Other Goods
170	Leather goods		Leather, Rubber and Plastic	Balance Other Goods
171	Leather refuse		Leather, Rubber and Plastic	Balance Other Goods
172	Plastic Goods		Leather, Rubber and Plastic	Balance Other Goods
173	PVC Pipes		Leather, Rubber and Plastic	Balance Other Goods
174	Rubber crude		Leather, Rubber and Plastic	Balance Other Goods
175	Rubber Tyres & Tubes		Leather, Rubber and Plastic	Balance Other Goods
176	Alunite		Mineral and Ores	Iron Ore
177	Barytes powder		Mineral and Ores	Iron Ore
178	Bauxite		Mineral and Ores	Iron Ore
179	Calcite		Mineral and Ores	Iron Ore
180	*Chemical Gypsum		Mineral and Ores	Iron Ore
181	Chrome ore		Mineral and Ores	Iron Ore
182	Dolomite		Mineral and Ores	Iron Ore
183	Dolomite powder/lumps		Mineral and Ores	Iron Ore
184	Dunite		Mineral and Ores	Iron Ore
185	*Gypsum		Mineral and Ores	Iron Ore
186	*Gypsum in lumps / powder		Mineral and Ores	Iron Ore
187	High Density Iron ore		Mineral and Ores	Iron Ore
188	Ilmenite ore		Mineral and Ores	Iron Ore
189	**Iron ores for Export		Mineral and Ores	Iron Ore
190	Iron pyrites		Mineral and Ores	Iron Ore

#	Commodity	Remarks	Commodity Head	Broad Category
191	Laterite		Mineral and Ores	Iron Ore
192	Lime stone		Mineral and Ores	Iron Ore
193	Lime stone powder / lumps		Mineral and Ores	Iron Ore
194	Lithium ores		Mineral and Ores	Iron Ore
195	Manganese ores		Mineral and Ores	Iron Ore
196	Pyroxinite		Mineral and Ores	Iron Ore
197	Soap Stone		Mineral and Ores	Iron Ore
198	Zinc ores		Mineral and Ores	Iron Ore
199	Boilers		Machinery and Machine tools	Pig Iron and Finished Steel
200	Cranes		Machinery and Machine tools	Pig Iron and Finished Steel
201	Engines		Machinery and Machine tools	Pig Iron and Finished Steel
202	Machinery parts		Machinery and Machine tools	Pig Iron and Finished Steel
203	Sewing machine		Machinery and Machine tools	Pig Iron and Finished Steel
204	Brass scrap		Metal Scrap and Pig Iron	Pig Iron and Finished Steel
205	Copper scrap		Metal Scrap and Pig Iron	Pig Iron and Finished Steel
206	Iron scrap		Metal Scrap and Pig Iron	Pig Iron and Finished Steel
207	Sponge Iron		Metal Scrap and Pig Iron	Pig Iron and Finished Steel
208	*Slag		Metal Scrap and Pig Iron	Pig Iron and Finished Steel
209	Cotton Seed		Oil Cakes and Seeds	Balance Other Goods
210	Cotton Seed oil cakes		Oil Cakes and Seeds	Balance Other Goods
211	Cotton Seed waste		Oil Cakes and Seeds	Balance Other Goods
212	De-oiled Cakes		Oil Cakes and Seeds	Balance Other Goods
213	De-oiled rice bran		Oil Cakes and Seeds	Balance Other Goods
214	Gingerly Seed		Oil Cakes and Seeds	Balance Other Goods
215	Linseed		Oil Cakes and Seeds	Balance Other Goods
216	Mustard Seed		Oil Cakes and Seeds	Balance Other Goods
217	Rape Seed		Oil Cakes and Seeds	Balance Other Goods
218	Soyabean		Oil Cakes and Seeds	Balance Other Goods
219	Sunflower		Oil Cakes and Seeds	Balance Other Goods
220	Sal Seed		Oil Cakes and Seeds	Balance Other Goods
221	Ammonia liquified gas		Petroleum Products and Gases	POL
222	Argon gas		Petroleum Products and Gases	POL
223	Aviation spirit		Petroleum Products and Gases	POL

#	Commodity	Remarks	Commodity Head	Broad Category
224	Aviation Turbine Fuel (ATF)		Petroleum Products and Gases	POL
225	*Bitumen		Petroleum Products and Gases	POL
226	*Coal Tar		Petroleum Products and Gases	POL
227	*Coal Tar Pitch		Petroleum Products and Gases	POL
228	Compressed gases		Petroleum Products and Gases	POL
229	Crude oil		Petroleum Products and Gases	POL
230	Diesel Oil		Petroleum Products and Gases	POL
231	Furnace oil		Petroleum Products and Gases	POL
232	Hexane		Petroleum Products and Gases	POL
233	High Speed Diesel (HSD)		Petroleum Products and Gases	POL
234	**Kerosene Oil		Petroleum Products and Gases	POL
235	**Liquefied Petroleum Gas (LPG)		Petroleum Products and Gases	POL
236	Light Diesel Oil		Petroleum Products and Gases	POL
237	Low sulphur heavy stock		Petroleum Products and Gases	POL
238	Methane gas		Petroleum Products and Gases	POL
239	Naphtha		Petroleum Products and Gases	POL
240	Nitrogen gas		Petroleum Products and Gases	POL
241	Paraffin oil		Petroleum Products and Gases	POL
242	Petrol (Motor Spirit)		Petroleum Products and Gases	POL
243	Residual Fuel Oil (RFO)		Petroleum Products and Gases	POL
244	Earth Salt		Salt	Balance Other Goods
245	Iodised Salt		Salt	Balance Other Goods
246	Non-refined Salt		Salt	Balance Other Goods
247	Ordinary non-refined salt for human		Salt	Balance Other Goods
248	consumption (Iodised Salt / Salt meant for		Salt	Balance Other Goods
249	human consumption)		Salt	Balance Other Goods

#	Commodity	Remarks	Commodity Head	Broad Category
250	Refined Salt		Salt	Balance Other Goods
251	Rock Salt		Salt	Balance Other Goods
252	*Salt for Industrial use		Salt	Balance Other Goods
253	Vacuum Salt		Salt	Balance Other Goods
254	Liquid soap		Soap	Balance Other Goods
255	Synthetic soap		Soap	Balance Other Goods
256	Sugar Candy		Sugar	Balance Other Goods
257	Betel Nuts		Miscellaneous	Balance Other Goods
258	Chalk Calcium Carbonate		Miscellaneous	Balance Other Goods
259	Chalk in lumps or powder		Miscellaneous	Balance Other Goods
260	Glucose		Miscellaneous	Balance Other Goods
261	Gunnies		Miscellaneous	Balance Other Goods
262	Household effects		Miscellaneous	Balance Other Goods
263	Molasses		Miscellaneous	Balance Other Goods
264	Starch		Miscellaneous	Balance Other Goods
265	Dry Batteries, Dynamos	Electrical appliances and fittings	DIVISION -'A'	Balance Other Goods
266	Electric Motors / Pumps / Generators	Electrical appliances and fittings	DIVISION -'A'	Balance Other Goods
267	Electric wires	Electrical appliances and fittings	DIVISION -'A'	Balance Other Goods
268	Electrical Bulbs	Electrical appliances and fittings	DIVISION -'A'	Balance Other Goods
269	Electrical Fans	Electrical appliances and fittings	DIVISION -'A'	Balance Other Goods
270	Fuse wire	Electrical appliances and fittings	DIVISION -'A'	Balance Other Goods
271	Empty drums, Jerrycans and Barrels		DIVISION -'A'	Balance Other Goods
272	Jagree		DIVISION -'A'	Balance Other Goods
273	Jute		DIVISION -'A'	Balance Other Goods
274	Milk and Milk products		DIVISION -'A'	Balance Other Goods
275	Organic Manures		DIVISION -'A'	Balance Other Goods
276	Colours and Dyes	Paints and Polishes	DIVISION -'A'	Balance Other Goods
277	Fire Wood	Timber	DIVISION -'A'	Balance Other Goods
278	Plywood in boards, panels	Timber	DIVISION -'A'	Balance Other Goods

#	Commodity	Remarks	Commodity Head	Broad Category
279	Sandal wood	Timber	DIVISION -'A'	Balance Other Goods
280	Splints for matches	Timber	DIVISION -'A'	Balance Other Goods
281	*Timber waste	Timber	DIVISION -'A'	Balance Other Goods
282	Wood pieces	Timber	DIVISION -'A'	Balance Other Goods
283	Veg Oil Pitches		DIVISION -'A'	Balance Other Goods
284	Water		DIVISION -'A'	Balance Other Goods
285	Fireworks		Division -'B'	Balance Other Goods
286	Boiler Components		Division C	Balance Other Goods
287	Charcoal		Division C	Balance Other Goods
288	Card Boards	Paper	Division C	Balance Other Goods
289	Paper in reels / rolls	Paper	Division C	Balance Other Goods
290	Paper waste	Paper	Division C	Balance Other Goods
291	Paper cuttings	Paper	Division C	Balance Other Goods
292	Paper sludge	Paper	Division C	Balance Other Goods
293	Bamboo chips	Bamboos	Division D	Balance Other Goods
294	Bamboo Crushed	Bamboos	Division D	Balance Other Goods
295	Bamboo pulp	Bamboos	Division D	Balance Other Goods
296	Sticks	Bamboos	Division D	Balance Other Goods
297	Brooms		Division D	Balance Other Goods
298	Coffee and Tea		Division D	Balance Other Goods
299	Coir		Division D	Balance Other Goods
300	Bed Sheets	Cotton and other Textiles	Division D	Balance Other Goods
301	Cotton half / full pressed	Cotton and other Textiles	Division D	Balance Other Goods
302	Cotton raw	Cotton and other Textiles	Division D	Balance Other Goods
303	Hand spun yarn cotton	Cotton and other Textiles	Division D	Balance Other Goods
304	Khaddar	Cotton and other Textiles	Division D	Balance Other Goods
305	Silk	Cotton and other Textiles	Division D	Balance Other Goods
306	Synthetic Yarns	Cotton and other Textiles	Division D	Balance Other Goods
307	Towels	Cotton and other Textiles	Division D	Balance Other Goods

#	Commodity	Remarks	Commodity Head	Broad Category
308	Wool	Cotton and other Textiles	Division D	Balance Other Goods
309	* Bhoosa	Fodder and Husk	Division D	Balance Other Goods
310	* Chari	Fodder and Husk	Division D	Balance Other Goods
311	* Dry Grass	Fodder and Husk	Division D	Balance Other Goods
312	**Chuni	Fodder and Husk	Division D	Balance Other Goods
313	Cotton Seed Husk	Fodder and Husk	Division D	Balance Other Goods
314	Coconut husk	Fodder and Husk	Division D	Balance Other Goods
315	Gram husk	Fodder and Husk	Division D	Balance Other Goods
316	Kirby	Fodder and Husk	Division D	Balance Other Goods
317	Kirby Kutti (Kuttar)	Fodder and Husk	Division D	Balance Other Goods
318	Paddy Husk	Fodder and Husk	Division D	Balance Other Goods
319	Peas husk	Fodder and Husk	Division D	Balance Other Goods
320	Toor husk	Fodder and Husk	Division D	Balance Other Goods
321	Wheat bran (chokar)	Fodder and Husk	Division D	Balance Other Goods
322	Banana	Fruits and Vegetables	Division D	Balance Other Goods
323	Garlic	Fruits and Vegetables	Division D	Balance Other Goods
324	Dates	Fruits and Vegetables	Division D	Balance Other Goods
325	Mango	Fruits and Vegetables	Division D	Balance Other Goods
326	Orange	Fruits and Vegetables	Division D	Balance Other Goods
327	Onions	Fruits and Vegetables	Division D	Balance Other Goods
328	Potatoes	Fruits and Vegetables	Division D	Balance Other Goods
329	Alum	Groceries	Division D	Balance Other Goods
330	Chillies, Dry Chillies	Groceries	Division D	Balance Other Goods
331	Edible snacks	Groceries	Division D	Balance Other Goods
332	Extruded foods	Groceries	Division D	Balance Other Goods
333	Jeera	Groceries	Division D	Balance Other Goods

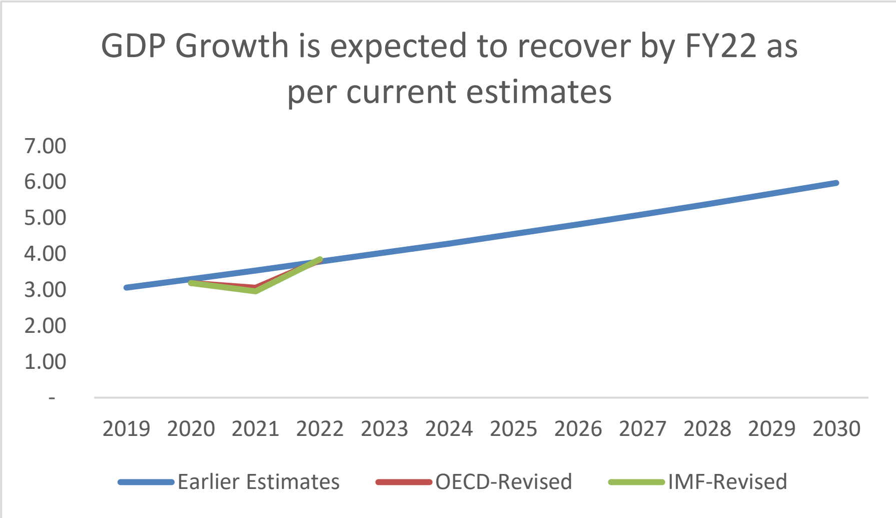
#	Commodity	Remarks	Commodity Head	Broad Category
334	Pepper	Groceries	Division D	Balance Other Goods
335	*Soya Protein Textured	Groceries	Division D	Balance Other Goods
336	Spices	Groceries	Division D	Balance Other Goods
337	Maize Flakes	Groceries	Division D	Balance Other Goods
338	Rice flakes	Groceries	Division D	Balance Other Goods
339	Rice Parched	Groceries	Division D	Balance Other Goods
340	Sago common	Groceries	Division D	Balance Other Goods
341	Turmeric	Groceries	Division D	Balance Other Goods
342	Livestock		Division D	Balance Other Goods
343	IV and Insecticide Fluid		Division D	Balance Other Goods
344	Motor Vehicles		Division D	Balance Other Goods
345	Sugarcae & Bagasse		Division D	Balance Other Goods
346	Containers		Containers	Containers

ANNEXURE 5.3: Impact of COVID-19 on demand for rail freight service

The COVID-19 pandemic impacted the Indian economy along with economies across the globe. Measures to contain the pandemic in terms of the lockdowns, impacted economic (GDP) growth in most economies including India.

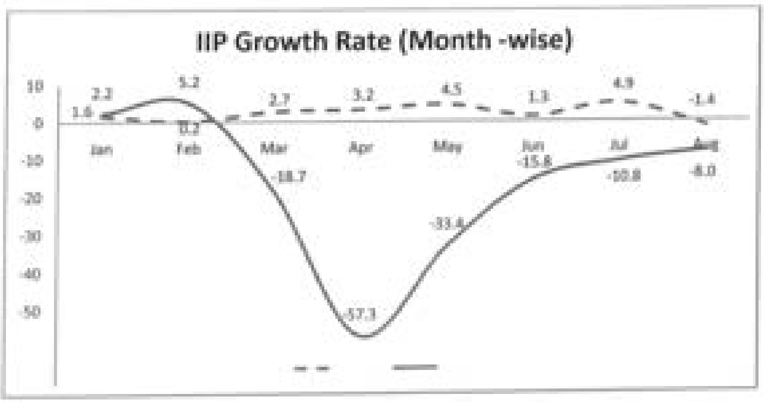
Given the uncertainties associated with containment of the pandemic in terms of availability of a vaccine, increase in cases in additional 'waves', etc., economists have been studying and hypothesizing on the possible contours of economic revival. Given the inter-connectedness of the global economy, revival in various regions would also impact specific economies like India.

At this stage, the estimates and assessments available[224] point to a recovery in economic activity to pre-COVID levels by 2022.



The pandemic and resultant lockdown not only impacted freight movement in 2020 but also impacted industrial activity widely within the economy.

As can be seen in the adjoining graph, there was a significant dip in the Index of Industrial Production (IIP) during the lockdown period in April and May 2020[225]. While the trend has been improving over the past few months, the growth rate continues to be in negative trajectory. The fall was primarily due to lower output in the manufacturing, mining and power generation sectors emanating from multitude of factors like limited manpower



[224] Earlier estimates based on GDP Growth projections by OECD; https://data.oecd.org/gdp/real-gdp-forecast.htm accessed in August/September,2019;
Revised estimates based on India Economic Forecast, June 2020, OECD; https://www.oecd.org/economy/india-economic-snapshot/) and World Economic Outlook, Oct 2020, IMF; https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD
[225] Highlights of Index of Industrial Production, Aug 2020, Office of Economic Advisor; https://eaindustry.nic.in/iip/IIP_Highlights.pdf

availability, social distancing limitations, etc. As per Ministry of Statistics and Program Implementation, it may not be appropriate to compare the IIP in the post pandemic months with the IIP for months preceding the COVID 19 pandemic. This is primarily because the pandemic has been unprecedented and essentially in the nature of an extremely rare and outlier event that cannot be accounted for in comparisons/ long-term projections.

In fact, interestingly, given the disruption in extant freight networks and flows, there were even instances where Indian Railway seems to have had a disproportionately higher modal share of freight flows even as it recorded freight volumes/ movement at similar levels as in the prior year.

The extent of impact of the lockdown seems to have been relatively limited on conventional commodities transported over Indian Railways –with positive production trends being reported in attendant industries in the recent months.

Table 1: Rail share and Production/Thoruhput trends for key Commodities during Lockdown

Commodity	%age share of Rail Traffic	Production/Throughput Trend, Q1 2020	Production/Throughput Trend, Q2 2020
Coal	49.6%	+	+
Food Grain	3.2%	+	+
Fertilizer	4.2%	+	+
Steel	4.4%	-	=
Iron Ore	11.2%	-	+

Note- %age share of Rail Traffic for FY 19; Production/Throughput Trend represent broad comparison with same quarter in FY 2019
Source- Indian Railways Annual Report, Data from Respective Ministries and News Publications, Consultant Analysis

The above is also reflected in monthly freight statistics released by Indian Railways.

Over the short-term, as economic activity picks-up across industries, freight networks and flows are also expected to stabilize over 2021. However, in the medium to longer term, economists are projecting economic (GDP) growth to recover and continue to be based on conventional factors like earlier – demographics, competitive positioning on factors of production, vibrant services sector etc[226]. The ongoing period of 1 to 2 years is therefore appearing more as a short-term disruption in economic growth that would have been otherwise expected.

As economic (GDP) growth recovers and picks-up over the medium to longer term, freight transport demand in the national transport system is also expected to recover concurrently. At this stage, there is no evidence of the pandemic having resulted in any structural change in nature of association/ linkage between economic activity/ growth and freight transport demand in the economy. Accordingly, macro-economic indicators such as GDP can continue to be considered as appropriate for projecting freight transport demand in the national transport system over the longer horizon.

Any potential variations in the growth of economic activity (GDP) would however need to be continuously monitored over time – an activity which would have been even otherwise relevant, vis-à-vis the demand projection scenarios.

[226] Global Economic Effects of COVID-19, Nov 2020; US Congressional Research Service

ANNEXURE 5.4: Output of Logit Model on commodity-wise rail shares for horizon years

The projected rail share by commodities under preferred scenario (scenario 3C[227]) is presented in Table below

Table 1: Existing and projectied rail shares

Commodity	Existing	2021	2026	2031	2041	2051
Conatinerizable BOG	23	42	73	171	292	429
Non-conatinerizable BOG	54	96	169	395	674	990
Total BOG	**77**	**138**	**242**	**567**	**966**	**1,419**
Ceme nt	114	185	288	405	686	1,079
Coal	575	646	810	1,050	1,455	1,577
Container	54	90	132	234	374	610
Fertilizer	49	64	87	113	174	256
Food grain	45	88	103	127	165	225
Iron Ore	137	132	202	289	435	652
Pig Iron	40	77	108	147	221	318
POL	43	50	84	179	264	630
Steel RM	28	31	42	55	83	120
Total	**1,162**	**1,500**	**2,096**	**3,167**	**4,823**	**6,885**

Please refer to **Chapter 4** of Draft Final Report for more details on Logit model.

[227] Scenario 3C entails enhancement of speed from existing 25 Kmph to 50 KMpph in a gradual manner- Year 2021 - 25 Kmph, Year 2026 – 30 Kmph, Year 2031 – 35 Kmph, Year 2041 – 40 Kmph, Year 2051 – 50 Kmph. Further to adoption of these speeds, reduction of 30% in tariff has been applied in selected commodities including BOG, Cement, Containers, Food Grains, Iron Ore and Raw Material for Steel

ANNEXURE 5.5: Estimation of potential capital expenditure for development of freight terminals

This Annexure presents the key considerations/ assumptions made for estimating the potential capital expenditure for development of freight terminal capacities at locations identified under this study as discussed in the section on freight flow assessment and modal share of railways.

Components of capital expenditure for development of freight terminals

For estimating capital expenditure for development of freight terminal infrastructure, the following components need to be taken into account:

- Cost of land acquisition;
- Cost of construction of external road/ rail connectivity;
- Cost of development of terminal[228] including hard infrastructure like platforms for handling, storage facilities, circulation area, etc.;
- Cost of ancillary services infrastructure including parking facilities, gate complex, TXR facility, office space for various stakeholders, etc.; and
- Cost of other miscellaneous infrastructure including open area, public utilities / conveniences etc.

Assumptions on sizing of areas/ facilities

The assumptions used by the study team relating to these components are presented below:

- The area required for developing a **rail siding** has been calculated based on an estimated siding length of 750 meters with a width of 7 meters, cumulating to a total area of 750m x 7m = 5250 sqm.
- It has also been assumed that each siding can serve a maximum of 2 trains per day, keeping bunching of traffic, operational variations etc. in mind. Accordingly, the total number of sidings has been determined based on the number of trains plying to a location in a day.
- The area required for loading/ unloading freight volumes at the **platforms** has been calculated by considering length of ~750m and a platform width of ~20m which results in an area of ~15000 sqm. Furthermore, it has been considered that each platform can serve a maximum of 2 railway sidings, as a result of which, the total number and consequent area of platforms for a terminal will be determined based on the total no of rail sidings that are required for a terminal.
- In view of the (multi) commodity basket to be handled at the proposed terminal locations, the storage requirements and facilities would differ (according to each commodity type). The total required **storage and handling area** would be dependent upon the commodity throughputs / volumes, dwell time and peak factors. Even though the throughput

[228] Estimates do not include cost of handling equipment since a majority of terminal owners/ developers follow a variable operating cost/ vendor deployment model, or at best procure equipment on lease instead of investing in them upfront.

volumes would differ by commodity type, the dwell time and peak factor for each commodity has been assumed to be the same at 8 days and 10% respectively for the purpose of this estimation. Additionally, for containers, stack height is assumed to be 3.5 units. The assumptions made with respect to required storage area, along with the formula for calculating required handling area for each commodity has been presented below.

Table 2: Assumptions made regarding storage and Handling area requirements

Commodity Type	Storage Area	Handling Area
Cement	~2 tonnes/sqm	Throughput / 30 * Peak * Dwell time
Steel	~4 tonnes/sqm	Throughput / 30 * Peak * Dwell time
Container (incl. EXIM and Domestic)	~1 TEU/15 sqm	Throughput / 30 * Peak * Dwell time /Stack Height

Source: Expert inputs and Consultants' Analyses

- **Circulation area** accounting for ~50% of the handling and storage area and **parking area** accounting for ~30% of the handling and storage area have been taken as per industry norms.
- **Business support area** including office blocks, canteen facilities and other amenities will be required to be built for which an area equivalent to ~1000 sqm has been considered for each terminal.
- 10% of the total area for sidings, handling, storage, parking and circulation has been considered as the **area for open space**.

Considerations/ assumptions with respect to capital costs

The land area requirement for developing a terminal along with the corresponding typical/ benchmark capital costs for developing associated facilities has been presented below.

Table 3: Total land requirement for developing a freight terminal and corresponding capital cost estimates

Sr. No.	Components	Length/Area (in m/sqm)	Cost (in INR lakhs)
A.	**Connectivity Infrastructure**		
	Rail Siding	750m	0.4-0.6/m
B.	**Development of Terminal Infrastructure**		
	Platform for loading / unloading	15000sqm	0.04/sqm
	Handling Area	As defined above	0.04/sqm
	Storage Area	As defined in above	0.04/sqm
	Circulation Area	As defined above	0.03/sqm
C.	**Ancillary Services Infrastructure**		
	Gate Complex	1000 Sqm	60-70/unit
	TXR Facility	24 Sqm	60/unit
	Office Complex	1000sqm	0.3/sqm

Source: These assumptions have been made based on accepted industry norms and standards and were validated by experts during stakeholder consultations.

The total land required for developing a terminal can be determined based on the assumptions presented in the table above and after additionally accounting for land required for parking area and open area.

Cost of land (acquisition) required for development of freight terminals depends on two major factors:

- Selected/ identified location for development of the said terminal – town/ city/ metropolitan/ megalopolis; and
- Strategy with respect to procuring land – owned/ leased/ licensed.

The block estimates used for cost/acre depending upon the location type are presented below.

Table 4: Block estimates for cost/acre vis-à-vis location type

Sr. No.	Location Type	Cost (in INR crores / acre)	Increase in cost of terminal development
1.	Town - Urban area with population <1 lakh	0.5	~25%
2.	City - Urban area with population >1 lakh but less than 10 lakhs	0.75	~33%
3.	Metropolitan - Urban area with population >10 lakhs	1	~40%
4.	Megalopolis - Metropolitan agglomeration	1.5	~50%

Source: Consultant Analysis

The cost of land alone could account for an increase in the capital cost of terminal development – in the range of 25-50%, in a scenario where the terminal developer acquires and owns the land parcel himself. It is due to this reason that the practice of leasing/ licensing of land is also prevalent in the industry.

Furthermore, since strategic land parcels are found to be around railway lines, railways could also provide land to the terminal developers in exchange of a rental/ license fee.

Depending upon the strategy with respect to procuring the land parcel, the cost of land could be either in the nature of an operating expenditure or in the nature of a capital expenditure for the development/ project.

Number of terminals required in each identified district

Several factors will inform/ influence the total number of freight terminals that are required to be developed in each of the identified 42 districts (broad terminal locations) in phases till the horizon year 2031. These factors include:

- **Actual growth in cargo volumes**: The projected freight traffic could materialise in a staggered manner over the horizon period.
- **No of railway sidings/ lines**: For operational reasons, it has been assumed that a terminal can serve a maximum of 4 railway sidings/ lines before congestion issues related to common access area on rail start to impact. The number of sidings will be determined by the cargo volumes that govern the number of trains to be plied at a terminal. It has been considered/ assumed that if any location requires more than 4 sidings/ handling lines, a new/incremental terminal would be planned/ developed. While this may be seen to increase the overall number of estimated terminals, it should be noted that in reality the final decision(s) would need to have reference to land availability, location specific demand patterns, etc.
- **Availability of land (parcels)** at the identified districts (broad terminal locations) for terminal development.
- Degree of **investor participation and interest**.

The following table presents the overall estimated capital expenditure requirements for developing the required freight terminal infrastructure/ capacities in a phased manner.

It is estimated that ~INR 10,000 crores could be required for development of required freight terminal infrastructure/ capacities.

Table A-1: Estimated capital expenditure requirements for developing freight terminal infrastructure/ capacities at identified districts (broad terminal locations)

Sr. No.	Cluster/ Location	No of terminals	Average construction cost per terminal (in INR crores)	Average land cost per terminal (in INR crores)	Total Construction Cost (in INR crores)	Total Land Cost (in INR crores)
1.	North Goa/South Goa/Belgaum/Dharwad/Kolhapur	2	55	36	110	72
2.	Allahabad/Mirzapur/Sonbhadra/Varanasi	2	51	34	101	67
3.	Bhagalpur/Kishanganj/Purnia/Darjiling/Jalpaiguri	2	52	26	104	52
4.	Lakhimpur/Sivasagar/Tinsukia/Dimapur/Kohima	1	82	41	82	41
5.	Bhind/Gwalior/Jhansi	1	38	25	38	25
6.	Burhanpur/Jalgaon	1	36	18	36	18
7.	Pune/Solapur	5	62	61	310	307
8.	Baksa/Barpeta/Kamrup Metropolitan/Kamrup	5	60	40	302	200
9.	Bharuch/Surat/Vadodara	3	56	36	168	109
10	Ernakulam/Kottayam/Thrissur/Coimbatore	4	64	43	256	171
11	Jammu /Srinagar /Amritsar /Gurdaspur	3	73	50	219	149
12	Thiruvananthapuram/Kanniyakumari/Thoothukkudi/Tirunelveli	3	65	44	195	131
13	Chandigarh/Ambala/Yamunanagar/Hardwar	3	60	40	179	119
14	Valsad/Nashik/Palghar	2	59	38	118	77
15	Bathinda/Ganganagar/Hanumangarh	2	59	29	117	59
16	Madurai/Virudunagar	1	90	62	90	62
17	Dakshina Kannada/Mysore/	1	96	68	96	68
18	Guntur/Krishna/	1	79	40	79	40
19	Bhopal/Hoshangabad/	1	28	16	28	16
20	Agra/Aligarh	1	83	56	83	56
21	Chittoor/Nellore/Chennai/Kancheepuram/Thiruvallur/Vellore	17	62	62	1056	1051
22	Haora/Hugli/Kolkata/North 24 Parganas/Purba Medinipur/South 24 Parganas/	16	61	61	981	972
23	Gurgaon/Hisar/Jhajjar/Karnal/Panipat/Gautam Buddha Nagar/Ghaziabad/Meerut/Faridabad/South West Delhi/New Delhi/Central Delhi/	20	63	63	1263	1255
24	Bangalore Rural/Bangalore/Kolar/Tumkur/Krishnagiri/	14	62	61	865	859
25	Mumbai/Raigarh/Thane	11	62	61	681	674

26	Ahmadabad/Kheda/Mahesana/Surendranagar/	9	59	39	527	347
27	Hyderabad/Mahbubnagar	7	59	58	411	407
28	Mahendragarh/Rewari/Alwar/Jaipur/Sikar	5	68	45	338	227
29	Arwal/Aurangabad/Buxar/Gaya/Jehanabad/Lakhisarai/Munger/Nalanda/Nawada/Patna/Rohtas/Saran/Vaishali	5	64	43	320	216
30	Kachchh/Morbi/	4	64	32	255	127
31	Kanpur Dehat/Kanpur Nagar/Lucknow/Rae Bareli/	4	55	37	222	146
32	Dharmapuri/Erode/Salem	3	59	29	176	87
33	Ajmer/Nagaur/Pali	1	80	54	80	54
34	Indore/Ratlam/	1	20	11	20	11
35	Nagpur	1	61	40	61	40
36	Darbhanga/Gopalganj/Muzaffarpur/Pashchim Champaran/Purba Champaran/Saharsa/Sitamarhi/Gorakhpur/	1	83	43	83	43
37	Jalandhar/Ludhiana/Shahid Bhagat Singh Nagar	1	82	42	82	42
38	Purbi Singhbhum/Ranchi/	1	77	51	77	51
39	Bokaro/Dhanbad/Hazaribagh	1	34	22	34	22
40	Bellary	1	35	17	35	17
41	Bilaspur/Hamirpur/Shimla/Solan	2	47	15	93	30
42	Amreli/Rajkot	1	32	20	32	20
	Total				**10,402**	

ANNEXURE 5.6: Suggestions received from stakeholders on tactical/ transactional initiatives by IR

The section on freight flow assessment and modal share of railways, sought to address key strategic levers/ enablers to increase rail share – at a system level as well as at the level of key commodities by enhancing the value proposition of rail transport with respect to overall logistics cost, time and quality.

During the study, the team undertook stakeholder consultations and had reference to various inputs received in formulation/ recommendation on the modal shift strategies. However, some inputs received were more focused on alleviation of short-term issues faced by stakeholders and/ or tactical in nature. This annexure presents some such inputs for reference of Indian Railways.

Suggestions received from Stakeholders on transactional initiatives requested from IR:

Automobile Sector –

- Railway support is required to develop more Auto Hubs to facilitate loading/unloading, for example, Agartala should be developed a railway goods shed with proper infrastructure and security as a potential automobile hub.
- Multi-point loading and unloading to facilitate meeting mixed destination loads in optimal quantities.
- Conversion of 4-6 NMG Rakes for the dedicated use of 2 wheeler transportation
- The floor of the wagon should be flat and should not have a central shoulder/rib which does not allow two-wheelers to be loaded properly and efficiently
- NMG freight should be competitive with road freight as road transportation can deliver the consignment up to last mile.

Cement –

- Reclassification sought for Clinker and Pet Coke from 140 to 120 class.
- Development of 22 identified goods sheds as bulk terminals on railway land with CRWC.
- Easing of restrictions due to congestions on routes and terminals
- Cement is a short lead sector, and short lead traffic of less than 300 km can be attracted in containers. This would be possible only if such containers would be charged at FAK rates instead of the present system of charging cement at CC rates.

Containers -

- Extend provision of Station to Station Rates for container traffic
- Charge 40 ft containers at 1.5 X TEU as per global norms, instead of the current 1.8 X TEU
- Currently commercial routes are determined by availability and nearness to base location for rakes. There is a need to increase base notifications and consider universalisation of bases
- Certain commodity specific discounts such as for Fly Ash and Salt have been offered (between 15-20%) but only for Rail owned wagons. These discounts need to be extended to the container sector as well.
- Fertilizer subsidy currently provided for Rail wagons should also extended for movement of fertilizer in containers as well.

Steel & Iron ore–

- Increase in priority and for rake allocation for transportation of Iron Ore & Coal to Integrated steel units from Mines and port for domestic customers over exports
- Extend a freight discount on the long lead concession (recently awarded) by including a volume based commitment for iron ore by the steel producers. For instance, if a steel producers commits to move 1 million tons of Iron ore through the year by rail then he may be awarded Rs 100 per ton additional discount over and above the long lead discount.
- Concord rakes are usually supplied with a combination of BRN & BOST wagons with PCC of 61t - 66t per wagon. As there is no advance information on composition of rakes, users are unable to plan production to optimize the loadabiltiy in each. This leads to either under loading of wagons or non-uniform loading of the rakes. Standardisation of all wagons PCC used for Concord rakes will help resolve this issue.
- Classification of Granulated Slag to be revised from Class 140 to Class LR1. Slag, which is a by-product of the steel industry, is used along with fly ash by cement industry as a replacement for clinker. Slag also has high potential to be used as a replacement for river sand which is scarce in India due to strict environmental norms. Due to high freight on account of 140 class, Slag which is usually sold at a low price of INR 100 – 200 pmt, becomes expensive and un-economical for end purchasers. The reduction in class of Slag can lead to increase in volumes by 3.0 – 6.0 MTPA in addition to the current volumes.
- Development of TXR facility closer to high volume plants will improve the Rake TAT and avoid unproductive movement.
- All steel plants need to be treated at par, w.r.t free time and allowances (Both Public and Private Sector). All public sector enterprises and certain old ISP's enjoy higher free time and many allowances as compared to other entities. Disparity should be removed to create a level playing field.
- 18 – 20% inflated mileage on the KK line is affecting steel plants that are dependent on iron ore from Bailadila mines of NMDC. This system of tariff was meant for recovering cost of construction of Railway lines in difficult terrains (Ghat section & Hilly Area) . With the passage of time of about 25 years, the cost should have been recovered and inflated freight system is required to be withdrawn.
- Several railway routes carrying iron ore have been subjected to Route Rationalisation due to congestion in the Railway Network (despite delays in doubling/ trebling of lines to ease the situation). For example, though the actual rail distance from the iron ore producing belt around Joda and Barbil to the Kalinga Nagar Industrial Complex is about 225 Km by the shortest available route, freight is presently being charged on a longer route via Tatanagar, Kharagpur, Bhadrak with a chargeable distance of 501 Km. This rationalisation results in increased freight to the tune of 85%. Therefore, Route Rationalisation such as these, need to be reconsidered and corrected.
- In case of any private sidings that have become non-operational due to closure of mines or expiry/suspension of mining lease, railway should permit such sidings to be used by other private players or new lessees as co-users.

Coal –

- The freight rate for coal and coal based products fall under rate class of 145A which is much higher than other essential commodities. In order to provide relief to end users inclusion of coal in the bracket of essential commodities may be considered.
- Distance based concession for transportation of Coal & Coke, Iron & Steel and Iron ore may be provided for a distance of more than 500 km.

- In order to provide relief to Power Utilities and Industries, the Ministry of Coal has already allowed the facility of Usance Letter of Credit to the consumers for payment of coal value. Usance LC mode of payment for freights may be considered by the Railways as well.
- For bulk procurement of coal in the slab below 50 km, commensurate freight may be worked upon to attract the volume of traffic from Road mode to Rail for ultra-short lead moves.
- Permissible Chargeable Capacity (PCC) of Imported Coal/Coke in BOXN wagon works to the disadvantage of imported coal. Imported Coal has density in the range of 0.85 ~ 0.94 mt/m3 (due to less ash content and volatile matter). Thus Imported coal can be loaded only up to 56 ~ 62.4 mt/wagon. Similarly, the Density of Imported Coke is around 0.45 ~ 0.6 mt/m3 thus can be loaded only 42 ~ 45 mt/wagon. However, Indigenous Coal / Coke have higher densities and which can be loaded over 66 mt/wagon. Thus, importers are charged higher idle freights as Chargeable weight is 68 mt/wagon & it is impossible to load the same. IR may accordingly consider a new classification for Imported Coal/ Coke and the PCC may be accordingly charged as 63 MT/ wagon for imported coal and 45 Mt/wagon for imported coke.

ANNEXURE 7.1: Sanctioned Doubling Works

S.No	Railway	Division	Name of Work	Length (Km)
1	CR	Bhusawal,Solapur	Daund - Manmad	247.5
2	CR	Nagpur	Itarsi-Nagpur	280.0
3	CR	Pune	Pune-Miraj-Londa	467.0
4	ER		Sagardighi-Malda Town (Nimtita-New Farakka)	25.4
5	NR		Muzaffarnagar - Tapri	51.5
6	NR	Lucknow	Alamnagar - Utretia	18.1
7	NR		Rajpura - Bhatinda	172.6
8	NR		Jaunpur - Tanda	77.3
9	NR		Bareilly-Chandausi-Aligarh	167.7
10	NR	Ambala	Ludhiana-Kila Raipur	19.0
11	NR	Delhi	Delhi-Shamli-Tapri incl Saharanpur by-pass	175.0
12	NR	Firozpur	Ludhiana-Mullanpur	21.0
13	NR	Firozpur	Amritsar-Chheharta	7.0
14	NR	Lucknow	Barabanki - Akbarpur	161.0
15	NR	Lucknow	Janghai - Pratapgarh - Amethi	87.0
16	NR	Lucknow	Jaunpur Jn-Jaunpur City - Chord line	2.2
17	NR	Lucknow	Janghai-Phaphamau - Doubling with electrification	46.8
18	NR	Lucknow	Phaphamau-Unnao via Kunda Harnamhganj	200.0
19	NER	Varanasi	Varanasi - Madhosingh - Allahabad	120.2
20	NER	Lucknow	Rosa-Sitapur Cantt - Burhwal	180.8
21	NER	Varanasi	Aunrihar-Jaunpur	59.6
22	NER	Lucknow	Malhaur-Daliganj - Doubling with electrification	12.6
23	NER	Varanasi	Ballia-Ghazipur City	65.1
24	NER	Varanasi	Bhatni - Aunrihar with electrification (excl Indara - Mau)	242.0
25	NER	Varanasi	Phephna-Indara, Mau-Shahganj (excl Indara-Mau)	150.3
26	NFR		New Bongaigaon - Goalpara - Guwahati (Kamakhya)	176.0
27	NFR		Digaru - Hojai	102.0
28	NFR	Lumding	Kamakhya-New Guwahati - Quadrupling	10.3
29	NFR		Saraighat Bridge doubling	7.0
30	NFR	Alipurduar Jn	New Maynaguri-Gumanihat - Doubling of remaining portion	51.7
31	SR	Salem	Salem-Magnasite Jn-Omalur	11.0
32	SR	Madurai	Madurai - Maniyachi - Tuticorin	160.0
33	SR	Madurai	Maniyachi - Nagercoil	102.0
34	SR	Palghat	Netravati - Mangalore Central	1.5
35	SR	Trivandrum	Turavur - Ambalapuzha	50.0
36	SR	Trivandrum	Trivandrum - Kanyakumari	86.6
37	SCR		Gooty - Dharmavaram	90.2
38	SCR		Kalluru - Guntakal	41.0
39	SCR		Renigunta , Wadi & Gooty - Bypass	21.0
40	SCR		Vijayawada & Kazipet -Byepass line	30.2
41	SCR		Secunderabad - Mehboobnagar	85.2

S.No	Railway	Division	Name of Work	Length (Km)
42	SCR		Guntakal - Guntur	401.5
43	SER	Ranchi	Bondamunda - Ranchi	158.5
44	SER	Adra	Mohishila-Kali Pahari Link - Doubling with one addl loop line at Mohana	2.9
45	SER	Adra	Damodar - Mohishila	8.2
46	SER	Adra	Radhanagar Siding Line of Adra Division to Barachak & Y-connection Line to Sitarampur	10.0
47	SER	Adra	Purulia-Kotshila	36.0
48	SER	Adra	Talgaria-Bokaro-N/Cabin - Doubling with two loops at Chas & Ispatnagar	38.0
49	SER	Chakradharpur	Dumetra-Link-C Line - Connections with Bisra station	2.3
50	SER	Ranchi	Lodhma-Piska - Link line bypassing Hatia / Ranchi with Y connection	17.2
51	WR	Ratlam	Indore -Devas -Ujjain	79.2
52	WR	Vadodara	Anand-Godhra	79.0
53	WR		Bhildi-Bypass line	1.4
54	WR		Ujjain-Flyover	2.2
55	WR	Ahmedabad	Mehsana-Palanpur	65.1
56	WR	Rajkot	Surendranagar-Rajkot - Doubling of broad gauge single line section	116.2
57	WR	Rajkot	Rajkot-Kanalus	111.2
58	WR	Ratlam	Nimuch-Chittaurgarh	55.7
59	WR	Ratlam	Nagda-Ujjain - Doubling of Gambhir Bridge	1.6
60	WR	Ratlam	Nimach-Ratlam	133.0
61	ECR	Danapur	Rampur Dumra-Tal-Rajendrapul - Addl bridge and doubling	14.0
62	ECR	Danapur	Kiul - Gaya	124.0
63	ECR	Danapur	Karota Patner-Mankatha - Surface triangle line	7.9
64	ECR	Dhanbad	Renukut-Chopan	39.9
65	ECR	Dhanbad	Karaila Road-Shaktinagar	32.2
66	ECR	Dhanbad	Ranchi Road-Patratu - Patch doubling	31.0
67	ECR	Dhanbad	Ramna-Singrauli	160.0
68	ECR	Dhanbad	Garwa Road - Rail over rail	10.0
69	ECR	Dhanbad	Gomoh - Flyover for down trains	20.0
70	ECR	Mughalsarai	Gaya - Bypass line for Manpur	1.6
71	ECR	Samastipur	Samastipur-Darbhanga	38.0
72	ECR	Samastipur	Muzaffarpur - Sagauli	100.6
73	ECR	Samastipur	Sagauli - Valmikinagar	109.7
74	ECR	Sonepur	Hajipur-Bachwara	72.0
75	ECR	Samastipur	Darbhanga - Bypass line connecting Shisho Halt & Kakarghati, excl Darbhanga Yard	7.6
76	ECoR	Khurda Road	Khurda Road, Vizianagaram(Argul-Haripurgram) -	1.6
77	ECoR	Khurda Road	Baghuapal-Fly-over	20.0
78	ECoR	WALTAIR	Jagdalpur-Koraput	110.2
79	ECoR	WALTAIR	Kottavalasa-Koraput	189.3
80	ECoR	WALTAIR	Koraput-Singapur Road	164.6

S.No	Railway	Division	Name of Work	Length (Km)
81	NCR		Sainthia, Sitarampur, Mughalsarai, Allahabad & Etawah - Bypass	35.0
82	NCR	Jhansi	Jhansi - Khairar - Manickpur & Khairar - Bhimsen	411.0
83	NCR	Jhansi	Lalitpur - Birari with flyover at Lalitpur	15.8
84	NCR	Allahabad	Allahabad Division - Construction of Kanpur Fly-over	
85	NCR	Agra Cantt	Mathura - Murhesi Rampur - Flyover for avoiding surface crossing at Mathura	11.1
86	NCR	Agra Cantt	Yamuna Bridge-Agra Fort - Double line with major bridge at Yamuna river	2.1
87	NCR	Agra Cantt	Agra Fort-Bandikui	150.0
88	NCR	Agra Cantt	Bhandai - Flyover for Etawah bound down trains	10.0
89	NCR	Allahabad	Allahabad Division - Construction of Aligarh flyover	25.0
90	NCR	Allahabad	Iradatganj - Kunwadih - Construction of flyover	20.1
91	NCR	Allahabad	Jeonathpur - flyover	13.0
92	NCR	Allahabad	Naini - Iradatganj - Construction of flyover	12.0
93	NCR	Allahabad	Kanpur New Coaching Complex-Kanpur	2.5
94	NCR	Jhansi	Dailwara-Berari - Chord line	5.2
95	NWR		Degana-Rai ka Bagh	145.0
96	NWR		Sawai Madhopur-Jaipur	131.3
97	NWR	Jodhpur	Phulera - Digana	108.8
98	SECR	Bilaspur	Gevra Road - Pendra Road	122.0
99	SECR	Bilaspur	Jharsuguda - Bilaspur - Flyover / bypass	10.0
100	SWR		Hubli - Chikjajur	190.0
101	SWR		Arsikere - Tumkur	96.0
102	SWR		Birur - Shimoga	60.0
103	SWR	Bangalore	Yalahanka-Penukonda	120.5
104	SWR	Bangalore	Baiyyappanahalli-Hosur	48.0
105	SWR	Bangalore	Penukonda-Dharmavaram, excl. Dharmavaram	41.5
106	SWR	Bangalore	Yeshvanthpur-Channasandra	21.7
107	WCR		Satna - Rewa	50.0
108	WCR		Guna-Bypass line	2.0
109	WCR	Bhopal	Powarkheda - Jujharpur - Single line flyover in up direction	15.9
110	WCR	Jabalpur	Sontalai-Bagra Tawa - Patch doubling	7.0
111	WCR	Jabalpur	Malkhedi-Mahadevkhedi	8.7
112	WCR	Jabalpur	Katni - Grade separator / bypass	21.5
113	WCR	Jabalpur	Katni-Singrauli	261.0
114	WCR	Jabalpur	Jukehi chord line at Katni	1.6
Total Length				8830.7

ANNEXURE 7.2: Sanctioned Works of 3rd Line

S.No	Railway Zone	Division	Name of Work	Length (Km)
1	CR		Igatpuri-Manmad - 3rd line	124
2	CR	Bhusawal	Manmad - Jalgaon - 3rd line	160
3	CR	Nagpur	Teegaon - Chichonda 3rd Ghat line	16.53
4	CR	Nagpur	Wardha-Balharshah - 3rd line	132
5	NR	Lucknow	Varanasi-Mughalsarai - 3rd line with sub structure of 2 lines on bridge No.11 (Malviya Bridge)	16.72
6	NER	Lucknow	Burhwal - Gonda - 3rd line	61.72
7	NER	Lucknow	Domingarh - Gorakhpur - Gorakhpur Cantt - Kusumhi - 3rd running line	21.15
8	SR		Shoranur-Ernakulam - 3rd line	107
9	SCR		Duvvada - Vijayawada - 3rd line	335
10	SCR		Kazipet - Balharshah(201.04 Km)- 3rd line Exc. Mandamarri - Rahgavapuram Stn	234.46
11	SCR		Vijayawada-Gudur - 3rd line	287.67
12	SER	Chakradharpur	Rourkela-Jharsuguda - 3rd line	101
13	SER	Chakradharpur	Chakradharpur-Goilkera - 3rd line	34
14	SER	Kharagpur	Kharagpur-Adityapur - 3rd line	132
15	SER	Adra	Chandil-Anara-Burnpur - 3rd line with addl loop lines at Nimdih, Urma, Tamna, Charra & Bagalia	125
16	SER	Kharagpur	Narayangarh - Bhadrak - 3rd line	155
17	ECR	Dhanbad	Dhanbad-Sonnagar (Patratu-Sonnagar) - 3rd line	291
18	ECoR	Khurda Road	Bhadrak-Vizianagaram - 3rd line in balance section	525
19	ECoR	Sambalpur	Vizianagaram-Sambalpur(Titlagarh) - 3rd line	264.6
20	NCR		Mathura-Jhansi - 3rd line	273.8
21	NCR	Allahabad	Mughalsarai - Allahabad - 3rd line	152
22	NCR	Allahabad	Naini-Chheoki - 3rd down line with addl platform (2 km)	2
23	NCR	Allahabad	Aligarh-Daud Khan - 3rd line & construction of flyover at Daud Khan	6.9
24	NCR	Allahabad	Rooma-Chakeri-Chandari - 3rd line	12.5
25	NCR	Jhansi	Jhansi-Bina - 3rd line	152.57
26	SECR	Bilaspur	Anuppur - Katni - 3rd line	165.52
27	SECR	Bilaspur	Pendra Road- Anuppur - 3rd line	50.1
28	SECR	Nagpur (SECR)	Rajnandgaon-Nagpur - 3rd line	228
29	WCR	Jabalpur	Katni - Bina - 3rd line	278.7

Source: Pink Book (2018-19), Ministry of Railways

ANNEXURE 7.3: Sanctioned Works of 3rd & 4th Line

SN	Railway Zone	Division	Name of Work	Length (Km)
1	NR	Lucknow	Barabanki-Malhaur - 3rd & 4th Line	32.84
2	ECoR	Khurda Road	Jarapaada-Budhapank with flyover at Talcher Road - 3rd & 4th line	47.44
3	ECoR	Khurda Road	Budhapank-Salegaon via Rajatgarh - 3rd & 4th line	85

Source: Pink Book (2018-19), Ministry of Railways

ANNEXURE 7.4: Sanctioned Works of 4th Line

S.No	Railway Zone	Division	Name of Work	Length (Km)
1	CR		Wardha-Nagpur - 4th line	78.7
2	CR	Bhusawal	Jalgaon-Bhusawal - 4th line	24.46
3	SER	Chakradharpur	Bondamunda - Rourkela - 4th line	9.3
4	WR	Ahmedabad	Vatva - Ahmedabad - Sabarmati - 4th line	17.98
5	NCR	Agra Cantt	Mathura-Palwal - 4th line	80
6	NCR	Agra Cantt	Mathura-Dholpur - 4th line	107
7	NCR	Allahabad	Bhaupur-Panki - 4th line connecting down loop of Baupur to shunting neck of Panki	11
8	NCR	Allahabad	Allahabad-Bamhrauli - 4th line with fly-over at Subedarganj	10
9	NCR	Allahabad	Chipiyana Buzurg-Dadri - 4th line	12
10	NCR	Jhansi	Dholpur-Jhansi-Bina - 4th line	321.8
11	SECR	Bilaspur	Jharsuguda - Bilaspur - 4th line	206

Source: Pink Book (2018-19), Ministry of Railways

ANNEXURE 7.5: Sanctioned Works of Developing Satellite Terminals

S.No	Railway Zones	Satellite Terminals (Proposed and Sanctioned)
1	Central Railway	Hadapsar Parel at Chatrapati Shivaji Maharaj Terminal Kalyan Station Ajni.
2	Eastern Railway	1) Jagadishpur Terminal: 2) Naihati coaching terminal :
3	East Coast Railway	1) Mancheswar 2) Visakhapatnam New
4	Northern Railway	Shakurbasti, Bijwasan, Holambikalan
8	North Western Railway	Madar , Durai , Ranapratapnagar , Lalgarh
9	South Central railway	Charlapalli, Renigunta, Nallapadu
10	South East Central railway	Bilaspur
12	Southern Railway	Nemam
14	Western Railway	Pratapnagar, K.Nagar & Etawa Kala Matta, Fatehabad Chandravati Ganj, Laxmibainagar
15	West Central Railway	Madan Mahal , Sant Hirdaram Nagar station

Source: Pink Book (2018-19), Ministry of Railways

ANNEXURE 7.6: Sanctioned Works of Developing Flyovers

S.no	Railway Zones	Flyover, Bypasses and Bypass Lines (Proposed and Sanctioned)		
		Bypass Lines	Bypasses	Flyovers
1	Central Railway	Bypass line at Miraj between Pandharpur to Kolhapur.		
2	Eastern Railway	Sainthia bypass connecting Rampurhat Jn-Khana Jn. Andal bypass connecting Sainthia Jn -Andal Jn branch line to Barddhaman Jn-Asansol Jn Jasidih Bypass line.	Sitarampur By pass Pirpainti By-Pass Rampurhat By-pass Nalhati By-pass Ahmedpur By-Pass Hansdiha By-pass	
3	East Coast Railway	Bye-pass line Vishakhapanam	Bypass at Khurda Road Jn Sambalpur Jn	
4	Northern Railway	Bye Pass line at Dhanari Ghatla.		
5	North central Railway			Naini-iradatganj-Flyover (12km) Iradatganj-kunwadih Flyover (22Km) Karchna-Iradatgang flyover (10Km) Underpass between Jhansi- Mustara Flyover connecting Orchha to Jhansi Flyover at Subedarganj
9	South Central railway	Bye-pass line at Motumarri(2.12 Km) Renigunta(9.60 Km) Wadi (7.60) Gooty(3.8 Km) Vijayawada(19.50 km) Kazipet(10.65 Km)	Bye-pass between Tirupati-Renigunta- Chennai Central	
10	South East Central railway			Flyover at Bilaspur
12	Southern Railway		Bye-pass at Palakkad	Flyover at - Melpakkam Katpadi Erode Shoranur Villupuram
13	South Eastern Railway		By-passes at Ondagram-Masagram Jn, Basta-Betnoti, Purulia Junction	Adra-Joychandi Pahar Junction, Rukni-Anara, Gunda Bihar-Chandil Jn,

S.no	Railway Zones	Flyover, Bypasses and Bypass Lines (Proposed and Sanctioned)		
		Bypass Lines	**Bypasses**	**Flyovers**
			Gourinathdham-Chharra sections	Burnpur-Asansol, Gourinathdham-Purulia Junction, Birarajpur-Kandra Junction,
14	Western Railway		Double line bypass with flyover between Naigaon and Juchandra By-pass at Vadodara & Anand, Ratlam , Chittorgarh, Nagda, Rau, Palanpur, Bhildi By-pass Double line between Geratpur - Sanand	Flyover Proposed at 1) Udhna 2)Vasai Road 3)Godhra 4) Vadodara 5) Nagda & Maksi Flyover sanctioned at 1) Ujjain 2) Viramgam 3) Samakhiyali 4)Wankaner
15	West Central Railway		Bypass between Swai Madhopur-Jaipur Ramganj Mandi station Guna, Ruthiyai & Kachhpura Station	

Source: Pink Book (2018-19), Ministry of Railways

ANNEXURE 11.1: Existing Configuration and Capacity Utilization by sections of HDN

HDN 1

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Delhi Jn	Shahdara Jn	20	85	6.58	NR	DLI	Delhi Jn, - Delhi Shahdra	209	3rd Line
Shahdara Jn	Sahibabad	3	85	5.98	NR	DLI	Delhi Shahdra - A Panel	178	3rd Line
Sahibabad	Ghaziabad Jn	7	160	7.47	NR	DLI	Sahibabad - Ghaziabad Jn	442	4th Line
Ghaziabad Jn	Dadri	16.66	98	17.14	NCR	ALD	Dadri - Ghaziabad	202	4th Line
Dankaur	Dadri	17.67	98	17.82	NCR	ALD	Dankaur - Dadri	217	3rd Line
Chola	Dankaur	28.2	98	14.10	NCR	ALD	Khurja - Dankaur	213	3rd Line
Khurja Jn	Chola	28.2	98	14.50	NCR	ALD	Khurja - Dankaur	213	3rd Line
Aligarh Jn	Khurja Jn	17.67	98	43.89	NCR	ALD	Dankaur - Dadri	217	3rd Line
Hathras Jn	Aligarh Jn	63.3	91	30.25	NCR	ALD	Barhan - Aligarh Jn.	217	2nd Line
Barhan Jn	Hathras Jn	63.3	91	31.54	NCR	ALD	Barhan - Aligarh Jn.	217	2nd Line
Motawali	Barhan Jn	2.69	91	8.10	NCR	ALD	Mitawali - Barhan	220	2nd Line
Tundla Jn	Motawali	5.51	91	6.95	NCR	ALD	Tundla/West - Mitawali	201	2nd Line
Firozabad	Tundla Jn	36.48	91	16.45	NCR	ALD	Sikohabad - Tundla	232	2nd Line
Shikohabad Jn	Firozabad	36.48	91	20.09	NCR	ALD	Sikohabad - Tundla	232	2nd Line
Etawah	Shikohabad Jn	183.5	91	55.60	NCR	ALD	Panki - Sikohabad	233	2nd Line
Etawah	Phaphund	183.5	91	56.57	NCR	ALD	Panki - Sikohabad	233	2nd Line
Phaphund	Panki	183.5	91	71.76	NCR	ALD	Panki - Sikohabad	233	2nd Line
Juhi cabin	Panki	7.4	91	10.47	NCR	ALD	Juhi/West - Panki	232	4th Line
Juhi cabin	Kanpur Central	1.4	97	1.25	NCR	ALD	Kanpur - Juhi/west	298	4th Line
Chandari	Kanpur Central	3.92	55	4.12	NCR	ALD	Chandari - kanpur	124	2nd Line
Chandari	Juhi cabin	2.04	55	3.38	NCR	ALD	Chandari - Juhi/West	79	2nd Line
Fatehpur	Chandari	73.64	75	73.06	NCR	ALD	Fatehpur - Chandari	197	2nd Line
Subedarganj	Fatehpur	107.71	75	114.87	NCR	ALD	Subedarganj - Fatehpur	195	2nd Line
Allahabad Jn	Subedarganj	3.5	80	3.33	NCR	ALD	Allahabad - Subedarganj	196	4th Line
Allahabad Jn	Naini Jn	7	91	7.06	NCR	ALD	Naini - Allahabad	218	3rd Line
Naini Jn	Chheoki	1	91	2.17	NCR	ALD	Cheoki - Naini	180	3rd Line
Chheoki	Mirzapur	81	91	79.55	NCR	ALD	Mirzapur - Cheoki	218	3rd Line
Mirzapur	Chunar jn	31	91	31.99	NCR	ALD	Chunar - Mirzapur	217	3rd Line
Chunar jn	Jeonathpur	24	91	24.58	NCR	ALD	Jeonathpur - Chunar	205	3rd Line
Jeonathpur	Mughal Sarai Jn	8	91	7.53	NCR	ALD	Mughalsarai - Jeonathpur	188	3rd Line
Chandauli Majhwar	Mughal Sarai Jn	117.15	80	15.31	ECR	MGS	Dehri - on - Sone - Mughalsarai	167	3rd Line
Bhabua Road	Chandauli Majhwar	117.15	80	38.26	ECR	MGS	Dehri - on - Sone - Mughalsarai	167	3rd Line
Sasaram Jn	Bhabua Road	117.15	80	47.91	ECR	MGS	Dehri - on - Sone - Mughalsarai	167	3rd Line
Sasaram Jn	Pahleza	117.15	80	13.10	ECR	MGS	Dehri - on - Sone - Mughalsarai	167	3rd Line
Pahleza	Dehri on Sone Jn	117.15	80	4.44	ECR	MGS	Dehri - on - Sone - Mughalsarai	167	3rd Line
Dehri on Sone Jn	Sonnagar Jn	5.76	77	5.71	ECR	MGS	Sonnagar - Dehri - on - Sone	178	3rd Line
Sonnagar Jn	Anugraha Narayan Road	79.4	66	11.05	ECR	MGS	Gaya - Sonnagar	117	3rd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Anugraha Narayan Road	Rafiganj	79.4	66	31.86	ECR	MGS	Gaya - Sonnagar	117	3rd Line
Rafiganj	Gaya Jn	79.4	66	37.67	ECR	MGS	Gaya - Sonnagar	117	3rd Line
Gaya Jn	Manpur Jn	93.4	85	4.54	ECR	DHN	Gomoh - Gaya	122	3rd Line
Koderma Jn	Manpur Jn	93.4	85	71.38	ECR	DHN	Gomoh - Gaya	122	3rd Line
Koderma Jn	Hazaribagh Road	93.4	85	49.23	ECR	DHN	Gomoh - Gaya	122	3rd Line
Hazaribagh Road	NSC Bose Jn Gomoh	93.4	85	44.58	ECR	DHN	Gomoh - Gaya	122	3rd Line
NSC Bose Jn Gomoh	Dhanbad Jn	29.27	72	29.66	ECR	DHN	Dhanbad - N.S.C.B.Gomoh	104	3rd Line
Dhanbad Jn	Pradhankhu nta Jn	9.57	79	10.24	ECR	DHN	Pradhankhanta - Dhanbad	126	2nd Line
Pradhankhu nta Jn	Chhota Ambana	5.55	67	5.77	ER	ASN	CHOTAAMBANA - PRADHANKHANTA	146	2nd Line
Kulti	Chhota Ambana	34.41	67	30.01	ER	ASN	SITARAMPUR - CHOTAAMBONA	146	2nd Line
Kulti	Sitarampur Jn	34.41	67	4.81	ER	ASN	SITARAMPUR - CHOTAAMBONA	146	2nd Line
Sitarampur Jn	Asansol jn	25.71	117	9.04	ER	ASN	ANDAL - ASANSOL	277	4th Line
Asansol jn	Kalipahari	25.71	117	5.66	ER	ASN	ANDAL - ASANSOL	277	4th Line
Kalipahari	Andal Jn	25.71	117	20.84	ER	ASN	ANDAL - ASANSOL	277	4th Line
Andal Jn	Khana Jn	66.53	123	67.51	ER	ASN	KHANA - ANDAL	267	4th Line
Khana Jn	Barddhaman Jn	13.15	130	13.75	ER	HWH	BARDDHAMAN - KHANA	278	4th Line
Barddhaman Jn	Saktigarh Jn	11.52	160	15.49	ER	HWH	SAKTIGARH - BARDDHAMAN	340	4th Line
Masagram	Saktigarh Jn	68.07	103	10.04	ER	HWH	DANKUNI - SAKTIGARH	230	4th Line
Kamarkund u Jn	Masagram	68.07	103	39.60	ER	HWH	DANKUNI - SAKTIGARH	230	4th Line
Kamarkund u Jn	Dankuni Jn	68.07	103	18.51	ER	HWH	DANKUNI - SAKTIGARH	230	4th Line
Dankuni Jn	Bally	8.24	80	6.29	ER	HWH	BELUR - DANKUNI	154	4th Line
Bally	Belur	8.24	248	1.63	ER	HWH	BELUR - DANKUNI	540	4th Line
Belur	Howrah	3.11	266	6.05	ER	HWH	HOWRAH - SORTING YARD RRI	818	6th Line
Howrah	Liluah	3.46	244	4.73	ER	HWH	SORTING YARD RRI - BELUR	540	4th Line

HDN 2

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Divisio n	Section	Train Coun t 18	Configuration after completion of Works as per Pink Book
Chhatrapati Shivaji Terminus	Dadar	9	205	9.35	CR	CSTM	Chhatrapati Shivaji Terminus, MUMBAI - Dadar	413	4th Line
Dadar	Kurla Jn	7	205	6.13	CR	CSTM	Dadar - Kurka	418	4th Line
Kurla Jn	Thane Jn	18	205	18.62	CR	CSTM	Kurka - Thane	420	4th Line
Thane Jn	Diva Jn	9	205	7.40	CR	CSTM	Thane - Diva	494	4th Line
Diva Jn	Kalyan Jn	11	205	10.97	CR	CSTM	Diva - Kalyan	465	6th Line
Kalyan Jn	Titvala	11	144	10.76	CR	CSTM	Kalyan - Titvala	306	3rd Line
Titvala	Asangaon	21	70	20.62	CR	CSTM	Titvala - Asangaon	220	3rd Line
Asangaon	Kasara	35	70	33.88	CR	CSTM	Asangaon - Kasara	175	3rd Line
Kasara	Igatpuri	16	54	13.60	CR	CSTM	Kasara - Igatpuri	135	3rd Line
Lahavit	Igatpuri	124	60	33.46	CR	BSL	Igatpuri - Manmad Junction	106	3rd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Devlali	Lahavit	124	60	10.76	CR	BSL	Igatpuri - Manmad Junction	106	3rd Line
Nasik Road	Devlali	124	60	6.07	CR	BSL	Igatpuri - Manmad Junction	106	3rd Line
Kasbe Sukene	Nasik Road	124	60	25.50	CR	BSL	Igatpuri - Manmad Junction	106	3rd Line
Manmad Jn	Kasbe Sukene	124	60	47.80	CR	BSL	Igatpuri - Manmad Junction	106	3rd Line
Nandgaon	Manmad Jn	25	62	24.85	CR	BSL	Manmad Junction - Nandgaon	130	4th Line
Chalisgaon jn	Nandgaon	135	62	41.70	CR	BSL	Nandgaon - Jalgaon Junction	133	4th Line
Pachora jn	Chalisgaon jn	135	62	45.06	CR	BSL	Nandgaon - Jalgaon Junction	133	4th Line
Jalgaon Jn	Pachora jn	135	62	47.81	CR	BSL	Nandgaon - Jalgaon Junction	133	4th Line
Jalgaon Jn	Bhusawal jn	24	80	24.24	CR	BSL	Jalgaon Junction - Bhusaval Junction	179	4th Line
Bhusawal jn	Jalamb jn	219	62	89.89	CR	BSL	Bhusaval Junction - Badnera Junction	116	4th Line
Jalamb jn	Akola Jn	219	62	49.08	CR	BSL	Bhusaval Junction - Badnera Junction	116	4th Line
Akola Jn	Murtajapur Jn	219	62	37.79	CR	BSL	Bhusaval Junction - Badnera Junction	116	4th Line
Murtajapur Jn	Badnera Jn	219	62	41.54	CR	BSL	Bhusaval Junction - Badnera Junction	116	4th Line
Badnera Jn	Pulgaon Jn	95	62	65.70	CR	NGP	Badnera Junction - Wardha	125	4th Line
Pulgaon Jn	Wardha Jn	95	62	29.68	CR	NGP	Badnera Junction - Wardha	125	4th Line
Itwari Jn	Nagpur Jn	0	70	3.28	SECR	BSP	TUMSAR ROAD - KALUMNA - ITWARI - NAGPUR	158	4th Line
Itwari Jn	Kalamna	0	70	2.84	SECR	BSP	TUMSAR ROAD - KALUMNA - ITWARI - NAGPUR	158	4th Line
Kalamna	Kanhan Jn	0	70	12.07	SECR	BSP	TUMSAR ROAD - KALUMNA - ITWARI - NAGPUR	148	4th Line
Kanhan Jn	Bhandara Road	73.8	70	44.13	SECR	NGP	TUMSAR ROAD - KALUMNA - ITWARI - NAGPUR	158	4th Line
Bhandara Road	Tumsar Road Jn	0	67	17.87	SECR	BSP	TUMSAR ROAD - KALUMNA - ITWARI - NAGPUR	184	4th Line
Tumsar Road Jn	Gondia Jn	49.8	67	49.63	SECR	NGP	GONDIA - TUMSAR ROAD	163	4th Line
Gondia Jn	Rajnandgaon	0	70	104.08	SECR	BSP	DURG - GONDIA	192	4th Line
Durg Jn	Rajnandgaon	134.9	70	30.56	SECR	NGP	DURG - GONDIA	175	4th Line
Bhilai	Durg Jn	13.6	88	13.85	SECR	R	BHILAI - DURG	224	4th Line
Srona	Bhilai	17.3	90	16.81	SECR	R	SARONA - KUMHARI - BHILAI	253	3rd Line
Urkura	Srona	9.4	45	9.82	SECR	R	URKURA - SARONA	121	2nd Line
Bilaspur Jn	Urkura	105	115	105.80	SECR	R	BILASPUR - URKURA	270	4th Line
Bilaspur Jn	Janjgir Naila	52.5	90	42.34	SECR	BSP	CHAMPA - BILASPUR	233	4th Line
Janjgir Naila	Champa Jn	52.5	90	10.74	SECR	BSP	CHAMPA - BILASPUR	232	4th Line
Champa Jn	Kharsia	151.7	69	46.58	SECR	BSP	JHARSUGUDA - CHAMPA	203	4th Line
Kharsia	Raigarh	151.7	69	33.91	SECR	BSP	JHARSUGUDA - CHAMPA	203	4th Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Belpahar	Raigarh	151.7	69	51.45	SECR	BSP	JHARSUGUDA - CHAMPA	203	4th Line
Lb	Belpahar	151.7	69	11.47	SECR	BSP	JHARSUGUDA - CHAMPA	203	4th Line
Jharsuguda Jn	Lb	151.7	69	8.94	ECOR	SBP	JHARSUGUDA - CHAMPA	203	4th Line
Dharuadihi	Jharsuguda Jn	101	70	27.33	SER	CKP	ROURKELA - JHARSUGUDA	145	4th Line
Rourkela Jn	Dharuadihi	101	70	74.89	SER	CKP	ROURKELA - JHARSUGUDA	145	4th Line
Bondamunda PH	Rourkela Jn	8.5	67	6.79	SER	CKP	BONDAMUNDA - ROURKELA	137	4th Line
Bondamunda PH	Chakradharpur	92.9	67	94.78	SER	CKP	CHAKRADHARPUR - BONDAMUNDA	102	3rd Line
Rajkharswan Jn	Chakradharpur	20.3	75	20.04	SER	CKP	RAJKHARSWAN - CHAKRADHARPUR	119	3rd Line
Sini Jn	Rajkharswan Jn	15.3	138	15.52	SER	CKP	SINI - RAJKHARSWAN	185	3rd Line
Sini Jn	Gamharia Jn	16.2	138	16.83	SER	CKP	GAMRAHIA - SINI	128	3rd Line
Gamharia Jn	Tatanagar Jn	10.6	113	11.10	SER	CKP	TATA - GAMHARIA	210	4th Line
Tatanagar Jn	Chakulia	134	61	67.22	SER	KGP	KHARAGPUR - TATANAGAR	126	4th Line
Jhargram	Chakulia	134	61	29.94	SER	KGP	KHARAGPUR - TATANAGAR	126	4th Line
Nimpura Jn	Jhargram	134	61	33.27	SER	KGP	KHARAGPUR - TATANAGAR	126	4th Line
Kharagpur Jn	Nimpura Jn	134	61	6.41	SER	KGP	KHARAGPUR - TATANAGAR	126	4th Line
Panskura Jn	Kharagpur Jn	45	124	45.52	SER	KGP	PANSKURA - KHARAGPUR	218	3rd Line
Mecheda	Panskura Jn	12	124	12.35	SER	KGP	MECHEDA - PANSKURA	274	3rd Line
Kulgachia FS	Mecheda	27	152	18.86	SER	KGP	ULUBERIA - MECHEDA	288	3rd Line
Uluberia	Kulgachia FS	27	152	7.76	SER	KGP	ULUBERIA - MECHEDA	288	3rd Line
Andul	Uluberia	20	155	20.52	SER	KGP	ANDUL - ULUBERIA	295	3rd Line
Santragachhi Jn	Andul	5	130	5.06	SER	KGP	SANTRAGACHI - ANDUL	261	3rd Line
Tikiapara	Santragachhi Jn	6	161	3.53	SER	KGP	TIKIAPARA - SANTRAGACHI	310	4th Line
Howrah	Tikiapara	2	167	3.19	SER	KGP	HOWRAH - TIKIAPARA	316	4th Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
New Delhi	Tilak Bridge	5	180	4.68	NR	DLI	New Delhi - Tilak Bridge	322	4th Line
Tilak Bridge	H Nizamuddin Jn	10	80	2.23	NR	DLI	Tilak Bridge - Nizamuddin	193	4th Line
H Nizamuddin Jn	Tughlakabad	9.42	80	10.70	NR	DLI	Nizamuddin - Tuglakabad M/L	223	2nd Line
Faridabad	Tughlakabad	39	125	10.36	NR	DLI	Tughlakabad - Palwal	297	4th Line
Palwal	Faridabad	39	125	29.24	NR	DLI	Tughlakabad - Palwal	297	4th Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Kosi Kalan	Palwal	83.4	98	42.76	NCR	AGC	Palwal - Mathura	193	4th Line
Mathura Jn	Kosi Kalan	83.4	98	40.57	NCR	AGC	Palwal - Mathura	193	4th Line
Bharatpur Jn	Mathura Jn	75.41	71	33.61	WCR	Kota	MATHURA Jn. - BAYANA	104	2nd Line
Bharatpur Jn	Bayana Jn	75.41	71	41.78	WCR	Kota	MATHURA Jn. - BAYANA	104	2nd Line
Bayana Jn	Gangapur city	140.83	75	77.29	WCR	Kota	BAYANA - SWAI MADHOPUR	140	2nd Line
Sawai Madhopur Jn	Gangapur city	140.83	75	64.63	WCR	Kota	BAYANA - SWAI MADHOPUR	140	2nd Line
Sawai Madhopur Jn	Gurla	102.2	75	101.27	WCR	Kota	SWAI MADHOPUR - GURLA	162	2nd Line
Gurla	Kota Jn	5.56	70	5.18	WCR	Kota	GURLA - KOTA	185	2nd Line
Kota Jn	Ramganj Mandi jn	224.98	72	71.05	WCR	Kota	KOTA - NAGDA	138	2nd Line
Nagda JN	Ramganj Mandi jn	224.98	72	152.80	WCR	Kota	KOTA - NAGDA	138	2nd Line
Ratlam JN	Nagda JN	41.35	75	41.12	WR	RTM	Ratlam - Nagda	178	2nd Line
Ratlam JN	Dahod	185.21	68	109.89	WR	RTM	Godhra - Ratlam	163	2nd Line
Piplod	Dahod	185.21	68	40.80	WR	RTM	Godhra - Ratlam	163	2nd Line
Godhra Jn	Piplod	185.21	68	32.00	WR	RTM	Godhra - Ratlam	163	2nd Line
Godhra Jn	Champaner Road	67.04	80	36.23	WR	BRC	Vadodara 'Z' - Godhra	132	2nd Line
Champaner Road	Samlaya	67.04	80	11.50	WR	BRC	Vadodara 'Z' - Godhra	132	2nd Line
Samlaya	Vadodara E	67.04	80	20.84	WR	BRC	Vadodara 'Z' - Godhra	132	2nd Line
Vadodara D	Vadodara E	2.11	80	4.07	WR	BRC	Vadodara 'D' - Vadodara 'Z'	118	2nd Line
Vadodara D	Vadodara Jn	4.58	80	1.09	WR	BRC	Vadodara 'P' - Vadodara 'D'	317	2nd Line
Vadodara Jn	Vishvamitri Jn	70.12	110	3.15	WR	BRC	Bharuch - Vadodara (P)	235	2nd Line
Vishvamitri Jn	Miyagam Karjan Jn	70.12	110	27.10	WR	BRC	Bharuch - Vadodara (P)	235	2nd Line
Miyagam Karjan Jn	Bharuch Jn	70.12	110	40.25	WR	BRC	Bharuch - Vadodara (P)	235	2nd Line
Bharuch Jn	Ankleshwar Jn	58.94	110	8.91	WR	BRC	Surat - Bharuch	231	2nd Line
Ankleshwar Jn	Kosamba Jn	58.94	110	19.15	WR	BRC	Surat - Bharuch	231	2nd Line
Kosamba Jn	Surat	58.94	110	31.30	WR	BRC	Surat - Bharuch	231	2nd Line
Surat	Udhna Jn	4.01	110	4.25	WR	BCT	Udhana - Surat	247	2nd Line
Udhna Jn	Bhestan	64.55	100	5.19	WR	BCT	Valsad - Udhana	206	2nd Line
Bhestan	Navsari	64.55	100	19.86	WR	BCT	Valsad - Udhana	206	2nd Line
Navsari	Bilimora Jn	64.55	100	21.05	WR	BCT	Valsad - Udhana	206	2nd Line
Bilimora Jn	Valsad	64.55	100	17.84	WR	BCT	Valsad - Udhana	206	2nd Line
Dahanu Road	Valsad	74.44	100	74.72	WR	BCT	Dahanu Rd - Valsad	203	2nd Line
Palghar	Dahanu Road	63.8	100	32.80	WR	BCT	Virar - Dahanu Rd	233	2nd Line
Virar	Palghar	63.8	100	31.13	WR	BCT	Virar - Dahanu Rd	233	2nd Line
Vasai Road Jn	Virar	0	432	8.53	WR	BCT	Vasai Road Jn - Virar	1060	6th Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Borivali	Vasai Road Jn	0	432	17.27	WR	BCT	Borivali - Vasai Road Jn	1060	6th Line
Goregaon	Borivali	80.67	432	7.38	WR	BCT	Goregaon - Borivali	1060	4th Line
Andheri	Goregaon	0	432	4.94	WR	BCT	Andheri - Goregaon	1060	8th Line
Bandra	Andheri	0	432	7.47	WR	BCT	Bandra - Andheri	1060	8th Line
Mahim Jn	Bandra	0	516	1.49	WR	BCT	Mahim Jn - Bandra	1086	6th Line
Dadar	Mahim Jn	0	762	2.30	WR	BCT	Dadar - Mahim Jn	1254	6th Line
Mumbai Central	Dadar	0	516	6.26	WR	BCT	Mumbai Central - Dadar	1086	6th Line
okhla	Tughlakabad	17	60	6.85	NR	DLI	Okhla - Tugalkabad GAL	95	4th Line
New Delhi	Delhi Kishanganj	4	36	2.60	NR	DLI	New Delhi - Delhi Kishanganj	48	3rd Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Ghaziabad Jn	Hapur Jn	37	50	36.96	NR	MB	Hapur Jn. - Ghaziabad Jn	96	2nd Line
Hapur Jn	Gajraula Jn	51	60	51.44	NR	MB	Gajraula Jn. - Hapur Jn.	98	2nd Line
Gajraula Jn	Amroha	53	60	23.17	NR	MB	Moradabad Jn. - Gajraula Jn.	100	2nd Line
Amroha	Moradabad Jn	53	60	30.35	NR	MB	Moradabad Jn. - Gajraula Jn.	100	2nd Line
Moradabad Jn	Kathgarh Left Bank	5.8	60	5.22	NR	MB	Katghar Left Bank - Moradabad	185	2nd Line
Kathgarh Left Bank	Rampur Jn	27	60	22.43	NR	MB	Rampur Jn. - Katghar Left Bank	163	2nd Line
Rampur Jn	Bareilly Jn	63	60	61.16	NR	MB	Bareilly Jn. - Rampur Jn.	159	2nd Line
Bareilly Jn	Chaneti	7	60	3.55	NR	MB	Shahjahanpur Jn. - Bareilly Cantt.	175	2nd Line
Chaneti	Shahjahanpur Jn	7	60	68.48	NR	MB	Shahjahanpur Jn. - Bareilly Cantt.	175	2nd Line
Shahjahanpur Jn	Roza Jn	88	60	8.03	NR	MB	Roza Jn. - Shahjahanpur Jn.	182	2nd Line
Roza Jn	Sitapur City Jn	70	24	80.50	NR	MB	Roza Jn. - Sitapur City	56	2nd Line
Sitapur City Jn	Sitapur Jn	96.46	14	3.50	NER	LJN	Sitapur City. - Burhwal	18	2nd Line
Burhwal Jn	Sitapur Jn	96.46	24	96.38	NER	LJN	Sitapur City. - Burhwal	44	2nd Line
Burhwal Jn	Jarwal Road	61.72	55	16.01	NER	LJN	Burhwal - Gonda	125	3rd Line
Jarwal Road	Gonda Jn	61.72	55	46.44	NER	LJN	Burhwal - Gonda	125	3rd Line
Gonda Jn	Mankapur Jn	27.94	52	28.13	NER	LJN	Gonda - Mankapur	112	2nd Line
Basti	Mankapur Jn	125.16	50	61.02	NER	LJN	Mankapur - Gorakhpur	118	3rd Line
Basti	Khalilabad	125.16	50	29.60	NER	LJN	Mankapur - Gorakhpur	118	3rd Line
Khalilabad	Gorakhpur Jn	125.16	50	34.08	NER	LJN	Mankapur - Gorakhpur	118	3rd Line
Gorakhpur Jn	Gorakhpur Cantt Jn	3.22	52	3.96	NER	LJN	Gorakhpur - GorakhpurCantt.	133	3rd Line
Gorakhpur Cantt Jn	Deoria Sadar	176.61	54	46.02	NER	BSB	Gorakhpur Cantt. - Chhapra	90	3rd Line
Deoria Sadar	Bhatni Jn	176.61	54	20.40	NER	BSB	Gorakhpur Cantt. - Chhapra	90	3rd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Bhatni Jn	Siwan Jn	176.61	54	48.99	NER	BSB	Gorakhpur Cantt. - Chhapra	90	3rd Line
Siwan Jn	Duraundha Jn	176.61	54	18.23	NER	BSB	Gorakhpur Cantt. - Chhapra	90	3rd Line
Duraundha Jn	Chhapra Jn	176.61	54	43.66	NER	BSB	Gorakhpur Cantt. - Chhapra	90	3rd Line
Chhapra Jn	Chhapra Kacheri jn	5.26	60	2.31	NER	BSB	Chhapra - Chhapra Gramin	102	2nd Line
Chhapra Kacheri jn	Sonpur Jn	51.64	50	52.97	ECR	SEE	Chhapra Gramin - Sonpur	88	2nd Line
Sonpur Jn	Hajipur Jn	5.58	50	5.25	ECR	SEE	Sonpur - Hajipur	117	2nd Line
Hajipur Jn	Bachhwara Jn	71.31	22	72.32	ECR	SEE	Hajipur - Bachhwara	60	2nd Line
Barauni Jn	Bachhwara Jn	16.52	50	16.60	ECR	SEE	Bachhwara - Barauni	136	2nd Line
Barauni Jn	Begusarai	55.54	50	15.38	ECR	SEE	Barauni - Khagaria	88	2nd Line
Sahebpur Kamal Jn	Begusarai	55.54	50	27.37	ECR	SEE	Barauni - Khagaria	88	2nd Line
Khagaria Jn	Sahebpur Kamal Jn	55.54	50	13.44	ECR	SEE	Barauni - Khagaria	88	2nd Line
Mansi Jn	Khagaria Jn	8.74	50	8.76	ECR	SEE	Khagaria - Mansi	105	2nd Line
Mansi Jn	Koshi Cabin	70	50	75.08	ECR	SEE	Mansi - Koshi Block 'Hut'	65	2nd Line
Koshi Cabin	Kursela	3.82	36	3.22	ECR	SEE	Koshi Block'Hut' - Kursela	65	2nd Line
Kursela	Katihar Jn	39.18	45	39.51	ECR	SEE	Kursela - Katihar	65	2nd Line
Kumedpur Jn	Katihar Jn	29.5	23	30.70	NFR	KIR	KATIHAR - KUMEDPUR	52	Single Line
Kumedpur Jn	Mukuria Jn	23	49	24.23	NFR	KIR	KUMEDPUR - MUKURIA	100	2nd Line
Mukuria Jn	Barsoi Jn	5	49	4.43	NFR	KIR	MUKURIA - BARSOI	152	2nd Line
Barsoi Jn	Kishanganj	145	49	58.52	NFR	KIR	BARSOI - NEW JALPAIGURI	148	2nd Line
Kishanganj	Aluabari Road	145	49	30.92	NFR	KIR	BARSOI - NEW JALPAIGURI	148	2nd Line
Aluabari Road	New Jalpaiguri Jn	145	49	57.89	NFR	KIR	BARSOI - NEW JALPAIGURI	148	2nd Line
New Jalpaiguri Jn	Raninagar Jalpaiguri Jn	26	44	26.83	NFR	KIR	NEW JALPAIGURI - RANINAGAR JALPAIGURI	86	2nd Line
Raninagar Jalpaiguri Jn	New Domohani	88	14	15.17	NFR	APDJ	Y' LEG OF MAYNAGURI ROAD - JALPAIGURI ROAD - NEW DOMOHANI - NEW COOCH BEHAR	23	2nd Line
New Domohani	New Maynaguri	88	28	3.83	NFR	APDJ	Y' LEG OF MAYNAGURI ROAD - JALPAIGURI ROAD - NEW DOMOHANI - NEW COOCH BEHAR	23	2nd Line
New Maynaguri	New Cooch Behar jn	88	14	82.27	NFR	APDJ	Y' LEG OF MAYNAGURI ROAD - JALPAIGURI ROAD - NEW DOMOHANI - NEW COOCH BEHAR	23	2nd Line
New Cooch Behar jn	Samuktala Road	129	28	29.68	NFR	APDJ	RANINAGAR JALPAIGURI - SAMUKTALA ROAD	80	2nd Line
Fakiragram Jn	Samuktala Road	96	49	59.85	NFR	APDJ	SAMUKTALA ROAD - NEW BONGAIGAON	96	2nd Line
Kokrajhar	Fakiragram Jn	96	49	10.31	NFR	APDJ	SAMUKTALA ROAD - NEW BONGAIGAON	96	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Kokrajhar	New Bongaigaon Jn	96	49	28.53	NFR	APDJ	SAMUKTALA ROAD - NEW BONGAIGAON	96	2nd Line
New Bongaigaon Jn	Barpeta Road	109	23	45.38	NFR	RNY	NEW BONGAIGAON - RANGIYA Jn.	66	2nd Line
Barpeta Road	Nalbari	109	23	49.90	NFR	RNY	NEW BONGAIGAON - RANGIYA Jn.	66	2nd Line
Nalbari	Rangiya Jn	109	23	17.57	NFR	RNY	NEW BONGAIGAON - RANGIYA Jn.	66	2nd Line
Rangiya Jn	Agthori	34	23	34.56	NFR	RNY	RANGIYA JN. - AGTHORI	67	2nd Line
Agthori	Kamakhya Jn	7.42	24	7.80	NFR	LMG	AGTHORI - KAMAKHYA	59	2nd Line
Kamakhya Jn	Guwahati	6.48	40	6.53	NFR	LMG	KAMAKHYA - GUWAHATI	96	4th Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Delhi Jn	Delhi Kishanganj	3	32	0.95	NR	DLI	Delhi Jn, - Delhi Kishanganj	63	2nd Line
Raja Ki Mandi	Mathura Jn	54.1	78	49.40	NCR	AGC	Mathura - Agra cantt	148	4th Line
Agra Cantt Jn	Raja Ki Mandi	54.1	78	3.73	NCR	AGC	Mathura - Agra cantt	148	4th Line
Agra Cantt Jn	Bhandai	52.5	74	10.85	NCR	AGC	Agra cantt - Dhaulpur	147	4th Line
Bhandai	Dhaulpur Jn	52.5	74	42.26	NCR	AGC	Agra cantt - Dhaulpur	148	4th Line
Morena	Dhaulpur Jn	154.4	70	26.84	NCR	JHS	DHO - JHS	173	4th Line
Banmourgaon	Morena	154.4	70	20.72	NCR	JHS	DHO - JHS	173	4th Line
Gwalior jn	Banmourgaon	154.4	70	17.72	NCR	JHS	DHO - JHS	173	4th Line
Gwalior jn	Sithouli	227.46	9	8.51	WCR	BPL	DHO - JHS	16	4th Line
Sithouli	Datia	154.4	70	67.26	NCR	JHS	DHO - JHS	173	4th Line
Datia	Jhansi Jn	154.4	70	24.75	NCR	JHS	DHO - JHS	173	4th Line
Jhansi Jn	Babina	152	70	24.12	NCR	JHS	JHS - BINA	165	4th Line
Babina	Lalitpur Jn	152	70	67.44	NCR	JHS	JHS - BINA	165	4th Line
Bina jn	Lalitpur Jn	152	70	63.58	NCR	JHS	JHS - BINA	165	4th Line
Bina jn	Vidisha	138.38	70	84.90	WCR	BPL	BINA - BHOPAL	196	4th Line
Vidisha	Bhopal jn	138.38	70	53.55	WCR	BPL	BINA - BHOPAL	196	4th Line
Hoshangabad	Bhopal jn	47.35	69	72.74	WCR	BPL	BPL - BKA	204	4th Line
Itarsi jn	Hoshangabad	24.91	69	17.48	WCR	BPL	BNI - ET	204	4th Line
Itarsi jn	Betul	130	46	104.69	CR	NGP	AMLA - Itarsi	142	4th Line
Betul	Amla Jn	130	46	23.12	CR	NGP	AMLA - Itarsi	142	4th Line
Narkher	Amla Jn	167	44	80.87	CR	NGP	Nagpur - AMLA	101	4th Line
Nagpur Jn	Narkher	167	44	85.85	CR	NGP	Nagpur - AMLA	101	4th Line
Buti Bori Jn	Nagpur Jn	79	63	27.37	CR	NGP	Wardha - Nagpur	152	4th Line
Wardha Jn	Buti Bori Jn	79	63	51.58	CR	NGP	Wardha - Nagpur	152	4th Line
Chikni Road	Wardha Jn	132	58	62.26	CR	NGP	Wardha - Balharshah Junction	128	4th Line
Warora	Chikni Road	132	58	10.79	CR	NGP	Wardha - Balharshah Junction	128	4th Line
Majri Jn	Warora	132	58	12.53	CR	NGP	Wardha - Balharshah Junction	128	4th Line
Majri Jn	Tadla Jn	132	58	19.31	CR	NGP	Wardha - Balharshah Junction	128	4th Line
Tadla Jn	Chandrapur Maharashtra	132	58	14.32	CR	NGP	Wardha - Balharshah Junction	128	4th Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Chandrapur Maharashtra	Babupeth	132	58	4.63	CR	NGP	Wardha - Balharshah Junction	128	4th Line
Babupeth	Ballarshah	132	58	9.46	CR	NGP	Wardha - Balharshah Junction	128	4th Line
Ballarshah	Manikgarh Jn	108	63	9.64	SCR	SC	Balharshah - Bellampalli	126	3rd Line
Asifabad Road	Manikgarh Jn	108	63	74.99	SCR	SC	Balharshah - Bellampalli	126	3rd Line
Bellampalli	Asifabad Road	108	63	24.30	SCR	SC	Balharshah - Bellampalli	126	3rd Line
Manchiryal	Bellampalli	126	65	19.67	SCR	SC	Bellampalli - Kazipet	140	4th Line
Raghavapuram	Manchiryal	126	65	23.43	SCR	SC	Bellampalli - Kazipet	140	4th Line
Peddapalli Jn	Raghavapuram	126	65	7.01	SCR	SC	Bellampalli - Kazipet	140	4th Line
Jamikunta	Peddapalli Jn	126	65	40.03	SCR	SC	Bellampalli - Kazipet	140	4th Line
Kazipet Jn	Jamikunta	126	65	36.59	SCR	SC	Bellampalli - Kazipet	140	4th Line
Warangal	Kazipet Jn	94	69	10.71	SCR	SC	Kazipet - Dornakal	130	3rd Line
Nekonda	Warangal	94	69	29.51	SCR	SC	Kazipet - Dornakal	130	3rd Line
Mahbubabad	Nekonda	94	69	31.14	SCR	SC	Kazipet - Dornakal	130	3rd Line
Dornakal Jn	Mahbubabad	94	69	24.28	SCR	SC	Kazipet - Dornakal	130	3rd Line
Khammam	Dornakal Jn	125	70	22.76	SCR	SC	Dornakal - Vijayawada	134	3rd Line
Motumari Jn	Khammam	125	70	38.61	SCR	SC	Dornakal - Vijayawada	134	3rd Line
Kondapalli	Motumari Jn	96	70	46.51	SCR	SC	Dornakal - Vijayawada	134	3rd Line
Vijayawada Jn	Kondapalli	16	70	15.60	SCR	BZA	Dornakal - Vijayawada	134	3rd Line
Krishna Canal Jn	Vijayawada Jn	6	80	4.29	SCR	BZA	Krishnacanal - Vijayawada	172	3rd Line
Tenali Jn	Krishna Canal Jn	26	62	26.22	SCR	BZA	Tenali - Krishnacanal	140	3rd Line
Tsunduru	Tenali Jn	107	59	11.55	SCR	BZA	Ongole - Tenali	144	3rd Line
Chirala	Tsunduru	107	59	46.30	SCR	BZA	Ongole - Tenali	144	3rd Line
Vetapalem	Chirala	107	59	7.72	SCR	BZA	Ongole - Tenali	144	3rd Line
Ongole	Vetapalem	107	59	41.52	SCR	BZA	Ongole - Tenali	144	3rd Line
Bitragunta	Ongole	82	59	83.01	SCR	BZA	Bitragunta - Ongole	146	3rd Line
Nellore	Bitragunta	34	59	33.90	SCR	BZA	Nellore - Bitragunta	146	3rd Line
Venkatachalam	Nellore	38	67	16.73	SCR	BZA	Gudur - Nellore	165	4th Line
Kommarapudi	Venkatachalam	38	67	6.40	SCR	BZA	Gudur - Nellore	165	4th Line
Gudur Jn	Kommarapudi	38	67	15.39	SCR	BZA	Gudur - Nellore	165	4th Line
Sullurupeta	Gudur Jn	54.85	92	55.10	SR	MAS	Sullurupeta - Gudur	73	2nd Line
Gummidipundi	Sullurupeta	35.11	93	35.45	SR	MAS	Gummidipundi - Sullurupeta	97	2nd Line
Minjur	Gummidipundi	25.2	94	21.31	SR	MAS	Attipattu - Gummidipundi	155	2nd Line
Attipattu	Minjur	25.2	94	4.04	SR	MAS	Attipattu - Gummidipundi	155	2nd Line
Attipattu pudunagar	Attipattu	6	184	1.96	SR	MAS	Ennore - Attipattu	169	4th Line
Ennore	Attipattu pudunagar	6	184	4.30	SR	MAS	Ennore - Attipattu	169	4th Line
Tiruvottiyur	Ennore	7.07	184	6.85	SR	MAS	Tiruvottiyur - Ennore	171	4th Line
Korukkupet	Tiruvottiyur	4.88	116	5.04	SR	MAS	Korukkupet Jn. - Tiruvottiyur	176	3rd Line
Korukkupet	Basin Bridge	0.71	92	2.33	SR	MAS	Basin Bridge Jn. - Korukkupet Jn.	126	2nd Line

HDN 6

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Kharagpur Jn	Jaleswar	177	63	68.59	SER	KGP	KHARAGPUR/NIMPURA - BHADRAK	136	3rd Line
Rupsa Jn	Jaleshwar	177	63	30.44	SER	KGP	KHARAGPUR/NIMPURA - BHADRAK	136	3rd Line
Rupsa Jn	Balasore	177	63	17.82	SER	KGP	KHARAGPUR/NIMPURA - BHADRAK	136	3rd Line
Balasore	Ranital Jn Cabin	177	63	58.67	SER	KGP	KHARAGPUR/NIMPURA - BHADRAK	136	3rd Line
Ranital Jn Cabin	Bhadrak	5.03	80	4.89	ECOR	KUR	Ranital Link Cabin - Bhadrak	139	3rd Line
Jajpur Keonjhar	Bhadrak	51.4	68	44.37	ECOR	KUR	Bhadrak - Jakhapura	159	3rd Line
Jakhapura Jn	Jajpur Keonjhar	51.4	68	8.51	ECOR	KUR	Bhadrak - Jakhapura	159	3rd Line
Jenapur	Jakhapura Jn	23.5	110	7.51	ECOR	KUR	Jakhapura - Haridaspur	170	3rd Line
Haridaspur	Jenapur	23.5	110	15.64	ECOR	KUR	Jakhapura - Haridaspur	170	3rd Line
Kapilas Road Jn	Haridaspur	30.4	77	26.97	ECOR	KUR	Haridaspur - Nergundi	175	3rd Line
Nergundi Jn	Kapilas Road Jn	30.4	77	4.42	ECOR	KUR	Haridaspur - Nergundi	175	3rd Line
Nergundi Jn	Cuttack Jn	10.69	93	10.62	ECOR	KUR	Nergundi - Cuttack	207	3rd Line
Cuttack Jn	Barang Jn	11.5	87	11.79	ECOR	KUR	Cuttack - Barang	145	3rd Line
Barang Jn	Bhubaneshwar	9.4	103	16.24	ECOR	KUR	Barang - Mancheswar	199	3rd Line
Bhubaneshwar	Khurda Road Jn	19.3	120	19.53	ECOR	KUR	Bhubaneswar - Khurda Road	200	3rd Line
Khurda Road Jn	Chatrapur	146.8	66	127.57	ECOR	KUR	Khurda Road - Brahmapur	152	3rd Line
Chatrapur	Brahmapur	146.8	66	21.57	ECOR	KUR	Khurda Road - Brahmapur	152	3rd Line
Palasa	Brahmapur	73.9	60	75.39	ECOR	KUR	Brahmapur - Palasa	149	3rd Line
Naupada Jn	Palasa	26	64	25.78	ECOR	WAT	Palasa - Naupada	136	3rd Line
Srikakulam Road	Naupada Jn	116.7	61	47.96	ECOR	WAT	Naupada - Vizianagaram	133	3rd Line
Vizianagaram Jn	Srikakulam Road	116.7	61	69.91	ECOR	WAT	Naupada - Vizianagaram	133	3rd Line
Kottavalasa Jn	Vizianagaram Jn	34.63	114	34.50	ECOR	WAT	Vizianagaram - Kottavalasa	204	3rd Line
Simhachalam North Jn	Kottavalasa Jn	16.8	128	16.92	ECOR	WAT	Kottavalasa - Simhachalam North	234	4th Line
Simhachalam North Jn	Gopalapatnam	2.7	65	2.69	ECOR	WAT	Simhachalam North - Gopalpatnam	112	3rd Line
Duvada	Gopalapatnam	10.4	77	9.81	ECOR	WAT	Gopalpatnam - Duvvada	135	3rd Line
Anakapalle	Duvada	133	58	15.80	SCR	BZA	Samalkot - Duvvada	148	3rd Line
Pithapuram	Anakapalle	133	58	106.79	SCR	BZA	Samalkot - Duvvada	148	3rd Line
Samalkot Jn	Pithapuram	133	58	12.30	SCR	BZA	Samalkot - Duvvada	148	3rd Line
Rajahmundry	Samalkot Jn	50	58	50.23	SCR	BZA	Rajamundry - Samalkot	162	3rd Line
Kowur	Rajahmundry	22	58	7.18	SCR	BZA	Nidadavolu - Rajamundry	161	3rd Line
Nidadavolu Jn	Kowur	22	58	14.99	SCR	BZA	Nidadavolu - Rajamundry	161	3rd Line
Eluru	Nidadavolu Jn	127	58	67.64	SCR	BZA	Vijayawada - Nidadavolu	149	3rd Line
Vijayawada Jn	Eluru	127	58	59.71	SCR	BZA	Vijayawada - Nidadavolu	149	3rd Line

HDN 7

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Kalyan Jn	Badlapur	14	144	14.03	CR	CSTM	Kalyan - Badlapur	343	4th Line
Badlapur	Neral jn	32	144	18.23	CR	CSTM	Badlapur - Karjat Junction	173	2nd Line
Neral jn	Karjat Jn	32	144	13.31	CR	CSTM	Badlapur - Karjat Junction	173	2nd Line
Karjat Jn	Lonavla	28	48	27.47	CR	CSTM	Karjat Junction - Lonavala	125	3rd Line
Lonavla	Talegaon	30	68	29.31	CR	PUNE	Lonavala - Talegaon	142	4th Line
Talegaon	Dehu Road	35	64	9.99	CR	PUNE	Talegaon - PUNE	146	4th Line
Dehu Road	Chinchvad	35	64	8.19	CR	PUNE	Talegaon - PUNE	146	4th Line
Chinchvad	Pune	35	64	16.17	CR	PUNE	Talegaon - PUNE	146	4th Line
Pune	Daund jn	76	65	76.61	CR	PUNE	PUNE - Daund Junction	116	2nd Line
Daund jn	Bhigwan	28	63	27.41	CR	SUR	Daund Junction - Bhigwan	76	2nd Line
Bhigwan	Parewadi	81	31	20.89	CR	SUR	Bhigwan - Kurduvadi Junction	76	2nd Line
Parewadi	Kurduvadi Jn	81	31	58.97	CR	SUR	Bhigwan - Kurduvadi Junction	76	2nd Line
Kurduvadi Jn	Mohol	45	31	45.65	CR	SUR	Kurduvadi Junction - Mohol	72	2nd Line
Mohol	Solapur Jn	34	64	32.29	CR	SUR	Mohol - Solapur	72	2nd Line
Solapur Jn	Hotgi Jn	16	64	15.11	CR	SUR	Solapur - Hotgi	90	2nd Line
Hotgi Jn	Akalkot Road	98	31	20.48	CR	SUR	Hotgi - Gulbarga	74	2nd Line
Akalkot Road	Bablad	98	31	73.14	CR	SUR	Hotgi - Gulbarga	74	2nd Line
Gulbarga	Bablad	98	31	4.72	CR	SUR	Hotgi - Gulbarga	74	2nd Line
Wadi Jn	Gulbarga	37	63	36.49	CR	SUR	Gulbarga - Wadi	78	2nd Line
Krishna	Wadi Jn	107.48	47	81.46	SCR	GKL	Raichur - Wadi	78	2nd Line
Krishna	Raichur Jn	107.48	47	25.60	SCR	GKL	Raichur - Wadi	78	2nd Line
Raichur Jn	Matmari	120.84	40	16.99	SCR	GKL	Guntakal - Raichur	73	2nd Line
Mantralayam Road	Matmari	120.84	40	11.28	SCR	GKL	Guntakal - Raichur	73	2nd Line
Guntakal Jn	Mantralayam Road	120.84	40	93.07	SCR	GKL	Guntakal - Raichur	73	2nd Line
Gooty Jn	Guntakal Jn	28.55	45	28.16	SCR	GKL	Gooty - Guntakal	79	2nd Line
Gooty Jn Cabin	Gooty Jn	194.32	48	2.44	SCR	GKL	Nandaluru - Gooty	90	2nd Line
Kondapuram	Gooty Jn Cabin	194.32	48	73.81	SCR	GKL	Nandaluru - Gooty	90	2nd Line
Mangapatnam	Kondapuram	194.32	48	9.19	SCR	GKL	Nandaluru - Gooty	90	2nd Line
Yerraguntala Jn	Mangapatnam	194.32	48	32.33	SCR	GKL	Nandaluru - Gooty	90	2nd Line
Kadapa	Yerraguntala Jn	194.32	48	38.92	SCR	GKL	Nandaluru - Gooty	90	2nd Line
Nandalur	Kadapa	194.32	48	39.71	SCR	GKL	Nandaluru - Gooty	90	2nd Line
Obulavaripalle	Nandalur	85.41	46	32.59	SCR	GKL	Renigunta - Nandalur	67	2nd Line
Renigunta	Obulavaripalle	85.41	46	53.99	SCR	GKL	Renigunta - Nandalur	67	2nd Line
Pudi	Renigunta	53.55	52	9.48	SR	MAS	Tiruttani - Renigunta	77	2nd Line
Puttur	Pudi	53.55	52	15.21	SR	MAS	Tiruttani - Renigunta	77	2nd Line
Nagari	Puttur	53.55	52	15.67	SR	MAS	Tiruttani - Renigunta	77	2nd Line
Nagari	Venkatanarasimharajuvaripeta Halt	53.55	52	3.79	SR	MAS	Tiruttani - Renigunta	77	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Venkatanarasimharajuvaripeta Halt	Ponpadi	53.55	52	3.72	SR	MAS	Tiruttani - Renigunta	77	2nd Line
Ponpadi	Tiruttani	53.55	52	6.69	SR	MAS	Tiruttani - Renigunta	77	2nd Line
Tiruttani	Arakkonam North Cabin	11.31	66	9.51	SR	MAS	Arakkonam North Cabin - Tiruttani	105	2nd Line
Arakkonam North Cabin	Arakkonam	1.44	60	3.64	SR	MAS	Arakkonam Jn. - Arakkonam North Cabin	69	2nd Line
Arakkonam	Tiruvallur	26.83	222	26.74	SR	MAS	Tiruvallur - Arakkonam	201	4th Line
Tiruvallur	Pattabiram	16.72	222	17.06	SR	MAS	Pattabiram - Tiruvallur	282	4th Line
Pattabiram	Hindu College	3.91	222	1.90	SR	MAS	Avadi - Pattabiram	322	4th Line
Hindu College	Avadi	3.91	222	2.02	SR	MAS	Avadi - Pattabiram	322	4th Line
Avadi	Villivakkam	11.61	222	11.65	SR	MAS	Villivakkam - Avadi	364	4th Line
Villivakkam	Veysarpadi	5.8	222	5.55	SR	MAS	Vyasarpadi - Villivakkam	365	4th Line
Veysarpadi	Basin Bridge	1.39	222	1.88	SR	MAS	Basin Bridge Jn. - Vyasarpadi	276	4th Line
Basin Bridge	Chennai Central	2.22	320	1.21	SR	MAS	Chennai Central - Basin Bridge Jn.	395	6th Line

ANNEXURE 11.2: HDN Train Forecast by Section by Cardinal Years (Passengers + Freight)

HDN 1

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Delhi Jn	Shahdara Jn	209	239	295	353	331	239 (179 + 61)	295 (191 + 104)	353 (244 + 109)	331 (278 + 53)
Shahdara Jn	Sahibabad	178	225	283	347	328	225 (165 + 60)	283 (180 + 104)	347 (237 + 109)	328 (274 + 54)
Sahibabad	Ghaziabad Jn	442	423	484	567	650	423 (352 + 71)	484 (366 + 119)	567 (447 + 121)	650 (498 + 152)
Ghaziabad Jn	Dadri	202	196	213	227	279	196 (189 + 7)	213 (203 + 10)	227 (214 + 13)	279 (262 + 16)
Dankaur	Dadri	217	192	208	219	270	192 (189 + 3)	208 (203 + 4)	219 (213 + 5)	270 (262 + 8)
Chola	Dankaur	213	187	202	212	265	187 (185 + 2)	202 (199 + 2)	212 (208 + 3)	265 (260 + 5)
Khurja Jn	Chola	213	184	197	205	256	184 (184 + 0)	197 (197 + 1)	205 (203 + 2)	256 (253 + 3)
Aligarh Jn	Khurja Jn	217	190	204	218	268	190 (188 + 2)	204 (202 + 3)	218 (205 + 12)	268 (264 + 4)
Hathras Jn	Aligarh Jn	217	169	183	195	247	169 (162 + 7)	183 (173 + 10)	195 (179 + 16)	247 (216 + 31)
Barhan Jn	Hathras Jn	217	161	173	174	236	161 (160 + 1)	173 (172 + 1)	174 (172 + 2)	236 (229 + 7)
Motawali	Barhan Jn	220	163	175	180	238	163 (162 + 1)	175 (174 + 2)	180 (177 + 3)	238 (230 + 8)
Tundla Jn	Motawali	201	187	218	234	278	187 (149 + 38)	218 (161 + 57)	234 (162 + 72)	278 (226 + 52)
Firozabad	Tundla Jn	232	182	201	275	370	182 (177 + 6)	201 (191 + 10)	275 (257 + 18)	370 (355 + 15)
Shikohabad Jn	Firozabad	232	181	199	272	366	181 (177 + 5)	199 (191 + 8)	272 (257 + 15)	366 (355 + 11)
Etawah	Shikohabad Jn	233	176	191	261	306	176 (174 + 1)	191 (189 + 3)	261 (253 + 8)	306 (304 + 2)
Etawah	Phaphund	233	189	204	296	422	189 (187 + 2)	204 (199 + 6)	296 (291 + 5)	422 (383 + 40)
Phaphund	Panki	233	194	214	306	422	194 (189 + 5)	214 (204 + 10)	306 (300 + 5)	422 (389 + 33)
Juhi cabin	Panki	232	215	250	347	476	215 (195 + 20)	250 (213 + 36)	347 (326 + 20)	476 (401 + 75)
Juhi cabin	Kanpur Central	298	328	371	443	654	328 (244 + 84)	371 (245 + 127)	443 (334 + 109)	654 (479 + 174)
Chandari	Kanpur Central	124	104	104	108	152	104 (104 + 0)	104 (104 + 0)	108 (108 + 0)	152 (152 + 0)
Chandari	Juhi cabin	79	39	56	121	162	39 (34 + 5)	56 (49 + 8)	121 (108 + 13)	162 (146 + 16)
Fatehpur	Chandari	197	143	160	229	314	143 (138 + 4)	160 (154 + 7)	229 (215 + 14)	314 (296 + 18)
Subedarganj	Fatehpur	195	140	157	225	308	140 (135 + 4)	157 (150 + 7)	225 (211 + 13)	308 (292 + 17)
Allahabad Jn	Subedarganj	196	140	158	225	310	140 (136 + 4)	158 (151 + 6)	225 (212 + 13)	310 (293 + 17)
Allahabad Jn	Naini Jn	218	210	234	282	420	210 (196 + 14)	234 (221 + 13)	282 (250 + 32)	420 (379 + 41)
Naini Jn	Chheoki	180	123	137	167	261	123 (119 + 4)	137 (131 + 6)	167 (158 + 9)	261 (247 + 14)
Chheoki	Mirzapur	218	194	222	268	373	194 (170 + 24)	222 (201 + 20)	268 (232 + 35)	373 (325 + 48)
Mirzapur	Chunar jn	217	183	222	239	384	183 (162 + 21)	222 (199 + 23)	239 (199 + 40)	384 (331 + 53)
Chunar jn	Jeonathpur	205	167	188	241	307	167 (164 + 2)	188 (185 + 4)	241 (236 + 4)	307 (301 + 5)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Jeonathpur	Mughal Sarai Jn	188	154	176	219	276	154 (152 + 2)	176 (172 + 4)	219 (215 + 4)	276 (271 + 6)
Chandauli Majhwar	Mughal Sarai Jn	167	103	123	212	299	103 (102 + 1)	123 (122 + 1)	212 (211 + 1)	299 (296 + 3)
Bhabua Road	Chandauli Majhwar	167	102	122	211	296	102 (102 + 0)	122 (122 + 0)	211 (210 + 0)	296 (296 + 0)
Sasaram Jn	Bhabua Road	167	90	105	189	258	90 (89 + 1)	105 (104 + 1)	189 (187 + 2)	258 (256 + 2)
Sasaram Jn	Pahleza	167	97	115	204	394	97 (95 + 2)	115 (112 + 2)	204 (199 + 5)	394 (387 + 7)
Pahleza	Dehri on Sone Jn	167	96	114	203	311	96 (95 + 1)	114 (113 + 2)	203 (201 + 2)	311 (307 + 4)
Dehri on Sone Jn	Sonnagar Jn	178	117	128	188	262	117 (113 + 4)	128 (122 + 5)	188 (177 + 10)	262 (251 + 11)
Sonnagar Jn	Anugraha Narayan Road	117	174	230	345	369	174 (133 + 40)	230 (176 + 54)	345 (260 + 86)	369 (236 + 132)
Anugraha Narayan Road	Rafiganj	117	121	141	255	374	121 (87 + 34)	141 (98 + 43)	255 (202 + 54)	374 (285 + 90)
Rafiganj	Gaya Jn	117	113	129	239	351	113 (80 + 33)	129 (87 + 42)	239 (190 + 48)	351 (267 + 84)
Gaya Jn	Manpur Jn	122	106	123	266	381	106 (74 + 32)	123 (84 + 39)	266 (212 + 54)	381 (275 + 106)
Koderma Jn	Manpur Jn	122	95	113	188	241	95 (71 + 23)	113 (84 + 29)	188 (152 + 36)	241 (185 + 56)
Koderma Jn	Hazaribagh Road	122	104	135	249	283	104 (76 + 28)	135 (91 + 43)	249 (157 + 92)	283 (183 + 100)
Hazaribagh Road	NSC Bose Jn Gomoh	122	104	135	249	283	104 (76 + 28)	135 (91 + 43)	249 (157 + 92)	283 (183 + 100)
NSC Bose Jn Gomoh	Dhanbad Jn	104	116	131	226	284	116 (63 + 53)	131 (71 + 60)	226 (100 + 126)	284 (145 + 139)
Dhanbad Jn	Pradhankhunta Jn	126	98	104	112	129	98 (98 + 0)	104 (104 + 0)	112 (112 + 0)	129 (129 + 0)
Pradhankhunta Jn	Chhota Ambana	146	102	111	129	159	102 (102 + 0)	111 (111 + 0)	129 (129 + 0)	159 (159 + 0)
Kulti	Chhota Ambana	146	102	111	129	159	102 (102 + 0)	111 (111 + 0)	129 (129 + 0)	159 (159 + 0)
Kulti	Sitarampur Jn	146	134	112	134	169	134 (99 + 35)	112 (111 + 1)	134 (130 + 4)	169 (163 + 6)
Sitarampur Jn	Asansol jn	277	174	185	211	286	174 (174 + 0)	185 (185 + 0)	211 (211 + 0)	286 (286 + 0)
Asansol jn	Kalipahari	277	179	192	220	237	179 (179 + 0)	192 (192 + 0)	220 (220 + 0)	237 (237 + 0)
Kalipahari	Andal Jn	277	179	192	221	253	179 (179 + 0)	192 (192 + 0)	221 (220 + 0)	253 (250 + 3)
Andal Jn	Khana Jn	267	194	232	267	321	194 (185 + 8)	232 (187 + 46)	267 (215 + 52)	321 (240 + 80)
Khana Jn	Barddhaman Jn	278	264	285	319	354	264 (254 + 10)	285 (271 + 13)	319 (285 + 34)	354 (320 + 34)
Barddhaman Jn	Saktigarh Jn	340	318	334	342	342	318 (317 + 1)	334 (332 + 2)	342 (340 + 2)	342 (337 + 5)
Masagram	Saktigarh Jn	230	200	207	214	218	200 (198 + 1)	207 (206 + 2)	214 (212 + 2)	218 (216 + 2)
Kamarkundu Jn	Masagram	230	198	205	210	214	198 (198 + 0)	205 (205 + 0)	210 (210 + 0)	214 (214 + 0)
Kamarkundu Jn	Dankuni Jn	230	207	221	233	244	207 (200 + 7)	221 (206 + 15)	233 (210 + 23)	244 (215 + 29)
Dankuni Jn	Bally	154	236	296	408	464	236 (141 + 95)	296 (137 + 159)	408 (179 + 229)	464 (161 + 302)
Bally	Belur	540	570	623	728	778	570 (468 + 102)	623 (464 + 158)	728 (534 + 194)	778 (536 + 243)
Belur	Howrah	818	569	621	724	768	569 (467 + 102)	621 (462 + 158)	724 (526 + 198)	768 (519 + 249)
Howrah	Liluah	540	469	470	472	478	469 (469 + 0)	470 (470 + 0)	472 (472 + 0)	478 (478 + 0)

HDN 2

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Chhatrapati Shivaji Terminus	Dadar	413	366	375	389	407	366 (352 + 14)	375 (352 + 23)	389 (352 + 37)	407 (352 + 55)
Dadar	Kurla Jn	418	1733	1798	1885	1778	1733 (1715 + 19)	1798 (1774 + 23)	1885 (1854 + 31)	1778 (1738 + 40)
Kurla Jn	Thane Jn	420	1389	1651	1101	1098	1389 (1370 + 19)	1651 (1628 + 23)	1101 (1072 + 29)	1098 (1057 + 41)
Thane Jn	Diva Jn	494	1560	1736	1682	1535	1560 (1552 + 9)	1736 (1734 + 2)	1682 (1677 + 6)	1535 (1468 + 68)
Diva Jn	Kalyan Jn	465	1765	1840	1835	1816	1765 (1757 + 8)	1840 (1837 + 2)	1835 (1830 + 5)	1816 (1746 + 70)
Kalyan Jn	Titvala	306	1670	1724	1682	1579	1670 (1618 + 52)	1724 (1710 + 13)	1682 (1661 + 20)	1579 (1554 + 25)
Titvala	Asangaon	220	323	345	277	277	323 (283 + 40)	345 (345 + 0)	277 (277 + 0)	277 (277 + 0)
Asangaon	Kasara	175	582	674	561	580	582 (539 + 43)	674 (668 + 5)	561 (554 + 8)	580 (566 + 14)
Kasara	Igatpuri	135	514	603	496	513	514 (470 + 44)	603 (597 + 6)	496 (487 + 9)	513 (497 + 16)
Lahavit	Igatpuri	106	484	568	456	469	484 (440 + 44)	568 (568 + 0)	456 (456 + 0)	469 (469 + 0)
Devlali	Lahavit	106	484	568	456	469	484 (440 + 44)	568 (568 + 0)	456 (456 + 0)	469 (469 + 0)
Nasik Road	Devlali	106	484	568	456	469	484 (440 + 44)	568 (568 + 0)	456 (456 + 0)	469 (469 + 0)
Kasbe Sukene	Nasik Road	106	484	579	472	486	484 (440 + 44)	579 (569 + 10)	472 (457 + 14)	486 (468 + 18)
Manmad Jn	Kasbe Sukene	106	481	585	499	524	481 (438 + 43)	585 (567 + 17)	499 (474 + 24)	524 (486 + 38)
Nandgaon	Manmad Jn	130	369	449	395	432	369 (356 + 13)	449 (449 + 0)	395 (395 + 0)	432 (432 + 0)
Chalisgaon jn	Nandgaon	133	369	449	395	432	369 (356 + 13)	449 (449 + 0)	395 (395 + 0)	432 (432 + 0)
Pachora jn	Chalisgaon jn	133	368	448	394	431	368 (355 + 13)	448 (448 + 0)	394 (394 + 0)	431 (431 + 0)
Jalgaon Jn	Pachora jn	133	368	448	396	434	368 (355 + 13)	448 (448 + 0)	396 (394 + 1)	434 (432 + 2)
Jalgaon Jn	Bhusawal jn	179	378	354	553	751	378 (285 + 92)	354 (330 + 24)	553 (525 + 28)	751 (701 + 50)
Bhusawal jn	Jalamb jn	116	187	117	271	417	187 (99 + 88)	117 (116 + 0)	271 (271 + 0)	417 (415 + 2)
Jalamb jn	Akola Jn	116	170	107	244	361	170 (86 + 84)	107 (99 + 8)	244 (233 + 11)	361 (349 + 12)
Akola Jn	Murtajapur Jn	116	169	101	204	346	169 (84 + 85)	101 (97 + 4)	204 (199 + 5)	346 (340 + 6)
Murtajapur Jn	Badnera Jn	116	165	96	203	337	165 (81 + 84)	96 (95 + 1)	203 (201 + 2)	337 (333 + 4)
Badnera Jn	Pulgaon Jn	125	169	100	182	298	169 (86 + 83)	100 (98 + 2)	182 (180 + 2)	298 (295 + 3)
Pulgaon Jn	Wardha Jn	125	171	99	181	296	171 (86 + 85)	99 (98 + 1)	181 (181 + 0)	296 (296 + 0)
Itwari Jn	Nagpur Jn	158	180	257	327	441	180 (140 + 40)	257 (173 + 84)	327 (250 + 77)	441 (334 + 108)
Itwari Jn	Kalamna	158	163	169	245	336	163 (135 + 29)	169 (164 + 4)	245 (239 + 5)	336 (322 + 14)
Kalamna	Kanhan Jn	148	162	166	274	374	162 (134 + 28)	166 (164 + 2)	274 (268 + 6)	374 (359 + 15)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Kanhan Jn	Bhandara Road	158	162	166	274	374	162 (134 + 28)	166 (164 + 2)	274 (268 + 6)	374 (359 + 15)
Bhandara Road	Tumsar Road Jn	184	161	168	280	370	161 (129 + 32)	168 (154 + 13)	280 (263 + 16)	370 (359 + 10)
Tumsar Road Jn	Gondia Jn	163	160	167	278	368	160 (129 + 31)	167 (154 + 13)	278 (262 + 16)	368 (358 + 9)
Gondia Jn	Rajnandgaon	192	169	160	277	390	169 (131 + 37)	160 (159 + 1)	277 (275 + 2)	390 (387 + 3)
Durg Jn	Rajnandgaon	175	169	162	281	393	169 (133 + 36)	162 (161 + 1)	281 (279 + 2)	393 (390 + 3)
Bhilai	Durg Jn	224	197	287	319	571	197 (161 + 36)	287 (174 + 113)	319 (241 + 78)	571 (385 + 186)
Srona	Bhilai	253	222	284	387	624	222 (163 + 59)	284 (177 + 107)	387 (314 + 73)	624 (476 + 148)
Urkura	Srona	121	54	35	93	141	54 (23 + 31)	35 (31 + 4)	93 (84 + 9)	141 (129 + 12)
Bilaspur Jn	Urkura	270	160	130	310	409	160 (124 + 36)	130 (130 + 0)	310 (295 + 14)	409 (409 + 0)
Bilaspur Jn	Janjgir Naila	233	134	146	231	350	134 (103 + 32)	146 (105 + 40)	231 (166 + 65)	350 (268 + 82)
Janjgir Naila	Champa Jn	232	132	142	227	345	132 (101 + 31)	142 (104 + 39)	227 (165 + 63)	345 (266 + 79)
Champa Jn	Kharsia	203	103	89	126	226	103 (64 + 39)	89 (76 + 13)	126 (107 + 19)	226 (180 + 46)
Kharsia	Raigarh	203	83	72	91	162	83 (54 + 28)	72 (72 + 1)	91 (91 + 1)	162 (154 + 8)
Belpahar	Raigarh	203	115	125	164	241	115 (56 + 59)	125 (77 + 49)	164 (110 + 54)	241 (180 + 61)
Lb	Belpahar	203	115	125	164	241	115 (56 + 59)	125 (77 + 49)	164 (110 + 54)	241 (180 + 61)
Jharsuguda Jn	Lb	203	112	120	153	221	112 (54 + 58)	120 (73 + 48)	153 (100 + 54)	221 (134 + 87)
Dharuadihi	Jharsuguda Jn	145	257	204	272	269	257 (71 + 185)	204 (98 + 105)	272 (194 + 78)	269 (203 + 66)
Rourkela Jn	Dharuadihi	145	221	89	135	268	221 (68 + 154)	89 (89 + 0)	135 (135 + 0)	268 (268 + 0)
Bondamunda PH	Rourkela Jn	137	219	111	192	311	219 (66 + 153)	111 (90 + 21)	192 (161 + 31)	311 (249 + 62)
Bondamunda PH	Chakradharpur	102	188	62	84	198	188 (39 + 149)	62 (62 + 0)	84 (66 + 18)	198 (157 + 41)
Rajkharswan Jn	Chakradharpur	119	205	208	252	301	205 (52 + 153)	208 (79 + 128)	252 (144 + 108)	301 (296 + 6)
Sini Jn	Rajkharswan Jn	185	203	187	249	396	203 (50 + 152)	187 (78 + 109)	249 (121 + 128)	396 (236 + 160)
Sini Jn	Gamharia Jn	128	109	165	214	263	109 (57 + 53)	165 (68 + 97)	214 (83 + 131)	263 (107 + 156)
Gamharia Jn	Tatanagar Jn	210	178	221	291	362	178 (104 + 74)	221 (124 + 97)	291 (157 + 134)	362 (194 + 168)
Tatanagar Jn	Chakulia	126	103	83	96	102	103 (70 + 33)	83 (83 + 0)	96 (96 + 0)	102 (102 + 0)
Jhargram	Chakulia	126	142	95	121	145	142 (77 + 65)	95 (94 + 1)	121 (120 + 1)	145 (143 + 2)
Nimpura Jn	Jhargram	126	143	95	121	146	143 (77 + 65)	95 (94 + 1)	121 (120 + 1)	146 (143 + 3)
Kharagpur Jn	Nimpura Jn	126	148	116	150	178	148 (77 + 71)	116 (94 + 22)	150 (120 + 30)	178 (142 + 36)
Panskura Jn	Kharagpur Jn	218	318	209	253	262	318 (173 + 145)	209 (208 + 1)	253 (251 + 2)	262 (258 + 4)
Mecheda	Panskura Jn	274	385	318	376	400	385 (240 + 145)	318 (268 + 50)	376 (307 + 70)	400 (313 + 86)
Kulgachia FS	Mecheda	288	405	338	396	420	405 (260 + 145)	338 (288 + 50)	396 (326 + 70)	420 (333 + 87)
Uluberia	Kulgachia FS	288	405	338	396	420	405 (260 + 145)	338 (288 + 50)	396 (326 + 70)	420 (333 + 87)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Andul	Uluberia	295	406	346	393	419	406 (259 + 147)	346 (278 + 68)	393 (301 + 93)	419 (303 + 116)
Santragachhi Jn	Andul	261	326	290	345	376	326 (239 + 87)	290 (243 + 47)	345 (333 + 11)	376 (349 + 26)
Tikiapara	Santragachhi Jn	310	318	371	476	518	318 (216 + 102)	371 (213 + 157)	476 (271 + 205)	518 (279 + 240)
Howrah	Tikiapara	316	318	371	476	518	318 (216 + 102)	371 (213 + 157)	476 (271 + 205)	518 (279 + 240)

HDN 3

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
New Delhi	Tilak Bridge	322	299	311	359	509	299 (267 + 32)	311 (275 + 36)	359 (264 + 95)	509 (307 + 203)
Tilak Bridge	H Nizamuddin Jn	193	167	179	217	353	167 (135 + 31)	179 (144 + 36)	217 (144 + 73)	353 (220 + 134)
H Nizamuddin Jn	Tughlakabad	223	210	216	242	339	210 (177 + 32)	216 (177 + 40)	242 (150 + 92)	339 (191 + 148)
Faridabad	Tughlakabad	297	265	292	351	504	265 (228 + 37)	292 (239 + 53)	351 (239 + 112)	504 (319 + 185)
Palwal	Faridabad	297	269	300	365	524	269 (228 + 41)	300 (240 + 60)	365 (240 + 124)	524 (320 + 203)
Kosi Kalan	Palwal	193	182	205	249	240	182 (170 + 11)	205 (189 + 16)	249 (218 + 31)	240 (240 + 0)
Mathura Jn	Kosi Kalan	193	175	195	229	228	175 (167 + 9)	195 (183 + 12)	229 (207 + 22)	228 (223 + 4)
Bharatpur Jn	Mathura Jn	104	91	111	142	228	91 (75 + 17)	111 (82 + 29)	142 (110 + 32)	228 (193 + 35)
Bharatpur Jn	Bayana Jn	104	85	95	144	244	85 (74 + 11)	95 (81 + 14)	144 (117 + 27)	244 (222 + 22)
Bayana Jn	Gangapur city	140	110	121	201	361	110 (99 + 11)	121 (107 + 14)	201 (176 + 25)	361 (316 + 45)
Sawai Madhopur Jn	Gangapur city	140	116	126	216	302	116 (103 + 12)	126 (110 + 16)	216 (187 + 29)	302 (261 + 41)
Sawai Madhopur Jn	Gurla	162	155	176	278	363	155 (135 + 20)	176 (151 + 25)	278 (239 + 39)	363 (302 + 61)
Gurla	Kota Jn	185	167	188	290	371	167 (147 + 20)	188 (163 + 25)	290 (249 + 41)	371 (309 + 62)
Kota Jn	Ramganj Mandi jn	138	114	128	193	265	114 (109 + 5)	128 (122 + 6)	193 (180 + 13)	265 (252 + 13)
Nagda JN	Ramganj Mandi jn	138	110	122	210	291	110 (107 + 3)	122 (118 + 4)	210 (199 + 11)	291 (281 + 9)
Ratlam JN	Nagda JN	178	200	214	348	405	200 (197 + 3)	214 (209 + 5)	348 (332 + 16)	405 (394 + 11)
Ratlam JN	Dahod	163	200	211	341	403	200 (186 + 14)	211 (197 + 14)	341 (314 + 27)	403 (375 + 28)
Piplod	Dahod	163	229	225	347	427	229 (213 + 16)	225 (208 + 17)	347 (317 + 31)	427 (395 + 33)
Godhra Jn	Piplod	163	230	226	348	428	230 (213 + 16)	226 (208 + 17)	348 (316 + 32)	428 (394 + 35)
Godhra Jn	Champaner Road	132	214	207	323	393	214 (194 + 20)	207 (184 + 24)	323 (289 + 33)	393 (347 + 46)
Champaner Road	Samlaya	132	214	207	323	393	214 (194 + 20)	207 (184 + 24)	323 (289 + 33)	393 (347 + 46)
Samlaya	Vadodara E	132	214	207	315	325	214 (194 + 20)	207 (183 + 24)	315 (280 + 35)	325 (281 + 43)
Vadodara D	Vadodara E	118	203	192	252	288	203 (195 + 8)	192 (183 + 10)	252 (237 + 14)	288 (264 + 24)
Vadodara D	Vadodara Jn	317	376	386	561	670	376 (359 + 17)	386 (363 + 23)	561 (524 + 37)	670 (624 + 46)
Vadodara Jn	Vishvamitri Jn	235	320	330	505	614	320 (303 + 17)	330 (307 + 23)	505 (468 + 37)	614 (568 + 46)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Vishvamitri Jn	Miyagam Karjan Jn	235	303	301	414	492	303 (303 + 0)	301 (301 + 0)	414 (414 + 0)	492 (492 + 0)
Miyagam Karjan Jn	Bharuch Jn	235	310	309	470	596	310 (310 + 0)	309 (309 + 0)	470 (470 + 0)	596 (596 + 0)
Bharuch Jn	Ankleshwar Jn	231	316	319	534	677	316 (306 + 10)	319 (305 + 13)	534 (513 + 21)	677 (652 + 25)
Ankleshwar Jn	Kosamba Jn	231	327	329	547	699	327 (305 + 22)	329 (306 + 23)	547 (513 + 34)	699 (654 + 45)
Kosamba Jn	Surat	231	296	289	478	606	296 (296 + 0)	289 (289 + 0)	478 (478 + 0)	606 (606 + 0)
Surat	Udhna Jn	247	312	305	494	622	312 (312 + 0)	305 (305 + 0)	494 (494 + 0)	622 (622 + 0)
Udhna Jn	Bhestan	206	419	476	498	590	419 (416 + 3)	476 (471 + 5)	498 (490 + 8)	590 (578 + 12)
Bhestan	Navsari	206	420	476	532	624	420 (417 + 3)	476 (471 + 5)	532 (524 + 8)	624 (612 + 12)
Navsari	Bilimora Jn	206	420	476	532	624	420 (417 + 3)	476 (471 + 5)	532 (524 + 8)	624 (612 + 12)
Bilimora Jn	Valsad	206	424	479	537	630	424 (419 + 5)	479 (470 + 9)	537 (523 + 14)	630 (609 + 21)
Dahanu Road	Valsad	203	413	464	516	602	413 (413 + 0)	464 (464 + 0)	516 (516 + 0)	602 (602 + 0)
Palghar	Dahanu Road	233	450	502	557	646	450 (447 + 3)	502 (498 + 4)	557 (551 + 7)	646 (637 + 9)
Virar	Palghar	233	460	519	578	666	460 (459 + 1)	519 (518 + 1)	578 (576 + 2)	666 (664 + 3)
Vasai Road Jn	Virar	1060	1335	1394	1453	1541	1335 (1334 + 1)	1394 (1393 + 1)	1453 (1451 + 2)	1541 (1539 + 3)
Borivali	Vasai Road Jn	1060	1370	1421	1450	1548	1370 (1369 + 1)	1421 (1419 + 1)	1450 (1448 + 2)	1548 (1545 + 3)
Goregaon	Borivali	1060	1370	1421	1450	1548	1370 (1369 + 1)	1421 (1419 + 1)	1450 (1448 + 2)	1548 (1545 + 3)
Andheri	Goregaon	1060	1351	1403	1431	1520	1351 (1350 + 1)	1403 (1402 + 1)	1431 (1429 + 2)	1520 (1518 + 3)
Bandra	Andheri	1060	1433	1508	1559	1655	1433 (1430 + 3)	1508 (1504 + 4)	1559 (1553 + 7)	1655 (1645 + 10)
Mahim Jn	Bandra	1086	1459	1534	1585	1681	1459 (1456 + 3)	1534 (1530 + 4)	1585 (1579 + 7)	1681 (1671 + 10)
Dadar	Mahim Jn	1254	1627	1702	1753	1849	1627 (1624 + 3)	1702 (1698 + 4)	1753 (1747 + 7)	1849 (1839 + 10)
Mumbai Central	Dadar	1086	1133	1175	1259	1342	1133 (1086 + 47)	1175 (1076 + 99)	1259 (1085 + 173)	1342 (1082 + 259)
okhla	Tughlakabad	95	30	42	62	108	30 (30 + 1)	42 (36 + 7)	62 (52 + 10)	108 (82 + 27)
New Delhi	Delhi Kishanganj	48	42	41	67	190	42 (22 + 20)	41 (23 + 18)	67 (19 + 48)	190 (47 + 143)

HDN 4

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Ghaziabad Jn	Hapur Jn	96	116	166	243	255	116 (62 + 55)	166 (68 + 99)	243 (136 + 107)	255 (127 + 128)
Hapur Jn	Gajraula Jn	98	96	104	152	200	96 (86 + 10)	104 (88 + 15)	152 (133 + 19)	200 (157 + 43)
Gajraula Jn	Amroha	100	96	102	149	195	96 (89 + 7)	102 (93 + 9)	149 (137 + 12)	195 (173 + 22)
Amroha	Moradabad Jn	100	96	102	149	195	96 (89 + 7)	102 (94 + 9)	149 (137 + 12)	195 (173 + 22)
Moradabad Jn	Kathgarh Left Bank	185	190	226	290	348	190 (175 + 16)	226 (201 + 24)	290 (258 + 32)	348 (297 + 51)
Kathgarh Left Bank	Rampur Jn	163	168	204	268	322	168 (152 + 16)	204 (179 + 24)	268 (236 + 32)	322 (271 + 51)
Rampur Jn	Bareilly Jn	159	149	177	239	285	149 (136 + 13)	177 (157 + 20)	239 (213 + 25)	285 (247 + 38)
Bareilly Jn	Chaneti	175	171	213	253	267	171 (153 + 17)	213 (168 + 45)	253 (189 + 64)	267 (235 + 33)
Chaneti	Shahjahanpur Jn	175	229	264	304	433	229 (170 + 59)	264 (195 + 69)	304 (224 + 79)	433 (342 + 91)
Shahjahanpur Jn	Roza Jn	182	237	273	316	449	237 (178 + 59)	273 (204 + 69)	316 (236 + 80)	449 (357 + 92)
Roza Jn	Sitapur City Jn	56	97	111	116	135	97 (36 + 61)	111 (41 + 71)	116 (42 + 75)	135 (74 + 60)
Sitapur City Jn	Sitapur Jn	18	85	99	104	121	85 (24 + 61)	99 (29 + 70)	104 (33 + 71)	121 (69 + 52)
Burhwal Jn	Sitapur Jn	44	91	106	120	124	91 (28 + 63)	106 (32 + 73)	120 (38 + 82)	124 (67 + 57)
Burhwal Jn	Jarwal Road	125	221	262	293	308	221 (97 + 125)	262 (98 + 164)	293 (126 + 167)	308 (203 + 105)
Jarwal Road	Gonda Jn	125	221	262	293	308	221 (97 + 125)	262 (98 + 164)	293 (126 + 167)	308 (203 + 105)
Gonda Jn	Mankapur Jn	112	203	240	260	278	203 (81 + 122)	240 (80 + 160)	260 (101 + 159)	278 (184 + 93)
Basti	Mankapur Jn	118	206	251	283	297	206 (85 + 121)	251 (88 + 163)	283 (116 + 167)	297 (174 + 124)
Basti	Khalilabad	118	206	250	281	295	206 (85 + 120)	250 (88 + 163)	281 (116 + 166)	295 (174 + 121)
Khalilabad	Gorakhpur Jn	118	206	250	282	296	206 (85 + 120)	250 (88 + 163)	282 (116 + 166)	296 (174 + 122)
Gorakhpur Jn	Gorakhpur Cantt Jn	133	222	267	295	322	222 (101 + 120)	267 (104 + 163)	295 (129 + 167)	322 (189 + 133)
Gorakhpur Cantt Jn	Deoria Sadar	90	180	209	234	249	180 (63 + 117)	209 (64 + 145)	234 (76 + 158)	249 (126 + 123)
Deoria Sadar	Bhatni Jn	90	177	205	226	237	177 (62 + 115)	205 (62 + 143)	226 (70 + 156)	237 (118 + 120)
Bhatni Jn	Siwan Jn	90	172	194	222	219	172 (62 + 110)	194 (59 + 135)	222 (50 + 172)	219 (98 + 121)
Siwan Jn	Duraundha Jn	90	159	177	207	211	159 (62 + 97)	177 (59 + 118)	207 (53 + 154)	211 (104 + 107)
Duraundha Jn	Chhapra Jn	90	159	176	204	199	159 (62 + 97)	176 (59 + 117)	204 (52 + 152)	199 (98 + 101)
Chhapra Jn	Chhapra Kacheri jn	102	196	217	258	280	196 (84 + 112)	217 (92 + 126)	258 (84 + 174)	280 (144 + 136)
Chhapra Kacheri jn	Sonpur Jn	88	185	207	257	297	185 (74 + 111)	207 (81 + 125)	257 (82 + 175)	297 (155 + 142)
Sonpur Jn	Hajipur Jn	117	262	311	374	449	262 (119 + 143)	311 (138 + 173)	374 (133 + 241)	449 (246 + 204)
Hajipur Jn	Bachhwara Jn	60	155	194	234	287	155 (59 + 95)	194 (68 + 126)	234 (65 + 169)	287 (163 + 124)
Barauni Jn	Bachhwara Jn	136	204	249	289	261	204 (128 + 76)	249 (143 + 105)	289 (156 + 133)	261 (174 + 87)
Barauni Jn	Begusarai	88	189	206	244	325	189 (83 + 106)	206 (98 + 108)	244 (126 + 119)	325 (202 + 122)
Sahebpur Kamal Jn	Begusarai	88	190	208	247	328	190 (83 + 107)	208 (99 + 109)	247 (127 + 120)	328 (204 + 124)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Khagaria Jn	Sahebpur Kamal Jn	88	179	195	261	388	179 (78 + 101)	195 (93 + 102)	261 (134 + 127)	388 (241 + 146)
Mansi Jn	Khagaria Jn	105	190	206	279	418	190 (91 + 99)	206 (106 + 99)	279 (154 + 125)	418 (279 + 138)
Mansi Jn	Koshi Cabin	65	149	159	195	261	149 (56 + 93)	159 (68 + 90)	195 (90 + 105)	261 (173 + 88)
Koshi Cabin	Kursela	65	149	159	195	261	149 (56 + 93)	159 (68 + 90)	195 (90 + 105)	261 (173 + 88)
Kursela	Katihar Jn	65	149	159	195	261	149 (56 + 93)	159 (68 + 90)	195 (90 + 105)	261 (173 + 88)
Kumedpur Jn	Katihar Jn	52	141	139	142	141	141 (51 + 90)	139 (61 + 79)	142 (44 + 97)	141 (79 + 62)
Kumedpur Jn	Mukuria Jn	100	216	249	242	196	216 (92 + 123)	249 (113 + 136)	242 (104 + 138)	196 (77 + 119)
Mukuria Jn	Barsoi Jn	152	244	281	281	284	244 (120 + 124)	281 (139 + 142)	281 (140 + 141)	284 (133 + 151)
Barsoi Jn	Kishanganj	148	240	278	285	334	240 (116 + 124)	278 (135 + 142)	285 (140 + 144)	334 (155 + 179)
Kishanganj	Aluabari Road	148	245	286	388	518	245 (119 + 126)	286 (139 + 146)	388 (192 + 196)	518 (241 + 277)
Aluabari Road	New Jalpaiguri Jn	148	245	268	400	509	245 (119 + 126)	268 (150 + 119)	400 (168 + 232)	509 (205 + 304)
New Jalpaiguri Jn	Raninagar Jalpaiguri Jn	86	209	231	311	489	209 (89 + 120)	231 (118 + 112)	311 (286 + 25)	489 (182 + 308)
Raninagar Jalpaiguri Jn	New Domohani	23	161	182	259	439	161 (42 + 120)	182 (70 + 112)	259 (228 + 31)	439 (136 + 302)
New Domohani	New Maynaguri	23	138	158	172	421	138 (44 + 95)	158 (76 + 82)	172 (138 + 34)	421 (155 + 267)
New Maynaguri	New Cooch Behar jn	23	138	158	207	421	138 (44 + 95)	158 (76 + 82)	207 (167 + 40)	421 (155 + 267)
New Cooch Behar jn	Samuktala Road	80	177	196	211	440	177 (83 + 94)	196 (115 + 81)	211 (111 + 100)	440 (175 + 265)
Fakiragram Jn	Samuktala Road	96	180	223	336	499	180 (85 + 95)	223 (111 + 112)	336 (171 + 165)	499 (229 + 270)
Kokrajhar	Fakiragram Jn	96	179	221	380	518	179 (85 + 94)	221 (111 + 110)	380 (195 + 185)	518 (248 + 270)
Kokrajhar	New Bongaigaon Jn	96	179	222	382	521	179 (85 + 94)	222 (112 + 110)	382 (196 + 185)	521 (250 + 270)
New Bongaigaon Jn	Barpeta Road	66	152	177	242	474	152 (57 + 94)	177 (60 + 117)	242 (157 + 85)	474 (197 + 277)
Barpeta Road	Nalbari	66	151	176	239	473	151 (58 + 93)	176 (61 + 114)	239 (158 + 81)	473 (201 + 272)
Nalbari	Rangiya Jn	66	149	173	239	467	149 (59 + 91)	173 (62 + 111)	239 (159 + 80)	467 (202 + 266)
Rangiya Jn	Agthori	67	149	140	209	432	149 (63 + 86)	140 (55 + 85)	209 (144 + 65)	432 (197 + 235)
Agthori	Kamakhya Jn	59	147	138	207	430	147 (61 + 86)	138 (53 + 85)	207 (142 + 65)	430 (195 + 235)
Kamakhya Jn	Guwahati	96	176	183	358	474	176 (100 + 76)	183 (108 + 75)	358 (213 + 145)	474 (268 + 205)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Delhi Jn	Delhi Kishanganj	63	104	112	172	164	104 (91 + 13)	112 (106 + 6)	172 (146 + 27)	164 (147 + 17)
Raja Ki Mandi	Mathura Jn	148	150	178	246	268	150 (123 + 27)	178 (136 + 42)	246 (194 + 52)	268 (268 + 0)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Agra Cantt Jn	Raja Ki Mandi	148	148	163	218	250	148 (119 + 29)	163 (135 + 28)	218 (178 + 40)	250 (250 + 0)
Agra Cantt Jn	Bhandai	147	153	173	233	283	153 (125 + 28)	173 (146 + 28)	233 (193 + 40)	283 (261 + 22)
Bhandai	Dhaulpur Jn	148	141	156	214	257	141 (116 + 26)	156 (135 + 20)	214 (184 + 30)	257 (256 + 1)
Morena	Dhaulpur Jn	173	148	162	221	264	148 (122 + 26)	162 (142 + 20)	221 (190 + 30)	264 (262 + 1)
Banmourgaon	Morena	173	147	161	219	261	147 (122 + 25)	161 (142 + 19)	219 (189 + 29)	261 (261 + 0)
Gwalior jn	Banmourgaon	173	145	157	214	253	145 (123 + 22)	157 (143 + 14)	214 (191 + 23)	253 (253 + 0)
Gwalior jn	Sithouli	16	51	72	137	238	51 (51 + 0)	72 (72 + 0)	137 (137 + 0)	238 (223 + 15)
Sithouli	Datia	173	139	152	225	307	139 (131 + 8)	152 (145 + 6)	225 (217 + 8)	307 (307 + 0)
Datia	Jhansi Jn	173	139	152	227	309	139 (131 + 8)	152 (146 + 7)	227 (218 + 9)	309 (308 + 1)
Jhansi Jn	Babina	165	190	206	246	272	190 (172 + 18)	206 (190 + 16)	246 (222 + 24)	272 (270 + 3)
Babina	Lalitpur Jn	165	190	208	249	280	190 (172 + 19)	208 (189 + 18)	249 (222 + 27)	280 (272 + 8)
Bina jn	Lalitpur Jn	165	189	207	249	301	189 (171 + 19)	207 (188 + 19)	249 (221 + 28)	301 (293 + 9)
Bina jn	Vidisha	196	280	293	397	407	280 (236 + 44)	293 (261 + 32)	397 (335 + 62)	407 (404 + 3)
Vidisha	Bhopal jn	196	265	272	370	376	265 (224 + 41)	272 (241 + 31)	370 (308 + 62)	376 (370 + 6)
Hoshangabad	Bhopal jn	204	256	286	491	530	256 (215 + 41)	286 (251 + 35)	491 (425 + 66)	530 (530 + 0)
Itarsi jn	Hoshangabad	204	240	264	434	436	240 (199 + 41)	264 (228 + 36)	434 (367 + 66)	436 (428 + 8)
Itarsi jn	Betul	142	160	172	223	246	160 (124 + 36)	172 (146 + 26)	223 (223 + 0)	246 (245 + 0)
Betul	Amla Jn	142	157	171	232	253	157 (123 + 34)	171 (145 + 25)	232 (223 + 9)	253 (246 + 8)
Narkher	Amla Jn	101	116	129	181	195	116 (84 + 32)	129 (105 + 23)	181 (181 + 0)	195 (195 + 0)
Nagpur Jn	Narkher	101	116	128	152	187	116 (85 + 31)	128 (105 + 23)	152 (152 + 0)	187 (187 + 0)
Buti Bori Jn	Nagpur Jn	152	197	178	311	434	197 (147 + 49)	178 (172 + 6)	311 (302 + 9)	434 (422 + 12)
Wardha Jn	Buti Bori Jn	152	193	172	302	420	193 (147 + 46)	172 (172 + 0)	302 (302 + 0)	420 (420 + 0)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Chikni Road	Wardha Jn	128	156	119	188	251	156 (65 + 91)	119 (73 + 46)	188 (188 + 0)	251 (251 + 0)
Warora	Chikni Road	128	156	119	188	251	156 (65 + 91)	119 (73 + 46)	188 (188 + 0)	251 (251 + 0)
Majri Jn	Warora	128	156	119	188	251	156 (65 + 91)	119 (73 + 46)	188 (188 + 0)	251 (251 + 0)
Majri Jn	Tadla Jn	128	151	115	212	261	151 (63 + 88)	115 (71 + 43)	212 (211 + 1)	261 (230 + 30)
Tadla Jn	Chandrapur Maharashtra	128	151	115	212	261	151 (63 + 88)	115 (71 + 43)	212 (211 + 1)	261 (230 + 30)
Chandrapur Maharashtra	Babupeth	128	151	115	212	261	151 (63 + 88)	115 (71 + 43)	212 (211 + 1)	261 (230 + 30)
Babupeth	Ballarshah	128	155	166	244	334	155 (74 + 81)	166 (98 + 68)	244 (199 + 45)	334 (304 + 30)
Ballarshah	Manikgarh Jn	126	167	178	240	312	167 (85 + 82)	178 (110 + 68)	240 (239 + 1)	312 (311 + 2)
Asifabad Road	Manikgarh Jn	126	166	176	236	305	166 (85 + 81)	176 (109 + 67)	236 (236 + 0)	305 (305 + 0)
Bellampalli	Asifabad Road	126	168	178	239	308	168 (87 + 81)	178 (111 + 67)	239 (239 + 0)	308 (308 + 0)
Manchiryal	Bellampalli	140	168	178	271	391	168 (87 + 81)	178 (111 + 67)	271 (209 + 63)	391 (313 + 78)
Raghavapuram	Manchiryal	140	171	182	270	393	171 (87 + 83)	182 (112 + 70)	270 (211 + 59)	393 (315 + 78)
Peddapalli Jn	Raghavapuram	140	171	182	270	393	171 (87 + 83)	182 (112 + 70)	270 (211 + 59)	393 (315 + 78)
Jamikunta	Peddapalli Jn	140	183	200	309	434	183 (93 + 89)	200 (121 + 78)	309 (247 + 62)	434 (356 + 78)
Kazipet Jn	Jamikunta	140	185	202	373	408	185 (91 + 94)	202 (122 + 80)	373 (303 + 69)	408 (339 + 69)
Warangal	Kazipet Jn	130	214	234	215	279	214 (115 + 98)	234 (143 + 91)	215 (206 + 9)	279 (267 + 12)
Nekonda	Warangal	130	212	232	205	271	212 (113 + 99)	232 (140 + 92)	205 (204 + 1)	271 (270 + 1)
Mahbubabad	Nekonda	130	211	231	201	269	211 (111 + 100)	231 (138 + 93)	201 (201 + 0)	269 (269 + 0)
Dornakal Jn	Mahbubabad	130	211	232	205	273	211 (111 + 100)	232 (138 + 94)	205 (202 + 3)	273 (269 + 4)
Khammam	Dornakal Jn	134	199	220	206	262	199 (99 + 100)	220 (125 + 94)	206 (174 + 32)	262 (227 + 36)
Motumari Jn	Khammam	134	173	190	158	206	173 (94 + 78)	190 (115 + 75)	158 (158 + 0)	206 (206 + 0)
Kondapalli	Motumari Jn	134	186	207	182	232	186 (96 + 90)	207 (114 + 92)	182 (162 + 21)	232 (212 + 21)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Vijayawada Jn	Kondapalli	134	186	207	182	232	186 (96 + 90)	207 (114 + 92)	182 (162 + 21)	232 (212 + 21)
Krishna Canal Jn	Vijayawada Jn	172	251	380	378	508	251 (150 + 102)	380 (192 + 188)	378 (344 + 33)	508 (451 + 57)
Tenali Jn	Krishna Canal Jn	140	191	282	265	324	191 (120 + 71)	282 (157 + 125)	265 (265 + 0)	324 (307 + 17)
Tsunduru	Tenali Jn	144	195	286	269	305	195 (124 + 71)	286 (161 + 126)	269 (269 + 0)	305 (305 + 0)
Chirala	Tsunduru	144	197	290	302	368	197 (124 + 73)	290 (163 + 127)	302 (302 + 0)	368 (368 + 0)
Vetapalem	Chirala	144	197	290	302	368	197 (124 + 73)	290 (163 + 127)	302 (302 + 0)	368 (368 + 0)
Ongole	Vetapalem	144	197	290	302	368	197 (124 + 73)	290 (163 + 127)	302 (302 + 0)	368 (368 + 0)
Bitragunta	Ongole	146	197	290	309	377	197 (124 + 73)	290 (163 + 127)	309 (302 + 7)	377 (369 + 8)
Nellore	Bitragunta	146	198	291	310	378	198 (125 + 73)	291 (163 + 128)	310 (303 + 7)	378 (369 + 9)
Venkatachalam	Nellore	165	210	303	322	390	210 (136 + 74)	303 (175 + 128)	322 (315 + 7)	390 (381 + 9)
Kommarapudi	Venkatachalam	165	207	299	310	384	207 (135 + 72)	299 (172 + 127)	310 (307 + 3)	384 (383 + 1)
Gudur Jn	Kommarapudi	165	207	299	310	384	207 (135 + 72)	299 (172 + 127)	310 (307 + 3)	384 (383 + 1)
Sullurupeta	Gudur Jn	73	78	103	183	212	78 (75 + 3)	103 (82 + 21)	183 (183 + 0)	212 (212 + 0)
Gummidipundi	Sullurupeta	97	102	127	207	236	102 (99 + 3)	127 (106 + 21)	207 (207 + 0)	236 (236 + 0)
Minjur	Gummidipundi	155	157	180	264	294	157 (157 + 0)	180 (163 + 18)	264 (264 + 0)	294 (294 + 0)
Attipattu	Minjur	155	157	180	264	294	157 (157 + 0)	180 (163 + 18)	264 (264 + 0)	294 (294 + 0)
Attipattu pudunagar	Attipattu	169	157	180	264	294	157 (157 + 0)	180 (163 + 18)	264 (264 + 0)	294 (294 + 0)
Ennore	Attipattu pudunagar	169	157	180	264	294	157 (157 + 0)	180 (163 + 18)	264 (264 + 0)	294 (294 + 0)
Tiruvottiyur	Ennore	171	159	182	266	296	159 (159 + 0)	182 (165 + 18)	266 (266 + 0)	296 (296 + 0)
Korukkupet	Tiruvottiyur	176	159	182	266	296	159 (159 + 0)	182 (165 + 18)	266 (266 + 0)	296 (296 + 0)
Korukkupet	Basin Bridge	126	118	118	124	136	118 (118 + 0)	118 (118 + 0)	124 (124 + 0)	136 (136 + 0)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Kharagpur Jn	Jaleswar	136	259	160	249	306	259 (108 + 150)	160 (139 + 20)	249 (222 + 27)	306 (278 + 28)
Rupsa Jn	Jaleshwar	136	259	143	226	289	259 (108 + 150)	143 (139 + 4)	226 (221 + 6)	289 (283 + 5)
Rupsa Jn	Balasore	136	265	143	229	307	265 (112 + 153)	143 (141 + 1)	229 (227 + 2)	307 (305 + 2)
Balasore	Ranital Jn Cabin	136	267	145	235	303	267 (114 + 153)	145 (145 + 0)	235 (235 + 0)	303 (303 + 0)
Ranital Jn Cabin	Bhadrak	139	271	141	205	269	271 (117 + 154)	141 (137 + 4)	205 (199 + 6)	269 (260 + 9)
Jajpur Keonjhar	Bhadrak	159	277	143	192	235	277 (120 + 157)	143 (143 + 0)	192 (192 + 0)	235 (212 + 22)
Jakhapura Jn	Jajpur Keonjhar	159	242	137	181	214	242 (116 + 126)	137 (137 + 0)	181 (181 + 0)	214 (207 + 6)
Jenapur	Jakhapura Jn	170	268	224	304	391	268 (123 + 145)	224 (145 + 80)	304 (193 + 111)	391 (274 + 117)
Haridaspur	Jenapur	170	268	219	369	495	268 (123 + 145)	219 (181 + 38)	369 (310 + 59)	495 (390 + 105)
Kapilas Road Jn	Haridaspur	175	175	147	195	250	175 (76 + 99)	147 (138 + 9)	195 (179 + 16)	250 (211 + 38)
Nergundi Jn	Kapilas Road Jn	175	155	142	184	230	155 (70 + 86)	142 (134 + 8)	184 (171 + 13)	230 (195 + 35)
Nergundi Jn	Cuttack Jn	207	211	190	220	301	211 (95 + 116)	190 (156 + 34)	220 (184 + 36)	301 (209 + 92)
Cuttack Jn	Barang Jn	145	177	166	207	251	177 (131 + 46)	166 (127 + 39)	207 (175 + 32)	251 (156 + 96)
Barang Jn	Bhubanesh war	199	259	350	369	413	259 (180 + 79)	350 (206 + 143)	369 (225 + 144)	413 (325 + 88)
Bhubaneshwar	Khurda Road Jn	200	274	253	332	415	274 (160 + 113)	253 (200 + 53)	332 (263 + 70)	415 (393 + 23)
Khurda Road Jn	Chatrapur	152	211	130	174	229	211 (104 + 106)	130 (130 + 0)	174 (174 + 0)	229 (229 + 0)
Chatrapur	Brahmapur	152	210	139	193	261	210 (106 + 105)	139 (133 + 6)	193 (185 + 8)	261 (251 + 9)
Palasa	Brahmapur	149	206	129	180	245	206 (102 + 104)	129 (129 + 0)	180 (180 + 0)	245 (245 + 0)
Naupada Jn	Palasa	136	206	129	180	246	206 (102 + 104)	129 (129 + 0)	180 (180 + 0)	246 (245 + 0)
Srikakulam Road	Naupada Jn	133	202	125	176	244	202 (99 + 104)	125 (125 + 0)	176 (176 + 0)	244 (244 + 0)
Vizianagaram Jn	Srikakulam Road	133	202	125	176	241	202 (99 + 104)	125 (125 + 0)	176 (176 + 0)	241 (241 + 0)
Kottavalasa Jn	Vizianagara m Jn	204	358	228	355	443	358 (139 + 218)	228 (172 + 57)	355 (305 + 50)	443 (377 + 67)
Simhachalam North Jn	Kottavalasa Jn	234	334	235	320	448	334 (141 + 192)	235 (173 + 62)	320 (279 + 40)	448 (380 + 68)
Simhachalam North Jn	Gopalapatn am	112	147	172	232	294	147 (147 + 0)	172 (172 + 0)	232 (232 + 0)	294 (294 + 0)
Duvada	Gopalapatn am	135	170	195	259	336	170 (161 + 9)	195 (187 + 8)	259 (247 + 12)	336 (293 + 43)
Anakapalle	Duvada	148	272	160	274	400	272 (117 + 155)	160 (151 + 8)	274 (257 + 17)	400 (357 + 43)
Pithapuram	Anakapalle	148	272	154	303	359	272 (117 + 155)	154 (150 + 3)	303 (259 + 44)	359 (354 + 5)
Samalkot Jn	Pithapuram	148	310	245	338	549	310 (128 + 182)	245 (164 + 82)	338 (258 + 80)	549 (367 + 183)
Rajahmundry	Samalkot Jn	162	293	171	269	342	293 (136 + 157)	171 (171 + 0)	269 (269 + 0)	342 (342 + 0)
Kowur	Rajahmund ry	161	300	182	290	401	300 (137 + 163)	182 (174 + 9)	290 (276 + 15)	401 (350 + 51)
Nidadavolu Jn	Kowur	161	300	185	274	413	300 (136 + 163)	185 (173 + 12)	274 (256 + 18)	413 (354 + 59)
Eluru	Nidadavolu Jn	149	268	152	221	254	268 (119 + 149)	152 (152 + 0)	221 (221 + 0)	254 (254 + 0)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Vijayawada Jn	Eluru	149	268	152	221	254	268 (119 + 149)	152 (152 + 0)	221 (221 + 0)	254 (254 + 0)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Kalyan Jn	Badlapur	343	437	456	636	767	437 (415 + 22)	456 (410 + 46)	636 (582 + 53)	767 (675 + 92)
Badlapur	Neral jn	173	267	286	466	597	267 (245 + 23)	286 (239 + 47)	466 (414 + 52)	597 (506 + 91)
Neral jn	Karjat Jn	173	267	286	466	597	267 (245 + 23)	286 (239 + 47)	466 (414 + 52)	597 (506 + 91)
Karjat Jn	Lonavla	125	305	359	461	542	305 (265 + 39)	359 (290 + 69)	461 (393 + 68)	542 (434 + 108)
Lonavla	Talegaon	142	331	385	487	568	331 (292 + 39)	385 (316 + 69)	487 (419 + 68)	568 (460 + 108)
Talegaon	Dehu Road	146	335	389	491	572	335 (296 + 39)	389 (320 + 69)	491 (422 + 68)	572 (464 + 108)
Dehu Road	Chinchvad	146	335	389	491	572	335 (296 + 39)	389 (320 + 69)	491 (422 + 68)	572 (464 + 108)
Chinchvad	Pune	146	294	324	418	486	294 (265 + 30)	324 (281 + 43)	418 (411 + 6)	486 (453 + 33)
Pune	Daund jn	116	212	240	332	385	212 (201 + 12)	240 (231 + 9)	332 (323 + 9)	385 (372 + 13)
Daund jn	Bhigwan	76	124	143	215	275	124 (99 + 25)	143 (127 + 16)	215 (190 + 25)	275 (241 + 34)
Bhigwan	Parewadi	76	124	143	215	275	124 (99 + 25)	143 (127 + 16)	215 (190 + 25)	275 (241 + 34)
Parewadi	Kurduvadi Jn	76	124	143	215	275	124 (99 + 25)	143 (127 + 16)	215 (190 + 25)	275 (241 + 34)
Kurduvadi Jn	Mohol	72	84	97	185	221	84 (62 + 22)	97 (77 + 19)	185 (165 + 19)	221 (188 + 33)
Mohol	Solapur Jn	72	89	104	203	245	89 (64 + 25)	104 (80 + 24)	203 (176 + 27)	245 (201 + 44)
Solapur Jn	Hotgi Jn	90	105	120	219	261	105 (79 + 26)	120 (96 + 24)	219 (191 + 27)	261 (216 + 45)
Hotgi Jn	Akalkot Road	74	88	103	201	256	88 (67 + 21)	103 (82 + 21)	201 (154 + 47)	256 (178 + 77)
Akalkot Road	Bablad	74	88	104	202	257	88 (67 + 21)	104 (82 + 22)	202 (154 + 49)	257 (177 + 80)
Gulbarga	Bablad	74	90	104	163	248	90 (68 + 22)	104 (82 + 22)	163 (124 + 39)	248 (170 + 78)
Wadi Jn	Gulbarga	78	93	114	180	263	93 (72 + 21)	114 (90 + 24)	180 (141 + 39)	263 (187 + 76)
Krishna	Wadi Jn	78	73	91	136	156	73 (54 + 20)	91 (60 + 31)	136 (106 + 30)	156 (95 + 62)
Krishna	Raichur Jn	78	75	92	156	160	75 (55 + 20)	92 (61 + 31)	156 (122 + 34)	160 (97 + 63)
Raichur Jn	Matmari	73	70	89	146	138	70 (50 + 20)	89 (57 + 32)	146 (128 + 18)	138 (97 + 41)
Mantralayam Road	Matmari	73	66	83	140	130	66 (49 + 17)	83 (54 + 28)	140 (121 + 19)	130 (93 + 37)
Guntakal Jn	Mantralayam Road	73	66	83	140	130	66 (49 + 17)	83 (54 + 28)	140 (121 + 19)	130 (93 + 37)
Gooty Jn	Guntakal Jn	79	90	100	173	175	90 (54 + 36)	100 (52 + 48)	173 (133 + 40)	175 (94 + 80)
Gooty Jn Cabin	Gooty Jn	90	102	123	185	194	102 (63 + 39)	123 (67 + 56)	185 (137 + 48)	194 (109 + 85)
Kondapuram	Gooty Jn Cabin	90	94	105	161	212	94 (51 + 43)	105 (47 + 58)	161 (97 + 64)	212 (99 + 114)
Mangapatnam	Kondapuram	90	94	105	161	212	94 (51 + 43)	105 (47 + 58)	161 (97 + 64)	212 (99 + 114)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Yerraguntala Jn	Mangapatnam	90	94	105	161	212	94 (51 + 43)	105 (47 + 58)	161 (97 + 64)	212 (99 + 114)
Kadapa	Yerraguntala Jn	90	101	115	159	213	101 (55 + 46)	115 (51 + 64)	159 (92 + 67)	213 (99 + 114)
Nandalur	Kadapa	90	89	97	167	247	89 (45 + 44)	97 (44 + 53)	167 (80 + 87)	247 (105 + 142)
Obulavaripalle	Nandalur	67	79	87	156	225	79 (39 + 40)	87 (38 + 48)	156 (69 + 87)	225 (94 + 132)
Renigunta	Obulavaripalle	67	79	87	156	225	79 (39 + 40)	87 (38 + 48)	156 (69 + 87)	225 (94 + 132)
Pudi	Renigunta	77	169	205	90	119	169 (68 + 102)	205 (90 + 115)	90 (90 + 0)	119 (119 + 0)
Puttur	Pudi	77	169	205	90	119	169 (68 + 102)	205 (90 + 115)	90 (90 + 0)	119 (119 + 0)
Nagari	Puttur	77	169	205	90	119	169 (68 + 102)	205 (90 + 115)	90 (90 + 0)	119 (119 + 0)
Nagari	Venkatanarasimha rajuvaripeta Halt	77	169	205	90	119	169 (68 + 102)	205 (90 + 115)	90 (90 + 0)	119 (119 + 0)
Venkatanarasimha rajuvaripeta Halt	Ponpadi	77	169	205	90	119	169 (68 + 102)	205 (90 + 115)	90 (90 + 0)	119 (119 + 0)
Ponpadi	Tiruttani	77	169	205	90	119	169 (68 + 102)	205 (90 + 115)	90 (90 + 0)	119 (119 + 0)
Tiruttani	Arakkonam North Cabin	105	169	205	90	119	169 (68 + 102)	205 (90 + 115)	90 (90 + 0)	119 (119 + 0)
Arakkonam North Cabin	Arakkonam	69	67	68	66	81	67 (67 + 0)	68 (49 + 19)	66 (66 + 0)	81 (81 + 0)
Arakkonam	Tiruvallur	201	208	225	215	254	208 (199 + 9)	225 (210 + 16)	215 (215 + 0)	254 (254 + 0)
Tiruvallur	Pattabiram	282	286	302	500	614	286 (285 + 2)	302 (299 + 3)	500 (315 + 186)	614 (352 + 263)
Pattabiram	Hindu College	322	324	340	538	652	324 (323 + 2)	340 (337 + 3)	538 (352 + 186)	652 (389 + 263)
Hindu College	Avadi	322	324	340	538	652	324 (323 + 2)	340 (337 + 3)	538 (352 + 186)	652 (389 + 263)
Avadi	Villivakkam	364	364	380	578	692	364 (363 + 2)	380 (377 + 3)	578 (391 + 187)	692 (429 + 263)
Villivakkam	Veysarpadi	365	364	380	578	692	364 (363 + 2)	380 (377 + 3)	578 (391 + 187)	692 (429 + 263)
Veysarpadi	Basin Bridge	276	301	315	301	314	301 (301 + 0)	315 (315 + 0)	301 (301 + 0)	314 (314 + 0)
Basin Bridge	Chennai Central	395	378	378	378	378	378 (378 + 0)	378 (378 + 0)	378 (378 + 0)	378 (378 + 0)

ANNEXURE 11.3: Consolidated upgradation proposals for HDN

HDN 1

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Delhi Jn	Shahdara Jn	3L+ABTS	-	-	-
Shahdara Jn	Sahibabad	3L+ABTS	-	-	-
Sahibabad	Ghaziabad Jn	4L+ABTS	-	-	-
Ghaziabad Jn	Dadri	4L+ABTS	-	-	-
Dankaur	Dadri	3L+ABTS	-	-	-
Chola	Dankaur	3L+ABTS	-	-	-
Khurja Jn	Chola	3L+ABTS	-	-	-
Aligarh Jn	Khurja Jn	3L+ABTS	-	-	-
Hathras Jn	Aligarh Jn	2L+ABTS	-	-	-
Barhan Jn	Hathras Jn	2L+ABTS	-	-	-
Motawali	Barhan Jn	2L+ABTS	-	-	-
Tundla Jn	Motawali	2L+ABTS	-	3L+ABTS	-
Firozabad	Tundla Jn	2L+ABTS	-	-	-
Shikohabad Jn	Firozabad	2L+ABTS	-	-	-
Etawah	Shikohabad Jn	2L+ABTS	-	-	3L+ABTS
Etawah	Phaphund	2L+ABTS	-	-	3L+ABTS
Phaphund	Panki	2L+ABTS	-	-	3L+ABTS
Juhi cabin	Panki	4L+ABTS	-	-	-
Juhi cabin	Kanpur Central	4L+ABTS	-	-	6L+ABTS
Chandari	Kanpur Central	2L+ABTS	-	-	-
Chandari	Juhi cabin	2L+ABTS	-	-	-
Fatehpur	Chandari	2L+ABTS	-	-	-
Subedarganj	Fatehpur	2L+ABTS	-	-	-
Allahabad Jn	Subedarganj	4L+ABTS	-	-	-
Allahabad Jn	Naini Jn	3L+ABTS	-	-	-
Naini Jn	Chheoki	3L+ABTS	-	-	-
Chheoki	Mirzapur	3L+ABTS	-	-	-
Mirzapur	Chunar jn	3L+ABTS	-	-	-
Chunar jn	Jeonathpur	3L+ABTS	-	-	-
Jeonathpur	Mughal Sarai Jn	3L+ABTS	-	-	-
Chandauli Majhwar	Mughal Sarai Jn	3L+ABTS	-	-	-
Bhabua Road	Chandauli Majhwar	3L+ABTS	-	-	-
Sasaram Jn	Bhabua Road	3L+ABTS	-	-	-
Sasaram Jn	Pahleza	3L+ABTS	-	-	-
Pahleza	Dehri on Sone Jn	3L+ABTS	-	-	-
Dehri on Sone Jn	Sonnagar Jn	3L+ABTS	-	-	-
Sonnagar Jn	Anugraha Narayan Road	3L+ABTS	-	-	-
Anugraha Narayan Road	Rafiganj	3L+ABTS	-	-	-
Rafiganj	Gaya Jn	3L+ABTS	-	-	-
Gaya Jn	Manpur Jn	3L+ABTS	-	-	-
Koderma Jn	Manpur Jn	3L+ABTS	-	-	-
Koderma Jn	Hazaribagh Road	3L+ABTS	-	-	-
Hazaribagh Road	NSC Bose Jn Gomoh	3L+ABTS	-	-	-
NSC Bose Jn Gomoh	Dhanbad Jn	3L+ABTS	-	-	-
Dhanbad Jn	Pradhankhunta Jn	2L+ABTS	-	-	-
Pradhankhunta Jn	Chhota Ambana	2L+ABTS	-	-	-
Kulti	Chhota Ambana	2L+ABTS	-	-	-
Kulti	Sitarampur Jn	2L+ABTS	-	-	-
Sitarampur Jn	Asansol jn	4L+ABTS	-	-	-
Asansol jn	Kalipahari	4L+ABTS	-	-	-
Kalipahari	Andal Jn	4L+ABTS	-	-	-
Andal Jn	Khana Jn	4L+ABTS	-	-	-
Khana Jn	Barddhaman Jn	4L+ABTS	-	-	-
Barddhaman Jn	Saktigarh Jn	4L+ABTS	-	-	-
Masagram	Saktigarh Jn	4L+ABTS	-	-	-
Kamarkundu Jn	Masagram	4L+ABTS	-	-	-
Kamarkundu Jn	Dankuni Jn	4L+ABTS	-	-	-
Dankuni Jn	Bally	4L+ABTS	-	6L+ABTS	-
Bally	Belur	4L+ABTS	-	6L+ABTS	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Belur	Howrah	6L+ABTS	-	-	-
Howrah	Liluah	4L+ABTS	-	-	-

HDN 2

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Chhatrapati Shivaji Terminus	Dadar	4L+ABTS	-	-	-
Dadar	Kurla Jn	4L+ABTS	6L+ABTS	8L+ABTS	-
Kurla Jn	Thane Jn	4L+ABTS	6L+ABTS	-	-
Thane Jn	Diva Jn	4L+ABTS	6L+ABTS	-	-
Diva Jn	Kalyan Jn	6L+ABTS	8L+ABTS	-	-
Kalyan Jn	Titvala	3L+ABTS	6L+ABTS	-	-
Titvala	Asangaon	3L+ABTS	-	-	-
Asangaon	Kasara	3L+ABTS	4L+ABTS	-	-
Kasara	Igatpuri	3L+ABTS	4L+ABTS	-	-
Lahavit	Igatpuri	3L+ABTS	-	-	-
Devlali	Lahavit	3L+ABTS	-	-	-
Nasik Road	Devlali	3L+ABTS	-	-	-
Kasbe Sukene	Nasik Road	3L+ABTS	-	-	-
Manmad Jn	Kasbe Sukene	3L+ABTS	-	-	-
Nandgaon	Manmad Jn	4L+ABTS	-	-	-
Chalisgaon jn	Nandgaon	4L+ABTS	-	-	-
Pachora jn	Chalisgaon jn	4L+ABTS	-	-	-
Jalgaon Jn	Pachora jn	4L+ABTS	-	-	-
Jalgaon Jn	Bhusawal jn	4L+ABTS	-	-	-
Bhusawal jn	Jalamb jn	4L+ABTS	-	-	-
Jalamb jn	Akola Jn	4L+ABTS	-	-	-
Akola Jn	Murtajapur Jn	4L+ABTS	-	-	-
Murtajapur Jn	Badnera Jn	4L+ABTS	-	-	-
Badnera Jn	Pulgaon Jn	4L+ABTS	-	-	-
Pulgaon Jn	Wardha Jn	4L+ABTS	-	-	-
Itwari Jn	Nagpur Jn	4L+ABTS	-	-	-
Itwari Jn	Kalamna	4L+ABTS	-	-	-
Kalamna	Kanhan Jn	4L+ABTS	-	-	-
Kanhan Jn	Bhandara Road	4L+ABTS	-	-	-
Bhandara Road	Tumsar Road Jn	4L+ABTS	-	-	-
Tumsar Road Jn	Gondia Jn	4L+ABTS	-	-	-
Gondia Jn	Rajnandgaon	4L+ABTS	-	-	-
Durg Jn	Rajnandgaon	4L+ABTS	-	-	-
Bhilai	Durg Jn	4L+ABTS	-	-	-
Srona	Bhilai	3L+ABTS	-	-	4L+ABTS
Urkura	Srona	2L+ABTS	-	-	-
Bilaspur Jn	Urkura	4L+ABTS	-	-	-
Bilaspur Jn	Janjgir Naila	4L+ABTS	-	-	-
Janjgir Naila	Champa Jn	4L+ABTS	-	-	-
Champa Jn	Kharsia	4L+ABTS	-	-	-
Kharsia	Raigarh	4L+ABTS	-	-	-
Belpahar	Raigarh	4L+ABTS	-	-	-
Lb	Belpahar	4L+ABTS	-	-	-
Jharsuguda Jn	Lb	4L+ABTS	-	-	-
Dharuadihi	Jharsuguda Jn	4L+ABTS	-	-	-
Rourkela Jn	Dharuadihi	4L+ABTS	-	-	-
Bondamunda PH	Rourkela Jn	4L+ABTS	-	-	-
Bondamunda PH	Chakradharpur	3L+ABTS	-	-	-
Rajkharswan Jn	Chakradharpur	3L+ABTS	-	-	-
Sini Jn	Rajkharswan Jn	3L+ABTS	-	-	-
Sini Jn	Gamharia Jn	3L+ABTS	-	-	-
Gamharia Jn	Tatanagar Jn	4L+ABTS	-	-	-
Tatanagar Jn	Chakulia	4L+ABTS	-	-	-
Jhargram	Chakulia	4L+ABTS	-	-	-
Nimpura Jn	Jhargram	4L+ABTS	-	-	-
Kharagpur Jn	Nimpura Jn	4L+ABTS	-	-	-
Panskura Jn	Kharagpur Jn	3L+ABTS	-	-	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Mecheda	Panskura Jn	3L+ABTS	-	-	-
Kulgachia FS	Mecheda	3L+ABTS	-	-	-
Uluberia	Kulgachia FS	3L+ABTS	-	-	-
Andul	Uluberia	3L+ABTS	-	-	-
Santragachhi Jn	Andul	3L+ABTS	-	-	-
Tikiapara	Santragachhi Jn	4L+ABTS	-	-	-
Howrah	Tikiapara	4L+ABTS	-	-	-

HDN 3

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
New Delhi	Tilak Bridge	4L+ABTS	-	-	-
Tilak Bridge	H Nizamuddin Jn	4L+ABTS	-	-	-
H Nizamuddin Jn	Tughlakabad	2L+ABTS	-	-	-
Faridabad	Tughlakabad	4L+ABTS	-	-	-
Palwal	Faridabad	4L+ABTS	-	-	-
Kosi Kalan	Palwal	4L+ABTS	-	-	-
Mathura Jn	Kosi Kalan	4L+ABTS	-	-	-
Bharatpur Jn	Mathura Jn	2L+ABTS	-	-	-
Bharatpur Jn	Bayana Jn	2L+ABTS	-	-	-
Bayana Jn	Gangapur city	2L+ABTS	-	-	-
Sawai Madhopur Jn	Gangapur city	2L+ABTS	-	-	-
Sawai Madhopur Jn	Gurla	2L+ABTS	-	-	-
Gurla	Kota Jn	2L+ABTS	-	-	-
Kota Jn	Ramganj Mandi jn	2L+ABTS	-	-	-
Nagda JN	Ramganj Mandi jn	2L+ABTS	-	-	-
Ratlam JN	Nagda JN	2L+ABTS	-	-	3L+ABTS
Ratlam JN	Dahod	2L+ABTS	-	-	3L+ABTS
Piplod	Dahod	2L+ABTS	-	-	3L+ABTS
Godhra Jn	Piplod	2L+ABTS	-	-	3L+ABTS
Godhra Jn	Champaner Road	2L+ABTS	-	-	-
Champaner Road	Samlaya	2L+ABTS	-	-	-
Samlaya	Vadodara E	2L+ABTS	-	-	-
Vadodara D	Vadodara E	2L+ABTS	-	-	-
Vadodara D	Vadodara Jn	2L+ABTS	-	3L+ABTS	4L+ABTS
Vadodara Jn	Vishvamitri Jn	2L+ABTS	-	3L+ABTS	4L+ABTS
Vishvamitri Jn	Miyagam Karjan Jn	2L+ABTS	-	3L+ABTS	4L+ABTS
Miyagam Karjan Jn	Bharuch Jn	2L+ABTS	-	3L+ABTS	4L+ABTS
Bharuch Jn	Ankleshwar Jn	2L+ABTS	-	3L+ABTS	4L+ABTS
Ankleshwar Jn	Kosamba Jn	2L+ABTS	-	3L+ABTS	4L+ABTS
Kosamba Jn	Surat	2L+ABTS	-	3L+ABTS	4L+ABTS
Surat	Udhna Jn	2L+ABTS	-	3L+ABTS	4L+ABTS
Udhna Jn	Bhestan	2L+ABTS	3L+ABTS	-	4L+ABTS
Bhestan	Navsari	2L+ABTS	3L+ABTS	-	4L+ABTS
Navsari	Bilimora Jn	2L+ABTS	3L+ABTS	-	4L+ABTS
Bilimora Jn	Valsad	2L+ABTS	3L+ABTS	-	4L+ABTS
Dahanu Road	Valsad	2L+ABTS	3L+ABTS	-	4L+ABTS
Palghar	Dahanu Road	2L+ABTS	3L+ABTS	-	4L+ABTS
Virar	Palghar	2L+ABTS	3L+ABTS	-	4L+ABTS
Vasai Road Jn	Virar	6L+ABTS	-	-	-
Borivali	Vasai Road Jn	6L+ABTS	-	-	-
Goregaon	Borivali	4L+ABTS	6L+ABTS	-	-
Andheri	Goregaon	8L+ABTS	-	-	-
Bandra	Andheri	8L+ABTS	-	-	-
Mahim Jn	Bandra	6L+ABTS	-	-	-
Dadar	Mahim Jn	6L+ABTS	-	-	8L+ABTS
Mumbai Central	Dadar	6L+ABTS	-	-	-
okhla	Tughlakabad	4L+ABTS	-	-	-
New Delhi	Delhi Kishanganj	3L+ABTS	-	-	-

HDN 4

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Ghaziabad Jn	Hapur Jn	-	2L+TC	4L+TC	-
Hapur Jn	Gajraula Jn	-	-	2L+TC	-
Gajraula Jn	Amroha	-	-	2L+TC	-
Amroha	Moradabad Jn	-	-	2L+TC	-
Moradabad Jn	Kathgarh Left Bank	2L+TC	-	-	3L+TC
Kathgarh Left Bank	Rampur Jn	2L+TC	-	-	3L+TC
Rampur Jn	Bareilly Jn	2L+TC	-	-	-
Bareilly Jn	Chaneti	2L+TC	4L+TC	-	-
Chaneti	Shahjahanpur Jn	2L+TC	4L+TC	-	-
Shahjahanpur Jn	Roza Jn	2L+TC	4L+TC	-	-
Roza Jn	Sitapur City Jn	-	-	-	2L+TC
Sitapur City Jn	Sitapur Jn	-	-	2L+TC	-
Burhwal Jn	Sitapur Jn	-	-	2L+TC	-
Burhwal Jn	Jarwal Road	3L+TC	4L+TC	-	-
Jarwal Road	Gonda Jn	3L+TC	4L+TC	-	-
Gonda Jn	Mankapur Jn	2L+TC	4L+TC	-	-
Basti	Mankapur Jn	3L+TC	4L+TC	-	-
Basti	Khalilabad	3L+TC	4L+TC	-	-
Khalilabad	Gorakhpur Jn	3L+TC	4L+TC	-	-
Gorakhpur Jn	Gorakhpur Cantt Jn	3L+TC	4L+TC	-	-
Gorakhpur Cantt Jn	Deoria Sadar	3L+TC	-	-	4L+TC
Deoria Sadar	Bhatni Jn	3L+TC	-	-	4L+TC
Bhatni Jn	Siwan Jn	3L+TC	-	-	4L+TC
Siwan Jn	Duraundha Jn	3L+TC	-	-	4L+TC
Duraundha Jn	Chhapra Jn	3L+TC	-	-	4L+TC
Chhapra Jn	Chhapra Kacheri jn	2L+TC	3L+TC	4L+TC	-
Chhapra Kacheri jn	Sonpur Jn	2L+TC	3L+TC	4L+TC	-
Sonpur Jn	Hajipur Jn	2L+TC	4L+TC	-	-
Hajipur Jn	Bachhwara Jn	2L+TC	3L+TC	-	4L+TC
Barauni Jn	Bachhwara Jn	2L+TC	4L+TC	-	-
Barauni Jn	Begusarai	2L+TC	3L+TC	4L+TC	-
Sahebpur Kamal Jn	Begusarai	2L+TC	3L+TC	4L+TC	-
Khagaria Jn	Sahebpur Kamal Jn	2L+TC	3L+TC	4L+TC	-
Mansi Jn	Khagaria Jn	2L+TC	3L+TC	4L+TC	-
Mansi Jn	Koshi Cabin	2L+TC	-	3L+TC	4L+TC
Koshi Cabin	Kursela	2L+TC	-	3L+TC	4L+TC
Kursela	Katihar Jn	2L+TC	-	3L+TC	4L+TC
Kumedpur Jn	Katihar Jn	2L+TC	-	-	-
Kumedpur Jn	Mukuria Jn	2L+TC	4L+TC	-	-
Mukuria Jn	Barsoi Jn	2L+TC	4L+TC	-	-
Barsoi Jn	Kishanganj	2L+TC	4L+TC	-	-
Kishanganj	Aluabari Road	2L+TC	4L+TC	-	-
Aluabari Road	New Jalpaiguri Jn	2L+TC	4L+TC	-	-
New Jalpaiguri Jn	Raninagar Jalpaiguri Jn	2L+TC	3L+TC	4L+TC	-
Raninagar Jalpaiguri Jn	New Domohani	2L+TC	3L+TC	4L+TC	-
New Domohani	New Maynaguri	2L+TC	3L+TC	4L+TC	-
New Maynaguri	New Cooch Behar jn	2L+TC	3L+TC	4L+TC	-
New Cooch Behar jn	Samuktala Road	2L+TC	3L+TC	-	4L+TC
Fakiragram Jn	Samuktala Road	2L+TC	3L+TC	4L+TC	-
Kokrajhar	Fakiragram Jn	2L+TC	3L+TC	4L+TC	-
Kokrajhar	New Bongaigaon Jn	2L+TC	3L+TC	4L+TC	-
New Bongaigaon Jn	Barpeta Road	2L+TC	-	4L+TC	-
Barpeta Road	Nalbari	2L+TC	-	4L+TC	-
Nalbari	Rangiya Jn	2L+TC	-	4L+TC	-
Rangiya Jn	Agthori	2L+TC	-	3L+TC	4L+TC
Agthori	Kamakhya Jn	2L+TC	-	3L+TC	4L+TC
Kamakhya Jn	Guwahati	-	-	4L+TC	-

HDN 5

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Delhi Jn	Delhi Kishanganj	2L+ABTS	-	-	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Raja Ki Mandi	Mathura Jn	4L+ABTS	-	-	-
Agra Cantt Jn	Raja Ki Mandi	4L+ABTS	-	-	-
Agra Cantt Jn	Bhandai	4L+ABTS	-	-	-
Bhandai	Dhaulpur Jn	4L+ABTS	-	-	-
Morena	Dhaulpur Jn	4L+ABTS	-	-	-
Banmourgaon	Morena	4L+ABTS	-	-	-
Gwalior jn	Banmourgaon	4L+ABTS	-	-	-
Gwalior jn	Sithouli	4L+ABTS	-	-	-
Sithouli	Datia	4L+ABTS	-	-	-
Datia	Jhansi Jn	4L+ABTS	-	-	-
Jhansi Jn	Babina	4L+ABTS	-	-	-
Babina	Lalitpur Jn	4L+ABTS	-	-	-
Bina jn	Lalitpur Jn	4L+ABTS	-	-	-
Bina jn	Vidisha	4L+ABTS	-	-	-
Vidisha	Bhopal jn	4L+ABTS	-	-	-
Hoshangabad	Bhopal jn	4L+ABTS	-	-	-
Itarsi jn	Hoshangabad	4L+ABTS	-	-	-
Itarsi jn	Betul	4L+ABTS	-	-	-
Betul	Amla Jn	4L+ABTS	-	-	-
Narkher	Amla Jn	4L+ABTS	-	-	-
Nagpur Jn	Narkher	4L+ABTS	-	-	-
Buti Bori Jn	Nagpur Jn	4L+ABTS	-	-	-
Wardha Jn	Buti Bori Jn	4L+ABTS	-	-	-
Chikni Road	Wardha Jn	4L+ABTS	-	-	-
Warora	Chikni Road	4L+ABTS	-	-	-
Majri Jn	Warora	4L+ABTS	-	-	-
Majri Jn	Tadla Jn	4L+ABTS	-	-	-
Tadla Jn	Chandrapur Maharashtra	4L+ABTS	-	-	-
Chandrapur Maharashtra	Babupeth	4L+ABTS	-	-	-
Babupeth	Ballarshah	4L+ABTS	-	-	-
Ballarshah	Manikgarh Jn	3L+ABTS	-	-	-
Asifabad Road	Manikgarh Jn	3L+ABTS	-	-	-
Bellampalli	Asifabad Road	3L+ABTS	-	-	-
Manchiryal	Bellampalli	4L+ABTS	-	-	-
Raghavapuram	Manchiryal	4L+ABTS	-	-	-
Peddapalli Jn	Raghavapuram	4L+ABTS	-	-	-
Jamikunta	Peddapalli Jn	4L+ABTS	-	-	-
Kazipet Jn	Jamikunta	4L+ABTS	-	-	-
Warangal	Kazipet Jn	3L+ABTS	-	-	-
Nekonda	Warangal	3L+ABTS	-	-	-
Mahbubabad	Nekonda	3L+ABTS	-	-	-
Dornakal Jn	Mahbubabad	3L+ABTS	-	-	-
Khammam	Dornakal Jn	3L+ABTS	-	-	-
Motumari Jn	Khammam	3L+ABTS	-	-	-
Kondapalli	Motumari Jn	3L+ABTS	-	-	-
Vijayawada Jn	Kondapalli	3L+ABTS	-	-	-
Krishna Canal Jn	Vijayawada Jn	3L+ABTS	-	-	-
Tenali Jn	Krishna Canal Jn	3L+ABTS	-	-	-
Tsunduru	Tenali Jn	3L+ABTS	-	-	-
Chirala	Tsunduru	3L+ABTS	-	-	-
Vetapalem	Chirala	3L+ABTS	-	-	-
Ongole	Vetapalem	3L+ABTS	-	-	-
Bitragunta	Ongole	3L+ABTS	-	-	-
Nellore	Bitragunta	3L+ABTS	-	-	-
Venkatachalam	Nellore	4L+ABTS	-	-	-
Kommarapudi	Venkatachalam	4L+ABTS	-	-	-
Gudur Jn	Kommarapudi	4L+ABTS	-	-	-
Sullurupeta	Gudur Jn	2L+ABTS	-	-	-
Gummidipundi	Sullurupeta	2L+ABTS	-	-	-
Minjur	Gummidipundi	2L+ABTS	-	-	-
Attipattu	Minjur	2L+ABTS	-	-	-
Attipattu pudunagar	Attipattu	4L+ABTS	-	-	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Ennore	Attipattu pudunagar	4L+ABTS	-	-	-
Tiruvottiyur	Ennore	4L+ABTS	-	-	-
Korukkupet	Tiruvottiyur	3L+ABTS	-	-	-
Korukkupet	Basin Bridge	2L+ABTS	-	-	-

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NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Kharagpur Jn	Jaleswar	3L+ABTS	-	-	-
Rupsa Jn	Jaleshwar	3L+ABTS	-	-	-
Rupsa Jn	Balasore	3L+ABTS	-	-	-
Balasore	Ranital Jn Cabin	3L+ABTS	-	-	-
Ranital Jn Cabin	Bhadrak	3L+ABTS	-	-	-
Jajpur Keonjhar	Bhadrak	3L+ABTS	-	-	-
Jakhapura Jn	Jajpur Keonjhar	3L+ABTS	-	-	-
Jenapur	Jakhapura Jn	3L+ABTS	-	-	4L+ABTS
Haridaspur	Jenapur	3L+ABTS	-	-	4L+ABTS
Kapilas Road Jn	Haridaspur	3L+ABTS	-	-	-
Nergundi Jn	Kapilas Road Jn	3L+ABTS	-	-	-
Nergundi Jn	Cuttack Jn	3L+ABTS	-	-	-
Cuttack Jn	Barang Jn	3L+ABTS	-	-	-
Barang Jn	Bhubaneshwar	3L+ABTS	-	-	-
Bhubaneshwar	Khurda Road Jn	3L+ABTS	-	-	-
Khurda Road Jn	Chatrapur	3L+ABTS	-	-	-
Chatrapur	Brahmapur	3L+ABTS	-	-	-
Palasa	Brahmapur	3L+ABTS	-	-	-
Naupada Jn	Palasa	3L+ABTS	-	-	-
Srikakulam Road	Naupada Jn	3L+ABTS	-	-	-
Vizianagaram Jn	Srikakulam Road	3L+ABTS	-	-	-
Kottavalasa Jn	Vizianagaram Jn	3L+ABTS	-	-	-
Simhachalam North Jn	Kottavalasa Jn	4L+ABTS	-	-	-
Simhachalam North Jn	Gopalapatnam	3L+ABTS	-	-	-
Duvada	Gopalapatnam	3L+ABTS	-	-	-
Anakapalle	Duvada	3L+ABTS	-	-	4L+ABTS
Pithapuram	Anakapalle	3L+ABTS	-	-	4L+ABTS
Samalkot Jn	Pithapuram	3L+ABTS	-	-	4L+ABTS
Rajahmundry	Samalkot Jn	3L+ABTS	-	-	-
Kowur	Rajahmundry	3L+ABTS	-	-	-
Nidadavolu Jn	Kowur	3L+ABTS	-	-	-
Eluru	Nidadavolu Jn	3L+ABTS	-	-	-
Vijayawada Jn	Eluru	3L+ABTS	-	-	-

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NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Kalyan Jn	Badlapur	4L+ABTS	-	-	-
Badlapur	Neral jn	2L+ABTS	-	3L+ABTS	-
Neral jn	Karjat Jn	2L+ABTS	-	3L+ABTS	-
Karjat Jn	Lonavla	3L+ABTS	-	-	-
Lonavla	Talegaon	4L+ABTS	-	-	-
Talegaon	Dehu Road	4L+ABTS	-	-	-
Dehu Road	Chinchvad	4L+ABTS	-	-	-
Chinchvad	Pune	4L+ABTS	-	-	-
Pune	Daund jn	2L+ABTS	-	-	-
Daund jn	Bhigwan	2L+ABTS	-	-	-
Bhigwan	Parewadi	2L+ABTS	-	-	-
Parewadi	Kurduvadi Jn	2L+ABTS	-	-	-
Kurduvadi Jn	Mohol	2L+ABTS	-	-	-
Mohol	Solapur Jn	2L+ABTS	-	-	-
Solapur Jn	Hotgi Jn	2L+ABTS	-	-	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Hotgi Jn	Akalkot Road	2L+ABTS	-	-	-
Akalkot Road	Bablad	2L+ABTS	-	-	-
Gulbarga	Bablad	2L+ABTS	-	-	-
Wadi Jn	Gulbarga	2L+ABTS	-	-	-
Krishna	Wadi Jn	2L+ABTS	-	-	-
Krishna	Raichur Jn	2L+ABTS	-	-	-
Raichur Jn	Matmari	2L+ABTS	-	-	-
Mantralayam Road	Matmari	2L+ABTS	-	-	-
Guntakal Jn	Mantralayam Road	2L+ABTS	-	-	-
Gooty Jn	Guntakal Jn	2L+ABTS	-	-	-
Gooty Jn Cabin	Gooty Jn	2L+ABTS	-	3L+ABTS	-
Kondapuram	Gooty Jn Cabin	2L+ABTS	-	3L+ABTS	-
Mangapatnam	Kondapuram	2L+ABTS	-	3L+ABTS	-
Yerraguntala Jn	Mangapatnam	2L+ABTS	-	3L+ABTS	-
Kadapa	Yerraguntala Jn	2L+ABTS	-	3L+ABTS	-
Nandalur	Kadapa	2L+ABTS	-	3L+ABTS	-
Obulavaripalle	Nandalur	2L+ABTS	-	-	3L+ABTS
Renigunta	Obulavaripalle	2L+ABTS	-	-	3L+ABTS
Pudi	Renigunta	2L+ABTS	3L+ABTS	-	-
Puttur	Pudi	2L+ABTS	3L+ABTS	-	-
Nagari	Puttur	2L+ABTS	3L+ABTS	-	-
Nagari	Venkatanarasimhara juvaripeta Halt	2L+ABTS	3L+ABTS	-	-
Venkatanarasimhara juvaripeta Halt	Ponpadi	2L+ABTS	3L+ABTS	-	-
Ponpadi	Tiruttani	2L+ABTS	3L+ABTS	-	-
Tiruttani	Arakkonam North Cabin	2L+ABTS	3L+ABTS	-	-
Arakkonam North Cabin	Arakkonam	2L+ABTS	-	-	-
Arakkonam	Tiruvallur	4L+ABTS	-	-	-
Tiruvallur	Pattabiram	4L+ABTS	-	-	6L+ABTS
Pattabiram	Hindu College	4L+ABTS	-	-	6L+ABTS
Hindu College	Avadi	4L+ABTS	-	-	6L+ABTS
Avadi	Villivakkam	4L+ABTS	-	-	6L+ABTS
Villivakkam	Veysarpadi	4L+ABTS	-	-	6L+ABTS
Veysarpadi	Basin Bridge	4L+ABTS	-	-	-
Basin Bridge	Chennai Central	6L+ABTS	-	-	-

ANNEXURE 12.1: Existing Configuration and Capacity Utilization by sections of HUN

HUN 1

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Rajendranagar T	Patna Saheb	0	0	4.60	0	0	Rajendranagar T - Patna Saheb	0	2nd Line
Buxar	Ara Jn	69	60	69.50	ECR	DNR	Ara - Buxar	142	2nd Line
Fatuha Jn	Bakhtiyarpur Jn	24	60	24.09	ECR	DNR	Bakhtiyarpur - Fatuha	140	2nd Line
Dildarnagar Jn	Buxar	94	60	36.65	ECR	DNR	Buxar - Mughalsarai	140	2nd Line
Mughal Sarai Jn	Dildarnagar Jn	94	60	58.06	ECR	DNR	Buxar - Mughalsarai	140	2nd Line
Bihta	Danapur	39	60	17.48	ECR	DNR	Danapur - Ara	152	2nd Line
Ara Jn	Bihta	39	60	22.64	ECR	DNR	Danapur - Ara	152	2nd Line
Patna Saheb	Fatuha Jn	20	59	14.96	ECR	DNR	Fatuha - Rajendra Nagar (T)	150	2nd Line
Kiul Jn	Jamui	53	54	27.29	ECR	DNR	Jhajha - Kiul	130	2nd Line
Jamui	Jhajha	53	54	26.28	ECR	DNR	Jhajha - Kiul	130	2nd Line
Sheikhpura	Luckeesarai Jn	129	32	26.50	ECR	DNR	Kiul - Gaya	42	2nd Line
Manpur Jn	Tilaiya Jn	129	32	36.89	ECR	DNR	Kiul - Gaya	42	2nd Line
Nawadah	Sheikhpura	129	32	44.93	ECR	DNR	Kiul - Gaya	42	2nd Line
Tilaiya Jn	Nawadah	129	32	17.17	ECR	DNR	Kiul - Gaya	42	2nd Line
Luckeesarai Jn	Kiul Jn	22	54	2.07	ECR	DNR	Kiul - Rampur Dumra	154	2nd Line
Luckeesarai Jn	Rampur Dumra Jn	22	54	22.43	ECR	DNR	Kiul - Rampur Dumra	154	2nd Line
Bakhtiyarpur Jn	Mokama Jn	44	63	44.42	ECR	DNR	Mokama - Bakhtiyarpur	126	2nd Line
Danapur	Patliputra	6	20	4.99	ECR	DNR	Pahlezaghat - Phulwarishariff	18	Single Line
Patliputra	Phulwari sharif	6	20	5.41	ECR	DNR	Pahlezaghat - Phulwarishariff	18	Single Line
Patna Jn	Danapur	9	60	9.85	ECR	DNR	Patna - Danapur	154	2nd Line
Patna Jn	Rajendranagar T	2	60	2.47	ECR	DNR	Rajendra Nagar (T) - Patna	154	2nd Line
Hatidah Jn	Rampur Dumra Jn	7	48	3.28	ECR	DNR	Rampur Dumra - Tall	106	2nd Line
Tall Jn	Hatidah Jn	7	48	5.12	ECR	DNR	Rampur Dumra - Tall	106	2nd Line
Mokama Jn	Tall Jn	5	54	3.80	ECR	DNR	Tall - Mokama	130	2nd Line
Andal Jn	Ukhra	20.34	36	12.15	ER	ASN	ANDAL - PANDABESWAR	85	3rd Line
Jhajha	Jasidih Jn	43.93	61	43.92	ER	ASN	JASIDIH - JHAJHA	132	2nd Line
Bhimgara Jn	Siuri	53.06	40	30.98	ER	ASN	PANDEBESWAR - SAINTHIA	56	2nd Line
Siuri	Sainthia Jn	53.06	40	19.31	ER	ASN	PANDEBESWAR - SAINTHIA	56	2nd Line
Pandabeswar	Bhimgara Jn	53.06	40	3.22	ER	ASN	PANDEBESWAR - SAINTHIA	56	2nd Line
Madhupur Jn	Jamtara	101.45	61	42.26	ER	ASN	SITARAMPUR - JASIDIH	149	2nd Line
Sitarampur Jn	Jamtara	101.45	61	30.35	ER	ASN	SITARAMPUR - JASIDIH	149	2nd Line
Madhupur Jn	Jasidih Jn	101.45	61	29.39	ER	ASN	SITARAMPUR - JASIDIH	149	2nd Line
Ukhra	Pandabeswar	8.33	35	8.45	ER	ASN	UKHRA - PANDABESWAR	73	3rd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Gadadharpur	Tarapith Road	14.1	64	14.40	ER	HWH	GODADHARPUR - RAMPURHAT	143	3rd Line
Prantik	Ahmadpur Jn	70.93	53	14.97	ER	HWH	KHANA - SAINTHIA	120	2nd Line
Khana Jn	Prantik	70.93	53	43.41	ER	HWH	KHANA - SAINTHIA	120	2nd Line
Ahmadpur Jn	Sainthia Jn	70.93	53	13.72	ER	HWH	KHANA - SAINTHIA	120	2nd Line
Gumani	Nalhati Jn	57.79	54	57.89	ER	HWH	NALHATI - GUMANI	134	2nd Line
Rampurhat Jn	Nalhati Jn	14.09	59	14.35	ER	HWH	RAMPURHAT - NALHATI	136	3rd Line
Sainthia Jn	Gadadharpur	7.19	61	7.37	ER	HWH	SAINTHIA - GODADHARPUR	143	3rd Line
Tarapith Road	Rampurhat Jn	6.52	58	6.44	ER	HWH	TARAPITH - RAMPURHAT	139	3rd Line
Barharwa Jn	BoniDanga	4.73	22	5.91	ER	MLDT	BARHARWA - BONIDANGA	37	2nd Line
BoniDanga Link Cabin	Gumani	4.73	22	2.31	ER	MLDT	BARHARWA - BONIDANGA	37	2nd Line
Tinpahar Jn	Barharwa Jn	54.3	32	16.32	ER	MLDT	BARHARWA - SAHIBGANJ	61	2nd Line
Sahibganj	Tinpahar Jn	54.3	32	38.35	ER	MLDT	BARHARWA - SAHIBGANJ	61	2nd Line
Sultanganj	Bhagalpur Jn	46.64	36	23.98	ER	MLDT	BHAGALPUR - RATANPUR	69	2nd Line
Ratanpur	Sultanganj	46.64	36	24.74	ER	MLDT	BHAGALPUR - RATANPUR	69	2nd Line
BoniDanga	BoniDanga Link Cabin	1.59	41	2.38	ER	MLDT	BONIDANGA LINK CABIN - BONIDANDA	89	2nd Line
Jamalpur Jn	Kiul Jn	45.05	40	47.33	ER	MLDT	JAMALPUR - KIUL	63	2nd Line
Kahalgaon	Pirpainti	30.37	25	22.74	ER	MLDT	KAHALGAON - BHAGALPUR	51	2nd Line
Bhagalpur Jn	Kahalgaon	30.37	25	31.74	ER	MLDT	KAHALGAON - BHAGALPUR	51	Single Line
Jamalpur Jn	Ratanpur	6.35	33	6.75	ER	MLDT	RATANPUR - JAMALPUR	69	Single Line
Pirpainti	Sahibganj	43.88	32	23.44	ER	MLDT	SAHIBGANJ - KAHALGAON	57	2nd Line
Sonipat	Adarsh Nagar Delhi	79	85	33.57	NR	DLI	Adarsh Nagar Delhi - Panipat Jn	174	2nd Line
Sonipat	Panipat Jn	79	85	45.32	NR	DLI	Adarsh Nagar Delhi - Panipat Jn	174	2nd Line
Kurukshetra Jn	Ambala Cantt Jn	41.4	65	41.75	NR	DLI	Kurukshetra - Ambala	147	2nd Line
Panipat Jn	Karnal	67	85	34.14	NR	DLI	Panipat Jn - Kurukshetra	150	2nd Line
Karnal	Kurukshetra Jn	67	85	32.97	NR	DLI	Panipat Jn - Kurukshetra	150	2nd Line
Adarsh Nagar Delhi	Sabji Mandi	6	85	7.50	NR	DLI	Subzi Mandi - Adarsh Nagar Delhi	140	2nd Line
Verka Jn	Amritsar Jn	8	28	8.04	NR	FZP	Amritsar - Verka Jn.	37	Single Line
Kathua	Bharoli Jn	96.6	51	19.98	NR	FZP	Bharoli Jn. - Jammu Tawi	91	2nd Line
Jammu Tawi	Kathua	96.6	51	75.93	NR	FZP	Bharoli Jn. - Jammu Tawi	91	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Jalandhar city Jn	Jalandhar Cantt Jn	5	73	4.59	NR	FZP	Jalandhar Cantt. - Jalandhar City	118	2nd Line
Kartarpur	Jalandhar city Jn	78	73	15.19	NR	FZP	Jalandhar City - Amritsar Jn.	95	2nd Line
Beas Jn	Kartarpur	78	73	21.37	NR	FZP	Jalandhar City - Amritsar Jn.	95	2nd Line
Amritsar Jn	Beas Jn	78	73	42.07	NR	FZP	Jalandhar City - Amritsar Jn.	95	2nd Line
Phillaur Jn	Ludhiana Jn	13	77	13.40	NR	FZP	Ludhiana Jn - Phillaur Jn	170	3rd Line
Jalandhar Cantt Jn	Phagwara Jn	16	77	16.45	NR	FZP	Phagwara Jn. - Jalandhar Cantt.	160	2nd Line
Phagwara Jn	Phillaur Jn	22	77	22.72	NR	FZP	Phillaur Jn - Phagwara Jn.	158	2nd Line
Ludhiana Jn	Sanehwal	16	95	14.60	NR	FZP	Sanehwal - Ludhiana Jn	172	3rd Line
Batala Jn	Verka Jn	96	24	30.25	NR	FZP	Verka Jn. - Batala	29	Single Line
Bharoli Jn	Gurdaspur	96	24	32.13	NR	FZP	Verka Jn. - Batala	29	Single Line
Gurdaspur	Batala Jn	96	24	33.20	NR	FZP	Verka Jn. - Batala	29	Single Line
Ayodhya Jn	Akbarpur Jn	53.8	25	53.99	NR	LKO	Akbarpur - Ayodhya	53	2nd Line
Alambagh	Alamnagar	6	60	4.25	NR	LKO	Alamnagar - Alam Bagh	140	3rd Line
Ayodhya Jn	Faizabad Jn	7.2	25	6.89	NR	LKO	Ayodhya - Faizabad	63	2nd Line
Amethi	Chilbila Jn	91	26	31.39	NR	LKO	Chilbila Jn. - Rae - Bareli Jn.	68	2nd Line
Rai Bareli Jn	Gauriganj	91	26	46.81	NR	LKO	Chilbila Jn. - Rae - Bareli Jn.	68	2nd Line
Amethi	Gauriganj	91	26	13.56	NR	LKO	Chilbila Jn. - Rae - Bareli Jn.	68	2nd Line
Dalmau Jn	Unchahar Jn	31.4	10	31.85	NR	LKO	Dalamau - Unchahar	10	2nd Line
Lucknow	Dilkusha Cabin	3.6	60	3.59	NR	LKO	Dilkusha - Lucknow	219	3rd Line
BaraBanki Jn	Rudauli	90.2	25	62.16	NR	LKO	Faizabad - Barabanki	60	2nd Line
Rudauli	Faizabad Jn	90.2	25	38.52	NR	LKO	Faizabad - Barabanki	60	2nd Line
Janghai Jn	Phaphamau Jn	46.7	24	46.85	NR	LKO	Janghai - Phaphamau	45	2nd Line
Pratapgarh Jn	Janghai Jn	53	26	53.80	NR	LKO	Janghai Jn - Pratapgarh Jn.	48	2nd Line
Alambagh	Lucknow	2.2	60	1.74	NR	LKO	Lucknow - Alam Bagh	231	3rd Line
Chilbila Jn	Pratapgarh Jn	4	26	3.63	NR	LKO	Pratapgarh Jn. - Chilbila Jn.	76	2nd Line
Utratia Jn	Rai Bareli Jn	65.5	26	66.62	NR	LKO	Rae - Bareli Jn. - Utratia Jn.	74	2nd Line
Rai Bareli Jn	Daryapur Jn	37.7	24	5.84	NR	LKO	Raibareli - Unchahar	21	Single Line
Daryapur Jn	Unchahar Jn	37.7	24	32.01	NR	LKO	Raibareli - Unchahar	21	Single Line
Shahganj Jn	Akbarpur Jn	42.9	25	44.18	NR	LKO	Shahganj - Akbarpur	57	2nd Line
AkbarGanj	Adhinpur	186.25	60	25.42	NR	LKO	Sultanpur - Utratia	66	2nd Line
Utratia Jn	Chhandrauli	186.25	60	28.62	NR	LKO	Sultanpur - Utratia	66	2nd Line
Chhandrauli	AkbarGanj	186.25	60	33.29	NR	LKO	Sultanpur - Utratia	66	2nd Line
Sultanpur Jn	Adhinpur	186.25	60	39.58	NR	LKO	Sultanpur - Utratia	66	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Unchahar Jn	Phaphamau Jn	72.3	24	72.51	NR	LKO	Unchahar - Phaphamau	25	2nd Line
Unnao Jn	Lalganj	80.7	10	67.50	NR	LKO	Unnao - Dalamau	16	2nd Line
Lalganj	Dalmau Jn	80.7	10	13.47	NR	LKO	Unnao - Dalamau	16	2nd Line
Dilkusha Cabin	Utratia Jn	8.6	60	8.48	NR	LKO	Utratia Jn. - Dilkusha	108	2nd Line
Zafarabad Jn	Varanasi Jn	51.2	62	50.99	NR	LKO	Varanasi - Zafrabad Jn.	104	2nd Line
Janghai Jn	Bhadohi	75	26	30.76	NR	LKO	Varanasi Jn. - Janghai Jn	71	2nd Line
Bhadohi	Varanasi Jn	75	26	44.02	NR	LKO	Varanasi Jn. - Janghai Jn	71	2nd Line
Jaunpur Jn	Zafarabad Jn	6.3	25	6.58	NR	LKO	Zafrabad - Jaunpur	71	Single Line
Shahganj Jn	Jaunpur Jn	6.3	25	33.95	NR	LKO	Zafrabad - Jaunpur	71	2nd Line
Zafarabad Jn	Sultanpur Jn	34.1	60	92.46	NR	LKO	Zafrabad Jn. - Sulatanpur	61	2nd Line
Hardoi	Balamau Jn	31	60	32.48	NR	MB	Balamau Jn. - Roza Jn.	158	2nd Line
Roza Jn	Hardoi	31	60	56.35	NR	MB	Balamau Jn. - Roza Jn.	158	2nd Line
Raja Ka Sahaspur Jn	Chandausi Jn	24	22	19.87	NR	MB	Chandausi - Raja Ka Sahaspur	31	Single Line
Khanalampura west	Roorkee	53	60	32.58	NR	MB	Laksar Jn. - Khalaalampura	142	2nd Line
Laksar Jn	Roorkee	53	60	18.00	NR	MB	Laksar Jn. - Khalaalampura	142	2nd Line
Rahimabad	Alamnagar	4.44	60	31.31	NR	MB	Lucknow - Rahimabad	164	2nd Line
Seohara	Dhampur	11	60	14.07	NR	MB	Moradabad - Najibabad Jn.	118	2nd Line
Moradabad Jn	Seohara	11	60	46.00	NR	MB	Moradabad - Najibabad Jn.	118	2nd Line
Laksar Jn	Muzzampur Narain Jn	11	60	29.90	NR	MB	Muazzampur Narain Jn. - Laksar	122	2nd Line
Muzzampur Narain Jn	Najibabad Jn	11	60	11.38	NR	MB	Najibabad Jn. - Muazzampur Narain Jn.	128	2nd Line
Balamau Jn	Rahimabad	38	60	31.76	NR	MB	Rahimabad - Balamau Jn.	163	2nd Line
Moradabad Jn	Raja Ka Sahaspur Jn	24	22	24.41	NR	MB	Raja Ka Sahaspur - Moradabad	39	Single Line
Bareilly Jn	Ramganga Bridge	69	22	5.88	NR	MB	Ramganga Bridge - Bareilly JN.	24	Single Line
Chandausi Jn	Ramganga Bridge	69	22	61.46	NR	MB	Ramganga Bridge - Chandousi	33	Single Line
Shahjahanpur Jn	Roza Jn	88	60	8.03	NR	MB	Roza Jn. - Shahjahanpur Jn.	182	2nd Line
Chaneti	Shahjahanpur Jn	7	60	68.48	NR	MB	Shahjahanpur Jn. - Bareilly Cantt.	175	2nd Line
Bareilly Jn	Chaneti	7	60	3.55	NR	MB	Shahjahanpur Jn. - Bareilly Cantt.	175	2nd Line
Morinda	Chandigarh	53	22	43.91	NR	UMB	Abhor - Sri Ganga Nagar	24	Single Line
Chandigarh	Dhappar	45	60	21.71	NR	UMB	Ambala Cantt.Jn - Chandigarh	68	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Dhappar	Ambala Cantt Jn	45	60	22.78	NR	UMB	Ambala Cantt.Jn - Chandigarh	68	2nd Line
Rajpura Jn	Ambala Cantt Jn	28	80	28.16	NR	UMB	Ambala Cantt.Jn - Rajpura Jn.	213	2nd Line
Sanehwal	Morinda	0	24	55.44	NR	UMB	Chandigarh - Morinda	22	Single Line
Ambala Cantt Jn	Jagadhri	51	60	51.24	NR	UMB	Jagadhari - Ambala Cantt.Jn	129	2nd Line
Khanalampura west	Saharanpur Jn	2	60	2.41	NR	UMB	Khanalampura - Saharanpur Jn.	113	2nd Line
Sirhind Jn	Rajpura Jn	25	80	24.88	NR	UMB	Rajpura Jn. - Sirhind Jn.	174	2nd Line
Jagadhri	Saharanpur Jn	30	60	30.10	NR	UMB	Saharanpur Jn. - Jagadhari	136	2nd Line
Sanehwal	Doraha	38.9	60	7.47	NR	UMB	Sirhind - Sanehwal	142	2nd Line
Doraha	Sirhind Jn	38.9	60	38.54	NR	UMB	Sirhind - Sanehwal	142	2nd Line
Najibabad Jn	Dhampur	11.00	60	39.259	NR	MB	Moradabad - Najibabad Jn.	118	2nd Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Barkichampi	Lohardaga	0	0	14.63	0	0	Barkichampi - Lohardaga	0	Single Line
Nayagarh	Jaroli	0	0	14.59	0	0	Nayagarh - Jaroli	0	2nd Line
Khandwa jn	Burhanpur	123	62	68.15	CR	BSL	Bhusaval Junction - Khandwa Junction	103	2nd Line
Bhusawal jn	Burhanpur	123	62	54.20	CR	BSL	Bhusaval Junction - Khandwa Junction	103	2nd Line
Jalgaon Jn	Bhusawal jn	24	80	24.24	CR	BSL	Jalgaon Junction - Bhusaval Junction	179	4th Line
Jakhapura Jn	Sukinda Road	9.9	53	11.30	ECOR	KUR	Jakhapura - Sukinda Road	48	3rd Line
Kendujhargarh	Nayagarh	65.46	18	32.40	ECOR	KUR	Khurda Road - Nayagrah Town	8	2nd Line
Baghuapal	Tomka Jn	16.67	56	8.17	ECOR	KUR	Sukinda Road - Tomka	60	2nd Line
Sukinda Road	Baghuapal	16.67	56	8.39	ECOR	KUR	Sukinda Road - Tomka	60	2nd Line
Tomka Jn	Kendujhargargh	35	21	99.27	ECOR	KUR	Tomka - Chilikidara	45	2nd Line
Barkakana Jn	Patratu	20.21	79	18.36	ECR	DHN	Barkakana - Patratu	86	2nd Line
Garhwa Road Jn	Kajri	60.53	81	22.88	ECR	DHN	Barwadih - Garwa Road	112	2nd Line
Daltonganj	Barwadih	60.53	81	26.40	ECR	DHN	Barwadih - Garwa Road	112	2nd Line
Kajri	Daltonganj	60.53	81	10.83	ECR	DHN	Barwadih - Garwa Road	112	2nd Line
Chopan	Billi Jn	6.27	80	6.20	ECR	DHN	Billi - Chopan	87	Single Line
Billi Jn	Obra dam	5.6	68	5.46	ECR	DHN	Billi - Obradam	63	2nd Line
Meralgram	Garhwa Road Jn	21.63	83	20.71	ECR	DHN	Garwa Road - Meralgram	64	Single Line
Singrauli Jn	Karaila Road Jn	13.23	78	11.41	ECR	DHN	Karaila Road - Singrauli	63	2nd Line
Renukut	Meralgram	78.35	61	78.18	ECR	DHN	Meralgram - Renukut	66	2nd Line
Obra dam	Karaila Road Jn	37.58	78	37.80	ECR	DHN	Obradam - Karaila Road	84	2nd Line
Tori	Patratu	64.46	74	64.01	ECR	DHN	Patratu - Tori	78	2nd Line
Dhanbad Jn	Pradhankhunta Jn	9.57	79	10.24	ECR	DHN	Pradhankhanta - Dhanbad	126	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Pradhankhunta Jn	Pathardih	15.4	68	23.56	ECR	DHN	Pradhankhanta - Patherdih	27	2nd Line
Billi Jn	Renukut	35.62	82	34.83	ECR	DHN	Renukut - Billi	67	2nd Line
Latehar	Tori	72.21	86	32.69	ECR	DHN	Tori - Barwadih	107	2nd Line
Barwadih	Latehar	72.21	86	40.82	ECR	DHN	Tori - Barwadih	107	2nd Line
Sonnagar Jn	Garhwa Road Jn	92.79	70	93.05	ECR	MGS	Garwa Road - Sonnagar	69	2nd Line
Robertsganj	Chopan	102.8	12	26.60	NCR	ALD	Chunar - Chopan	21	Single Line
Chunar jn	Robertsganj	102.8	12	74.97	NCR	ALD	Chunar - Chopan	21	Single Line
Allahabad Jn	Naini Jn	7	91	7.06	NCR	ALD	Naini - Allahabad	218	3rd Line
Manikpur Jn	Link Jn Cabin	91	60	92.32	NCR	JHS	MKP - COI	78	2nd Line
Naini Jn	Link Jn Cabin	91	60	1.46	NCR	JHS	MKP - COI	78	2nd Line
Link Jn Cabin	Chheoki	91	60	1.67	NCR	JHS	MKP - COI	78	2nd Line
Allahabad Jn	Varanasi Jn	124	24	123.80	NER	BSB	Varanasi - Allahabad	64	2nd Line
Varanasi Jn	Block Hut B	16.8	65	14.61	NR	LKO	Mughalsarai - Block Hut B	123	3rd Line
Block Hut B	Mughal Sarai Jn	16.8	65	1.35	NR	LKO	Mughalsarai - Block Hut B	123	3rd Line
Garhdhrubeswar	Adra Jn	6.7	25	7.78	SER	Adra	ADRA - GARDHRUBESWAR	39	2nd Line
Sanka	Adra Jn	7.3	22	8.30	SER	Adra	ADRA - SANKA	35	2nd Line
Anara Jn	Garhdhrubeswar	6.7	62	6.70	SER	Adra	ANARA - GARDHRUBESWAR	97	3rd Line
Purulia Jn	Anara Jn	25.7	53	25.93	SER	Adra	ANARA - PURULIA	119	3rd Line
Pathardih	Bhojudin Jn	3	27	3.91	SER	Adra	BHOJUDIH - PATARDIH	6	Single Line
Burnpur	Asansol jn	5.6	28	4.45	SER	Adra	BURNPUR - ASANSOL	54	Single Line
Damodar Jn	Burnpur	4	73	4.15	SER	Adra	DAMODAR - BURNPUR	55	3rd Line
Garhdhrubeswar	Joychandipahar	6.4	70	6.76	SER	Adra	GARDHRUBESWAR - JOYCHANDIPAHAR	61	3rd Line
Joychandipahar	Ramkanali Jn	10.9	78	10.96	SER	Adra	JOYCHANDIPAHAR - RAMKANALI	103	3rd Line
Bankura Jn	Bishnupur Jn	155.4	40	31.51	SER	Adra	MIDNAPUR - ADRA	68	2nd Line
Bishnupur Jn	Bhadutala PH	155.4	40	66.75	SER	Adra	MIDNAPUR - ADRA	68	2nd Line
Bhadutala PH	Midnapore	155.4	40	7.43	SER	Adra	MIDNAPUR - ADRA	68	2nd Line
Chhatna	Adra Jn	155.4	40	38.59	SER	Adra	MIDNAPUR - ADRA	68	2nd Line
Chhatna	Bankura Jn	155.4	40	14.11	SER	Adra	MIDNAPUR - ADRA	68	2nd Line
Purulia Jn	Chandil Jn	54	66	55.81	SER	Adra	PURULIA - CHANDIL	124	3rd Line
Kotshila Jn	Purulia Jn	34.5	14	35.72	SER	Adra	PURULIA - KOTSHILA	28	2nd Line
Ramkanali Jn	Damodar Jn	17.1	79	17.26	SER	Adra	RAMKANALI - DAMODAR	101	3rd Line
Rukni Jn	Bhojudin Jn	14.9	50	15.75	SER	Adra	RUKNI - BHOJUDIH	63	2nd Line
Rukni Jn	Sanka	7.5	27	7.30	SER	Adra	SANKA - RUKNI	41	2nd Line
Bimalgarh Jn	Barsuan	21.2	13	20.77	SER	CKP	BIMLAGARH - BARSUAN	15	2nd Line
Champajharan	Bondamunda PH	47.4	24	27.29	SER	CKP	BONDAMUNDA - BIMLAGARH	35	2nd Line
Patasahi	Champajharan	47.4	24	12.95	SER	CKP	BONDAMUNDA - BIMLAGARH	35	2nd Line
Bimalgarh Jn	Patasahi	47.4	24	8.00	SER	CKP	BONDAMUNDA - BIMLAGARH	35	2nd Line
Bondamunda PH	Nawagaon	19.1	20	21.57	SER	CKP	BONDAMUNDA - NAWAGAON	40	2nd Line
Dangoaposi	Padapahar Jn	5.3	88	5.06	SER	CKP	DANGOAPOSI - PADAPAHAR	100	4th Line
Chandil Jn	Manikui	15.6	84	5.91	SER	CKP	KANDRA - CHANDIL	129	2nd Line
Manikui	Kandra Jn	15.6	84	8.48	SER	CKP	KANDRA - CHANDIL	129	2nd Line
Jaroli	Padapahar Jn	27.3	36	35.18	SER	CKP	PADAPAHAR - JARULI	54	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Rajkharswan Jn	Dangoaposi	74.8	45	75.19	SER	CKP	RAJKHARSWAN - DANGOAPOSI	104	3rd Line
Kandra Jn	Sini Jn	12.9	91	13.39	SER	CKP	SINI - KANDRA	65	2nd Line
Midnapore	Gokulpur	7	67	6.38	SER	KGP	GOKULPUR - MIDNAPUR	78	2nd Line
Kharagpur Jn	Gokulpur	7	34	5.65	SER	KGP	KHARAGPUR - GOKULPUR	53	2nd Line
Nawagaon	Hatia	135.9	17	136.92	SER	RNC	HATIA - NAWAGAON	40	2nd Line
Kotshila Jn	Muri Jn	24.1	41	23.43	SER	RNC	KOTSHILA - MURI	83	2nd Line
Muri Jn	Ramgarh Cantt	58.3	14	53.24	SER	RNC	MURI - BARKAKANA	35	Single Line
Ramgarh Cantt	Barkakana Jn	58.3	14	5.45	SER	RNC	MURI - BARKAKANA	35	Single Line
Namkom	Tatisilwai	71.9	43	6.62	SER	RNC	MURI - HATIA	85	2nd Line
Tatisilwai	Burwadag	71.9	43	32.15	SER	RNC	MURI - HATIA	85	2nd Line
Burwadag	Muri Jn	71.9	43	18.06	SER	RNC	MURI - HATIA	85	2nd Line
Ranchi Jn	Namkom	71.9	43	4.33	SER	RNC	MURI - HATIA	85	2nd Line
Ranchi Jn	Hatia	71.9	43	7.01	SER	RNC	MURI - HATIA	85	2nd Line
Lohardaga	Ranchi Jn	68.5	10	67.93	SER	RNC	RANCHI - LOHARDAGA	11	2nd Line
Harda	Itarsi jn	183.42	76	75.57	WCR	BPL	ET - KNW	144	2nd Line
Khandwa jn	Talvadya	183.42	76	15.67	WCR	BPL	ET - KNW	144	2nd Line
Khirkiya	Harda	183.42	76	31.97	WCR	BPL	ET - KNW	144	2nd Line
Talvadya	Khirkiya	183.42	76	60.46	WCR	BPL	ET - KNW	144	2nd Line
Narsinghpur	Itarsi jn	245.155	52	161.32	WCR	JBP	JABALPUR - ITARSI	98	2nd Line
Shridham	Narsinghpur	245.155	52	31.50	WCR	JBP	JABALPUR - ITARSI	98	2nd Line
Jabalpur Jn	Shridham	245.155	52	52.92	WCR	JBP	JABALPUR - ITARSI	98	2nd Line
Jabalpur Jn	Katni Jn	90.788	57	91.46	WCR	JBP	KATNI - JABALPUR	114	2nd Line
Satna Jn	Manikpur Jn	77.449	56	78.37	WCR	JBP	MANIKPUR - SATNA	127	2nd Line
Satna Jn	Katni Jn	98.202	77	96.69	WCR	JBP	SATNA - KATNI	117	2nd Line
Mahadiya	Singrauli Jn	257	21	6.33	WCR	JBP	SINGRAULI - NEW KATNI Jn.	37	2nd Line
New Katni Jn	Mahadiya	257	21	249.51	WCR	JBP	SINGRAULI - NEW KATNI Jn.	37	2nd Line
Dharangaon	Jalgaon Jn	150.62	24	30.53	WR	BCT	Nandurbar - Jalgaon	79	2nd Line
Nandurbar	Hol	150.62	24	61.90	WR	BCT	Nandurbar - Jalgaon	79	2nd Line
Hol	Nardana	150.62	24	5.10	WR	BCT	Nandurbar - Jalgaon	79	2nd Line
Nardana	Amalner	150.62	24	28.44	WR	BCT	Nandurbar - Jalgaon	79	2nd Line
Amalner	Dharangaon	150.62	24	24.30	WR	BCT	Nandurbar - Jalgaon	79	2nd Line
Udhna Jn	Chalthan	75.64	36	11.42	WR	BCT	Udhana - Ukai Songarh	77	2nd Line
Chalthan	Vyara	75.64	36	45.73	WR	BCT	Udhana - Ukai Songarh	77	2nd Line
Vyara	Ukai Songadh	75.64	36	18.45	WR	BCT	Udhana - Ukai Songarh	77	2nd Line
Chinchpada	Nandurbar	80.67	55	41.00	WR	BCT	Ukai Songarh - Nandurbar	82	2nd Line
Ukai Songadh	Chinchpada	80.67	55	39.86	WR	BCT	Ukai Songarh - Nandurbar	82	2nd Line
Tatisilwai	Barkakana Jn	71.90	43	61.6225 5859	SER	RNC	MURI - HATIA	84.8	Single Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Gaya Jn	Manpur Jn	93.4	85	4.54	ECR	DHN	Gomoh - Gaya	122	3rd Line
Rewari Jn	Jhajjar	0	22	43.73	NR	DLI	Asthalbohar - Rewari	9	Single Line
Jhajjar	Asthal Bohar Jn	0	22	30.22	NR	DLI	Asthalbohar - Rewari	9	Single Line
Garhi Harsaru Jn	Gurgaon	77.92	65	9.60	NR	DLI	Delhi Sarai Rohilla - Garhi Harsaru Jn	108	2nd Line
Gurgaon	Delhi Cantt	77.92	65	17.45	NR	DLI	Delhi Sarai Rohilla - Garhi Harsaru Jn	108	2nd Line
Rewari Jn	Garhi Harsaru Jn	11.27	65	41.44	NR	DLI	Garhi Harsaru Jn - Rewari	108	2nd Line
Gohana	Panipat Jn	71	15	38.92	NR	DLI	Rohtak Jn. - Panipat Jn	12	Single Line
Rohtak Jn	Gohana	71	15	31.88	NR	DLI	Rohtak Jn. - Panipat Jn	12	Single Line
Asthal Bohar Jn	Rohtak Jn	60	65	6.40	NR	DLI	Shakurbasti - Rohtak Jn.	128	2nd Line
Swarupganj	Abu Road	16.77	26	25.05	NWR	AII	ABUROAD - BHIMANA	71	2nd Line
Ajmer Jn	Madar	6.2	60	6.44	NWR	AII	AJMER - MADAR	55	2nd Line
Beawar	Daurai	45.07	26	45.03	NWR	AII	BEAWAR - DAURAI	58	2nd Line
Mori bera	Swarupganj	96.61	60	47.52	NWR	AII	BHIMANA - RANI	71	2nd Line
Daurai	Ajmer Jn	7.11	26	7.03	NWR	AII	DAURAI - AJMER	37	2nd Line
Chandawal	Beawar	41.32	26	51.15	NWR	AII	GURIYA - BEAWAR	58	2nd Line
Marwar Jn	Chandawal	0	60	35.93	NWR	AII	MARWAR - GURIYA	58	2nd Line
Abu Road	Palanpur Jn	52.64	26	52.75	NWR	AII	PALANPUR - ABUROAD	66	2nd Line
Marwar Jn	Mori bera	0	26	92.18	NWR	AII	RANI - MARWAR	71	2nd Line
Alwar Jn	Bandikui Jn	60.37	26	61.18	NWR	JP	ALWAR - BANDIKUI	54	2nd Line
Dausa	Jaipur Jn	90.32	60	61.65	NWR	JP	BANDIKUI - JAIPUR	84	2nd Line
Dausa	Bandikui Jn	90.32	60	28.78	NWR	JP	BANDIKUI - JAIPUR	84	2nd Line
Jaipur Jn	Phulera Jn	54.75	60	54.37	NWR	JP	JAIPUR - PHULERA	110	2nd Line
Phulera Jn	Madar	73.25	60	73.08	NWR	JP	PHULERA - MADAR	94	2nd Line
Alwar Jn	Rewari Jn	74.21	60	74.17	NWR	JP	REWARI - ALWAR	64	2nd Line
Sabarmati Jn	Ahmedabad Jn	8.9	24	6.44	WR	ADI	Ahmedabad - Sabarmati	6	4th Line
Viramgam Jn	Chandlodiya	0	80	53.86	WR	ADI	Chandlodiya - Viramgam	124	2nd Line
Vatva	Geratpur	0	100	5.71	WR	ADI	Geratpur - Vatva	194	2nd Line
Dhrangadhra Jn	Khakhrechi	0	36	59.76	WR	ADI	Jhund - Maliya Miyana	54	2nd Line
Maliya Miyana Jn	Khakhrechi	0	36	17.50	WR	ADI	Jhund - Maliya Miyana	54	2nd Line
Dhrangadhra Jn	Jhund Jn	0	36	53.10	WR	ADI	Jhund - Maliya Miyana	54	2nd Line
Mahesana Jn	Ambliyasan Jn	0	36	17.30	WR	ADI	Kalol - Mahesana	76	Single Line
Ambliyasan Jn	Kalol Jn	0	36	24.45	WR	ADI	Kalol - Mahesana	76	2nd Line
Ahmedabad Jn	Kankariya	0	95	1.40	WR	ADI	Kankariya - Ahmadabad	208	4th Line
Kalol Jn	Khodiyar Jn	0	36	10.84	WR	ADI	Khodiyar - Kalol	74	2nd Line
Mahesana Jn	Palanpur Jn	0	36	64.58	WR	ADI	Mahesana - Palanpur	80	2nd Line
Samakhiali Jn	Maliya Miyana Jn	0	27	39.09	WR	ADI	Maliya Miyana - Samakhiyali	58	2nd Line
Chandlodiya	Sabarmati Jn	0	95	4.98	WR	ADI	Sabarmati - Chandlodiya	137	2nd Line
Sabarmati Jn	Khodiyar Jn	0	42	9.27	WR	ADI	Sabarmati - Khodiyar	66	2nd Line
Kankariya	Vatva	0	100	5.98	WR	ADI	Vatva - Kankariya	217	4th Line
Jhund Jn	Viramgam Jn	0	45	12.91	WR	ADI	Viramgam - Jhund	54	2nd Line
Kanjari Boriyavi Jn	Anand Jn	7.54	100	7.58	WR	BRC	Anand - Kanjari Boriyavi	200	2nd Line
Bajva	Vasad Jn	12.96	100	13.45	WR	BRC	Bajva - Vasad	179	2nd Line
Geratpur	Nadiad Jn	43	100	32.43	WR	BRC	Kanjari Boriyavi - Geratpur	196	2nd Line
Nadiad Jn	Kanjari Boriyavi Jn	43	100	10.97	WR	BRC	Kanjari Boriyavi - Geratpur	196	2nd Line
Bajva	Vadodara C	2.7	100	1.19	WR	BRC	Vadodara 'D' - Bajva	179	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Vadodara C	Vadodara D	4.58	120	4.50	WR	BRC	Vadodara 'P' - Vadodara 'D'	317	2nd Line
Vasad Jn	Anand Jn	15.48	100	15.05	WR	BRC	Vasad - Anand	175	2nd Line
Surendranagar Jn	Than	74.44	30	48.02	WR	RJT	Surend'nagarWankaner	67	2nd Line
Than	Wankaner Jn	74.44	30	26.53	WR	RJT	Surend'nagarWankaner	67	2nd Line
Surendranagar Jn	Viramgam Jn	65.26	60	64.30	WR	RJT	Viramgam - Surend'nagar	90	2nd Line
Wankaner Jn	Rajkot City	41.73	30	40.46	WR	RJT	Wankaner - Rajkot	69	2nd Line
Dausa	Gangapur city	90.32	60	95.89	NWR	JP	BANDIKUI - JAIPUR	84	Single Line

HUN 4

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Adipur Jn	Mundra Port R&D yard	0	0	57.24	0	0	Adipur Jn - Mundra Port R&D yard	0	Single Line
Bathinda Jn	Sadda Singhwala	98	65	43.57	NR	DLI	Jakhal Jn. - Bathinda Jn./C - Cabin	46	2nd Line
Sadda Singhwala	Mansa	98	65	8.78	NR	DLI	Jakhal Jn. - Bathinda Jn./C - Cabin	46	2nd Line
Mansa	Jakhal Jn	98	65	45.11	NR	DLI	Jakhal Jn. - Bathinda Jn./C - Cabin	46	2nd Line
Firozpur Cantt Jn	Faridkot	44.6	33	31.24	NR	FZP	Firozpur Cantt Jn. - Kotkapura Jn	36	Single Line
Faridkot	Kot Kapura Jn	44.6	33	13.10	NR	FZP	Firozpur Cantt Jn. - Kotkapura Jn	36	Single Line
Kot Kapura Jn	Bathinda Jn	42.5	33	42.72	NR	FZP	Kotkapura Jn - Bhatinda	49	Single Line
Jakhal Jn	Hisar Jn	82	22	81.49	NR	UMB	Jakhal Jn. - Hisar	25	Single Line
Ratangarh jn	Churu Jn	42.81	20	43.25	NWR	BKN	CHURU - RATANGARH	28	Single Line
Bhattu	Hisar Jn	81.74	18	46.84	NWR	BKN	HISAR - SIRSA	20	Single Line
Suchan Kotli	Bhattu	81.74	18	20.27	NWR	BKN	HISAR - SIRSA	20	Single Line
Sirsa	Suchan Kotli	81.74	18	14.55	NWR	BKN	HISAR - SIRSA	20	Single Line
Churu Jn	Sadulpur Jn	57.84	21	57.68	NWR	BKN	SADULPUR - CHURU	26	Single Line
Hisar Jn	Suratpura Jn	69.79	17	65.45	NWR	BKN	SADULPUR - HISAR	16	Single Line
Sadulpur Jn	Suratpura Jn	69.79	17	3.90	NWR	BKN	SADULPUR - HISAR	16	Single Line
Bathinda Jn	Sirsa	75.59	18	75.46	NWR	BKN	SIRSA - BATHINDA Jn	18	Single Line
Merta Road Jn	Degana Jn	44.24	24	44.25	NWR	JU	DEGANA - MERTAROAD	59	2nd Line
Ratangarh jn	Degana Jn	152.28	24	151.53	NWR	JU	DEGANA - RATANGARH	18	Single Line
Jodhpur Jn	Luni Jn	31.53	60	32.38	NWR	JU	JODHPUR - LUNI	69	2nd Line
Luni Jn	Samdari Jn	48.54	26	47.20	NWR	JU	LUNI - SAMDARI	43	Single Line
Pipar Road Jn	Rai Ka Bagh	104.13	26	44.28	NWR	JU	MERTAROAD - RAI KA BAG	62	2nd Line
Merta Road Jn	Pipar Road Jn	104.13	26	57.25	NWR	JU	MERTAROAD - RAI KA BAG	62	2nd Line
Jodhpur Jn	Rai Ka Bagh	0	60	1.71	NWR	JU	RAI KA BAG - JODHPUR	78	2nd Line
Jalor	Bhildi Jn	223.4	26	164.22	NWR	JU	SAMDARI - BHILDI	29	Single Line
Samdari Jn	Jalor	223.4	26	59.00	NWR	JU	SAMDARI - BHILDI	29	Single Line
Samakhiali Jn	Santalpur	0	26	91.74	WR	ADI	Bhildi - Samakhiyali	46	Single Line
Santalpur	Bhildi Jn	0	26	110.91	WR	ADI	Bhildi - Samakhiyali	46	Single Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Adipur Jn	Gandhidham JN	0	54	8.56	WR	ADI	Gandhidham - Adipur	61	2nd Line
Gandhidham JN	Old Kandla Port	0	30	10.28	WR	ADI	Gandhidham - Kandla Port	19	2nd Line
Gandhidham JN	Bhimasar	0	60	13.79	WR	ADI	Samakhiyali - Gandhidham	103	2nd Line
Bhimasar	Samakhiali Jn	0	60	38.89	WR	ADI	Samakhiyali - Gandhidham	103	2nd Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Juhi cabin	Bhimsen Jn	0	0	13.17	0	0	Juhi cabin - Bhimsen Jn	0	2nd Line
Paniyahawa	Valmiki nagar road	0	0	13.18	0	0	Paniyahawa - Valmiki nagar road	0	Single Line
Ramdayalu Nagar	Goshawar Halt	42.39	30	43.01	ECR	SEE	Ghoswar - Ramdayalunagar	65	2nd Line
Hajipur Jn	Goshawar Halt	5.33	50	5.54	ECR	SEE	Hajipur - Ghoswar	93	2nd Line
Muzaffarpur Jn	Samastipur Jn	51.76	50	52.29	ECR	SEE	Muzaffarpur - Samastipur	78	2nd Line
Ramdayalu Nagar	Muzaffarpur Jn	6.06	44	7.14	ECR	SEE	Ramdayalunagar - Muzaffarpur	65	2nd Line
Bachhwara Jn	Samastipur Jn	34.45	50	34.76	ECR	SEE	Samastipur - Bachhwara	76	2nd Line
Raxaul Jn	Bairagnia	154.5	18	54.19	ECR	SPJ	Darbhanga - Raxaul	13	Single Line
Bairagnia	Sitamarhi Jn	154.5	18	28.92	ECR	SPJ	Darbhanga - Raxaul	13	Single Line
Janakpur Road	Sitamarhi Jn	154.5	18	25.70	ECR	SPJ	Darbhanga - Raxaul	13	Single Line
Darbhanga Jn	Janakpur Road	154.5	18	43.70	ECR	SPJ	Darbhanga - Raxaul	13	Single Line
Narkatiaganj Jn	Bettiah	58.54	20	36.79	ECR	SPJ	Narkatiaganj - Sagauli	66	2nd Line
Bettiah	Sagauli Jn	58.54	20	23.20	ECR	SPJ	Narkatiaganj - Sagauli	66	2nd Line
Bapudham Motihari	Motihari Court	100.58	23	2.41	ECR	SPJ	Sagauli - Muzaffarpur	82	2nd Line
Muzaffarpur Jn	Motihari Court	100.58	23	78.55	ECR	SPJ	Sagauli - Muzaffarpur	82	2nd Line
Sagauli Jn	Bapudham Motihari	100.58	23	21.09	ECR	SPJ	Sagauli - Muzaffarpur	82	2nd Line
Sagauli Jn	Raxaul Jn	29.19	18	28.30	ECR	SPJ	Sagauli - Raxual	42	Single Line
Samastipur Jn	Darbhanga Jn	37.42	24	37.36	ECR	SPJ	Samastipur - Darbhanga	98	2nd Line
Valmiki nagar road	Narkatiaganj Jn	50.99	19	50.28	ECR	SPJ	Valmikinagar Road - Narkatiaganj	66	2nd Line
Naini Jn	Chheoki	1	91	2.17	NCR	ALD	Cheoki - Naini	180	3rd Line
Mirzapur	Chunar jn	31	91	31.99	NCR	ALD	Chunar - Mirzapur	217	3rd Line
Chunar jn	Jeonathpur	24	91	24.58	NCR	ALD	Jeonathpur - Chunar	205	3rd Line
Juhi cabin	Kanpur Central	1.4	97	1.25	NCR	ALD	Kanpur - Juhi/west	298	4th Line
Chheoki	Mirzapur	81	91	79.55	NCR	ALD	Mirzapur - Cheoki	218	3rd Line
Jeonathpur	Mughal Sarai Jn	8	91	7.53	NCR	ALD	Mughalsarai - Jeonathpur	188	3rd Line
Pokhrayan	Orai	220	25	47.79	NCR	JHS	BZM - JHS	42	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Bhimsen Jn	Pokhrayan	220	25	44.66	NCR	JHS	BZM - JHS	42	2nd Line
Orai	Ait Jn	220	25	25.02	NCR	JHS	BZM - JHS	42	2nd Line
Ait Jn	Jhansi Jn	220	25	89.07	NCR	JHS	BZM - JHS	42	2nd Line
Mau Jn	Aunrihar Jn	57.69	22	58.58	NER	BSB	Aunrihar - Mau	43	2nd Line
Sarnath	Aunrihar Jn	31.2	48	25.58	NER	BSB	Aunrihar - Varanasi City	78	2nd Line
Phephna Jn	Ballia	75.05	20	10.23	NER	BSB	Chhapra - Phephna	63	2nd Line
Ballia	Chhapra Jn	75.05	20	66.25	NER	BSB	Chhapra - Phephna	63	2nd Line
Kaptanganj Jn	Ghughali	82.84	19	14.63	NER	BSB	Gorakhpur Cantt. - Paniyahwa	53	Single Line
Gorakhpur Cantt Jn	Kaptanganj Jn	82.84	19	35.38	NER	BSB	Gorakhpur Cantt. - Paniyahwa	53	Single Line
Ghughali	Paniyahawa	82.84	19	32.74	NER	BSB	Gorakhpur Cantt. - Paniyahwa	53	Single Line
Bhatni Jn	Salempur Jn	59.61	20	10.06	NER	BSB	Indara - Bhatni	42	2nd Line
Salempur Jn	Indara Jn	59.61	20	50.37	NER	BSB	Indara - Bhatni	42	2nd Line
Indara Jn	Mau Jn	8.3	42	7.53	NER	BSB	Mau - Indara	60	3rd Line
Ghazipur City	Aunrihar Jn	94.95	23	39.56	NER	BSB	Phephana - Aunrihar	55	2nd Line
Phephna Jn	Ghazipur Ghat halt	94.95	23	50.41	NER	BSB	Phephana - Aunrihar	55	2nd Line
Ghazipur Ghat halt	Ghazipur City	94.95	23	4.28	NER	BSB	Phephana - Aunrihar	55	2nd Line
Varanasi Jn	Sarnath	10.44	20	11.07	NER	BSB	Sarnath - Varanasi	80	2nd Line
BaraBanki Jn	Burhwal Jn	27.13	43	27.66	NER	LJN	Barabanki - Burhwal	90	2nd Line
Burhwal Jn	Jarwal Road	61.72	55	16.01	NER	LJN	Burhwal - Gonda	125	3rd Line
Jarwal Road	Gonda Jn	61.72	55	46.44	NER	LJN	Burhwal - Gonda	125	3rd Line
Gonda Jn	Balrampur	179.82	18	38.98	NER	LJN	Gonda - Anandnagar	28	Single Line
Balrampur	Gainsari Jn	179.82	18	44.43	NER	LJN	Gonda - Anandnagar	28	Single Line
Ahirauli Halt	Anand Nagar Jn	179.82	18	37.15	NER	LJN	Gonda - Anandnagar	28	Single Line
Gainsari Jn	Barhni	179.82	18	26.18	NER	LJN	Gonda - Anandnagar	28	Single Line
Barhni	Ahirauli Halt	179.82	18	34.15	NER	LJN	Gonda - Anandnagar	28	Single Line
Gorakhpur Jn	Anand Nagar Jn	41.4	21	41.25	NER	LJN	Gorakhpur - Anandnagar	45	Single Line
Gorakhpur Jn	Gorakhpur Cantt Jn	3.22	52	3.96	NER	LJN	Gorakhpur - GorakhpurCantt.	133	3rd Line
Unnao Jn	Manaknagar	4.67	60	50.17	NR	LKO	Alambagh - Manaknagar	101	2nd Line
Manaknagar	Alambagh	4.67	60	2.53	NR	LKO	Alambagh - Manaknagar	101	2nd Line
Malhaur	BaraBanki Jn	16.4	60	16.02	NR	LKO	Barabanki - Malhaur	164	4th Line
Lucknow	Dilkusha Cabin	3.6	60	3.59	NR	LKO	Dilkusha - Lucknow	219	3rd Line
Alambagh	Lucknow	2.2	60	1.74	NR	LKO	Lucknow - Alam Bagh	231	3rd Line
Dilkusha Cabin	Malhaur	8.2	60	8.86	NR	LKO	Malhaur - Dilkusha	126	2nd Line
Kanpur Central	Unnao Jn	17.3	60	17.25	NR	LKO	Unnao - Kanpur	162	2nd Line
Paniyahawa	Tamkuhi Road	0	0	61.13	0	0	Paniyahawa - Valmiki nagar road	0	Single Line

HUN 6

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Tribeni	Nabadwip Dham	104.7	43	58.91	ER	HWH	BANDEL - KATWA	66	2nd Line
Dainhat	Katwa Jn	104.7	43	6.68	ER	HWH	BANDEL - KATWA	66	2nd Line
Nabadwip Dham	Dainhat	104.7	43	33.51	ER	HWH	BANDEL - KATWA	66	2nd Line
Bandel Jn	Tribeni	104.7	43	8.23	ER	HWH	BANDEL - KATWA	66	2nd Line
Ambalgram	Azimganj	72.74	25	67.51	ER	HWH	KATWA - AZIMGANJ	50	2nd Line
Katwa Jn	Ambalgram	72.74	25	8.16	ER	HWH	KATWA - AZIMGANJ	50	2nd Line
Azimganj	Manigram	20.55	28	20.69	ER	MLDT	AZIMGANJ - MANIGRAM	42	2nd Line
Manigram	New Farakka Jn	57.05	21	61.44	ER	MLDT	MANIGRAM - NEW FARAKKA	42	2nd Line
New Farakka Jn	Old Malda Jn	34.81	53	42.39	ER	MLDT	NEW FARAKKA - MALDA TOWN	123	2nd Line
Fakiragram Jn	Golakganj	47	7	48.50	NFR	APDJ	FAKIRAGRAM - GOLAKGANJ	11	Single Line
Golakganj	Dhubri	13	7	20.12	NFR	APDJ	GOLAKGANJ - GAURIPUR	11	2nd Line
Golakganj	New Cooch Behar jn	55	4	59.20	NFR	APDJ	NEW COOCHBEHAR - GOLAKGANJ	11	2nd Line
Kokrajhar	New Bongaigaon Jn	96	49	28.53	NFR	APDJ	SAMUKTALA ROAD - NEW BONGAIGAON	96	2nd Line
Kokrajhar	Fakiragram Jn	96	49	10.31	NFR	APDJ	SAMUKTALA ROAD - NEW BONGAIGAON	96	2nd Line
Raninagar Jalpaiguri Jn	New Domohani	88	14	15.17	NFR	APDJ	Y' LEG OF MAYNAGURI ROAD - JALPAIGURI ROAD - NEW DOMOHANI - NEW COOCH BEHAR	23	2nd Line
New Domohani	New Maynaguri	88	28	3.83	NFR	APDJ	Y' LEG OF MAYNAGURI ROAD - JALPAIGURI ROAD - NEW DOMOHANI - NEW COOCH BEHAR	23	2nd Line
New Maynaguri	New Cooch Behar jn	88	14	82.27	NFR	APDJ	Y' LEG OF MAYNAGURI ROAD - JALPAIGURI ROAD - NEW DOMOHANI - NEW COOCH BEHAR	23	2nd Line
Kishanganj	Aluabari Road	145	49	30.92	NFR	KIR	BARSOI - NEW JALPAIGURI	148	2nd Line
Barsoi Jn	Kishanganj	145	49	58.52	NFR	KIR	BARSOI - NEW JALPAIGURI	148	2nd Line
Eklakhi Jn	Milangarh	41.91	49	31.63	NFR	KIR	EKLAKHI - KUMEDPUR	111	2nd Line
Milangarh	Kumedpur Jn	41.91	49	11.73	NFR	KIR	EKLAKHI - KUMEDPUR	111	2nd Line
Kumedpur Jn	Katihar Jn	29.5	23	30.70	NFR	KIR	KATIHAR - KUMEDPUR	52	Single Line
Kumedpur Jn	Mukuria Jn	23	49	24.23	NFR	KIR	KUMEDPUR - MUKURIA	100	2nd Line
Old Malda Jn	Eklakhi Jn	19	49	14.10	NFR	KIR	MALDA TOWN - EKLAKHI	111	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Mukuria Jn	Barsoi Jn	5	49	4.43	NFR	KIR	MUKURIA - BARSOI	152	2nd Line
New Jalpaiguri Jn	Raninagar Jalpaiguri Jn	26	44	26.83	NFR	KIR	NEW JALPAIGURI - RANINAGAR JALPAIGURI	86	2nd Line
Galgalia	Siliguri Jn	75.94	22	45.74	NFR	KIR	SILIGURI Jn. - ALUABARI	20	Single Line
Aluabari Road	Galgalia	75.94	22	32.23	NFR	KIR	SILIGURI Jn. - ALUABARI	20	Single Line
Siliguri Jn	Siliguri Town	8	16	2.35	NFR	KIR	SILIGURI Jn. - NEW JALPAIGURI	52	Single Line
New Jalpaiguri Jn	Siliguri Town	8	16	4.25	NFR	KIR	SILIGURI Jn. - NEW JALPAIGURI	52	Single Line
Digaru	Tetelia	147	22	5.61	NFR	LMG	DIGARU - LUMDING	62	2nd Line
Tetelia	Jagi road	147	22	18.83	NFR	LMG	DIGARU - LUMDING	62	2nd Line
Jagi road	Chaparmukh Jn	147	22	35.21	NFR	LMG	DIGARU - LUMDING	62	2nd Line
Chaparmukh Jn	Lumdiong South	147	22	92.43	NFR	LMG	DIGARU - LUMDING	62	2nd Line
Guwahati	New Guwahati	3.87	37	4.94	NFR	LMG	GUWAHATI - NEW GUWAHATI	83	4th Line
Kamakhya Jn	Guwahati	6.48	40	6.53	NFR	LMG	KAMAKHYA - GUWAHATI	96	4th Line
Lumdiong South	Diphu	139	17	35.38	NFR	LMG	LUMDING - FURKATING	42	Single Line
Diphu	Dimapur	139	17	35.39	NFR	LMG	LUMDING - FURKATING	42	Single Line
Dimapur	Furkating Jn	139	17	72.71	NFR	LMG	LUMDING - FURKATING	42	Single Line
New Guwahati	Digaru	30	40	29.66	NFR	LMG	NEW GUWAHATI - DIGARU	64	2nd Line
New Bongaigaon Jn	Abhayapuri Assam	176	20	17.55	NFR	RNY	NEW BONGAOGAON - GOALPARA TOWN - KAMAKHYA	50	Single Line
Abhayapuri Assam	Goalpara Town	176	20	35.05	NFR	RNY	NEW BONGAOGAON - GOALPARA TOWN - KAMAKHYA	50	Single Line
Dudhnol Jn	Kamakhya Jn	176	20	106.15	NFR	RNY	NEW BONGAOGAON - GOALPARA TOWN - KAMAKHYA	50	Single Line
Goalpara Town	Dudhnol Jn	176	20	21.02	NFR	RNY	NEW BONGAOGAON - GOALPARA TOWN - KAMAKHYA	50	Single Line
Furkating Jn	Mariani Jn	38	16	40.32	NFR	TSK	FURKATING - MARIANI.	36	Single Line
Mariani Jn	Amguri Jn	156.7	16	29.48	NFR	TSK	MARIANI - TINSUKIA	36	Single Line
Amguri Jn	Simaluguri Jn	156.7	16	26.98	NFR	TSK	MARIANI - TINSUKIA	36	Single Line
Simaluguri Jn	Namrup	156.7	16	69.94	NFR	TSK	MARIANI - TINSUKIA	36	Single Line
Tinsukia Jn	Namrup	156.7	16	37.46	NFR	TSK	MARIANI - TINSUKIA	36	Single Line
Dibrugarh	Tinsukia Jn	47.3	14	43.71	NFR	TSK	TINSUKIA - DIBRUGARH TOWN	26	Single Line
Katihar Jn	Mukuria Jn	35.00	18	35.16	NFR	KIR	KATIHAR - MUKURIA	60	Single Line

HUN 7

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Mandir Hasaud	Lakholi	0	0	12.13	0	0	Mandir Hasaud - Lakholi	0	2nd Line
Dhenkanal	Rajathgarh Jn	61.9	71	20.46	ECOR	KUR	Budhapank - Rajathgarh	147	4th Line
Budhapank	Nayabhagirathpur	61.9	71	17.22	ECOR	KUR	Budhapank - Rajathgarh	147	4th Line
Nayabhagirathpur	Dhenkanal	61.9	71	25.19	ECOR	KUR	Budhapank - Rajathgarh	147	4th Line
Cuttack Jn	Barang Jn	11.5	87	11.79	ECOR	KUR	Cuttack - Barang	145	3rd Line
Cuttack Jn	Bagadia Ph	82.9	55	80.09	ECOR	KUR	Cuttack - Paradeep	100	2nd Line
Bagadia Ph	Paradeep	82.9	55	3.08	ECOR	KUR	Cuttack - Paradeep	100	2nd Line
Machapur Jn	Radhakishorpur Jn	1.54	62	2.22	ECOR	KUR	Machhapur - Radhakishorpur	28	2nd Line
Radhakishorpur Jn	Barang Jn	29.3	58	22.01	ECOR	KUR	Rajathgarh - Barang	63	2nd Line
Rajathgarh Jn	Machapur Jn	18.04	74	3.07	ECOR	KUR	Rajathgarh - Charbatia	98	4th Line
Angul	Talcher Jn Cabin	18.5	28	13.41	ECOR	KUR	Talcher - Angul	64	4th Line
Talcher Jn Cabin	Budhapank	10.6	66	5.33	ECOR	KUR	Talcher - Budhapank	148	4th Line
Titlagarh Jn	Balangir	151	25	63.63	ECOR	SBP	Deobahal - Titlagarh	61	3rd Line
Balangir	Balangir Road PH	151	25	2.02	ECOR	SBP	Deobahal - Titlagarh	61	3rd Line
Balangir Road PH	Bargarh Road	151	25	73.64	ECOR	SBP	Deobahal - Titlagarh	61	3rd Line
Boinda	Angul	23.5	27	39.28	ECOR	SBP	Jarapada - Angul	62	4th Line
Jharsuguda Road Jn	Rengali	47	51	23.01	ECOR	SBP	Jharsuguda Road - Sambalpur	104	2nd Line
Rengali	Sarla Jn	47	51	15.50	ECOR	SBP	Jharsuguda Road - Sambalpur	104	2nd Line
Sambalpur Jn	Sarla Jn	47	51	6.95	ECOR	SBP	Jharsuguda Road - Sambalpur	104	2nd Line
Nawapara Road	Mahasamund	107.8	25	64.37	ECOR	SBP	Kantabanji - Arand	59	2nd Line
Bargarh Road	Sambalpur Jn	7	25	42.25	ECOR	SBP	Sambalpur - Hirakud	59	3rd Line
Sambalpur Jn	Sambalpur City Jn	96	27	6.44	ECOR	SBP	Sambalpur - Saragipalli	56	2nd Line
Sambalpur City Jn	Handapa	96	27	104.64	ECOR	SBP	Sambalpur - Saragipalli	56	2nd Line
Handapa	Boinda	36.7	51	7.46	ECOR	SBP	Saragipalli - Jarapada	57	2nd Line
Titlagarh Jn	Nawapara Road	33.3	45	87.04	ECOR	SBP	Titlagarh - Kantabanji	64	2nd Line
Lanjigarh Road Jn	Titlagarh Jn	130.3	50	47.05	ECOR	SBP	Titlagarh - Singapur Road	101	3rd Line
Singapuram Road Jn	Lanjigarh Road Jn	130.3	50	82.15	ECOR	SBP	Titlagarh - Singapur Road	101	3rd Line
Gopalapatnam	Visakhapatnam Jn	6.7	114	6.42	ECOR	WAT	Gopalpatnam - Visakhapatnam	222	3rd Line
Jagdalpur	Tokopal	45.4	20	17.50	ECOR	WAT	Jagdalpur - Silakjhori	29	2nd Line
Jeypore	Koraput Jn	105.9	22	40.68	ECOR	WAT	Koraput - Jagdalpur	34	2nd Line
Jeypore	Jagdalpur	105.9	22	64.66	ECOR	WAT	Koraput - Jagdalpur	34	2nd Line
Damonjodi	Singapuram Road Jn	163.7	18	133.38	ECOR	WAT	Koraput - Singapur Road	37	2nd Line
Koraput Jn	Damonjodi	163.7	18	18.48	ECOR	WAT	Koraput - Singapur Road	37	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Araku	Koraput Jn	189.9	17	84.36	ECOR	WAT	Kottavalasa - Koraput	33	2nd Line
Kottavalasa Jn	Araku	189.9	17	98.85	ECOR	WAT	Kottavalasa - Koraput	33	2nd Line
Simhachalam North Jn	Kottavalasa Jn	16.8	128	16.92	ECOR	WAT	Kottavalasa - Simhachalam North	234	4th Line
Tokopal	Dantewara	104.4	20	87.65	ECOR	WAT	Silakjhori - Kirandul	29	2nd Line
Dantewara	Kirandul	104.4	20	41.86	ECOR	WAT	Silakjhori - Kirandul	29	2nd Line
Simhachalam North Jn	Gopalapatnam	2.7	65	2.69	ECOR	WAT	Simhachalam North - Gopalpatnam	112	3rd Line
Vizianagaram Jn	Bobbili Jn	133.5	54	54.45	ECOR	WAT	Singapur Road - Vizianagaram	114	3rd Line
Singapuram Road Jn	Rayagada	133.5	54	10.20	ECOR	WAT	Singapur Road - Vizianagaram	114	3rd Line
Bobbili Jn	Rayagada	133.5	54	70.29	ECOR	WAT	Singapur Road - Vizianagaram	114	3rd Line
Kottavalasa Jn	Vizianagaram Jn	34.63	114	34.50	ECOR	WAT	Vizianagaram - Kottavalasa	204	3rd Line
Anuppur Jn	Kotma	31.6	65	31.61	SECR	BSP	ANUPPUR - KOTMA	66	2nd Line
Shahdol	Anuppur Jn	41	64	40.97	SECR	BSP	ANUPPUR - SAHDOL	126	3rd Line
Anuppur Jn	Pendra Road	150.9	30	50.15	SECR	BSP	BILASPUR - ANUPPUR	92	3rd Line
Pendra Road	Bilaspur Jn	150.9	30	99.88	SECR	BSP	BILASPUR - ANUPPUR	92	2nd Line
Darritola Jn	Baikunthpur Road	118.8	25	15.44	SECR	BSP	BORIDAND - AMBIKAPUR	40	Single Line
Boridand Jn	Darritola Jn	118.8	25	26.71	SECR	BSP	BORIDAND - AMBIKAPUR	40	Single Line
Baikunthpur Road	Ambikapur	118.8	25	75.13	SECR	BSP	BORIDAND - AMBIKAPUR	40	Single Line
Boridand Jn	Chirimiri	29	18	28.83	SECR	BSP	BORIDAND - CHIRMIRI	17	2nd Line
Gevra Road	Korba	47	50	7.89	SECR	BSP	CHAMPA - GEVRA ROAD	110	2nd Line
Champa Jn	Korba	47	50	36.87	SECR	BSP	CHAMPA - GEVRA ROAD	110	2nd Line
Kotma	Boridand Jn	25.4	65	23.89	SECR	BSP	KOTMA - BORIDAND	64	2nd Line
Katni Jn	New Katni Jn	125.3	60	5.17	SECR	BSP	SAHDOL - KATNI	123	3rd Line
Umaria	Shahdol	125.3	60	67.69	SECR	BSP	SAHDOL - KATNI	123	3rd Line
New Katni Jn	Umaria	125.3	60	53.39	SECR	BSP	SAHDOL - KATNI	123	3rd Line
Bilaspur Jn	Urkura	105	115	105.80	SECR	R	BILASPUR - URKURA	270	4th Line
Raipur Vizainagaram Hut	Mandir Hasaud	4.6	22	12.60	SECR	R	LAKHOLI - RAIPUR - RAIPUR VIZAINAGRAM HUT	64	2nd Line
Lakholi	Mahasamund	4.6	22	25.11	SECR	R	LAKHOLI - RAIPUR - RAIPUR VIZAINAGRAM HUT	64	2nd Line
Raipur Jn	Raipur Vizainagaram Hut	4.6	15	3.91	SECR	R	RAIPUR - RAIPUR VIZAINAGRAM HUT	42	2nd Line
Urkura	Raipur Jn	5.6	63	4.86	SECR	R	URKURA - RAIPUR	129	2nd Line
Guna jn	Ashoknagar	118.37	30	44.31	WCR	BPL	GUNA - BINA	67	2nd Line
Ashoknagar	Bina jn	118.37	30	74.04	WCR	BPL	GUNA - BINA	67	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Ruthiyai jn	Guna jn	20.47	66	19.32	WCR	BPL	RUTHIYAI - GUNA	69	2nd Line
Bina jn	Saugor	264	54	74.74	WCR	JBP	NEW KATNI Jn. - BINA	129	3rd Line
Katni Jn	Damoh	264	54	111.00	WCR	JBP	NEW KATNI Jn. - BINA	129	3rd Line
Damoh	Saugor	264	54	76.32	WCR	JBP	NEW KATNI Jn. - BINA	129	3rd Line
Ruthiyai jn	Baran	164.26	26	98.54	WCR	Kota	RUTHIYAI - KOTA	47	2nd Line
Kota Jn	Bhonra	164.26	26	29.01	WCR	Kota	RUTHIYAI - KOTA	47	2nd Line
Bhonra	Baran	164.26	26	36.98	WCR	Kota	RUTHIYAI - KOTA	47	2nd Line
Barwadih	Ambikapur	118.80	25	142.427 5469	SECR	BSP	BILASPUR-URKURA	40.4	Single Line
Gevra Road	Pendra Road	47.00	50	125.217 5078	SECR	BSP	BILASPUR-URKURA	109.8	Single Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Gudivada Jn	Machillpatnam	37	17	36.76	SCR	BZA	Gudivada - Machlipatnam	28	2nd Line
Krishna Canal Jn	Vijayawada Jn	6	80	4.29	SCR	BZA	Krishnacanal - Vijayawada	172	3rd Line
Vijayawada Jn	Ramavarappa du	43	20	6.91	SCR	BZA	Vijayawada - Gudivada	46	2nd Line
Ramavarappa du	Gudivada Jn	43	20	35.06	SCR	BZA	Vijayawada - Gudivada	46	2nd Line
Guntakal Jn	Ballari Jn	48.55	51	49.93	SCR	GKL	Bellary - Guntakal	68	2nd Line
Pendekallu Jn	Dhone Jn	68.54	30	25.75	SCR	GKL	Dhone - Guntakal	62	2nd Line
Guntakal Jn	Pendekallu Jn	68.54	30	41.26	SCR	GKL	Dhone - Guntakal	62	2nd Line
Dhone Jn	Nandyal	75.76	18	74.80	SCR	GKL	Nandyal - Dhone	44	2nd Line
Nallapadu	Guntur Jn	5	49	4.96	SCR	GNT	Guntur - Nallapadu	81	2nd Line
Guntur Jn	Krishna Canal Jn	27	67	27.19	SCR	GNT	Krishna Canal - Guntur	71	2nd Line
Pagidipalli Jn	Nalgonda	110	26	72.52	SCR	GNT	Miryalguda - Pagdipalli	37	Single Line
Nalgonda	Miryalaguda	110	26	37.62	SCR	GNT	Miryalguda - Pagdipalli	37	Single Line
Nadikudi Jn	Pondugula	38	26	8.71	SCR	GNT	Nadikude - Miryalaguda	36	Single Line
Pondugula	Vishnupuram	38	26	8.88	SCR	GNT	Nadikude - Miryalaguda	36	Single Line
Miryalaguda	Vishnupuram	38	26	20.89	SCR	GNT	Nadikude - Miryalaguda	36	Single Line
Piduguralla	Nadikudi Jn	90	26	21.55	SCR	GNT	Nallapadu - Nadikude	40	Single Line
Sattenapalli	Piduguralla	90	26	31.72	SCR	GNT	Nallapadu - Nadikude	40	Single Line
Bandarupalli	Sattenapalli	90	26	28.66	SCR	GNT	Nallapadu - Nadikude	40	Single Line
Nallapadu	Bandarupalli	90	26	8.34	SCR	GNT	Nallapadu - Nadikude	40	Single Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Narasaraopet	Nallapadu	252	23	40.81	SCR	GNT	Nallapadu - Nandyal	43	Single Line
Vinukonda	Narasaraopet	252	23	37.24	SCR	GNT	Nallapadu - Nandyal	43	2nd Line
Donakonda	Vinukonda	252	23	38.04	SCR	GNT	Nallapadu - Nandyal	43	2nd Line
Diguvametta	Donakonda	252	23	94.59	SCR	GNT	Nallapadu - Nandyal	43	2nd Line
Gazulapalli	Diguvametta	252	23	27.29	SCR	GNT	Nallapadu - Nandyal	43	2nd Line
Nandyal	Gazulapalli	252	23	14.90	SCR	GNT	Nallapadu - Nandyal	43	2nd Line
Hussain Sagar Jn	Secunderabad Jn	4	92	4.57	SCR	SC	Hussainsagar - Secunderabad	168	2nd Line
Sanathnagar	Lingampalli	14	94	14.50	SCR	SC	Lingampalli - Sanatnagar	212	2nd Line
Charlapalli	Pagidipalli Jn	31	84	25.16	SCR	SC	Moulaali - Pagidipalli	152	2nd Line
Maula Ali C	Charlapalli	31	84	6.88	SCR	SC	Moulaali - Pagidipalli	152	2nd Line
Moula Ali Cord Line Station Bypass	Charlapalli	31	84	6.34	SCR	SC	Moulaali - Pagidipalli	152	2nd Line
Bhongir	Pagidipalli Jn	94	75	9.22	SCR	SC	Pagidipalli - Kazipet	124	2nd Line
Jangaon	Bhongir	94	75	37.49	SCR	SC	Pagidipalli - Kazipet	124	2nd Line
Kazipet Jn	Jangaon	94	75	47.89	SCR	SC	Pagidipalli - Kazipet	124	2nd Line
Sanathnagar	Hussain Sagar Jn	5	94	4.58	SCR	SC	Sanatnagar - Hussainsagar	186	2nd Line
Sitaphalmandi B	Lallaguda	5	92	1.12	SCR	SC	Secunderabad - Moulaali	118	2nd Line
Lallaguda	Maula Ali C	5	92	1.45	SCR	SC	Secunderabad - Moulaali	118	2nd Line
Secunderabad Jn	Sitaphalmandi B	5	92	2.37	SCR	SC	Secunderabad - Moulaali	118	2nd Line
Lingampalli	Telapur	49	68	3.75	SCR	SC	Vikarabad - Lingampalli	104	2nd Line
Telapur	Shankarpalli	49	68	17.14	SCR	SC	Vikarabad - Lingampalli	104	2nd Line
Shankarpalli	Vikarabad Jn	49	68	28.91	SCR	SC	Vikarabad - Lingampalli	104	2nd Line
Vikarabad Jn	Godamgura	112	60	7.98	SCR	SC	Wadi - Vikarabad	104	2nd Line
Mailaram	Wadi Jn	112	60	95.90	SCR	SC	Wadi - Vikarabad	104	2nd Line
Godamgura	Mailaram	112	60	6.56	SCR	SC	Wadi - Vikarabad	104	2nd Line
Kulem	Castle Rock	26	17	22.16	SWR	UBL	Castle - Rock - Kulem	31	2nd Line
Dharwad	Hubbali Jn	24	36	20.25	SWR	UBL	Dharwar - Hubballi	59	2nd Line
Gadag Jn	Harlapur	18	28	18.10	SWR	UBL	Gadag - Harlapur	43	2nd Line
Harlapur	Koppal	39	49	39.46	SWR	UBL	Harlapur - Koppal	43	2nd Line
Hosapete Jn	Torangallu Jn	32	57	32.02	SWR	UBL	Hosapete - Tornagallu	58	2nd Line
Hebsur	Gadag Jn	35	59	38.96	SWR	UBL	Hubballi - Annigeri	56	2nd Line
Hubbali Jn	Hebsur	35	59	18.55	SWR	UBL	Hubballi - Annigeri	56	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Ginigera	Hosapete Jn	28	28	16.35	SWR	UBL	Koppal - Hosapete	44	2nd Line
Koppal	Ginigera	28	28	11.11	SWR	UBL	Koppal - Hosapete	44	2nd Line
Majorda Jn	Madgaon Jn	58	26	7.66	SWR	UBL	Kulem - Vasco - Da - Gama	33	2nd Line
Madgaon Jn	Kulem	58	26	33.10	SWR	UBL	Kulem - Vasco - Da - Gama	33	2nd Line
Majorda Jn	Vasco da Gama	58	26	17.31	SWR	UBL	Kulem - Vasco - Da - Gama	33	2nd Line
Londa Jn	Castle Rock	11.6	32	23.15	SWR	UBL	Londa - Tinaighat	30	2nd Line
Torangallu Jn	Ballari Jn	33	52	32.48	SWR	UBL	Tornagallu - Ballari	62	2nd Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Bhilwara	Nasirabad	178.28	20	107.88	NWR	AII	AJMER - CHANDERIA	37	Single Line
Chanderiya	Bhilwara	178.28	20	46.71	NWR	AII	AJMER - CHANDERIA	37	Single Line
Nasirabad	Ajmer Jn	178.28	20	23.16	NWR	AII	AJMER - CHANDERIA	37	Single Line
Madanapalle Road	Dharmavaram Jn	227	24	143.37	SCR	GKL	Dharmavaram - Pakala	8	Single Line
Viyalpad	Madanapalle Road	227	24	7.92	SCR	GKL	Dharmavaram - Pakala	8	Single Line
Pakala	Viyalpad	227	24	74.54	SCR	GKL	Dharmavaram - Pakala	8	Single Line
Pendekallu Jn	Dhone Jn	68.54	30	25.75	SCR	GKL	Dhone - Guntakal	62	2nd Line
Guntakal Jn	Pendekallu Jn	68.54	30	41.26	SCR	GKL	Dhone - Guntakal	62	2nd Line
Anantapur	Kalluru Jn	90.6	29	27.24	SCR	GKL	Gooty - Dharmavaram	62	2nd Line
Dharmavaram Jn	Anantapur	90.6	29	33.43	SCR	GKL	Gooty - Dharmavaram	62	2nd Line
Kalluru Jn	Gooty Jn Cabin	90.6	29	26.79	SCR	GKL	Gooty - Dharmavaram	62	2nd Line
Gooty Jn	Pendekallu Jn	28.76	17	29.01	SCR	GKL	Gooty - Pendikallu	28	2nd Line
Pakala	Chittoor	104.39	24	28.04	SCR	GKL	Katpadi - Pakala - Tirupati	41	Single Line
Katpadi	Chittoor	104.39	24	32.79	SCR	GKL	Katpadi - Pakala - Tirupati	41	Single Line
Gooty Jn Cabin	Gooty Jn	194.32	48	2.44	SCR	GKL	Nandaluru - Gooty	90	2nd Line
Manoharabad	Bolarum	27.11	24	27.36	SCR	HYB	Bolarum - Manoharabad	60	Single Line
Falaknuma	Umdanagar	13.2	42	13.24	SCR	HYB	Falaknuma - Umdanagar	78	2nd Line
Kacheguda	Falaknuma	7.18	100	7.41	SCR	HYB	Kacheguda - Falaknuma	160	2nd Line
Dhone Jn	Kurnool City	53.51	24	54.71	SCR	HYB	Kurnool City Dhone	56	Single Line
Kurnool City	Gadwal Jn	130.44	24	54.93	SCR	HYB	Mahaboobnagar - Kurnool City	56	Single Line
Devarkadra	Gadwal Jn	130.44	24	50.59	SCR	HYB	Mahaboobnagar - Kurnool City	56	Single Line
Mahbubnagar	Devarkadra	130.44	24	24.56	SCR	HYB	Mahaboobnagar - Kurnool City	56	Single Line
Kamareddi	Akanapet	119.54	24	26.43	SCR	HYB	Manoharabad - Nizamabad	56	Single Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Akanapet	Manoharabad	119.54	24	41.31	SCR	HYB	Manoharabad - Nizamabad	56	Single Line
Nizamabad	Kamareddi	119.54	24	52.01	SCR	HYB	Manoharabad - Nizamabad	56	Single Line
Jankampet Jn	Basar	88.28	24	23.23	SCR	HYB	Nizamabad - Mudkhed	58	Single Line
Nizamabad	Jankampet Jn	88.28	24	6.28	SCR	HYB	Nizamabad - Mudkhed	58	Single Line
Basar	Mudkhed Jn	88.28	24	59.32	SCR	HYB	Nizamabad - Mudkhed	58	Single Line
Secunderabad Jn	Lallaguda Gate Halt	13.85	120	1.58	SCR	HYB	Secundarabad - Bolarum	90	2nd Line
Lallaguda Gate Halt	Malkajgiri Jn	13.85	120	0.96	SCR	HYB	Secundarabad - Bolarum	90	2nd Line
Bolarum	Ammuguda Halt	13.85	120	5.80	SCR	HYB	Secundarabad - Bolarum	90	2nd Line
Ammuguda Halt	Malkajgiri Jn	13.85	120	4.68	SCR	HYB	Secundarabad - Bolarum	90	2nd Line
Sitaphalmandi A	Kacheguda	7.36	100	4.73	SCR	HYB	Secunderabad - Kacheguda	166	2nd Line
Secunderabad Jn	Sitaphalmandi A	7.36	100	1.89	SCR	HYB	Secunderabad - Kacheguda	166	2nd Line
Jadcherla	Mahbubnagar	85.24	24	17.87	SCR	HYB	Umdanagar - Mahaboobnagar	66	2nd Line
Umdanagar	Jadcherla	85.24	24	68.19	SCR	HYB	Umdanagar - Mahaboobnagar	66	2nd Line
Akola Jn	Khandwa jn	173	0	165.51	SCR	NED	Akola - Khandwa (MG)	0	Single Line
Akola Jn	Washim	210	24	78.68	SCR	NED	Purna - Akola	23	Single Line
Washim	Hingoli Deccan	210	24	47.62	SCR	NED	Purna - Akola	23	Single Line
Hingoli Deccan	Purna Jn	210	24	80.40	SCR	NED	Purna - Akola	23	Single Line
Hazur Sahib Nanded	Maltekdi	52.89	24	3.57	SCR	NED	Purna - Mudkhed	65	2nd Line
Purna Jn	Hazur Sahib Nanded	52.89	24	30.42	SCR	NED	Purna - Mudkhed	65	2nd Line
Maltekdi	Mudkhed Jn	52.89	24	18.97	SCR	NED	Purna - Mudkhed	65	2nd Line
Katpadi	Vellore Town	160.13	18	9.83	SR	TPJ	Villipuram - Katpadi Jn.	19	Single Line
Vellore Town	Tiruvannamallai	160.13	18	83.50	SR	TPJ	Villipuram - Katpadi Jn.	19	Single Line
Tiruvannamallai	Villupuram	160.13	18	67.89	SR	TPJ	Villipuram - Katpadi Jn.	19	Single Line
Chittaurgarh jn	Chanderiya	4.9	27	7.42	WR	RTM	Berach - Chanderiya	63	Single Line
Berach Jn Cabin	Chanderiya	4.9	27	5.05	WR	RTM	Berach - Chanderiya	63	Single Line
Chittaurgarh jn	Berach Jn Cabin	2.5	40	2.63	WR	RTM	Chittaurgarh - Berach	92	3rd Line
Fatehabad Chandrawatiganj Jn	Indore jn	60.83	18	39.23	WR	RTM	Fatehabad C'gunj * - Indore	13	Single Line
Indore jn	Rau	11.46	44	11.01	WR	RTM	Indore - Rau	18	2nd Line
Khandwa jn	Mhow	117.8	10	113.72	WR	RTM	Mhow - Khandwa	0	Single Line
Chittaurgarh jn	Nimach	55.73	20	55.55	WR	RTM	Nimach - Chittaurgarh	51	2nd Line
Nimach	Mandsaur	132	20	49.42	WR	RTM	Ratlam - Nimach	44	2nd Line
Mandsaur	Ratlam JN	79.24	18	83.46	WR	RTM	Ratlam * - Fatehabad C'gunj	13	2nd Line
Ratlam JN	Fatehabad Chandrawatiganj Jn	79.24	18	78.95	WR	RTM	Ratlam * - Fatehabad C'gunj	13	Single Line
Rau	Mhow	9.51	20	10.10	WR	RTM	Rau - MHOW	16	Single Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Villivakkam	Veysarpadi	5.8	222	5.55	SR	MAS	Vyasarpadi - Villivakkam	365	4th Line
Avadi	Villivakkam	11.61	222	11.65	SR	MAS	Villivakkam - Avadi	364	4th Line
Hindu College	Avadi	3.91	222	2.02	SR	MAS	Avadi - Pattabiram	322	4th Line
Pattabiram	Hindu College	3.91	222	1.90	SR	MAS	Avadi - Pattabiram	322	4th Line
Tiruvallur	Pattabiram	16.72	222	17.06	SR	MAS	Pattabiram - Tiruvallur	282	4th Line
Basin Bridge	Chennai Central	2.22	320	1.21	SR	MAS	Chennai Central - Basin Bridge Jn.	395	6th Line
Veysarpadi	Basin Bridge	1.39	222	1.88	SR	MAS	Basin Bridge Jn. - Vyasarpadi	276	4th Line
Arakkonam	Tiruvallur	26.83	222	26.74	SR	MAS	Tiruvallur - Arakkonam	201	4th Line
Pune	Daund jn	76	65	76.61	CR	PUNE	PUNE - Daund Junction	116	2nd Line
Dharwad	Hubbali Jn	24	36	20.25	SWR	UBL	Dharwar - Hubballi	59	2nd Line
Londa Jn	Alnavar Jn	13	47	33.67	SWR	UBL	Londa - Devarayi	47	2nd Line
Alnavar Jn	Dharwad	37	47	36.28	SWR	UBL	Alnavar - Dharwad	47	2nd Line
Jolarpettai	Katpadi	83.65	92	84.55	SR	MAS	Katpadi Jn. - Jolarpettai Jn.	148	2nd Line
Baiyyappanahall i	Baiyapannahalli ABC	46.95	64	2.58	SWR	SBC	Whitefield - Baiyyappanahalli	152	2nd Line
Baiyapannahalli ABC	Whitefield	46.95	64	10.34	SWR	SBC	Whitefield - Baiyyappanahalli	152	4th Line
Whitefield	Bangarapet	72.2	53	47.74	SWR	SBC	Bangarpet - Jolarpet	88	2nd Line
Bisanattam	Mulanur	70.2	53	27.33	SWR	SBC	Jolarpet - Bangarpet	88	2nd Line
Patchur	Mulanur	70.2	53	11.23	SWR	SBC	Jolarpet - Bangarpet	88	2nd Line
Jolarpettai	Patchur	70.2	53	16.18	SWR	SBC	Jolarpet - Bangarpet	88	2nd Line
Bangarapet	Bisanattam	70.2	53	19.89	SWR	SBC	Jolarpet - Bangarpet	88	2nd Line
St Thomas Mount	Tambaram	24.82	88	10.79	SR	MAS	Chennai Egmore - Tambaram	95	4th Line
Tiruchchirappall i Jn	Ponmalai	2.84	88	2.45	SR	TPJ	Ponmalai Jn. - Tiruchchirappalli Jn.	100	3rd Line
Tindivanam	Chengalpattu	102.92	56	66.12	SR	MAS	Chengalpattu Jn. - Villupuram	71	2nd Line
Villupuram	Tindivanam	102.92	56	37.67	SR	MAS	Chengalpattu Jn. - Villupuram	71	2nd Line
Tambaram	Chengalpattu	30.7	88	30.72	SR	MAS	Tambaram - Chengalpattu Jn.	161	2nd Line
Manmad Jn	Ankai Kila	237	26	9.57	CR	SUR	Daund Junction - Manmad Junction	49	2nd Line
Ankai Kila	Ankai	237	26	5.09	CR	SUR	Daund Junction - Manmad Junction	49	2nd Line
Bengaluru city	Baiyyappanahall i	47.95	61	9.76	SWR	SBC	Whiteeifeld - Bangarpet	110	4th Line
Ponmalai	Valadi	23.98	58	17.62	SR	TPJ	Lalgudi - Ponmalai Jn.	50	2nd Line
Valadi	Lalgudi	23.98	58	6.28	SR	TPJ	Lalgudi - Ponmalai Jn.	50	2nd Line
Lalgudi	Ariyalur	42.93	58	43.41	SR	TPJ	Ariyalur - Lalgudi	48	2nd Line
Ariyalur	Mathur	53.22	56	25.14	SR	TPJ	Vriddhachalam Jn. - Ariyalur	47	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Mathur	Vriddhachalam Jn	53.22	56	28.16	SR	TPJ	Vriddhachalam Jn. - Ariyalur	47	2nd Line
Ankai	Puntamba Jn	237	26	53.65	CR	SUR	Daund Junction - Manmad Junction	49	2nd Line
Puntamba Jn	Belapur	237	26	19.97	CR	SUR	Daund Junction - Manmad Junction	49	2nd Line
Kadur jn	Birur jn	54	44	6.26	SWR	MYS	Arsikere - Birur	57	2nd Line
Ahmadnagar	Daund jn	237	26	82.55	CR	SUR	Daund Junction - Manmad Junction	49	2nd Line
Kadur jn	Arsikere jn	54	44	38.72	SWR	MYS	Arsikere - Birur	57	2nd Line
Manaparai	Tiruchchirappall i Jn	92.61	56	36.21	SR	MDU	Tiruchchirappalli Jn. - Dindigul Jn.	43	2nd Line
Belapur	Ahmadnagar	237	26	67.89	CR	SUR	Daund Junction - Manmad Junction	49	2nd Line
Dindigul	Vadamadura	92.61	56	16.23	SR	MDU	Tiruchchirappalli Jn. - Dindigul Jn.	43	2nd Line
Vadamadura	Manaparai	92.61	56	42.00	SR	MDU	Tiruchchirappalli Jn. - Dindigul Jn.	43	2nd Line
Tirunelveli Jn	Vanchi Maniyachchi Jn	28.9	30	28.77	SR	MDU	Vanchi Maniyachchi Jn. - Tirunelveli Jn.	48	2nd Line
Chennai Egmore	St Thomas Mount	24.82	88	13.79	SR	MAS	Chennai Egmore - Tambaram	95	4th Line
Birur jn	Chikjajur jn	68	34	68.12	SWR	MYS	Birur - Chikjajur	45	2nd Line
Pune	Phursungi	145	23	17.21	CR	PUNE	Pune - Satara	40	2nd Line
Chikbanavar	Tumakuru	120.53	35	56.21	SWR	SBC	Penukonda - Yelahanka	62	2nd Line
Villupuram	Triuvennainallur Road	54.56	56	15.74	SR	TPJ	Villupuram Jn. - Vriddhachalam Jn.	47	2nd Line
Yeliyur	Mandya	138.3	53	7.55	SWR	SBC	Mysuru - Bengaluru	60	2nd Line
Mandya	Ramanagaram	138.3	53	48.40	SWR	SBC	Mysuru - Bengaluru	60	2nd Line
Ramanagaram	Kengeri	138.3	53	32.18	SWR	SBC	Mysuru - Bengaluru	60	2nd Line
Magnesite Jn	Omalur	7.98	27	7.58	SR	SA	Magnesite Jn. - Omalur	44	2nd Line
Triuvennainallur Road	Vriddhachalam Jn	54.56	56	38.72	SR	TPJ	Villupuram Jn. - Vriddhachalam Jn.	47	2nd Line
Mysuru Jn	Yeliyur	138.3	53	35.76	SWR	SBC	Mysuru - Bengaluru	60	2nd Line
Ambaturai	Dindigul	65.78	56	11.20	SR	MDU	Dindigul Jn. - Madurai Jn.	64	2nd Line
Pallappatti Halt	Ambaturai	65.78	56	18.86	SR	MDU	Dindigul Jn. - Madurai Jn.	64	2nd Line
Madurai Jn	Pallappatti Halt	65.78	56	33.16	SR	MDU	Dindigul Jn. - Madurai Jn.	64	2nd Line
Omalur	Dharmapuri	42.47	19	54.52	SWR	SBC	Dharmavaram - Penukonga via NGM	28	Single Line
Amaravathi Colony Jn	Davangere	60	28	7.67	SWR	MYS	Chikjajur - Harihar	43	2nd Line
Bengaluru city	Chikbanavar	12.52	32	13.24	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	34	2nd Line
Arsikere jn	Tumakuru	96	23	97.05	SWR	MYS	Tumkur - Arsikere	44	2nd Line
Belagavi	Gunji	51	24	37.34	SWR	UBL	Belagavi - Londa	35	2nd Line
Gunji	Londa Jn	51	24	12.85	SWR	UBL	Belagavi - Londa	35	2nd Line
Vanchi Maniyachchi Jn	Virudunagar Jn	84.48	27	84.15	SR	MDU	Virudunagar - Vanchi Maniyachchi Jn.	46	2nd Line
Sangli	Miraj Jn	7	24	7.38	CR	PUNE	Sangli - Miraj Junction	42	2nd Line
Koregaon	Karad	126	24	47.63	CR	PUNE	Satara - Sangli	40	2nd Line
Karad	Nandre	126	24	55.44	CR	PUNE	Satara - Sangli	40	2nd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Nandre	Sangli	126	24	12.33	CR	PUNE	Satara - Sangli	40	2nd Line
Phursungi	Rajevadi	145	23	20.85	CR	PUNE	Pune - Satara	40	2nd Line
Rajevadi	Lonand	145	23	46.00	CR	PUNE	Pune - Satara	40	2nd Line
Lonand	Palsi	145	23	31.89	CR	PUNE	Pune - Satara	40	2nd Line
Miraj Jn	Ugar Khurd	137	26	26.74	SWR	UBL	Miraj - Belagavi	35	2nd Line
Ugar Khurd	Kudachi	137	26	6.47	SWR	UBL	Miraj - Belagavi	35	2nd Line
Amaravathi Colony Jn	Harihar	60	28	5.06	SWR	MYS	Chikjajur - Harihar	43	2nd Line
Baiyyappanahalli	Hosur	42.47	19	49.11	SWR	SBC	Dharmavaram - Penukonga via NGM	28	2nd Line
Haveri	Hubbali Jn	131	23	74.89	SWR	MYS	Harihar - Hubli	37	2nd Line
Dharmapuri	Hosur	42.47	19	92.81	SWR	SBC	Dharmavaram - Penukonga via NGM	28	Single Line
Thiruvananthapuram Central	Nagercoil Jn	71.05	20	70.05	SR	TVC	Thiruvananthapuram Central - Nagercoil Jn.	35	2nd Line
Chikjajur jn	Davangere	60	28	46.56	SWR	MYS	Chikjajur - Harihar	43	2nd Line
Harihar	Haveri	131	23	55.73	SWR	MYS	Harihar - Hubli	37	2nd Line
Virudunagar Jn	Madurai Jn	43.18	28	43.48	SR	MDU	Madurai Jn. - Virudunagar	52	2nd Line
Kengeri	Bengaluru city	138.3	53	11.71	SWR	SBC	Mysuru - Bengaluru	60	2nd Line
Nagercoil Jn	Tirunelveli Jn	73.29	20	72.73	SR	TVC	Nagercoil Jn. - Tirunelveli Jn.	33	2nd Line
Namakkal	Salem Jn	85.19	20	51.96	SR	SA	SalemJn. - Karur Jn.	23	Single Line
Palsi	Satara	145	23	16.45	CR	PUNE	Pune - Satara	40	2nd Line
Karur	Namakkal	85.19	20	33.65	SR	SA	SalemJn. - Karur Jn.	23	Single Line
Satara	Koregaon	126	24	10.98	CR	PUNE	Satara - Sangli	40	2nd Line
Kudachi	Belagavi	137	26	104.26	SWR	UBL	Miraj - Belagavi	35	2nd Line
Dindigul	Karur	73.97	19	74.29	SR	SA	Karur Jn. - Dindigul Jn.	26	Single Line
Nagercoil Jn	Kanniyakumari	15.51	24	15.46	SR	TVC	Nagercoil Jn. - Kanniyakumari	29	2nd Line
Walajah Road	Melpakkam	60.89	92	33.86	SR	MAS	Arakkonam Jn. - Katpadi Jn.	133	2nd Line
Katpadi	Walajah Road	60.89	92	25.42	SR	MAS	Arakkonam Jn. - Katpadi Jn.	133	2nd Line
Melpakkam	Arakkonam	60.89	92	2.78	SR	MAS	Arakkonam Jn. - Katpadi Jn.	133	2nd Line
Baramati	Phaltan	145.00	23	31.014	CR	PUNE	Daund Junction - Baramati	40	Single Line

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NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Salem Jn	Magnesite Jn	3.34	69	3.38	SR	SA	Magnesite Jn. - Salem Jn.	123	2nd Line
Punkunnam	Thrissur	2.01	72	1.60	SR	TVC	Punkunnam - Thrisur	116	3rd Line
Chalakudi	Angamali for Kaladi	71.54	65	14.68	SR	TVC	Thrisur - Ernakulam Town	116	3rd Line
Thrissur	Ollur	71.54	65	7.21	SR	TVC	Thrisur - Ernakulam Town	116	3rd Line
Shoranur Jn	Punkunnam	30.8	60	29.45	SR	TVC	Shoranur Jn. - Punkunnam	102	3rd Line

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Train Count 18	Configuration after completion of Works as per Pink Book
Ollur	Chalakudi	71.54	65	23.39	SR	TVC	Thrisur - Ernakulam Town	116	3rd Line
Magudanchavadi	Salem Jn	59.25	66	20.97	SR	SA	Salem Jn. - Erode Jn.	106	2nd Line
Erode	Magudanchavadi	59.25	66	41.69	SR	SA	Salem Jn. - Erode Jn.	106	2nd Line
Tirupattur	Jolarpettai	116.7	62	7.64	SR	SA	Jolarpettai Jn - Magnesite Jn.	106	2nd Line
Morappur	Tirupattur	116.7	62	46.68	SR	SA	Jolarpettai Jn - Magnesite Jn.	106	2nd Line
Shoranur Jn	Palakkad Jn	44.49	62	44.39	SR	PGT	Palakkad Jn. - Shoranur Jn.	89	2nd Line
Ingur	Erode	82.84	62	19.16	SR	SA	Erode Jn. - Irugur Jn.	105	2nd Line
Tiruppur	Ingur	82.84	62	31.68	SR	SA	Erode Jn. - Irugur Jn.	105	2nd Line
Irugur	Tiruppur	82.84	62	32.57	SR	SA	Erode Jn. - Irugur Jn.	105	2nd Line
Magnesite Jn	Morappur	116.7	62	63.51	SR	SA	Jolarpettai Jn - Magnesite Jn.	106	2nd Line
Kozhikode	Kadalundi	85.93	56	14.48	SR	PGT	Shoranur Jn. - Kozhikode	75	2nd Line
Kadalundi	Tirur	85.93	56	26.36	SR	PGT	Shoranur Jn. - Kozhikode	75	2nd Line
Tirur	Kuttipuram	85.93	56	14.98	SR	PGT	Shoranur Jn. - Kozhikode	75	2nd Line
Kuttipuram	Shoranur Jn	85.93	56	29.83	SR	PGT	Shoranur Jn. - Kozhikode	75	2nd Line
Kayankulam Jn	Kollam Jn	40.84	64	43.06	SR	TVC	Kayankulam Jn. - Kollam Jn.	88	2nd Line
Palakkad Jn	Kanjikode	48.26	52	13.26	SR	PGT	Podanur Jn. - Palakkad Jn.	88	3rd Line
Kanjikode	Ettimadai	48.26	52	20.26	SR	PGT	Podanur Jn. - Palakkad Jn.	88	3rd Line
Podanur Jn	Ettimadai	48.26	52	14.41	SR	PGT	Podanur Jn. - Palakkad Jn.	88	3rd Line
Angamali for Kaladi	Ernakulam Town	71.54	65	25.69	SR	TVC	Thrisur - Ernakulam Town	116	3rd Line
Kasaragod	Kannur	129.06	56	86.04	SR	PGT	Kannur - Netravati	63	2nd Line
Kannur	Mahe	89.24	56	30.48	SR	PGT	Kozhikode - Kannur	72	2nd Line
Mahe	Kozhikode	89.24	56	58.96	SR	PGT	Kozhikode - Kannur	72	2nd Line
Netravathi	Kasaragod	129.06	56	40.29	SR	PGT	Kannur - Netravati	63	2nd Line
Mangalore Jn	Netravathi	3.11	52	4.66	SR	PGT	Netravati - Mangaluru Jn.	55	2nd Line
Kollam Jn	Thiruvananthapuram Central	64.48	60	61.50	SR	TVC	Kollam Jn. - Thiruvananthapuram Central	82	2nd Line
Ernakulam Town	Ernakulam Jn	2.5	54	2.78	SR	TVC	Ernakulam Town - Ernakulam Jn.	71	2nd Line
Ernakulam Jn	Alappuzha	57	27	56.78	SR	TVC	Ernakulam Jn. - Alappuzha	49	2nd Line
Podanur Jn	Irugur	10.77	28	11.16	SR	SA	Irugur Jn. - Podanur Jn.	21	Single Line
Karur	Erode	65.38	28	65.04	SR	SA	Erode Jn. - Karur Jn.	41	Single Line
Haripad	Kayankulam Jn	43.34	27	12.59	SR	TVC	Alappuzha - Kayankulam Jn.	43	2nd Line
Alappuzha	Haripad	43.34	27	29.89	SR	TVC	Alappuzha - Kayankulam Jn.	43	2nd Line

ANNEXURE 12.2: HUN Train Forecast by Section by Cardinal Years (Passengers + Freight)

HUN 1

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Rajendranagar T	Patna Saheb	0	1	1	24	175	1 (0 + 0)	1 (0 + 1)	24 (16 + 8)	175 (103 + 72)
Buxar	Ara Jn	142	149	175	235	426	149 (139 + 10)	175 (157 + 18)	235 (201 + 34)	426 (326 + 100)
Fatuha Jn	Bakhtiyarpur Jn	140	104	106	142	262	104 (84 + 20)	106 (81 + 25)	142 (120 + 22)	262 (187 + 75)
Dildarnagar Jn	Buxar	140	150	179	242	436	150 (137 + 13)	179 (154 + 25)	242 (177 + 65)	436 (321 + 115)
Mughal Sarai Jn	Dildarnagar Jn	140	152	182	242	435	152 (137 + 15)	182 (155 + 27)	242 (174 + 68)	435 (315 + 120)
Bihta	Danapur	152	197	236	320	594	197 (157 + 40)	236 (180 + 56)	320 (261 + 59)	594 (412 + 182)
Ara Jn	Bihta	152	197	236	320	594	197 (157 + 40)	236 (180 + 56)	320 (261 + 59)	594 (412 + 182)
Patna Saheb	Fatuha Jn	150	115	115	138	289	115 (94 + 21)	115 (87 + 28)	138 (121 + 17)	289 (208 + 81)
Kiul Jn	Jamui	130	117	115	172	248	117 (90 + 27)	115 (93 + 22)	172 (107 + 66)	248 (214 + 34)
Jamui	Jhajha	130	117	115	172	248	117 (90 + 27)	115 (93 + 22)	172 (107 + 66)	248 (214 + 34)
Sheikhpura	Luckeesarai Jn	42	42	48	129	150	42 (30 + 12)	48 (31 + 17)	129 (77 + 52)	150 (51 + 99)
Manpur Jn	Tilaiya Jn	42	44	50	120	155	44 (32 + 12)	50 (35 + 15)	120 (97 + 23)	155 (103 + 52)
Nawadah	Sheikhpura	42	42	48	129	137	42 (30 + 12)	48 (31 + 17)	129 (99 + 29)	137 (89 + 48)
Tilaiya Jn	Nawadah	42	41	47	128	136	41 (30 + 11)	47 (31 + 17)	128 (101 + 27)	136 (89 + 48)
Luckeesarai Jn	Kiul Jn	154	144	145	238	332	144 (111 + 34)	145 (111 + 34)	238 (149 + 89)	332 (213 + 120)
Luckeesarai Jn	Rampur Dumra Jn	154	146	141	260	314	146 (108 + 38)	141 (103 + 38)	260 (171 + 89)	314 (221 + 94)
Bakhtiyarpur Jn	Mokama Jn	126	96	98	134	258	96 (77 + 20)	98 (74 + 24)	134 (92 + 42)	258 (216 + 42)
Danapur	Patliputra	18	81	122	171	310	81 (47 + 35)	122 (80 + 42)	171 (98 + 73)	310 (182 + 127)
Patliputra	Phulwari sharif	18	38	53	76	145	38 (22 + 16)	53 (35 + 18)	76 (44 + 32)	145 (85 + 60)
Patna Jn	Danapur	154	125	125	163	356	125 (97 + 28)	125 (93 + 32)	163 (132 + 31)	356 (246 + 110)
Patna Jn	Rajendranagar T	154	119	119	142	293	119 (98 + 21)	119 (91 + 29)	142 (125 + 17)	293 (212 + 81)
Hatidah Jn	Rampur Dumra Jn	106	76	77	100	122	76 (70 + 7)	77 (66 + 11)	100 (83 + 16)	122 (106 + 16)
Tall Jn	Hatidah Jn	106	76	77	100	122	76 (70 + 7)	77 (66 + 11)	100 (83 + 16)	122 (106 + 16)
Mokama Jn	Tall Jn	130	100	102	138	262	100 (80 + 20)	102 (78 + 25)	138 (95 + 42)	262 (220 + 42)
Andal Jn	Ukhra	85	148	189	218	152	148 (40 + 109)	189 (52 + 136)	218 (77 + 141)	152 (84 + 68)
Jhajha	Jasidih Jn	132	133	131	188	264	133 (106 + 27)	131 (108 + 22)	188 (121 + 67)	264 (230 + 34)
Bhimgara Jn	Siuri	56	119	151	171	121	119 (34 + 85)	151 (44 + 108)	171 (75 + 96)	121 (74 + 47)
Siuri	Sainthia Jn	56	119	151	171	121	119 (34 + 85)	151 (44 + 108)	171 (75 + 96)	121 (74 + 47)
Pandabeswar	Bhimgara Jn	56	119	151	171	121	119 (34 + 85)	151 (44 + 108)	171 (75 + 96)	121 (74 + 47)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Madhupur Jn	Jamtara	149	142	141	201	272	142 (110 + 32)	141 (113 + 28)	201 (127 + 75)	272 (231 + 42)
Sitarampur Jn	Jamtara	149	142	141	201	272	142 (110 + 32)	141 (113 + 28)	201 (127 + 75)	272 (231 + 42)
Madhupur Jn	Jasidih Jn	149	139	138	199	268	139 (111 + 28)	138 (114 + 24)	199 (127 + 71)	268 (233 + 35)
Ukhra	Pandabeswar	73	119	151	171	121	119 (34 + 85)	151 (44 + 108)	171 (75 + 96)	121 (74 + 47)
Gadadharpur	Tarapith Road	143	264	282	321	258	264 (118 + 146)	282 (131 + 152)	321 (223 + 98)	258 (210 + 48)
Prantik	Ahmadpur Jn	120	104	143	156	170	104 (103 + 2)	143 (107 + 35)	156 (140 + 16)	170 (120 + 50)
Khana Jn	Prantik	120	104	143	156	170	104 (103 + 2)	143 (107 + 35)	156 (140 + 16)	170 (120 + 50)
Ahmadpur Jn	Sainthia Jn	120	176	168	191	192	176 (104 + 72)	168 (102 + 66)	191 (162 + 29)	192 (156 + 36)
Gumani	Nalhati Jn	134	210	239	259	337	210 (100 + 110)	239 (123 + 115)	259 (212 + 47)	337 (201 + 136)
Rampurhat Jn	Nalhati Jn	136	258	276	317	255	258 (113 + 145)	276 (125 + 151)	317 (218 + 98)	255 (206 + 49)
Sainthia Jn	Gadadharpur	143	258	274	307	246	258 (116 + 142)	274 (127 + 147)	307 (214 + 94)	246 (200 + 46)
Tarapith Road	Rampurhat Jn	139	260	278	317	254	260 (114 + 146)	278 (127 + 151)	317 (219 + 98)	254 (206 + 48)
Barharwa Jn	BoniDanga	37	28	31	65	68	28 (25 + 3)	31 (9 + 22)	65 (55 + 10)	68 (17 + 51)
BoniDanga Link Cabin	Gumani	37	88	159	186	139	88 (50 + 38)	159 (130 + 29)	186 (84 + 102)	139 (80 + 58)
Tinpahar Jn	Barharwa Jn	61	55	64	101	152	55 (46 + 9)	64 (55 + 9)	101 (84 + 18)	152 (87 + 65)
Sahibganj	Tinpahar Jn	61	45	46	86	106	45 (38 + 7)	46 (39 + 8)	86 (67 + 18)	106 (53 + 53)
Sultanganj	Bhagalpur Jn	69	76	87	138	174	76 (72 + 4)	87 (78 + 9)	138 (112 + 26)	174 (98 + 76)
Ratanpur	Sultanganj	69	76	87	138	174	76 (72 + 4)	87 (78 + 9)	138 (112 + 26)	174 (98 + 76)
BoniDanga	BoniDanga Link Cabin	89	106	173	202	167	106 (68 + 38)	173 (145 + 29)	202 (106 + 96)	167 (115 + 52)
Jamalpur Jn	Kiul Jn	63	71	80	131	203	71 (59 + 11)	80 (64 + 16)	131 (99 + 32)	203 (117 + 86)
Kahalgaon	Pirpainti	51	44	50	92	116	44 (36 + 8)	50 (41 + 9)	92 (71 + 21)	116 (57 + 59)
Bhagalpur Jn	Kahalgaon	51	37	41	77	91	37 (36 + 1)	41 (39 + 1)	77 (64 + 13)	91 (42 + 49)
Jamalpur Jn	Ratanpur	69	86	100	149	178	86 (70 + 16)	100 (76 + 24)	149 (102 + 46)	178 (85 + 93)
Pirpainti	Sahibganj	57	44	45	85	105	44 (36 + 8)	45 (37 + 8)	85 (66 + 20)	105 (52 + 54)
Sonipat	Adarsh Nagar Delhi	174	165	198	250	278	165 (148 + 18)	198 (169 + 29)	250 (204 + 46)	278 (200 + 78)
Sonipat	Panipat Jn	174	164	196	247	269	164 (148 + 17)	196 (169 + 27)	247 (204 + 43)	269 (197 + 72)
Kurukshetra Jn	Ambala Cantt Jn	147	146	167	204	231	146 (144 + 2)	167 (165 + 2)	204 (191 + 12)	231 (205 + 26)
Panipat Jn	Karnal	150	153	180	225	252	153 (140 + 13)	180 (161 + 20)	225 (196 + 29)	252 (199 + 53)
Karnal	Kurukshetra Jn	150	141	162	197	213	141 (139 + 2)	162 (159 + 3)	197 (192 + 5)	213 (190 + 23)
Adarsh Nagar Delhi	Sabji Mandi	140	150	212	230	243	150 (98 + 53)	212 (105 + 106)	230 (126 + 105)	243 (156 + 88)
Verka Jn	Amritsar Jn	37	55	68	85	133	55 (41 + 15)	68 (46 + 22)	85 (56 + 29)	133 (93 + 40)
Kathua	Bharoli Jn	91	82	91	131	175	82 (78 + 5)	91 (83 + 8)	131 (116 + 15)	175 (152 + 23)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Jammu Tawi	Kathua	91	81	89	127	169	81 (78 + 3)	89 (83 + 6)	127 (115 + 11)	169 (151 + 18)
Jalandhar city Jn	Jalandhar Cantt Jn	118	130	142	168	200	130 (106 + 23)	142 (109 + 33)	168 (128 + 40)	200 (137 + 63)
Kartarpur	Jalandhar city Jn	95	116	135	158	214	116 (93 + 24)	135 (100 + 35)	158 (109 + 48)	214 (148 + 66)
Beas Jn	Kartarpur	95	116	135	158	214	116 (93 + 24)	135 (100 + 35)	158 (109 + 48)	214 (148 + 66)
Amritsar Jn	Beas Jn	95	116	135	159	211	116 (93 + 24)	135 (100 + 35)	159 (110 + 48)	211 (146 + 65)
Phillaur Jn	Ludhiana Jn	170	223	271	361	436	223 (185 + 37)	271 (215 + 56)	361 (299 + 62)	436 (298 + 138)
Jalandhar Cantt Jn	Phagwara Jn	160	205	247	323	349	205 (177 + 29)	247 (205 + 43)	323 (271 + 51)	349 (256 + 93)
Phagwara Jn	Phillaur Jn	158	202	247	325	354	202 (171 + 32)	247 (198 + 48)	325 (269 + 56)	354 (251 + 103)
Ludhiana Jn	Sanehwal	172	192	227	261	272	192 (186 + 6)	227 (219 + 8)	261 (251 + 10)	272 (263 + 9)
Batala Jn	Verka Jn	29	30	33	48	85	30 (25 + 4)	33 (27 + 6)	48 (40 + 8)	85 (73 + 12)
Bharoli Jn	Gurdaspur	29	30	32	43	77	30 (29 + 0)	32 (31 + 0)	43 (43 + 1)	77 (76 + 1)
Gurdaspur	Batala Jn	29	26	27	38	71	26 (26 + 0)	27 (27 + 0)	38 (38 + 0)	71 (71 + 1)
Ayodhya Jn	Akbarpur Jn	53	66	74	94	127	66 (59 + 7)	74 (65 + 9)	94 (82 + 12)	127 (104 + 24)
Alambagh	Alamnagar	140	154	179	229	334	154 (143 + 12)	179 (163 + 16)	229 (209 + 20)	334 (311 + 23)
Ayodhya Jn	Faizabad Jn	63	72	87	115	158	72 (66 + 6)	87 (78 + 8)	115 (106 + 9)	158 (92 + 66)
Amethi	Chilbila Jn	68	77	77	88	98	77 (55 + 22)	77 (62 + 15)	88 (84 + 5)	98 (77 + 21)
Rai Bareli Jn	Gauriganj	68	57	62	101	101	57 (56 + 1)	62 (61 + 1)	101 (100 + 1)	101 (99 + 2)
Amethi	Gauriganj	68	57	62	101	101	57 (56 + 1)	62 (61 + 1)	101 (100 + 1)	101 (99 + 2)
Dalmau Jn	Unchahar Jn	10	8	8	9	16	8 (8 + 0)	8 (8 + 0)	9 (9 + 0)	16 (16 + 0)
Lucknow	Dilkusha Cabin	219	257	292	354	454	257 (187 + 70)	292 (189 + 103)	354 (283 + 72)	454 (338 + 116)
BaraBanki Jn	Rudauli	60	64	70	86	145	64 (62 + 2)	70 (68 + 3)	86 (82 + 4)	145 (87 + 58)
Rudauli	Faizabad Jn	60	64	70	86	145	64 (62 + 2)	70 (68 + 3)	86 (82 + 4)	145 (87 + 58)
Janghai Jn	Phaphamau Jn	45	63	65	73	76	63 (60 + 3)	65 (62 + 2)	73 (64 + 9)	76 (65 + 11)
Pratapgarh Jn	Janghai Jn	48	57	54	61	68	57 (33 + 24)	54 (36 + 17)	61 (57 + 4)	68 (48 + 20)
Alambagh	Lucknow	231	281	328	410	404	281 (212 + 69)	328 (226 + 101)	410 (328 + 82)	404 (334 + 70)
Chilbila Jn	Pratapgarh Jn	76	95	94	107	116	95 (69 + 25)	94 (77 + 17)	107 (100 + 7)	116 (90 + 26)
Utratia Jn	Rai Bareli Jn	74	60	66	84	107	60 (59 + 2)	66 (64 + 1)	84 (79 + 5)	107 (102 + 5)
Rai Bareli Jn	Daryapur Jn	21	25	27	66	64	25 (19 + 6)	27 (21 + 6)	66 (55 + 11)	64 (48 + 16)
Daryapur Jn	Unchahar Jn	21	21	22	32	44	21 (16 + 5)	22 (17 + 6)	32 (20 + 12)	44 (30 + 15)
Shahganj Jn	Akbarpur Jn	57	67	74	91	119	67 (62 + 5)	74 (67 + 6)	91 (82 + 9)	119 (107 + 12)
AkbarGanj	Adhinpur	66	61	68	108	153	61 (55 + 6)	68 (62 + 6)	108 (96 + 12)	153 (140 + 12)
Utratia Jn	Chhandrauli	66	63	70	109	155	63 (56 + 8)	70 (55 + 15)	109 (85 + 25)	155 (145 + 10)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Chhandrauli	AkbarGanj	66	63	70	109	155	63 (56 + 8)	70 (55 + 15)	109 (85 + 25)	155 (145 + 10)
Sultanpur Jn	Adhinpur	66	59	66	102	146	59 (55 + 4)	66 (62 + 4)	102 (89 + 13)	146 (131 + 15)
Unchahar Jn	Phaphamau Jn	25	21	22	32	52	21 (16 + 5)	22 (17 + 6)	32 (21 + 11)	52 (38 + 13)
Unnao Jn	Lalganj	16	20	22	55	48	20 (20 + 0)	22 (21 + 1)	55 (54 + 1)	48 (46 + 2)
Lalganj	Dalmau Jn	16	20	22	55	48	20 (20 + 0)	22 (21 + 1)	55 (54 + 1)	48 (46 + 2)
Dilkusha Cabin	Utratia Jn	108	118	131	186	234	118 (113 + 5)	131 (117 + 14)	186 (162 + 24)	234 (223 + 11)
Zafarabad Jn	Varanasi Jn	104	92	103	165	235	92 (85 + 7)	103 (91 + 12)	165 (139 + 26)	235 (216 + 19)
Janghai Jn	Bhadohi	71	92	88	102	107	92 (66 + 25)	88 (72 + 17)	102 (94 + 8)	107 (86 + 21)
Bhadohi	Varanasi Jn	71	60	59	55	71	60 (41 + 19)	59 (39 + 19)	55 (53 + 3)	71 (56 + 15)
Jaunpur Jn	Zafarabad Jn	71	78	84	90	119	78 (70 + 8)	84 (71 + 13)	90 (74 + 16)	119 (97 + 22)
Shahganj Jn	Jaunpur Jn	71	76	81	86	113	76 (70 + 7)	81 (72 + 9)	86 (73 + 13)	113 (92 + 20)
Zafarabad Jn	Sultanpur Jn	61	52	59	115	167	52 (51 + 1)	59 (57 + 2)	115 (101 + 14)	167 (162 + 5)
Hardoi	Balamau Jn	158	155	179	232	356	155 (139 + 16)	179 (159 + 20)	232 (212 + 20)	356 (340 + 16)
Roza Jn	Hardoi	158	154	177	227	345	154 (139 + 15)	177 (159 + 18)	227 (207 + 19)	345 (326 + 19)
Raja Ka Sahaspur Jn	Chandausi Jn	31	25	25	30	50	25 (25 + 0)	25 (25 + 0)	30 (28 + 2)	50 (42 + 8)
Khanalampura west	Roorkee	142	125	149	196	212	125 (112 + 13)	149 (129 + 20)	196 (160 + 36)	212 (182 + 29)
Laksar Jn	Roorkee	142	123	146	186	214	123 (114 + 8)	146 (134 + 11)	186 (165 + 21)	214 (200 + 15)
Rahimabad	Alamnagar	164	159	183	235	354	159 (143 + 16)	183 (163 + 20)	235 (215 + 21)	354 (325 + 29)
Seohara	Dhampur	118	102	130	166	197	102 (100 + 2)	130 (126 + 4)	166 (159 + 7)	197 (188 + 9)
Moradabad Jn	Seohara	118	102	130	166	197	102 (100 + 2)	130 (126 + 4)	166 (159 + 7)	197 (188 + 9)
Laksar Jn	Muzzampur Narain Jn	122	106	131	163	191	106 (101 + 4)	131 (126 + 5)	163 (155 + 8)	191 (158 + 33)
Muzzampur Narain Jn	Najibabad Jn	128	113	141	175	205	113 (107 + 6)	141 (130 + 10)	175 (158 + 17)	205 (180 + 25)
Balamau Jn	Rahimabad	163	158	182	234	353	158 (142 + 16)	182 (162 + 20)	234 (214 + 21)	353 (324 + 29)
Moradabad Jn	Raja Ka Sahaspur Jn	39	37	40	47	69	37 (33 + 5)	40 (33 + 7)	47 (36 + 11)	69 (49 + 19)
Bareilly Jn	Ramganga Bridge	24	37	54	57	93	37 (29 + 8)	54 (27 + 27)	57 (22 + 35)	93 (78 + 15)
Chandausi Jn	Ramganga Bridge	33	44	48	58	86	44 (44 + 0)	48 (47 + 0)	58 (49 + 9)	86 (78 + 8)
Shahjahanpur Jn	Roza Jn	182	237	273	316	449	237 (178 + 59)	273 (204 + 69)	316 (236 + 80)	449 (357 + 92)
Chaneti	Shahjahanpur Jn	175	229	264	304	433	229 (170 + 59)	264 (195 + 69)	304 (224 + 79)	433 (342 + 91)
Bareilly Jn	Chaneti	175	171	213	253	267	171 (153 + 17)	213 (168 + 45)	253 (189 + 64)	267 (235 + 33)
Morinda	Chandigarh	24	33	36	115	87	33 (30 + 2)	36 (32 + 5)	115 (82 + 33)	87 (82 + 5)
Chandigarh	Dhappar	68	79	96	135	148	79 (79 + 0)	96 (96 + 0)	135 (131 + 4)	148 (99 + 49)
Dhappar	Ambala Cantt Jn	68	79	96	129	138	79 (79 + 0)	96 (96 + 0)	129 (125 + 3)	138 (90 + 48)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Rajpura Jn	Ambala Cantt Jn	213	193	220	265	297	193 (184 + 9)	220 (209 + 11)	265 (257 + 8)	297 (256 + 41)
Sanehwal	Morinda	22	24	27	102	104	24 (24 + 0)	27 (27 + 0)	102 (64 + 38)	104 (54 + 51)
Ambala Cantt Jn	Jagadhri	129	124	149	196	234	124 (109 + 15)	149 (130 + 19)	196 (167 + 29)	234 (148 + 85)
Khanalampura west	Saharanpur Jn	113	104	127	170	203	104 (90 + 14)	127 (108 + 20)	170 (132 + 37)	203 (122 + 82)
Sirhind Jn	Rajpura Jn	174	167	192	238	265	167 (155 + 12)	192 (178 + 14)	238 (219 + 19)	265 (237 + 28)
Jagadhri	Saharanpur Jn	136	125	152	201	241	125 (109 + 16)	152 (130 + 22)	201 (166 + 34)	241 (149 + 92)
Sanehwal	Doraha	142	244	297	321	365	244 (143 + 101)	297 (164 + 133)	321 (178 + 143)	365 (276 + 89)
Doraha	Sirhind Jn	142	162	190	218	241	162 (147 + 14)	190 (169 + 20)	218 (202 + 16)	241 (226 + 15)
Najibabad Jn	Dhampur	118	98.70232	124.2456 1	155.7911 8	183.0769 2	99 (73 + 26)	124 (85 + 40)	156 (97 + 59)	183 (106 + 77)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Barkichampi	Lohardaga	0	98	50	112	120	98 (15 + 83)	50 (45 + 5)	112 (89 + 23)	120 (102 + 18)
Nayagarh	Jaroli	0	17	2	9	40	17 (1 + 16)	2 (2 + 0)	9 (9 + 0)	40 (40 + 0)
Khandwa jn	Burhanpur	103	221	271	313	381	221 (214 + 6)	271 (247 + 24)	313 (284 + 29)	381 (331 + 50)
Bhusawal jn	Burhanpur	103	221	272	315	378	221 (215 + 7)	272 (247 + 25)	315 (285 + 31)	378 (330 + 48)
Jalgaon Jn	Bhusawal jn	179	378	354	553	751	378 (285 + 92)	354 (330 + 24)	553 (525 + 28)	751 (701 + 50)
Jakhapura Jn	Sukinda Road	48	28	89	125	179	28 (9 + 19)	89 (9 + 80)	125 (14 + 111)	179 (42 + 137)
Kendujhargarh	Nayagarh	8	21	6	13	44	21 (5 + 16)	6 (6 + 0)	13 (13 + 0)	44 (44 + 0)
Baghuapal	Tomka Jn	60	55	99	144	214	55 (10 + 45)	99 (12 + 87)	144 (22 + 122)	214 (55 + 159)
Sukinda Road	Baghuapal	60	55	98	143	212	55 (10 + 44)	98 (12 + 87)	143 (22 + 121)	212 (55 + 157)
Tomka Jn	Kendujhargarh	45	9	10	34	55	9 (9 + 0)	10 (10 + 0)	34 (15 + 19)	55 (34 + 21)
Barkakana Jn	Patratu	86	65	58	113	188	65 (63 + 3)	58 (56 + 2)	113 (108 + 5)	188 (184 + 4)
Garhwa Road Jn	Kajri	112	135	90	175	203	135 (121 + 14)	90 (83 + 8)	175 (153 + 21)	203 (195 + 9)
Daltonganj	Barwadih	112	134	89	172	207	134 (123 + 11)	89 (84 + 5)	172 (156 + 17)	207 (201 + 6)
Kajri	Daltonganj	112	133	88	170	200	133 (122 + 11)	88 (82 + 5)	170 (153 + 17)	200 (194 + 6)
Chopan	Billi Jn	87	84	104	94	189	84 (59 + 25)	104 (75 + 29)	94 (56 + 38)	189 (123 + 66)
Billi Jn	Obra dam	63	109	169	213	219	109 (73 + 36)	169 (116 + 52)	213 (133 + 80)	219 (155 + 64)
Meralgram	Garhwa Road Jn	64	115	160	240	203	115 (83 + 33)	160 (114 + 46)	240 (186 + 54)	203 (164 + 38)
Singrauli Jn	Karaila Road Jn	63	99	159	207	213	99 (63 + 36)	159 (106 + 52)	207 (125 + 82)	213 (147 + 66)
Renukut	Meralgram	66	115	161	241	204	115 (83 + 33)	161 (114 + 47)	241 (186 + 55)	204 (165 + 39)
Obra dam	Karaila Road Jn	84	109	169	217	223	109 (73 + 36)	169 (116 + 52)	217 (135 + 81)	223 (158 + 65)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Tori	Patratu	78	45	38	92	167	45 (42 + 3)	38 (36 + 2)	92 (88 + 5)	167 (163 + 4)
Dhanbad Jn	Pradhankhunta Jn	126	98	104	112	129	98 (98 + 0)	104 (104 + 0)	112 (112 + 0)	129 (129 + 0)
Pradhankhunta Jn	Pathardih	27	10	10	10	10	10 (10 + 0)	10 (10 + 0)	10 (10 + 0)	10 (9 + 1)
Billi Jn	Renukut	67	115	161	241	204	115 (83 + 33)	161 (114 + 47)	241 (186 + 55)	204 (165 + 39)
Latehar	Tori	107	115	79	129	161	115 (111 + 4)	79 (76 + 3)	129 (121 + 9)	161 (158 + 3)
Barwadih	Latehar	107	115	79	129	160	115 (111 + 4)	79 (76 + 3)	129 (120 + 9)	160 (157 + 3)
Sonnagar Jn	Garhwa Road Jn	69	164	173	320	316	164 (99 + 64)	173 (112 + 60)	320 (227 + 93)	316 (264 + 53)
Robertsganj	Chopan	21	32	52	42	137	32 (12 + 21)	52 (21 + 31)	42 (17 + 25)	137 (67 + 71)
Chunar jn	Robertsganj	21	32	52	42	137	32 (12 + 21)	52 (21 + 31)	42 (17 + 25)	137 (67 + 71)
Allahabad Jn	Naini Jn	218	210	234	282	420	210 (196 + 14)	234 (221 + 13)	282 (250 + 32)	420 (379 + 41)
Manikpur Jn	Link Jn Cabin	78	168	189	231	298	168 (148 + 21)	189 (183 + 7)	231 (198 + 33)	298 (255 + 42)
Naini Jn	Link Jn Cabin	78	118	128	146	190	118 (109 + 9)	128 (121 + 7)	146 (122 + 24)	190 (163 + 27)
Link Jn Cabin	Chheoki	78	99	110	127	138	99 (86 + 13)	110 (105 + 5)	127 (111 + 16)	138 (117 + 22)
Allahabad Jn	Varanasi Jn	64	54	57	74	94	54 (54 + 0)	57 (57 + 0)	74 (74 + 0)	94 (94 + 0)
Varanasi Jn	Block Hut B	123	124	154	265	374	124 (91 + 33)	154 (109 + 44)	265 (147 + 118)	374 (252 + 122)
Block Hut B	Mughal Sarai Jn	123	123	153	258	359	123 (90 + 33)	153 (109 + 44)	258 (145 + 114)	359 (237 + 122)
Garhdhrubeswar	Adra Jn	39	36	35	35	35	36 (34 + 2)	35 (34 + 0)	35 (34 + 1)	35 (34 + 1)
Sanka	Adra Jn	35	27	28	44	64	27 (25 + 2)	28 (26 + 2)	44 (41 + 3)	64 (61 + 3)
Anara Jn	Garhdhrubeswar	97	90	64	83	124	90 (55 + 35)	64 (63 + 1)	83 (80 + 2)	124 (121 + 3)
Purulia Jn	Anara Jn	119	163	67	89	169	163 (47 + 116)	67 (67 + 0)	89 (88 + 1)	169 (167 + 1)
Pathardih	Bhojudin Jn	6	7	9	29	70	7 (7 + 0)	9 (9 + 0)	29 (29 + 0)	70 (70 + 0)
Burnpur	Asansol jn	54	51	58	82	108	51 (51 + 0)	58 (58 + 0)	82 (82 + 0)	108 (108 + 0)
Damodar Jn	Burnpur	55	51	58	82	108	51 (51 + 0)	58 (58 + 0)	82 (82 + 0)	108 (108 + 0)
Garhdhrubeswar	Joychandipahar	61	54	29	48	89	54 (22 + 33)	29 (29 + 1)	48 (46 + 2)	89 (87 + 2)
Joychandipahar	Ramkanali Jn	103	83	59	86	131	83 (50 + 33)	59 (58 + 1)	86 (83 + 3)	131 (128 + 3)
Bankura Jn	Bishnupur Jn	68	53	54	81	105	53 (49 + 3)	54 (52 + 2)	81 (76 + 5)	105 (101 + 4)
Bishnupur Jn	Bhadutala PH	68	52	54	81	104	52 (48 + 3)	54 (52 + 2)	81 (76 + 5)	104 (101 + 4)
Bhadutala PH	Midnapore	68	52	54	81	104	52 (48 + 3)	54 (52 + 2)	81 (76 + 5)	104 (101 + 4)
Chhatna	Adra Jn	68	52	52	77	100	52 (48 + 3)	52 (50 + 2)	77 (72 + 5)	100 (96 + 4)
Chhatna	Bankura Jn	68	52	52	77	100	52 (48 + 3)	52 (50 + 2)	77 (72 + 5)	100 (96 + 4)
Purulia Jn	Chandil Jn	124	157	60	75	170	157 (36 + 121)	60 (57 + 3)	75 (71 + 4)	170 (162 + 8)
Kotshila Jn	Purulia Jn	28	31	35	46	63	31 (17 + 13)	35 (34 + 0)	46 (44 + 2)	63 (59 + 3)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Ramkanali Jn	Damodar Jn	101	83	59	86	131	83 (50 + 33)	59 (58 + 1)	86 (83 + 3)	131 (128 + 3)
Rukni Jn	Bhojudin Jn	63	102	35	59	122	102 (20 + 82)	35 (31 + 4)	59 (54 + 5)	122 (115 + 6)
Rukni Jn	Sanka	41	27	28	44	66	27 (25 + 2)	28 (26 + 2)	44 (41 + 3)	66 (63 + 3)
Bimalgarh Jn	Barsuan	15	4	4	4	4	4 (4 + 0)	4 (4 + 0)	4 (4 + 0)	4 (4 + 0)
Champajharan	Bondamunda PH	35	85	15	46	133	85 (11 + 73)	15 (13 + 2)	46 (5 + 41)	133 (14 + 119)
Patasahi	Champajharan	35	54	13	17	50	54 (54 + 0)	13 (13 + 0)	17 (17 + 0)	50 (50 + 0)
Bimalgarh Jn	Patasahi	35	54	13	17	50	54 (54 + 0)	13 (13 + 0)	17 (17 + 0)	50 (50 + 0)
Bondamunda PH	Nawagaon	40	75	57	93	115	75 (55 + 21)	57 (33 + 24)	93 (81 + 12)	115 (79 + 37)
Dangoaposi	Padapahar Jn	100	31	16	23	54	31 (15 + 16)	16 (16 + 0)	23 (23 + 0)	54 (54 + 0)
Chandil Jn	Manikui	129	164	68	97	211	164 (39 + 125)	68 (65 + 3)	97 (81 + 17)	211 (202 + 10)
Manikui	Kandra Jn	129	164	68	97	211	164 (39 + 125)	68 (65 + 3)	97 (81 + 17)	211 (202 + 10)
Jaroli	Padapahar Jn	54	21	6	13	44	21 (5 + 16)	6 (6 + 0)	13 (13 + 0)	44 (44 + 0)
Rajkharswan Jn	Dangoaposi	104	12	12	14	45	12 (12 + 0)	12 (12 + 0)	14 (14 + 0)	45 (14 + 30)
Kandra Jn	Sini Jn	65	91	12	23	113	91 (5 + 86)	12 (10 + 3)	23 (17 + 6)	113 (106 + 7)
Midnapore	Gokulpur	78	87	99	143	176	87 (71 + 16)	99 (78 + 21)	143 (115 + 28)	176 (148 + 27)
Kharagpur Jn	Gokulpur	53	59	66	102	129	59 (59 + 0)	66 (66 + 0)	102 (102 + 0)	129 (129 + 0)
Nawagaon	Hatia	40	75	57	93	115	75 (55 + 21)	57 (33 + 24)	93 (81 + 12)	115 (79 + 37)
Kotshila Jn	Muri Jn	83	80	71	87	118	80 (62 + 18)	71 (56 + 16)	87 (68 + 20)	118 (95 + 24)
Muri Jn	Ramgarh Cantt	35	18	22	33	44	18 (17 + 1)	22 (21 + 1)	33 (30 + 4)	44 (42 + 3)
Ramgarh Cantt	Barkakana Jn	35	18	22	33	44	18 (17 + 1)	22 (21 + 1)	33 (30 + 4)	44 (42 + 3)
Namkom	Tatisilwai	85	96	90	146	225	96 (73 + 22)	90 (72 + 18)	146 (105 + 42)	225 (184 + 41)
Tatisilwai	Burwadag	85	82	72	91	129	82 (63 + 19)	72 (58 + 14)	91 (65 + 26)	129 (106 + 23)
Burwadag	Muri Jn	85	82	72	91	129	82 (63 + 19)	72 (58 + 14)	91 (65 + 26)	129 (106 + 23)
Ranchi Jn	Namkom	85	75	98	136	121	75 (73 + 2)	98 (98 + 0)	136 (136 + 0)	121 (120 + 1)
Ranchi Jn	Hatia	85	102	68	88	90	102 (102 + 0)	68 (68 + 0)	88 (88 + 0)	90 (90 + 0)
Lohardaga	Ranchi Jn	11	60	51	70	48	60 (51 + 9)	51 (51 + 0)	70 (68 + 1)	48 (47 + 1)
Harda	Itarsi jn	144	238	291	353	450	238 (229 + 9)	291 (281 + 11)	353 (331 + 23)	450 (408 + 42)
Khandwa jn	Talvadya	144	243	304	354	442	243 (235 + 8)	304 (291 + 13)	354 (330 + 24)	442 (402 + 40)
Khirkiya	Harda	144	237	291	348	440	237 (228 + 9)	291 (280 + 11)	348 (325 + 23)	440 (398 + 42)
Talvadya	Khirkiya	144	125	125	226	275	125 (118 + 7)	125 (115 + 10)	226 (205 + 21)	275 (263 + 13)
Narsinghpur	Itarsi jn	98	196	250	233	257	196 (193 + 3)	250 (247 + 3)	233 (223 + 10)	257 (242 + 15)
Shridham	Narsinghpur	98	194	248	226	250	194 (192 + 3)	248 (246 + 2)	226 (217 + 8)	250 (238 + 12)
Jabalpur Jn	Shridham	98	188	240	204	220	188 (187 + 1)	240 (239 + 1)	204 (204 + 1)	220 (219 + 1)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Jabalpur Jn	Katni Jn	114	229	291	287	349	229 (224 + 5)	291 (285 + 5)	287 (277 + 9)	349 (340 + 9)
Satna Jn	Manikpur Jn	127	206	228	264	304	206 (185 + 22)	228 (209 + 18)	264 (231 + 33)	304 (267 + 37)
Satna Jn	Katni Jn	117	206	226	310	336	206 (194 + 13)	226 (215 + 11)	310 (287 + 23)	336 (310 + 26)
Mahadiya	Singrauli Jn	37	64	141	141	151	64 (50 + 14)	141 (94 + 47)	141 (85 + 56)	151 (105 + 46)
New Katni Jn	Mahadiya	37	56	106	105	99	56 (47 + 9)	106 (90 + 16)	105 (84 + 21)	99 (79 + 20)
Dharangaon	Jalgaon Jn	79	263	275	347	441	263 (185 + 78)	275 (256 + 19)	347 (321 + 26)	441 (396 + 45)
Nandurbar	Hol	79	270	267	266	322	270 (186 + 84)	267 (259 + 8)	266 (256 + 10)	322 (297 + 25)
Hol	Nardana	79	273	268	284	321	273 (189 + 84)	268 (260 + 9)	284 (273 + 11)	321 (292 + 29)
Nardana	Amalner	79	273	268	284	321	273 (189 + 84)	268 (260 + 9)	284 (273 + 11)	321 (292 + 29)
Amalner	Dharangaon	79	273	268	284	321	273 (189 + 84)	268 (260 + 9)	284 (273 + 11)	321 (292 + 29)
Udhna Jn	Chalthan	77	279	294	320	363	279 (191 + 88)	294 (263 + 32)	320 (270 + 50)	363 (312 + 51)
Chalthan	Vyara	77	272	269	267	323	272 (189 + 84)	269 (262 + 7)	267 (258 + 9)	323 (299 + 24)
Vyara	Ukai Songadh	77	272	269	267	323	272 (189 + 84)	269 (262 + 7)	267 (258 + 9)	323 (299 + 24)
Chinchpada	Nandurbar	82	274	271	269	325	274 (190 + 84)	271 (263 + 8)	269 (260 + 10)	325 (301 + 25)
Ukai Songadh	Chinchpada	82	273	270	268	323	273 (189 + 84)	270 (263 + 7)	268 (259 + 9)	323 (300 + 23)
Tatisilwai	Barkakana Jn	84.8	71.61439	75.97415	113.70496	153.21631	72 (55 + 17)	76 (61 + 15)	114 (81 + 32)	153 (125 + 28)

HUN 3

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Gaya Jn	Manpur Jn	122	106	123	266	381	106 (74 + 32)	123 (84 + 39)	266 (212 + 54)	381 (275 + 106)
Rewari Jn	Jhajjar	9	10	12	13	30	10 (8 + 2)	12 (9 + 3)	13 (5 + 7)	30 (22 + 8)
Jhajjar	Asthal Bohar Jn	9	11	13	14	33	11 (10 + 1)	13 (11 + 2)	14 (6 + 8)	33 (25 + 8)
Garhi Harsaru Jn	Gurgaon	108	112	129	173	204	112 (101 + 11)	129 (109 + 20)	173 (143 + 30)	204 (161 + 42)
Gurgaon	Delhi Cantt	108	96	105	129	161	96 (95 + 2)	105 (102 + 3)	129 (127 + 2)	161 (147 + 14)
Rewari Jn	Garhi Harsaru Jn	108	130	157	213	260	130 (102 + 29)	157 (109 + 48)	213 (145 + 68)	260 (176 + 84)
Gohana	Panipat Jn	12	12	12	13	26	12 (12 + 0)	12 (12 + 0)	13 (13 + 0)	26 (25 + 0)
Rohtak Jn	Gohana	12	12	12	13	26	12 (12 + 0)	12 (12 + 0)	13 (13 + 1)	26 (26 + 0)
Asthal Bohar Jn	Rohtak Jn	128	78	93	137	230	78 (43 + 36)	93 (45 + 48)	137 (66 + 71)	230 (158 + 72)
Swarupganj	Abu Road	71	56	64	94	161	56 (48 + 8)	64 (52 + 11)	94 (81 + 13)	161 (130 + 32)
Ajmer Jn	Madar	55	68	76	144	190	68 (68 + 0)	76 (76 + 0)	144 (144 + 0)	190 (190 + 0)
Beawar	Daurai	58	49	59	96	164	49 (38 + 11)	59 (41 + 18)	96 (73 + 23)	164 (125 + 40)
Mori bera	Swarupganj	71	47	51	96	132	47 (47 + 0)	51 (51 + 0)	96 (96 + 0)	132 (124 + 8)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Daurai	Ajmer Jn	37	49	59	95	88	49 (38 + 11)	59 (41 + 18)	95 (73 + 23)	88 (60 + 28)
Chandawal	Beawar	58	38	41	79	124	38 (38 + 0)	41 (41 + 0)	79 (79 + 0)	124 (124 + 0)
Marwar Jn	Chandawal	58	111	127	177	183	111 (40 + 71)	127 (46 + 81)	177 (102 + 75)	183 (110 + 73)
Abu Road	Palanpur Jn	66	50	54	93	136	50 (50 + 0)	54 (54 + 0)	93 (93 + 0)	136 (136 + 0)
Marwar Jn	Mori bera	71	47	51	96	132	47 (47 + 0)	51 (51 + 0)	96 (96 + 0)	132 (124 + 8)
Alwar Jn	Bandikui Jn	54	61	67	105	132	61 (59 + 2)	67 (64 + 3)	105 (101 + 4)	132 (114 + 18)
Dausa	Jaipur Jn	84	95	117	188	229	95 (81 + 14)	117 (94 + 23)	188 (143 + 45)	229 (180 + 49)
Dausa	Bandikui Jn	84	92	115	168	201	92 (85 + 7)	115 (97 + 18)	168 (150 + 18)	201 (164 + 37)
Jaipur Jn	Phulera Jn	110	108	124	185	231	108 (89 + 19)	124 (95 + 29)	185 (137 + 48)	231 (185 + 46)
Phulera Jn	Madar	94	71	77	136	178	71 (71 + 0)	77 (77 + 0)	136 (136 + 0)	178 (174 + 4)
Alwar Jn	Rewari Jn	64	64	79	98	137	64 (57 + 7)	79 (63 + 16)	98 (73 + 25)	137 (89 + 47)
Sabarmati Jn	Ahmedabad Jn	6	15	20	26	44	15 (6 + 9)	20 (6 + 14)	26 (5 + 21)	44 (21 + 23)
Viramgam Jn	Chandlodiya	124	163	206	278	362	163 (84 + 79)	206 (88 + 117)	278 (92 + 186)	362 (116 + 245)
Vatva	Geratpur	194	188	215	291	399	188 (181 + 7)	215 (205 + 10)	291 (274 + 17)	399 (376 + 23)
Dhrangadhra Jn	Khakhrechi	54	26	28	104	186	26 (25 + 2)	28 (26 + 2)	104 (27 + 77)	186 (70 + 116)
Maliya Miyana Jn	Khakhrechi	54	40	55	122	172	40 (25 + 15)	55 (26 + 30)	122 (28 + 94)	172 (58 + 114)
Dhrangadhra Jn	Jhund Jn	54	24	25	100	173	24 (24 + 0)	25 (25 + 0)	100 (27 + 74)	173 (62 + 110)
Mahesana Jn	Ambliyasan Jn	76	87	98	141	193	87 (83 + 5)	98 (91 + 6)	141 (135 + 6)	193 (180 + 13)
Ambliyasan Jn	Kalol Jn	76	87	98	148	195	87 (83 + 4)	98 (93 + 6)	148 (141 + 7)	195 (181 + 14)
Ahmedabad Jn	Kankariya	208	190	217	293	401	190 (183 + 7)	217 (207 + 10)	293 (276 + 17)	401 (378 + 23)
Kalol Jn	Khodiyar Jn	74	85	96	146	189	85 (81 + 4)	96 (91 + 6)	146 (139 + 7)	189 (175 + 14)
Mahesana Jn	Palanpur Jn	80	77	86	138	217	77 (77 + 0)	86 (86 + 0)	138 (138 + 0)	217 (217 + 0)
Samakhiali Jn	Maliya Miyana Jn	58	44	59	126	178	44 (29 + 15)	59 (30 + 30)	126 (32 + 94)	178 (62 + 116)
Chandlodiya	Sabarmati Jn	137	151	186	235	334	151 (97 + 54)	186 (101 + 85)	235 (103 + 131)	334 (131 + 203)
Sabarmati Jn	Khodiyar Jn	66	81	91	140	175	81 (80 + 0)	91 (90 + 1)	140 (139 + 1)	175 (171 + 4)
Kankariya	Vatva	217	188	215	291	399	188 (181 + 7)	215 (205 + 10)	291 (274 + 17)	399 (376 + 23)
Jhund Jn	Viramgam Jn	54	25	25	99	173	25 (24 + 0)	25 (25 + 0)	99 (26 + 73)	173 (62 + 110)
Kanjari Boriyavi Jn	Anand Jn	200	183	207	277	379	183 (181 + 2)	207 (204 + 2)	277 (271 + 6)	379 (374 + 5)
Bajva	Vasad Jn	179	166	184	259	365	166 (164 + 2)	184 (180 + 4)	259 (250 + 9)	365 (357 + 8)
Geratpur	Nadiad Jn	196	185	212	288	396	185 (178 + 7)	212 (202 + 10)	288 (271 + 17)	396 (373 + 23)
Nadiad Jn	Kanjari Boriyavi Jn	196	179	203	273	375	179 (177 + 2)	203 (200 + 2)	273 (267 + 6)	375 (370 + 5)
Bajva	Vadodara C	179	184	208	297	417	184 (164 + 20)	208 (181 + 27)	297 (261 + 36)	417 (363 + 54)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Vadodara C	Vadodara D	317	261	281	398	470	261 (252 + 9)	281 (268 + 13)	398 (375 + 23)	470 (447 + 23)
Vasad Jn	Anand Jn	175	162	180	255	361	162 (160 + 2)	180 (176 + 4)	255 (246 + 9)	361 (353 + 8)
Surendranagar Jn	Than	67	132	169	171	177	132 (61 + 70)	169 (67 + 103)	171 (60 + 111)	177 (62 + 115)
Than	Wankaner Jn	67	132	169	171	177	132 (61 + 70)	169 (67 + 103)	171 (60 + 111)	177 (62 + 115)
Surendranagar Jn	Viramgam Jn	90	149	192	209	237	149 (70 + 80)	192 (75 + 118)	209 (69 + 140)	237 (71 + 166)
Wankaner Jn	Rajkot City	69	142	191	259	297	142 (61 + 81)	191 (66 + 126)	259 (72 + 188)	297 (81 + 215)
Dausa	Gangapur city	84	74	76	91	167	74 (64 + 9)	76 (65 + 11)	91 (78 + 13)	167 (139 + 28)

HUN 4

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Adipur Jn	Mundra Port R&D yard	0	33	50	67	110	33 (0 + 33)	50 (0 + 50)	67 (0 + 67)	110 (0 + 110)
Bathinda Jn	Sadda Singhwala	46	88	113	171	176	88 (25 + 63)	113 (28 + 85)	171 (45 + 126)	176 (85 + 92)
Sadda Singhwala	Mansa	46	96	124	182	187	96 (34 + 62)	124 (39 + 85)	182 (57 + 125)	187 (95 + 92)
Mansa	Jakhal Jn	46	97	124	183	188	97 (34 + 62)	124 (39 + 85)	183 (57 + 126)	188 (95 + 93)
Firozpur Cantt Jn	Faridkot	36	25	26	34	57	25 (21 + 4)	26 (19 + 6)	34 (19 + 15)	57 (45 + 13)
Faridkot	Kot Kapura Jn	36	25	26	34	57	25 (21 + 4)	26 (19 + 6)	34 (19 + 15)	57 (45 + 13)
Kot Kapura Jn	Bathinda Jn	49	58	64	81	107	58 (33 + 25)	64 (33 + 31)	81 (36 + 45)	107 (73 + 34)
Jakhal Jn	Hisar Jn	25	125	156	169	83	125 (121 + 4)	156 (141 + 15)	169 (140 + 30)	83 (44 + 39)
Ratangarh jn	Churu Jn	28	23	25	35	52	23 (22 + 1)	25 (24 + 1)	35 (33 + 2)	52 (42 + 9)
Bhattu	Hisar Jn	20	18	20	25	36	18 (17 + 1)	20 (18 + 2)	25 (22 + 3)	36 (29 + 7)
Suchan Kotli	Bhattu	20	18	20	25	38	18 (17 + 1)	20 (18 + 2)	25 (22 + 3)	38 (33 + 5)
Sirsa	Suchan Kotli	20	18	20	25	38	18 (17 + 1)	20 (18 + 2)	25 (22 + 3)	38 (33 + 5)
Churu Jn	Sadulpur Jn	26	20	22	34	46	20 (20 + 0)	22 (22 + 0)	34 (33 + 1)	46 (40 + 6)
Hisar Jn	Suratpura Jn	16	11	12	18	31	11 (11 + 0)	12 (12 + 0)	18 (18 + 0)	31 (28 + 3)
Sadulpur Jn	Suratpura Jn	16	11	12	19	42	11 (11 + 0)	12 (12 + 0)	19 (16 + 3)	42 (30 + 12)
Bathinda Jn	Sirsa	18	12	12	17	34	12 (11 + 1)	12 (11 + 1)	17 (15 + 2)	34 (32 + 1)
Merta Road Jn	Degana Jn	59	44	50	71	123	44 (42 + 2)	50 (48 + 3)	71 (68 + 3)	123 (95 + 27)
Ratangarh jn	Degana Jn	18	12	12	14	21	12 (11 + 0)	12 (12 + 0)	14 (13 + 1)	21 (15 + 7)
Jodhpur Jn	Luni Jn	69	51	72	95	166	51 (46 + 5)	72 (64 + 8)	95 (85 + 10)	166 (136 + 30)
Luni Jn	Samdari Jn	43	78	77	93	144	78 (26 + 52)	77 (32 + 45)	93 (62 + 31)	144 (88 + 56)
Pipar Road Jn	Rai Ka Bagh	62	52	60	90	143	52 (49 + 3)	60 (56 + 3)	90 (86 + 4)	143 (113 + 30)
Merta Road Jn	Pipar Road Jn	62	52	60	91	145	52 (49 + 3)	60 (57 + 4)	91 (87 + 4)	145 (115 + 30)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Jodhpur Jn	Rai Ka Bagh	78	59	80	103	174	59 (54 + 5)	80 (72 + 7)	103 (93 + 10)	174 (144 + 31)
Jalor	Bhildi Jn	29	15	20	39	149	15 (12 + 3)	20 (12 + 7)	39 (29 + 10)	149 (91 + 58)
Samdari Jn	Jalor	29	16	20	44	151	16 (12 + 3)	20 (12 + 7)	44 (34 + 11)	151 (93 + 58)
Samakhiali Jn	Santalpur	46	107	167	232	285	107 (10 + 96)	167 (11 + 157)	232 (14 + 218)	285 (37 + 248)
Santalpur	Bhildi Jn	46	107	167	232	285	107 (10 + 96)	167 (11 + 157)	232 (14 + 218)	285 (37 + 248)
Adipur Jn	Gandhidham JN	61	51	68	85	128	51 (18 + 33)	68 (18 + 50)	85 (18 + 67)	128 (18 + 110)
Gandhidham JN	Old Kandla Port	19	10	16	18	32	10 (0 + 10)	16 (0 + 16)	18 (0 + 18)	32 (0 + 32)
Gandhidham JN	Bhimasar	103	78	101	120	177	78 (35 + 43)	101 (35 + 66)	120 (35 + 85)	177 (35 + 142)
Bhimasar	Samakhiali Jn	103	147	199	280	375	147 (38 + 109)	199 (39 + 160)	280 (41 + 239)	375 (44 + 331)

HUN 5

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Juhi cabin	Bhimsen Jn	0	67	83	108	117	67 (46 + 21)	83 (50 + 32)	108 (53 + 55)	117 (90 + 27)
Paniyahawa	Valmiki nagar road	0	13	33	36	90	13 (3 + 9)	33 (5 + 28)	36 (22 + 14)	90 (51 + 39)
Ramdayalu Nagar	Goshawar Halt	65	100	107	120	127	100 (59 + 41)	107 (68 + 39)	120 (81 + 39)	127 (77 + 50)
Hajipur Jn	Goshawar Halt	93	128	135	148	155	128 (88 + 40)	135 (97 + 38)	148 (111 + 37)	155 (104 + 51)
Muzaffarpur Jn	Samastipur Jn	78	68	77	92	142	68 (62 + 6)	77 (68 + 9)	92 (80 + 12)	142 (105 + 37)
Ramdayalu Nagar	Muzaffarpur Jn	65	84	87	94	126	84 (55 + 29)	87 (63 + 24)	94 (79 + 15)	126 (85 + 41)
Bachhwara Jn	Samastipur Jn	76	84	95	199	247	84 (59 + 25)	95 (63 + 32)	199 (62 + 137)	247 (146 + 101)
Raxaul Jn	Bairagnia	13	12	24	23	41	12 (11 + 1)	24 (9 + 16)	23 (21 + 2)	41 (22 + 19)
Bairagnia	Sitamarhi Jn	13	12	24	23	41	12 (11 + 1)	24 (9 + 16)	23 (21 + 2)	41 (22 + 19)
Janakpur Road	Sitamarhi Jn	13	11	11	49	78	11 (10 + 1)	11 (11 + 1)	49 (15 + 34)	78 (44 + 33)
Darbhanga Jn	Janakpur Road	13	11	11	49	78	11 (10 + 1)	11 (11 + 1)	49 (15 + 34)	78 (44 + 33)
Narkatiaganj Jn	Bettiah	66	43	45	54	63	43 (41 + 2)	45 (42 + 3)	54 (48 + 6)	63 (58 + 5)
Bettiah	Sagauli Jn	66	43	45	54	63	43 (41 + 2)	45 (42 + 3)	54 (48 + 6)	63 (58 + 5)
Bapudham Motihari	Motihari Court	82	52	55	66	76	52 (46 + 6)	55 (47 + 8)	66 (51 + 16)	76 (47 + 29)
Muzaffarpur Jn	Motihari Court	82	52	55	66	76	52 (46 + 6)	55 (47 + 8)	66 (51 + 15)	76 (47 + 29)
Sagauli Jn	Bapudham Motihari	82	49	51	60	69	49 (47 + 2)	51 (48 + 3)	60 (54 + 6)	69 (51 + 19)
Sagauli Jn	Raxaul Jn	42	20	20	20	20	20 (20 + 0)	20 (20 + 0)	20 (20 + 0)	20 (10 + 10)
Samastipur Jn	Darbhanga Jn	98	96	106	198	234	96 (75 + 21)	106 (81 + 25)	198 (66 + 132)	234 (150 + 84)
Valmiki nagar road	Narkatiaganj Jn	66	43	56	58	83	43 (40 + 3)	56 (37 + 19)	58 (55 + 3)	83 (72 + 11)
Naini Jn	Chheoki	180	123	137	167	261	123 (119 + 4)	137 (131 + 6)	167 (158 + 9)	261 (247 + 14)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Mirzapur	Chunar jn	217	183	222	239	384	183 (162 + 21)	222 (199 + 23)	239 (199 + 40)	384 (331 + 53)
Chunar jn	Jeonathpur	205	167	188	241	307	167 (164 + 2)	188 (185 + 4)	241 (236 + 4)	307 (301 + 5)
Juhi cabin	Kanpur Central	298	328	371	443	654	328 (244 + 84)	371 (245 + 127)	443 (334 + 109)	654 (479 + 174)
Chheoki	Mirzapur	218	194	222	268	373	194 (170 + 24)	222 (201 + 20)	268 (232 + 35)	373 (325 + 48)
Jeonathpur	Mughal Sarai Jn	188	154	176	219	276	154 (152 + 2)	176 (172 + 4)	219 (215 + 4)	276 (271 + 6)
Pokhrayan	Orai	42	84	95	101	119	84 (71 + 13)	95 (86 + 9)	101 (83 + 18)	119 (97 + 23)
Bhimsen Jn	Pokhrayan	42	83	94	100	119	83 (70 + 13)	94 (85 + 9)	100 (82 + 18)	119 (96 + 23)
Orai	Ait Jn	42	80	85	91	115	80 (67 + 13)	85 (76 + 8)	91 (73 + 18)	115 (93 + 21)
Ait Jn	Jhansi Jn	42	70	72	70	82	70 (68 + 1)	72 (68 + 5)	70 (66 + 4)	82 (81 + 1)
Mau Jn	Aunrihar Jn	43	57	67	84	125	57 (43 + 14)	67 (51 + 16)	84 (27 + 57)	125 (76 + 49)
Sarnath	Aunrihar Jn	78	105	115	135	207	105 (72 + 33)	115 (89 + 26)	135 (57 + 78)	207 (113 + 94)
Phephna Jn	Ballia	63	81	86	98	127	81 (62 + 19)	86 (75 + 11)	98 (79 + 19)	127 (77 + 49)
Ballia	Chhapra Jn	63	79	83	96	125	79 (60 + 19)	83 (72 + 11)	96 (76 + 20)	125 (76 + 50)
Kaptanganj Jn	Ghughali	53	51	74	84	136	51 (39 + 12)	74 (41 + 33)	84 (69 + 16)	136 (93 + 43)
Gorakhpur Cantt Jn	Kaptanganj Jn	53	53	78	83	131	53 (39 + 14)	78 (40 + 38)	83 (61 + 21)	131 (79 + 52)
Ghughali	Paniyahawa	53	47	67	70	127	47 (37 + 9)	67 (37 + 30)	70 (56 + 14)	127 (88 + 39)
Bhatni Jn	Salempur Jn	42	42	50	69	103	42 (31 + 12)	50 (38 + 13)	69 (20 + 49)	103 (63 + 40)
Salempur Jn	Indara Jn	42	42	50	67	99	42 (31 + 11)	50 (37 + 12)	67 (19 + 48)	99 (60 + 40)
Indara Jn	Mau Jn	60	79	92	122	160	79 (68 + 11)	92 (82 + 11)	122 (60 + 62)	160 (111 + 49)
Ghazipur City	Aunrihar Jn	55	65	65	68	101	65 (45 + 19)	65 (53 + 12)	68 (50 + 18)	101 (58 + 44)
Phephna Jn	Ghazipur Ghat halt	55	64	63	65	96	64 (45 + 19)	63 (52 + 12)	65 (47 + 18)	96 (54 + 43)
Ghazipur Ghat halt	Ghazipur City	55	64	64	66	99	64 (45 + 19)	64 (52 + 12)	66 (48 + 18)	99 (55 + 44)
Varanasi Jn	Sarnath	80	119	136	169	238	119 (76 + 43)	136 (100 + 36)	169 (68 + 101)	238 (111 + 127)
BaraBanki Jn	Burhwal Jn	90	140	167	185	194	140 (74 + 66)	167 (70 + 97)	185 (94 + 92)	194 (124 + 70)
Burhwal Jn	Jarwal Road	125	221	262	293	308	221 (97 + 125)	262 (98 + 164)	293 (126 + 167)	308 (203 + 105)
Jarwal Road	Gonda Jn	125	221	262	293	308	221 (97 + 125)	262 (98 + 164)	293 (126 + 167)	308 (203 + 105)
Gonda Jn	Balrampur	28	24	26	32	48	24 (24 + 0)	26 (25 + 1)	32 (31 + 2)	48 (28 + 20)
Balrampur	Gainsari Jn	28	24	25	32	47	24 (24 + 0)	25 (24 + 1)	32 (30 + 1)	47 (28 + 19)
Ahirauli Halt	Anand Nagar Jn	28	23	23	29	43	23 (23 + 0)	23 (23 + 0)	29 (29 + 0)	43 (26 + 17)
Gainsari Jn	Barhni	28	22	23	28	41	22 (22 + 0)	23 (23 + 0)	28 (28 + 0)	41 (24 + 17)
Barhni	Ahirauli Halt	28	22	23	28	41	22 (22 + 0)	23 (23 + 0)	28 (28 + 0)	41 (24 + 17)
Gorakhpur Jn	Anand Nagar Jn	45	38	38	57	63	38 (38 + 0)	38 (38 + 0)	57 (46 + 11)	63 (45 + 17)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Gorakhpur Jn	Gorakhpur Cantt Jn	133	222	267	295	322	222 (101 + 120)	267 (104 + 163)	295 (129 + 167)	322 (189 + 133)
Unnao Jn	Manaknagar	101	216	255	268	448	216 (134 + 82)	255 (134 + 121)	268 (169 + 99)	448 (280 + 167)
Manaknagar	Alambagh	101	216	255	264	318	216 (134 + 82)	255 (134 + 121)	264 (167 + 98)	318 (243 + 74)
Malhaur	BaraBanki Jn	164	219	254	288	360	219 (151 + 68)	254 (150 + 104)	288 (190 + 98)	360 (250 + 110)
Lucknow	Dilkusha Cabin	219	257	292	354	454	257 (187 + 70)	292 (189 + 103)	354 (283 + 72)	454 (338 + 116)
Alambagh	Lucknow	231	281	328	410	404	281 (212 + 69)	328 (226 + 101)	410 (328 + 82)	404 (334 + 70)
Dilkusha Cabin	Malhaur	126	160	182	192	242	160 (90 + 69)	182 (79 + 103)	192 (102 + 89)	242 (123 + 119)
Kanpur Central	Unnao Jn	162	283	327	397	562	283 (199 + 84)	327 (201 + 126)	397 (288 + 109)	562 (390 + 172)
Paniyahawa	Tamkuhi Road	0	0	0	0	6	0 (0 + 0)	0 (0 + 0)	0 (0 + 0)	6 (3 + 2)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Tribeni	Nabadwip Dham	66	65	67	81	105	65 (64 + 0)	67 (65 + 2)	81 (74 + 7)	105 (51 + 54)
Dainhat	Katwa Jn	66	138	93	116	122	138 (67 + 71)	93 (59 + 33)	116 (99 + 17)	122 (66 + 56)
Nabadwip Dham	Dainhat	66	138	93	116	122	138 (67 + 71)	93 (59 + 33)	116 (99 + 17)	122 (66 + 56)
Bandel Jn	Tribeni	66	64	66	79	97	64 (64 + 0)	66 (64 + 2)	79 (71 + 8)	97 (45 + 52)
Ambalgram	Azimganj	50	49	49	81	142	49 (49 + 0)	49 (49 + 0)	81 (58 + 23)	142 (64 + 78)
Katwa Jn	Ambalgram	50	120	75	113	146	120 (50 + 70)	75 (43 + 32)	113 (77 + 36)	146 (78 + 68)
Azimganj	Manigram	42	61	93	150	113	61 (36 + 25)	93 (36 + 57)	150 (64 + 85)	113 (74 + 39)
Manigram	New Farakka Jn	42	61	93	150	113	61 (36 + 25)	93 (36 + 57)	150 (64 + 85)	113 (74 + 39)
New Farakka Jn	Old Malda Jn	123	170	222	275	302	170 (104 + 65)	222 (121 + 101)	275 (237 + 38)	302 (123 + 179)
Fakiragram Jn	Golakganj	11	6	6	52	29	6 (6 + 0)	6 (6 + 0)	52 (34 + 18)	29 (29 + 0)
Golakganj	Dhubri	11	6	7	7	8	6 (6 + 0)	7 (6 + 1)	7 (6 + 1)	8 (6 + 2)
Golakganj	New Cooch Behar jn	11	6	7	53	30	6 (6 + 0)	7 (6 + 1)	53 (33 + 20)	30 (29 + 2)
Kokrajhar	New Bongaigaon Jn	96	179	222	382	521	179 (85 + 94)	222 (112 + 110)	382 (196 + 185)	521 (250 + 270)
Kokrajhar	Fakiragram Jn	96	179	221	380	518	179 (85 + 94)	221 (111 + 110)	380 (195 + 185)	518 (248 + 270)
Raninagar Jalpaiguri Jn	New Domohani	23	161	182	259	439	161 (42 + 120)	182 (70 + 112)	259 (228 + 31)	439 (136 + 302)
New Domohani	New Maynaguri	23	138	158	172	421	138 (44 + 95)	158 (76 + 82)	172 (138 + 34)	421 (155 + 267)
New Maynaguri	New Cooch Behar jn	23	138	158	207	421	138 (44 + 95)	158 (76 + 82)	207 (167 + 40)	421 (155 + 267)
Kishanganj	Aluabari Road	148	245	286	388	518	245 (119 + 126)	286 (139 + 146)	388 (192 + 196)	518 (241 + 277)
Barsoi Jn	Kishanganj	148	240	278	285	334	240 (116 + 124)	278 (135 + 142)	285 (140 + 144)	334 (155 + 179)
Eklakhi Jn	Milangarh	111	133	178	224	211	133 (86 + 48)	178 (101 + 77)	224 (173 + 51)	211 (80 + 130)
Milangarh	Kumedpur Jn	111	133	178	224	211	133 (86 + 48)	178 (101 + 77)	224 (173 + 51)	211 (80 + 130)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Kumedpur Jn	Katihar Jn	52	141	139	142	141	141 (51 + 90)	139 (61 + 79)	142 (44 + 97)	141 (79 + 62)
Kumedpur Jn	Mukuria Jn	100	216	249	242	196	216 (92 + 123)	249 (113 + 136)	242 (104 + 138)	196 (77 + 119)
Old Malda Jn	Eklakhi Jn	111	152	204	254	283	152 (86 + 65)	204 (103 + 101)	254 (223 + 31)	283 (108 + 174)
Mukuria Jn	Barsoi Jn	152	244	281	281	284	244 (120 + 124)	281 (139 + 142)	281 (140 + 141)	284 (133 + 151)
New Jalpaiguri Jn	Raninagar Jalpaiguri Jn	86	209	231	311	489	209 (89 + 120)	231 (118 + 112)	311 (286 + 25)	489 (182 + 308)
Galgalia	Siliguri Jn	20	15	44	89	142	15 (15 + 0)	44 (12 + 32)	89 (89 + 0)	142 (142 + 0)
Aluabari Road	Galgalia	20	14	33	47	80	14 (14 + 0)	33 (9 + 24)	47 (47 + 0)	80 (80 + 0)
Siliguri Jn	Siliguri Town	52	40	43	69	138	40 (33 + 6)	43 (34 + 9)	69 (61 + 7)	138 (116 + 22)
New Jalpaiguri Jn	Siliguri Town	52	43	48	136	135	43 (35 + 8)	48 (37 + 11)	136 (41 + 95)	135 (105 + 30)
Digaru	Tetelia	62	135	122	269	362	135 (74 + 61)	122 (73 + 49)	269 (164 + 105)	362 (213 + 149)
Tetelia	Jagi road	62	134	121	265	360	134 (73 + 61)	121 (72 + 49)	265 (163 + 103)	360 (211 + 148)
Jagi road	Chaparmukh Jn	62	134	121	265	360	134 (73 + 61)	121 (72 + 49)	265 (163 + 103)	360 (211 + 148)
Chaparmukh Jn	Lumdiong South	62	127	110	250	340	127 (69 + 58)	110 (66 + 45)	250 (153 + 97)	340 (199 + 141)
Guwahati	New Guwahati	83	160	167	342	458	160 (84 + 76)	167 (93 + 74)	342 (197 + 144)	458 (254 + 204)
Kamakhya Jn	Guwahati	96	176	183	358	474	176 (100 + 76)	183 (108 + 75)	358 (213 + 145)	474 (268 + 205)
Lumdiong South	Diphu	42	63	74	148	188	63 (40 + 24)	74 (43 + 31)	148 (95 + 53)	188 (125 + 63)
Diphu	Dimapur	42	63	74	147	187	63 (40 + 23)	74 (45 + 29)	147 (95 + 52)	187 (125 + 62)
Dimapur	Furkating Jn	42	51	63	106	137	51 (34 + 17)	63 (38 + 25)	106 (63 + 43)	137 (80 + 57)
New Guwahati	Digaru	64	129	114	253	339	129 (69 + 60)	114 (66 + 48)	253 (149 + 104)	339 (191 + 147)
New Bongaigaon Jn	Abhayapuri Assam	50	73	112	192	144	73 (45 + 27)	112 (75 + 38)	192 (82 + 110)	144 (95 + 49)
Abhayapuri Assam	Goalpara Town	50	51	83	184	103	51 (45 + 6)	83 (75 + 8)	184 (77 + 108)	103 (93 + 10)
Dudhnol Jn	Kamakhya Jn	50	49	74	165	92	49 (45 + 4)	74 (68 + 6)	165 (73 + 92)	92 (84 + 8)
Goalpara Town	Dudhnol Jn	50	50	76	178	89	50 (45 + 4)	76 (70 + 6)	178 (71 + 106)	89 (80 + 8)
Furkating Jn	Mariani Jn	36	47	60	72	124	47 (31 + 16)	60 (35 + 25)	72 (43 + 29)	124 (92 + 32)
Mariani Jn	Amguri Jn	36	44	58	98	131	44 (30 + 14)	58 (35 + 23)	98 (58 + 41)	131 (76 + 56)
Amguri Jn	Simaluguri Jn	36	44	58	113	164	44 (30 + 14)	58 (35 + 23)	113 (66 + 47)	164 (97 + 67)
Simaluguri Jn	Namrup	36	36	34	78	104	36 (28 + 8)	34 (24 + 10)	78 (53 + 26)	104 (67 + 37)
Tinsukia Jn	Namrup	36	36	34	78	103	36 (28 + 8)	34 (24 + 10)	78 (53 + 25)	103 (67 + 37)
Dibrugarh	Tinsukia Jn	26	27	27	63	82	27 (21 + 7)	27 (18 + 8)	63 (39 + 24)	82 (49 + 34)
Katihar Jn	Mukuria Jn	60	32	36	43	102	32 (32 + 0)	36 (27 + 10)	43 (43 + 0)	102 (102 + 0)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Mandir Hasaud	Lakholi	0	71	139	177	266	71 (31 + 40)	139 (45 + 95)	177 (100 + 77)	266 (147 + 119)
Dhenkanal	Rajathgarh Jn	147	156	137	149	275	156 (78 + 77)	137 (73 + 65)	149 (80 + 69)	275 (127 + 148)
Budhapank	Nayabhagirathpur	147	143	116	121	237	143 (83 + 59)	116 (74 + 42)	121 (78 + 43)	237 (130 + 107)
Nayabhagirathpur	Dhenkanal	147	139	114	116	232	139 (81 + 57)	114 (72 + 42)	116 (75 + 41)	232 (126 + 106)
Cuttack Jn	Barang Jn	145	177	166	207	251	177 (131 + 46)	166 (127 + 39)	207 (175 + 32)	251 (156 + 96)
Cuttack Jn	Bagadia Ph	100	59	53	41	74	59 (7 + 52)	53 (11 + 42)	41 (10 + 32)	74 (5 + 69)
Bagadia Ph	Paradeep	100	138	52	128	207	138 (21 + 117)	52 (6 + 46)	128 (18 + 110)	207 (16 + 191)
Machapur Jn	Radhakishorpur Jn	28	8	7	8	9	8 (5 + 3)	7 (7 + 0)	8 (8 + 0)	9 (2 + 7)
Radhakishorpur Jn	Barang Jn	63	82	97	119	204	82 (45 + 37)	97 (46 + 51)	119 (55 + 64)	204 (72 + 132)
Rajathgarh Jn	Machapur Jn	98	83	61	56	97	83 (40 + 43)	61 (34 + 28)	56 (32 + 24)	97 (45 + 53)
Angul	Talcher Jn Cabin	64	90	105	107	192	90 (51 + 39)	105 (66 + 40)	107 (68 + 39)	192 (104 + 88)
Talcher Jn Cabin	Budhapank	148	143	116	122	239	143 (83 + 60)	116 (74 + 42)	122 (79 + 43)	239 (131 + 108)
Titlagarh Jn	Balangir	61	205	168	215	196	205 (46 + 159)	168 (71 + 97)	215 (124 + 91)	196 (126 + 69)
Balangir	Balangir Road PH	61	205	168	215	200	205 (46 + 159)	168 (71 + 97)	215 (124 + 92)	200 (128 + 72)
Balangir Road PH	Bargarh Road	61	198	156	199	179	198 (43 + 155)	156 (65 + 92)	199 (111 + 88)	179 (109 + 70)
Boinda	Angul	62	45	54	87	103	45 (40 + 5)	54 (54 + 0)	87 (87 + 0)	103 (91 + 12)
Jharsuguda Road Jn	Rengali	104	210	194	313	326	210 (52 + 158)	194 (74 + 120)	313 (149 + 164)	326 (214 + 113)
Rengali	Sarla Jn	104	210	194	313	326	210 (52 + 158)	194 (74 + 120)	313 (149 + 164)	326 (214 + 113)
Sambalpur Jn	Sarla Jn	104	166	122	157	170	166 (44 + 121)	122 (66 + 56)	157 (106 + 51)	170 (138 + 33)
Nawapara Road	Mahasamund	59	95	129	125	189	95 (46 + 49)	129 (56 + 73)	125 (101 + 24)	189 (124 + 65)
Bargarh Road	Sambalpur Jn	59	197	157	202	186	197 (41 + 156)	157 (61 + 95)	202 (108 + 94)	186 (111 + 75)
Sambalpur Jn	Sambalpur City Jn	56	82	89	110	95	82 (43 + 38)	89 (50 + 38)	110 (72 + 38)	95 (56 + 39)
Sambalpur City Jn	Handapa	56	64	74	139	101	64 (39 + 25)	74 (45 + 29)	139 (95 + 45)	101 (81 + 20)
Handapa	Boinda	57	75	92	178	146	75 (45 + 30)	92 (61 + 32)	178 (131 + 46)	146 (112 + 34)
Titlagarh Jn	Nawapara Road	64	94	128	123	185	94 (46 + 49)	128 (56 + 72)	123 (100 + 23)	185 (122 + 63)
Lanjigarh Road Jn	Titlagarh Jn	101	234	251	284	302	234 (60 + 174)	251 (84 + 166)	284 (175 + 109)	302 (202 + 100)
Singapuram Road Jn	Lanjigarh Road Jn	101	227	239	271	280	227 (57 + 170)	239 (77 + 162)	271 (171 + 101)	280 (187 + 93)
Gopalapatnam	Visakhapatnam Jn	222	272	291	269	334	272 (222 + 50)	291 (222 + 69)	269 (222 + 47)	334 (222 + 112)
Jagdalpur	Tokopal	29	43	58	72	50	43 (13 + 30)	58 (19 + 39)	72 (43 + 30)	50 (34 + 16)
Jeypore	Koraput Jn	34	43	52	88	123	43 (17 + 25)	52 (20 + 33)	88 (69 + 19)	123 (106 + 17)
Jeypore	Jagdalpur	34	43	52	88	123	43 (17 + 25)	52 (20 + 33)	88 (69 + 19)	123 (106 + 17)
Damonjodi	Singapuram Road Jn	37	47	55	58	60	47 (20 + 28)	55 (20 + 35)	58 (29 + 29)	60 (41 + 19)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Koraput Jn	Damonjodi	37	47	54	57	57	47 (19 + 28)	54 (26 + 28)	57 (49 + 8)	57 (39 + 18)
Araku	Koraput Jn	33	45	55	92	47	45 (12 + 33)	55 (15 + 41)	92 (59 + 33)	47 (29 + 18)
Kottavalasa Jn	Araku	33	44	17	70	35	44 (8 + 35)	17 (9 + 7)	70 (33 + 37)	35 (27 + 8)
Simhachalam North Jn	Kottavalasa Jn	234	334	235	320	448	334 (141 + 192)	235 (173 + 62)	320 (279 + 40)	448 (380 + 68)
Tokopal	Dantewara	29	48	65	87	76	48 (19 + 30)	65 (26 + 39)	87 (61 + 26)	76 (59 + 17)
Dantewara	Kirandul	29	38	49	52	31	38 (9 + 29)	49 (11 + 38)	52 (22 + 30)	31 (16 + 15)
Simhachalam North Jn	Gopalapatnam	112	147	172	232	294	147 (147 + 0)	172 (172 + 0)	232 (232 + 0)	294 (294 + 0)
Vizianagaram Jn	Bobbili Jn	114	215	219	275	301	215 (65 + 150)	219 (85 + 134)	275 (185 + 90)	301 (209 + 92)
Singapuram Road Jn	Rayagada	114	215	219	270	296	215 (66 + 148)	219 (87 + 132)	270 (183 + 87)	296 (208 + 87)
Bobbili Jn	Rayagada	114	215	219	270	296	215 (66 + 148)	219 (87 + 132)	270 (183 + 87)	296 (208 + 87)
Kottavalasa Jn	Vizianagaram Jn	204	358	228	355	443	358 (139 + 218)	228 (172 + 57)	355 (305 + 50)	443 (377 + 67)
Anuppur Jn	Kotma	66	45	48	93	109	45 (28 + 17)	48 (27 + 21)	93 (44 + 49)	109 (54 + 55)
Shahdol	Anuppur Jn	126	93	98	163	205	93 (64 + 29)	98 (66 + 32)	163 (119 + 44)	205 (166 + 38)
Anuppur Jn	Pendra Road	92	73	85	188	254	73 (51 + 22)	85 (56 + 29)	188 (140 + 48)	254 (210 + 44)
Pendra Road	Bilaspur Jn	92	58	74	165	217	58 (42 + 16)	74 (50 + 24)	165 (126 + 40)	217 (184 + 33)
Darritola Jn	Baikunthpur Road	40	35	31	72	95	35 (19 + 15)	31 (15 + 16)	72 (28 + 44)	95 (37 + 58)
Boridand Jn	Darritola Jn	40	32	30	72	91	32 (18 + 14)	30 (15 + 16)	72 (28 + 44)	91 (36 + 55)
Baikunthpur Road	Ambikapur	40	22	14	46	67	22 (22 + 0)	14 (14 + 0)	46 (46 + 0)	67 (67 + 0)
Boridand Jn	Chirimiri	17	12	12	12	12	12 (10 + 2)	12 (10 + 2)	12 (9 + 3)	12 (11 + 2)
Gevra Road	Korba	110	52	54	80	98	52 (28 + 24)	54 (27 + 28)	80 (31 + 49)	98 (38 + 60)
Champa Jn	Korba	110	76	63	132	183	76 (42 + 35)	63 (31 + 32)	132 (51 + 81)	183 (71 + 112)
Kotma	Boridand Jn	64	46	49	94	110	46 (29 + 17)	49 (27 + 21)	94 (44 + 49)	110 (54 + 55)
Katni Jn	New Katni Jn	123	131	181	212	250	131 (97 + 34)	181 (146 + 35)	212 (166 + 46)	250 (201 + 49)
Umaria	Shahdol	123	92	101	151	190	92 (61 + 31)	101 (69 + 31)	151 (108 + 43)	190 (145 + 45)
New Katni Jn	Umaria	123	89	94	143	179	89 (59 + 30)	94 (67 + 27)	143 (105 + 37)	179 (140 + 39)
Bilaspur Jn	Urkura	270	160	130	310	409	160 (124 + 36)	130 (130 + 0)	310 (295 + 14)	409 (409 + 0)
Raipur Vizainagaram Hut	Mandir Hasaud	64	88	153	157	218	88 (50 + 39)	153 (60 + 93)	157 (86 + 70)	218 (96 + 122)
Lakholi	Mahasamund	64	62	98	85	131	62 (35 + 27)	98 (40 + 58)	85 (74 + 11)	131 (91 + 41)
Raipur Jn	Raipur Vizainagaram Hut	42	75	151	114	216	75 (47 + 28)	151 (60 + 91)	114 (68 + 46)	216 (97 + 120)
Urkura	Raipur Jn	129	94	94	165	248	94 (93 + 1)	94 (94 + 0)	165 (164 + 1)	248 (246 + 1)
Guna jn	Ashoknagar	67	63	65	134	245	63 (35 + 29)	65 (42 + 23)	134 (97 + 37)	245 (207 + 38)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Ashoknagar	Bina jn	67	61	62	133	241	61 (33 + 28)	62 (39 + 23)	133 (96 + 37)	241 (204 + 37)
Ruthiyai jn	Guna jn	69	68	75	153	243	68 (54 + 15)	75 (58 + 16)	153 (127 + 26)	243 (219 + 24)
Bina jn	Saugor	129	133	141	248	278	133 (95 + 37)	141 (103 + 38)	248 (183 + 65)	278 (200 + 78)
Katni Jn	Damoh	129	122	126	235	266	122 (91 + 31)	126 (96 + 31)	235 (183 + 52)	266 (205 + 61)
Damoh	Saugor	129	122	126	233	263	122 (90 + 32)	126 (94 + 32)	233 (179 + 55)	263 (200 + 63)
Ruthiyai jn	Baran	47	40	47	118	191	40 (26 + 14)	47 (32 + 15)	118 (96 + 23)	191 (168 + 23)
Kota Jn	Bhonra	47	43	51	113	182	43 (24 + 19)	51 (27 + 24)	113 (81 + 32)	182 (145 + 37)
Bhonra	Baran	47	37	44	113	186	37 (26 + 10)	44 (32 + 12)	113 (95 + 18)	186 (167 + 18)
Barwadih	Ambikapur	40.4	22.27646	13.77216	46.38058	66.64474	22 (18 + 4)	14 (11 + 3)	46 (35 + 12)	67 (57 + 9)
Gevra Road	Pendra Road	109.8	33.49289	29.9511	43.36223	57.85655	33 (26 + 8)	30 (30 + 0)	43 (41 + 2)	58 (58 + 0)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Gudivada Jn	Machillpatnam	28	24	24	24	24	24 (24 + 0)	24 (24 + 0)	24 (24 + 0)	24 (24 + 0)
Krishna Canal Jn	Vijayawada Jn	172	251	380	378	508	251 (150 + 102)	380 (192 + 188)	378 (344 + 33)	508 (451 + 57)
Vijayawada Jn	Ramavarappadu	46	68	81	116	134	68 (57 + 11)	81 (68 + 13)	116 (89 + 27)	134 (107 + 27)
Ramavarappadu	Gudivada Jn	46	40	41	55	73	40 (40 + 0)	41 (41 + 0)	55 (55 + 0)	73 (73 + 0)
Guntakal Jn	Ballari Jn	68	98	125	195	272	98 (41 + 58)	125 (38 + 87)	195 (187 + 8)	272 (159 + 113)
Pendekallu Jn	Dhone Jn	62	87	120	91	114	87 (60 + 27)	120 (69 + 51)	91 (83 + 8)	114 (98 + 16)
Guntakal Jn	Pendekallu Jn	62	69	92	73	90	69 (46 + 24)	92 (49 + 43)	73 (71 + 2)	90 (83 + 7)
Dhone Jn	Nandyal	44	49	78	59	79	49 (26 + 23)	78 (27 + 51)	59 (52 + 8)	79 (65 + 14)
Nallapadu	Guntur Jn	81	101	140	142	198	101 (69 + 32)	140 (75 + 65)	142 (107 + 35)	198 (132 + 66)
Guntur Jn	Krishna Canal Jn	71	91	129	143	217	91 (60 + 31)	129 (65 + 64)	143 (109 + 33)	217 (176 + 42)
Pagidipalli Jn	Nalgonda	37	39	43	65	91	39 (34 + 4)	43 (38 + 6)	65 (60 + 5)	91 (85 + 6)
Nalgonda	Miryalaguda	37	34	38	58	81	34 (33 + 2)	38 (35 + 3)	58 (58 + 0)	81 (81 + 0)
Nadikudi Jn	Pondugula	36	37	43	69	86	37 (31 + 7)	43 (33 + 10)	69 (57 + 13)	86 (66 + 20)
Pondugula	Vishnupuram	36	37	43	69	86	37 (31 + 7)	43 (33 + 10)	69 (57 + 13)	86 (66 + 20)
Miryalaguda	Vishnupuram	36	38	44	71	104	38 (31 + 7)	44 (34 + 10)	71 (58 + 13)	104 (80 + 24)
Piduguralla	Nadikudi Jn	40	41	47	73	90	41 (35 + 7)	47 (37 + 10)	73 (61 + 13)	90 (70 + 20)
Sattenapalli	Piduguralla	40	41	47	73	90	41 (35 + 7)	47 (37 + 10)	73 (61 + 13)	90 (70 + 20)
Bandarupalli	Sattenapalli	40	41	49	75	84	41 (36 + 5)	49 (37 + 12)	75 (51 + 24)	84 (64 + 20)
Nallapadu	Bandarupalli	40	41	49	69	61	41 (36 + 5)	49 (37 + 12)	69 (46 + 23)	61 (42 + 19)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Narasaraopet	Nallapadu	43	60	91	74	156	60 (30 + 30)	91 (33 + 58)	74 (63 + 11)	156 (110 + 46)
Vinukonda	Narasaraopet	43	59	92	74	140	59 (32 + 27)	92 (34 + 58)	74 (64 + 10)	140 (113 + 27)
Donakonda	Vinukonda	43	59	92	74	140	59 (32 + 27)	92 (34 + 58)	74 (64 + 10)	140 (113 + 27)
Diguvametta	Donakonda	43	57	90	70	135	57 (31 + 26)	90 (33 + 57)	70 (61 + 9)	135 (112 + 23)
Gazulapalli	Diguvametta	43	57	90	70	135	57 (31 + 26)	90 (33 + 57)	70 (61 + 9)	135 (112 + 23)
Nandyal	Gazulapalli	43	57	90	70	135	57 (31 + 26)	90 (33 + 57)	70 (61 + 9)	135 (112 + 23)
Hussain Sagar Jn	Secunderabad Jn	168	173	190	322	396	173 (163 + 9)	190 (179 + 11)	322 (288 + 34)	396 (351 + 45)
Sanathnagar	Lingampalli	212	206	229	360	458	206 (195 + 11)	229 (203 + 26)	360 (325 + 35)	458 (412 + 47)
Charlapalli	Pagidipalli Jn	152	168	204	423	572	168 (137 + 31)	204 (158 + 46)	423 (291 + 132)	572 (382 + 190)
Maula Ali C	Charlapalli	152	132	153	305	368	132 (102 + 30)	153 (106 + 47)	305 (174 + 132)	368 (244 + 124)
Moula Ali Cord Line Station Bypass	Charlapalli	152	139	154	219	304	139 (138 + 1)	154 (153 + 1)	219 (215 + 4)	304 (239 + 65)
Bhongir	Pagidipalli Jn	124	139	175	398	526	139 (111 + 28)	175 (134 + 41)	398 (270 + 128)	526 (342 + 184)
Jangaon	Bhongir	124	135	165	365	492	135 (108 + 28)	165 (125 + 40)	365 (236 + 129)	492 (308 + 184)
Kazipet Jn	Jangaon	124	134	164	364	490	134 (107 + 28)	164 (124 + 40)	364 (235 + 129)	490 (307 + 184)
Sanathnagar	Hussain Sagar Jn	186	205	222	354	428	205 (195 + 9)	222 (211 + 11)	354 (320 + 34)	428 (383 + 45)
Sitaphalmandi B	Lallaguda	118	120	141	293	356	120 (90 + 30)	141 (94 + 47)	293 (161 + 132)	356 (232 + 124)
Lallaguda	Maula Ali C	118	120	141	293	356	120 (90 + 30)	141 (94 + 47)	293 (161 + 132)	356 (232 + 124)
Secunderabad Jn	Sitaphalmandi B	118	100	102	141	231	100 (91 + 8)	102 (92 + 10)	141 (107 + 33)	231 (158 + 73)
Lingampalli	Telapur	104	100	123	254	352	100 (89 + 10)	123 (99 + 24)	254 (218 + 36)	352 (305 + 47)
Telapur	Shankarpalli	104	97	126	245	337	97 (86 + 10)	126 (102 + 24)	245 (208 + 36)	337 (285 + 52)
Shankarpalli	Vikarabad Jn	104	97	126	245	337	97 (86 + 10)	126 (102 + 24)	245 (208 + 36)	337 (285 + 52)
Vikarabad Jn	Godamgura	104	79	106	200	274	79 (70 + 10)	106 (83 + 23)	200 (172 + 28)	274 (233 + 41)
Mailaram	Wadi Jn	104	79	105	199	273	79 (70 + 10)	105 (83 + 23)	199 (172 + 27)	273 (233 + 40)
Godamgura	Mailaram	104	79	105	199	273	79 (70 + 10)	105 (83 + 23)	199 (172 + 27)	273 (233 + 40)
Kulem	Castle Rock	31	38	52	117	126	38 (17 + 20)	52 (12 + 39)	117 (68 + 48)	126 (88 + 39)
Dharwad	Hubbali Jn	59	62	77	144	177	62 (43 + 19)	77 (45 + 32)	144 (106 + 37)	177 (145 + 32)
Gadag Jn	Harlapur	43	98	97	162	175	98 (58 + 40)	97 (49 + 47)	162 (96 + 67)	175 (164 + 12)
Harlapur	Koppal	43	99	97	163	176	99 (58 + 41)	97 (49 + 48)	163 (96 + 67)	176 (165 + 12)
Hosapete Jn	Torangallu Jn	58	113	119	181	224	113 (50 + 63)	119 (40 + 80)	181 (169 + 13)	224 (160 + 64)
Hebsur	Gadag Jn	56	70	101	154	191	70 (48 + 21)	101 (63 + 38)	154 (114 + 40)	191 (128 + 64)
Hubbali Jn	Hebsur	56	66	94	148	183	66 (44 + 21)	94 (56 + 38)	148 (107 + 41)	183 (125 + 59)
Ginigera	Hosapete Jn	44	98	99	157	171	98 (55 + 43)	99 (47 + 52)	157 (90 + 67)	171 (155 + 16)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Koppal	Ginigera	44	99	97	163	176	99 (58 + 41)	97 (49 + 48)	163 (96 + 67)	176 (165 + 12)
Majorda Jn	Madgaon Jn	33	58	71	135	158	58 (42 + 16)	71 (43 + 27)	135 (75 + 60)	158 (105 + 52)
Madgaon Jn	Kulem	33	26	33	81	88	26 (18 + 8)	33 (14 + 19)	81 (62 + 20)	88 (74 + 14)
Majorda Jn	Vasco da Gama	33	14	14	14	14	14 (14 + 0)	14 (14 + 0)	14 (14 + 0)	14 (14 + 0)
Londa Jn	Castle Rock	30	40	54	119	128	40 (19 + 21)	54 (14 + 40)	119 (70 + 48)	128 (90 + 39)
Torangallu Jn	Ballari Jn	62	113	119	181	224	113 (50 + 63)	119 (40 + 80)	181 (169 + 13)	224 (160 + 64)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Bhilwara	Nasirabad	37	33	38	64	75	33 (32 + 0)	38 (38 + 0)	64 (59 + 5)	75 (64 + 11)
Chanderiya	Bhilwara	37	33	38	61	69	33 (33 + 0)	38 (38 + 0)	61 (56 + 4)	69 (60 + 9)
Nasirabad	Ajmer Jn	37	33	38	63	65	33 (32 + 0)	38 (38 + 0)	63 (58 + 5)	65 (54 + 11)
Madanapalle Road	Dharmavaram Jn	8	8	9	16	86	8 (7 + 1)	9 (7 + 2)	16 (3 + 13)	86 (11 + 75)
Viyalpad	Madanapalle Road	8	8	9	16	86	8 (7 + 1)	9 (7 + 2)	16 (3 + 13)	86 (11 + 75)
Pakala	Viyalpad	8	6	8	15	65	6 (6 + 0)	8 (7 + 2)	15 (2 + 13)	65 (7 + 58)
Pendekallu Jn	Dhone Jn	62	87	120	91	114	87 (60 + 27)	120 (69 + 51)	91 (83 + 8)	114 (98 + 16)
Guntakal Jn	Pendekallu Jn	62	69	92	73	90	69 (46 + 24)	92 (49 + 43)	73 (71 + 2)	90 (83 + 7)
Anantapur	Kalluru Jn	62	76	93	109	111	76 (61 + 16)	93 (71 + 22)	109 (95 + 14)	111 (84 + 27)
Dharmavaram Jn	Anantapur	62	66	78	91	92	66 (56 + 10)	78 (64 + 14)	91 (90 + 1)	92 (83 + 9)
Kalluru Jn	Gooty Jn Cabin	62	60	69	82	133	60 (58 + 2)	69 (67 + 1)	82 (72 + 11)	133 (101 + 32)
Gooty Jn	Pendekallu Jn	28	36	46	36	43	36 (32 + 4)	46 (37 + 9)	36 (30 + 6)	43 (35 + 8)
Pakala	Chittoor	41	42	82	66	83	42 (41 + 1)	82 (40 + 42)	66 (60 + 7)	83 (35 + 48)
Katpadi	Chittoor	41	42	82	66	83	42 (41 + 1)	82 (40 + 42)	66 (60 + 7)	83 (35 + 48)
Gooty Jn Cabin	Gooty Jn	90	102	123	185	194	102 (63 + 39)	123 (67 + 56)	185 (137 + 48)	194 (109 + 85)
Manoharabad	Bolarum	60	79	99	101	129	79 (61 + 17)	99 (64 + 35)	101 (96 + 5)	129 (121 + 8)
Falaknuma	Umdanagar	78	89	103	150	150	89 (74 + 15)	103 (85 + 18)	150 (135 + 15)	150 (130 + 20)
Kacheguda	Falaknuma	160	153	159	211	217	153 (144 + 9)	159 (151 + 8)	211 (201 + 10)	217 (203 + 14)
Dhone Jn	Kurnool City	56	61	75	64	82	61 (45 + 16)	75 (54 + 21)	64 (52 + 13)	82 (63 + 19)
Kurnool City	Gadwal Jn	56	63	77	66	84	63 (47 + 16)	77 (56 + 21)	66 (53 + 13)	84 (65 + 19)
Devarkadra	Gadwal Jn	56	61	74	74	84	61 (47 + 14)	74 (56 + 18)	74 (68 + 7)	84 (75 + 9)
Mahbubnagar	Devarkadra	56	60	71	112	115	60 (48 + 12)	71 (56 + 15)	112 (105 + 7)	115 (106 + 9)
Kamareddi	Akanapet	56	90	120	119	144	90 (73 + 17)	120 (84 + 35)	119 (114 + 5)	144 (136 + 8)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Akanapet	Manoharabad	56	75	95	97	125	75 (57 + 17)	95 (60 + 34)	97 (92 + 5)	125 (117 + 8)
Nizamabad	Kamareddi	56	77	99	81	87	77 (60 + 17)	99 (65 + 34)	81 (78 + 3)	87 (84 + 3)
Jankampet Jn	Basar	58	82	118	92	111	82 (64 + 18)	118 (77 + 41)	92 (88 + 4)	111 (106 + 5)
Nizamabad	Jankampet Jn	58	82	118	92	111	82 (64 + 18)	118 (77 + 41)	92 (88 + 4)	111 (106 + 5)
Basar	Mudkhed Jn	58	75	107	77	93	75 (57 + 18)	107 (67 + 40)	77 (74 + 3)	93 (90 + 3)
Secunderabad Jn	Lallaguda Gate Halt	90	136	167	225	317	136 (122 + 15)	167 (147 + 20)	225 (224 + 1)	317 (254 + 64)
Lallaguda Gate Halt	Malkajgiri Jn	90	136	167	225	317	136 (122 + 15)	167 (147 + 20)	225 (224 + 1)	317 (254 + 64)
Bolarum	Ammuguda Halt	90	109	129	132	160	109 (92 + 17)	129 (93 + 36)	132 (127 + 6)	160 (150 + 10)
Ammuguda Halt	Malkajgiri Jn	90	105	120	119	147	105 (89 + 15)	120 (98 + 21)	119 (117 + 1)	147 (145 + 2)
Sitaphalmandi A	Kacheguda	166	242	296	442	522	242 (204 + 38)	296 (236 + 60)	442 (338 + 104)	522 (374 + 148)
Secunderabad Jn	Sitaphalmandi A	166	221	257	289	398	221 (205 + 16)	257 (234 + 23)	289 (284 + 5)	398 (300 + 98)
Jadcherla	Mahbubnagar	66	73	86	131	133	73 (60 + 13)	86 (70 + 16)	131 (120 + 11)	133 (118 + 15)
Umdanagar	Jadcherla	66	73	86	130	130	73 (60 + 13)	86 (70 + 16)	130 (120 + 10)	130 (116 + 14)
Akola Jn	Khandwa jn	0	4	3	5	36	4 (2 + 2)	3 (3 + 0)	5 (5 + 0)	36 (36 + 0)
Akola Jn	Washim	23	18	57	55	83	18 (17 + 2)	57 (18 + 39)	55 (50 + 5)	83 (74 + 9)
Washim	Hingoli Deccan	23	19	60	61	86	19 (17 + 1)	60 (19 + 41)	61 (56 + 5)	86 (78 + 8)
Hingoli Deccan	Purna Jn	23	18	59	60	85	18 (17 + 1)	59 (19 + 40)	60 (55 + 4)	85 (78 + 7)
Hazur Sahib Nanded	Maltekdi	65	95	135	115	124	95 (76 + 20)	135 (90 + 45)	115 (110 + 6)	124 (116 + 8)
Purna Jn	Hazur Sahib Nanded	65	95	135	115	124	95 (76 + 20)	135 (90 + 45)	115 (110 + 6)	124 (116 + 8)
Maltekdi	Mudkhed Jn	65	85	124	101	116	85 (67 + 18)	124 (82 + 42)	101 (99 + 3)	116 (112 + 4)
Katpadi	Vellore Town	19	27	32	40	72	27 (21 + 6)	32 (23 + 9)	40 (25 + 16)	72 (33 + 40)
Vellore Town	Tiruvannamallai	19	19	19	23	55	19 (16 + 2)	19 (17 + 3)	23 (18 + 6)	55 (26 + 28)
Tiruvannamallai	Villupuram	19	18	19	22	52	18 (16 + 2)	19 (16 + 3)	22 (18 + 5)	52 (25 + 27)
Chittaurgarh jn	Chanderiya	63	55	60	71	76	55 (54 + 1)	60 (59 + 2)	71 (69 + 2)	76 (72 + 4)
Berach Jn Cabin	Chanderiya	63	47	48	65	71	47 (47 + 0)	48 (48 + 0)	65 (59 + 6)	71 (63 + 8)
Chittaurgarh jn	Berach Jn Cabin	92	95	103	122	156	95 (80 + 15)	103 (82 + 21)	122 (92 + 30)	156 (114 + 42)
Fatehabad Chandrawatiganj Jn	Indore jn	13	27	38	65	87	27 (22 + 5)	38 (32 + 5)	65 (59 + 7)	87 (81 + 6)
Indore jn	Rau	18	60	88	176	241	60 (59 + 1)	88 (87 + 2)	176 (175 + 1)	241 (239 + 2)
Khandwa jn	Mhow	0	53	62	47	52	53 (49 + 4)	62 (50 + 11)	47 (32 + 16)	52 (38 + 14)
Chittaurgarh jn	Nimach	51	45	50	68	90	45 (40 + 5)	50 (44 + 6)	68 (58 + 10)	90 (77 + 12)
Nimach	Mandsaur	44	39	44	62	84	39 (34 + 5)	44 (38 + 6)	62 (52 + 10)	84 (72 + 12)
Mandsaur	Ratlam JN	13	22	29	41	57	22 (17 + 5)	29 (22 + 6)	41 (30 + 11)	57 (45 + 12)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Ratlam JN	Fatehabad Chandrawatiganj Jn	13	23	28	53	66	23 (14 + 9)	28 (19 + 9)	53 (42 + 11)	66 (46 + 20)
Rau	Mhow	16	86	100	94	112	86 (82 + 4)	100 (88 + 12)	94 (78 + 16)	112 (94 + 18)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Villivakkam	Veysarpadi	365	364	380	578	692	364 (363 + 2)	380 (377 + 3)	578 (391 + 187)	692 (429 + 263)
Avadi	Villivakkam	364	364	380	578	692	364 (363 + 2)	380 (377 + 3)	578 (391 + 187)	692 (429 + 263)
Hindu College	Avadi	322	324	340	538	652	324 (323 + 2)	340 (337 + 3)	538 (352 + 186)	652 (389 + 263)
Pattabiram	Hindu College	322	324	340	538	652	324 (323 + 2)	340 (337 + 3)	538 (352 + 186)	652 (389 + 263)
Tiruvallur	Pattabiram	282	286	302	500	614	286 (285 + 2)	302 (299 + 3)	500 (315 + 186)	614 (352 + 263)
Basin Bridge	Chennai Central	395	378	378	378	378	378 (378 + 0)	378 (378 + 0)	378 (378 + 0)	378 (378 + 0)
Veysarpadi	Basin Bridge	276	301	315	301	314	301 (301 + 0)	315 (315 + 0)	301 (301 + 0)	314 (314 + 0)
Arakkonam	Tiruvallur	201	208	225	215	254	208 (199 + 9)	225 (210 + 16)	215 (215 + 0)	254 (254 + 0)
Pune	Daund jn	116	212	240	332	385	212 (201 + 12)	240 (231 + 9)	332 (323 + 9)	385 (372 + 13)
Dharwad	Hubbali Jn	59	62	77	144	177	62 (43 + 19)	77 (45 + 32)	144 (106 + 37)	177 (145 + 32)
Londa Jn	Alnavar Jn	47	53	68	135	164	53 (34 + 20)	68 (35 + 33)	135 (96 + 39)	164 (131 + 34)
Alnavar Jn	Dharwad	47	53	68	135	164	53 (34 + 20)	68 (35 + 33)	135 (96 + 39)	164 (131 + 34)
Jolarpettai	Katpadi	148	199	273	411	415	199 (137 + 62)	273 (162 + 111)	411 (216 + 195)	415 (211 + 204)
Baiyyappanahalli	Baiyapannahalli ABC	152	175	219	294	355	175 (138 + 37)	219 (156 + 63)	294 (166 + 129)	355 (169 + 185)
Baiyapannahalli ABC	Whitefield	152	156	188	270	289	156 (123 + 33)	188 (130 + 58)	270 (148 + 122)	289 (137 + 152)
Whitefield	Bangarapet	88	106	138	220	239	106 (74 + 32)	138 (82 + 56)	220 (100 + 120)	239 (94 + 144)
Bisanattam	Mulanur	88	106	140	226	235	106 (71 + 34)	140 (79 + 61)	226 (100 + 126)	235 (91 + 143)
Patchur	Mulanur	88	106	140	226	235	106 (71 + 34)	140 (79 + 61)	226 (100 + 126)	235 (91 + 143)
Jolarpettai	Patchur	88	106	140	226	235	106 (71 + 34)	140 (79 + 61)	226 (100 + 126)	235 (91 + 143)
Bangarapet	Bisanattam	88	106	138	224	239	106 (71 + 35)	138 (79 + 59)	224 (100 + 125)	239 (93 + 147)
St Thomas Mount	Tambaram	95	177	229	189	182	177 (100 + 77)	229 (114 + 115)	189 (186 + 3)	182 (167 + 16)
Tiruchchirappalli Jn	Ponmalai	100	105	112	167	206	105 (95 + 10)	112 (97 + 15)	167 (134 + 33)	206 (144 + 62)
Tindivanam	Chengalpattu	71	82	95	173	219	82 (74 + 8)	95 (81 + 14)	173 (134 + 40)	219 (151 + 69)
Villupuram	Tindivanam	71	82	95	173	219	82 (74 + 8)	95 (81 + 14)	173 (134 + 40)	219 (151 + 69)
Tambaram	Chengalpattu	161	239	285	242	237	239 (163 + 76)	285 (172 + 113)	242 (242 + 0)	237 (229 + 8)
Manmad Jn	Ankai Kila	49	172	180	214	193	172 (137 + 35)	180 (161 + 18)	214 (171 + 43)	193 (152 + 42)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Ankai Kila	Ankai	49	172	180	214	193	172 (137 + 35)	180 (161 + 18)	214 (171 + 43)	193 (152 + 42)
Bengaluru city	Baiyyappanahalli	110	123	150	147	184	123 (113 + 10)	150 (133 + 17)	147 (90 + 56)	184 (98 + 87)
Ponmalai	Valadi	50	53	60	109	146	53 (47 + 6)	60 (49 + 11)	109 (80 + 29)	146 (83 + 63)
Valadi	Lalgudi	50	53	60	109	146	53 (47 + 6)	60 (49 + 11)	109 (80 + 29)	146 (83 + 63)
Lalgudi	Ariyalur	48	49	56	105	142	49 (43 + 6)	56 (45 + 11)	105 (76 + 29)	142 (79 + 63)
Ariyalur	Mathur	47	47	53	101	136	47 (43 + 4)	53 (45 + 8)	101 (76 + 25)	136 (78 + 58)
Mathur	Vriddhachalam Jn	47	47	53	101	136	47 (43 + 4)	53 (45 + 8)	101 (76 + 25)	136 (78 + 58)
Ankai	Puntamba Jn	49	100	89	150	156	100 (81 + 19)	89 (74 + 15)	150 (114 + 37)	156 (118 + 39)
Puntamba Jn	Belapur	49	100	89	150	156	100 (81 + 19)	89 (74 + 15)	150 (114 + 37)	156 (118 + 39)
Kadur jn	Birur jn	57	60	67	78	114	60 (44 + 16)	67 (45 + 21)	78 (42 + 36)	114 (40 + 74)
Ahmadnagar	Daund jn	49	98	107	158	170	98 (83 + 15)	107 (96 + 11)	158 (130 + 28)	170 (141 + 28)
Kadur jn	Arsikere jn	57	53	58	60	68	53 (45 + 8)	58 (46 + 12)	60 (35 + 25)	68 (30 + 38)
Manaparai	Tiruchchirappalli Jn	43	42	44	89	100	42 (41 + 1)	44 (42 + 2)	89 (71 + 18)	100 (89 + 11)
Belapur	Ahmadnagar	49	93	87	134	132	93 (79 + 14)	87 (79 + 8)	134 (110 + 24)	132 (111 + 21)
Dindigul	Vadamadura	43	41	43	88	100	41 (41 + 1)	43 (42 + 1)	88 (71 + 17)	100 (90 + 10)
Vadamadura	Manaparai	43	41	43	88	100	41 (41 + 1)	43 (42 + 1)	88 (71 + 17)	100 (90 + 10)
Tirunelveli Jn	Vanchi Maniyachchi Jn	48	48	50	76	97	48 (39 + 9)	50 (38 + 12)	76 (61 + 15)	97 (81 + 16)
Chennai Egmore	St Thomas Mount	95	83	86	78	78	83 (79 + 4)	86 (80 + 6)	78 (78 + 0)	78 (77 + 1)
Birur jn	Chikjajur jn	45	44	50	60	88	44 (30 + 14)	50 (31 + 19)	60 (30 + 30)	88 (40 + 49)
Pune	Phursungi	40	98	117	139	160	98 (73 + 25)	117 (76 + 41)	139 (125 + 14)	160 (139 + 21)
Chikbanavar	Tumakuru	62	75	98	87	114	75 (66 + 9)	98 (81 + 17)	87 (48 + 39)	114 (58 + 56)
Villupuram	Triuvennainallur Road	47	48	54	118	151	48 (46 + 2)	54 (52 + 2)	118 (112 + 6)	151 (99 + 52)
Yeliyur	Mandya	60	57	60	60	75	57 (50 + 7)	60 (53 + 7)	60 (44 + 16)	75 (35 + 40)
Mandya	Ramanagaram	60	57	60	60	75	57 (50 + 7)	60 (53 + 7)	60 (44 + 16)	75 (35 + 40)
Ramanagaram	Kengeri	60	57	60	60	74	57 (50 + 7)	60 (53 + 7)	60 (44 + 16)	74 (35 + 40)
Magnesite Jn	Omalur	44	44	55	65	73	44 (39 + 5)	55 (47 + 8)	65 (52 + 13)	73 (51 + 22)
Triuvennainallur Road	Vriddhachalam Jn	47	46	51	114	148	46 (46 + 0)	51 (50 + 0)	114 (111 + 3)	148 (99 + 50)
Mysuru Jn	Yeliyur	60	56	58	58	72	56 (49 + 7)	58 (52 + 7)	58 (43 + 15)	72 (34 + 38)
Ambaturai	Dindigul	64	65	69	92	124	65 (63 + 2)	69 (66 + 4)	92 (89 + 3)	124 (111 + 13)
Pallappatti Halt	Ambaturai	64	65	69	92	124	65 (63 + 2)	69 (66 + 4)	92 (89 + 3)	124 (111 + 13)
Madurai Jn	Pallappatti Halt	64	65	69	92	124	65 (63 + 2)	69 (66 + 4)	92 (89 + 3)	124 (111 + 13)
Omalur	Dharmapuri	28	38	49	59	67	38 (33 + 5)	49 (42 + 8)	59 (46 + 13)	67 (45 + 22)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Amaravathi Colony Jn	Davangere	43	43	52	62	138	43 (34 + 8)	52 (40 + 13)	62 (34 + 28)	138 (58 + 80)
Bengaluru city	Chikbanavar	34	71	98	95	122	71 (60 + 11)	98 (77 + 21)	95 (46 + 48)	122 (56 + 66)
Arsikere jn	Tumakuru	44	40	42	41	41	40 (36 + 4)	42 (35 + 6)	41 (23 + 18)	41 (22 + 19)
Belagavi	Gunji	35	34	36	53	78	34 (25 + 9)	36 (20 + 16)	53 (46 + 7)	78 (70 + 8)
Gunji	Londa Jn	35	34	36	53	78	34 (25 + 9)	36 (20 + 16)	53 (46 + 7)	78 (70 + 8)
Vanchi Maniyachchi Jn	Virudunagar Jn	46	40	40	49	60	40 (40 + 0)	40 (40 + 0)	49 (44 + 5)	60 (43 + 17)
Sangli	Miraj Jn	42	94	113	111	98	94 (66 + 28)	113 (57 + 56)	111 (99 + 12)	98 (76 + 22)
Koregaon	Karad	40	92	111	130	168	92 (63 + 29)	111 (54 + 57)	130 (120 + 11)	168 (145 + 24)
Karad	Nandre	40	92	111	130	168	92 (63 + 29)	111 (54 + 57)	130 (120 + 11)	168 (145 + 24)
Nandre	Sangli	40	92	111	109	96	92 (63 + 29)	111 (54 + 57)	109 (97 + 12)	96 (74 + 22)
Phursungi	Rajevadi	40	93	114	132	162	93 (64 + 29)	114 (56 + 57)	132 (120 + 12)	162 (138 + 25)
Rajevadi	Lonand	40	93	114	132	162	93 (64 + 29)	114 (56 + 57)	132 (120 + 12)	162 (138 + 25)
Lonand	Palsi	40	95	114	133	171	95 (65 + 30)	114 (56 + 57)	133 (121 + 12)	171 (145 + 26)
Miraj Jn	Ugar Khurd	35	86	103	90	157	86 (65 + 20)	103 (59 + 43)	90 (80 + 9)	157 (128 + 29)
Ugar Khurd	Kudachi	35	86	103	90	157	86 (65 + 20)	103 (59 + 43)	90 (80 + 9)	157 (128 + 29)
Amaravathi Colony Jn	Harihar	43	40	47	54	109	40 (34 + 6)	47 (38 + 8)	54 (40 + 14)	109 (57 + 52)
Baiyyappanahalli	Hosur	28	38	49	58	60	38 (34 + 4)	49 (43 + 6)	58 (46 + 12)	60 (40 + 20)
Haveri	Hubbali Jn	37	38	45	51	106	38 (32 + 6)	45 (36 + 9)	51 (38 + 14)	106 (55 + 51)
Dharmapuri	Hosur	28	38	49	59	61	38 (33 + 5)	49 (42 + 7)	59 (47 + 12)	61 (41 + 20)
Thiruvananthapuram Central	Nagercoil Jn	35	37	39	54	69	37 (37 + 0)	39 (38 + 1)	54 (52 + 2)	69 (64 + 5)
Chikjajur jn	Davangere	43	41	49	54	104	41 (33 + 7)	49 (39 + 10)	54 (30 + 24)	104 (68 + 37)
Harihar	Haveri	37	38	44	51	106	38 (32 + 6)	44 (36 + 8)	51 (38 + 13)	106 (55 + 51)
Virudunagar Jn	Madurai Jn	52	46	47	63	76	46 (46 + 0)	47 (47 + 0)	63 (59 + 4)	76 (65 + 11)
Kengeri	Bengaluru city	60	53	54	56	60	53 (51 + 2)	54 (52 + 3)	56 (42 + 14)	60 (32 + 28)
Nagercoil Jn	Tirunelveli Jn	33	32	35	53	66	32 (30 + 2)	35 (32 + 3)	53 (49 + 3)	66 (61 + 5)
Namakkal	Salem Jn	23	19	22	65	74	19 (19 + 0)	22 (21 + 1)	65 (52 + 13)	74 (39 + 34)
Palsi	Satara	40	89	101	60	82	89 (58 + 31)	101 (46 + 55)	60 (43 + 17)	82 (48 + 34)
Karur	Namakkal	23	19	21	64	72	19 (19 + 0)	21 (21 + 0)	64 (52 + 12)	72 (39 + 33)
Satara	Koregaon	40	86	98	56	77	86 (56 + 29)	98 (44 + 54)	56 (42 + 14)	77 (47 + 30)
Kudachi	Belagavi	35	32	32	44	71	32 (26 + 6)	32 (20 + 12)	44 (43 + 1)	71 (71 + 1)
Dindigul	Karur	26	24	27	44	60	24 (22 + 3)	27 (23 + 3)	44 (34 + 10)	60 (49 + 12)
Nagercoil Jn	Kanniyakumari	29	22	22	22	22	22 (22 + 0)	22 (22 + 0)	22 (22 + 0)	22 (22 + 0)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Walajah Road	Melpakkam	133	189	233	395	410	189 (122 + 68)	233 (151 + 82)	395 (184 + 211)	410 (188 + 222)
Katpadi	Walajah Road	133	188	231	392	406	188 (122 + 67)	231 (151 + 80)	392 (184 + 208)	406 (187 + 219)
Melpakkam	Arakkonam	133	191	243	147	225	191 (106 + 85)	243 (133 + 110)	147 (112 + 36)	225 (158 + 68)
Baramati	Phaltan	40	31.44699	35.18905	76.68622	75.85429	31 (22 + 10)	35 (17 + 18)	77 (70 + 7)	76 (64 + 12)

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NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Salem Jn	Magnesite Jn	123	168	232	304	296	168 (131 + 37)	232 (168 + 64)	304 (222 + 82)	296 (225 + 71)
Punkunnam	Thrissur	116	166	220	278	323	166 (145 + 20)	220 (192 + 28)	278 (224 + 53)	323 (241 + 82)
Chalakudi	Angamali for Kaladi	116	159	213	272	318	159 (138 + 21)	213 (184 + 29)	272 (217 + 54)	318 (235 + 83)
Thrissur	Ollur	116	158	212	270	315	158 (137 + 20)	212 (184 + 28)	270 (216 + 53)	315 (233 + 82)
Shoranur Jn	Punkunnam	102	152	206	264	309	152 (131 + 20)	206 (178 + 28)	264 (210 + 53)	309 (228 + 82)
Ollur	Chalakudi	116	156	210	266	311	156 (137 + 19)	210 (183 + 27)	266 (215 + 51)	311 (232 + 79)
Magudanchavad i	Salem Jn	106	147	205	248	241	147 (114 + 33)	205 (149 + 56)	248 (181 + 66)	241 (208 + 33)
Erode	Magudanchavad i	106	147	205	248	241	147 (114 + 33)	205 (149 + 56)	248 (181 + 66)	241 (208 + 33)
Tirupattur	Jolarpettai	106	130	184	247	237	130 (96 + 34)	184 (124 + 59)	247 (174 + 73)	237 (183 + 54)
Morappur	Tirupattur	106	130	184	247	237	130 (96 + 34)	184 (124 + 59)	247 (174 + 73)	237 (183 + 54)
Shoranur Jn	Palakkad Jn	89	113	149	202	227	113 (97 + 15)	149 (125 + 23)	202 (159 + 43)	227 (194 + 32)
Ingur	Erode	105	134	182	231	268	134 (118 + 16)	182 (154 + 29)	231 (194 + 37)	268 (204 + 64)
Tiruppur	Ingur	105	134	182	230	267	134 (118 + 16)	182 (154 + 28)	230 (194 + 36)	267 (206 + 61)
Irugur	Tiruppur	105	134	181	228	264	134 (118 + 15)	181 (154 + 27)	228 (194 + 34)	264 (206 + 57)
Magnesite Jn	Morappur	106	128	181	243	227	128 (96 + 32)	181 (124 + 57)	243 (174 + 69)	227 (178 + 48)
Kozhikode	Kadalundi	75	105	140	168	209	105 (91 + 14)	140 (119 + 21)	168 (139 + 29)	209 (156 + 52)
Kadalundi	Tirur	75	105	140	168	209	105 (91 + 14)	140 (119 + 21)	168 (139 + 29)	209 (156 + 52)
Tirur	Kuttipuram	75	105	140	168	209	105 (91 + 14)	140 (119 + 21)	168 (139 + 29)	209 (156 + 52)
Kuttipuram	Shoranur Jn	75	105	140	168	209	105 (91 + 14)	140 (119 + 21)	168 (139 + 29)	209 (156 + 52)
Kayankulam Jn	Kollam Jn	88	107	126	155	177	107 (100 + 7)	126 (116 + 10)	155 (135 + 20)	177 (145 + 32)
Palakkad Jn	Kanjikode	88	115	159	200	226	115 (102 + 14)	159 (138 + 21)	200 (173 + 27)	226 (194 + 32)
Kanjikode	Ettimadai	88	115	159	200	226	115 (102 + 14)	159 (138 + 21)	200 (173 + 27)	226 (194 + 32)
Podanur Jn	Ettimadai	88	107	147	187	208	107 (98 + 9)	147 (132 + 16)	187 (168 + 19)	208 (169 + 40)
Angamali for Kaladi	Ernakulam Town	116	120	142	154	173	120 (112 + 7)	142 (132 + 10)	154 (132 + 23)	173 (136 + 37)
Kasaragod	Kannur	63	89	115	136	183	89 (72 + 18)	115 (90 + 25)	136 (103 + 34)	183 (115 + 68)

NODE_A	NODE_B	Train Count 18	Train Count 26	Train Count 31	Train Count 41	Train Count 51	Train Share 26	Train Share 31	Train Share 41	Train Share 51
Kannur	Mahe	72	96	121	137	183	96 (80 + 17)	121 (97 + 24)	137 (106 + 32)	183 (120 + 63)
Mahe	Kozhikode	72	92	114	128	172	92 (78 + 15)	114 (92 + 21)	128 (100 + 28)	172 (115 + 58)
Netravathi	Kasaragod	63	85	107	123	166	85 (67 + 18)	107 (82 + 25)	123 (88 + 34)	166 (99 + 68)
Mangalore Jn	Netravathi	55	77	99	115	158	77 (59 + 18)	99 (74 + 25)	115 (80 + 34)	158 (91 + 68)
Kollam Jn	Thiruvananthapuram Central	82	79	82	95	112	79 (78 + 1)	82 (80 + 1)	95 (89 + 7)	112 (98 + 14)
Ernakulam Town	Ernakulam Jn	71	69	78	88	86	69 (68 + 1)	78 (76 + 2)	88 (81 + 7)	86 (70 + 16)
Ernakulam Jn	Alappuzha	49	53	62	72	70	53 (52 + 1)	62 (60 + 2)	72 (65 + 7)	70 (55 + 16)
Podanur Jn	Irugur	21	58	91	68	73	58 (42 + 15)	91 (65 + 26)	68 (40 + 28)	73 (62 + 11)
Karur	Erode	41	52	64	60	80	52 (34 + 18)	64 (35 + 29)	60 (28 + 32)	80 (34 + 46)
Haripad	Kayankulam Jn	43	40	41	63	63	40 (39 + 1)	41 (40 + 1)	63 (58 + 6)	63 (51 + 11)
Alappuzha	Haripad	43	38	38	47	42	38 (38 + 0)	38 (38 + 0)	47 (43 + 4)	42 (32 + 10)

ANNEXURE 12.3: HUN Proposals by Section by Cardinal Years

HUN 1

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Rajendranagar T	Patna Saheb	-	-	-	2L+TC
Buxar	Ara Jn	2L+TC	-	3L+TC	4L+TC
Fatuha Jn	Bakhtiyarpur Jn	-	-	2L+TC	4L+TC
Dildarnagar Jn	Buxar	2L+TC	3L+TC	4L+TC	-
Mughal Sarai Jn	Dildarnagar Jn	2L+TC	3L+TC	4L+TC	-
Bihta	Danapur	3L+TC	-	4L+TC	6L+TC
Ara Jn	Bihta	3L+TC	-	4L+TC	6L+TC
Patna Saheb	Fatuha Jn	-	-	2L+TC	4L+TC
Kiul Jn	Jamui	-	-	2L+TC	4L+TC
Jamui	Jhajha	-	-	2L+TC	4L+TC
Sheikhpura	Luckeesarai Jn	-	-	2L+TC	-
Manpur Jn	Tilaiya Jn	-	-	2L+TC	-
Nawadah	Sheikhpura	-	-	2L+TC	-
Tilaiya Jn	Nawadah	-	-	2L+TC	-
Luckeesarai Jn	Kiul Jn	2L+TC	-	4L+TC	-
Luckeesarai Jn	Rampur Dumra Jn	2L+TC	-	4L+TC	-
Bakhtiyarpur Jn	Mokama Jn	-	-	-	4L+TC
Danapur	Patliputra	2L	2L+TC	-	4L+TC
Patliputra	Phulwari sharif	2L	2L+TC	-	4L+TC
Patna Jn	Danapur	2L+TC	-	-	4L+TC
Patna Jn	Rajendranagar T	-	-	2L+TC	4L+TC
Hatidah Jn	Rampur Dumra Jn	-	-	-	2L+TC
Tall Jn	Hatidah Jn	-	-	-	2L+TC
Mokama Jn	Tall Jn	-	-	2L+TC	4L+TC
Andal Jn	Ukhra	3L+TC	-	-	-
Jhajha	Jasidih Jn	2L+TC	-	3L+TC	-
Bhimgara Jn	Siuri	-	2L+TC	-	-
Siuri	Sainthia Jn	-	2L+TC	-	-
Pandabeswar	Bhimgara Jn	-	2L+TC	-	-
Madhupur Jn	Jamtara	2L+TC	-	3L+TC	4L+TC
Sitarampur Jn	Jamtara	2L+TC	-	3L+TC	4L+TC
Madhupur Jn	Jasidih Jn	2L+TC	-	3L+TC	4L+TC
Ukhra	Pandabeswar	-	3L+TC	-	-
Gadadharpur	Tarapith Road	4L+TC	-	-	-
Prantik	Ahmadpur Jn	2L+TC	-	3L+TC	-
Khana Jn	Prantik	2L+TC	-	3L+TC	-
Ahmadpur Jn	Sainthia Jn	2L+TC	-	3L+TC	-
Gumani	Nalhati Jn	3L+TC	-	4L+TC	-
Rampurhat Jn	Nalhati Jn	4L+TC	-	-	-
Sainthia Jn	Gadadharpur	4L+TC	-	-	-
Tarapith Road	Rampurhat Jn	4L+TC	-	-	-
Barharwa Jn	BoniDanga	-	2L+TC	3L+TC	-
BoniDanga Link Cabin	Gumani	-	2L+TC	3L+TC	-
Tinpahar Jn	Barharwa Jn	-	-	-	2L+TC
Sahibganj	Tinpahar Jn	-	-	-	2L+TC
Sultanganj	Bhagalpur Jn	-	-	2L+TC	-
Ratanpur	Sultanganj	-	-	2L+TC	-
BoniDanga	BoniDanga Link Cabin	-	2L+TC	3L+TC	-
Jamalpur Jn	Kiul Jn	-	-	2L+TC	3L+TC
Kahalgaon	Pirpainti	-	-	-	-
Bhagalpur Jn	Kahalgaon	2L	-	-	-
Jamalpur Jn	Ratanpur	-	-	2L+TC	-
Pirpainti	Sahibganj	-	-	-	-
Sonipat	Adarsh Nagar Delhi	-	2L+TC	-	4L+TC
Sonipat	Panipat Jn	-	2L+TC	-	4L+TC
Kurukshetra Jn	Ambala Cantt Jn	-	-	2L+TC	-
Panipat Jn	Karnal	-	2L+TC	-	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Karnal	Kurukshetra Jn	-	2L+TC	-	-
Adarsh Nagar Delhi	Sabji Mandi	-	3L+TC	-	4L+TC
Verka Jn	Amritsar Jn	-	2L	-	2L+TC
Kathua	Bharoli Jn	-	-	2L+TC	-
Jammu Tawi	Kathua	-	-	2L+TC	-
Jalandhar city Jn	Jalandhar Cantt Jn	-	-	2L+TC	3L+TC
Kartarpur	Jalandhar city Jn	-	-	2L+TC	3L+TC
Beas Jn	Kartarpur	-	-	2L+TC	3L+TC
Amritsar Jn	Beas Jn	-	-	2L+TC	3L+TC
Phillaur Jn	Ludhiana Jn	3L+TC	4L+TC	-	-
Jalandhar Cantt Jn	Phagwara Jn	2L+TC	-	4L+TC	-
Phagwara Jn	Phillaur Jn	2L+TC	4L+TC	-	-
Ludhiana Jn	Sanehwal	3L+TC	-	-	-
Batala Jn	Verka Jn	-	-	-	2L
Bharoli Jn	Gurdaspur	-	-	-	2L
Gurdaspur	Batala Jn	-	-	-	2L
Ayodhya Jn	Akbarpur Jn	-	-	-	2L+TC
Alambagh	Alamnagar	3L+TC	-	-	4L+TC
Ayodhya Jn	Faizabad Jn	-	-	-	2L+TC
Amethi	Chilbila Jn	-	-	-	-
Rai Bareli Jn	Gauriganj	-	-	-	-
Amethi	Gauriganj	-	-	-	-
Dalmau Jn	Unchahar Jn	-	-	-	-
Lucknow	Dilkusha Cabin	3L+TC	4L+TC	-	-
BaraBanki Jn	Rudauli	-	-	-	2L+TC
Rudauli	Faizabad Jn	-	-	-	2L+TC
Janghai Jn	Phaphamau Jn	-	-	-	-
Pratapgarh Jn	Janghai Jn	-	-	-	-
Alambagh	Lucknow	3L+TC	4L+TC	-	-
Chilbila Jn	Pratapgarh Jn	-	-	-	-
Utratia Jn	Rai Bareli Jn	-	-	-	-
Rai Bareli Jn	Daryapur Jn	-	-	2L	-
Daryapur Jn	Unchahar Jn	-	-	2L	-
Shahganj Jn	Akbarpur Jn	-	-	-	-
AkbarGanj	Adhinpur	-	-	-	2L+TC
Utratia Jn	Chhandrauli	-	-	-	2L+TC
Chhandrauli	AkbarGanj	-	-	-	2L+TC
Sultanpur Jn	Adhinpur	-	-	-	2L+TC
Unchahar Jn	Phaphamau Jn	-	-	-	-
Unnao Jn	Lalganj	-	-	-	-
Lalganj	Dalmau Jn	-	-	-	-
Dilkusha Cabin	Utratia Jn	-	2L+TC	-	-
Zafarabad Jn	Varanasi Jn	-	-	2L+TC	-
Janghai Jn	Bhadohi	-	-	-	-
Bhadohi	Varanasi Jn	-	-	-	-
Jaunpur Jn	Zafarabad Jn	2L	-	-	-
Shahganj Jn	Jaunpur Jn	-	-	-	-
Zafarabad Jn	Sultanpur Jn	-	-	-	2L+TC
Hardoi	Balamau Jn	2L+TC	-	-	4L+TC
Roza Jn	Hardoi	2L+TC	-	-	4L+TC
Raja Ka Sahaspur Jn	Chandausi Jn	-	-	-	-
Khanalampura west	Roorkee	2L+TC	-	-	-
Laksar Jn	Roorkee	2L+TC	-	-	-
Rahimabad	Alamnagar	2L+TC	-	-	4L+TC
Seohara	Dhampur	-	2L+TC	-	-
Moradabad Jn	Seohara	-	2L+TC	-	-
Laksar Jn	Muzzampur Narain Jn	-	2L+TC	-	-
Muzzampur Narain Jn	Najibabad Jn	-	2L+TC	-	-
Balamau Jn	Rahimabad	2L+TC	-	-	4L+TC

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Moradabad Jn	Raja Ka Sahaspur Jn	-	-	-	2L
Bareilly Jn	Ramganga Bridge	-	2L	-	-
Chandausi Jn	Ramganga Bridge	-	-	2L	-
Shahjahanpur Jn	Roza Jn	2L+TC	4L+TC	-	-
Chaneti	Shahjahanpur Jn	2L+TC	4L+TC	-	-
Bareilly Jn	Chaneti	2L+TC	4L+TC	-	-
Morinda	Chandigarh	-	-	2L	-
Chandigarh	Dhappar	-	-	2L+TC	-
Dhappar	Ambala Cantt Jn	-	-	2L+TC	-
Rajpura Jn	Ambala Cantt Jn	2L+TC	-	-	-
Sanehwal	Morinda	-	-	2L	-
Ambala Cantt Jn	Jagadhri	2L+TC	-	-	-
Khanalampura west	Saharanpur Jn	-	2L+TC	-	3L+TC
Sirhind Jn	Rajpura Jn	2L+TC	-	-	-
Jagadhri	Saharanpur Jn	2L+TC	-	-	-
Sanehwal	Doraha	4L+TC	-	-	-
Doraha	Sirhind Jn	4L+TC	-	-	-
Najibabad Jn	Dhampur	-	2L+TC	-	-

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NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Barkichampi	Lohardaga	2L	-	-	-
Nayagarh	Jaroli	-	-	-	-
Khandwa jn	Burhanpur	2L+TC	-	3L+TC	-
Bhusawal jn	Burhanpur	2L+TC	-	3L+TC	-
Jalgaon Jn	Bhusawal jn	4L+ABTS	-	-	-
Jakhapura Jn	Sukinda Road	-	-	3L+TC	-
Kendujhargarh	Nayagarh	-	-	-	-
Baghuapal	Tomka Jn	-	-	2L+TC	3L+TC
Sukinda Road	Baghuapal	-	-	2L+TC	3L+TC
Tomka Jn	Kendujhargarh	-	-	-	-
Barkakana Jn	Patratu	-	-	-	2L+TC
Garhwa Road Jn	Kajri	-	-	2L+TC	-
Daltonganj	Barwadih	-	-	2L+TC	-
Kajri	Daltonganj	-	-	2L+TC	-
Chopan	Billi Jn	-	-	-	3L+TC
Billi Jn	Obra dam	-	2L+TC	3L+TC	-
Meralgram	Garhwa Road Jn	-	-	4L+TC	-
Singrauli Jn	Karaila Road Jn	-	2L+TC	3L+TC	-
Renukut	Meralgram	-	2L+TC	4L+TC	-
Obra dam	Karaila Road Jn	-	2L+TC	3L+TC	-
Tori	Patratu	-	-	-	2L+TC
Dhanbad Jn	Pradhankhunta Jn	2L+ABTS	-	-	-
Pradhankhunta Jn	Pathardih	-	-	-	-
Billi Jn	Renukut	-	-	4L+TC	-
Latehar	Tori	-	-	-	-
Barwadih	Latehar	-	-	-	-
Sonnagar Jn	Garhwa Road Jn	2L+TC	-	4L+TC	-
Robertsganj	Chopan	-	2L	-	2L+TC
Chunar jn	Robertsganj	-	2L	-	2L+TC
Allahabad Jn	Naini Jn	3L+ABTS	-	-	-
Manikpur Jn	Link Jn Cabin	2L+TC	-	-	-
Naini Jn	Link Jn Cabin	2L+TC	-	-	-
Link Jn Cabin	Chheoki	2L+TC	-	-	-
Allahabad Jn	Varanasi Jn	-	-	-	-
Varanasi Jn	Block Hut B	-	-	4L+TC	-
Block Hut B	Mughal Sarai Jn	-	-	4L+TC	-
Garhdhrubeswar	Adra Jn	-	-	-	-
Sanka	Adra Jn	-	-	-	-
Anara Jn	Garhdhrubeswar	-	-	-	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Purulia Jn	Anara Jn	-	-	-	-
Pathardih	Bhojudin Jn	-	-	-	2L
Burnpur	Asansol jn	-	2L	-	-
Damodar Jn	Burnpur	-	-	-	-
Garhdhrubeswar	Joychandipahar	-	-	-	-
Joychandipahar	Ramkanali Jn	-	-	-	-
Bankura Jn	Bishnupur Jn	-	-	-	-
Bishnupur Jn	Bhadutala PH	-	-	-	-
Bhadutala PH	Midnapore	-	-	-	-
Chhatna	Adra Jn	-	-	-	-
Chhatna	Bankura Jn	-	-	-	-
Purulia Jn	Chandil Jn	-	-	-	-
Kotshila Jn	Purulia Jn	-	-	-	-
Ramkanali Jn	Damodar Jn	-	-	-	-
Rukni Jn	Bhojudin Jn	-	-	-	2L+TC
Rukni Jn	Sanka	-	-	-	-
Bimalgarh Jn	Barsuan	-	-	-	-
Champajharan	Bondamunda PH	-	-	-	2L+TC
Patasahi	Champajharan	-	-	-	2L+TC
Bimalgarh Jn	Patasahi	-	-	-	2L+TC
Bondamunda PH	Nawagaon	-	-	-	-
Dangoaposi	Padapahar Jn	-	-	-	-
Chandil Jn	Manikui	-	-	-	2L+TC
Manikui	Kandra Jn	-	-	-	2L+TC
Jaroli	Padapahar Jn	-	-	-	-
Rajkharswan Jn	Dangoaposi	-	-	-	-
Kandra Jn	Sini Jn	-	-	-	-
Midnapore	Gokulpur	-	-	2L+TC	-
Kharagpur Jn	Gokulpur	-	-	-	2L+TC
Nawagaon	Hatia	-	-	-	-
Kotshila Jn	Muri Jn	-	-	-	-
Muri Jn	Ramgarh Cantt	-	-	-	-
Ramgarh Cantt	Barkakana Jn	-	-	-	-
Namkom	Tatisilwai	-	-	2L+TC	-
Tatisilwai	Burwadag	-	-	2L+TC	-
Burwadag	Muri Jn	-	-	2L+TC	-
Ranchi Jn	Namkom	-	-	2L+TC	-
Ranchi Jn	Hatia	-	-	2L+TC	-
Lohardaga	Ranchi Jn	-	-	-	-
Harda	Itarsi jn	2L+TC	3L+TC	-	-
Khandwa jn	Talvadya	2L+TC	3L+TC	-	-
Khirkiya	Harda	2L+TC	3L+TC	-	-
Talvadya	Khirkiya	2L+TC	3L+TC	-	-
Narsinghpur	Itarsi jn	2L+TC	-	-	-
Shridham	Narsinghpur	2L+TC	-	-	-
Jabalpur Jn	Shridham	2L+TC	-	-	-
Jabalpur Jn	Katni Jn	2L+TC	-	-	3L+TC
Satna Jn	Manikpur Jn	2L+TC	-	-	3L+TC
Satna Jn	Katni Jn	2L+TC	-	3L+TC	-
Mahadiya	Singrauli Jn	-	2L+TC	-	-
New Katni Jn	Mahadiya	-	2L+TC	-	-
Dharangaon	Jalgaon Jn	2L+TC	-	3L+TC	-
Nandurbar	Hol	2L+TC	-	3L+TC	-
Hol	Nardana	2L+TC	-	3L+TC	-
Nardana	Amalner	2L+TC	-	3L+TC	-
Amalner	Dharangaon	2L+TC	-	3L+TC	-
Udhna Jn	Chalthan	2L+TC	-	3L+TC	-
Chalthan	Vyara	2L+TC	-	3L+TC	-
Vyara	Ukai Songadh	2L+TC	-	3L+TC	-
Chinchpada	Nandurbar	2L+TC	-	-	3L+TC
Ukai Songadh	Chinchpada	2L+TC	-	-	3L+TC
Tatisilwai	Barkakana Jn	2L	-	2L+TC	-

HUN 3

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Gaya Jn	Manpur Jn	3L+ABTS	-	-	-
Rewari Jn	Jhajjar	-	-	-	-
Jhajjar	Asthal Bohar Jn	-	-	-	-
Garhi Harsaru Jn	Gurgaon	-	-	2L+TC	-
Gurgaon	Delhi Cantt	-	-	2L+TC	-
Rewari Jn	Garhi Harsaru Jn	2L+TC	-	3L+TC	4L+TC
Gohana	Panipat Jn	-	-	-	-
Rohtak Jn	Gohana	-	-	-	-
Asthal Bohar Jn	Rohtak Jn	-	-	2L+TC	4L+TC
Swarupganj	Abu Road	-	-	-	2L+TC
Ajmer Jn	Madar	-	-	2L+TC	3L+TC
Beawar	Daurai	-	-	-	2L+TC
Mori bera	Swarupganj	-	-	-	2L+TC
Daurai	Ajmer Jn	-	-	-	-
Chandawal	Beawar	-	-	-	2L+TC
Marwar Jn	Chandawal	-	2L+TC	-	3L+TC
Abu Road	Palanpur Jn	-	-	-	2L+TC
Marwar Jn	Mori bera	-	-	-	2L+TC
Alwar Jn	Bandikui Jn	-	-	-	2L+TC
Dausa	Jaipur Jn	-	-	3L+TC	-
Dausa	Bandikui Jn	-	-	3L+TC	-
Jaipur Jn	Phulera Jn	-	2L+TC	3L+TC	-
Phulera Jn	Madar	-	-	2L+TC	-
Alwar Jn	Rewari Jn	-	-	-	2L+TC
Sabarmati Jn	Ahmedabad Jn	-	-	-	-
Viramgam Jn	Chandlodiya	2L+TC	3L+TC	4L+TC	-
Vatva	Geratpur	-	2L+TC	-	3L+TC
Dhrangadhra Jn	Khakhrechi	-	-	2L+TC	3L+TC
Maliya Miyana Jn	Khakhrechi	-	-	2L+TC	3L+TC
Dhrangadhra Jn	Jhund Jn	-	-	2L+TC	3L+TC
Mahesana Jn	Ambliyasan Jn	2L	-	2L+TC	-
Ambliyasan Jn	Kalol Jn	-	-	2L+TC	-
Ahmedabad Jn	Kankariya	4L+TC	-	-	-
Kalol Jn	Khodiyar Jn	-	-	2L+TC	-
Mahesana Jn	Palanpur Jn	-	-	2L+TC	-
Samakhiali Jn	Maliya Miyana Jn	-	-	2L+TC	-
Chandlodiya	Sabarmati Jn	-	-	3L+TC	4L+TC
Sabarmati Jn	Khodiyar Jn	-	-	2L+TC	-
Kankariya	Vatva	-	-	-	4L+TC
Jhund Jn	Viramgam Jn	-	-	-	2L+TC
Kanjari Boriyavi Jn	Anand Jn	-	2L+TC	-	3L+TC
Bajva	Vasad Jn	-	-	2L+TC	3L+TC
Geratpur	Nadiad Jn	-	2L+TC	-	3L+TC
Nadiad Jn	Kanjari Boriyavi Jn	-	2L+TC	-	3L+TC
Bajva	Vadodara C	-	2L+TC	-	3L+TC
Vadodara C	Vadodara D	2L+ABTS	-	3L+ABTS	4L+ABTS
Vasad Jn	Anand Jn	-	-	2L+TC	3L+TC
Surendranagar Jn	Than	2L+TC	-	-	-
Than	Wankaner Jn	2L+TC	-	-	-
Surendranagar Jn	Viramgam Jn	2L+TC	3L+TC	-	-
Wankaner Jn	Rajkot City	2L+TC	3L+TC	4L+TC	-
Dausa	Gangapur city	2L	-	3L+TC	-

HUN 4

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Adipur Jn	Mundra Port R&D yard	-	-	2L	-
Bathinda Jn	Sadda Singhwala	-	-	3L+TC	-
Sadda Singhwala	Mansa	-	-	3L+TC	-
Mansa	Jakhal Jn	-	-	3L+TC	-
Firozpur Cantt Jn	Faridkot	-	-	-	-
Faridkot	Kot Kapura Jn	-	-	-	-
Kot Kapura Jn	Bathinda Jn	-	-	2L	-
Jakhal Jn	Hisar Jn	2L+TC	-	-	-
Ratangarh jn	Churu Jn	-	-	-	2L
Bhattu	Hisar Jn	-	-	-	-
Suchan Kotli	Bhattu	-	-	-	-
Sirsa	Suchan Kotli	-	-	-	-
Churu Jn	Sadulpur Jn	-	-	-	-
Hisar Jn	Suratpura Jn	-	-	-	-
Sadulpur Jn	Suratpura Jn	-	-	-	-
Bathinda Jn	Sirsa	-	-	-	-
Merta Road Jn	Degana Jn	-	-	-	2L+TC
Ratangarh jn	Degana Jn	-	-	-	-
Jodhpur Jn	Luni Jn	-	-	-	2L+TC
Luni Jn	Samdari Jn	2L	-	-	2L+TC
Pipar Road Jn	Rai Ka Bagh	-	-	-	2L+TC
Merta Road Jn	Pipar Road Jn	-	-	-	2L+TC
Jodhpur Jn	Rai Ka Bagh	-	-	-	2L+TC
Jalor	Bhildi Jn	2L	-	-	2L+TC
Samdari Jn	Jalor	2L	-	-	2L+TC
Samakhiali Jn	Santalpur	2L	2L+TC	3L+TC	4L+TC
Santalpur	Bhildi Jn	2L	2L+TC	3L+TC	4L+TC
Adipur Jn	Gandhidham JN	-	-	-	2L+TC
Gandhidham JN	Old Kandla Port	-	-	-	-
Gandhidham JN	Bhimasar	2L+TC	3L+TC	4L+TC	-
Bhimasar	Samakhiali Jn	2L+TC	3L+TC	4L+TC	-

HUN 5

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Juhi cabin	Bhimsen Jn	-	-	-	-
Paniyahawa	Valmiki nagar road	-	-	-	2L
Ramdayalu Nagar	Goshawar Halt	-	-	2L+TC	-
Hajipur Jn	Goshawar Halt	2L+TC	-	-	-
Muzaffarpur Jn	Samastipur Jn	-	-	-	2L+TC
Ramdayalu Nagar	Muzaffarpur Jn	-	-	-	2L+TC
Bachhwara Jn	Samastipur Jn	-	-	3L+TC	4L+TC
Raxaul Jn	Bairagnia	-	-	-	2L
Bairagnia	Sitamarhi Jn	-	-	-	2L
Janakpur Road	Sitamarhi Jn	-	-	-	2L
Darbhanga Jn	Janakpur Road	-	-	-	2L
Narkatiaganj Jn	Bettiah	-	-	-	-
Bettiah	Sagauli Jn	-	-	-	-
Bapudham Motihari	Motihari Court	-	-	-	-
Muzaffarpur Jn	Motihari Court	-	-	-	-
Sagauli Jn	Bapudham Motihari	-	-	-	-
Sagauli Jn	Raxaul Jn	-	-	-	-
Samastipur Jn	Darbhanga Jn	-	-	3L+TC	-
Valmiki nagar road	Narkatiaganj Jn	-	-	-	-
Naini Jn	Chheoki	3L+ABTS	-	-	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Mirzapur	Chunar jn	3L+ABTS	-	-	-
Chunar jn	Jeonathpur	3L+ABTS	-	-	-
Juhi cabin	Kanpur Central	4L+ABTS	-	-	6L+ABTS
Chheoki	Mirzapur	3L+ABTS	-	-	-
Jeonathpur	Mughal Sarai Jn	3L+ABTS	-	-	-
Pokhrayan	Orai	-	-	-	-
Bhimsen Jn	Pokhrayan	-	-	-	-
Orai	Ait Jn	-	-	-	-
Ait Jn	Jhansi Jn	-	-	-	-
Mau Jn	Aunrihar Jn	-	-	-	2L+TC
Sarnath	Aunrihar Jn	-	-	2L+TC	3L+TC
Phephna Jn	Ballia	-	-	-	2L+TC
Ballia	Chhapra Jn	-	-	-	2L+TC
Kaptanganj Jn	Ghughali	2L	-	-	2L+TC
Gorakhpur Cantt Jn	Kaptanganj Jn	2L	-	-	2L+TC
Ghughali	Paniyahawa	2L	-	-	2L+TC
Bhatni Jn	Salempur Jn	-	-	-	-
Salempur Jn	Indara Jn	-	-	-	-
Indara Jn	Mau Jn	-	-	3L+TC	-
Ghazipur City	Aunrihar Jn	-	-	-	-
Phephna Jn	Ghazipur Ghat halt	-	-	-	-
Ghazipur Ghat halt	Ghazipur City	-	-	-	-
Varanasi Jn	Sarnath	-	2L+TC	-	3L+TC
BaraBanki Jn	Burhwal Jn	2L+TC	-	3L+TC	-
Burhwal Jn	Jarwal Road	3L+TC	4L+TC	-	-
Jarwal Road	Gonda Jn	3L+TC	4L+TC	-	-
Gonda Jn	Balrampur	-	-	-	-
Balrampur	Gainsari Jn	-	-	-	-
Ahirauli Halt	Anand Nagar Jn	-	-	-	-
Gainsari Jn	Barhni	-	-	-	-
Barhni	Ahirauli Halt	-	-	-	-
Gorakhpur Jn	Anand Nagar Jn	-	-	-	-
Gorakhpur Jn	Gorakhpur Cantt Jn	3L+TC	4L+TC	-	-
Unnao Jn	Manaknagar	3L+TC	4L+TC	-	-
Manaknagar	Alambagh	3L+TC	4L+TC	-	-
Malhaur	BaraBanki Jn	-	4L+TC	-	-
Lucknow	Dilkusha Cabin	3L+TC	4L+TC	-	-
Alambagh	Lucknow	3L+TC	4L+TC	-	-
Dilkusha Cabin	Malhaur	2L+TC	3L+TC	-	4L+TC
Kanpur Central	Unnao Jn	4L+TC	-	-	6L+TC
Paniyahawa	Tamkuhi Road	-	-	-	2L

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NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Tribeni	Nabadwip Dham	2L+TC	-	-	-
Dainhat	Katwa Jn	2L+TC	-	-	-
Nabadwip Dham	Dainhat	2L+TC	-	-	-
Bandel Jn	Tribeni	2L+TC	-	-	-
Ambalgram	Azimganj	2L+TC	-	-	-
Katwa Jn	Ambalgram	2L+TC	-	-	-
Azimganj	Manigram	-	-	2L+TC	-
Manigram	New Farakka Jn	-	-	2L+TC	-
New Farakka Jn	Old Malda Jn	2L+TC	3L+TC	4L+TC	-
Fakiragram Jn	Golakganj	-	-	2L	-
Golakganj	Dhubri	-	-	-	-
Golakganj	New Cooch Behar jn	-	-	-	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Kokrajhar	New Bongaigaon Jn	2L+TC	3L+TC	4L+TC	-
Kokrajhar	Fakiragram Jn	2L+TC	3L+TC	4L+TC	-
Raninagar Jalpaiguri Jn	New Domohani	2L+TC	3L+TC	4L+TC	-
New Domohani	New Maynaguri	2L+TC	3L+TC	4L+TC	-
New Maynaguri	New Cooch Behar jn	2L+TC	3L+TC	4L+TC	-
Kishanganj	Aluabari Road	2L+TC	4L+TC	-	-
Barsoi Jn	Kishanganj	2L+TC	4L+TC	-	-
Eklakhi Jn	Milangarh	2L+TC	-	3L+TC	-
Milangarh	Kumedpur Jn	2L+TC	-	3L+TC	-
Kumedpur Jn	Katihar Jn	2L+TC	-	-	-
Kumedpur Jn	Mukuria Jn	2L+TC	4L+TC	-	-
Old Malda Jn	Eklakhi Jn	2L+TC	3L+TC	4L+TC	-
Mukuria Jn	Barsoi Jn	2L+TC	4L+TC	-	-
New Jalpaiguri Jn	Raninagar Jalpaiguri Jn	2L+TC	3L+TC	4L+TC	-
Galgalia	Siliguri Jn	-	-	2L	2L+TC
Aluabari Road	Galgalia	-	-	2L	2L+TC
Siliguri Jn	Siliguri Town	-	-	2L+TC	-
New Jalpaiguri Jn	Siliguri Town	-	-	2L+TC	-
Digaru	Tetelia	2L+TC	-	4L+TC	-
Tetelia	Jagi road	2L+TC	-	4L+TC	-
Jagi road	Chaparmukh Jn	2L+TC	-	4L+TC	-
Chaparmukh Jn	Lumdiong South	2L+TC	-	4L+TC	-
Guwahati	New Guwahati	4L+TC	-	-	-
Kamakhya Jn	Guwahati	-	-	4L+TC	-
Lumdiong South	Diphu	2L	-	2L+TC	3L+TC
Diphu	Dimapur	2L	-	2L+TC	3L+TC
Dimapur	Furkating Jn	2L	-	2L+TC	3L+TC
New Guwahati	Digaru	2L+TC	-	4L+TC	-
New Bongaigaon Jn	Abhayapuri Assam	-	-	3L+TC	-
Abhayapuri Assam	Goalpara Town	-	-	3L+TC	-
Dudhnol Jn	Kamakhya Jn	-	-	3L+TC	-
Goalpara Town	Dudhnol Jn	-	-	3L+TC	-
Furkating Jn	Mariani Jn	-	2L	-	2L+TC
Mariani Jn	Amguri Jn	-	2L	-	2L+TC
Amguri Jn	Simaluguri Jn	-	2L	-	2L+TC
Simaluguri Jn	Namrup	-	2L	-	2L+TC
Tinsukia Jn	Namrup	-	2L	-	2L+TC
Dibrugarh	Tinsukia Jn	-	-	2L	-
Katihar Jn	Mukuria Jn	-	-	-	2L

HUN 7

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Mandir Hasaud	Lakholi	-	-	-	4L+TC
Dhenkanal	Rajathgarh Jn	-	-	-	4L+TC
Budhapank	Nayabhagirathpur	-	-	-	4L+TC
Nayabhagirathpur	Dhenkanal	-	-	-	4L+TC
Cuttack Jn	Barang Jn	3L+ABTS	-	-	-
Cuttack Jn	Bagadia Ph	-	-	-	3L+TC
Bagadia Ph	Paradeep	-	-	-	3L+TC
Machapur Jn	Radhakishorpur Jn	-	-	-	-
Radhakishorpur Jn	Barang Jn	-	-	-	3L+TC
Rajathgarh Jn	Machapur Jn	-	-	-	-
Angul	Talcher Jn Cabin	-	-	-	4L+TC
Talcher Jn Cabin	Budhapank	4L+TC	-	-	-
Titlagarh Jn	Balangir	3L+TC	-	-	-
Balangir	Balangir Road PH	3L+TC	-	-	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Balangir Road PH	Bargarh Road	3L+TC	-	-	-
Boinda	Angul	-	-	-	-
Jharsuguda Road Jn	Rengali	-	-	4L+TC	-
Rengali	Sarla Jn	-	-	4L+TC	-
Sambalpur Jn	Sarla Jn	-	-	4L+TC	-
Nawapara Road	Mahasamund	-	-	-	3L+TC
Bargarh Road	Sambalpur Jn	3L+TC	-	-	-
Sambalpur Jn	Sambalpur City Jn	-	-	2L+TC	-
Sambalpur City Jn	Handapa	-	-	2L+TC	-
Handapa	Boinda	-	-	2L+TC	-
Titlagarh Jn	Nawapara Road	-	-	-	3L+TC
Lanjigarh Road Jn	Titlagarh Jn	3L+TC	4L+TC	-	-
Singapuram Road Jn	Lanjigarh Road Jn	3L+TC	4L+TC	-	-
Gopalapatnam	Visakhapatnam Jn	3L+TC	4L+TC	-	-
Jagdalpur	Tokopal	-	-	-	-
Jeypore	Koraput Jn	-	-	-	2L+TC
Jeypore	Jagdalpur	-	-	-	2L+TC
Damonjodi	Singapuram Road Jn	-	-	-	-
Koraput Jn	Damonjodi	-	-	-	-
Araku	Koraput Jn	-	-	-	-
Kottavalasa Jn	Araku	-	-	-	-
Simhachalam North Jn	Kottavalasa Jn	4L+ABTS	-	-	-
Tokopal	Dantewara	-	-	-	-
Dantewara	Kirandul	-	-	-	-
Simhachalam North Jn	Gopalapatnam	3L+ABTS	-	-	-
Vizianagaram Jn	Bobbili Jn	3L+TC	-	4L+TC	-
Singapuram Road Jn	Rayagada	3L+TC	-	4L+TC	-
Bobbili Jn	Rayagada	3L+TC	-	4L+TC	-
Kottavalasa Jn	Vizianagaram Jn	3L+ABTS	-	-	-
Anuppur Jn	Kotma	-	-	-	-
Shahdol	Anuppur Jn	-	-	-	3L+TC
Anuppur Jn	Pendra Road	-	-	3L+TC	-
Pendra Road	Bilaspur Jn	3L	-	3L+TC	-
Darritola Jn	Baikunthpur Road	-	-	2L	-
Boridand Jn	Darritola Jn	-	-	2L	-
Baikunthpur Road	Ambikapur	-	-	2L	-
Boridand Jn	Chirimiri	-	-	-	-
Gevra Road	Korba	-	-	2L+TC	3L+TC
Champa Jn	Korba	-	-	2L+TC	3L+TC
Kotma	Boridand Jn	-	-	-	-
Katni Jn	New Katni Jn	-	3L+TC	-	-
Umaria	Shahdol	-	3L+TC	-	-
New Katni Jn	Umaria	-	3L+TC	-	-
Bilaspur Jn	Urkura	4L+ABTS	-	-	-
Raipur Vizainagaram Hut	Mandir Hasaud	-	-	-	3L+TC
Lakholi	Mahasamund	-	-	-	3L+TC
Raipur Jn	Raipur Vizainagaram Hut	-	-	-	3L+TC
Urkura	Raipur Jn	-	-	2L+TC	-
Guna jn	Ashoknagar	-	-	2L+TC	-
Ashoknagar	Bina jn	-	-	2L+TC	-
Ruthiyai jn	Guna jn	-	-	2L+TC	-
Bina jn	Saugor	-	-	4L+TC	-
Katni Jn	Damoh	-	-	4L+TC	-
Damoh	Saugor	-	-	4L+TC	-
Ruthiyai jn	Baran	-	-	-	3L+TC
Kota Jn	Bhonra	-	-	-	3L+TC
Bhonra	Baran	-	-	-	3L+TC

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Barwadih	Ambikapur	-	-	2L	-
Gevra Road	Pendra Road	-	-	2L	-

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NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Gudivada Jn	Machillpatnam	-	-	-	-
Krishna Canal Jn	Vijayawada Jn	3L+ABTS	-	-	-
Vijayawada Jn	Ramavarappadu	-	-	-	-
Ramavarappadu	Gudivada Jn	-	-	-	-
Guntakal Jn	Ballari Jn	-	2L+TC	3L+TC	4L+TC
Pendekallu Jn	Dhone Jn	-	-	-	-
Guntakal Jn	Pendekallu Jn	-	-	-	-
Dhone Jn	Nandyal	-	-	-	-
Nallapadu	Guntur Jn	-	2L+TC	-	3L+TC
Guntur Jn	Krishna Canal Jn	-	-	2L+TC	3L+TC
Pagidipalli Jn	Nalgonda	-	-	2L	-
Nalgonda	Miryalaguda	-	-	2L	-
Nadikudi Jn	Pondugula	-	-	2L	-
Pondugula	Vishnupuram	-	-	2L	-
Miryalaguda	Vishnupuram	-	-	2L	-
Piduguralla	Nadikudi Jn	-	-	2L	-
Sattenapalli	Piduguralla	-	-	2L	-
Bandarupalli	Sattenapalli	-	-	2L	-
Nallapadu	Bandarupalli	-	-	2L	-
Narasaraopet	Nallapadu	2L	-	-	2L+TC
Vinukonda	Narasaraopet	-	-	-	2L+TC
Donakonda	Vinukonda	-	-	-	2L+TC
Diguvametta	Donakonda	-	-	-	2L+TC
Gazulapalli	Diguvametta	-	-	-	2L+TC
Nandyal	Gazulapalli	-	-	-	2L+TC
Hussain Sagar Jn	Secunderabad Jn	-	2L+TC	3L+TC	-
Sanathnagar	Lingampalli	2L+TC	-	3L+TC	4L+TC
Charlapalli	Pagidipalli Jn	-	-	4L+TC	6L+TC
Maula Ali C	Charlapalli	-	-	4L+TC	6L+TC
Moula Ali Cord Line Station Bypass	Charlapalli	-	-	4L+TC	6L+TC
Bhongir	Pagidipalli Jn	-	2L+TC	4L+TC	-
Jangaon	Bhongir	-	2L+TC	4L+TC	-
Kazipet Jn	Jangaon	-	2L+TC	4L+TC	-
Sanathnagar	Hussain Sagar Jn	2L+TC	-	3L+TC	-
Sitaphalmandi B	Lallaguda	-	-	4L+TC	-
Lallaguda	Maula Ali C	-	-	4L+TC	-
Secunderabad Jn	Sitaphalmandi B	-	-	4L+TC	-
Lingampalli	Telapur	-	-	2L+TC	3L+TC
Telapur	Shankarpalli	-	-	2L+TC	3L+TC
Shankarpalli	Vikarabad Jn	-	-	2L+TC	3L+TC
Vikarabad Jn	Godamgura	-	-	2L+TC	-
Mailaram	Wadi Jn	-	-	2L+TC	-
Godamgura	Mailaram	-	-	2L+TC	-
Kulem	Castle Rock	-	-	-	2L+TC
Dharwad	Hubbali Jn	-	-	2L+TC	-
Gadag Jn	Harlapur	-	-	2L+TC	-
Harlapur	Koppal	-	-	2L+TC	-
Hosapete Jn	Torangallu Jn	-	-	3L+TC	-
Hebsur	Gadag Jn	-	-	2L+TC	3L+TC
Hubbali Jn	Hebsur	-	-	2L+TC	3L+TC
Ginigera	Hosapete Jn	-	-	2L+TC	-
Koppal	Ginigera	-	-	2L+TC	-
Majorda Jn	Madgaon Jn	-	-	2L+TC	-
Madgaon Jn	Kulem	-	-	2L+TC	-
Majorda Jn	Vasco da Gama	-	-	2L+TC	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Londa Jn	Castle Rock	-	-	-	2L+TC
Torangallu Jn	Ballari Jn	-	-	3L+TC	-

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NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Bhilwara	Nasirabad	2L	-	-	-
Chanderiya	Bhilwara	2L	-	-	-
Nasirabad	Ajmer Jn	2L	-	-	-
Madanapalle Road	Dharmavaram Jn	-	-	-	2L
Viyalpad	Madanapalle Road	-	-	-	2L
Pakala	Viyalpad	-	-	-	2L
Pendekallu Jn	Dhone Jn	-	-	-	-
Guntakal Jn	Pendekallu Jn	-	-	-	-
Anantapur	Kalluru Jn	-	-	-	2L+TC
Dharmavaram Jn	Anantapur	-	-	-	2L+TC
Kalluru Jn	Gooty Jn Cabin	-	-	-	2L+TC
Gooty Jn	Pendekallu Jn	-	-	-	-
Pakala	Chittoor	2L	-	-	2L+TC
Katpadi	Chittoor	2L	-	-	2L+TC
Gooty Jn Cabin	Gooty Jn	2L+ABTS	-	3L+ABTS	-
Manoharabad	Bolarum	2L	-	-	2L+TC
Falaknuma	Umdanagar	-	-	2L+TC	-
Kacheguda	Falaknuma	-	-	2L+TC	-
Dhone Jn	Kurnool City	2L	-	-	-
Kurnool City	Gadwal Jn	2L	-	-	-
Devarkadra	Gadwal Jn	2L	-	-	-
Mahbubnagar	Devarkadra	2L	-	-	-
Kamareddi	Akanapet	2L	-	-	2L+TC
Akanapet	Manoharabad	2L	-	-	2L+TC
Nizamabad	Kamareddi	2L	-	-	2L+TC
Jankampet Jn	Basar	2L	-	-	-
Nizamabad	Jankampet Jn	2L	-	-	-
Basar	Mudkhed Jn	2L	-	-	-
Secunderabad Jn	Lallaguda Gate Halt	-	-	-	3L+TC
Lallaguda Gate Halt	Malkajgiri Jn	-	-	-	3L+TC
Bolarum	Ammuguda Halt	-	-	-	3L+TC
Ammuguda Halt	Malkajgiri Jn	-	-	-	3L+TC
Sitaphalmandi A	Kacheguda	2L+TC	-	4L+TC	-
Secunderabad Jn	Sitaphalmandi A	2L+TC	-	4L+TC	-
Jadcherla	Mahbubnagar	-	-	2L+TC	-
Umdanagar	Jadcherla	-	-	2L+TC	-
Akola Jn	Khandwa jn	-	-	-	-
Akola Jn	Washim	-	2L	-	-
Washim	Hingoli Deccan	-	2L	-	-
Hingoli Deccan	Purna Jn	-	2L	-	-
Hazur Sahib Nanded	Maltekdi	-	2L+TC	-	-
Purna Jn	Hazur Sahib Nanded	-	2L+TC	-	-
Maltekdi	Mudkhed Jn	-	2L+TC	-	-
Katpadi	Vellore Town	-	-	-	2L
Vellore Town	Tiruvannamallai	-	-	-	2L
Tiruvannamallai	Villupuram	-	-	-	2L
Chittaurgarh jn	Chanderiya	2L	-	-	-
Berach Jn Cabin	Chanderiya	2L	-	-	-
Chittaurgarh jn	Berach Jn Cabin	-	-	3L+TC	-
Fatehabad Chandrawatiganj Jn	Indore jn	-	-	2L	-
Indore jn	Rau	-	-	2L+TC	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Khandwa jn	Mhow	2L	-	-	-
Chittaurgarh jn	Nimach	-	-	-	-
Nimach	Mandsaur	-	-	-	-
Mandsaur	Ratlam JN	-	-	-	-
Ratlam JN	Fatehabad Chandrawatiganj Jn	2L	-	-	-
Rau	Mhow	2L	-	-	-

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NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Villivakkam	Veysarpadi	4L+ABTS	-	-	6L+ABTS
Avadi	Villivakkam	4L+ABTS	-	-	6L+ABTS
Hindu College	Avadi	4L+ABTS	-	-	6L+ABTS
Pattabiram	Hindu College	4L+ABTS	-	-	6L+ABTS
Tiruvallur	Pattabiram	4L+ABTS	-	-	6L+ABTS
Basin Bridge	Chennai Central	6L+ABTS	-	-	-
Veysarpadi	Basin Bridge	4L+ABTS	-	-	-
Arakkonam	Tiruvallur	4L+ABTS	-	-	-
Pune	Daund jn	2L+ABTS	-	-	-
Dharwad	Hubbali Jn	-	-	2L+TC	-
Londa Jn	Alnavar Jn	-	-	2L+TC	-
Alnavar Jn	Dharwad	-	-	2L+TC	-
Jolarpettai	Katpadi	3L+TC	4L+TC	-	-
Baiyyappanahalli	Baiyapannahalli ABC	4L	-	4L+TC	-
Baiyapannahalli ABC	Whitefield	-	-	4L+TC	-
Whitefield	Bangarapet	-	-	3L+TC	-
Bisanattam	Mulanur	-	-	3L+TC	-
Patchur	Mulanur	-	-	3L+TC	-
Jolarpettai	Patchur	-	-	3L+TC	-
Bangarapet	Bisanattam	-	-	3L+TC	-
St Thomas Mount	Tambaram	4L+TC	-	-	-
Tiruchchirappalli Jn	Ponmalai	-	-	-	3L+TC
Tindivanam	Chengalpattu	-	-	2L+TC	3L+TC
Villupuram	Tindivanam	-	-	2L+TC	3L+TC
Tambaram	Chengalpattu	3L+TC	4L+TC	-	-
Manmad Jn	Ankai Kila	2L+TC	-	-	3L+TC
Ankai Kila	Ankai	2L+TC	-	-	3L+TC
Bengaluru city	Baiyyappanahalli	-	-	-	-
Ponmalai	Valadi	-	-	-	2L+TC
Valadi	Lalgudi	-	-	-	2L+TC
Lalgudi	Ariyalur	-	-	-	2L+TC
Ariyalur	Mathur	-	-	-	2L+TC
Mathur	Vriddhachalam Jn	-	-	-	2L+TC
Ankai	Puntamba Jn	2L+TC	-	-	3L+TC
Puntamba Jn	Belapur	2L+TC	-	-	3L+TC
Kadur jn	Birur jn	-	-	-	-
Ahmadnagar	Daund jn	2L+TC	-	-	3L+TC
Kadur jn	Arsikere jn	-	-	-	-
Manaparai	Tiruchchirappalli Jn	-	-	-	-
Belapur	Ahmadnagar	2L+TC	-	-	3L+TC
Dindigul	Vadamadura	-	-	-	-
Vadamadura	Manaparai	-	-	-	-
Tirunelveli Jn	Vanchi Maniyachchi Jn	-	-	-	-
Chennai Egmore	St Thomas Mount	4L+TC	-	-	-
Birur jn	Chikjajur jn	-	-	-	-
Pune	Phursungi	-	-	2L+TC	-

NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Chikbanavar	Tumakuru	-	-	-	-
Villupuram	Triuvennainallur Road	-	-	-	2L+TC
Yeliyur	Mandya	-	-	-	-
Mandya	Ramanagaram	-	-	-	-
Ramanagaram	Kengeri	-	-	-	-
Magnesite Jn	Omalur	-	-	-	-
Triuvennainallur Road	Vriddhachalam Jn	-	-	-	2L+TC
Mysuru Jn	Yeliyur	-	-	-	-
Ambaturai	Dindigul	-	-	-	2L+TC
Pallappatti Halt	Ambaturai	-	-	-	2L+TC
Madurai Jn	Pallappatti Halt	-	-	-	2L+TC
Omalur	Dharmapuri	2L	-	-	-
Amaravathi Colony Jn	Davangere	-	-	-	2L+TC
Bengaluru city	Chikbanavar	-	-	-	2L+TC
Arsikere jn	Tumakuru	-	-	-	-
Belagavi	Gunji	-	-	-	-
Gunji	Londa Jn	-	-	-	-
Vanchi Maniyachchi Jn	Virudunagar Jn	-	-	-	-
Sangli	Miraj Jn	-	-	-	-
Koregaon	Karad	-	-	2L+TC	-
Karad	Nandre	-	-	2L+TC	-
Nandre	Sangli	-	-	2L+TC	-
Phursungi	Rajevadi	-	-	2L+TC	-
Rajevadi	Lonand	-	-	2L+TC	-
Lonand	Palsi	-	-	2L+TC	-
Miraj Jn	Ugar Khurd	-	-	-	2L+TC
Ugar Khurd	Kudachi	-	-	-	2L+TC
Amaravathi Colony Jn	Harihar	-	-	-	2L+TC
Baiyyappanahalli	Hosur	-	-	-	-
Haveri	Hubbali Jn	-	-	-	-
Dharmapuri	Hosur	2L	-	-	-
Thiruvananthapuram Central	Nagercoil Jn	-	-	-	-
Chikjajur jn	Davangere	-	-	-	2L+TC
Harihar	Haveri	-	-	-	-
Virudunagar Jn	Madurai Jn	-	-	-	-
Kengeri	Bengaluru city	-	-	-	-
Nagercoil Jn	Tirunelveli Jn	-	-	-	-
Namakkal	Salem Jn	-	-	2L	-
Palsi	Satara	-	-	2L+TC	-
Karur	Namakkal	-	-	2L	-
Satara	Koregaon	-	-	2L+TC	-
Kudachi	Belagavi	-	-	-	2L+TC
Dindigul	Karur	-	-	-	2L
Nagercoil Jn	Kanniyakumari	-	-	-	-
Walajah Road	Melpakkam	3L+TC	4L+TC	-	-
Katpadi	Walajah Road	3L+TC	4L+TC	-	-
Melpakkam	Arakkonam	3L+TC	4L+TC	-	-
Baramati	Phaltan	-	-	2L	-

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NODE_A	NODE_B	Additional Proposal 2026	Additional Proposal 2031	Additional Proposal 2041	Additional Proposal 2051
Salem Jn	Magnesite Jn	2L+TC	3L+TC	4L+TC	-
Punkunnam	Thrissur	3L+TC	-	-	4L+TC
Chalakudi	Angamali for Kaladi	-	3L+TC	-	4L+TC
Thrissur	Ollur	-	3L+TC	-	4L+TC
Shoranur Jn	Punkunnam	-	3L+TC	-	4L+TC
Ollur	Chalakudi	-	3L+TC	-	4L+TC
Magudanchavadi	Salem Jn	2L+TC	3L+TC	4L+TC	-
Erode	Magudanchavadi	2L+TC	3L+TC	4L+TC	-
Tirupattur	Jolarpettai	2L+TC	3L+TC	4L+TC	-
Morappur	Tirupattur	2L+TC	3L+TC	4L+TC	-
Shoranur Jn	Palakkad Jn	-	2L+TC	-	3L+TC
Ingur	Erode	2L+TC	-	3L+TC	4L+TC
Tiruppur	Ingur	2L+TC	-	3L+TC	4L+TC
Irugur	Tiruppur	2L+TC	-	3L+TC	4L+TC
Magnesite Jn	Morappur	2L+TC	3L+TC	4L+TC	-
Kozhikode	Kadalundi	-	2L+TC	-	3L+TC
Kadalundi	Tirur	-	2L+TC	-	3L+TC
Tirur	Kuttipuram	-	2L+TC	-	3L+TC
Kuttipuram	Shoranur Jn	-	2L+TC	-	3L+TC
Kayankulam Jn	Kollam Jn	-	-	2L+TC	-
Palakkad Jn	Kanjikode	-	3L+TC	-	-
Kanjikode	Ettimadai	-	3L+TC	-	-
Podanur Jn	Ettimadai	-	3L+TC	-	-
Angamali for Kaladi	Ernakulam Town	-	3L+TC	-	4L+TC
Kasaragod	Kannur	-	-	2L+TC	3L+TC
Kannur	Mahe	-	2L+TC	-	3L+TC
Mahe	Kozhikode	-	2L+TC	-	3L+TC
Netravathi	Kasaragod	-	-	2L+TC	3L+TC
Mangalore Jn	Netravathi	-	-	-	2L+TC
Kollam Jn	Thiruvananthapuram Central	-	-	-	-
Ernakulam Town	Ernakulam Jn	-	-	-	-
Ernakulam Jn	Alappuzha	-	-	-	-
Podanur Jn	Irugur	2L	-	-	-
Karur	Erode	-	2L	-	-
Haripad	Kayankulam Jn	-	-	-	-
Alappuzha	Haripad	-	-	-	-

ANNEXURE 17.1: Forecast Passenger Footfalls by Cardinal Years

Station Clusters	2018	2021	2026	2031	2051	2051
Mumbai City	1,03,55,456	1,15,92,463	1,37,09,937	1,62,32,817	1,97,19,808	2,35,79,932
Thane	39,81,454	43,67,749	48,97,336	54,98,405	66,82,498	80,14,263
Howrah	28,32,090	31,01,024	35,68,996	41,17,600	50,54,987	61,00,577
Chennai	16,99,708	18,78,599	21,58,456	24,86,107	28,98,546	33,36,553
North 24 Parganas	10,89,093	11,78,657	13,25,320	14,90,581	18,01,809	21,32,628
New Delhi	10,41,749	11,92,061	14,23,777	17,12,042	23,88,011	33,04,325
Hooghly	9,88,198	10,66,695	11,95,959	13,41,041	16,16,466	19,06,534
South 24 Parganas	7,86,195	8,48,122	9,51,448	10,67,479	12,84,265	15,10,845
Hyderabad	6,26,861	7,12,184	8,64,586	10,54,618	13,52,431	17,12,866
Kanchipuram	4,51,716	4,86,894	5,37,047	5,92,960	6,74,277	7,50,645
Pune	4,32,481	4,87,286	5,83,396	7,00,881	8,67,788	10,62,016
Nadia	4,22,336	4,61,577	5,21,791	5,90,132	7,23,122	8,71,167
Bangalore	3,87,721	4,40,965	5,22,012	6,22,269	7,99,485	10,22,688
Patna	3,71,317	4,48,923	5,85,107	7,71,539	12,28,381	19,84,052
Raigad	3,06,507	3,38,756	3,83,611	4,35,378	5,37,172	6,56,408
Thiruvallur	2,81,786	3,02,576	3,31,190	3,62,820	4,12,899	4,60,240
Paschim Medinipur	2,76,565	3,02,664	3,43,005	3,89,210	4,80,316	5,84,418
Surat	2,68,521	3,03,697	3,56,102	4,18,939	5,67,155	7,60,255
Lucknow	2,50,448	2,97,648	3,72,334	4,70,852	7,03,964	10,57,056
Buldhana	2,28,094	2,52,259	2,86,203	3,25,532	4,04,445	5,00,517
Ahmedabad	2,24,897	2,64,801	3,29,133	4,13,258	5,83,988	8,19,449
Purba Barddhaman	2,21,785	2,43,001	2,75,903	3,13,529	3,85,570	4,66,678
Paschim Bardhaman	2,12,887	2,34,840	2,68,460	3,07,407	3,86,894	4,81,308
Varanasi	2,04,634	2,37,186	2,86,422	3,47,969	5,07,691	7,42,791
Guntur	1,94,436	2,11,758	2,34,413	2,60,161	3,13,611	3,74,451
Palghar	1,93,856	2,13,602	2,41,100	2,72,542	3,32,111	3,99,655
Jaipur	1,89,426	2,27,705	2,93,978	3,85,438	5,88,572	9,01,674
Ernakulam	1,88,324	2,08,205	2,38,393	2,74,244	3,52,373	4,50,987
Rohtas	1,84,470	2,17,041	2,69,146	3,35,517	5,06,798	7,69,937
Valsad	1,75,601	1,97,670	2,29,871	2,67,730	3,54,840	4,63,962
Kanpur Nagar	1,71,981	1,99,113	2,39,716	2,89,914	4,19,600	6,06,214
Munger	1,70,911	2,01,741	2,51,550	3,14,836	4,80,266	7,31,581
Krishna	1,67,812	1,85,372	2,09,435	2,37,844	2,98,026	3,73,080
Hazaribagh	1,62,617	1,87,056	2,24,528	2,70,154	3,93,513	5,71,046
Chittoor	1,56,427	1,72,552	1,94,482	2,20,269	2,74,424	3,41,446
Gorakhpur	1,54,845	1,79,005	2,15,244	2,59,892	3,76,386	5,42,758
Kollam	1,51,125	1,65,331	1,87,221	2,12,741	2,68,858	3,36,881
Bilaspur	1,50,761	1,64,638	1,89,211	2,18,013	2,80,147	3,55,642
Darbhanga	1,50,693	1,78,746	2,24,796	2,83,878	4,42,319	6,88,345
Gurgaon	1,50,656	1,73,216	2,07,117	2,47,995	3,34,313	4,42,751
Kathgodam	1,50,531	1,73,989	2,06,841	2,47,110	3,48,261	4,87,857
Nagpur	1,44,377	1,59,548	1,82,096	2,09,081	2,68,385	3,43,629
Vellore	1,44,276	1,57,689	1,75,510	1,96,054	2,36,961	2,85,376
Vadodara	1,41,159	1,59,787	1,87,769	2,21,484	3,02,380	4,08,749
Thanjavur	1,40,230	1,52,658	1,69,658	1,89,447	2,30,282	2,79,632
Jalgaon	1,38,350	1,52,056	1,71,514	1,93,991	2,40,539	2,95,467
Murshidabad	1,34,346	1,47,209	1,67,042	1,89,758	2,34,703	2,85,990
Gaya	1,29,559	1,52,728	1,90,016	2,37,511	3,59,617	5,45,344
Palakkad	1,29,292	1,41,961	1,61,390	1,84,216	2,34,397	2,96,300
Kannur	1,28,185	1,39,463	1,57,027	1,77,242	2,22,277	2,75,655
Ghaziabad	1,24,298	1,42,472	1,69,401	2,01,852	2,86,200	4,01,361
Raipur	1,21,107	1,37,988	1,63,377	1,94,239	2,74,409	3,85,535
Saran	1,20,271	1,42,084	1,77,575	2,22,926	3,42,693	5,27,232

Station Clusters	2018	2021	2026	2031	2051	2051
Ranchi	1,19,847	1,38,886	1,69,118	2,07,156	3,16,222	4,86,419
Coimbatore	1,19,844	1,31,200	1,47,335	1,66,394	2,06,878	2,57,371
Agra	1,19,403	1,38,339	1,66,639	2,01,735	2,92,222	4,23,607
Bhopal	1,18,564	1,40,327	1,74,348	2,18,995	3,21,616	4,72,793
Kozhikode	1,18,315	1,28,956	1,45,469	1,64,558	2,06,955	2,57,685
Dhanbad	1,18,008	1,34,740	1,61,093	1,93,516	2,82,603	4,15,305
Bareilly	1,17,726	1,35,478	1,61,481	1,92,854	2,74,750	3,86,994
Visakhapatnam	1,15,938	1,31,887	1,54,642	1,82,562	2,36,893	3,08,178
Allahabad	1,15,378	1,33,979	1,62,122	1,97,422	2,89,348	4,25,750
Muzaffarpur	1,11,555	1,32,186	1,66,032	2,09,626	3,26,865	5,11,624
Moradabad	1,11,339	1,28,029	1,52,207	1,81,245	2,54,154	3,52,707
Nellore	1,10,999	1,21,442	1,35,229	1,51,023	1,83,583	2,21,420
Mysore	1,10,219	1,21,349	1,36,122	1,53,156	1,89,366	2,32,047
Khordha	1,08,723	1,21,488	1,42,947	1,69,188	2,33,466	3,19,779
Nashik	1,07,667	1,19,190	1,35,830	1,55,483	1,96,839	2,48,175
Ambala	1,06,678	1,20,622	1,41,444	1,66,342	2,26,082	3,03,846
Mathura	1,04,431	1,20,527	1,44,120	1,72,801	2,45,900	3,47,720
Dharwad	1,02,179	1,12,467	1,26,030	1,41,660	1,75,360	2,15,178
Gulbarga	1,02,065	1,12,068	1,25,139	1,40,077	1,72,106	2,09,216
Jodhpur	99,294	1,15,836	1,41,164	1,73,113	2,60,681	3,94,566
Purulia	99,137	1,08,644	1,23,340	1,40,150	1,74,558	2,14,403
Purnia	98,408	1,15,767	1,44,051	1,80,153	2,75,739	4,23,832
East Godavari	97,315	1,07,156	1,20,590	1,36,402	1,70,106	2,11,851
Amritsar	97,203	1,07,785	1,23,469	1,42,117	1,82,142	2,32,260
Solapur	96,537	1,06,667	1,21,063	1,37,872	1,72,487	2,14,423
Birbhum	96,386	1,06,020	1,20,902	1,38,089	1,73,437	2,15,215
Bhagalpur	95,209	1,12,831	1,41,759	1,78,880	2,78,668	4,34,212
Nanded	93,622	1,02,469	1,15,131	1,29,678	1,60,067	1,95,458
Durg	91,292	1,03,690	1,22,058	1,44,057	2,01,359	2,78,685
Anantapur	91,108	99,745	1,11,157	1,24,249	1,51,169	1,82,539
Meerut	90,688	1,04,433	1,24,374	1,48,342	2,09,284	2,91,827
Kheda	90,013	1,01,451	1,17,984	1,37,343	1,82,008	2,37,654
Ludhiana	89,703	99,696	1,14,213	1,31,290	1,66,972	2,10,935
Jhansi	89,382	1,03,513	1,24,656	1,50,886	2,19,008	3,17,912
Kota	89,044	1,03,656	1,25,875	1,53,695	2,29,909	3,44,670
Jabalpur	87,918	1,02,035	1,22,706	1,48,460	2,15,225	3,11,250
East Singhbhum	86,466	1,00,141	1,21,795	1,48,984	2,26,482	3,46,751
(Sri Ganganagar	85,850	99,176	1,18,923	1,42,805	2,06,317	2,94,590
Gwalior	83,388	96,444	1,15,253	1,38,330	1,97,960	2,81,441
Ratlam	82,386	94,576	1,11,511	1,31,672	1,81,157	2,46,228
Bharuch	82,380	92,281	1,06,920	1,23,997	1,65,130	2,16,010
Rohtak	81,876	91,886	1,06,509	1,23,480	1,63,906	2,13,435
Belgaum	81,294	89,316	99,760	1,11,687	1,37,142	1,66,597
Karnal	81,264	91,579	1,06,586	1,24,151	1,64,960	2,15,699
Gonda	80,102	92,028	1,09,420	1,30,290	1,83,335	2,55,095
Saharanpur	79,862	91,460	1,08,456	1,28,838	1,80,565	2,50,307
Salem	79,829	87,522	98,043	1,10,379	1,35,565	1,66,500

ANNEXURE 18.1: Network Upgradation proposals for Other Network

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Delhi Sarai Rohila	Delhi Kishanganj	3.00	45	2.40	NR	DLI	Delhi Kishanganj - Daya Basti	2nd Line	2L+TC	-	4L+TC	-
Dayabasti	Delhi Sarai Rohila	3.00	45	1.80	NR	DLI	Delhi Kishanganj - Daya Basti	2nd Line	2L+TC	-	4L+TC	-
Bhildi Jn	Palanpur Jn	0.00	22	44.98	WR	ADI	Palanpur - Bhildi	2nd Line	-	3L+TC	4L+TC	-
Rampura Cabin	Shakurbasti	1.80	60	2.21	NR	DLI	Daya Basti - Shakurbasti	2nd Line	2L+TC	-	3L+TC	4L+TC
Jharsuguda Jn	Jharsuguda Road Jn	2.00	51	2.92	ECOR	SBP	Jharsuguda - Jharsuguda Road	2nd Line	2L+TC	3L+TC	4L+TC	-
Shakurbasti	Nangloi	60.00	65	6.99	NR	DLI	Shakurbasti - Rohtak Jn.	2nd Line	-	-	2L+TC	4L+TC
Bahadurgarh	Nangloi	60.00	65	12.37	NR	DLI	Shakurbasti - Rohtak Jn.	2nd Line	-	-	2L+TC	4L+TC
Rampura Cabin	Dayabasti	3.30	45	2.27	NR	DLI	Daya Basti - Rampur Jn.	2nd Line	-	-	2L+TC	4L+TC
Asthal Bohar Jn	Bahadurgarh	60.00	65	34.43	NR	DLI	Shakurbasti - Rohtak Jn.	2nd Line	-	-	2L+TC	4L+TC
Patel Nagar	Dayabasti	0.00	40	2.21	NR	DLI	Daya Basti - Patel Nagar	2nd Line	-	-	2L+TC	-
Rohtak Jn	Jind Jn	57.00	65	56.79	NR	DLI	Rohtak Jn. - Jind	2nd Line	-	-	-	3L+TC
Jind Jn	Narwana Jn	34.00	65	34.01	NR	DLI	Jind - Narwana Jn.	2nd Line	-	-	-	3L+TC
Jakhal Jn	Narwana Jn	38.00	65	38.11	NR	DLI	Narwana Jn. - Jakhal Jn.	2nd Line	-	-	-	3L+TC
Chittaurgarh jn	Bundi	163.82	74	133.34	WCR	Kota	CHITHAURGARH - KOTA	Single Line	2L	-	2L+TC	-
Patel Nagar	Delhi Cantt	3.40	24	5.97	NR	DLI	PATEL NAGAR - DELHI CANTT(NORTH LINE)	2nd Line	-	-	-	-
Panvel Jn	Jasai	16.00	48	15.29	CR	CSTM	Panvel - Jasai Chirle	2nd Line	-	-	-	-
Jasai	JNPT	9.00	48	9.85	CR	CSTM	Jasai Chirle - Jawaharlal Nehru Port Trust	2nd Line	-	-	-	-
Bathinda Jn	Hanumangarh Jn	142.33	20	91.88	NWR	BKN	BATHINDA Jn - SURATGARH	2nd Line	-	-	-	-
Suratgarh Jn	Hanumangarh Jn	142.33	20	50.28	NWR	BKN	BATHINDA Jn - SURATGARH	2nd Line	-	-	-	-
Narnaul	Rewari Jn	148.66	26	51.37	NWR	JP	REWARI - RINGAS	2nd Line	-	-	-	-
Ringas Jn	Narnaul	148.66	26	99.37	NWR	JP	REWARI - RINGAS	2nd Line	-	-	-	-
Bundi	Kota Jn	163.82	24	35.76	WCR	Kota	CHITHAURGARH - KOTA	Single Line	2L	-	2L+TC	-
Phulera Jn	Ringas Jn	66.76	26	64.44	NWR	JP	RINGAS - PHULERA	2nd Line	-	-	-	-
Lalgarh Jn	Bikaner Jn	3.73	18	3.75	NWR	BKN	LALGARH - BIKANER	Single Line	2L	-	-	-
Biradhwal	Lalgarh Jn	177.84	24	159.69	NWR	BKN	SURATGARH - LALGARH	2nd Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Suratgarh Jn	Piperan	177.84	24	6.18	NWR	BKN	SURATGARH - LALGARH	2nd Line	-	-	-	-
Piperan	Biradhwal	177.84	24	11.50	NWR	BKN	SURATGARH - LALGARH	2nd Line	-	-	-	-
Bikaner Jn	Nagaur	0.00	18	115.63	NWR	JU	MERTAROAD - BIKANER	2nd Line	-	-	-	-
Nagaur	Merta Road Jn	0.00	18	56.48	NWR	JU	MERTAROAD - BIKANER	2nd Line	-	-	-	-
Dum Dum Jn	Kankurgachhi Jn	4.78	244	5.33	ER	SDAH	KANKURGACHI - DUM DUM JN.	4th Line	6L+TC	-	8L+ABTS	-
Kankurgachhi Jn	Sealdah	2.08	237	1.86	ER	SDAH	SEALDAH - KANKURGACHHI	4th Line	6L+TC	-	-	-
Vashi	Belapur	10.00	288	9.04	CR	CSTM	Vashi - Belapur	2nd Line	6L+TC	-	-	8L+ABTS
Mankhurd	Vashi	9.00	288	7.33	CR	CSTM	Mankhurd - Vashi	2nd Line	6L+TC	-	8L+ABTS	-
Kurla Jn	Mankhurd	7.00	268	6.30	CR	CSTM	Kurka - Mankhurd	2nd Line	6L+TC	-	8L+ABTS	-
Naihati Jn	Dum Dum Jn	15.53	166	31.61	ER	SDAH	DUM DUM JN. - BARRACKPORE	4th Line	4L+TC	6L+TC	-	-
Washermanpet	Royapuram	1.51	54	1.00	SR	MAS	Royapuram - Washermanpet.	4th Line	-	-	4L+TC	-
Royapuram	Chennai Beach	1.23	54	1.23	SR	MAS	Chennai Beach - Royapuram	4th Line	4L+TC	-	-	-
Belapur	Panvel Jn	11.00	288	10.89	CR	CSTM	Belapur - Panvel	2nd Line	4L+TC	-	6L+TC	-
Hatidah Jn Upper	Rajendra pul	13.00	35	3.39	ECR	DNR	Tall - Rajendrapul	2nd Line	-	-	3L+TC	4L+TC
Dinkar Gram Simaria	Barauni Jn	6.26	50	5.62	ECR	SEE	Barauni - Simaria	3rd Line	-	-	3L+TC	4L+TC
Kalyani	Naihati Jn	10.37	90	10.29	ER	SDAH	NAIHATI - KALYANI	3rd Line	4L+TC	-	-	-
Anand Vihar Terminal	Sahibabad	3.00	80	4.61	NR	DLI	B panel - Sahibabad	4th Line	-	-	-	-
Chennai Beach	Chennai Egmore	4.32	30	4.29	SR	MAS	Chennai Beach - Chennai Egmore	4th Line	-	4L+TC	-	-
Ranaghat Jn	Kalyani	25.17	73	25.86	ER	SDAH	KALYANI - RANAGHAT	3rd Line	4L+TC	-	-	-
Seoraphuli Jn	Bally	15.58	167	14.03	ER	HWH	BELUR - SEORAPHULI	3rd Line	-	-	3L+TC	-
Tilak Bridge	Anand Vihar Terminal	6.70	80	8.76	NR	DLI	Tilak Bridge - B Panel	2nd Line	-	-	-	-
Rampur Dumra Jn	Hatidah Jn Upper	7.00	35	4.60	ECR	DNR	Rajendrapul - Rampur Dumra	2nd Line	-	-	3L+TC	-
Sealdah	Ballygunge Jn	5.07	141	6.13	ER	SDAH	SEALDAH (SOUTH) - BALLYGUNGE	4th Line	4L+TC	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Ballygunge Jn	Sonarpur Jn	10.98	112	10.54	ER	SDAH	BALLYGUNGE - SONARPUR	2nd Line	2L+TC	-	-	-
Barasat Jn	Dum Dum Jn	15.24	86	15.16	ER	SDAH	DUM DUM JN. - BARASAT	2nd Line	2L+TC	-	-	4L+TC
SBT A Cabin	Ahmedabad Jn	0.00	90	5.10	WR	ADI	Ahmadabad - SBTA	3rd Line	-	3L+TC	-	-
Ranaghat Jn	Gede	43.27	39	44.20	ER	SDAH	RANAGHAT - GEDE	2nd Line	4L+TC	-	-	-
BoniDanga	New Farakka Jn	12.05	54	12.70	ER	MLDT	BONIDANGA - NEW FARAKKA	2nd Line	2L+TC	3L+TC	4L+TC	-
Duttapukur	Barasat Jn	54.18	68	8.06	ER	SDAH	BARASAT - BONGAON	2nd Line	2L+TC	-	3L+TC	-
Habra	Duttapukur	14.49	68	15.04	ER	SDAH	DUTTAPUKUR - HABRA	2nd Line	2L+TC	-	3L+TC	-
Seoraphuli Jn	Bandel Jn	17.14	123	17.92	ER	HWH	SEORAPHULI - BANDEL	3rd Line	-	-	3L+TC	4L+TC
Kalinarayanpur Jn	Ranaghat Jn	4.05	61	4.72	ER	SDAH	RANAGHAT - KALINARAYANPUR	2nd Line	3L+TC	4L+TC	-	-
Sonarpur Jn	Baruipur Jn	8.59	76	9.06	ER	SDAH	SONARPUR - BARUIPUR	2nd Line	2L+TC	-	-	-
Turbhe	Thane Jn	15.00	280	13.55	CR	CSTM	Thane - Turbhe	2nd Line	-	-	6L+TC	-
Veysarpadi	Washermanpet	2.55	48	2.87	SR	MAS	Washermanpet - Vyasarpadi.	2nd Line	-	-	4L+TC	-
Sabarmati Jn	SBT A Cabin	0.00	90	1.45	WR	ADI	SBTA - Sabarmati	2nd Line	-	-	2L+TC	-
Chennai Beach	Tambaram	29.14	200	28.95	SR	MAS	Chennai Beach - Tambaram (Suburban)	2nd Line	-	-	-	-
Bhopal jn	Bairagarh	10.20	46	9.88	WR	RTM	Bairagarh - Bhopal	3rd Line	3L+TC	-	-	-
Dharmavaram Jn	Penukonda Jn	10.75	64	40.97	SWR	SBC	Baiyyappanahalli - Bengaluru	2nd Line	2L+TC	-	-	3L+TC
Santragachhi Jn	Shalimar	4.00	60	4.54	SER	KGP	SHALIMAR - SANTRAGACHI	2nd Line	-	2L+TC	3L+TC	4L+TC
Dankuni Jn	Dum Dum Jn	14.53	57	16.92	ER	SDAH	DUM DUM JN. - DANKUNI	2nd Line	-	-	2L+TC	-
Bir	Khirkiya	183.42	76	34.94	WCR	BPL	ET - KNW	2nd Line	2L+TC	3L+TC	-	-
Rajkot City	Hadmatiya	76.13	27	39.46	WR	RJT	Rajkot - Hapa	2nd Line	2L+TC	-	3L+TC	-
Hadmatiya	Hapa	76.13	27	37.40	WR	RJT	Rajkot - Hapa	2nd Line	2L+TC	-	3L+TC	-
Talvadya	Bir	183.42	76	19.10	WCR	BPL	ET - KNW	2nd Line	2L+TC	3L+TC	-	-
Raipur Jn	Srona	6.00	60	6.87	SECR	R	RAIPUR - SARONA	2nd Line	-	4L+TC	-	-
Sivok	New Mal Jn	174.00	23	27.56	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2L	2L+TC	-
Bandel Jn	Magra	55.91	79	6.80	ER	HWH	BANDEL - SAKTIGARH	3rd Line	-	-	-	-
Panvel Jn	Pen	35.00	60	34.28	CR	CSTM	Panvel - PEN	2nd Line	2L+TC	-	4L+TC	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Kasu	Roha	40.00	60	26.28	CR	CSTM	PEN - Roha	2nd Line	2L+TC	-	4L+TC	-
Pen	Kasu	40.00	60	13.57	CR	CSTM	PEN - Roha	2nd Line	2L+TC	-	4L+TC	-
Saktigarh Jn	Memari	55.91	79	12.55	ER	HWH	BANDEL - SAKTIGARH	3rd Line	-	-	-	-
Magra	Memari	55.91	79	36.16	ER	HWH	BANDEL - SAKTIGARH	3rd Line	-	-	-	-
Krishnanagar City Jn	Kalinarayanpur Jn	21.99	40	22.55	ER	SDAH	KALINARAYANPUR - KRISHNANAGAR	3rd Line	3L+TC	-	-	-
Delhi Jn	New Delhi	3.00	40	2.79	NR	DLI	Delhi Jn. - New Delhi	2nd Line	-	-	-	-
Coimbatore Jn	Coimbatore North Jn	2.68	68	2.84	SR	SA	Coimbatore North Jn. - Coimbatore Jn.	2nd Line	-	-	2L+TC	-
Sehore	Maksi Jn	132.38	46	104.10	WR	RTM	Maksi - Bairagarh	2nd Line	2L+TC	-	-	-
Bairagarh	Sehore	132.38	46	27.86	WR	RTM	Maksi - Bairagarh	2nd Line	2L+TC	-	-	-
New Delhi	Sabji Mandi	4.00	36	4.02	NR	DLI	New Delhi - Subzi Mandi	2nd Line	-	-	2L+TC	-
Coimbatore North Jn	Irugur	15.02	62	15.31	SR	SA	Irugur Jn. - Coimbatore North Jn.	2nd Line	-	-	2L+TC	-
Ujjain Jn	Maksi Jn	40.88	55	41.07	WR	RTM	Ujjain - Maksi	2nd Line	2L+TC	-	-	-
Bongaon Jn	Machlandapur	32.02	68	23.09	ER	SDAH	HABRA - BONGAON	2nd Line	2L+TC	-	-	-
Machlandapur	Habra	32.02	68	9.53	ER	SDAH	HABRA - BONGAON	2nd Line	2L+TC	-	-	-
Phaphamau Jn	Prayag	6.40	31	6.55	NR	LKO	Phaphamau - Prayag	2nd Line	-	-	2L+TC	-
Nagda JN	Ujjain Jn	54.98	60	55.95	WR	RTM	Nagda - Ujjain	2nd Line	2L+TC	-	-	-
Kotshila Jn	Bokaro Steel City Jn	28.50	49	28.91	SER	Adra	BOKARO STEEL CITY - KOTSHILA	2nd Line	-	-	-	-
Kottayam	Chengannur	114.66	36	33.77	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2L+TC	-	-
Chengannur	Kayankulam Jn	114.66	36	20.08	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2L+TC	-	-
Podanur Jn	Coimbatore Jn	6.00	62	5.94	SR	SA	Coimbatore Jn. - Podanur Jn.	2nd Line	-	-	2L+TC	-
Piravam Road	Vaikam Road	114.66	36	5.91	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2L+TC	-	-
Sitaphalmandi A	Sitaphalmandi B	4.90	50	1.07	SCR	HYB	Malkajgiri - Moula Ali Cord line	2nd Line	-	-	3L+TC	-
Rajabhatkhowa	New Mal Jn	174.00	23	103.70	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2L	2L+TC	-
Alipur Duar Jn	Rajabhatkhowa	174.00	23	11.46	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2L	2L+TC	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Rajabera	Bokaro Steel City Jn	11.10	52	10.48	SER	Adra	RAJABERA - BOKARO STEEL	2nd Line	-	-	-	-
Tundla Jn	Yamuna Bridge	17.87	43	20.52	NCR	AGC	Yamuna Bridge/ Tundla	2nd Line	-	-	2L+TC	3L+TC
Tall Jn	Hatidah Jn Upper	13.00	35	5.30	ECR	DNR	Tall - Rajendrapul	2nd Line	-	-	3L+TC	4L+TC
Naihati Jn	Bandel Jn	8.79	54	7.59	ER	HWH	BANDEL - NAIHATI	3rd Line	-	3L+TC	-	-
Chaneti	Ramganga Bridge	69.00	22	5.47	NR	MB	Ramganga Bridge - Bareilly Cantt.	Single Line	2L	-	-	2L+TC
Prayag	Allahabad Jn	6.40	31	6.28	NR	LKO	Prayag - Allahabad	2nd Line	-	-	2L+TC	-
Hindupur	Someshwara	17.12	35	28.83	SWR	SBC	Yelahanka - Penukonda	2nd Line	-	-	-	2L+TC
Someshwara	Yelahanka	17.12	35	54.81	SWR	SBC	Yelahanka - Penukonda	2nd Line	-	-	-	2L+TC
Rupnagar	Bhanupali	56.00	24	46.21	NR	UMB	Rupnagar - Nangaldam	Single Line	2L	-	2L+TC	3L+TC
Alipur Duar Jn	Samuktala Road	174.00	23	14.21	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2L	2L+TC	-
Penukonda Jn	Hindupur	17.12	35	37.20	SWR	SBC	Yelahanka - Penukonda	2nd Line	-	-	-	2L+TC
Turbhe	Nerul	3.00	288	4.96	CR	CSTM	Turbhe - Nerul	2nd Line	-	-	-	-
Chennai Fort	Velachery	19.34	144	17.56	SR	MAS	Chennai Beach - Velachery (MRTS)	2nd Line	-	-	-	-
Chennai Beach	Chennai Fort	19.34	144	1.42	SR	MAS	Chennai Beach - Velachery (MRTS)	2nd Line	-	-	-	-
Renigunta	Tirupati	9.79	33	9.43	SCR	GKL	Tirupati - Renigunta	2nd Line	-	-	-	2L+TC
Vaikam Road	Kottayam	114.66	36	24.44	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2L+TC	-	-
Ningala	Botad Jn	42.88	24	17.74	WR	BVP	Botad - Dhola	Single Line	-	2L	-	2L+TC
Lajpat Nagar	Patel Nagar	1.80	50	16.03	NR	DLI	Lajpat Nagar - Patel Nagar	2nd Line	-	-	-	2L+TC
Panskura Jn	Tamluk Jn	70.00	27	23.96	SER	KGP	PANSKURA - HALDIA	2nd Line	-	-	-	2L+TC
Dhola Jn	Ningala	42.88	24	24.32	WR	BVP	Botad - Dhola	Single Line	-	2L	-	2L+TC
Malkajgiri Jn	Moula Ali Cord Line Station Bypass	1.00	50	3.23	SCR	HYB	STPD 'A' - STPD - 'B'	2nd Line	-	-	2L+TC	-
Vishvamitri Jn	PratapNagar	7.63	22	4.06	WR	BRC	Vadodara - Pratap Nagar	Single Line	-	2L	2L+TC	-
Korukkupet	Washermanpet	1.55	48	1.07	SR	MAS	Washermanpet - Korukkupet.	2nd Line	-	-	2L+TC	-
Daurala	Meerut City Jn	47.00	60	16.63	NR	DLI	Ghaziabad Jn - Khatauli	2nd Line	-	-	-	-
Chandrapura Jn	Rajabera	4.00	92	6.08	ECR	DHN	Chandrapura - Rajabera	2nd Line	-	-	-	-
Block Hut B	Jeonathpur	8.00	91	6.49	NCR	ALD	Mughalsarai - Jeonathpur	2nd Line	3L+ABTS	-	-	-
Sabji Mandi	Delhi Jn	3.00	25	1.76	NR	DLI	Delhi Jn, - Subzi Mandi	2nd Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Bhattanagar	Dankuni Jn	5.50	18	5.37	ER	HWH	DUNKUNI CCLW - BHATTANAGAR	2nd Line	-	-	-	-
Indore jn	dewas jn	38.84	30	38.53	WR	RTM	Dewas - Indore	2nd Line	-	2L+TC	-	-
Suchi Pind Halt	Jalandhar city Jn	3.00	24	3.00	NR	FZP	Jalandhar City - Suchi Pind	2nd Line	-	2L+TC	-	-
Andul	Baltkuri	16.00	22	7.81	SER	KGP	ANDUL - BHATTANAGAR	2nd Line	-	-	-	-
Baltkuri	Bhattanagar	16.00	22	2.72	SER	KGP	ANDUL - BHATTANAGAR	Single Line	2L	-	-	-
Vashi	Turbhe	3.00	288	2.56	CR	CSTM	Turbhe - Vashi	2nd Line	-	-	6L+TC	-
NSC Bose Jn Gomoh	Chandrapura Jn	16.82	69	16.74	ECR	DHN	N.S.C.B.Gomoh - Chandrapura	2nd Line	-	-	-	-
Chengalpattu	Kanchipuram	62.96	18	35.76	SR	MAS	Chengalpattu Jn. - Arakkonam Jn.	2nd Line	-	2L+TC	-	-
Kanchipuram	Takkolam	62.96	18	20.28	SR	MAS	Chengalpattu Jn. - Arakkonam Jn.	2nd Line	-	2L+TC	-	-
Takkolam	Arakkonam	62.96	18	6.44	SR	MAS	Chengalpattu Jn. - Arakkonam Jn.	2nd Line	-	2L+TC	-	-
Sawantwadi Road	Karmali	442.36	20	47.11	KR	RN	ROHA - Madgaon	Single Line	2L	-	3L+TC	-
Katihar Jn	Mukuria Jn	35.00	18	35.16	NFR	KIR	KATIHAR - MUKURIA	Single Line	-	-	-	2L
Dhanbad Jn	Kusunda Jn	13.19	38	3.26	ECR	DHN	Dhanbad - Katras Garh	3rd Line	3L+TC	-	-	-
Karmali	Majorda Jn	442.36	20	20.76	KR	RN	ROHA - Madgaon	Single Line	2L	-	3L+TC	-
Tirupati	Pakala	104.39	24	42.18	SCR	GKL	Katpadi - Pakala - Tirupati	2nd Line	-	-	-	2L+TC
Ratnagiri	Nivasar	442.36	20	15.15	KR	RN	ROHA - Madgaon	Single Line	2L	-	3L+TC	-
Nivasar	Sindhudurg	442.36	20	113.20	KR	RN	ROHA - Madgaon	Single Line	2L	-	3L+TC	-
Muzaffar Nagar	Daurala	107.00	29	39.14	NR	DLI	Khatauli - Tapri	2nd Line	-	-	-	-
Saharanpur Jn	Tapri Jn	7.00	60	6.51	NR	DLI	Tapri - Saharanpur Jn.	Single Line	-	-	-	-
Khurda Road Jn	Puri	43.60	54	44.42	ECOR	KUR	Khurda Road - Puri	2nd Line	-	-	-	-
Sindhudurg	Sawantwadi Road	442.36	20	31.07	KR	RN	ROHA - Madgaon	Single Line	2L	-	3L+TC	-
Villupuram	Tiruppadirippuliyur	46.44	26	42.88	SR	TPJ	Villupuram - Cuddalore Port Jn.	Single Line	-	-	2L	-
Tiruppadirippuliyur	Cuddalore Port Jn	46.44	26	3.84	SR	TPJ	Villupuram - Cuddalore Port Jn.	Single Line	-	-	2L	-
Panvel Jn	Diva Jn	26.00	56	26.01	CR	CSTM	Diva - Panvel	2nd Line	3L+TC	-	-	-
Murshidabad	Azimganj	127.67	27	6.58	ER	SDAH	KRISHNANAGAR - LALGOLA	2nd Line	3L	-	3L+TC	-
Krishnanagar City Jn	Murshidabad	127.67	27	98.86	ER	SDAH	KRISHNANAGAR - LALGOLA	3rd Line	-	-	3L+TC	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Dharmavaram Jn	Sri Sathya Sai Prasanthi Nilayam	10.75	64	33.11	SWR	SBC	Bengaluru - Baiyyappanahallli	2nd Line	-	-	-	-
Sri Sathya Sai Prasanthi Nilayam	Penukonda Jn	10.75	64	20.65	SWR	SBC	Bengaluru - Baiyyappanahallli	2nd Line	-	-	-	-
Renigunta	Gudur Jn	83.17	54	83.16	SCR	GKL	Gudur - Renigunta	2nd Line	-	3L+TC	-	-
Lucknow	Malhaur	19.96	32	12.40	NER	LJN	Lucknow - Malhaur	2nd Line	-	-	-	-
Kandra Jn	Gamharia Jn	10.00	53	8.93	SER	CKP	KANDRA - GAMHARIA	2nd Line	-	-	-	-
Mukerian	Pathankot Cantt	110.00	68	38.71	NR	FZP	Suchi Pind - Pathankot cantt	2nd Line	-	-	2L+TC	-
Fatuha Jn	Daniyawan jn	43.00	25	9.43	ECR	DNR	Fatuha - Islampur	Single Line	-	-	2L	-
Daniyawan jn	Islampur	43.00	25	33.36	ECR	DNR	Fatuha - Islampur	Single Line	-	-	2L	-
Darbhanga Jn	Sakri Jn	19.31	22	19.89	ECR	SPJ	Darbhanga - Sakri	Single Line	2L	-	-	2L+TC
Mukerian	Suchi Pind Halt	110.00	68	69.12	NR	FZP	Suchi Pind - Pathankot cantt	2nd Line	-	-	2L+TC	-
Manamadurai Jn	Sivaganga	61.16	22	20.29	SR	MDU	Karaikkudi Jn. - Manamadurai	Single Line	-	2L	-	-
Sivaganga	Karaikkudi	61.16	22	40.98	SR	MDU	Karaikkudi Jn. - Manamadurai	Single Line	-	2L	-	-
Jehanabad	Patna Jn	60.53	81	45.53	ECR	DHN	Barwadih - Garwa Road	2nd Line	-	-	2L+TC	-
Ernakulam C Cabin	Piravam Road	114.66	36	28.06	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2L+TC	-	-
Suchi Pind Halt	Jalandhar Cantt Jn	3.00	68	3.69	NR	FZP	Jalandhar Cantt. - Suchi Pind	2nd Line	-	-	2L+TC	-
Begunia	Khurda Road Jn	65.46	18	32.18	ECOR	KUR	Khurda Road - Nayagrah Town	Single Line	2L	-	-	-
Morbi Jn	Wankaner Jn	55.14	17	27.65	WR	RJT	Wankaner - Dahinsara	Single Line	-	-	2L	2L+TC
Madgaon Jn	Karwar	295.98	21	59.69	KR	KAWR	Madgaon - Tokur	Single Line	2L	-	-	-
Hussain Sagar Jn	Hyderabad	5.00	65	4.70	SCR	SC	Hussainsagar - Hyderabad	2nd Line	-	-	-	-
Jaipur Jn	Sanganer	131.27	20	12.64	NWR	JP	SAWAIMADHOPUR - JAIPUR	2nd Line	-	-	-	-
Jhansi Jn	Mau Ranipur	181.00	16	64.01	NCR	JHS	JHS - BNDA	2nd Line	-	-	-	-
Tapri Jn	Deoband	107.00	29	27.34	NR	DLI	Khatauli - Tapri	2nd Line	-	-	-	-
Deoband	Muzaffar Nagar	107.00	29	24.02	NR	DLI	Khatauli - Tapri	2nd Line	-	-	-	-
Thokur	Mangalore Jn	16.20	25	14.65	SR	PGT	Mangaluru Jn. - Thokur	Single Line	2L	-	-	2L+TC
Gaya Jn	Jehanabad	60.53	81	47.50	ECR	DHN	Barwadih - Garwa Road	2nd Line	-	-	2L+TC	-
Chandigarh	Kalka	25.00	24	23.80	NR	UMB	Chandigarh - Kalka Jn.	Single Line	-	2L	2L+TC	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Aligarh Jn	Harduaganj	13.32	30	13.25	NCR	ALD	Aligarh Jn. - Harduaganj	2nd Line	-	-	-	-
Sawai Madhopur Jn	Sanganer	131.27	20	118.32	NWR	JP	SAWAIMADHOPUR - JAIPUR	2nd Line	-	-	-	-
Yamuna Bridge	Idgah Agra Jn	3.95	28	4.61	NCR	AGC	Idgah - Agra Fort - Yamuna /Bridge/w	2nd Line	-	-	2L+TC	-
Yelahanka	Baiyapannahalli ABC	17.12	35	14.61	SWR	SBC	Yelahanka - Baiyyappanahalli via CSDR	2nd Line	-	-	-	2L+TC
Simri Bakhtiyarpur	Fungo Halt	43.13	24	11.58	ECR	SPJ	Mansi - Saharsa	Single Line	-	2L	-	2L+TC
Rampura Cabin	Adarsh Nagar Delhi	3.00	60	5.11	NR	DLI	Rampura CABIN - ADARSH NAGAR	2nd Line	-	-	-	-
Fungo Halt	Mansi Jn	43.13	24	14.13	ECR	SPJ	Mansi - Saharsa	Single Line	-	2L	-	2L+TC
Katihar Jn	Purnea Jn	28.00	20	28.55	NFR	KIR	KATIHAR - PURNEA	Single Line	-	-	2L+TC	-
Roha	Indapur	442.36	20	23.85	KR	RN	ROHA - Madgaon	Single Line	2L	-	3L+TC	-
Indapur	Chiplun	442.36	20	103.23	KR	RN	ROHA - Madgaon	Single Line	2L	-	3L+TC	-
Gudivada Jn	Bhimavaram Jn	66.00	18	65.74	SCR	BZA	Gudivada - Bhimavaram	2nd Line	-	-	-	-
Harduaganj	Bahjoi	64.00	16	68.56	NR	MB	Chandausi - Hardunaganj	2nd Line	-	-	-	-
Palakkad Jn	Palakkad Town	4.09	34	4.14	SR	PGT	Palakkad Town - Palakkad Jn.	Single Line	-	-	-	-
H Nizamuddin Jn	okhla	2.00	50	3.93	NR	DLI	Nizzamudin - Okhla	4th Line	-	-	-	-
Shamli	Tapri Jn	64.00	25	63.27	NR	DLI	Shamli - Tapri	2nd Line	-	-	-	-
Bahjoi	Chandausi Jn	64.00	16	16.58	NR	MB	Chandausi - Hardunaganj	2nd Line	-	-	-	-
Botad Jn	Surendranagar Jn	77.18	24	76.88	WR	BVP	Surend'nagar - Botad	Single Line	-	-	2L	-
Mavli Jn	Chittaurgarh jn	114.16	20	70.97	NWR	AII	CHITTORGARH - UDAIPUR CITY	2nd Line	-	-	-	2L+TC
Veysarpadi	Korukkupet	2.00	48	2.61	SR	MAS	Korukkupet - Vyasarpadi	2nd Line	-	-	-	-
Tomka Jn	Daltari	8.00	24	8.18	ECOR	KUR	Tomka - Daitari	Single Line	-	2L	-	2L+TC
Palakkad Town	Kollengode	53.80	21	18.76	SR	PGT	Pollachi Jn. - Palakkad Town.	Single Line	-	-	-	2L
Kollengode	Pollachi Jn	53.80	21	34.50	SR	PGT	Pollachi Jn. - Palakkad Town.	Single Line	-	-	-	2L
Katrasgarh Jn	Phulwartanr	8.43	27	8.96	ECR	DHN	Katras Garh - Phulwaritanr	3rd Line	-	-	-	-
Katrasgarh Jn	Kusunda Jn	13.19	38	9.36	ECR	DHN	Dhanbad - Katras Garh	3rd Line	3L+TC	-	-	-
Kanalus Jn	Wansjaliya Jn	71.53	20	70.21	WR	BVP	Kanalus - Wansjaliya	Single Line	-	-	-	2L

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Washermanpet	Basin Bridge	1.93	48	1.84	SR	MAS	Washermanpet - Basin Bridge Jn.	2nd Line	-	-	-	-
Chiplun	Ratnagiri	442.36	20	75.67	KR	RN	ROHA - Madgaon	Single Line	2L	-	3L+TC	-
Ballygunge Jn	Majerhat	6.42	44	5.94	ER	SDAH	BALLYGUNGE - MAJHERHAT(for passenger train)	2nd Line	-	-	-	-
Dhasa Jn	Dhola Jn	26.02	20	23.65	WR	BVP	Dhola - Dhasa	Single Line	-	-	2L	-
Phulwartanr	Jamuniatanr H	4.45	38	4.58	ECR	DHN	Phulwartanr - Jamuniatanr	3rd Line	-	-	-	-
Ranaghat Jn	Bongaon Jn	32.93	18	32.94	ER	SDAH	RANAGHAT - BONGAON	2nd Line	-	-	-	-
Haridwar	Laksar Jn	27.00	24	26.76	NR	MB	Laksar Jn. - Haridwar	2nd Line	-	-	-	-
Ernakulam Town	Ernakulam C Cabin	1.98	42	1.26	SR	TVC	Ernakulam Town - Ernakulam 'C' Cabin	3rd Line	-	-	-	-
Hathras Jn	Kasganj Jn	105.00	25	54.88	NER	ZN	KASGANJ - MATHURA	Single Line	-	-	2L	2L+TC
Dinagaon Halt	Aurangabad	62.00	24	57.55	SCR	NED	Aurangabad - Jalna	Single Line	2L	2L+TC	-	-
Khijadiya Jn	Dhasa Jn	26.16	16	26.51	WR	BVP	Dhasa - Khijadiya	Single Line	-	-	-	2L
Bhimavaram Jn	Nidadavolu Jn	47.00	16	46.78	SCR	BZA	Bhimavaram - Nidadavolu	2nd Line	-	-	-	-
Aurangabad	Rotegaon	113.15	24	61.23	SCR	NED	Manmad - Aurangabad	Single Line	2L	2L+TC	-	-
Rotegaon	Ankai	113.15	24	37.29	SCR	NED	Manmad - Aurangabad	Single Line	2L	2L+TC	-	-
Jalna	Dinagaon Halt	62.00	24	5.39	SCR	NED	Aurangabad - Jalna	Single Line	2L	2L+TC	-	-
Rajkot City	Jetalasar Jn	77.05	20	77.98	WR	BVP	Rajkot - Jetalsar	Single Line	-	-	-	2L
Lumdiong South	New Haflong	169.20	15	89.82	NFR	LMG	LUMDING - BADARPUR.	Single Line	2L	-	2L+TC	3L+TC
Idgah Agra Jn	Agra Cantt Jn	82.25	22	1.63	NCR	AGC	Bayana - Idgah	2nd Line	-	-	-	2L+TC
Aruppukkottai	Manamadurai Jn	66.55	17	44.55	SR	MDU	Manamadurai Jn. - Virudunagar Jn.	Single Line	-	-	2L	-
Virudunagar Jn	Aruppukkottai	66.55	17	22.05	SR	MDU	Manamadurai Jn. - Virudunagar Jn.	Single Line	-	-	2L	-
Tapri Jn	Khanalampura west	2.00	20	4.15	NR	DLI	Tapri - Khanalampura	2nd Line	-	-	-	-
Diva Jn	Vasai Road Jn	42.00	48	43.00	CR	CSTM	Vasai Road - Diva	2nd Line	2L+TC	-	-	3L+TC
Meerut City Jn	Ghaziabad Jn	47.00	60	47.74	NR	DLI	Ghaziabad Jn - Khatauli	2nd Line	-	-	-	-
Kannauj	Mandhana Jn	132.37	24	62.05	NER	ZN	RAWATPUR - FARUKHABAD	Single Line	-	-	2L	-
Mandhana Jn	Rawatpur	132.37	24	12.28	NER	ZN	RAWATPUR - FARUKHABAD	Single Line	-	-	2L	-
Farrukhabad Jn	Kannauj	132.37	24	59.07	NER	ZN	RAWATPUR - FARUKHABAD	Single Line	-	-	2L	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Kalinarayanpur Jn	Shantipur	15.85	26	16.63	ER	SDAH	KALINARAYANPUR - SHANTIPUR	2nd Line	-	-	-	-
Hathras Jn	Hathras City	105.00	25	8.79	NER	ZN	KASGANJ - MATHURA	Single Line	-	-	2L	2L+TC
Mathura Jn	Hathras City	105.00	25	40.14	NER	ZN	KASGANJ - MATHURA	Single Line	-	-	2L	2L+TC
Hansi	Bhiwani Jn	60.00	19	36.26	NWR	BKN	BHIWANI - HISAR	2nd Line	2L+TC	-	3L+TC	-
Tenkasi Jn	Sivakasi	122.16	16	96.65	SR	MDU	Virudunagar - Tenkasi Jn.	Single Line	-	-	2L	-
Bengaluru city	Yesvantpur	17.12	35	5.34	SWR	SBC	Yelahanka - Penukonda	2nd Line	-	-	-	2L+TC
Phulera Jn	Degana Jn	108.75	24	108.26	NWR	JU	PHULERA - DEGANA	2nd Line	-	-	-	-
Sivakasi	Virudunagar Jn	122.16	16	23.91	SR	MDU	Virudunagar - Tenkasi Jn.	Single Line	-	-	2L	-
Kamarkundu Jn	Seoraphuli Jn	34.94	43	14.52	ER	HWH	SEORAPHULI - TARAKESWAR	2nd Line	-	-	-	-
Luni Jn	Marwar Jn	71.71	24	71.92	NWR	JU	LUNI - MARWAR	2nd Line	-	-	-	-
Lajpat Nagar	okhla	7.00	42	4.14	NR	DLI	Okhla - Lajpat Nagar	2nd Line	-	-	-	-
Dum Dum Jn	Kolkata Terminus	3.92	44	6.88	ER	SDAH	DUMDUM - KOLKATA	3rd Line	-	-	-	-
Srinagar	Awantipura	3.00	68	22.48	NR	FZP	Jalandhar Cantt. - Suchi Pind	Single Line	2L	-	2L+TC	-
Machapur Jn	Charbatia	18.04	74	15.04	ECOR	KUR	Rajathgarh - Charbatia	4th Line	-	-	-	-
Charbatia	Salegaon	7.50	93	4.71	ECOR	KUR	Charbatia - Nergundi	4th Line	-	-	-	-
Dindigul	Palani	58.30	17	57.91	SR	MDU	Dindigul Jn. - Palani	Single Line	-	-	2L	-
Bijnor	Muzzampur Narain Jn	95.00	15	24.80	NR	MB	Gajraula Jn. - Muzzampur Narain	Single Line	-	-	-	-
Gajraula Jn	Bijnor	95.00	15	70.97	NR	MB	Gajraula Jn. - Muzzampur Narain	Single Line	-	-	-	-
Barkakana Jn	Mandu	57.14	60	29.86	ECR	DHN	Hazaribag Town - Barkakana	Single Line	-	-	-	2L+TC
Bharatpur Jn	Achhnera Jn	27.31	20	27.79	NCR	AGC	Achnera - Bharatpur	2nd Line	-	-	-	-
Wansjaliya Jn	Jetalasar Jn	90.61	16	90.85	WR	BVP	Jetalsar - Wansjaliya	Single Line	-	-	-	2L
Palani	Udumalaipettai	62.90	20	34.22	SR	MDU	Palani - Pollachi Jn.	Single Line	-	-	2L	-
Raiwala jn	Haridwar	11.00	24	11.07	NR	MB	Haridwar - Raiwala Jn.	Single Line	-	2L	-	-
Bhandaridah	Jarangdih	13.65	70	13.48	ECR	DHN	Bhandaridah - Jarangdih	3rd Line	-	-	-	-
Jarangdih	Gumia	13.38	87	11.71	ECR	DHN	Jarangdih - Gomia	Single Line	-	-	-	-
Gumia	Barkakana Jn	52.30	71	52.30	ECR	DHN	Gomia - Barkakana	2nd Line	-	-	-	-
Udumalaipettai	Pollachi Jn	62.90	20	28.85	SR	MDU	Palani - Pollachi Jn.	Single Line	-	-	2L	-
Tarakeshwar	Kamarkundu Jn	34.94	43	21.53	ER	HWH	SEORAPHULI - TARAKESWAR	2nd Line	-	-	-	-
Charkhi Dadri	Rewari Jn	41.69	60	54.93	NWR	BKN	REWARI - JHARLI	2nd Line	2L+TC	-	3L+TC	-

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Agra Cantt Jn	Achhnera Jn	24.28	20	23.28	NCR	AGC	Achnera - Idgah	2nd Line	-	-	-	-
Chandrapura Jn	Bhandaridah	6.64	34	6.59	ECR	DHN	Chandrapura - Bhandaridah	2nd Line	-	-	-	-
Tenkasi Jn	Sengottai	7.83	28	8.02	SR	MDU	Tenkasi Jn. - Sengottai Jn.	Single Line	-	-	2L	-
Arakkonam North Cabin	Melpakkam	0.97	60	3.16	SR	MAS	Arakkonam North Cabin - Melpakkam	2nd Line	2L+TC	-	-	-
Nalhati Jn	Azimganj	45.16	25	47.34	ER	HWH	AZIMGANJ - NALHATI	3rd Line	-	-	-	3L+TC
New Haflong	Badarpur Jn	169.20	15	69.40	NFR	LMG	LUMDING - BADARPUR.	Single Line	2L	-	2L+TC	3L+TC
Bhiwani Jn	Charkhi Dadri	40.87	23	27.55	NWR	BKN	JHARLI - BHIWANI	2nd Line	2L+TC	-	3L+TC	-
Netravathi	Mangalore Central	2.34	48	3.70	SR	PGT	Netravati - Mangaluru Central	2nd Line	-	-	-	-
Raja Ki Mandi	Yamuna Bridge	4.50	16	4.53	NCR	AGC	Raja ki Mandi - Agra City Yamuna Bridge/W	2nd Line	-	-	-	-
Saharsa Jn	Simri Bakhtiyarpur	43.13	24	17.15	ECR	SPJ	Mansi - Saharsa	Single Line	-	2L	-	2L+TC
Ujjain Jn	dewas jn	40.39	26	40.31	WR	RTM	Ujjain - Dewas	Single Line	-	-	-	2L+TC
Rajgir	Bihar Sharif	53.00	30	23.52	ECR	DNR	Bakhtiyarpur - Rajgir	2nd Line	-	-	-	-
Karjat Jn	Panvel Jn	28.00	17	27.44	CR	CSTM	Panvel - Karjat junction	Single Line	2L+TC	-	-	-
Mau Jn	Azamgarh	99.75	16	43.71	NER	BSB	Mau - Shahganj	2nd Line	-	-	-	-
Patel Nagar	Rampura Cabin	2.00	38	2.58	NR	DLI	Patel Nagar - Rampura CABIN	2nd Line	-	-	-	-
Dekpura Halt	Bakhtiyarpur Jn	53.00	30	23.41	ECR	DNR	Bakhtiyarpur - Rajgir	2nd Line	-	-	-	-
Bihar Sharif	Dekpura Halt	53.00	30	5.89	ECR	DNR	Bakhtiyarpur - Rajgir	2nd Line	-	-	-	-
Bharatpur Jn	Bandikui Jn	97.00	20	97.49	NCR	AGC	Bharatpur - Bandikui	2nd Line	-	-	-	-
Tapasi	Andal Jn	11.06	17	11.99	ER	ASN	ANDAL - SONACHARA - TOPSI	3rd Line	-	-	-	3L+TC
Gadag Jn	Bagalkot	94.00	20	93.10	SWR	UBL	Gadag - Bagalkot	2nd Line	-	-	-	2L+TC
Badarpur Jn	Karimganj Jn	20.00	21	20.48	NFR	LMG	BADARPUR - KARIMGANJ	Single Line	2L	-	2L+TC	3L+TC
Barmer	Samdari Jn	129.14	18	129.03	NWR	JU	SAMDARI - BARMER	2nd Line	-	-	-	-
Gondia Jn	Balaghat Jn	8.50	20	39.71	SECR	NGP	GODHANI CHORD CABIN - KAUMANA	Single Line	-	-	2L	-
Rangiya Jn	Tangla	30.00	40	39.72	NFR	LMG	NEW GUWAHATI - DIGARU	2nd Line	2L+TC	-	4L+TC	-
Dhola Jn	Sihor Gujarat Jn	28.81	24	29.15	WR	BVP	Dhola - Sihor	Single Line	-	-	-	2L
Majerhat	Komagata Maru Budge Budge	14.02	50	14.63	ER	SDAH	MAJHERHAT - BUDGE BUDGE	2nd Line	-	-	-	-
Sonarpur Jn	Kalikapur FS	29.01	32	6.14	ER	SDAH	SONARPUR - CANNING	2nd Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Kalikapur FS	Canning	29.01	32	24.15	ER	SDAH	SONARPUR - CANNING	2nd Line	-	-	-	-
Sarupsar Jn	Suratgarh Jn	21.49	19	21.32	NWR	BKN	SURATGARH - SARUPSAR	2nd Line	-	-	-	-
Sihor Gujarat Jn	Bhavnagar Terminus	20.16	24	20.19	WR	BVP	Sihor - Bhavnagar	Single Line	-	-	-	2L
Urkura	Raipur Vizainagaram Hut	3.40	24	4.59	SECR	R	URKURA - RAIPUR STORE DEPOT - RAIPUR VIZAINAGRAM HUT	Single Line	-	-	-	-
Salegaon	Nergundi Jn	7.50	93	4.29	ECOR	KUR	Charbatia - Nergundi	2nd Line	4L	-	-	-
H Nizamuddin Jn	Lajpat Nagar	1.50	45	2.36	NR	DLI	Nizzamudin - Lajpat Nagar(DAL)	2nd Line	-	-	-	-
Jamuniatanr H	Dugda Halt	57.14	60	3.74	ECR	DHN	Hazaribag Town - Barkakana	Single Line	-	-	-	2L+TC
Jakhal Jn	Sunam	66.00	24	37.21	NR	UMB	Dhuri Jn. - Jakhal Jn.	Single Line	2L	2L+TC	-	-
Muri Jn	Tiruldih	66.50	18	30.36	SER	RNC	CHANDIL - MURI	2nd Line	-	-	-	-
Tiruldih	Chandil Jn	66.50	18	27.27	SER	RNC	CHANDIL - MURI	Single Line	2L	-	-	-
Parbhani Jn	Purna Jn	28.54	24	28.80	SCR	NED	Parbhani - Purna	2nd Line	-	-	2L+TC	-
Solan	Kalka	96.00	9	24.16	NR	UMB	Kalka Jn. - Shimla	Single Line	-	-	2L	-
Hapa	Jamnagar Jn	8.64	24	7.20	WR	RJT	Hapa - Jamnagar	2nd Line	-	-	-	-
Bharoli Jn	Pathankot Jn	5.00	51	3.18	NR	FZP	Pathankot cantt - Bharoli Jn.	Single Line	-	-	2L	2L+TC
Jetalasar Jn	Junagadh Jn	25.96	20	26.38	WR	BVP	Jetalsar - Junagarh	Single Line	-	-	-	2L
Katra	Udhampur	53.00	28	24.72	NR	FZP	Jammu Tawi - Udhampur	Single Line	-	-	2L	2L+TC
Dharuadihi	Ghuriadhor Mines	101.00	70	13.68	SER	CKP	ROURKELA - JHARSUGUDA	2nd Line	4L+ABTS	-	-	-
Karimganj Jn	Baraigram Jn	21.00	15	22.11	NFR	LMG	KARIMGANJ - BARAIGRAM	Single Line	2L	-	2L+TC	3L+TC
Khijadiya Jn	Kunkavav	78.28	14	34.13	WR	BVP	Khijadiya - Jetalsar	Single Line	-	-	-	2L
Udhampur	Jammu Tawi	53.00	28	52.64	NR	FZP	Jammu Tawi - Udhampur	Single Line	-	-	2L	2L+TC
Baruipur Jn	Lakshmikantapur	36.72	29	37.53	ER	SDAH	BARUIPUR - LAKSHMIKANTAPUR	2nd Line	-	-	-	-
Bagalkot	Vijayapura	97.00	21	95.72	SWR	UBL	Bagalkot - Vijayapura	2nd Line	-	-	-	-
Liluah	Belur	2.51	13	1.34	ER	HWH	LILUAH - BELUR MATH	4th Line	-	-	-	-
Bharoli Jn	Pathankot Cantt	2.98	24	2.54	NR	FZP	Bharoli Jn. - Pathankot	2nd Line	-	-	-	2L+TC

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Indara Jn	Phephna Jn	50.52	16	51.03	NER	BSB	Indara - Phephna	2nd Line	-	-	-	-
dewas jn	Maksi Jn	36.04	16	36.54	WR	RTM	Dewas - Maksi	Single Line	-	2L	-	2L+TC
Kunkavav	Jetalasar Jn	78.28	14	44.29	WR	BVP	Khijadiya - Jetalsar	Single Line	-	-	-	2L
Sakri Jn	Madhubani	48.69	19	17.22	ECR	SPJ	Sakri - Jaynagar	Single Line	-	2L	-	-
Azamgarh	Shahganj Jn	99.75	16	55.71	NER	BSB	Mau - Shahganj	2nd Line	-	-	-	-
Katosan Road Jn	Mahesana Jn	0.00	24	26.51	WR	ADI	Viramgam - Mahesana	Single Line	-	-	-	2L
Kalluru Jn	Guntakal Jn	41.00	20	40.23	SCR	GKL	Kalluru - Guntakal	2nd Line	-	-	-	-
Mahendragarh	Rewari Jn	141.28	20	49.94	NWR	BKN	REWARI - SADULPUR	2nd Line	-	-	-	-
Tangla	Rangapara	30.00	40	88.57	NFR	LMG	NEW GUWAHATI - DIGARU	2nd Line	2L+TC	-	4L+TC	-
Rangapara	Balipara Jn	147.00	22	11.60	NFR	LMG	DIGARU - LUMDING	Single Line	2L+TC	-	4L+TC	-
Mau Ranipur	Harpalpur	181.00	16	20.89	NCR	JHS	JHS - BNDA	2nd Line	-	-	-	-
Yesvantpur	Yelahanka	17.12	35	10.57	SWR	SBC	Yelahanka - Baiyyappanahalli via CSDR	2nd Line	-	-	-	2L+TC
Baraigram Jn	Dharmanagar	42.00	13	43.74	NFR	LMG	BARAIGRAM - DHARMANAGAR	Single Line	-	-	2L+TC	3L+TC
Kurduvadi Jn	Pandharpur	52.00	18	52.79	CR	SUR	Kurduvadi Junction - Pandharpur	Single Line	-	-	2L	-
Mahoba Jn	Khairar Jn	181.00	16	43.00	NCR	JHS	JHS - BNDA	2nd Line	-	-	-	-
Bareilly City	Bhojipura Jn	81.67	23	16.47	NER	ZN	BARELLY CITY - LALKUA	Single Line	-	-	2L	-
Dugda Halt	Chandrapura Jn	3.62	36	4.13	ECR	DHN	Dugda - Chandrapura	Single Line	-	-	-	-
Kasganj Jn	Farrukhabad Jn	107.84	20	107.52	NER	ZN	FARUKHABAD - KASGANJ	Single Line	-	-	2L	-
Banda	Khairar Jn	122.00	20	10.65	NCR	JHS	BZM - BNDA	2nd Line	-	-	-	-
Balipara Jn	Harmurti Jn	147.00	22	138.69	NFR	LMG	DIGARU - LUMDING	Single Line	2L+TC	-	4L+TC	-
Baruipur Jn	Diamond Harbour	34.76	29	35.77	ER	SDAH	BARUIPUR - DIAMONDHARBOUR	2nd Line	-	-	-	-
Chikballapur	Yelahanka	138.30	53	45.62	SWR	SBC	Mysuru - Bengaluru	2nd Line	-	-	-	-
Natesar	Rajgir	46.00	32	17.60	ECR	DNR	Rajgir - Tilaiya	Single Line	-	-	2L	-
Natesar	Tilaiya Jn	46.00	32	28.34	ECR	DNR	Rajgir - Tilaiya	Single Line	-	-	2L	-
Manikpur Jn	Chitrakot Dham Karwi	100.00	16	31.07	NCR	JHS	MKP - BNDA	2nd Line	-	-	-	-
Mavli Jn	Udaipur City	114.16	20	42.59	NWR	AII	CHITTORGARH - UDAIPUR CITY	2nd Line	-	-	-	2L+TC
Loharu Jn	Mahendragarh	141.28	20	41.10	NWR	BKN	REWARI - SADULPUR	2nd Line	-	-	-	-
Jhanjharpur Jn	Sakri Jn	51.50	0	20.16	ECR	SPJ	Sakri - Nirmali	2nd Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Jhanjharpur Jn	Nirmali	51.50	0	32.28	ECR	SPJ	Sakri - Nirmali	2nd Line	-	-	-	-
Hisar Jn	Hansi	60.00	19	23.35	NWR	BKN	BHIWANI - HISAR	2nd Line	2L+TC	-	3L+TC	-
Phalodi Jn	Jaisalmer	156.17	15	156.06	NWR	JU	PHALODI - JAISALMER	2nd Line	-	-	-	-
Nanjangud	Chamarajanagar	120.53	35	34.77	SWR	SBC	Penukonda - Yelahanka	Single Line	2L	-	-	-
Harpalpur	Mahoba Jn	181.00	16	52.96	NCR	JHS	JHS - BNDA	2nd Line	-	-	-	-
Jamnagar Jn	Kanalus Jn	26.43	24	26.89	WR	RJT	Jamnagar - Kanalus	2nd Line	-	-	-	-
Punalur	Sengottai	49.38	16	47.25	SR	MDU	Sengottai - Punalur	Single Line	-	-	2L	-
Chitrakot Dham Karwi	Banda	100.00	16	68.70	NCR	JHS	MKP - BNDA	2nd Line	-	-	-	-
Harmurti Jn	North Lakhimpur	147.00	22	31.71	NFR	LMG	DIGARU - LUMDING	Single Line	2L+TC	-	4L+TC	-
Badaun	Kasganj Jn	108.92	29	60.30	NER	ZN	KASGANJ - BAREILLY CITY	Single Line	-	-	-	-
Etawah	Udi	118.00	16	12.70	NCR	JHS	ETW - BLNR	Single Line	-	-	2L	2L+TC
Viramgam Jn	Katosan Road Jn	0.00	24	37.87	WR	ADI	Viramgam - Mahesana	Single Line	-	-	-	2L
Sangrur	Dhuri Jn	66.00	24	15.08	NR	UMB	Dhuri Jn. - Jakhal Jn.	Single Line	2L	2L+TC	-	-
Sunam	Sangrur	66.00	24	12.92	NR	UMB	Dhuri Jn. - Jakhal Jn.	Single Line	2L	2L+TC	-	-
LalKuan Jn	Kiccha	81.67	23	17.85	NER	ZN	BARELLY CITY - LALKUA	Single Line	-	-	2L	-
Mankapur Jn	Ayodhya Jn	37.65	14	37.36	NER	LJN	Mankapur - Ayodhya	Single Line	-	-	-	2L
Wani Jn	Majri Jn	13.00	15	13.75	CR	NGP	Majri Junction - WANI	Single Line	-	-	-	2L
Pimpalkuti	Wani Jn	66.00	15	65.50	CR	NGP	WANI - Pimpal Khuti	Single Line	-	-	-	2L
Bangarapet	Kolar	53.12	21	16.60	SWR	SBC	Dharmavaram - Penukonga via SSPN	Single Line	-	-	-	-
Hapur Jn	Meerut City Jn	30.00	16	29.24	NR	MB	Hapur Jn. - Meerut City	2nd Line	-	-	-	-
Maksi Jn	Shajapur	192.70	14	27.66	WCR	BPL	MAKSI - RUTHIYAI	Single Line	-	-	2L	-
Arariya	Arariya Court	80.00	20	4.53	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2L+TC	3L+TC
Arariya Court	Jalalgarh	80.00	20	20.21	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2L+TC	3L+TC
Jalalgarh	Purnea Jn	80.00	20	18.87	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2L+TC	3L+TC
Shri Chhatrapati Shahu Maharaj Terminus, Kolhapur	Miraj Jn	47.00	24	45.93	CR	PUNE	Miraj Junction - Kolahpur	Single Line	-	-	-	-
Ludhiana Jn	Malerkotla	62.00	24	44.71	NR	UMB	Ludhiana Jn - Dhuri Jn.	2nd Line	-	-	2L+TC	-
Malerkotla	Dhuri Jn	62.00	24	16.56	NR	UMB	Ludhiana Jn - Dhuri Jn.	Single Line	2L	-	2L+TC	-
Muktsar	Kot Kapura Jn	42.89	22	32.36	NR	FZP	Fazilka Jn - Kotkapura Jn	Single Line	-	-	2L	-
Shahdara Jn	Baghpat Road	88.00	25	32.71	NR	DLI	Delhi Shahdara - Shamli	2nd Line	-	-	-	-
Barddhaman Jn	Shrikhanda	52.19	10	49.25	ER	HWH	BARDDHAMAN - KATWA	2nd Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
New Mal Jn	New Domohani	62.00	5	40.29	NFR	APDJ	NEW MAL JN - CHANGRABANDHA	Single Line	-	-	2L	-
Kinattukadavu	Podanur Jn	18.65	16	18.28	SR	SA	Podanur Jn - Kinattukkadavu	Single Line	-	-	2L	-
Bayana Jn	Agra Cantt Jn	82.25	22	81.08	NCR	AGC	Bayana - Idgah	2nd Line	-	-	-	2L+TC
Ahmadpur Jn	Ambalgram	53.02	12	46.39	ER	HWH	AHMEDPUR - KATWA	Single Line	2L	-	-	-
Sadulpur Jn	Loharu Jn	141.28	20	49.47	NWR	BKN	REWARI - SADULPUR	2nd Line	-	-	-	-
Talcher Jn Cabin	Talcher	10.60	66	5.81	ECOR	KUR	Talcher - Budhapank	2nd Line	4L+TC	-	-	-
Barasat Jn	Sondalia	12.12	28	12.45	ER	SDAH	BARASAT - SONDALIA	2nd Line	-	-	-	-
Barasat Jn	Hasnabad	16.54	23	56.61	ER	SDAH	CHAMPAPUKUR - HASNABAD	Single Line	2L	-	-	-
Sondalia	Labutala	6.58	24	6.36	ER	SDAH	SONDALIA - LABUTALA	2nd Line	-	-	-	-
Basirhat	Hasnabad	16.54	23	10.75	ER	SDAH	CHAMPAPUKUR - HASNABAD	2nd Line	-	-	-	-
Champapukur	Basirhat	16.54	23	6.60	ER	SDAH	CHAMPAPUKUR - HASNABAD	2nd Line	-	-	-	-
Labutala	Champapukur	17.69	28	17.99	ER	SDAH	LABUTALA - CHAMPAPUKUR	2nd Line	-	-	-	-
Jaggayapalem	Simhachalam North Jn	6.00	57	1.90	ECOR	WAT	Simhachalam North - Jaggayyapalem	3rd Line	-	-	-	-
Jaggayapalem	Gopalapatnam	4.35	36	1.66	ECOR	WAT	Jaggayyapalem - Gopalpatnam	2nd Line	-	-	-	-
Samalkot Jn	Kakinada Town	15.60	30	12.10	SCR	BZA	Samalkot - Kakinada	2nd Line	-	-	-	-
Nabadwip Dham	Krishnanagar City Jn	0.00	0	15.59	ER	SDAH	KRISHNANAGAR - NABADWIP GHAT	Single Line	2L	-	-	-
Amritsar Jn	Atari Jn	23.00	24	23.82	NR	FZP	Amritsar Jn. - Atari	Single Line	-	-	-	-
Krishnanagar City Jn	Shantipur	15.29	11	15.55	ER	SDAH	SANTIPUR - KRISHNANAGAR	2nd Line	-	-	-	-
Anara Jn	Rukni Jn	8.25	17	7.72	SER	Adra	ANARA - RUKNI	2nd Line	-	-	-	-
Hasanpur Road	Samastipur Jn	85.88	23	46.04	ECR	SPJ	Samastipur - Khagaria	Single Line	-	-	2L	-
Hasanpur Road	Khagaria Jn	85.88	23	40.73	ECR	SPJ	Samastipur - Khagaria	Single Line	-	-	2L	-
Gokulpur	Nimpura Jn	6.00	20	10.07	SER	KGP	NIMPURA - GOKULPUR	Single Line	-	-	-	-
Chitradurg	Rayadurg	131.00	20	97.22	SWR	MYS	Chikjajur - Raydurga	Single Line	-	-	-	2L
Ballari Jn	Rayadurg	53.00	16	52.30	SWR	UBL	Ballari - Rayadurga	Single Line	2L	-	-	-
Siliguri Jn	Sivok	174.00	23	21.24	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2L	2L+TC	-
Parbhani Jn	Jalna	114.58	24	114.07	SCR	NED	Jalna - Parbhani	Single Line	2L	-	-	-

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Pratapgarh Jn	Phaphamau Jn	46.10	16	46.86	NR	LKO	Pratapgarh - Phaphamau	Single Line	-	-	-	-
Bhind	Udi	118.00	16	23.80	NCR	JHS	ETW - BLNR	Single Line	-	-	2L	2L+TC
Villianur Halt	Villupuram	37.63	19	29.69	SR	TPJ	Villupuram - Puducherry	Single Line	-	-	-	-
Puducherry	Villianur Halt	37.63	19	7.61	SR	TPJ	Villupuram - Puducherry	Single Line	-	-	-	-
Baghpat Road	Shamli	88.00	25	55.36	NR	DLI	Delhi Shahdara - Shamli	2nd Line	-	-	-	-
Anand Jn	Sevaliya	51.76	24	51.18	WR	BRC	Sevaliya - Anand	2nd Line	-	-	-	-
Gwalior jn	Bhind	118.00	16	83.11	NCR	JHS	ETW - BLNR	Single Line	-	-	2L	2L+TC
Arsikere jn	Hassan Jn	47.00	20	46.49	SWR	MYS	Arsikere - Hassan	Single Line	-	-	-	-
Kashipur Jn	Moradabad Jn	50.30	18	49.53	NER	ZN	MORADABAD - KASHIPUR	Single Line	-	-	-	-
Nathdwara	Mavli Jn	15.27	21	15.01	NWR	AII	MAVLI - NATHDWARA	Single Line	-	-	-	-
Tinpahar Jn	Rajmahal	11.25	12	11.73	ER	MLDT	TINPAHAR - RAJMAHAL	Single Line	-	-	2L	-
Phulwartanr	Mahuda Jn	20.20	23	6.55	SER	Adra	MOHUDA - GOMOH	Single Line	2L	-	-	-
Chandlodiya	Khodiyar Jn	0.00	30	9.80	WR	ADI	Chandlodiya - Khodiyar	2nd Line	-	-	-	-
LalKuan Jn	Rudrapur	66.63	24	22.49	NER	ZN	RAMPUR - LALKUA	Single Line	-	-	-	-
Dharmanagar	Ambassa	139.00	21	74.35	NFR	LMG	DHARMANAGAR - AGARTALA	Single Line	-	-	2L	2L+TC
Biyavra Rajgarh	Ruthiyai jn	192.70	14	77.20	WCR	BPL	MAKSI - RUTHIYAI	Single Line	-	-	2L	-
Sevaliya	Timba Road	27.04	24	3.30	WR	BRC	Godhra - Sevaliya	2nd Line	-	-	-	-
Timba Road	Godhra Jn	27.04	24	24.38	WR	BRC	Godhra - Sevaliya	2nd Line	-	-	-	-
Ara Jn	Sasaram Jn	97.20	14	97.37	ECR	MGS	Ara - Sasaram	Single Line	-	-	-	2L+TC
Adilabad	Mudkhed Jn	162.00	18	162.08	SCR	NED	Mudkhed - Adilabad	Single Line	-	-	-	-
Joychandipahar	Adra Jn	4.40	51	4.47	SER	Adra	ADRA - JOYCHANDIPAHAR	2nd Line	-	-	-	-
Chikjajur jn	Chitradurg	131.00	20	32.86	SWR	MYS	Chikjajur - Raydurga	Single Line	-	-	-	2L
Rudrapur	Rampur Jn	66.63	24	46.11	NER	ZN	RAMPUR - LALKUA	Single Line	-	-	-	-
Amreli	Khijadiya Jn	92.03	14	16.62	WR	BVP	Khijadiaya - Visavadar	Single Line	-	-	-	-
Bhagalpur Jn	Barahat Jn	37.62	11	37.45	ER	MLDT	BHAGALPUR - BARAHAT	Single Line	-	-	-	2L
Wadsa	Nagbhir Jn	40.80	16	28.31	SECR	NGP	GONDIA - BALAGHAT	2nd Line	-	-	-	-
Babupeth	Nagbhir Jn	40.80	16	108.11	SECR	NGP	GONDIA - BALAGHAT	Single Line	2L	-	-	-
Janghai Jn	Zafarabad Jn	47.30	12	46.97	NR	LKO	Zafrabad - Janghai	Single Line	-	-	-	-
Shajapur	Biyavra Rajgarh	192.70	14	89.05	WCR	BPL	MAKSI - RUTHIYAI	Single Line	-	-	2L	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Pandharpur	Miraj Jn	137.00	17	135.35	CR	SUR	Pandharpur - Miraj Junction	Single Line	-	-	2L	-
Gondia Jn	Wadsa	40.80	16	102.73	SECR	NGP	GONDIA - BALAGHAT	2nd Line	-	-	-	-
Daurai	Madar	13.31	26	10.10	NWR	AII	DAURAI - MADAR (Bye - Pass)	Single Line	-	-	-	2L
Karjat Jn	Khopoli	14.00	17	14.76	CR	CSTM	Karjat Junction - Khopoli	Single Line	-	-	-	-
Vejandla	Guntur Jn	25.00	17	11.98	SCR	GNT	Guntur - Tenali	2nd Line	-	-	-	-
Utratia Jn	Alamnagar	18.50	22	18.41	NR	LKO	Utratia Jn. - Alamnagar	Single Line	-	-	-	-
Vanchi Maniyachchi Jn	Milavittam	31.15	23	23.48	SR	MDU	Vanchi Maniyachchi Jn. - Tuticorin.	2nd Line	-	-	-	-
Kollam Jn	Punalur	44.10	24	43.33	SR	MDU	Punalur - Kollam Jn.	Single Line	-	-	-	-
Sapaul	Saharsa Jn	93.63	0	27.86	ECR	SPJ	Saharsa - Narpatganj	2nd Line	-	-	-	2L+TC
Pollachi Jn	Kinattukadavu	21.14	16	19.69	SR	PGT	Kinattukkadavu - Pollachi Jn.	Single Line	-	-	2L	-
Merta Road Jn	Merta City	14.50	9	14.72	NWR	JU	MERTA ROAD - MERTA CITY	2nd Line	-	-	-	-
Dahinsara Jn	Morbi Jn	55.14	17	26.64	WR	RJT	Wankaner - Dahinsara	Single Line	-	-	2L	2L+TC
Pimpalkuti	Adilabad	21.00	18	20.86	SCR	NED	Adilabad - Pimpalkuti	Single Line	-	-	-	-
Alwar Jn	Mathura Jn	123.35	14	121.79	NCR	AGC	Alwar - Mathura	2nd Line	-	-	-	-
Awantipura	Qazigund	83.00	24	39.07	NR	FZP	Banihal - Budgam	Single Line	-	-	-	2L
Surendranagar Jn	Dhrangadhra Jn	14.69	10	33.68	WR	RJT	Surend'nagar - Dhrangadhra	Single Line	-	-	-	-
Rau	Tihi	9.51	20	8.69	WR	RTM	Rau - MHOW	2nd Line	-	-	-	-
Mahuva	Rajula Jn	30.50	14	30.97	WR	BVP	Rajula Road - Mahuva	Single Line	-	-	-	-
Asarva	Nandol Dahegam	26.81	16	26.55	WR	ADI	Asarva - Nandol Dahegam	Single Line	-	-	-	2L
Tirunelveli Jn	Tenkasi Jn	72.02	20	71.05	SR	MDU	Tenkasi Jn. - Tirunelveli	Single Line	-	-	-	-
Nandol Dahegam	Himmatnagar Jn	54.83	16	58.81	WR	ADI	Nandol Dahegam - Himmatnagar	Single Line	-	-	-	2L
Botad Jn	Sabarmati Jn	164.67	14	169.26	WR	BVP	Sabarmati - Botad	Single Line	-	-	-	-
Lalgarh Jn	Phalodi Jn	158.15	20	157.69	NWR	BKN	LALGARH - PHALODI	2nd Line	-	-	-	-
Hassan Jn	Mysuru Jn	119.00	19	116.78	SWR	MYS	Hasan - Mysore	Single Line	-	-	-	-
Bhojipura Jn	Pilibhit Jn	39.03	27	39.71	NER	ZN	BHOJIPURA - PILIBHIT	Single Line	-	-	-	-
Ramganga Bridge	Badaun	108.92	29	39.07	NER	ZN	KASGANJ - BAREILLY CITY	Single Line	-	-	-	-
Guna jn	Shivpuri	227.46	9	102.54	WCR	BPL	GUWALIOR - GUNA	Single Line	-	-	-	-
Tenali Jn	Vejandla	25.00	17	13.61	SCR	GNT	Guntur - Tenali	2nd Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Lohian Khas Jn	Firozpur Cantt Jn	65.90	24	65.54	NR	FZP	Lohian khas - Firozpur cantt	Single Line	-	-	-	2L
Morinda	Rupnagar	48.00	24	24.69	NR	UMB	Sirhind Jn. - New Morinda	Single Line	-	-	2L	-
Vikarabad Jn	Zahirabad	268.00	29	58.61	SCR	SC	Vikarabad - Parlivaijnath	Single Line	-	-	2L	2L+TC
Shamlaji Road	Himmatnagar Jn	209.80	0	41.95	NWR	AII	UDAIPUR CITY - HIMMATNAGAR	Single Line	-	-	-	2L
Dungarpur	Shamlaji Road	209.80	0	51.01	NWR	AII	UDAIPUR CITY - HIMMATNAGAR	Single Line	-	-	-	2L
Bhojudin Jn	Talgoria Jn	22.50	26	11.85	SER	Adra	BHOJUDIH - MOHUDA	2nd Line	-	-	-	-
Mahuda Jn	Talgoria Jn	22.50	26	10.75	SER	Adra	BHOJUDIH - MOHUDA	2nd Line	-	-	-	-
Sirhind Jn	Fatehgarh Sahib	48.00	24	4.71	NR	UMB	Sirhind Jn. - New Morinda	Single Line	-	-	2L	-
Fatehgarh Sahib	New Morinda Jn	48.00	24	17.03	NR	UMB	Sirhind Jn. - New Morinda	Single Line	-	-	2L	-
Belapur	Harigaon	237.00	26	9.02	CR	SUR	Daund Junction - Manmad Junction	Single Line	2L+TC	-	-	3L+TC
Kolkata Terminus	Majerhat	14.48	20	13.19	ER	SDAH	KOLKATA - PRINCEP GHAT - MAJHERHAT	2nd Line	-	-	-	-
Forbesganj Jn	Arariya	80.00	20	24.57	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2L+TC	3L+TC
Junagadh Jn	Visavadar jn	42.28	9	42.10	WR	BVP	Visavadar - Junagarh	Single Line	-	-	-	-
Shrikhanda	Katwa Jn	0.00	0	6.26	ER	HWH	SRIPAT SRIKHANDA - KATWA	2nd Line	-	-	-	-
Rajpura Jn	Patiala	25.00	22	25.34	NR	UMB	Rajpura Jn. - Patiala	2nd Line	-	-	-	-
North Lakhimpur	Dhemaji	139.00	17	71.39	NFR	LMG	LUMDING - FURKATING	Single Line	2L	-	2L+TC	3L+TC
Dhemaji	Sisibargaon	139.00	17	19.43	NFR	LMG	LUMDING - FURKATING	Single Line	2L	-	2L+TC	3L+TC
Shoranur Jn	Angadipuram	65.80	16	27.31	SR	PGT	Shoranur Jn. - Nilambur Road	Single Line	-	-	-	-
Kapurthala	Jalandhar city Jn	51.56	24	21.31	NR	FZP	Jalandhar City - Lohian khas	Single Line	-	-	-	2L
Kanalus Jn	Khambhaliya	95.60	16	28.02	WR	BVP	Dhasa - Rajula Road	Single Line	-	-	-	-
Khanapur Jn	Bidar	268.00	29	14.65	SCR	SC	Vikarabad - Parlivaijnath	Single Line	-	-	2L	2L+TC
Zahirabad	Bidar	268.00	29	31.87	SCR	SC	Vikarabad - Parlivaijnath	Single Line	-	-	2L	2L+TC
Shivpuri	Sithouli	227.46	9	118.39	WCR	BPL	GUWALIOR - GUNA	Single Line	-	-	-	-
Madhubani	Jaynagar	48.69	19	31.65	ECR	SPJ	Sakri - Jaynagar	Single Line	-	2L	-	-
Lalgola	Murshidabad	127.67	27	31.65	ER	SDAH	KRISHNANAGAR - LALGOLA	3rd Line	-	-	3L+TC	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
New Jalpaiguri Jn	Siliguri Jn	86.00	4	6.33	NFR	KIR	NEW JALPAIGURI - DARJEELING	Single Line	-	-	-	-
Nakodar Jn	Phillaur Jn	64.10	24	32.41	NR	FZP	Phillaur Jn - Lohian Khas Jn.	Single Line	-	-	-	2L
Kapurthala	Lohian Khas Jn	51.56	24	30.30	NR	FZP	Jalandhar City - Lohian khas	Single Line	-	-	-	2L
BoniDanga Link Cabin	Barharwa Jn	5.02	37	5.21	ER	MLDT	BONIDANDA LINK - BARHARWA	2nd Line	-	-	-	-
Shivamogga Town	Birur jn	63.00	20	62.22	SWR	MYS	Birur - Shimoga	2nd Line	-	-	-	-
Kashipur Jn	LalKuan Jn	58.34	19	57.84	NER	ZN	LALKUA - KASHIPUR	Single Line	-	-	-	-
Bhiwani Jn	Rohtak Jn	48.00	20	48.38	NWR	BKN	BHIWANI - ROHTAK	2nd Line	-	-	-	-
Phulwartanr	NSC Bose Jn Gomoh	20.20	23	13.84	SER	Adra	MOHUDA - GOMOH	Single Line	2L	-	-	-
Bikaner Jn	Ratangarh jn	137.26	20	135.50	NWR	BKN	RATANGARH - BIKANER	2nd Line	-	-	-	-
Ghatampur	Bhimsen Jn	122.00	20	32.65	NCR	JHS	BZM - BNDA	2nd Line	-	-	-	-
Khairar Jn	Ghatampur	122.00	20	86.41	NCR	JHS	BZM - BNDA	2nd Line	-	-	-	-
Sisibargaon	Murkong Selek	139.00	17	69.45	NFR	LMG	LUMDING - FURKATING	Single Line	2L	-	2L+TC	3L+TC
Dehradun	Raiwala jn	40.00	19	40.29	NR	MB	Raiwala Jn. - Dehradun	Single Line	-	-	-	-
Lakshmikantapur	Namkhana	46.56	18	48.02	ER	SDAH	LAKSHMIKANTAPUR - NAMKHANA	2nd Line	-	-	-	-
Rai Ka Bagh	Phalodi Jn	134.29	18	134.11	NWR	JU	RAI KA BAG - PHALODI	2nd Line	-	-	-	-
Milavittam	Tuticorin	31.15	23	7.44	SR	MDU	Vanchi Maniyachchi Jn. - Tuticorin.	2nd Line	-	-	-	-
Anand Nagar Jn	Nautanwa	40.53	16	40.52	NER	LJN	Anandnagar - Nautanwa	Single Line	-	-	-	-
Barnala	Dhuri Jn	95.00	22	31.11	NR	UMB	Dhuri Jn. - Bathinda Jn.	2nd Line	-	-	-	-
Bulandshahr	Hapur Jn	42.50	16	41.14	NR	MB	Bulandshar - Hapur Jn.	2nd Line	-	-	-	-
Badarpur Jn	Katakhal Jn	10.43	21	10.33	NFR	LMG	BADARPUR - KATAKHAL	Single Line	-	-	-	-
Latur Road Jn	Khanapur Jn	268.00	29	98.14	SCR	SC	Vikarabad - Parlivaijnath	Single Line	-	-	2L	2L+TC
Bathinda Jn	Barnala	95.00	22	64.14	NR	UMB	Dhuri Jn. - Bathinda Jn.	2nd Line	-	-	-	-
Bhanupali	Una Himachal	33.00	22	25.53	NR	UMB	Nangaldam - Una	Single Line	-	-	-	2L
Katosan Road Jn	Kalol Jn	37.21	9	37.37	WR	ADI	Katosan Road - Kalol	Single Line	-	-	-	2L
Udaipur City	Dungarpur	209.80	0	110.44	NWR	AII	UDAIPUR CITY - HIMMATNAGAR	Single Line	-	-	-	2L
New Cooch Behar jn	Alipur Duar Jn	22.00	12	22.47	NFR	APDJ	ALIPURDUAR JN. - NEW COOCHBEHAR	Single Line	-	-	2L	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Madurai Jn	Manamadurai Jn	47.52	22	46.58	SR	MDU	Madurai - Manamadurai Jn.	Single Line	-	-	-	-
Shravanabelagola	Kunigal	12.52	32	67.01	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2L	-	-	2L+TC
Chikbanavar	Solur	12.52	32	31.78	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2L	-	-	2L+TC
Mysuru Jn	Nanjangud	25.00	15	24.41	SWR	MYS	Mysore - Nanjangud	Single Line	-	-	-	-
Peddapalli Jn	Karimnagar	35.00	24	34.94	SCR	SC	Peddapalli - Karimnagar	Single Line	-	-	2L	-
Farrukhabad Jn	Mainpuri	106.30	12	59.48	NCR	ALD	Sikohabad - Farrukhabad	Single Line	-	-	-	2L
Raiwala jn	Rishikesh	12.00	18	11.53	NR	MB	Raiwala Jn. - Rishikesh	Single Line	-	-	-	-
Shimla	Solan	96.00	9	33.48	NR	UMB	Kalka Jn. - Shimla	Single Line	-	-	2L	-
Chaparmukh Jn	Senchoa Jn	25.30	8	20.13	NFR	LMG	CHAPARMUKH - HAIBARGAON.	Single Line	-	-	-	-
Hansdiha	Barahat Jn	77.20	9	37.25	ER	MLDT	BARAHAT - HANSDIHA - DUMKA	Single Line	-	-	-	2L
Khurja Jn	Bulandshahr	21.00	16	22.74	NR	MB	Khurja - Bulandshar	2nd Line	-	-	-	-
Ratangarh jn	Sardarshahar	47.10	7	46.53	NWR	BKN	RATANGARH - SARDARSHAR	2nd Line	-	-	-	-
Abohar Jn	Hindumalkot	53.00	22	27.13	NR	UMB	Abhor - Sri Ganga Nagar	Single Line	-	-	2L	-
Hindumalkot	Shri Ganganagar	53.00	22	25.30	NR	UMB	Abhor - Sri Ganga Nagar	Single Line	-	-	2L	-
Katakhal Jn	Arunachal Jn	13.00	21	13.50	NFR	LMG	KATAKHAL - ARUNACHAL	Single Line	-	-	-	-
Marwar Jn	Nathdwara	151.65	6	128.68	NWR	AII	MAVLI - MARWAR	Single Line	-	-	-	-
Arunachal Jn	Silchar	13.00	21	6.22	NFR	LMG	KATAKHAL - ARUNACHAL	Single Line	-	-	-	-
Tamluk Jn	Haldia	70.00	27	46.26	SER	KGP	PANSKURA - HALDIA	2nd Line	-	-	-	2L+TC
Arambag	Tarakeshwar	24.48	15	24.78	ER	HWH	TARAKESWAR - ARAMBAGH	2nd Line	-	-	-	-
Saharsa Jn	Dauram Madhepura	98.57	10	20.93	ECR	SPJ	Saharsa - Purnia Court	Single Line	-	-	-	2L
Wansjaliya Jn	Porbandar	33.69	22	33.37	WR	BVP	Wansjaliya - Porbander	Single Line	-	-	-	-
Banmankhi Jn	Dauram Madhepura	98.57	10	43.02	ECR	SPJ	Saharsa - Purnia Court	Single Line	-	-	-	2L
Jubbasahani	Muzaffarpur Jn	64.52	12	10.94	ECR	SPJ	Muzaffarpur - Sitamarhi	Single Line	-	-	-	-
Mainpuri	Shikohabad Jn	106.30	12	47.42	NCR	ALD	Sikohabad - Farrukhabad	Single Line	-	-	-	2L
Jawalmukhi Road	Pathankot Jn	83.00	14	81.60	NR	FZP	Pathankot - Baijnath Paprola	Single Line	-	2L	2L+TC	-
Junagadh Jn	Veraval Jn	81.72	20	81.74	WR	BVP	Junagarh - Veraval	Single Line	-	-	-	-
Khodiyar Jn	Gandhinagar Capital	0.00	20	12.70	WR	ADI	Khodiyar - Gandhinagar	2nd Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Karimnagar	Lingampet Jagityal	48.00	24	48.01	SCR	SC	Karimnagar - Lingampet Jagityal	Single Line	-	-	-	-
Bhandaridah	Rajabera	2.64	36	3.60	ECR	DHN	Rajabera - Bhandaridah	2nd Line	-	-	-	-
Jasidih Jn	Baidyanath dham	6.25	15	6.68	ER	ASN	JASIDIH - BAIDYANATHDHAM	Single Line	-	-	-	-
Visavadar jn	Amreli	92.03	14	74.42	WR	BVP	Khijadiaya - Visavadar	Single Line	-	-	-	-
Budgam	Srinagar	83.00	24	11.54	NR	FZP	Banihal - Budgam	Single Line	-	-	-	2L
Yesvantpur	Banaswadi	53.12	21	10.10	SWR	SBC	Penukonda - Dharmavaram via SSPN	2nd Line	-	-	-	-
Banaswadi	Baiyyappanahalli	53.12	21	6.13	SWR	SBC	Penukonda - Dharmavaram via SSPN	Single Line	2L	-	-	-
Badnera Jn	New Amravati	9.00	25	9.14	CR	BSL	Badnera Junction - Amravati (Terminal)	Single Line	-	-	-	-
Anand Jn	Petlad Jn	51.79	11	21.98	WR	BRC	Anand - Khambhat	Single Line	-	-	-	-
Jaunpur Jn	Aunrihar Jn	59.55	15	58.75	NER	BSB	Aunrihar - Jaunpur	2nd Line	-	-	-	-
Senchoa Jn	Nagaon	61.00	7	6.42	NFR	LMG	SENCHOA - SILGHAT TOWN	Single Line	-	-	-	-
Daryapur Jn	Dalmau Jn	24.80	15	24.33	NR	LKO	Daryapur - Dalamau	Single Line	-	-	-	-
Patiala	Dhuri Jn	52.00	22	52.08	NR	UMB	Patiala - Dhuri Jn.	2nd Line	-	-	-	-
Maliya Miyana Jn	Dahinsara Jn	25.10	16	24.63	WR	RJT	Dahinsara - Maliya Miyana	Single Line	-	-	-	-
Ahmedabad Jn	Asarva	1.87	22	2.55	WR	ADI	Ahmedabad - Asarva	Single Line	-	-	-	2L
Thawe Jn	Hathuwa	28.20	21	9.44	NER	BSB	Thawe - Siwan	2nd Line	-	-	-	-
Hathuwa	Siwan Jn	28.20	21	18.52	NER	BSB	Thawe - Siwan	2nd Line	-	-	-	-
Dhasa Jn	Rajula Jn	95.60	16	95.33	WR	BVP	Dhasa - Rajula Road	Single Line	-	-	-	-
Bhimavaram Jn	Gorintada	29.00	13	24.18	SCR	BZA	Bhimavaram - Narsapur	2nd Line	-	-	-	-
Gorintada	Narasapur	29.00	13	5.50	SCR	BZA	Bhimavaram - Narsapur	2nd Line	-	-	-	-
Parli Vaijnath	Parbhani Jn	63.61	24	63.36	SCR	NED	Parbhani - Parli - Vaijnath	Single Line	-	-	2L	-
LalKuan Jn	Kathgodam	22.53	13	21.90	NER	ZN	LALKUA - KATHGODAM	Single Line	-	-	-	2L
Sultanpur Jn	Chilbila Jn	35.20	14	36.07	NR	LKO	Sultanpur - Chilbila	Single Line	-	-	2L	-
Gazole	Buniadpur	22.00	16	28.87	NFR	KIR	EKLAKHI - BUNIADPUR	Single Line	-	-	-	2L
Eklakhi Jn	Gazole	22.00	16	13.41	NFR	KIR	EKLAKHI - BUNIADPUR	Single Line	-	-	-	2L
Katihar Jn	Manihari	24.00	8	24.11	NFR	KIR	KATIHAR - MANIHARI	Single Line	-	-	-	-
Dornakal Jn	Karepalli Jn	15.00	21	15.16	SCR	SC	Karepalli - Dornakal	Single Line	-	-	2L	-

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Karepalli Jn	Bhadrachalam Road	39.00	21	39.25	SCR	SC	BhadrachallamRd - Karepalli	Single Line	-	-	2L	-
Sitarampur Jn	Barabani	11.20	9	13.62	ER	ASN	BARABANI - SITARAMPUR	2nd Line	-	-	-	-
Pathankot Cantt	Pathankot Jn	4.00	24	5.17	NR	FZP	Pathankot cantt - Pathankot Jn.	2nd Line	-	-	-	-
Purnea Court	Banmankhi Jn	98.57	10	32.07	ECR	SPJ	Saharsa - Purnia Court	Single Line	-	-	-	2L
Kashipur Jn	Ramnagar	27.36	11	32.29	NER	ZN	KASHIPUR - RAMNAGAR	Single Line	-	-	-	-
Najibabad Jn	Kotdwara	24.00	15	23.85	NR	MB	Najibabad Jn. - Kotdwara	Single Line	-	-	-	-
Bangarapet	Marikuppam	41.47	19	15.23	SWR	SBC	Penukonda - Dharmavaram via NGM	2nd Line	-	-	-	-
Manamadurai Jn	Ramanathapuram	113.38	18	60.36	SR	MDU	Manamadurai Jn. - Rameswaram	Single Line	-	-	-	-
Ramanathapuram	Pamban	113.38	18	43.01	SR	MDU	Manamadurai Jn. - Rameswaram	Single Line	-	-	-	-
Pamban	Rameshwaram	113.38	18	10.73	SR	MDU	Manamadurai Jn. - Rameswaram	Single Line	-	-	-	-
Santragachhi Jn	Amta	44.60	13	41.53	SER	KGP	SANTRAGACHI - AMTA	2nd Line	-	-	-	-
Sitamarhi Jn	Jubbasahani	64.52	12	54.88	ECR	SPJ	Muzaffarpur - Sitamarhi	Single Line	-	-	-	-
Damodar Jn	Kalipahari	12.80	23	12.11	SER	Adra	DAMODAR - KALIPAHARI	2nd Line	-	-	-	-
Tinsukia Jn	Makum Jn	56.90	10	11.50	NFR	TSK	NEW TINSUKIA - LEDO	Single Line	-	-	-	-
Sabarmati Jn	Kalol Jn	20.67	20	20.20	WR	ADI	Sabarmati - Kalol	Single Line	-	-	-	-
Subrahmanya Road	Sakleshpur	55.00	6	53.63	SWR	MYS	Sakaleshpur - Subramanyaroad	Single Line	-	-	-	2L
Mangalore Jn	Subrahmanya Road	84.00	22	85.21	SWR	MYS	Subramanya Road - Padil	Single Line	-	-	-	2L
Tapasi	Barabani	15.75	9	15.80	ER	ASN	TOPASI - BARABANI (via IKRA)	Single Line	-	-	-	-
Mahesana Jn	Ranuj Jn	0.00	24	25.74	WR	ADI	Mahesana - Patan	Single Line	-	-	-	-
Barhan Jn	Etah	58.77	12	58.28	NCR	ALD	Barhan - Etah	Single Line	-	-	-	-
Masodha	Sultanpur Jn	58.20	14	51.74	NR	LKO	Faizabad - Sultanpur	Single Line	-	-	-	-
Salegaon	Kapilas Road Jn	4.30	34	3.96	ECOR	KUR	Salegaon - Kapilas Road	2nd Line	-	-	-	-
Buramara PH	Baripada	88.00	26	23.18	SER	KGP	RUPSA - BANGRIPOSI	Single Line	-	-	-	-
Baripada	Rupsa Jn	88.00	26	50.72	SER	KGP	RUPSA - BANGRIPOSI	Single Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Ujjain Jn	Fatehabad Chandrawatiganj Jn	22.96	8	22.51	WR	RTM	Fatehabad - C'gunj - Ujjain	2nd Line	-	-	-	-
Sapaul	Narpalganj	93.63	0	67.21	ECR	SPJ	Saharsa - Narpatganj	2nd Line	-	-	-	2L+TC
Baramula	Budgam	83.00	24	45.78	NR	FZP	Budgam - Baramulla	Single Line	-	-	-	-
Rewa	Satna Jn	48.55	22	49.99	WCR	JBP	REWA - SATNA	2nd Line	-	-	-	-
Ernakulam Jn	Ernakulam C Cabin	1.60	26	1.53	SR	TVC	Ernakulam Jn. - Ernakulam 'C' Cabin	3rd Line	-	-	-	-
Forbesganj Jn	Bathnaha	80.00	20	6.18	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2L+TC	3L+TC
Bathnaha	Jogbani	80.00	20	6.68	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2L+TC	3L+TC
Puntamba Jn	Sainagar Shirdi	16.00	20	17.06	CR	SUR	Puntamba Junction - Shirdi	Single Line	-	-	-	-
Bhuj	Ajnar	0.00	20	42.26	WR	ADI	Adipur - Bhuj	Single Line	-	-	-	-
Ajnar	Adipur Jn	0.00	20	7.15	WR	ADI	Adipur - Bhuj	Single Line	-	-	-	-
Tamluk Jn	Kanthi	89.00	33	61.61	SER	KGP	TAMLUK - DIGHA	2nd Line	-	-	-	-
Kanthi	Ramnagar	89.00	33	24.41	SER	KGP	TAMLUK - DIGHA	2nd Line	-	-	-	-
Ramnagar	Digha	89.00	33	8.13	SER	KGP	TAMLUK - DIGHA	2nd Line	-	-	-	-
Dhamalgaon	Dibrugarh	94.00	10	14.09	NFR	TSK	SIMALUGURI - DIBRUGARH	Single Line	-	-	2L	-
Sibsagar Town	Dhamalgaon	94.00	10	68.03	NFR	TSK	SIMALUGURI - DIBRUGARH	Single Line	-	-	2L	-
Ludhiana Jn	Moga	55.00	24	68.43	NR	FZP	Firozpur Cantt Jn. - Moga	Single Line	-	-	-	-
Phagwara Jn	Nawanshahr Doaba Jn	36.00	28	35.35	NR	FZP	Phagwara Jn. - Nawanshahar Doaba	Single Line	-	-	-	-
Sihor Gujarat Jn	Palitana	27.62	16	27.90	WR	BVP	Sihor - Palitana	Single Line	-	-	-	-
Moga	Firozpur Cantt Jn	55.00	24	54.42	NR	FZP	Firozpur Cantt Jn. - Moga	Single Line	-	-	-	-
Kakinada Town	Kakinada Port	15.60	30	3.28	SCR	BZA	Samalkot - Kakinada	2nd Line	-	-	-	-
Jhunjhunu	Sikar Jn	121.97	17	64.46	NWR	JP	SIKER - LOHARU	2nd Line	-	-	-	-
Jorhat Town	Mariani Jn	85.50	11	17.02	NFR	TSK	MARIANI - JORHAT TOWN - FURKATING.	Single Line	-	-	-	-
Kurduvadi Jn	Barsi Town	188.00	17	36.92	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2L	-
Barsi Town	Pangri	188.00	17	19.75	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2L	-
Simaluguri Jn	Sibsagar Town	94.00	10	16.82	NFR	TSK	SIMALUGURI - DIBRUGARH	Single Line	-	-	2L	-
Sikar Jn	Ringas Jn	0.00	0	51.24	NWR	JP	RINGAS - SIKER	2nd Line	-	-	-	-
Dildarnagar Jn	Tarighat	19.00	8	19.64	ECR	DNR	Dildarnagar - Tarighat	2nd Line	-	-	-	-

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Biradhwal	Suratgarh TPS	177.84	24	16.69	NWR	BKN	SURATGARH - LALGARH	2nd Line	-	-	-	-
Bhadrak	Bhatatira	11.00	48	6.91	ECOR	KUR	Bhatatira - Bhadrak	2nd Line	-	-	-	-
Madhoganj	Unnao Jn	102.00	12	77.01	NR	MB	Balamau Jn. - Unnao Jn.	Single Line	-	-	-	-
Chandur Bazar	Badnera Jn	41.00	16	42.76	CR	BSL	Badnera Junction - chandur Bazar	Single Line	-	-	-	2L
Harangul	Latur	188.00	17	8.89	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2L	-
Yedshi	Harangul	188.00	17	58.23	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2L	-
Kankurgachhi Jn	Ballygunge Jn	6.53	32	7.88	ER	SDAH	KANKURGACHHI - BALLYGUNGE	2nd Line	-	-	-	-
Petlad Jn	Tarapur	51.79	11	14.00	WR	BRC	Anand - Khambhat	Single Line	-	-	-	-
Tarapur	Khambhat	51.79	11	16.64	WR	BRC	Anand - Khambhat	Single Line	-	-	-	-
Raiganj	Barsoi Jn	54.00	18	22.47	NFR	KIR	BARSOI - RADHIKAPUR	Single Line	-	-	-	2L
Raiganj	Kaliyaganj	54.00	18	20.60	NFR	KIR	BARSOI - RADHIKAPUR	Single Line	-	-	-	2L
Patan	Ranuj Jn	0.00	24	13.36	WR	ADI	Mahesana - Patan	Single Line	-	-	-	-
Latur	Latur Road Jn	188.00	17	32.99	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2L	-
Balaghat Jn	Katangi	121.00	14	47.32	SECR	NGP	KACHHPURA - NAINPUR	Single Line	-	-	-	-
Sakleshpur	Hassan Jn	42.00	25	41.16	SWR	MYS	Hassan - Sakleshpur	Single Line	-	-	-	-
Fazilka jn	Abohar Jn	89.00	24	42.15	NR	FZP	Firozpur Cantt Jn. - Fazilka Jn	Single Line	-	-	-	-
Angadipuram	Nilambur Road	65.80	16	37.87	SR	PGT	Shoranur Jn. - Nilambur Road	Single Line	-	-	-	-
Narkher	Chandur Bazar	96.00	12	94.95	CR	NGP	CNDB - NRKR	Single Line	-	-	-	2L
Bhadrachalam Road	Pandurangapuram	49.00	18	24.92	SCR	SC	BhadrachalamRd - Manuguru	Single Line	-	-	-	2L
Raninagar Jalpaiguri Jn	Haldibari	30.40	7	30.61	NFR	KIR	RANINAGAR JALPAIGURI - HALDIBARI	Single Line	-	-	-	-
Kaithal	Narwana Jn	86.00	12	36.83	NR	DLI	Narwana Jn. - Kurukshetra	Single Line	-	-	-	-
Jhunjhunu	Loharu Jn	121.97	17	57.63	NWR	JP	SIKER - LOHARU	2nd Line	-	-	-	-
Balamau Jn	Madhoganj	102.00	12	22.05	NR	MB	Balamau Jn. - Unnao Jn.	Single Line	-	-	-	-

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Punkunnam	Guruvayur	19.98	16	20.04	SR	TVC	Punkunnam - Guruvayur	Single Line	-	-	-	-
Tirunelveli Jn	Tiruchendur	61.30	21	60.95	SR	MDU	Tirunelveli Jn. - Tiruchendur	Single Line	-	-	-	-
Tenali Jn	Repalle	34.00	12	32.43	SCR	GNT	Tenali - Repalle	Single Line	-	-	-	-
Khamgaon	Jalamb jn	12.00	20	11.86	CR	BSL	Jalamb Junction - Khamgaon	Single Line	-	-	-	-
Giridih	Madhupur Jn	37.96	11	38.17	ER	ASN	MADHUPUR - GIRIDIH	Single Line	-	-	-	-
Lohian Khas Jn	Nakodar Jn	64.10	24	31.63	NR	FZP	Phillaur Jn - Lohian Khas Jn.	Single Line	-	-	-	2L
Sabarmati Jn	Asarva	6.57	18	9.03	WR	ADI	Sabarmati - Asarva	Single Line	-	-	-	-
Veraval Jn	Somnath	4.86	18	4.47	WR	BVP	Veraval - Somnath	Single Line	-	-	-	-
Kotturu	Amaravathi Colony Jn	65.00	13	65.58	SWR	UBL	Kottur - Amaravathi colony	Single Line	-	-	-	2L
Shri Ganganagar	Sarupsar Jn	115.76	20	116.30	NWR	BKN	SARUPSAR - SRIGANGANAGAR	Single Line	-	-	-	-
Sukinda Road	Jajpur Keonjhar	10.51	21	11.04	ECOR	KUR	Sukinda Road - Jajpur Keonjhar Road (Bypass)	2nd Line	-	-	-	-
Lanjigarh Road Jn	Bhawanipatha	54.00	12	29.67	ECOR	SBP	Lanjigarh Road - Junagarh	Single Line	-	2L	2L+TC	-
Rajula Jn	Rajula City	6.55	22	7.61	WR	BVP	Rajula Road - Rajula City	Single Line	-	-	-	-
Kurukshetra Jn	Kaithal	86.00	12	48.32	NR	DLI	Narwana Jn. - Kurukshetra	Single Line	-	-	-	-
Golaghat	Jorhat Town	85.50	11	62.54	NFR	TSK	MARIANI - JORHAT TOWN - FURKATING.	Single Line	-	-	-	-
Koderma Jn	Dhanwar	86.14	12	49.16	ECR	DHN	Koderma - Kanwar	Single Line	-	-	-	-
Jharsuguda Road Jn	Lb	8.50	13	8.81	SECR	BSP	IB - JHARSUGUDA ROAD	Single Line	-	-	-	-
Fazilka jn	Muktsar	42.89	22	48.19	NR	FZP	Fazilka Jn - Kotkapura Jn	Single Line	-	-	2L	-
Pangri	Usmanabad	188.00	17	16.00	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2L	-
Old Malda Jn	Singhabad	24.50	8	24.68	NFR	KIR	OLDMALDA - SINGHABAD	Single Line	-	-	-	-
Furkating Jn	Golaghat	85.50	11	7.04	NFR	TSK	MARIANI - JORHAT TOWN - FURKATING.	Single Line	-	-	-	-
Baijnath Paprola	Jawalmukhi Road	83.00	14	50.24	NR	FZP	Jawalamukhi - Baijnath Paprola	Single Line	-	-	-	-
Padapahar Jn	Noamundi	2.70	57	2.70	SER	CKP	PADAPAHAR - NOAMUNDI	2nd Line	-	-	-	-

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Noamundi	Barajamda jn	13.70	37	14.35	SER	CKP	NOAMUNDI - BARAJAMDA	2nd Line	-	-	-	-
Kanhan Jn	Ramtek	250.00	14	22.72	SECR	NGP	GONDIA - BALLARSHAH	2nd Line	-	-	-	-
Neral jn	Matheran	20.00	12	8.83	CR	CSTM	Neral Junction - Matheran	Single Line	-	-	-	-
Kaliyaganj	Radhikapur	54.00	18	12.45	NFR	KIR	BARSOI - RADHIKAPUR	Single Line	-	-	-	2L
Goghai	Arambag	9.57	8	9.54	ER	HWH	ARAMBAGH - GOGHAT	2nd Line	-	-	-	-
Belur	Belur Math	2.51	13	1.45	ER	HWH	LILUAH - BELUR MATH	2nd Line	4L	-	-	-
Liluah	Belur Math	2.51	13	1.55	ER	HWH	LILUAH - BELUR MATH	2nd Line	4L	-	-	-
Bangriposi	Buramara PH	88.00	26	14.61	SER	KGP	RUPSA - BANGRIPOSI	Single Line	-	-	-	-
Hathras Jn	Hathras Quila	8.57	10	8.91	NCR	ALD	Hathras - Hathras Fort	Single Line	-	-	-	-
Naupada Jn	Parlakhemundi PH	90.20	0	39.56	ECOR	WAT	Naupada - Gunupur	Single Line	-	-	-	-
Makum Jn	Rupai	30.77	4	19.06	NFR	TSK	MAKUM - DANGARI	Single Line	-	-	-	-
Jalandhar city Jn	Nakodar Jn	32.00	8	31.11	NR	FZP	Jalandhar city - Nakodar	Single Line	-	-	-	-
Sarupsar Jn	Anupgarh	56.04	18	55.28	NWR	BKN	SARUPSAR - ANUPGARH	2nd Line	-	-	-	-
Gadwal Jn	Raichur Jn	58.00	15	54.73	SCR	HYB	Gadwal - Raichur (New Line)	Single Line	-	-	-	-
Banka	Barahat Jn	15.35	9	15.87	ER	MLDT	BARAHAT - BANKA	Single Line	-	-	-	-
Tamkuhi Road	Thawe Jn	98.80	17	36.34	NER	BSB	Kaptanganj - Thawe	Single Line	-	-	-	-
Padrauna	Tamkuhi Road	98.80	17	31.71	NER	BSB	Kaptanganj - Thawe	Single Line	-	-	-	-
Usmanabad	Yedshi	188.00	17	11.82	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2L	-
Gunda Road	Kotturu	54.70	12	52.97	SWR	UBL	Vyasa colony - Kottur	Single Line	-	-	-	2L
Maroda	Bhilai	75.10	21	9.58	SECR	R	MARODA - DALLIRAZRA	Single Line	-	-	2L	-
Shri Ganganagar	Hanumangarh Jn	66.88	20	66.61	NWR	BKN	SRIGANGANAGAR - HANUMANGARH	Single Line	-	-	-	-
Shivamogga Town	Talguppa	97.00	13	97.43	SWR	MYS	Shimoga - Talguppa	Single Line	-	-	-	-
Rourkela Jn	Birmitrapur	27.00	26	26.69	SER	CKP	ROURKELA - BIRMITRAPUR	2nd Line	-	-	-	-
Kaptanganj Jn	Padrauna	98.80	17	30.86	NER	BSB	Kaptanganj - Thawe	Single Line	-	-	-	-
Karaila Road Jn	Shaktinagar	32.13	68	31.21	ECR	DHN	Karaila Road - Shaktinagar	2nd Line	-	-	-	-

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Sakri Jn	Benipur Halt	30.05	6	19.95	ECR	SPJ	Sakri - Biraul	Single Line	-	-	-	-
Khajuraho	Mahoba Jn	64.00	12	63.27	NCR	JHS	MBA - Khajuraho	Single Line	-	-	-	-
Miyagam Karjan Jn	Dabhoi Jn	32.14	0	32.79	WR	BRC	Miyagam Karjan - Dabhoi	Single Line	-	-	2L	-
Tumsar Road Jn	Tirodi	23.00	11	46.65	SECR	NGP	KANHAN - RAMTEK	Single Line	-	-	-	-
Coimbatore North Jn	Mettupalaiyam Jn	30.11	17	32.44	SR	SA	Coimbatore North Jn. - Mettupalayam	Single Line	-	-	-	-
Durg Jn	Maroda	11.20	17	9.90	SECR	R	DURG - MARODA	Single Line	-	-	2L	-
Maroda	Dalli Rajhara	75.10	21	76.04	SECR	R	MARODA - DALLIRAZRA	Single Line	-	-	2L	-
Achhnera Jn	Mathura Jn	35.00	14	35.30	NCR	AGC	Mathura - Achnera	Single Line	-	-	-	-
Makum Jn	Ledo	56.90	10	47.46	NFR	TSK	NEW TINSUKIA - LEDO	Single Line	-	-	-	-
New Cooch Behar jn	Bamanhat	50.00	15	50.69	NFR	APDJ	NEW COOCHBEHAR - BAMANHAT	Single Line	-	-	-	-
Gunupur	Parlakhemundi PH	90.20	0	52.29	ECOR	WAT	Naupada - Gunupur	Single Line	-	-	-	-
Murtajapur Jn	Karanja	112.00	2	31.37	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Amritsar Jn	Tarn taran	32.50	21	22.64	NR	FZP	Amritsar Jn. - Patti	Single Line	-	-	-	-
Khambhaliya	Okha	95.60	16	113.72	WR	BVP	Dhasa - Rajula Road	Single Line	-	-	-	-
Hoshiarpur	Jalandhar Cantt Jn	32.00	8	37.61	NR	FZP	Jalandhar city - Nakodar	Single Line	-	-	-	-
Talala Jn	Veraval Jn	32.32	11	24.62	WR	BVP	Talala - Veraval	Single Line	-	-	-	-
Karanja	Karanja Town	112.00	2	1.41	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Karanja Town	Darwha Moti Bagh	112.00	2	38.08	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Darwha Moti Bagh	Yavatmal	112.00	2	40.65	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Chalisgaon jn	Dhule	56.00	14	57.41	CR	BSL	Chalisgaon Junction - Dhule	Single Line	-	-	-	-
Panipat Jn	Khukrana Halt	4.00	18	6.16	NR	DLI	Khukrana - Panipat Jn	Single Line	-	-	-	-
Dabhoi Jn	Chhuchhapura Jn	21.28	20	21.39	WR	BRC	Dabhoi - Chhuchhapura	Single Line	-	-	2L	-
Chhuchhapura Jn	Chhota Udepur	50.46	18	49.37	WR	BRC	Chhuchhapura - Chhota Udepur	Single Line	-	-	2L	-
Sakleshpur	Chikkamagaluru	45.00	15	46.57	SWR	MYS	Kadur - Chikmagalur	2nd Line	-	-	-	-
Tikamgarh	Lalitpur Jn	168.00	12	51.21	NCR	JHS	LAR - Khajuraho	2nd Line	-	-	-	-
Coonoor	Udagamandalam	18.85	10	15.80	SR	SA	Coonoor - Udagamandalam	Single Line	-	-	-	-
PratapNagar	Dabhoi Jn	30.55	14	26.76	WR	BRC	Pratap Nagar - Dabhoi	Single Line	-	-	-	-
Pandurangapuram	Manuguru	49.00	18	24.13	SCR	SC	BhadrachalamRd - Manuguru	Single Line	-	-	-	2L
Barabil	Barajamda jn	9.80	56	8.76	SER	CKP	BARAJAMDA - BARBIL	2nd Line	-	-	-	-

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Sonpur Jn	Paleza Ghat	6.00	20	3.48	ECR	DNR	Pahlezaghat - Phulwarishariff	Single Line	2L	2L+TC	-	4L+TC
Monghyr	Jamalpur Jn	9.25	10	9.67	ER	MLDT	JAMALPUR - MUNGER	Single Line	-	2L	-	-
Tarn taran	Khem Karan	32.50	21	53.70	NR	FZP	Amritsar Jn. - Patti	Single Line	-	-	-	-
Ambassa	Agartala	139.00	21	68.51	NFR	LMG	DHARMANAGAR - AGARTALA	Single Line	-	-	2L	2L+TC
Beas Jn	Goindwal Sahib	27.20	16	26.83	NR	FZP	Beas - Govindwal sahib	Single Line	-	-	-	-
Deoghar	Mohanpur	65.11	10	9.90	ER	ASN	DEOGHAR - DUMKA	Single Line	-	-	-	-
Tarn taran	Goindwal Sahib	21.50	16	21.11	NR	FZP	Govindwal sahib - Tarantaran	Single Line	-	-	-	-
Baramati	Daund jn	44.00	6	42.94	CR	PUNE	Daund Junction - Baramati	Single Line	-	-	2L	-
Rangapara	Dekargaon	25.30	8	18.45	NFR	LMG	CHAPARMUKH - HAIBARGAON.	Single Line	-	-	-	-
Dera Baba Nanak	Verka Jn	45.00	6	44.91	NR	FZP	Verka Jn. - Dera Baba Nanak	Single Line	-	-	-	-
Manihari	Tejnarayanpur	10.00	8	5.93	NFR	KIR	MANIHARI - TEZNARAYANPUR	Single Line	-	-	-	-
Siliguri Jn	Darjeeling	86.00	4	54.97	NFR	KIR	NEW JALPAIGURI - DARJEELING	Single Line	-	-	-	-
Buniadpur	Balurghat	45.00	8	45.30	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-
Miyagam Karjan Jn	Choranda Jn	8.90	0	8.45	WR	BRC	Choranda - Miyagaon Karjan	Single Line	-	-	-	-
Raja Ka Sahaspur Jn	Sambhal Hatim Sarai	23.00	10	23.16	NR	MB	Raja Ka Sahaspur - Sambhal Hatim Sarai	Single Line	-	-	-	-
Chikkamagaluru	Kadur jn	45.00	15	44.66	SWR	MYS	Kadur - Chikmagalur	Single Line	2L	-	-	-
Ranuj Jn	Chanasma	64.56	14	12.87	WR	ADI	Ranuj - Chanasma - Katosan Road	Single Line	-	-	-	-
Prachi Road Jn	Talala Jn	20.27	11	19.92	WR	BVP	Talala - Prachi Road	Single Line	-	-	-	-
Kolar	Srinivaspura	85.13	14	27.31	SWR	SBC	Kolar - Chikballapur	Single Line	-	-	-	-
Srinivaspura	Chikballapur	85.13	14	58.51	SWR	SBC	Kolar - Chikballapur	Single Line	-	-	-	-
Pulgaon Jn	Arvi	34.00	5	34.47	CR	NGP	Pulgaon Junction - ARVI(NG)	Single Line	-	-	-	-
Churu Jn	Sikar Jn	90.46	16	89.12	NWR	JP	SIKAR - CHURU	2nd Line	-	-	-	-
Visavadar jn	Talala Jn	47.98	9	46.37	WR	BVP	Visavadar - Talala	Single Line	-	-	-	-
Jambusar Jn	PratapNagar	51.25	0	52.41	WR	BRC	Jambusar - Pratapnagar	Single Line	-	-	2L	-
Jambusar Jn	Samni Jn	50.13	0	24.29	WR	BRC	Samni - Kavi	Single Line	-	-	2L	-
Murtajapur Jn	Achalpur	76.00	3	78.09	CR	BSL	Murtizapur - Achalpur	Single Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Hazaribagh Town	Koderma Jn	79.60	48	80.36	ECR	DHN	Koderma - Hazaribag Town	Single Line	-	-	-	-
Katakhal Jn	Hailakandi	83.00	12	19.06	NFR	LMG	KATAKHAL - BHAIRABI	Single Line	-	-	-	-
Hosapete Jn	Vyasa Colony	59.00	12	13.33	SWR	UBL	Hosapete - Swamihalli	Single Line	-	-	-	-
Vyasa Colony	Gunda Road	59.00	12	3.76	SWR	UBL	Hosapete - Swamihalli	Single Line	-	-	-	-
Bhawanipatha	Junagarh Road	54.00	12	24.83	ECOR	SBP	Lanjigarh Road - Junagarh	Single Line	-	2L	2L+TC	-
Khukrana Halt	Jind Jn	66.00	12	61.38	NR	DLI	Jind - Khukrana	Single Line	-	-	-	-
Jankampet Jn	Bodhan	20.05	16	20.50	SCR	HYB	Jankampet - Bodhan	Single Line	-	-	-	-
Barapalasi	Dumka Jn	77.20	9	13.92	ER	MLDT	BARAHAT - HANSDIHA - DUMKA	Single Line	-	-	-	2L
New Changrabandha	New Maynaguri	88.00	14	21.77	NFR	APDJ	Y' LEG OF MAYNAGURI ROAD - JALPAIGURI ROAD - NEW DOMOHANI - NEW COOCH BEHAR	Single Line	2L+TC	3L+TC	4L+TC	-
Hansdiha	Bhaturia	77.20	9	12.22	ER	MLDT	BARAHAT - HANSDIHA - DUMKA	Single Line	-	-	-	2L
Benipur Halt	Biraul	30.05	6	15.63	ECR	SPJ	Sakri - Biraul	Single Line	-	-	-	-
Nawanshahr Doaba Jn	Jaijon Doaba	31.00	3	31.00	NR	FZP	Nawanshahar - Doaba - Jaijon Doaba	Single Line	-	-	-	-
Ambliyasan Jn	Vijapur	41.95	0	41.40	WR	ADI	Vijapur - Ambliyasan	Single Line	-	-	-	-
Choranda Jn	Malsar	28.96	0	29.21	WR	BRC	Malasar - Choranda	Single Line	-	-	-	-
Nadikudi Jn	Macherla	35.00	10	34.72	SCR	GNT	Nadikude - Macherla	Single Line	-	-	-	-
Nawanshahr Doaba Jn	Rahon	7.00	3	7.53	NR	FZP	Nawanshahar Doaba - Rohan	Single Line	-	-	-	-
Raipur Jn	Abhanpur Jn	35.10	21	27.71	SECR	R	DALLIRAJHARA - BHANUPRATAPPUR	Single Line	-	-	2L	-
Gopalganj	Masrakh	108.76	22	59.21	NER	BSB	Thawe - Chhapra	Single Line	-	-	-	-
Suratpura Jn	Hanumangarh Jn	174.07	16	173.98	NWR	BKN	HANUMANGARH - SURATPURA	2nd Line	-	-	-	-
Bolagarh	Raj Sunakhala	65.46	18	7.51	ECOR	KUR	Khurda Road - Nayagrah Town	2nd Line	-	-	-	-
Raj Sunakhala	Begunia	65.46	18	9.52	ECOR	KUR	Khurda Road - Nayagrah Town	Single Line	2L	-	-	-
Akbarpur Jn	Tanda	2.80	24	16.13	NR	LKO	Akbarpur - Tanda	2nd Line	-	-	-	-
Naimisarnaya	Sitapur City Jn	60.00	16	33.56	NR	MB	Balamau Jn. - Sitapur City	Single Line	-	-	-	-

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Balamau Jn	Naimisarnaya	60.00	16	24.96	NR	MB	Balamau Jn. - Sitapur City	Single Line	-	-	-	-
Banmankhi Jn	Barhara Kothi	27.36	0	15.64	ECR	SPJ	Banmankhi - Bihariganj	Single Line	-	-	-	-
Thawe Jn	Gopalganj	108.76	22	4.91	NER	BSB	Thawe - Chhapra	Single Line	-	-	-	-
Hailakandi	Bhairabi	83.00	12	65.55	NFR	LMG	KATAKHAL - BHAIRABI	Single Line	-	-	-	-
Samni Jn	Bharuch Jn	61.50	16	22.56	WR	BRC	Bharuch - Dahej	Single Line	-	-	-	2L
Gunda Road	Yeshwantnagar	59.00	12	21.69	SWR	UBL	Hosapete - Swamihalli	Single Line	-	-	-	-
Duvada	Simhachalam North Jn	2.60	31	8.15	ECOR	WAT	Simhachalam North - Duvvada (By - Pass)	2nd Line	2L+TC	-	-	-
Chamuria	Dhamtari	35.10	21	25.59	SECR	R	DALLIRAJHARA - BHANUPRATAPPUR	Single Line	-	-	2L	-
Vijapur	Adraj Moti	39.05	0	40.16	WR	ADI	Adraj Moti - Vijapur	Single Line	-	-	-	-
Nagaon	Amoni	61.00	7	28.16	NFR	LMG	SENCHOA - SILGHAT TOWN	Single Line	-	-	-	-
Amoni	Silghat town	28.00	4	28.93	NFR	LMG	AMONI - SILGHAT	Single Line	-	-	-	-
Shravanabelagola	Hassan Jn	41.35	10	41.22	SWR	MYS	Shravanabelagola - Hassan (RG - 1in100)	Single Line	-	-	-	-
Katosan Road Jn	Chanasma	64.56	14	51.84	WR	ADI	Ranuj - Chanasma - Katosan Road	Single Line	-	-	-	-
Rampurhat Jn	Dumka Jn	64.68	9	64.42	ER	HWH	RAMPURHAT DUMKA	Single Line	-	-	-	-
Bilimora Jn	Waghai	62.54	0	61.71	WR	BCT	Billimora - Waghai	Single Line	-	-	-	-
Joginder nagar	Baijnath Paprola	83.00	13	17.83	NR	FZP	Baijnath Paprola - Joginder Nagar	Single Line	-	-	-	-
Bochasan Jn	Vasad Jn	42.48	13	25.73	WR	BRC	Vasad - Kathana	Single Line	-	-	-	-
Omalur	Mettur Dam	28.93	15	28.06	SR	SA	Omalur - Mettur Dam	2nd Line	-	-	-	-
Chhattarpur	Tikamgarh	168.00	12	83.70	NCR	JHS	LAR - Khajuraho	Single Line	2L	-	-	-
Barajamda jn	Gua	8.30	25	7.52	SER	CKP	BARAJAMDA - GUA	Single Line	-	-	-	-
Aunlajori Jn	Tatanagar Jn	89.30	11	54.14	SER	CKP	TATA - BADAMPAHAR	Single Line	-	-	-	-
Badampahar	Aunlajori Jn	89.30	11	33.81	SER	CKP	TATA - BADAMPAHAR	Single Line	-	-	-	-
Dabhoi Jn	Chandod	17.07	0	16.87	WR	BRC	Dabhoi - Chandod	Single Line	-	-	-	-
Masrakh	Chhapra Kacheri jn	108.76	22	40.17	NER	BSB	Thawe - Chhapra	Single Line	-	-	-	-
Digha Ghat	Patna Jn	9.00	11	7.25	ECR	DNR	Patna - Digha Ghat	Single Line	-	-	2L	-
Patna Saheb	Patna Ghat	1.00	12	5.15	ECR	DNR	Patna Saheb - Patna Ghat	Single Line	-	-	-	-
Harmurti Jn	Naharlagun	61.00	7	20.16	NFR	LMG	SENCHOA - SILGHAT TOWN	Single Line	-	-	-	-
Humnabad	Khanapur Jn	37.00	12	37.53	SCR	SC	Khanapur - Homnabad	Single Line	-	-	2L	-
Banka	Karjhusa	64.76	10	16.13	ER	ASN	DEOGHAR - BANKA	Single Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Katuria	Deoghar	64.76	10	29.35	ER	ASN	DEOGHAR - BANKA	Single Line	-	-	-	-
Bochasan Jn	Kathana	42.48	13	16.40	WR	BRC	Vasad - Kathana	Single Line	-	-	-	-
Karimganj Jn	Maishashan	10.00	5	10.45	NFR	LMG	KARIMGANJ - MAISHASHAN	Single Line	-	-	-	-
Gandhinagar Capital	Kalol Jn	0.00	24	19.91	WR	ADI	Gandhinagar - Kalol	Single Line	-	-	-	-
Prachi Road Jn	Delvada	50.31	6	49.72	WR	BVP	Prachi Road - Delvada	Single Line	-	-	-	-
Modasa	Nadiad Jn	104.84	0	104.47	WR	BRC	Nadiad - Modasa	Single Line	-	-	-	-
Kanjari Boriyavi Jn	Vadtal Swaminarayan	6.40	0	5.72	WR	BRC	Kanjari Boriyavi - V's'narayan	Single Line	-	-	-	-
Choranda Jn	Moti Koral	18.45	0	18.05	WR	BRC	Choranda - Moti Koral	Single Line	-	-	-	-
Jambusar Jn	Kavi	50.13	0	26.41	WR	BRC	Samni - Kavi	Single Line	-	-	2L	-
Damodar Jn	Radhanagar	7.00	16	8.28	SER	Adra	DAMODAR - RADHANAGAR	Single Line	-	-	-	-
Pipar Road Jn	Bilara	41.14	6	41.55	NWR	JU	PIPAR ROAD - BILARA	Single Line	-	-	-	-
Amguri Jn	Tuli	14.60	7	22.05	NFR	TSK	AMGURI - TULI	2nd Line	-	-	-	-
Ranital Jn Cabin	Bhatatira	9.00	48	8.96	ECOR	KUR	Ranital Link Cabin - Bhatatira	2nd Line	-	-	-	-
Ammuguda Halt	Sanathnagar	22.00	38	12.29	SCR	SC	Sanatnagar - Moulaali Byepass	Single Line	-	-	-	-
Dudhnol Jn	Mendipathar	19.00	16	20.35	NFR	RNY	DUDHNOI - MENDIPATHAR	Single Line	-	-	-	-
Sahebpur Kamal Jn	Sabdalpur	5.40	36	4.71	ECR	SEE	Sahibpur Kamal - Sabdalpur	Single Line	-	-	2L	-
Nadiad Jn	Petlad Jn	37.24	0	35.64	WR	BRC	Nadiad - Petlad	Single Line	-	-	-	-
Barmer	Munabao	118.83	9	118.40	NWR	JU	BARMER - MUNABAO	2nd Line	-	-	-	-
Mavli Jn	Bari Sadri	82.01	0	81.62	NWR	AII	MAVLI - BARI SADRI	Single Line	-	-	-	-
Rupai	Dangari	30.77	4	13.20	NFR	TSK	MAKUM - DANGARI	Single Line	-	-	-	-
Jhagadiya Jn	Rajpipla	62.84	0	41.99	WR	BRC	Ankaleshwar - Rajpipala	Single Line	-	-	-	-
Ankleshwar Jn	Jhagadiya Jn	62.84	0	20.85	WR	BRC	Ankaleshwar - Rajpipala	Single Line	-	-	-	-
Mettupalaiyam Jn	Coonoor	27.05	4	18.34	SR	SA	Mettupalayam - Coonoor	Single Line	-	-	-	-
Arunachal Jn	Jiribam	49.00	3	50.89	NFR	LMG	ARUNACHAL - JIRIBAM	Single Line	-	-	-	-
Baraigram Jn	Dullacherra	29.00	3	29.60	NFR	LMG	BARAIGRAM - DULLAVCHERA	Single Line	-	-	-	-
Senchoa Jn	mairabari	45.00	3	51.77	NFR	LMG	HAIBARGAON - MAIRABARI	Single Line	-	-	-	-
Samni Jn	Dahej	61.50	16	39.70	WR	BRC	Bharuch - Dahej	Single Line	-	-	-	2L

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
New Domohani	New Changrabandha	62.00	5	24.11	NFR	APDJ	NEW MAL JN - CHANGRABANDHA	Single Line	-	-	2L	-
Balipara Jn	Bhalukpong	45.00	3	35.62	NFR	LMG	HAIBARGAON - MAIRABARI	Single Line	-	-	-	-
Chikkabenekal	Ginigera	26.00	9	68.72	SWR	UBL	Ginigera - Chikkabenekal	Single Line	-	-	-	-
Batala Jn	Qadian	19.00	16	19.36	NR	FZP	Batala Jn. - Qadian	Single Line	-	-	-	-
Pushkar Terminus	Madar	25.00	10	24.87	NWR	AII	MADAR - PUSHKAR	2nd Line	-	-	-	-
Kharaghoda	Jhund Jn	0.00	0	22.87	WR	ADI	Jhund - Kharaghoda	Single Line	-	-	-	-
Bhilai	Ahiwara Mines	19.39	11	19.06	SECR	R	BHILAI - AHIWARA	Single Line	-	-	-	-
Ammuguda Halt	Moula Ali Cord Line Station Bypass	22.00	38	5.08	SCR	SC	Sanatnagar - Moulaali Byepass	Single Line	-	-	-	-
Sanka	Joychandipahar	6.80	18	6.93	SER	Adra	JOYCHANDIPAHAR - SANKA	2nd Line	-	-	-	-
Kakinada Town	Kottapalli	47.00	12	45.04	SCR	BZA	Kakinada - Kotipalli	Single Line	-	-	-	-
Bochasan Jn	Bhadran	22.50	0	7.95	WR	BRC	Petlad - Bhadran	Single Line	-	-	-	-
Kosamba Jn	Umarpada	61.96	0	60.11	WR	BRC	Kosamba - Umarpada	Single Line	-	-	-	-
Bhimgara Jn	Palasthali	26.87	0	27.62	ER	ASN	BHIMGARH - PALASTHALI	Single Line	-	-	-	-
Talgoria Jn	Bokaro Steel City Jn	33.00	14	37.60	SER	Adra	BOKARO STEEL CITY - TALGORIA	2nd Line	-	-	-	-
Vadlapudi	Gate Jn Cabin	4.70	72	7.62	ECOR	WAT	Gate Jnc. Cabin - Vadlapudi	3rd Line	-	-	-	-
Simhachalam North Jn	WMY OEC	10.00	58	8.83	ECOR	WAT	Simhachalam North - WMY/OEC	3rd Line	-	-	-	-
Jaggayapalem	Vadlapudi	2.10	72	7.73	ECOR	WAT	Vadlapudi - Jaggayyapalem	3rd Line	-	-	-	-
Gate Jn Cabin	Visakhapatnam Steel Plant Sdg	3.10	48	4.00	ECOR	WAT	VSPS - Gate Jnc. Cabin	3rd Line	-	-	-	-
Kommarapudi	Krishnapatnam Port	19.00	32	28.78	SCR	BZA	Kommarapudi - Krishnapatnam Port	2nd Line	-	-	-	-
Gopalapatnam	WMY OEC	4.35	50	6.10	ECOR	WAT	Gopalpatnam - WMY	2nd Line	-	-	-	-
Duvada	Jaggayapalem	6.00	29	8.07	ECOR	WAT	Jaggayyapalem - Duvvada	2nd Line	-	-	-	-
Bhatatira	Dhamra	50.00	22	53.18	ECOR	KUR	Bhatatira - Dhamara Terminal	Single Line	-	-	-	-
Manikgarh Jn	Gadchandur	28.00	24	28.47	SCR	SC	Manickgarh - Gadchandur	Single Line	-	-	-	-

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Bimalgarh Jn	Kiriburu	36.20	14	38.71	SER	CKP	BIMLAGARH - KIRIBURU	2nd Line	-	-	-	-
Duvada	Vadlapudi	5.00	29	2.85	ECOR	WAT	Duvvada - Vadlapudi	Single Line	-	-	-	-
Duvada	NTPC Simhadri TPS	16.30	21	22.63	ECOR	WAT	Duvvada - NTPC	Single Line	-	-	-	-
Motumari Jn	Jaggayyapeta	26.00	25	25.94	SCR	SC	Motumari - Jaggayyapet	Single Line	-	-	-	-
Rajula City	Pipavav Port	16.43	22	19.21	WR	BVP	Rajula City - Pipavav	Single Line	-	-	-	-
Pen	Rashtriya Chemicals & Fertilizers, Thal Vaishet	26.00	10	28.90	CR	CSTM	PEN - THAL	Single Line	-	-	-	-
Barabil	Bolanikhadan	6.10	16	6.44	SER	CKP	BARABIL - BOLANIKHADAN	2nd Line	-	-	-	-
Kanalus Jn	Sikka	14.69	22	15.02	WR	RJT	Kanalus - Sikka	Single Line	-	-	-	-
Ranjithpura	Torangallu Jn	23.00	15	21.90	SWR	UBL	Toranagallu - Ranjitpura	2nd Line	-	-	-	-
Jaggayyapeta	Mellacheruvu	19.00	25	23.96	SCR	SC	Jaggayapet - Mattampalli	Single Line	-	-	-	-
Karepalli Jn	Singareni Collieries	10.00	12	10.30	SCR	SC	Karepalli - Singareni	2nd Line	-	-	-	-
Firozpur City Jn	Fazilka jn	43.70	6	84.57	NR	FZP	Patti - Khemkaran	Single Line	-	-	-	-
Jasai	Uran City	12.00	12	10.69	CR	CSTM	Jasai Chirle - Uran City	2nd Line	-	-	-	-
Chalthan	Bhestan	5.62	16	13.67	WR	BCT	Bhestan - Chalthan(Bypass)	2nd Line	-	-	-	-
Villivakkam	Annanagar West	3.09	14	4.28	SR	MAS	Villivakkam - Annanagar	Single Line	-	-	-	-
Ledo	Tirap sdg	9.00	5	3.47	NFR	TSK	LEDO - TIRAP	Single Line	-	-	-	-
Ramkanali Jn	Chourashi	7.00	17	6.95	SER	Adra	RAMKANALI - CHOWRASHI	Single Line	-	-	-	-
Ernakulam Jn	Cochin Harbour Terminus	7.75	21	8.02	SR	TVC	Ernakulam Jn. - Kochi Harbour Terminus	Single Line	-	-	-	-
Dahinsara Jn	Navlakhi	17.55	20	18.33	WR	RJT	Dahinsara - Navlakhi	Single Line	-	-	-	-
Jamnagar Jn	Windmill	10.55	9	1.79	WR	RJT	Jamnagar - Windmill	Single Line	-	-	-	-
Laukaha Bazar	Jhanjharpur Jn	43.00	0	43.63	ECR	SPJ	Laukaha Bazar - Jhanjharpur	2nd Line	-	-	-	-
Barhara Kothi	Bihariganj	27.36	0	12.00	ECR	SPJ	Banmankhi - Bihariganj	Single Line	-	-	-	-
Naliya	Bhuj	95.50	0	99.62	WR	ADI	New Bhuj - Naliya	Single Line	-	-	-	-
Mahesana Jn	Taranga Hill	56.35	0	56.54	WR	ADI	Mehsana - Taranga Hill	Single Line	-	-	-	-
Himmatnagar Jn	Khed Brahma	54.83	0	54.79	WR	ADI	Himmatnagar - Khedbramha	Single Line	-	-	-	-
Kodinar	Prachi Road Jn	25.48	7	25.36	WR	BVP	Prachi Road - Kodinar	Single Line	-	-	-	-
Petlad Jn	Bochasan Jn	22.50	0	13.17	WR	BRC	Petlad - Bhadran	Single Line	-	-	-	-
Chhuchhapura Jn	Tankhala	38.00	0	36.90	WR	BRC	Chhuchhapura - Tankhala	Single Line	-	-	-	-

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Rajendra pul	Dinkar Gram Simaria	0.00	0	3.41	0	0	Rajendra pul - Dinkar Gram Simaria	2nd Line	-	-	2L+TC	4L+TC
Sarla Jn	Sambalpur City Jn	0.00	0	3.88	0	0	Sarla Jn - Sambalpur City Jn	2nd Line	-	-	2L+TC	-
Siliguri Town	Sivok	0.00	0	20.40	0	0	Siliguri Town - Sivok	Single Line	-	-	2L	-
Doraha	Rupnagar	0.00	0	54.30	0	0	Doraha - Rupnagar	Single Line	2L	-	-	2L+TC
Aishbagh Jn	Lucknow	0.00	0	1.87	0	0	Aishbagh Jn - Lucknow	2nd Line	-	-	-	2L+TC
Dehri on Sone Jn	Bidiha Shankarpuri	0.00	0	6.53	0	0	Dehri on Sone Jn - Bidiha Shankarpuri	Single Line	-	-	2L+TC	3L+TC
Tiruvallur	Temple	0.00	0	3.92	0	0	Tiruvallur - Temple	Single Line	-	-	2L	-
Manaknagar	Aishbagh Jn	0.00	0	3.52	0	0	Manaknagar - Aishbagh Jn	Single Line	-	-	-	2L+TC
Bareilly Jn	Bareilly City	0.00	0	3.02	0	0	Bareilly Jn - Bareilly City	Single Line	-	-	2L	-
Koderma Jn	Tilaiya Jn	0.00	0	47.51	0	0	Koderma Jn - Tilaiya Jn	2nd Line	-	-	-	2L+TC
Puddukkottai	Tiruchchirappalli Jn	0.00	0	53.32	0	0	Puddukkottai - Tiruchchirappalli Jn	Single Line	-	-	2L	-
Karaikkudi	Puddukkottai	0.00	0	36.62	0	0	Karaikkudi - Puddukkottai	Single Line	-	-	2L	-
Vriddhachalam Jn	Cuddalore Port Jn	0.00	0	57.59	0	0	Vriddhachalam Jn - Cuddalore Port Jn	Single Line	-	-	-	-
Khakhrechi	Morbi Jn	0.00	0	28.93	0	0	Khakhrechi - Morbi Jn	Single Line	-	-	2L	2L+TC
Ankola	Karwar	0.00	0	28.13	0	0	Ankola - Karwar	Single Line	-	-	2L	-
Ankola	Udupi	0.00	0	161.69	0	0	Ankola - Udupi	Single Line	-	2L	-	-
Udupi	Thokur	0.00	0	45.10	0	0	Udupi - Thokur	Single Line	-	2L	-	-
Salem Jn	Salem Market	0.00	0	3.43	0	0	Salem Jn - Salem Market	Single Line	-	-	2L	-
Mathura Jn	Vrindavan	0.00	0	10.62	0	0	Mathura Jn - Vrindavan	Single Line	-	-	-	2L
Purnea Court	Purnea Jn	0.00	0	5.38	0	0	Purnea Court - Purnea Jn	Single Line	-	-	-	2L
Nainpur Jn	Balaghat Jn	0.00	0	73.85	0	0	Nainpur Jn - Balaghat Jn	Single Line	-	-	2L	-
Juhi cabin	Rawatpur	0.00	0	5.15	0	0	Juhi cabin - Rawatpur	Single Line	-	-	-	2L
Jabalpur Jn	Nainpur Jn	0.00	0	108.22	0	0	Jabalpur Jn - Nainpur Jn	Single Line	-	-	2L	2L+TC
Nirmali	Sapaul	0.00	0	37.20	0	0	Nirmali - Sapaul	Single Line	-	-	2L	-
Telapur	Patancheru	0.00	0	8.60	0	0	Telapur - Patancheru	Single Line	-	-	2L+TC	-
Vadodara C	Vadodara E	0.00	0	0.81	0	0	Vadodara C - Vadodara E	2nd Line	-	-	-	-
Dum Dum Jn	Ballygunge Jn	0.00	0	12.97	t	t	Dum Dum Jn - Ballygunge Jn	4th Line	-	-	-	-
Aishbagh Jn	Daliganj Jn	0.00	0	4.98	0	0	Aishbagh Jn - Daliganj Jn	Single Line	-	-	-	-
Dhanbad Jn	Pathardih	0.00	0	15.49	0	0	Dhanbad Jn - Pathardih	Single Line	-	-	-	2L

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Karur	Tiruchchirappalli Jn	0.00	0	76.79	0	0	Karur - Tiruchchirappalli Jn	2nd Line	-	-	-	-
Radhakishorpur Jn	Rajathgarh Jn	0.00	0	2.79	0	0	Radhakishorpur Jn - Rajathgarh Jn	2nd Line	-	-	-	2L+TC
Hotgi Jn	Vijayapura	0.00	0	93.87	0	0	Hotgi Jn - Vijayapura	2nd Line	-	-	-	-
Kiccha	Bhojipura Jn	0.00	0	48.71	0	0	Kiccha - Bhojipura Jn	Single Line	-	-	-	-
H Nizamuddin Jn	Anand Vihar Terminal	0.00	0	10.45	0	0	H Nizamuddin Jn - Anand Vihar Terminal	2nd Line	-	-	-	-
Barharwa Jn	Gumani	0.00	0	7.52	0	0	Barharwa Jn - Gumani	2nd Line	-	-	-	-
Bhavnagar Terminus	Mahuva	0.00	0	105.68	0	0	Bhavnagar Terminus - Mahuva	Single Line	-	-	-	-
Sitapur Jn	Daliganj Jn	0.00	0	79.95	0	0	Sitapur Jn - Daliganj Jn	Single Line	-	-	-	-
Tarakeshwar	Berugram Ph	0.00	0	28.99	0	0	Tarakeshwar - Berugram Ph	Single Line	-	-	-	-
Berugram Ph	Masagram	0.00	0	5.95	0	0	Berugram Ph - Masagram	Single Line	-	-	-	-
Morinda	New Morinda Jn	0.00	0	2.81	0	0	Morinda - New Morinda Jn	Single Line	-	-	-	-
Daliganj Jn	Malhaur	0.00	0	12.15	0	0	Daliganj Jn - Malhaur	2nd Line	-	-	-	-
Urkura	Mandir Hasaud	0.00	0	16.86	0	0	Urkura - Mandir Hasaud	2nd Line	-	-	-	-
Narkatiaganj Jn	Bhikna Thori	0.00	0	36.16	0	0	Narkatiaganj Jn - Bhikna Thori	Single Line	-	-	-	-
Ponmalai	Thanjavur	0.00	0	47.34	0	0	Ponmalai - Thanjavur	2nd Line	-	-	-	-
Narpalganj	Forbesganj Jn	0.00	0	16.55	0	0	Narpalganj - Forbesganj Jn	2nd Line	-	-	-	2L+TC
Dohrighat	Indara Jn	0.00	0	35.28	0	0	Dohrighat - Indara Jn	Single Line	-	-	-	-
Parasia	Khirsadoh	0.00	0	2.11	0	0	Parasia - Khirsadoh	Single Line	-	-	-	-
Salem Market	Chinna Salem	0.00	0	83.68	0	0	Salem Market - Chinna Salem	Single Line	-	-	-	-
Chinna Salem	Vriddhachalam Jn	0.00	0	50.14	0	0	Chinna Salem - Vriddhachalam Jn	Single Line	-	-	-	-
Faizabad Jn	Masodha	0.00	0	7.55	0	0	Faizabad Jn - Masodha	Single Line	-	-	-	-
Una Himachal	Amb Andaura	0.00	0	27.30	0	0	Una Himachal - Amb Andaura	Single Line	-	-	-	2L
Narkatiaganj Jn	Raxaul Jn	0.00	0	41.06	0	0	Narkatiaganj Jn - Raxaul Jn	2nd Line	-	-	-	-
Shalimar	Howrah	0.00	0	10.75	0	0	Shalimar - Howrah	2nd Line	-	-	-	-
Bahraich	Gonda Jn	0.00	0	60.77	0	0	Bahraich - Gonda Jn	Single Line	-	-	-	-
Amla Jn	Parasia	0.00	0	86.55	0	0	Amla Jn - Parasia	2nd Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Mughal Sarai Jn	New Mughal Sarai Jn	0.00	0	132.85	0	0	Mughal Sarai Jn - New Mughal Sarai Jn	2nd Line	-	-	-	-
Jind Jn	Pandu Pindara	0.00	0	8.84	0	0	Jind Jn - Pandu Pindara	Single Line	-	-	-	-
Ramganj Mandi jn	Jhalawar city	0.00	0	25.38	0	0	Ramganj Mandi jn - Jhalawar city	Single Line	-	-	-	2L
Pilibhit Jn	Mailani Jn	0.00	0	68.79	0	0	Pilibhit Jn - Mailani Jn	Single Line	-	-	-	-
Dharmapuri	Morappur	0.00	0	27.73	0	0	Dharmapuri - Morappur	2nd Line	-	-	-	-
Patiala	Sunam	0.00	0	65.60	0	0	Patiala - Sunam	Single Line	-	-	-	-
Gwalior jn	Golaka Mandir	0.00	0	3.18	0	0	Gwalior jn - Golaka Mandir	Single Line	-	-	-	-
Golaka Mandir	Morar Cantt	0.00	0	2.76	0	0	Golaka Mandir - Morar Cantt	Single Line	-	-	-	-
Mailani Jn	Dudwa	0.00	0	44.10	0	0	Mailani Jn - Dudwa	Single Line	-	-	-	-
Dudwa	Tikunia	0.00	0	33.92	0	0	Dudwa - Tikunia	Single Line	-	-	-	-
Tikunia	Nanpara Jn	0.00	0	92.76	0	0	Tikunia - Nanpara Jn	Single Line	-	-	-	-
Palsi	Koregaon	0.00	0	17.03	0	0	Palsi - Koregaon	Single Line	-	-	2L	-
Lakhimpur	Sitapur Jn	0.00	0	46.43	0	0	Lakhimpur - Sitapur Jn	Single Line	-	-	-	-
Bilaspur	Pilibhit Jn	0.00	0	37.87	0	0	Bilaspur - Pilibhit Jn	Single Line	-	-	-	-
Davangere	Shivamogga Town	0.00	0	77.33	0	0	Davangere - Shivamogga Town	2nd Line	-	-	-	-
Nanpara Jn	Bahraich	0.00	0	33.87	0	0	Nanpara Jn - Bahraich	Single Line	-	-	-	-
Mailani Jn	Gola Gokaranath	0.00	0	26.72	0	0	Mailani Jn - Gola Gokaranath	Single Line	-	-	-	-
Thanjavur	Vadavar	0.00	0	5.11	0	0	Thanjavur - Vadavar	Single Line	-	-	-	-
Vadavar	Kumbakonam	0.00	0	33.75	0	0	Vadavar - Kumbakonam	Single Line	-	-	-	-
Fatehabad	Hisar Jn	0.00	0	50.34	0	0	Fatehabad - Hisar Jn	2nd Line	-	-	-	-
Kumbakonam	Mayiladuturai	0.00	0	31.52	0	0	Kumbakonam - Mayiladuturai	Single Line	-	-	-	-
Mayiladuturai	Cuddalore Port Jn	0.00	0	76.16	0	0	Mayiladuturai - Cuddalore Port Jn	Single Line	-	-	-	2L
Junagadh Jn	Saradiya	0.00	0	52.10	0	0	Junagadh Jn - Saradiya	Single Line	-	-	-	-
Khirsadoh	Chhindwara Jn	0.00	0	25.49	0	0	Khirsadoh - Chhindwara Jn	Single Line	-	-	-	-
Ait Jn	Konch	0.00	0	13.47	0	0	Ait Jn - Konch	Single Line	-	-	-	-
Pangri	Yedshi	0.00	0	12.04	0	0	Pangri - Yedshi	Single Line	-	-	-	-
Ranippettai	Walajah Road	0.00	0	8.25	0	0	Ranippettai - Walajah Road	Single Line	-	-	-	-
Thiruvarur	Peralam Jn	0.00	0	22.13	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Nidamangalam Jn	Thiruvarur	0.00	0	24.33	0	0	Nidamangalam Jn - Thiruvarur	Single Line	-	-	-	-
Thanjavur	Nidamangalam Jn	0.00	0	30.24	0	0	Thanjavur - Nidamangalam Jn	Single Line	-	-	-	-
Ujjain Jn	Agar	0.00	0	65.82	0	0	Ujjain Jn - Agar	Single Line	-	-	-	-
Parli Vaijnath	Latur Road Jn	0.00	0	62.69	0	0	Parli Vaijnath - Latur Road Jn	Single Line	-	-	2L	-
Radhanagar	Kulti	0.00	0	7.33	0	0	Radhanagar - Kulti	Single Line	-	-	-	-
Abhanpur Jn	Chamuria	0.00	0	19.46	0	0	Abhanpur Jn - Chamuria	Single Line	-	-	2L	-
Chanasma	Harij	0.00	0	21.03	0	0	Chanasma - Harij	Single Line	-	-	-	-
Khapri Kheda	Chhindwara Jn	0.00	0	132.96	0	0	Khapri Kheda - Chhindwara Jn	Single Line	-	-	-	-
Kalamna	Khapri Kheda	0.00	0	12.47	0	0	Kalamna - Khapri Kheda	Single Line	-	-	-	-
Gola Gokaranath	Lakhimpur	0.00	0	34.00	0	0	Gola Gokaranath - Lakhimpur	Single Line	-	-	-	-
Jaipur Jn	Ringas Jn	0.00	0	56.21	0	0	Jaipur Jn - Ringas Jn	Single Line	-	-	-	-
Tsunduru	Vejandla	0.00	0	11.42	0	0	Tsunduru - Vejandla	Single Line	-	-	-	2L
Shahjahanpur Jn	Bilaspur	0.00	0	47.23	0	0	Shahjahanpur Jn - Bilaspur	Single Line	-	-	-	-
Shivpuri	Ghosipura	0.00	0	113.43	0	0	Shivpuri - Ghosipura	Single Line	-	-	-	-
Pandu Pindara	Khukrana Halt	0.00	0	54.44	0	0	Pandu Pindara - Khukrana Halt	Single Line	-	-	-	-
Ghosipura	Gwalior jn	0.00	0	3.27	0	0	Ghosipura - Gwalior jn	Single Line	-	-	-	-
Shahjahanpur Jn	Mailani Jn	0.00	0	63.65	0	0	Shahjahanpur Jn - Mailani Jn	Single Line	-	-	-	-
Fatehabad	Bhattu	0.00	0	19.24	0	0	Fatehabad - Bhattu	Single Line	-	-	-	-
Madhoganj	Auhadpur	0.00	0	27.50	0	0	Madhoganj - Auhadpur	Single Line	-	-	-	-
Talwara	Mukerian	0.00	0	26.75	0	0	Talwara - Mukerian	Single Line	-	-	-	2L
Tribeni	Magra	0.00	0	3.26	0	0	Tribeni - Magra	Single Line	-	-	-	-
Malout	Bathinda Jn	0.00	0	43.79	0	0	Malout - Bathinda Jn	Single Line	-	-	-	-
Alamnagar	Aishbagh Jn	0.00	0	4.71	0	0	Alamnagar - Aishbagh Jn	2nd Line	-	-	-	-
Sivakasi	TN Cement Corpn Alangulam	0.00	0	15.93	0	0	Sivakasi - TN Cement Corpn Alangulam	Single Line	-	-	-	-
Barabani	Ikra Jn	0.00	0	11.92	0	0	Barabani - Ikra Jn	2nd Line	-	-	-	-
Ikra Jn	Tapasi	0.00	0	3.81	0	0	Ikra Jn - Tapasi	2nd Line	-	-	-	-
Chhindwara Jn	Seoni	0.00	0	64.24	0	0	Chhindwara Jn - Seoni	Single Line	-	-	-	-
Yerraguntala Jn	Banganapalle	0.00	0	93.07	0	0	Yerraguntala Jn - Banganapalle	Single Line	-	-	-	2L

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Nainpur Jn	Mandla Fort	0.00	0	42.61	0	0	Nainpur Jn - Mandla Fort	Single Line	-	-	-	2L
Garhi Harsaru Jn	Farukhnagar	0.00	0	11.63	0	0	Garhi Harsaru Jn - Farukhnagar	Single Line	-	-	-	-
Tanakpur	Khatima	0.00	0	23.89	0	0	Tanakpur - Khatima	Single Line	-	-	-	2L
Khatima	Pilibhit Jn	0.00	0	39.25	0	0	Khatima - Pilibhit Jn	Single Line	-	-	-	2L
Seoni	Nainpur Jn	0.00	0	74.82	0	0	Seoni - Nainpur Jn	Single Line	-	-	-	-
Bihar Sharif	Sheikhpura	0.00	0	39.55	0	0	Bihar Sharif - Sheikhpura	2nd Line	-	-	-	-
Adraj Moti	Kalol Jn	0.00	0	7.26	0	0	Adraj Moti - Kalol Jn	2nd Line	-	-	-	-
Mannargudi	Nidamangalam Jn	0.00	0	13.76	0	0	Mannargudi - Nidamangalam Jn	Single Line	-	-	-	-
Simaluguri Jn	Naginimora	0.00	0	15.23	0	0	Simaluguri Jn - Naginimora	Single Line	-	-	-	-
Gandhinagar Capital	Adraj Moti	0.00	0	13.26	0	0	Gandhinagar Capital - Adraj Moti	2nd Line	-	-	-	-
Peralam Jn	Mayiladuturai	0.00	0	16.29	0	0	Peralam Jn - Mayiladuturai	Single Line	-	-	-	-
Sivok	Gieliekhola	0.00	0	20.81	0	0	Sivok - Gieliekhola	Single Line	-	-	-	-
Motijheel	Banmourgaon	0.00	0	11.07	0	0	Motijheel - Banmourgaon	Single Line	-	-	-	-
Motijheel	Ghosipura	0.00	0	4.41	0	0	Motijheel - Ghosipura	Single Line	-	-	-	-
Kathgodam	Nandhaur	0.00	0	41.96	0	0	Kathgodam - Nandhaur	Single Line	-	-	-	-
Madurai Jn	Teni	0.00	0	73.92	0	0	Madurai Jn - Teni	Single Line	-	-	-	-
Teni	Bodinayakannur	0.00	0	15.01	0	0	Teni - Bodinayakannur	Single Line	-	-	-	-
Fazilka jn	Chananwala	0.00	0	11.25	0	0	Fazilka jn - Chananwala	Single Line	-	-	-	-
Bowaichandi PH	Berugram Ph	0.00	0	35.57	0	0	Bowaichandi PH - Berugram Ph	Single Line	-	-	-	-
Bowaichandi PH	Bankura Jn	0.00	0	79.89	0	0	Bowaichandi PH - Bankura Jn	Single Line	-	-	-	-
Karai-Kovilpathu	Karaikal	0.00	0	1.45	0	0	Karai-Kovilpathu - Karaikal	Single Line	-	-	-	-
Kashipur Jn	Kathgarh Left Bank	0.00	0	45.08	0	0	Kashipur Jn - Kathgarh Left Bank	Single Line	-	-	-	-
Hathuwa	Bathua Pazar	0.00	0	20.47	0	0	Hathuwa - Bathua Pazar	Single Line	-	-	-	-
Duraundha Jn	Maharajganj	0.00	0	6.15	0	0	Duraundha Jn - Maharajganj	Single Line	-	-	-	-
Banjari	Tiura Pipardih	0.00	0	27.55	0	0	Banjari - Tiura Pipardih	Single Line	-	-	-	-
Dekargaon	Tezpur	0.00	0	7.11	0	0	Dekargaon - Tezpur	Single Line	-	-	-	-
Sondalia	Dum Dum Jn	0.00	0	24.86	0	0	Sondalia - Dum Dum Jn	Single Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Tarakeshwar	Magra	0.00	0	50.10	0	0	Tarakeshwar - Magra	2nd Line	-	-	-	-
Bishnupur Jn	Maynapur	0.00	0	21.78	0	0	Bishnupur Jn - Maynapur	2nd Line	-	-	-	-
Kanthi	Egra	0.00	0	25.37	0	0	Kanthi - Egra	2nd Line	-	-	-	-
Malkera Jn	Bhaga Jn	0.00	0	14.22	0	0	Malkera Jn - Bhaga Jn	2nd Line	-	-	-	-
Bhojudin Jn	Bhaga Jn	0.00	0	11.39	0	0	Bhojudin Jn - Bhaga Jn	2nd Line	-	-	-	-
Mahuda Jn	Malkera Jn	0.00	0	5.08	0	0	Mahuda Jn - Malkera Jn	2nd Line	-	-	-	-
Aunlajori Jn	Grumahisani	0.00	0	9.02	0	0	Aunlajori Jn - Grumahisani	Single Line	-	-	-	-
Bangriposi	Talbandh	0.00	0	31.24	0	0	Bangriposi - Talbandh	Single Line	-	-	-	-
Chamuria	Likhma	0.00	0	89.53	0	0	Chamuria - Likhma	Single Line	-	-	-	-
Banmourgaon	Sheopur Kalan	0.00	0	185.04	0	0	Banmourgaon - Sheopur Kalan	Single Line	-	-	-	-
Gwalior jn	Motijheel	0.00	0	6.90	0	0	Gwalior jn - Motijheel	Single Line	-	-	-	-
Parasia	Digha Wani	0.00	0	6.56	0	0	Parasia - Digha Wani	Single Line	-	-	-	-
Digha Wani	Khirsadoh	0.00	0	6.50	0	0	Digha Wani - Khirsadoh	Single Line	-	-	-	-
Warsamedi	Gandhidham JN	0.00	0	10.30	0	0	Warsamedi - Gandhidham JN	Single Line	-	-	-	-
Ajnar	Warsamedi	0.00	0	6.04	0	0	Ajnar - Warsamedi	Single Line	-	-	-	-
Warsamedi	Bhimasar	0.00	0	10.27	0	0	Warsamedi - Bhimasar	Single Line	-	-	-	-
Patan	Kakoshi Metrana Road	0.00	0	39.31	0	0	Patan - Kakoshi Metrana Road	Single Line	-	-	-	-
Surendranagar Jn	Sayla	0.00	0	29.78	0	0	Surendranagar Jn - Sayla	Single Line	-	-	-	-
Than	Chotila	0.00	0	21.04	0	0	Than - Chotila	Single Line	-	-	-	-
Botad Jn	Jasdan	0.00	0	51.27	0	0	Botad Jn - Jasdan	Single Line	-	-	-	-
Khakhrechi	Ghantila	0.00	0	16.12	0	0	Khakhrechi - Ghantila	Single Line	-	-	-	-
Sanala	Tankara	0.00	0	15.86	0	0	Sanala - Tankara	Single Line	-	-	-	-
Sanala	Amran Road	0.00	0	20.98	0	0	Sanala - Amran Road	Single Line	-	-	-	-
Morbi Jn	Sanala	0.00	0	5.76	0	0	Morbi Jn - Sanala	Single Line	-	-	-	-
Kunkavav	Derdi	0.00	0	11.82	0	0	Kunkavav - Derdi	Single Line	-	-	-	-
Hadmatiya	Jodiya Bandar	0.00	0	44.65	0	0	Hadmatiya - Jodiya Bandar	Single Line	-	-	-	-
Kunkavav	Bagasra	0.00	0	19.07	0	0	Kunkavav - Bagasra	Single Line	-	-	-	-
Ningala	Gadhada Swaminayayan	0.00	0	16.55	0	0	Ningala - Gadhada Swaminayayan	Single Line	-	-	-	-
Timba Road	Samlaya	0.00	0	52.20	0	0	Timba Road - Samlaya	2nd Line	-	-	-	-
Piplod	Devgadh Baria	0.00	0	14.65	0	0	Piplod - Devgadh Baria	Single Line	-	-	-	-
Samlaya	Dabhoi Jn	0.00	0	44.67	0	0	Samlaya - Dabhoi Jn	2nd Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Samlaya	Pani Mines	0.00	0	58.66	0	0	Samlaya - Pani Mines	Single Line	-	-	-	-
Jhagadiya Jn	Netrang	0.00	0	24.95	0	0	Jhagadiya Jn - Netrang	2nd Line	-	-	-	-
Nagpur Jn	Kalamna	0.00	0	6.28	0	0	Nagpur Jn - Kalamna	2nd Line	-	-	-	-
Nagbhir Jn	Itwari Jn	0.00	0	106.12	0	0	Nagbhir Jn - Itwari Jn	Single Line	-	-	-	-
Nasik Road	Nasik	0.00	0	7.11	0	0	Nasik Road - Nasik	Single Line	-	-	-	-
Kasbe Sukene	HAL, Nasik	0.00	0	13.60	0	0	Kasbe Sukene - HAL, Nasik	Single Line	-	-	-	-
Roha	Bhira	0.00	0	35.00	0	0	Roha - Bhira	Single Line	-	-	-	-
Indapur	Dighi Port	0.00	0	35.51	0	0	Indapur - Dighi Port	Single Line	-	-	-	-
Mulshi Dam	Chinchvad	0.00	0	34.27	0	0	Mulshi Dam - Chinchvad	2nd Line	-	-	-	-
Central Ordnance depot	Dehu Road	0.00	0	6.41	0	0	Central Ordnance depot - Dehu Road	Single Line	-	-	-	-
Harangul	Latur Old Terminus	0.00	0	9.99	0	0	Harangul - Latur Old Terminus	Single Line	-	-	-	-
Nandre	Miraj Jn	0.00	0	18.32	0	0	Nandre - Miraj Jn	Single Line	-	-	-	2L
Janpahad	Vishnupuram	0.00	0	11.52	0	0	Janpahad - Vishnupuram	Single Line	-	-	-	-
Naupada Jn	Salt Factory	0.00	0	6.95	0	0	Naupada Jn - Salt Factory	Single Line	-	-	-	-
Bobbili Jn	Salur	0.00	0	16.98	0	0	Bobbili Jn - Salur	Single Line	-	-	-	-
Visakhapatnam Jn	Visakhaptnam Port	0.00	0	3.57	0	0	Visakhapatnam Jn - Visakhaptnam Port	2nd Line	-	-	-	-
Machillpatnam	Machilipatnam Fort	0.00	0	3.60	0	0	Machillpatnam - Machilipatnam Fort	Single Line	-	-	-	-
Guntur Jn	Bandarupalli	0.00	0	11.44	0	0	Guntur Jn - Bandarupalli	Single Line	-	-	-	-
Pondugula	Andhra Cement	0.00	0	3.91	0	0	Pondugula - Andhra Cement	Single Line	-	-	-	-
Banaswadi	Baiyapannahalli ABC	0.00	0	7.73	0	0	Banaswadi - Baiyapannahalli ABC	Single Line	-	-	-	-
Bablad	Mahagaon	0.00	0	26.72	0	0	Bablad - Mahagaon	Single Line	-	-	-	2L
Kadalundi	Beypore	0.00	0	2.60	0	0	Kadalundi - Beypore	Single Line	-	-	-	-
Chalakudi	Parambikulam	0.00	0	52.64	0	0	Chalakudi - Parambikulam	Single Line	-	-	-	-
Munnar	Top Station	0.00	0	23.79	0	0	Munnar - Top Station	Single Line	-	-	-	-
Avadi	Poonamallee	0.00	0	8.49	0	0	Avadi - Poonamallee	Single Line	-	-	-	-
Pattabiram	Pattabiram East Depot	0.00	0	5.74	0	0	Pattabiram - Pattabiram East Depot	Single Line	-	-	-	-
Tirupattur	Krishnagiri	0.00	0	39.93	0	0	Tirupattur - Krishnagiri	Single Line	-	-	-	-
Ponmalai	Sircarpalayam	0.00	0	5.72	0	0	Ponmalai - Sircarpalayam	Single Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Ponmalai	Ordnance Factory	0.00	0	15.02	0	0	Ponmalai - Ordnance Factory	Single Line	-	-	-	-
Nagapattinam Jn	Velankanni	0.00	0	10.51	0	0	Nagapattinam Jn - Velankanni	Single Line	-	-	-	-
Nagapattinam Jn	Thiruvarur	0.00	0	23.49	0	0	Nagapattinam Jn - Thiruvarur	Single Line	-	-	-	-
Nagore	Nagapattinam Jn	0.00	0	6.96	0	0	Nagore - Nagapattinam Jn	Single Line	-	-	-	-
Mayiladuturai	Karai-Kovilpathu	0.00	0	40.14	0	0	Mayiladuturai - Karai-Kovilpathu	Single Line	-	-	-	-
Thanjavur	Pulliarpatti	0.00	0	8.22	0	0	Thanjavur - Pulliarpatti	Single Line	-	-	-	-
Pamban	Dhanushkodi Pier	0.00	0	27.15	0	0	Pamban - Dhanushkodi Pier	Single Line	-	-	-	-
Rameshwaram	Rameshwaram Port	0.00	0	1.29	0	0	Rameshwaram - Rameshwaram Port	Single Line	-	-	-	-
Tiruchendur	Kulasekharapatnam Port Jn	0.00	0	13.11	0	0	Tiruchendur - Kulasekharapatnam Port Jn	Single Line	-	-	-	-
Kulasekharapatnam Port Jn	Manapad	0.00	0	3.62	0	0	Kulasekharapatnam Port Jn - Manapad	Single Line	-	-	-	-
Kulasekharapatnam Port Jn	Kulasekharapatnam Central Jn	0.00	0	1.53	0	0	Kulasekharapatnam Port Jn - Kulasekharapatnam Central Jn	Single Line	-	-	-	-
Kulasekharapatnam Central Jn	Tisaiyanvilai	0.00	0	22.55	0	0	Kulasekharapatnam Central Jn - Tisaiyanvilai	Single Line	-	-	-	-
Kulasekharapatnam Central Jn	Udangudi	0.00	0	4.31	0	0	Kulasekharapatnam Central Jn - Udangudi	Single Line	-	-	-	-
Karaikal	Nagore	0.00	0	11.38	0	0	Karaikal - Nagore	Single Line	-	-	-	-
Firozpur City Jn	Firozpur Cantt Jn	0.00	0	3.31	0	0	Firozpur City Jn - Firozpur Cantt Jn	Single Line	-	-	-	-
Firozpur City Jn	Husainiwala	0.00	0	8.36	0	0	Firozpur City Jn - Husainiwala	Single Line	-	-	-	-
Abohar Jn	Malout	0.00	0	29.67	0	0	Abohar Jn - Malout	Single Line	-	-	-	-
Sadda Singhwala	Talwandi Sabo Power Plant	0.00	0	20.99	0	0	Sadda Singhwala - Talwandi Sabo Power Plant	Single Line	-	-	-	-
Khukrana Halt	Panipat Refinery	0.00	0	9.60	0	0	Khukrana Halt - Panipat Refinery	Single Line	-	-	-	-
Dhaulpur Jn	Mohari Jn	0.00	0	39.56	0	0	Dhaulpur Jn - Mohari Jn	Single Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Rajakhera	Agra Cantt Jn	0.00	0	35.13	0	0	Rajakhera - Agra Cantt Jn	Single Line	-	-	-	-
Bah	Rajakhera	0.00	0	47.34	0	0	Bah - Rajakhera	Single Line	-	-	-	-
Sanganer	Toda Rai singh	0.00	0	104.65	0	0	Sanganer - Toda Rai singh	Single Line	-	-	-	-
Dudwa	Gauriphanta	0.00	0	23.41	0	0	Dudwa - Gauriphanta	Single Line	-	-	-	-
Salempur Jn	Barhaj Bazar	0.00	0	20.34	0	0	Salempur Jn - Barhaj Bazar	Single Line	-	-	-	-
Arariya Court	Galgalia	80.00	20	90.045	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2L+TC	3L+TC
Kishanganj	Jalalgarh	80.00	20	48.468	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2L+TC	3L+TC
Bithan	Biraul	30.05	6	30.83441	ECR	SPJ	Sakri - Biraul	Single Line	-	-	-	-
Chhapra Kacheri jn	Vaishali	64.52	12	46.051	ECR	SPJ	Muzaffarpur - Sitamarhi	Single Line	-	-	-	-
Bhatni Jn	Bathua Pazar	0.00	0	45.77628	0	0	Hathuwa - Bathua Pazar	Single Line	-	-	-	-
Masrakh	Maharajganj	0.00	0	36.38181	0	0	Duraundha Jn - Maharajganj	Single Line	-	-	-	-
Digha Ghat	Sonpur Jn	9.00	11	10.88725	ECR	DNR	Pahlezaghat-Phulwarishariff	Single Line	2L	-	2L+TC	3L+TC
Digha Ghat	Patliputra	9.00	11	4.84975	ECR	DNR	Pahlezaghat-Phulwarishariff	Single Line	2L	-	2L+TC	3L+TC
Hasanpur Road	Biraul	30.05	6	15.62757	ECR	SPJ	Sakri - Biraul	Single Line	-	-	-	-
Monghyr	Sabdalpur	5.40	36	5.77924	ECR	SEE	Sahibpur Kamal - Sabdalpur	Single Line	-	-	2L	-
Godda	Pirpainti	0.00	0	62.245	ER	MLDT	Pirpainti - Hansdiha	Single Line	-	-	-	2L
Karjhusa	Katuria	15.35	9	8.89513	ER	MLDT	DEOGHAR-BANKA	Single Line	-	-	-	-
Dekpura Halt	Daniyawan jn	53.00	30	33.12269	ECR	DNR	Daniawan-Biharshariff	Single Line	-	-	-	-
Natesar	Islampur	43.00	25	20.967	ECR	DNR	Fatuha - Islampur	Single Line	-	-	2L	-
Pasighat	Murkong Selek	139.00	17	33.32519	NFR	LMG	LUMDING - FURKATING	Single Line	2L	-	2L+TC	3L+TC
Imphal	Jiribam	49.00	3	97.0388	NFR	LMG	ARUNACHAL - JIRIBAM	Single Line	-	-	-	-
Kawnpui	Bhairabi	83.00	12	31.924	NFR	LMG	KATAKHAL - BHAIRABI	Single Line	-	-	-	-
Belonia	Agartala	139.00	21	75.27732	NFR	LMG	DHARMANAGAR - AGARTALA	Single Line	-	-	2L	2L+TC
Sisibargaon	Dhamalgaon	94.00	10	31.262	NFR	TSK	SIMALUGURI - DIBRUGARH	Single Line	-	-	2L	-
Raiganj	Itahar	45.00	8	19.898	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Buniadpur	Itahar	45.00	8	26.07294	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-
Gazole	Itahar	45.00	8	26.573	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-
Buniadpur	Kaliyaganj	45.00	8	30.70477	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-
Siuri	Prantik	26.87	0	27.489	ER	ASN	Siuri - Prantik	Single Line	-	-	-	-
Bowaichandi PH	Khana Jn	0.00	0	23.563	0	0	Bowaichandi PH - Berugram Ph	Single Line	-	-	-	-
Bowaichandi PH	Arambag	0.00	0	31.246	0	0	Bowaichandi PH - Berugram Ph	Single Line	-	-	-	-
Arambag	Panskura Jn	24.48	15	61.914	ER	HWH	Arambag - Panskura Jn	Single Line	-	-	-	2L
Goghai	Maynapur	0.00	0	28.24452	0	0	Bishnupur Jn - Maynapur	Single Line	2L	-	-	-
Kulgachia FS	Amta	44.60	13	12.52478	SER	KGP	SANTRAGACHI - AMTA	Single Line	2L	-	-	-
Jaleshwar	Digha	89.00	33	41.298	SER	KGP	Jaleshwar - DIGHA	Single Line	-	-	-	-
Kawar	Girigdih	86.14	12	49.15698	ECR	DHN	Koderma - Kanwar	Single Line	-	-	-	-
Rema	Dhanwar	86.14	12	11.44968	ECR	DHN	Koderma - Kanwar	Single Line	-	-	-	-
Rema	Kawar	86.14	12	25.17305	ECR	DHN	Koderma - Kanwar	Single Line	-	-	-	-
Jasidih Jn	Deoghar	64.76	10	6.43703	ER	ASN	JASIDIH-DEOGHAR	Single Line	-	-	-	-
Mohanpur	Dumka Jn	77.20	9	56.19177	ER	MLDT	BARAHAT - HANSDIHA - DUMKA	Single Line	-	-	-	2L
Godda	Hansdiha	0.00	0	28.499	ER	MLDT	Pirpainti - Hansdiha	Single Line	-	-	-	2L
Lohardaga	Korba	0.00	0	7.890926	SECR	BSP	BILASPUR- URKURA	Single Line	-	-	2L	-
Tori	Barkichampi	0.00	0	29.12199	0	0	Tori - Barkichampi	Single Line	2L	-	-	2L+TC
Barwadih	Ambikapur	118.80	25	142.4275	SECR	BSP	BILASPUR- URKURA	Single Line	-	-	2L	-
Hazaribagh Town	Mandu	57.14	60	27.43733	ECR	DHN	Hazaribag Town - Barkakana	Single Line	-	-	-	2L+TC
Tatisilwai	Barkakana Jn	71.90	43	61.62256	SER	RNC	MURI - HATIA	Single Line	2L	-	2L+TC	-
Bimalgarh Jn	Talcher	10.60	66	141.213	ECOR	KUR	Talcher - Budhapank	Single Line	4L+TC	-	-	-
Kendrapara	Paradeep	82.90	55	37.841	ECOR	KUR	Haridaspur-Paradeep	Single Line	2L+TC	-	-	4L+TC
Kendrapara	Haridaspur	82.90	55	37.841	ECOR	KUR	Haridaspur-Paradeep	Single Line	2L+TC	-	-	4L+TC
Budhapank	Baghuapal	0.00	0	93.48437	ECOR	KUR	Budhapank - Baghuapal	Single Line	-	-	-	-
Nayagarh New	Bolagarh	65.46	18	18.22506	ECOR	KUR	Khurda Road - Nayagrah Town	Single Line	2L	-	-	-

NODE_A	NODE_B	Section Length	Present Capacity (One way)	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	Proposed Configuration 26	Proposed Configuration 31	Proposed Configuration 41	Proposed Configuration 51
Nayagarh New	Boudh	65.46	18	131.6848	ECOR	KUR	Khurda Road - Nayagrah Town	Single Line	2L	-	-	-
Sonepur	Boudh	0.00	25	48.244	ECOR	SBP	Sonepur - Balangir Road PH	Single Line	-	-	-	-
Sonepur	Balangir Road PH	0.00	0	47.6092	ECOR	SBP	Sonepur - Balangir Road PH	Single Line	-	-	-	-
Gevra Road	Pendra Road	47.00	50	125.2175	SECR	BSP	BILASPUR- URKURA	Single Line	-	-	2L	-
Dalli Rajhara	Rowghat	45.40	20	85.27	ECOR	WAT	Jagdalpur - Durg	Single Line	-	-	-	2L
Abhanpur Jn	Mandir Hasaud	0.00	0	22.47129	0	0	Abhanpur Jn - Chamuria	Single Line	-	-	2L	-
Jagdalpur	Rowghat	45.40	20	135.5797	ECOR	WAT	Jagdalpur - Durg	Single Line	-	-	-	2L
Chhattarpur	Khajuraho	168.00	12	31.414	NCR	JHS	LAR - Khajuraho	Single Line	2L	-	-	-
Rewa	Singrauli Jn	48.55	22	166.5604	WCR	JBP	Rewa - Singrauli Jn	Single Line	-	-	2L	-
Dhar	Tihi	0.00	20	44.937	WR	RTM	Rau - MHOW	Single Line	2L	-	-	-
Dhar	Dahod	0.00	0	116.468	WR	RTM	Dhar - Dahod	Single Line	-	-	2L	-
Dhar	Chhota Udepur	0.00	0	152.6942	WR	RTM	Chhuchhapura - Chhota Udepur	Single Line	-	-	2L	-
Bhopal jn	Biyavra Rajgarh	192.70	14	105.7148	WCR	BPL	MAKSI - RUTHIYAI	Single Line	-	-	2L	-
Ramganj Mandi jn	Biyavra Rajgarh	0.00	0	25.3789	0	0	Ramganj Mandi jn - Jhalawar city	Single Line	-	-	-	2L
Katangi	Tirodi	23.00	11	13.075	SECR	NGP	KANHAN - RAMTEK	Single Line	-	-	-	-
Bhagdara	Jamner	135.00	4	8.24784	CR	BSL	Pachora - Jamner	Single Line	-	-	-	-
Pachora jn	Bhagdara	135.00	4	0	CR	BSL	Pachora - Jamner	Single Line	-	-	-	-
Washim	Karanja	210.00	24	59.722	SCR	NED	Washim - Badnera	Single Line	-	-	-	-
Wardha Jn	Yavatmal	112.00	2	65.656	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Pusad	Darwha Moti Bagh	112.00	2	58.47232	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Pusad	Maltekdi	112.00	2	90.754	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Baramati	Phaltan	145.00	23	31.014	CR	PUNE	Daund Junction - Baramati	Single Line	-	-	2L	-
Ahmadnagar	Beed	0.00	0	141.0649	CR	SUR	Ahmadnagar - Parli Vaijnath	Single Line	-	-	2L	-
Parli Vaijnath	Beed	0.00	0	91.993	CR	SUR	Ahmadnagar - Parli Vaijnath	Single Line	-	-	2L	-
Lonand	Phaltan	145.00	23	24.72139	CR	PUNE	Daund Junction - Baramati	Single Line	-	-	2L	-
Mettampalle	Mellacheruvu	19.00	25	12.807	SCR	SC	Jaggayapet - Mattampalli	Single Line	-	-	-	-
Janpahad	Mettampalle	0.00	0	15.75486	0	0	Janpahad - Vishnupuram	Single Line	-	-	-	-
Bhadrachalam Road	Kowur	49.00	18	150.292	SCR	SC	BhadrachalamRd - Manuguru	Single Line	-	-	-	2L

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Kadapa	Viyalpad	227.00	24	122.063	SCR	GKL	Kapada - Viyalpad	Single Line	-	-	-	2L
Banganapalle	Nandyal	0.00	0	29.96201	0	0	Yerraguntala Jn - Banganapalle	Single Line	-	-	-	2L
Pavagada	Rayadurg	12.52	32	114.733	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2L	-	-	2L+TC
Madakasira	Tumakuru	12.52	32	81.2187	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2L	-	-	2L+TC
Pavagada	Madakasira	12.52	32	17.67384	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2L	-	-	2L+TC
Bagalkot	Kudachi	97.00	21	129.4313	SWR	UBL	Bagalkot - Vijayapura	Single Line	2L	-	-	-
Humnabad	Mahagaon	0.00	0	40.54214	0	0	Bablad - Mahagaon	Single Line	-	-	-	2L
Raichur Jn	Ginigera	26.00	9	111.3709	SWR	UBL	Ginigera - Chikkabenekal	Single Line	-	-	-	-
Ankola	Hubbali Jn	0.00	0	141.1322	0	0	Ankola - Karwar	Single Line	-	-	2L	-
Davangere	Chitradurg	0.00	0	58.945	SWR	MYS	Davangere - Chitradurg	Single Line	-	-	-	-
Tumakuru	Chitradurg	0.00	0	133.843	SWR	MYS	Tumakuru - Chitradurg	Single Line	-	-	-	-
Kunigal	Solur	12.52	32	26.945	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2L	-	-	2L+TC
Kaladi	Angamali for Kaladi	71.54	65	9.08325	SR	TVC	Thrisur - Ernakulam Town 2	Single Line	-	-	-	-
St Thomas Mount	Velachery	19.34	144	4.05114	SR	MAS	Chennai Beach - Velachery (MRTS)	Single Line	2L	-	-	-
Chinna Salem	Kallakurichi	0.00	0	10.187	0	0	Chinna Salem - Vriddhachalam Jn	Single Line	-	-	-	-
Kodikkarai	Agasthiampalli	0.00	0	9.01573	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Tiruturaipundi Jn	Agasthiampalli	0.00	0	36.83052	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Thiruvarur	25766.28	0.00	0	22.12904	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Karai-Kovilpathu	Peralam Jn	0.00	0	22.12904	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Tiruturaipundi Jn	Pattukkottai	0.00	0	49.79592	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Arantangi	Pattukkottai	0.00	0	45.0572	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Arantangi	Karaikkudi	0.00	0	26.643	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Madurai Jn	Aruppukkottai	66.55	17	50.51	SR	MDU	Madurai Jn - Aruppukkottai	Single Line	-	-	-	-
Milavittam	Aruppukkottai	83.73	0	83.733	SR	MDU	Milavittam - Aruppukkottai	Single Line	-	-	-	2L
Metpally	Lingampet Jagityal	48.00	24	29.27	SCR	SC	Karimnagar - Lingampet Jagityal	Single Line	-	-	-	-
Metpally	Nizamabad	48.00	24	65.921	SCR	SC	Karimnagar - Lingampet Jagityal	Single Line	-	-	-	-

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Devarkadra	Krishna	130.44	24	63.93425	SCR	HYB	Devarkadra - Krishna	Single Line	-	-	2L	-
Akanapet	Medak	35.00	24	15.381	SCR	SC	Akanapet - Medak	Single Line	-	-	-	-
Siddipet	Manoharabad	35.00	24	71.887	SCR	SC	Peddapalli - Karimnagar	Single Line	-	-	2L	-
Siddipet	Sircilla	35.00	24	35.305	SCR	SC	Peddapalli - Karimnagar	Single Line	-	-	2L	-
Talwara	Amb Andaura	0.00	0	39.32978	0	0	Una Himachal - Amb Andaura	Single Line	-	-	-	2L
Kiccha	Khatima	0.00	0	23.88721	0	0	Kiccha - Khatima	Single Line	-	-	-	-
Deoband	Roorkee	107.00	29	29.31107	NR	DLI	Khatauli - Tapri	Single Line	2L	-	-	-
Sonipat	Gohana	79.00	85	38.94301	NR	DLI	Adarsh Nagar Delhi - Panipat Jn	Single Line	2L	2L+TC	-	4L+TC
Pandu Pindara	Gohana	71.00	15	39.93127	NR	DLI	Pandu Pindara - Khukrana Halt	Single Line	-	-	-	-
Hansi	Rohtak Jn	60.00	19	66.76176	NWR	BKN	BHIWANI - HISAR	Single Line	2L+TC	-	3L+TC	-
Dausa	Gangapur city	90.32	60	95.89159	NWR	JP	BANDIKUI - JAIPUR	Single Line	2L	-	3L+TC	-
Pushkar Terminus	Merta City	14.50	9	58.85541	NWR	JU	Pushkar Terminus - MERTA CITY	Single Line	-	-	-	-
Dungarpur	Banswara	209.80	0	88.23812	NWR	AII	Dungarpur - Banswara	Single Line	-	-	-	-
Najibabad Jn	Dhampur	11.00	60	39.259	NR	MB	Moradabad - Najibabad Jn.	2nd Line	-	2L+TC	-	-
Bah	Udi	0.00	0	37.332	0	0	Bhandai-Udimor	2nd Line	-	-	-	-
Mainpuri	Etawah	118.00	0	55.316	NCR	JHS	Etawah-MNQ	Single Line	-	-	-	-
Rai Bareli Jn	AkbarGanj	35.20	14	46.488	NR	LKO	Sultanpur - Chilbila	Single Line	-	-	2L	-
Sultanpur Jn	Amethi	35.20	14	30.752	NR	LKO	Sultanpur - Chilbila	Single Line	-	-	2L	-
Paniyahawa	Tamkuhi Road	0.00	0	61.131	0	0	Paniyahawa - Valmiki nagar road	Single Line	-	-	-	2L
Mau Jn	Ghazipur Ghat halt	50.52	16	40.794	NER	BSB	Mau Jn - Ghazipur Ghat halt	Single Line	-	-	-	-
Kasganj Jn	Etah	107.84	20	27.069	NER	ZN	FARUKHABAD - KASGANJ	Single Line	-	-	2L	-

NODE_A	NODE_B	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	New Proposed Configuration 26	New Proposed Configuration 31	New Proposed Configuration 41	New Proposed Configuration 51
Abhanpur Jn	Chamuria	19.46	0	0	Abhanpur Jn - Chamuria	Single Line	-	-	2nd Line with Normal Signalling	-

NODE_A	NODE_B	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	New Proposed Configuration 26	New Proposed Configuration 31	New Proposed Configuration 41	New Proposed Configuration 51
Abhanpur Jn	Mandir Hasaud	22.47	0	0	Abhanpur Jn - Chamuria	Single Line	-	-	2nd Line with Normal Signalling	-
Abohar Jn	Malout	29.67	0	0	Abohar Jn - Malout	Single Line	-	-	-	-
Adraj Moti	Kalol Jn	7.26	0	0	Adraj Moti - Kalol Jn	2nd Line	-	-	-	-
Aishbagh Jn	Daliganj Jn	4.98	0	0	Aishbagh Jn - Daliganj Jn	Single Line	-	-	-	-
Aishbagh Jn	Lucknow	1.87	0	0	Aishbagh Jn - Lucknow	2nd Line	-	-	-	2nd Line with TCAS Signalling
Ait Jn	Konch	13.47	0	0	Ait Jn - Konch	Single Line	-	-	-	-
Ajnar	Warsamedi	6.04	0	0	Ajnar - Warsamedi	Single Line	-	-	-	-
Alamnagar	Aishbagh Jn	4.71	0	0	Alamnagar - Aishbagh Jn	2nd Line	-	-	-	-
Amla Jn	Parasia	86.55	0	0	Amla Jn - Parasia	2nd Line	-	-	-	-
Ankola	Karwar	28.13	0	0	Ankola - Karwar	Single Line	-	-	2nd Line with Normal Signalling	-
Ankola	Hubbali Jn	141.13	0	0	Ankola - Karwar	Single Line	-	-	2nd Line with Normal Signalling	-
Ankola	Udupi	161.69	0	0	Ankola - Udupi	Single Line	-	2nd Line with Normal Signalling	-	-
Aunlajori Jn	Grumahisani	9.02	0	0	Aunlajori Jn - Grumahisani	Single Line	-	-	-	-
Avadi	Poonamallee	8.49	0	0	Avadi - Poonamallee	Single Line	-	-	-	-
Bablad	Mahagaon	26.72	0	0	Bablad - Mahagaon	Single Line	-	-	-	2nd Line with Normal Signalling
Humnabad	Mahagaon	40.54	0	0	Bablad - Mahagaon	Single Line	-	-	-	2nd Line with Normal Signalling
Bah	Rajakhera	47.34	0	0	Bah - Rajakhera	Single Line	-	-	-	-
Bahraich	Gonda Jn	60.77	0	0	Bahraich - Gonda Jn	Single Line	-	-	-	-
Banaswadi	Baiyapannahalli ABC	7.73	0	0	Banaswadi - Baiyapannahalli ABC	Single Line	-	-	-	-
Bangriposi	Talbandh	31.24	0	0	Bangriposi - Talbandh	Single Line	-	-	-	-
Banjari	Tiura Pipardih	27.55	0	0	Banjari - Tiura Pipardih	Single Line	-	-	-	-
Banmourgaon	Sheopur Kalan	185.04	0	0	Banmourgaon - Sheopur Kalan	Single Line	-	-	-	-
Barabani	Ikra Jn	11.92	0	0	Barabani - Ikra Jn	2nd Line	-	-	-	-
Bareilly Jn	Bareilly City	3.02	0	0	Bareilly Jn - Bareilly City	Single Line	-	-	2nd Line with Normal Signalling	-
Barharwa Jn	Gumani	7.52	0	0	Barharwa Jn - Gumani	2nd Line	-	-	-	-
Berugram Ph	Masagram	5.95	0	0	Berugram Ph - Masagram	Single Line	-	-	-	-
Bah	Udi	37.33	0	0	Bhandai-Udimor	2nd Line	-	-	-	-

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Bhavnagar Terminus	Mahuva	105.68	0	0	Bhavnagar Terminus - Mahuva	Single Line	-	-	-	-
Bhojudin Jn	Bhaga Jn	11.39	0	0	Bhojudin Jn - Bhaga Jn	2nd Line	-	-	-	-
Bihar Sharif	Sheikhpura	39.55	0	0	Bihar Sharif - Sheikhpura	2nd Line	-	-	-	-
Bilaspur	Pilibhit Jn	37.87	0	0	Bilaspur - Pilibhit Jn	Single Line	-	-	-	-
Bishnupur Jn	Maynapur	21.78	0	0	Bishnupur Jn - Maynapur	2nd Line	-	-	-	-
Goghai	Maynapur	28.24	0	0	Bishnupur Jn - Maynapur	Single Line	2nd Line with Normal Signalling	-	-	-
Bobbili Jn	Salur	16.98	0	0	Bobbili Jn - Salur	Single Line	-	-	-	-
Botad Jn	Jasdan	51.27	0	0	Botad Jn - Jasdan	Single Line	-	-	-	-
Bowaichandi PH	Bankura Jn	79.89	0	0	Bowaichandi PH - Bankura Jn	Single Line	-	-	-	-
Bowaichandi PH	Berugram Ph	35.57	0	0	Bowaichandi PH - Berugram Ph	Single Line	-	-	-	-
Bowaichandi PH	Khana Jn	23.56	0	0	Bowaichandi PH - Berugram Ph	Single Line	-	-	-	-
Bowaichandi PH	Arambag	31.25	0	0	Bowaichandi PH - Berugram Ph	Single Line	-	-	-	-
Central Ordnance depot	Dehu Road	6.41	0	0	Central Ordnance depot - Dehu Road	Single Line	-	-	-	-
Chalakudi	Parambikulam	52.64	0	0	Chalakudi - Parambikulam	Single Line	-	-	-	-
Chamuria	Likhma	89.53	0	0	Chamuria - Likhma	Single Line	-	-	-	-
Chanasma	Harij	21.03	0	0	Chanasma - Harij	Single Line	-	-	-	-
Chhindwara Jn	Seoni	64.24	0	0	Chhindwara Jn - Seoni	Single Line	-	-	-	-
Chinna Salem	Vriddhachalam Jn	50.14	0	0	Chinna Salem - Vriddhachalam Jn	Single Line	-	-	-	-
Chinna Salem	Kallakurichi	10.19	0	0	Chinna Salem - Vriddhachalam Jn	Single Line	-	-	-	-
Daliganj Jn	Malhaur	12.15	0	0	Daliganj Jn - Malhaur	2nd Line	-	-	-	-
Davangere	Shivamogga Town	77.33	0	0	Davangere - Shivamogga Town	2nd Line	-	-	-	-
Dehri on Sone Jn	Bidiha Shankarpuri	6.53	0	0	Dehri on Sone Jn - Bidiha Shankarpuri	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Dekargaon	Tezpur	7.11	0	0	Dekargaon - Tezpur	Single Line	-	-	-	-
Dhanbad Jn	Pathardih	15.49	0	0	Dhanbad Jn - Pathardih	Single Line	-	-	-	2nd Line with Normal Signalling
Dharmapuri	Morappur	27.73	0	0	Dharmapuri - Morappur	2nd Line	-	-	-	-
Dhaulpur Jn	Mohari Jn	39.56	0	0	Dhaulpur Jn - Mohari Jn	Single Line	-	-	-	-

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Digha Wani	Khirsadoh	6.50	0	0	Digha Wani - Khirsadoh	Single Line	-	-	-	-
Dohrighat	Indara Jn	35.28	0	0	Dohrighat - Indara Jn	Single Line	-	-	-	-
Doraha	Rupnagar	54.30	0	0	Doraha - Rupnagar	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Dudwa	Gauriphanta	23.41	0	0	Dudwa - Gauriphanta	Single Line	-	-	-	-
Dudwa	Tikunia	33.92	0	0	Dudwa - Tikunia	Single Line	-	-	-	-
Duraundha Jn	Maharajganj	6.15	0	0	Duraundha Jn - Maharajganj	Single Line	-	-	-	-
Masrakh	Maharajganj	36.38	0	0	Duraundha Jn - Maharajganj	Single Line	-	-	-	-
Faizabad Jn	Masodha	7.55	0	0	Faizabad Jn - Masodha	Single Line	-	-	-	-
Fatehabad	Bhattu	19.24	0	0	Fatehabad - Bhattu	Single Line	-	-	-	-
Fatehabad	Hisar Jn	50.34	0	0	Fatehabad - Hisar Jn	2nd Line	-	-	-	-
Fazilka jn	Chananwala	11.25	0	0	Fazilka jn - Chananwala	Single Line	-	-	-	-
Firozpur City Jn	Firozpur Cantt Jn	3.31	0	0	Firozpur City Jn - Firozpur Cantt Jn	Single Line	-	-	-	-
Firozpur City Jn	Husainiwala	8.36	0	0	Firozpur City Jn - Husainiwala	Single Line	-	-	-	-
Gandhinagar Capital	Adraj Moti	13.26	0	0	Gandhinagar Capital - Adraj Moti	2nd Line	-	-	-	-
Garhi Harsaru Jn	Farukhnagar	11.63	0	0	Garhi Harsaru Jn - Farukhnagar	Single Line	-	-	-	-
Ghosipura	Gwalior jn	3.27	0	0	Ghosipura - Gwalior jn	Single Line	-	-	-	-
Gola Gokaranath	Lakhimpur	34.00	0	0	Gola Gokaranath - Lakhimpur	Single Line	-	-	-	-
Golaka Mandir	Morar Cantt	2.76	0	0	Golaka Mandir - Morar Cantt	Single Line	-	-	-	-
Guntur Jn	Bandarupalli	11.44	0	0	Guntur Jn - Bandarupalli	Single Line	-	-	-	-
Gwalior jn	Golaka Mandir	3.18	0	0	Gwalior jn - Golaka Mandir	Single Line	-	-	-	-
Gwalior jn	Motijheel	6.90	0	0	Gwalior jn - Motijheel	Single Line	-	-	-	-
H Nizamuddin Jn	Anand Vihar Terminal	10.45	0	0	H Nizamuddin Jn - Anand Vihar Terminal	2nd Line	-	-	-	-
Hadmatiya	Jodiya Bandar	44.65	0	0	Hadmatiya - Jodiya Bandar	Single Line	-	-	-	-
Harangul	Latur Old Terminus	9.99	0	0	Harangul - Latur Old Terminus	Single Line	-	-	-	-
Hathuwa	Bathua Pazar	20.47	0	0	Hathuwa - Bathua Pazar	Single Line	-	-	-	-
Bhatni Jn	Bathua Pazar	45.78	0	0	Hathuwa - Bathua Pazar	Single Line	-	-	-	-
Hotgi Jn	Vijayapura	93.87	0	0	Hotgi Jn - Vijayapura	2nd Line	-	-	-	-

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Ikra Jn	Tapasi	3.81	0	0	Ikra Jn - Tapasi	2nd Line	-	-	-	-
Indapur	Dighi Port	35.51	0	0	Indapur - Dighi Port	Single Line	-	-	-	-
Jabalpur Jn	Nainpur Jn	108.22	0	0	Jabalpur Jn - Nainpur Jn	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Jaipur Jn	Ringas Jn	56.21	0	0	Jaipur Jn - Ringas Jn	Single Line	-	-	-	-
Janpahad	Vishnupuram	11.52	0	0	Janpahad - Vishnupuram	Single Line	-	-	-	-
Janpahad	Mettampalle	15.75	0	0	Janpahad - Vishnupuram	Single Line	-	-	-	-
Jhagadiya Jn	Netrang	24.95	0	0	Jhagadiya Jn - Netrang	2nd Line	-	-	-	-
Jind Jn	Pandu Pindara	8.84	0	0	Jind Jn - Pandu Pindara	Single Line	-	-	-	-
Juhi cabin	Rawatpur	5.15	0	0	Juhi cabin - Rawatpur	Single Line	-	-	-	2nd Line with Normal Signalling
Junagadh Jn	Saradiya	52.10	0	0	Junagadh Jn - Saradiya	Single Line	-	-	-	-
Kadalundi	Beypore	2.60	0	0	Kadalundi - Beypore	Single Line	-	-	-	-
Kalamna	Khapri Kheda	12.47	0	0	Kalamna - Khapri Kheda	Single Line	-	-	-	-
Kanthi	Egra	25.37	0	0	Kanthi - Egra	2nd Line	-	-	-	-
Karaikal	Nagore	11.38	0	0	Karaikal - Nagore	Single Line	-	-	-	-
Karaikkudi	Puddukkottai	36.62	0	0	Karaikkudi - Puddukkottai	Single Line	-	-	2nd Line with Normal Signalling	-
Karai-Kovilpathu	Karaikal	1.45	0	0	Karai-Kovilpathu - Karaikal	Single Line	-	-	-	-
Karur	Tiruchchirappalli Jn	76.79	0	0	Karur - Tiruchchirappalli Jn	2nd Line	-	-	-	-
Kasbe Sukene	HAL, Nasik	13.60	0	0	Kasbe Sukene - HAL, Nasik	Single Line	-	-	-	-
Kashipur Jn	Kathgarh Left Bank	45.08	0	0	Kashipur Jn - Kathgarh Left Bank	Single Line	-	-	-	-
Kathgodam	Nandhaur	41.96	0	0	Kathgodam - Nandhaur	Single Line	-	-	-	-
Khakhrechi	Ghantila	16.12	0	0	Khakhrechi - Ghantila	Single Line	-	-	-	-
Khakhrechi	Morbi Jn	28.93	0	0	Khakhrechi - Morbi Jn	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Khapri Kheda	Chhindwara Jn	132.96	0	0	Khapri Kheda - Chhindwara Jn	Single Line	-	-	-	-
Khatima	Pilibhit Jn	39.25	0	0	Khatima - Pilibhit Jn	Single Line	-	-	-	2nd Line with Normal Signalling
Khirsadoh	Chhindwara Jn	25.49	0	0	Khirsadoh - Chhindwara Jn	Single Line	-	-	-	-
Khukrana Halt	Panipat Refinery	9.60	0	0	Khukrana Halt - Panipat Refinery	Single Line	-	-	-	-
Kiccha	Bhojipura Jn	48.71	0	0	Kiccha - Bhojipura Jn	Single Line	-	-	-	-
Kiccha	Khatima	23.89	0	0	Kiccha - Khatima	Single Line	-	-	-	-

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Koderma Jn	Tilaiya Jn	47.51	0	0	Koderma Jn - Tilaiya Jn	2nd Line	-	-	-	2nd Line with TCAS Signalling
Kulasekharapatnam Central Jn	Tisaiyanvilai	22.55	0	0	Kulasekharapatnam Central Jn - Tisaiyanvilai	Single Line	-	-	-	-
Kulasekharapatnam Central Jn	Udangudi	4.31	0	0	Kulasekharapatnam Central Jn - Udangudi	Single Line	-	-	-	-
Kulasekharapatnam Port Jn	Kulasekharapatnam Central Jn	1.53	0	0	Kulasekharapatnam Port Jn - Kulasekharapatnam Central Jn	Single Line	-	-	-	-
Kulasekharapatnam Port Jn	Manapad	3.62	0	0	Kulasekharapatnam Port Jn - Manapad	Single Line	-	-	-	-
Kumbakonam	Mayiladuturai	31.52	0	0	Kumbakonam - Mayiladuturai	Single Line	-	-	-	-
Kunkavav	Bagasra	19.07	0	0	Kunkavav - Bagasra	Single Line	-	-	-	-
Kunkavav	Derdi	11.82	0	0	Kunkavav - Derdi	Single Line	-	-	-	-
Lakhimpur	Sitapur Jn	46.43	0	0	Lakhimpur - Sitapur Jn	Single Line	-	-	-	-
Machillpatnam	Machilipatnam Fort	3.60	0	0	Machillpatnam - Machilipatnam Fort	Single Line	-	-	-	-
Madhoganj	Auhadpur	27.50	0	0	Madhoganj - Auhadpur	Single Line	-	-	-	-
Madurai Jn	Teni	73.92	0	0	Madurai Jn - Teni	Single Line	-	-	-	-
Mahuda Jn	Malkera Jn	5.08	0	0	Mahuda Jn - Malkera Jn	2nd Line	-	-	-	-
Mailani Jn	Dudwa	44.10	0	0	Mailani Jn - Dudwa	Single Line	-	-	-	-
Mailani Jn	Gola Gokaranath	26.72	0	0	Mailani Jn - Gola Gokaranath	Single Line	-	-	-	-
Malkera Jn	Bhaga Jn	14.22	0	0	Malkera Jn - Bhaga Jn	2nd Line	-	-	-	-
Malout	Bathinda Jn	43.79	0	0	Malout - Bathinda Jn	Single Line	-	-	-	-
Manaknagar	Aishbagh Jn	3.52	0	0	Manaknagar - Aishbagh Jn	Single Line	-	-	-	2nd Line with TCAS Signalling
Mannargudi	Nidamangalam Jn	13.76	0	0	Mannargudi - Nidamangalam Jn	Single Line	-	-	-	-
Mathura Jn	Vrindavan	10.62	0	0	Mathura Jn - Vrindavan	Single Line	-	-	-	2nd Line with Normal Signalling
Mayiladuturai	Cuddalore Port Jn	76.16	0	0	Mayiladuturai - Cuddalore Port Jn	Single Line	-	-	-	2nd Line with Normal Signalling
Mayiladuturai	Karai-Kovilpathu	40.14	0	0	Mayiladuturai - Karai-Kovilpathu	Single Line	-	-	-	-
Morbi Jn	Sanala	5.76	0	0	Morbi Jn - Sanala	Single Line	-	-	-	-
Morinda	New Morinda Jn	2.81	0	0	Morinda - New Morinda Jn	Single Line	-	-	-	-

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Motijheel	Banmourgaon	11.07	0	0	Motijheel - Banmourgaon	Single Line	-	-	-	-
Motijheel	Ghosipura	4.41	0	0	Motijheel - Ghosipura	Single Line	-	-	-	-
Mughal Sarai Jn	New Mughal Sarai Jn	132.85	0	0	Mughal Sarai Jn - New Mughal Sarai Jn	2nd Line	-	-	-	-
Mulshi Dam	Chinchvad	34.27	0	0	Mulshi Dam - Chinchvad	2nd Line	-	-	-	-
Munnar	Top Station	23.79	0	0	Munnar - Top Station	Single Line	-	-	-	-
Nagapattinam Jn	Thiruvarur	23.49	0	0	Nagapattinam Jn - Thiruvarur	Single Line	-	-	-	-
Nagapattinam Jn	Velankanni	10.51	0	0	Nagapattinam Jn - Velankanni	Single Line	-	-	-	-
Nagbhir Jn	Itwari Jn	106.12	0	0	Nagbhir Jn - Itwari Jn	Single Line	-	-	-	-
Nagore	Nagapattinam Jn	6.96	0	0	Nagore - Nagapattinam Jn	Single Line	-	-	-	-
Nagpur Jn	Kalamna	6.28	0	0	Nagpur Jn - Kalamna	2nd Line	-	-	-	-
Nainpur Jn	Balaghat Jn	73.85	0	0	Nainpur Jn - Balaghat Jn	Single Line	-	-	2nd Line with Normal Signalling	-
Nainpur Jn	Mandla Fort	42.61	0	0	Nainpur Jn - Mandla Fort	Single Line	-	-	-	2nd Line with Normal Signalling
Nandre	Miraj Jn	18.32	0	0	Nandre - Miraj Jn	Single Line	-	-	-	2nd Line with Normal Signalling
Nanpara Jn	Bahraich	33.87	0	0	Nanpara Jn - Bahraich	Single Line	-	-	-	-
Narkatiaganj Jn	Bhikna Thori	36.16	0	0	Narkatiaganj Jn - Bhikna Thori	Single Line	-	-	-	-
Narkatiaganj Jn	Raxaul Jn	41.06	0	0	Narkatiaganj Jn - Raxaul Jn	2nd Line	-	-	-	-
Narpalganj	Forbesganj Jn	16.55	0	0	Narpalganj - Forbesganj Jn	2nd Line	-	-	-	2nd Line with TCAS Signalling
Nasik Road	Nasik	7.11	0	0	Nasik Road - Nasik	Single Line	-	-	-	-
Naupada Jn	Salt Factory	6.95	0	0	Naupada Jn - Salt Factory	Single Line	-	-	-	-
Nidamangalam Jn	Thiruvarur	24.33	0	0	Nidamangalam Jn - Thiruvarur	Single Line	-	-	-	-
Ningala	Gadhada Swaminayayan	16.55	0	0	Ningala - Gadhada Swaminayayan	Single Line	-	-	-	-
Nirmali	Sapaul	37.20	0	0	Nirmali - Sapaul	Single Line	-	-	2nd Line with Normal Signalling	-
Palsi	Koregaon	17.03	0	0	Palsi - Koregaon	Single Line	-	-	2nd Line with Normal Signalling	-

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Pamban	Dhanushkodi Pier	27.15	0	0	Pamban - Dhanushkodi Pier	Single Line	-	-	-	-
Pandu Pindara	Khukrana Halt	54.44	0	0	Pandu Pindara - Khukrana Halt	Single Line	-	-	-	-
Pangri	Yedshi	12.04	0	0	Pangri - Yedshi	Single Line	-	-	-	-
Parasia	Digha Wani	6.56	0	0	Parasia - Digha Wani	Single Line	-	-	-	-
Parasia	Khirsadoh	2.11	0	0	Parasia - Khirsadoh	Single Line	-	-	-	-
Parli Vaijnath	Latur Road Jn	62.69	0	0	Parli Vaijnath - Latur Road Jn	Single Line	-	-	2nd Line with Normal Signalling	-
Patan	Kakoshi Metrana Road	39.31	0	0	Patan - Kakoshi Metrana Road	Single Line	-	-	-	-
Patiala	Sunam	65.60	0	0	Patiala - Sunam	Single Line	-	-	-	-
Pattabiram	Pattabiram East Depot	5.74	0	0	Pattabiram - Pattabiram East Depot	Single Line	-	-	-	-
Peralam Jn	Mayiladuturai	16.29	0	0	Peralam Jn - Mayiladuturai	Single Line	-	-	-	-
Pilibhit Jn	Mailani Jn	68.79	0	0	Pilibhit Jn - Mailani Jn	Single Line	-	-	-	-
Piplod	Devgadh Baria	14.65	0	0	Piplod - Devgadh Baria	Single Line	-	-	-	-
Pondugula	Andhra Cement	3.91	0	0	Pondugula - Andhra Cement	Single Line	-	-	-	-
Ponmalai	Ordnance Factory	15.02	0	0	Ponmalai - Ordnance Factory	Single Line	-	-	-	-
Ponmalai	Sircarpalayam	5.72	0	0	Ponmalai - Sircarpalayam	Single Line	-	-	-	-
Ponmalai	Thanjavur	47.34	0	0	Ponmalai - Thanjavur	2nd Line	-	-	-	-
Puddukkottai	Tiruchchirappalli Jn	53.32	0	0	Puddukkottai - Tiruchchirappalli Jn	Single Line	-	-	2nd Line with Normal Signalling	-
Purnea Court	Purnea Jn	5.38	0	0	Purnea Court - Purnea Jn	Single Line	-	-	-	2nd Line with Normal Signalling
Radhakishorpur Jn	Rajathgarh Jn	2.79	0	0	Radhakishorpur Jn - Rajathgarh Jn	2nd Line	-	-	-	2nd Line with TCAS Signalling
Radhanagar	Kulti	7.33	0	0	Radhanagar - Kulti	Single Line	-	-	-	-
Rajakhera	Agra Cantt Jn	35.13	0	0	Rajakhera - Agra Cantt Jn	Single Line	-	-	-	-
Rajendra pul	Dinkar Gram Simaria	3.41	0	0	Rajendra pul - Dinkar Gram Simaria	2nd Line	-	-	2nd Line with TCAS Signalling	4th Line with TCAS Signalling
Rameshwaram	Rameshwaram Port	1.29	0	0	Rameshwaram - Rameshwaram Port	Single Line	-	-	-	-
Ramganj Mandi jn	Jhalawar city	25.38	0	0	Ramganj Mandi jn - Jhalawar city	Single Line	-	-	-	2nd Line with Normal Signalling

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Ramganj Mandi jn	Biyavra Rajgarh	25.38	0	0	Ramganj Mandi jn - Jhalawar city	Single Line	-	-	-	2nd Line with Normal Signalling
Ranippettai	Walajah Road	8.25	0	0	Ranippettai - Walajah Road	Single Line	-	-	-	-
Roha	Bhira	35.00	0	0	Roha - Bhira	Single Line	-	-	-	-
Sadda Singhwala	Talwandi Sabo Power Plant	20.99	0	0	Sadda Singhwala - Talwandi Sabo Power Plant	Single Line	-	-	-	-
Salem Jn	Salem Market	3.43	0	0	Salem Jn - Salem Market	Single Line	-	-	2nd Line with Normal Signalling	-
Salem Market	Chinna Salem	83.68	0	0	Salem Market - Chinna Salem	Single Line	-	-	-	-
Salempur Jn	Barhaj Bazar	20.34	0	0	Salempur Jn - Barhaj Bazar	Single Line	-	-	-	-
Samlaya	Dabhoi Jn	44.67	0	0	Samlaya - Dabhoi Jn	2nd Line	-	-	-	-
Samlaya	Pani Mines	58.66	0	0	Samlaya - Pani Mines	Single Line	-	-	-	-
Sanala	Amran Road	20.98	0	0	Sanala - Amran Road	Single Line	-	-	-	-
Sanala	Tankara	15.86	0	0	Sanala - Tankara	Single Line	-	-	-	-
Sanganer	Toda Rai singh	104.65	0	0	Sanganer - Toda Rai singh	Single Line	-	-	-	-
Sarla Jn	Sambalpur City Jn	3.88	0	0	Sarla Jn - Sambalpur City Jn	2nd Line	-	-	2nd Line with TCAS Signalling	-
Seoni	Nainpur Jn	74.82	0	0	Seoni - Nainpur Jn	Single Line	-	-	-	-
Shahjahanpur Jn	Bilaspur	47.23	0	0	Shahjahanpur Jn - Bilaspur	Single Line	-	-	-	-
Shahjahanpur Jn	Mailani Jn	63.65	0	0	Shahjahanpur Jn - Mailani Jn	Single Line	-	-	-	-
Shalimar	Howrah	10.75	0	0	Shalimar - Howrah	2nd Line	-	-	-	-
Shivpuri	Ghosipura	113.43	0	0	Shivpuri - Ghosipura	Single Line	-	-	-	-
Siliguri Town	Sivok	20.40	0	0	Siliguri Town - Sivok	Single Line	-	-	2nd Line with Normal Signalling	-
Simaluguri Jn	Naginimora	15.23	0	0	Simaluguri Jn - Naginimora	Single Line	-	-	-	-
Sitapur Jn	Daliganj Jn	79.95	0	0	Sitapur Jn - Daliganj Jn	Single Line	-	-	-	-
Sivakasi	TN Cement Corpn Alangulam	15.93	0	0	Sivakasi - TN Cement Corpn Alangulam	Single Line	-	-	-	-
Sivok	Gieliekhola	20.81	0	0	Sivok - Gieliekhola	Single Line	-	-	-	-
Sondalia	Dum Dum Jn	24.86	0	0	Sondalia - Dum Dum Jn	Single Line	-	-	-	-
Surendranagar Jn	Sayla	29.78	0	0	Surendranagar Jn - Sayla	Single Line	-	-	-	-

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Talwara	Mukerian	26.75	0	0	Talwara - Mukerian	Single Line	-	-	-	2nd Line with Normal Signalling
Tanakpur	Khatima	23.89	0	0	Tanakpur - Khatima	Single Line	-	-	-	2nd Line with Normal Signalling
Tarakeshwar	Berugram Ph	28.99	0	0	Tarakeshwar - Berugram Ph	Single Line	-	-	-	-
Tarakeshwar	Magra	50.10	0	0	Tarakeshwar - Magra	2nd Line	-	-	-	-
Telapur	Patancheru	8.60	0	0	Telapur - Patancheru	Single Line	-	-	2nd Line with TCAS Signalling	-
Teni	Bodinayakannur	15.01	0	0	Teni - Bodinayakannur	Single Line	-	-	-	-
Than	Chotila	21.04	0	0	Than - Chotila	Single Line	-	-	-	-
Thanjavur	Nidamangalam Jn	30.24	0	0	Thanjavur - Nidamangalam Jn	Single Line	-	-	-	-
Thanjavur	Pulliarpatti	8.22	0	0	Thanjavur - Pulliarpatti	Single Line	-	-	-	-
Thanjavur	Vadavar	5.11	0	0	Thanjavur - Vadavar	Single Line	-	-	-	-
Thiruvarur	Peralam Jn	22.13	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Kodikkarai	Agasthiampalli	9.02	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Tiruturaipundi Jn	Agasthiampalli	36.83	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Thiruvarur	25766.28	22.13	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Karai-Kovilpathu	Peralam Jn	22.13	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Tiruturaipundi Jn	Pattukkottai	49.80	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Arantangi	Pattukkottai	45.06	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Arantangi	Karaikkudi	26.64	0	0	Thiruvarur - Peralam Jn	Single Line	-	-	-	-
Tikunia	Nanpara Jn	92.76	0	0	Tikunia - Nanpara Jn	Single Line	-	-	-	-
Timba Road	Samlaya	52.20	0	0	Timba Road - Samlaya	2nd Line	-	-	-	-
Tiruchendur	Kulasekharapatnam Port Jn	13.11	0	0	Tiruchendur - Kulasekharapatnam Port Jn	Single Line	-	-	-	-
Tirupattur	Krishnagiri	39.93	0	0	Tirupattur - Krishnagiri	Single Line	-	-	-	-
Tiruvallur	Temple	3.92	0	0	Tiruvallur - Temple	Single Line	-	-	2nd Line with Normal Signalling	-
Tori	Barkichampi	29.12	0	0	Tori - Barkichampi	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Tribeni	Magra	3.26	0	0	Tribeni - Magra	Single Line	-	-	-	-
Tsunduru	Vejandla	11.42	0	0	Tsunduru - Vejandla	Single Line	-	-	-	2nd Line with Normal Signalling
Udupi	Thokur	45.10	0	0	Udupi - Thokur	Single Line	-	2nd Line with Normal Signalling	-	-
Ujjain Jn	Agar	65.82	0	0	Ujjain Jn - Agar	Single Line	-	-	-	-

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Una Himachal	Amb Andaura	27.30	0	0	Una Himachal - Amb Andaura	Single Line	-	-	-	2nd Line with Normal Signalling
Talwara	Amb Andaura	39.33	0	0	Una Himachal - Amb Andaura	Single Line	-	-	-	2nd Line with Normal Signalling
Urkura	Mandir Hasaud	16.86	0	0	Urkura - Mandir Hasaud	2nd Line	-	-	-	-
Vadavar	Kumbakonam	33.75	0	0	Vadavar - Kumbakonam	Single Line	-	-	-	-
Vadodara C	Vadodara E	0.81	0	0	Vadodara C - Vadodara E	2nd Line	-	-	-	-
Visakhapatnam Jn	Visakhaptnam Port	3.57	0	0	Visakhapatnam Jn - Visakhaptnam Port	2nd Line	-	-	-	-
Vriddhachalam Jn	Cuddalore Port Jn	57.59	0	0	Vriddhachalam Jn - Cuddalore Port Jn	Single Line	-	-	-	-
Warsamedi	Bhimasar	10.27	0	0	Warsamedi - Bhimasar	Single Line	-	-	-	-
Warsamedi	Gandhidham JN	10.30	0	0	Warsamedi - Gandhidham JN	Single Line	-	-	-	-
Yerraguntala Jn	Banganapalle	93.07	0	0	Yerraguntala Jn - Banganapalle	Single Line	-	-	-	2nd Line with Normal Signalling
Banganapalle	Nandyal	29.96	0	0	Yerraguntala Jn - Banganapalle	Single Line	-	-	-	2nd Line with Normal Signalling
Badnera Jn	New Amravati	9.14	CR	BSL	Badnera Junction - Amravati (Terminal)	Single Line	-	-	-	-
Chandur Bazar	Badnera Jn	42.76	CR	BSL	Badnera Junction - chandur Bazar	Single Line	-	-	-	2nd Line with Normal Signalling
Chalisgaon jn	Dhule	57.41	CR	BSL	Chalisgaon Junction - Dhule	Single Line	-	-	-	-
Khamgaon	Jalamb jn	11.86	CR	BSL	Jalamb Junction - Khamgaon	Single Line	-	-	-	-
Murtajapur Jn	Achalpur	78.09	CR	BSL	Murtizapur - Achalpur	Single Line	-	-	-	-
Murtajapur Jn	Karanja	31.37	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Karanja	Karanja Town	1.41	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Karanja Town	Darwha Moti Bagh	38.08	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Darwha Moti Bagh	Yavatmal	40.65	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Wardha Jn	Yavatmal	65.66	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Pusad	Darwha Moti Bagh	58.47	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Pusad	Maltekdi	90.75	CR	BSL	Murtizapur - Yavatmal	Single Line	-	-	-	-
Bhagdara	Jamner	8.25	CR	BSL	Pachora - Jamner	Single Line	-	-	-	-
Pachora jn	Bhagdara	0.00	CR	BSL	Pachora - Jamner	Single Line	-	-	-	-
Belapur	Panvel Jn	10.89	CR	CSTM	Belapur - Panvel	2nd Line	4th Line with TCAS Signalling	-	6th Line with TCAS Signalling	-

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Panvel Jn	Diva Jn	26.01	CR	CSTM	Diva - Panvel	2nd Line	3rd Line with TCAS Signalling	-	-	-
Jasai	Uran City	10.69	CR	CSTM	Jasai Chirle - Uran City	2nd Line	-	-	-	-
Karjat Jn	Khopoli	14.76	CR	CSTM	Karjat Junction - Khopoli	Single Line	-	-	-	-
Kurla Jn	Mankhurd	6.30	CR	CSTM	Kurka - Mankhurd	2nd Line	6th Line with TCAS Signalling	-	More than 6th Line with TCAS Signalling	-
Mankhurd	Vashi	7.33	CR	CSTM	Mankhurd - Vashi	2nd Line	6th Line with TCAS Signalling	-	More than 6th Line with TCAS Signalling	-
Neral jn	Matheran	8.83	CR	CSTM	Neral Junction - Matheran	Single Line	-	-	-	-
Karjat Jn	Panvel Jn	27.44	CR	CSTM	Panvel - Karjat junction	Single Line	2nd Line with TCAS Signalling	-	-	-
Panvel Jn	Pen	34.28	CR	CSTM	Panvel - PEN	2nd Line	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling	-
Kasu	Roha	26.28	CR	CSTM	PEN - Roha	2nd Line	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling	-
Pen	Kasu	13.57	CR	CSTM	PEN - Roha	2nd Line	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling	-
Pen	Rashtriya Chemicals & Fertilizers, Thal Vaishet	28.90	CR	CSTM	PEN - THAL	Single Line	-	-	-	-
Turbhe	Thane Jn	13.55	CR	CSTM	Thane - Turbhe	2nd Line	-	-	6th Line with TCAS Signalling	-
Turbhe	Nerul	4.96	CR	CSTM	Turbhe - Nerul	2nd Line	-	-	-	-
Vashi	Turbhe	2.56	CR	CSTM	Turbhe - Vashi	2nd Line	-	-	6th Line with TCAS Signalling	-
Diva Jn	Vasai Road Jn	43.00	CR	CSTM	Vasai Road - Diva	2nd Line	2nd Line with TCAS Signalling	-	-	3rd Line with TCAS Signalling
Vashi	Belapur	9.04	CR	CSTM	Vashi - Belapur	2nd Line	6th Line with TCAS Signalling	-	-	More than 6th Line with TCAS Signalling
Narkher	Chandur Bazar	94.95	CR	NGP	CNDB - NRKR	Single Line	-	-	-	2nd Line with Normal Signalling
Wani Jn	Majri Jn	13.75	CR	NGP	Majri Junction - WANI	Single Line	-	-	-	2nd Line with Normal Signalling
Pulgaon Jn	Arvi	34.47	CR	NGP	Pulgaon Junction - ARVI(NG)	Single Line	-	-	-	-

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Pimpalkuti	Wani Jn	65.50	CR	NGP	WANI - Pimpal Khuti	Single Line	-	-	-	2nd Line with Normal Signalling
Baramati	Daund jn	42.94	CR	PUNE	Daund Junction - Baramati	Single Line	-	-	2nd Line with Normal Signalling	-
Lonand	Phaltan	24.72	CR	PUNE	Daund Junction - Baramati	Single Line	-	-	2nd Line with Normal Signalling	-
Shri Chhatrapati Shahu Maharaj Terminus, Kolhapur	Miraj Jn	45.93	CR	PUNE	Miraj Junction - Kolahpur	Single Line	-	-	-	-
Ahmadnagar	Beed	141.06	CR	SUR	Ahmadnagar - Parli Vaijnath	Single Line	-	-	2nd Line with Normal Signalling	-
Parli Vaijnath	Beed	91.99	CR	SUR	Ahmadnagar - Parli Vaijnath	Single Line	-	-	2nd Line with Normal Signalling	-
Belapur	Harigaon	9.02	CR	SUR	Daund Junction - Manmad Junction	Single Line	2nd Line with TCAS Signalling	-	-	3rd Line with TCAS Signalling
Kurduvadi Jn	Barsi Town	36.92	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2nd Line with Normal Signalling	-
Barsi Town	Pangri	19.75	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2nd Line with Normal Signalling	-
Harangul	Latur	8.89	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2nd Line with Normal Signalling	-
Yedshi	Harangul	58.23	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2nd Line with Normal Signalling	-
Latur	Latur Road Jn	32.99	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2nd Line with Normal Signalling	-
Pangri	Usmanabad	16.00	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2nd Line with Normal Signalling	-
Usmanabad	Yedshi	11.82	CR	SUR	Kurduvadi Junction - Latur Road	Single Line	-	-	2nd Line with Normal Signalling	-
Kurduvadi Jn	Pandharpur	52.79	CR	SUR	Kurduvadi Junction - Pandharpur	Single Line	-	-	2nd Line with Normal Signalling	-
Pandharpur	Miraj Jn	135.35	CR	SUR	Pandharpur - Miraj Junction	Single Line	-	-	2nd Line with Normal Signalling	-
Puntamba Jn	Sainagar Shirdi	17.06	CR	SUR	Puntamba Junction - Shirdi	Single Line	-	-	-	-
Bhadrak	Bhatatira	6.91	ECOR	KUR	Bhatatira - Bhadrak	2nd Line	-	-	-	-
Bhatatira	Dhamra	53.18	ECOR	KUR	Bhatatira - Dhamara Terminal	Single Line	-	-	-	-
Budhapank	Baghuapal	93.48	ECOR	KUR	Budhapank - Baghuapal	Single Line	-	-	-	-
Charbatia	Salegaon	4.71	ECOR	KUR	Charbatia - Nergundi	4th Line	-	-	-	-

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Salegaon	Nergundi Jn	4.29	ECOR	KUR	Charbatia - Nergundi	2nd Line	4th Line with Normal Signalling	-	-	-
Kendrapara	Paradeep	37.84	ECOR	KUR	Haridaspur-Paradeep	Single Line	2nd Line with TCAS Signalling	-	-	4th Line with TCAS Signalling
Kendrapara	Haridaspur	37.84	ECOR	KUR	Haridaspur-Paradeep	Single Line	2nd Line with TCAS Signalling	-	-	4th Line with TCAS Signalling
Begunia	Khurda Road Jn	32.18	ECOR	KUR	Khurda Road - Nayagrah Town	Single Line	2nd Line with Normal Signalling	-	-	-
Bolagarh	Raj Sunakhala	7.51	ECOR	KUR	Khurda Road - Nayagrah Town	2nd Line	-	-	-	-
Raj Sunakhala	Begunia	9.52	ECOR	KUR	Khurda Road - Nayagrah Town	Single Line	2nd Line with Normal Signalling	-	-	-
Nayagarh New	Bolagarh	18.23	ECOR	KUR	Khurda Road - Nayagrah Town	Single Line	2nd Line with Normal Signalling	-	-	-
Nayagarh New	Boudh	131.68	ECOR	KUR	Khurda Road - Nayagrah Town	Single Line	2nd Line with Normal Signalling	-	-	-
Khurda Road Jn	Puri	44.42	ECOR	KUR	Khurda Road - Puri	2nd Line	-	-	-	-
Machapur Jn	Charbatia	15.04	ECOR	KUR	Rajathgarh - Charbatia	4th Line	-	-	-	-
Ranital Jn Cabin	Bhatatira	8.96	ECOR	KUR	Ranital Link Cabin - Bhatatira	2nd Line	-	-	-	-
Salegaon	Kapilas Road Jn	3.96	ECOR	KUR	Salegaon - Kapilas Road	2nd Line	-	-	-	-
Sukinda Road	Jajpur Keonjhar	11.04	ECOR	KUR	Sukinda Road - Jajpur Keonjhar Road (Bypass)	2nd Line	-	-	-	-
Talcher Jn Cabin	Talcher	5.81	ECOR	KUR	Talcher - Budhapank	2nd Line	4th Line with TCAS Signalling	-	-	-
Bimalgarh Jn	Talcher	141.21	ECOR	KUR	Talcher - Budhapank	Single Line	4th Line with TCAS Signalling	-	-	-
Tomka Jn	Daltari	8.18	ECOR	KUR	Tomka - Daitari	Single Line	-	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling
Lanjigarh Road Jn	Bhawanipatha	29.67	ECOR	SBP	Lanjigarh Road - Junagarh	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
Bhawanipatha	Junagarh Road	24.83	ECOR	SBP	Lanjigarh Road - Junagarh	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
Sonepur	Boudh	48.24	ECOR	SBP	Sonepur - Balangir Road PH	Single Line	-	-	-	-
Sonepur	Balangir Road PH	47.61	ECOR	SBP	Sonepur - Balangir Road PH	Single Line	-	-	-	-
Duvada	NTPC Simhadri TPS	22.63	ECOR	WAT	Duvvada - NTPC	Single Line	-	-	-	-
Duvada	Vadlapudi	2.85	ECOR	WAT	Duvvada - Vadlapudi	Single Line	-	-	-	-

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Vadlapudi	Gate Jn Cabin	7.62	ECOR	WAT	Gate Jnc. Cabin - Vadlapudi	3rd Line	-	-	-	-
Gopalapatnam	WMY OEC	6.10	ECOR	WAT	Gopalpatnam - WMY	2nd Line	-	-	-	-
Dalli Rajhara	Rowghat	85.27	ECOR	WAT	Jagdalpur - Durg	Single Line	-	-	-	2nd Line with Normal Signalling
Jagdalpur	Rowghat	135.58	ECOR	WAT	Jagdalpur - Durg	Single Line	-	-	-	2nd Line with Normal Signalling
Duvada	Jaggayapalem	8.07	ECOR	WAT	Jaggayyapalem - Duvvada	2nd Line	-	-	-	-
Jaggayapalem	Gopalapatnam	1.66	ECOR	WAT	Jaggayyapalem - Gopalpatnam	2nd Line	-	-	-	-
Naupada Jn	Parlakhemundi PH	39.56	ECOR	WAT	Naupada - Gunupur	Single Line	-	-	-	-
Gunupur	Parlakhemundi PH	52.29	ECOR	WAT	Naupada - Gunupur	Single Line	-	-	-	-
Duvada	Simhachalam North Jn	8.15	ECOR	WAT	Simhachalam North - Duvvada (By - Pass)	2nd Line	2nd Line with TCAS Signalling	-	-	-
Jaggayapalem	Simhachalam North Jn	1.90	ECOR	WAT	Simhachalam North - Jaggayyapalem	3rd Line	-	-	-	-
Simhachalam North Jn	WMY OEC	8.83	ECOR	WAT	Simhachalam North - WMY/OEC	3rd Line	-	-	-	-
Jaggayapalem	Vadlapudi	7.73	ECOR	WAT	Vadlapudi - Jaggayyapalem	3rd Line	-	-	-	-
Gate Jn Cabin	Visakhapatnam Steel Plant Sdg	4.00	ECOR	WAT	VSPS - Gate Jnc. Cabin	3rd Line	-	-	-	-
Jehanabad	Patna Jn	45.53	ECR	DHN	Barwadih - Garwa Road	2nd Line	-	-	2nd Line with TCAS Signalling	-
Gaya Jn	Jehanabad	47.50	ECR	DHN	Barwadih - Garwa Road	2nd Line	-	-	2nd Line with TCAS Signalling	-
Bhandaridah	Jarangdih	13.48	ECR	DHN	Bhandaridah - Jarangdih	3rd Line	-	-	-	-
Chandrapura Jn	Bhandaridah	6.59	ECR	DHN	Chandrapura - Bhandaridah	2nd Line	-	-	-	-
Chandrapura Jn	Rajabera	6.08	ECR	DHN	Chandrapura - Rajabera	2nd Line	-	-	-	-
Dhanbad Jn	Kusunda Jn	3.26	ECR	DHN	Dhanbad - Katras Garh	3rd Line	3rd Line with TCAS Signalling	-	-	-
Katrasgarh Jn	Kusunda Jn	9.36	ECR	DHN	Dhanbad - Katras Garh	3rd Line	3rd Line with TCAS Signalling	-	-	-
Dugda Halt	Chandrapura Jn	4.13	ECR	DHN	Dugda - Chandrapura	Single Line	-	-	-	-
Gumia	Barkakana Jn	52.30	ECR	DHN	Gomia - Barkakana	2nd Line	-	-	-	-
Barkakana Jn	Mandu	29.86	ECR	DHN	Hazaribag Town - Barkakana	Single Line	-	-	-	2nd Line with TCAS Signalling

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Jamuniatanr H	Dugda Halt	3.74	ECR	DHN	Hazaribag Town - Barkakana	Single Line	-	-	-	2nd Line with TCAS Signalling
Hazaribagh Town	Mandu	27.44	ECR	DHN	Hazaribag Town - Barkakana	Single Line	-	-	-	2nd Line with TCAS Signalling
Jarangdih	Gumia	11.71	ECR	DHN	Jarangdih - Gomia	Single Line	-	-	-	-
Karaila Road Jn	Shaktinagar	31.21	ECR	DHN	Karaila Road - Shaktinagar	2nd Line	-	-	-	-
Katrasgarh Jn	Phulwartanr	8.96	ECR	DHN	Katras Garh - Phulwaritanr	3rd Line	-	-	-	-
Hazaribagh Town	Koderma Jn	80.36	ECR	DHN	Koderma - Hazaribag Town	Single Line	-	-	-	-
Koderma Jn	Dhanwar	49.16	ECR	DHN	Koderma - Kanwar	Single Line	-	-	-	-
Kawar	Girigdih	49.16	ECR	DHN	Koderma - Kanwar	Single Line	-	-	-	-
Rema	Dhanwar	11.45	ECR	DHN	Koderma - Kanwar	Single Line	-	-	-	-
Rema	Kawar	25.17	ECR	DHN	Koderma - Kanwar	Single Line	-	-	-	-
NSC Bose Jn Gomoh	Chandrapura Jn	16.74	ECR	DHN	N.S.C.B.Gomoh - Chandrapura	2nd Line	-	-	-	-
Phulwartanr	Jamuniatanr H	4.58	ECR	DHN	Phulwartanr - Jamuniatanr	3rd Line	-	-	-	-
Bhandaridah	Rajabera	3.60	ECR	DHN	Rajabera - Bhandaridah	2nd Line	-	-	-	-
Rajgir	Bihar Sharif	23.52	ECR	DNR	Bakhtiyarpur - Rajgir	2nd Line	-	-	-	-
Dekpura Halt	Bakhtiyarpur Jn	23.41	ECR	DNR	Bakhtiyarpur - Rajgir	2nd Line	-	-	-	-
Bihar Sharif	Dekpura Halt	5.89	ECR	DNR	Bakhtiyarpur - Rajgir	2nd Line	-	-	-	-
Dekpura Halt	Daniyawan jn	33.12	ECR	DNR	Daniawan-Biharshariff	Single Line	-	-	-	-
Dildarnagar Jn	Tarighat	19.64	ECR	DNR	Dildarnagar - Tarighat	2nd Line	-	-	-	-
Fatuha Jn	Daniyawan jn	9.43	ECR	DNR	Fatuha - Islampur	Single Line	-	-	2nd Line with Normal Signalling	-
Daniyawan jn	Islampur	33.36	ECR	DNR	Fatuha - Islampur	Single Line	-	-	2nd Line with Normal Signalling	-
Natesar	Islampur	20.97	ECR	DNR	Fatuha - Islampur	Single Line	-	-	2nd Line with Normal Signalling	-
Sonpur Jn	Paleza Ghat	3.48	ECR	DNR	Pahlezaghat - Phulwarishariff	Single Line	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling
Digha Ghat	Sonpur Jn	10.89	ECR	DNR	Pahlezaghat-Phulwarishariff	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Digha Ghat	Patliputra	4.85	ECR	DNR	Pahlezaghat-Phulwarishariff	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Digha Ghat	Patna Jn	7.25	ECR	DNR	Patna - Digha Ghat	Single Line	-	-	2nd Line with Normal Signalling	-
Patna Saheb	Patna Ghat	5.15	ECR	DNR	Patna Saheb - Patna Ghat	Single Line	-	-	-	-

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Rampur Dumra Jn	Hatidah Jn Upper	4.60	ECR	DNR	Rajendrapul - Rampur Dumra	2nd Line	-	-	3rd Line with TCAS Signalling	-
Natesar	Rajgir	17.60	ECR	DNR	Rajgir - Tilaiya	Single Line	-	-	2nd Line with Normal Signalling	-
Natesar	Tilaiya Jn	28.34	ECR	DNR	Rajgir - Tilaiya	Single Line	-	-	2nd Line with Normal Signalling	-
Hatidah Jn Upper	Rajendra pul	3.39	ECR	DNR	Tall - Rajendrapul	2nd Line	-	-	3rd Line with TCAS Signalling	4th Line with TCAS Signalling
Tall Jn	Hatidah Jn Upper	5.30	ECR	DNR	Tall - Rajendrapul	2nd Line	-	-	3rd Line with TCAS Signalling	4th Line with TCAS Signalling
Ara Jn	Sasaram Jn	97.37	ECR	MGS	Ara - Sasaram	Single Line	-	-	-	2nd Line with TCAS Signalling
Dinkar Gram Simaria	Barauni Jn	5.62	ECR	SEE	Barauni - Simaria	3rd Line	-	-	3rd Line with TCAS Signalling	4th Line with TCAS Signalling
Sahebpur Kamal Jn	Sabdalpur	4.71	ECR	SEE	Sahibpur Kamal - Sabdalpur	Single Line	-	-	2nd Line with Normal Signalling	-
Monghyr	Sabdalpur	5.78	ECR	SEE	Sahibpur Kamal - Sabdalpur	Single Line	-	-	2nd Line with Normal Signalling	-
Banmankhi Jn	Barhara Kothi	15.64	ECR	SPJ	Banmankhi - Bihariganj	Single Line	-	-	-	-
Barhara Kothi	Bihariganj	12.00	ECR	SPJ	Banmankhi - Bihariganj	Single Line	-	-	-	-
Darbhanga Jn	Sakri Jn	19.89	ECR	SPJ	Darbhanga - Sakri	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Laukaha Bazar	Jhanjharpur Jn	43.63	ECR	SPJ	Laukaha Bazar - Jhanjharpur	2nd Line	-	-	-	-
Simri Bakhtiyarpur	Fungo Halt	11.58	ECR	SPJ	Mansi - Saharsa	Single Line	-	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling
Fungo Halt	Mansi Jn	14.13	ECR	SPJ	Mansi - Saharsa	Single Line	-	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling
Saharsa Jn	Simri Bakhtiyarpur	17.15	ECR	SPJ	Mansi - Saharsa	Single Line	-	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling
Jubbasahani	Muzaffarpur Jn	10.94	ECR	SPJ	Muzaffarpur - Sitamarhi	Single Line	-	-	-	-
Sitamarhi Jn	Jubbasahani	54.88	ECR	SPJ	Muzaffarpur - Sitamarhi	Single Line	-	-	-	-
Chhapra Kacheri jn	Vaishali	46.05	ECR	SPJ	Muzaffarpur - Sitamarhi	Single Line	-	-	-	-
Sapaul	Saharsa Jn	27.86	ECR	SPJ	Saharsa - Narpatganj	2nd Line	-	-	-	2nd Line with TCAS Signalling
Sapaul	Narpalganj	67.21	ECR	SPJ	Saharsa - Narpatganj	2nd Line	-	-	-	2nd Line with TCAS Signalling
Saharsa Jn	Dauram Madhepura	20.93	ECR	SPJ	Saharsa - Purnia Court	Single Line	-	-	-	2nd Line with Normal Signalling

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Banmankhi Jn	Dauram Madhepura	43.02	ECR	SPJ	Saharsa - Purnia Court	Single Line	-	-	-	2nd Line with Normal Signalling
Purnea Court	Banmankhi Jn	32.07	ECR	SPJ	Saharsa - Purnia Court	Single Line	-	-	-	2nd Line with Normal Signalling
Sakri Jn	Benipur Halt	19.95	ECR	SPJ	Sakri - Biraul	Single Line	-	-	-	-
Benipur Halt	Biraul	15.63	ECR	SPJ	Sakri - Biraul	Single Line	-	-	-	-
Bithan	Biraul	30.83	ECR	SPJ	Sakri - Biraul	Single Line	-	-	-	-
Hasanpur Road	Biraul	15.63	ECR	SPJ	Sakri - Biraul	Single Line	-	-	-	-
Sakri Jn	Madhubani	17.22	ECR	SPJ	Sakri - Jaynagar	Single Line	-	2nd Line with Normal Signalling	-	-
Madhubani	Jaynagar	31.65	ECR	SPJ	Sakri - Jaynagar	Single Line	-	2nd Line with Normal Signalling	-	-
Jhanjharpur Jn	Sakri Jn	20.16	ECR	SPJ	Sakri - Nirmali	2nd Line	-	-	-	-
Jhanjharpur Jn	Nirmali	32.28	ECR	SPJ	Sakri - Nirmali	2nd Line	-	-	-	-
Hasanpur Road	Samastipur Jn	46.04	ECR	SPJ	Samastipur - Khagaria	Single Line	-	-	2nd Line with Normal Signalling	-
Hasanpur Road	Khagaria Jn	40.73	ECR	SPJ	Samastipur - Khagaria	Single Line	-	-	2nd Line with Normal Signalling	-
Tapasi	Andal Jn	11.99	ER	ASN	ANDAL - SONACHARA - TOPSI	3rd Line	-	-	-	3rd Line with TCAS Signalling
Sitarampur Jn	Barabani	13.62	ER	ASN	BARABANI - SITARAMPUR	2nd Line	-	-	-	-
Bhimgara Jn	Palasthali	27.62	ER	ASN	BHIMGARH - PALASTHALI	Single Line	-	-	-	-
Banka	Karjhusa	16.13	ER	ASN	DEOGHAR - BANKA	Single Line	-	-	-	-
Katuria	Deoghar	29.35	ER	ASN	DEOGHAR - BANKA	Single Line	-	-	-	-
Deoghar	Mohanpur	9.90	ER	ASN	DEOGHAR - DUMKA	Single Line	-	-	-	-
Jasidih Jn	Baidyanath dham	6.68	ER	ASN	JASIDIH - BAIDYANATHDHAM	Single Line	-	-	-	-
Jasidih Jn	Deoghar	6.44	ER	ASN	JASIDIH-DEOGHAR	Single Line	-	-	-	-
Giridih	Madhupur Jn	38.17	ER	ASN	MADHUPUR - GIRIDIH	Single Line	-	-	-	-
Siuri	Prantik	27.49	ER	ASN	Siuri - Prantik	Single Line	-	-	-	-
Tapasi	Barabani	15.80	ER	ASN	TOPASI - BARABANI (via IKRA)	Single Line	-	-	-	-
Ahmadpur Jn	Ambalgram	46.39	ER	HWH	AHMEDPUR - KATWA	Single Line	2nd Line with Normal Signalling	-	-	-
Arambag	Panskura Jn	61.91	ER	HWH	Arambag - Panskura Jn	Single Line	-	-	-	2nd Line with Normal Signalling
Goghai	Arambag	9.54	ER	HWH	ARAMBAGH - GOGHAT	2nd Line	-	-	-	-

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Nalhati Jn	Azimganj	47.34	ER	HWH	AZIMGANJ - NALHATI	3rd Line	-	-	-	3rd Line with TCAS Signalling
Naihati Jn	Bandel Jn	7.59	ER	HWH	BANDEL - NAIHATI	3rd Line	-	3rd Line with TCAS Signalling	-	-
Bandel Jn	Magra	6.80	ER	HWH	BANDEL - SAKTIGARH	3rd Line	-	-	-	-
Saktigarh Jn	Memari	12.55	ER	HWH	BANDEL - SAKTIGARH	3rd Line	-	-	-	-
Magra	Memari	36.16	ER	HWH	BANDEL - SAKTIGARH	3rd Line	-	-	-	-
Barddhaman Jn	Shrikhanda	49.25	ER	HWH	BARDDHAMAN - KATWA	2nd Line	-	-	-	-
Seoraphuli Jn	Bally	14.03	ER	HWH	BELUR - SEORAPHULI	3rd Line	-	-	3rd Line with TCAS Signalling	-
Bhattanagar	Dankuni Jn	5.37	ER	HWH	DUNKUNI CCLW - BHATTANAGAR	2nd Line	-	-	-	-
Liluah	Belur	1.34	ER	HWH	LILUAH - BELUR MATH	4th Line	-	-	-	-
Belur	Belur Math	1.45	ER	HWH	LILUAH - BELUR MATH	2nd Line	4th Line with Normal Signalling	-	-	-
Liluah	Belur Math	1.55	ER	HWH	LILUAH - BELUR MATH	2nd Line	4th Line with Normal Signalling	-	-	-
Rampurhat Jn	Dumka Jn	64.42	ER	HWH	RAMPURHAT DUMKA	Single Line	-	-	-	-
Seoraphuli Jn	Bandel Jn	17.92	ER	HWH	SEORAPHULI - BANDEL	3rd Line	-	-	3rd Line with TCAS Signalling	4th Line with TCAS Signalling
Kamarkundu Jn	Seoraphuli Jn	14.52	ER	HWH	SEORAPHULI - TARAKESWAR	2nd Line	-	-	-	-
Tarakeshwar	Kamarkundu Jn	21.53	ER	HWH	SEORAPHULI - TARAKESWAR	2nd Line	-	-	-	-
Shrikhanda	Katwa Jn	6.26	ER	HWH	SRIPAT SRIKHANDA - KATWA	2nd Line	-	-	-	-
Arambag	Tarakeshwar	24.78	ER	HWH	TARAKESWAR - ARAMBAGH	2nd Line	-	-	-	-
Banka	Barahat Jn	15.87	ER	MLDT	BARAHAT - BANKA	Single Line	-	-	-	-
Hansdiha	Barahat Jn	37.25	ER	MLDT	BARAHAT - HANSDIHA - DUMKA	Single Line	-	-	-	2nd Line with Normal Signalling
Barapalasi	Dumka Jn	13.92	ER	MLDT	BARAHAT - HANSDIHA - DUMKA	Single Line	-	-	-	2nd Line with Normal Signalling
Hansdiha	Bhaturia	12.22	ER	MLDT	BARAHAT - HANSDIHA - DUMKA	Single Line	-	-	-	2nd Line with Normal Signalling
Mohanpur	Dumka Jn	56.19	ER	MLDT	BARAHAT - HANSDIHA - DUMKA	Single Line	-	-	-	2nd Line with Normal Signalling

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Bhagalpur Jn	Barahat Jn	37.45	ER	MLDT	BHAGALPUR - BARAHAT	Single Line	-	-	-	2nd Line with Normal Signalling
BoniDanga Link Cabin	Barharwa Jn	5.21	ER	MLDT	BONIDANDA LINK - BARHARWA	2nd Line	-	-	-	-
BoniDanga	New Farakka Jn	12.70	ER	MLDT	BONIDANGA - NEW FARAKKA	2nd Line	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling	4th Line with TCAS Signalling	-
Karjhusa	Katuria	8.90	ER	MLDT	DEOGHAR-BANKA	Single Line	-	-	-	-
Monghyr	Jamalpur Jn	9.67	ER	MLDT	JAMALPUR - MUNGER	Single Line	-	2nd Line with Normal Signalling	-	-
Godda	Pirpainti	62.25	ER	MLDT	Pirpainti - Hansdiha	Single Line	-	-	-	2nd Line with Normal Signalling
Godda	Hansdiha	28.50	ER	MLDT	Pirpainti - Hansdiha	Single Line	-	-	-	2nd Line with Normal Signalling
Tinpahar Jn	Rajmahal	11.73	ER	MLDT	TINPAHAR - RAJMAHAL	Single Line	-	-	2nd Line with Normal Signalling	-
Ballygunge Jn	Majerhat	5.94	ER	SDAH	BALLYGUNGE - MAJHERHAT(for passenger train)	2nd Line	-	-	-	-
Ballygunge Jn	Sonarpur Jn	10.54	ER	SDAH	BALLYGUNGE - SONARPUR	2nd Line	2nd Line with TCAS Signalling	-	-	-
Duttapukur	Barasat Jn	8.06	ER	SDAH	BARASAT - BONGAON	2nd Line	2nd Line with TCAS Signalling	-	3rd Line with TCAS Signalling	-
Barasat Jn	Sondalia	12.45	ER	SDAH	BARASAT - SONDALIA	2nd Line	-	-	-	-
Baruipur Jn	Diamond Harbour	35.77	ER	SDAH	BARUIPUR - DIAMONDHARBOUR	2nd Line	-	-	-	-
Baruipur Jn	Lakshmikantapur	37.53	ER	SDAH	BARUIPUR - LAKSHMIKANTAPUR	2nd Line	-	-	-	-
Barasat Jn	Hasnabad	56.61	ER	SDAH	CHAMPAPUKUR - HASNABAD	Single Line	2nd Line with Normal Signalling	-	-	-
Basirhat	Hasnabad	10.75	ER	SDAH	CHAMPAPUKUR - HASNABAD	2nd Line	-	-	-	-
Champapukur	Basirhat	6.60	ER	SDAH	CHAMPAPUKUR - HASNABAD	2nd Line	-	-	-	-
Barasat Jn	Dum Dum Jn	15.16	ER	SDAH	DUM DUM JN. - BARASAT	2nd Line	2nd Line with TCAS Signalling	-	-	4th Line with TCAS Signalling
Naihati Jn	Dum Dum Jn	31.61	ER	SDAH	DUM DUM JN. - BARRACKPORE	4th Line	4th Line with TCAS Signalling	6th Line with TCAS Signalling	-	-
Dankuni Jn	Dum Dum Jn	16.92	ER	SDAH	DUM DUM JN. - DANKUNI	2nd Line	-	-	2nd Line with TCAS Signalling	-
Dum Dum Jn	Kolkata Terminus	6.88	ER	SDAH	DUMDUM - KOLKATA	3rd Line	-	-	-	-

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Habra	Duttapukur	15.04	ER	SDAH	DUTTAPUKUR - HABRA	2nd Line	2nd Line with TCAS Signalling	-	3rd Line with TCAS Signalling	-
Bongaon Jn	Machlandapur	23.09	ER	SDAH	HABRA - BONGAON	2nd Line	2nd Line with TCAS Signalling	-	-	-
Machlandapur	Habra	9.53	ER	SDAH	HABRA - BONGAON	2nd Line	2nd Line with TCAS Signalling	-	-	-
Krishnanagar City Jn	Kalinarayanpur Jn	22.55	ER	SDAH	KALINARAYANPUR - KRISHNANAGAR	3rd Line	3rd Line with TCAS Signalling	-	-	-
Kalinarayanpur Jn	Shantipur	16.63	ER	SDAH	KALINARAYANPUR - SHANTIPUR	2nd Line	-	-	-	-
Ranaghat Jn	Kalyani	25.86	ER	SDAH	KALYANI - RANAGHAT	3rd Line	4th Line with TCAS Signalling	-	-	-
Kankurgachhi Jn	Ballygunge Jn	7.88	ER	SDAH	KANKURGACHHI - BALLYGUNGE	2nd Line	-	-	-	-
Dum Dum Jn	Kankurgachhi Jn	5.33	ER	SDAH	KANKURGACHI - DUM DUM JN.	4th Line	6th Line with TCAS Signalling	-	More than 6th Line with TCAS Signalling	-
Kolkata Terminus	Majerhat	13.19	ER	SDAH	KOLKATA - PRINCEP GHAT - MAJHERHAT	2nd Line	-	-	-	-
Murshidabad	Azimganj	6.58	ER	SDAH	KRISHNANAGAR - LALGOLA	2nd Line	3rd Line with Normal Signalling	-	3rd Line with TCAS Signalling	-
Krishnanagar City Jn	Murshidabad	98.86	ER	SDAH	KRISHNANAGAR - LALGOLA	3rd Line	-	-	3rd Line with TCAS Signalling	-
Lalgola	Murshidabad	31.65	ER	SDAH	KRISHNANAGAR - LALGOLA	3rd Line	-	-	3rd Line with TCAS Signalling	-
Nabadwip Dham	Krishnanagar City Jn	15.59	ER	SDAH	KRISHNANAGAR - NABADWIP GHAT	Single Line	2nd Line with Normal Signalling	-	-	-
Labutala	Champapukur	17.99	ER	SDAH	LABUTALA - CHAMPAPUKUR	2nd Line	-	-	-	-
Lakshmikantapur	Namkhana	48.02	ER	SDAH	LAKSHMIKANTAPUR - NAMKHANA	2nd Line	-	-	-	-
Majerhat	Komagata Maru Budge Budge	14.63	ER	SDAH	MAJHERHAT - BUDGE BUDGE	2nd Line	-	-	-	-
Kalyani	Naihati Jn	10.29	ER	SDAH	NAIHATI - KALYANI	3rd Line	4th Line with TCAS Signalling	-	-	-
Ranaghat Jn	Bongaon Jn	32.94	ER	SDAH	RANAGHAT - BONGAON	2nd Line	-	-	-	-
Ranaghat Jn	Gede	44.20	ER	SDAH	RANAGHAT - GEDE	2nd Line	4th Line with TCAS Signalling	-	-	-

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Kalinarayanpur Jn	Ranaghat Jn	4.72	ER	SDAH	RANAGHAT - KALINARAYANPUR	2nd Line	3rd Line with TCAS Signalling	4th Line with TCAS Signalling	-	-
Krishnanagar City Jn	Shantipur	15.55	ER	SDAH	SANTIPUR - KRISHNANAGAR	2nd Line	-	-	-	-
Kankurgachhi Jn	Sealdah	1.86	ER	SDAH	SEALDAH - KANKURGACHHI	4th Line	6th Line with TCAS Signalling	-	-	-
Sealdah	Ballygunge Jn	6.13	ER	SDAH	SEALDAH (SOUTH) - BALLYGUNGE	4th Line	4th Line with TCAS Signalling	-	-	-
Sonarpur Jn	Baruipur Jn	9.06	ER	SDAH	SONARPUR - BARUIPUR	2nd Line	2nd Line with TCAS Signalling	-	-	-
Sonarpur Jn	Kalikapur FS	6.14	ER	SDAH	SONARPUR - CANNING	2nd Line	-	-	-	-
Kalikapur FS	Canning	24.15	ER	SDAH	SONARPUR - CANNING	2nd Line	-	-	-	-
Sondalia	Labutala	6.36	ER	SDAH	SONDALIA - LABUTALA	2nd Line	-	-	-	-
Madgaon Jn	Karwar	59.69	KR	KAWR	Madgaon - Tokur	Single Line	2nd Line with Normal Signalling	-	-	-
Sawantwadi Road	Karmali	47.11	KR	RN	ROHA - Madgaon	Single Line	2nd Line with Normal Signalling	-	3rd Line with TCAS Signalling	-
Karmali	Majorda Jn	20.76	KR	RN	ROHA - Madgaon	Single Line	2nd Line with Normal Signalling	-	3rd Line with TCAS Signalling	-
Ratnagiri	Nivasar	15.15	KR	RN	ROHA - Madgaon	Single Line	2nd Line with Normal Signalling	-	3rd Line with TCAS Signalling	-
Nivasar	Sindhudurg	113.20	KR	RN	ROHA - Madgaon	Single Line	2nd Line with Normal Signalling	-	3rd Line with TCAS Signalling	-
Sindhudurg	Sawantwadi Road	31.07	KR	RN	ROHA - Madgaon	Single Line	2nd Line with Normal Signalling	-	3rd Line with TCAS Signalling	-
Roha	Indapur	23.85	KR	RN	ROHA - Madgaon	Single Line	2nd Line with Normal Signalling	-	3rd Line with TCAS Signalling	-
Indapur	Chiplun	103.23	KR	RN	ROHA - Madgaon	Single Line	2nd Line with Normal Signalling	-	3rd Line with TCAS Signalling	-
Chiplun	Ratnagiri	75.67	KR	RN	ROHA - Madgaon	Single Line	2nd Line with Normal Signalling	-	3rd Line with TCAS Signalling	-
Bharatpur Jn	Achhnera Jn	27.79	NCR	AGC	Achnera - Bharatpur	2nd Line	-	-	-	-
Agra Cantt Jn	Achhnera Jn	23.28	NCR	AGC	Achnera - Idgah	2nd Line	-	-	-	-
Alwar Jn	Mathura Jn	121.79	NCR	AGC	Alwar - Mathura	2nd Line	-	-	-	-
Idgah Agra Jn	Agra Cantt Jn	1.63	NCR	AGC	Bayana - Idgah	2nd Line	-	-	-	2nd Line with TCAS Signalling

NODE_A	NODE_B	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	New Proposed Configuration 26	New Proposed Configuration 31	New Proposed Configuration 41	New Proposed Configuration 51
Bayana Jn	Agra Cantt Jn	81.08	NCR	AGC	Bayana - Idgah	2nd Line	-	-	-	2nd Line with TCAS Signalling
Bharatpur Jn	Bandikui Jn	97.49	NCR	AGC	Bharatpur - Bandikui	2nd Line	-	-	-	-
Yamuna Bridge	Idgah Agra Jn	4.61	NCR	AGC	Idgah - Agra Fort - Yamuna /Bridge/w	2nd Line	-	-	2nd Line with TCAS Signalling	-
Achhnera Jn	Mathura Jn	35.30	NCR	AGC	Mathura - Achnera	Single Line	-	-	-	-
Raja Ki Mandi	Yamuna Bridge	4.53	NCR	AGC	Raja ki Mandi - Agra City Yamuna Bridge/W	2nd Line	-	-	-	-
Tundla Jn	Yamuna Bridge	20.52	NCR	AGC	Yamuna Bridge/ Tundla	2nd Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Aligarh Jn	Harduaganj	13.25	NCR	ALD	Aligarh Jn. - Harduaganj	2nd Line	-	-	-	-
Barhan Jn	Etah	58.28	NCR	ALD	Barhan - Etah	Single Line	-	-	-	-
Hathras Jn	Hathras Quila	8.91	NCR	ALD	Hathras - Hathras Fort	Single Line	-	-	-	-
Farrukhabad Jn	Mainpuri	59.48	NCR	ALD	Sikohabad - Farrukhabad	Single Line	-	-	-	2nd Line with Normal Signalling
Mainpuri	Shikohabad Jn	47.42	NCR	ALD	Sikohabad - Farrukhabad	Single Line	-	-	-	2nd Line with Normal Signalling
Banda	Khairar Jn	10.65	NCR	JHS	BZM - BNDA	2nd Line	-	-	-	-
Ghatampur	Bhimsen Jn	32.65	NCR	JHS	BZM - BNDA	2nd Line	-	-	-	-
Khairar Jn	Ghatampur	86.41	NCR	JHS	BZM - BNDA	2nd Line	-	-	-	-
Mainpuri	Etawah	55.32	NCR	JHS	Etawah-MNQ	Single Line	-	-	-	-
Etawah	Udi	12.70	NCR	JHS	ETW - BLNR	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Bhind	Udi	23.80	NCR	JHS	ETW - BLNR	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Gwalior jn	Bhind	83.11	NCR	JHS	ETW - BLNR	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Jhansi Jn	Mau Ranipur	64.01	NCR	JHS	JHS - BNDA	2nd Line	-	-	-	-
Mau Ranipur	Harpalpur	20.89	NCR	JHS	JHS - BNDA	2nd Line	-	-	-	-
Mahoba Jn	Khairar Jn	43.00	NCR	JHS	JHS - BNDA	2nd Line	-	-	-	-
Harpalpur	Mahoba Jn	52.96	NCR	JHS	JHS - BNDA	2nd Line	-	-	-	-
Tikamgarh	Lalitpur Jn	51.21	NCR	JHS	LAR - Khajuraho	2nd Line	-	-	-	-
Chhattarpur	Tikamgarh	83.70	NCR	JHS	LAR - Khajuraho	Single Line	2nd Line with Normal Signalling	-	-	-
Chhattarpur	Khajuraho	31.41	NCR	JHS	LAR - Khajuraho	Single Line	2nd Line with Normal Signalling	-	-	-
Khajuraho	Mahoba Jn	63.27	NCR	JHS	MBA - Khajuraho	Single Line	-	-	-	-
Manikpur Jn	Chitrakot Dham Karwi	31.07	NCR	JHS	MKP - BNDA	2nd Line	-	-	-	-

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Chitrakot Dham Karwi	Banda	68.70	NCR	JHS	MKP - BNDA	2nd Line	-	-	-	-
Jaunpur Jn	Aunrihar Jn	58.75	NER	BSB	Aunrihar - Jaunpur	2nd Line	-	-	-	-
Indara Jn	Phephna Jn	51.03	NER	BSB	Indara - Phephna	2nd Line	-	-	-	-
Tamkuhi Road	Thawe Jn	36.34	NER	BSB	Kaptanganj - Thawe	Single Line	-	-	-	-
Padrauna	Tamkuhi Road	31.71	NER	BSB	Kaptanganj - Thawe	Single Line	-	-	-	-
Kaptanganj Jn	Padrauna	30.86	NER	BSB	Kaptanganj - Thawe	Single Line	-	-	-	-
Mau Jn	Azamgarh	43.71	NER	BSB	Mau - Shahganj	2nd Line	-	-	-	-
Azamgarh	Shahganj Jn	55.71	NER	BSB	Mau - Shahganj	2nd Line	-	-	-	-
Mau Jn	Ghazipur Ghat halt	40.79	NER	BSB	Mau Jn - Ghazipur Ghat halt	Single Line	-	-	-	-
Gopalganj	Masrakh	59.21	NER	BSB	Thawe - Chhapra	Single Line	-	-	-	-
Thawe Jn	Gopalganj	4.91	NER	BSB	Thawe - Chhapra	Single Line	-	-	-	-
Masrakh	Chhapra Kacheri jn	40.17	NER	BSB	Thawe - Chhapra	Single Line	-	-	-	-
Thawe Jn	Hathuwa	9.44	NER	BSB	Thawe - Siwan	2nd Line	-	-	-	-
Hathuwa	Siwan Jn	18.52	NER	BSB	Thawe - Siwan	2nd Line	-	-	-	-
Anand Nagar Jn	Nautanwa	40.52	NER	LJN	Anandnagar - Nautanwa	Single Line	-	-	-	-
Lucknow	Malhaur	12.40	NER	LJN	Lucknow - Malhaur	2nd Line	-	-	-	-
Mankapur Jn	Ayodhya Jn	37.36	NER	LJN	Mankapur - Ayodhya	Single Line	-	-	-	2nd Line with Normal Signalling
Bareilly City	Bhojipura Jn	16.47	NER	ZN	BARELLY CITY - LALKUA	Single Line	-	-	2nd Line with Normal Signalling	-
LalKuan Jn	Kiccha	17.85	NER	ZN	BARELLY CITY - LALKUA	Single Line	-	-	2nd Line with Normal Signalling	-
Bhojipura Jn	Pilibhit Jn	39.71	NER	ZN	BHOJIPURA - PILIBHIT	Single Line	-	-	-	-
Kasganj Jn	Farrukhabad Jn	107.52	NER	ZN	FARUKHABAD - KASGANJ	Single Line	-	-	2nd Line with Normal Signalling	-
Kasganj Jn	Etah	27.07	NER	ZN	FARUKHABAD - KASGANJ	Single Line	-	-	2nd Line with Normal Signalling	-
Badaun	Kasganj Jn	60.30	NER	ZN	KASGANJ - BAREILLY CITY	Single Line	-	-	-	-
Ramganga Bridge	Badaun	39.07	NER	ZN	KASGANJ - BAREILLY CITY	Single Line	-	-	-	-
Hathras Jn	Kasganj Jn	54.88	NER	ZN	KASGANJ - MATHURA	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Hathras Jn	Hathras City	8.79	NER	ZN	KASGANJ - MATHURA	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Mathura Jn	Hathras City	40.14	NER	ZN	KASGANJ - MATHURA	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling

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Kashipur Jn	Ramnagar	32.29	NER	ZN	KASHIPUR - RAMNAGAR	Single Line	-	-	-	-
Kashipur Jn	LalKuan Jn	57.84	NER	ZN	LALKUA - KASHIPUR	Single Line	-	-	-	-
LalKuan Jn	Kathgodam	21.90	NER	ZN	LALKUA - KATHGODAM	Single Line	-	-	-	2nd Line with Normal Signalling
Kashipur Jn	Moradabad Jn	49.53	NER	ZN	MORADABAD - KASHIPUR	Single Line	-	-	-	-
LalKuan Jn	Rudrapur	22.49	NER	ZN	RAMPUR - LALKUA	Single Line	-	-	-	-
Rudrapur	Rampur Jn	46.11	NER	ZN	RAMPUR - LALKUA	Single Line	-	-	-	-
Kannauj	Mandhana Jn	62.05	NER	ZN	RAWATPUR - FARUKHABAD	Single Line	-	-	2nd Line with Normal Signalling	-
Mandhana Jn	Rawatpur	12.28	NER	ZN	RAWATPUR - FARUKHABAD	Single Line	-	-	2nd Line with Normal Signalling	-
Farrukhabad Jn	Kannauj	59.07	NER	ZN	RAWATPUR - FARUKHABAD	Single Line	-	-	2nd Line with Normal Signalling	-
New Cooch Behar jn	Alipur Duar Jn	22.47	NFR	APDJ	ALIPURDUAR JN. - NEW COOCHBEHAR	Single Line	-	-	2nd Line with Normal Signalling	-
New Cooch Behar jn	Bamanhat	50.69	NFR	APDJ	NEW COOCHBEHAR - BAMANHAT	Single Line	-	-	-	-
New Mal Jn	New Domohani	40.29	NFR	APDJ	NEW MAL JN - CHANGRABANDHA	Single Line	-	-	2nd Line with Normal Signalling	-
New Domohani	New Changrabandha	24.11	NFR	APDJ	NEW MAL JN - CHANGRABANDHA	Single Line	-	-	2nd Line with Normal Signalling	-
Sivok	New Mal Jn	27.56	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
Rajabhatkhowa	New Mal Jn	103.70	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
Alipur Duar Jn	Rajabhatkhowa	11.46	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
Alipur Duar Jn	Samuktala Road	14.21	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
Siliguri Jn	Sivok	21.24	NFR	APDJ	SILIGURI JN - SAMUKTALA ROAD	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
New Changrabandha	New Maynaguri	21.77	NFR	APDJ	Y' LEG OF MAYNAGURI ROAD - JALPAIGURI ROAD - NEW DOMOHANI - NEW COOCH BEHAR	Single Line	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling	4th Line with TCAS Signalling	-
Raiganj	Barsoi Jn	22.47	NFR	KIR	BARSOI - RADHIKAPUR	Single Line	-	-	-	2nd Line with Normal Signalling

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Raiganj	Kaliyaganj	20.60	NFR	KIR	BARSOI - RADHIKAPUR	Single Line	-	-	-	2nd Line with Normal Signalling
Kaliyaganj	Radhikapur	12.45	NFR	KIR	BARSOI - RADHIKAPUR	Single Line	-	-	-	2nd Line with Normal Signalling
Buniadpur	Balurghat	45.30	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-
Raiganj	Itahar	19.90	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-
Buniadpur	Itahar	26.07	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-
Gazole	Itahar	26.57	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-
Buniadpur	Kaliyaganj	30.70	NFR	KIR	BUNIADPUR - BALURGHAT	Single Line	-	-	-	-
Gazole	Buniadpur	28.87	NFR	KIR	EKLAKHI - BUNIADPUR	Single Line	-	-	-	2nd Line with Normal Signalling
Eklakhi Jn	Gazole	13.41	NFR	KIR	EKLAKHI - BUNIADPUR	Single Line	-	-	-	2nd Line with Normal Signalling
Katihar Jn	Manihari	24.11	NFR	KIR	KATIHAR - MANIHARI	Single Line	-	-	-	-
Katihar Jn	Mukuria Jn	35.16	NFR	KIR	KATIHAR - MUKURIA	Single Line	-	-	-	2nd Line with Normal Signalling
Katihar Jn	Purnea Jn	28.55	NFR	KIR	KATIHAR - PURNEA	Single Line	-	-	2nd Line with TCAS Signalling	-
Manihari	Tejnarayanpur	5.93	NFR	KIR	MANIHARI - TEZNARAYANPUR	Single Line	-	-	-	-
New Jalpaiguri Jn	Siliguri Jn	6.33	NFR	KIR	NEW JALPAIGURI - DARJEELING	Single Line	-	-	-	-
Siliguri Jn	Darjeeling	54.97	NFR	KIR	NEW JALPAIGURI - DARJEELING	Single Line	-	-	-	-
Old Malda Jn	Singhabad	24.68	NFR	KIR	OLDMALDA - SINGHABAD	Single Line	-	-	-	-
Arariya	Arariya Court	4.53	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Arariya Court	Jalalgarh	20.21	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Jalalgarh	Purnea Jn	18.87	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Forbesganj Jn	Arariya	24.57	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling

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Forbesganj Jn	Bathnaha	6.18	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Bathnaha	Jogbani	6.68	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Arariya Court	Galgalia	90.05	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Kishanganj	Jalalgarh	48.47	NFR	KIR	PURNEA - JOGBANI	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Raninagar Jalpaiguri Jn	Haldibari	30.61	NFR	KIR	RANINAGAR JALPAIGURI - HALDIBARI	Single Line	-	-	-	-
Amoni	Silghat town	28.93	NFR	LMG	AMONI - SILGHAT	Single Line	-	-	-	-
Arunachal Jn	Jiribam	50.89	NFR	LMG	ARUNACHAL - JIRIBAM	Single Line	-	-	-	-
Imphal	Jiribam	97.04	NFR	LMG	ARUNACHAL - JIRIBAM	Single Line	-	-	-	-
Badarpur Jn	Karimganj Jn	20.48	NFR	LMG	BADARPUR - KARIMGANJ	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Badarpur Jn	Katakhal Jn	10.33	NFR	LMG	BADARPUR - KATAKHAL	Single Line	-	-	-	-
Baraigram Jn	Dharmanagar	43.74	NFR	LMG	BARAIGRAM - DHARMANAGAR	Single Line	-	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Baraigram Jn	Dullacherra	29.60	NFR	LMG	BARAIGRAM - DULLAVCHERA	Single Line	-	-	-	-
Chaparmukh Jn	Senchoa Jn	20.13	NFR	LMG	CHAPARMUKH - HAIBARGAON.	Single Line	-	-	-	-
Rangapara	Dekargaon	18.45	NFR	LMG	CHAPARMUKH - HAIBARGAON.	Single Line	-	-	-	-
Dharmanagar	Ambassa	74.35	NFR	LMG	DHARMANAGAR - AGARTALA	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Ambassa	Agartala	68.51	NFR	LMG	DHARMANAGAR - AGARTALA	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Belonia	Agartala	75.28	NFR	LMG	DHARMANAGAR - AGARTALA	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Rangapara	Balipara Jn	11.60	NFR	LMG	DIGARU - LUMDING	Single Line	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling	-
Balipara Jn	Harmurti Jn	138.69	NFR	LMG	DIGARU - LUMDING	Single Line	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling	-
Harmurti Jn	North Lakhimpur	31.71	NFR	LMG	DIGARU - LUMDING	Single Line	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling	-

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Senchoa Jn	mairabari	51.77	NFR	LMG	HAIBARGAON - MAIRABARI	Single Line	-	-	-	-
Balipara Jn	Bhalukpong	35.62	NFR	LMG	HAIBARGAON - MAIRABARI	Single Line	-	-	-	-
Karimganj Jn	Baraigram Jn	22.11	NFR	LMG	KARIMGANJ - BARAIGRAM	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Karimganj Jn	Maishashan	10.45	NFR	LMG	KARIMGANJ - MAISHASHAN	Single Line	-	-	-	-
Katakhal Jn	Arunachal Jn	13.50	NFR	LMG	KATAKHAL - ARUNACHAL	Single Line	-	-	-	-
Arunachal Jn	Silchar	6.22	NFR	LMG	KATAKHAL - ARUNACHAL	Single Line	-	-	-	-
Katakhal Jn	Hailakandi	19.06	NFR	LMG	KATAKHAL - BHAIRABI	Single Line	-	-	-	-
Hailakandi	Bhairabi	65.55	NFR	LMG	KATAKHAL - BHAIRABI	Single Line	-	-	-	-
Kawnpui	Bhairabi	31.92	NFR	LMG	KATAKHAL - BHAIRABI	Single Line	-	-	-	-
Lumdiong South	New Haflong	89.82	NFR	LMG	LUMDING - BADARPUR.	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
New Haflong	Badarpur Jn	69.40	NFR	LMG	LUMDING - BADARPUR.	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
North Lakhimpur	Dhemaji	71.39	NFR	LMG	LUMDING - FURKATING	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Dhemaji	Sisibargaon	19.43	NFR	LMG	LUMDING - FURKATING	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Sisibargaon	Murkong Selek	69.45	NFR	LMG	LUMDING - FURKATING	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Pasighat	Murkong Selek	33.33	NFR	LMG	LUMDING - FURKATING	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Rangiya Jn	Tangla	39.72	NFR	LMG	NEW GUWAHATI - DIGARU	2nd Line	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling	-
Tangla	Rangapara	88.57	NFR	LMG	NEW GUWAHATI - DIGARU	2nd Line	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling	-
Senchoa Jn	Nagaon	6.42	NFR	LMG	SENCHOA - SILGHAT TOWN	Single Line	-	-	-	-
Nagaon	Amoni	28.16	NFR	LMG	SENCHOA - SILGHAT TOWN	Single Line	-	-	-	-
Harmurti Jn	Naharlagun	20.16	NFR	LMG	SENCHOA - SILGHAT TOWN	Single Line	-	-	-	-

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Dudhnol Jn	Mendipathar	20.35	NFR	RNY	DUDHNOI - MENDIPATHAR	Single Line	-	-	-	-
Amguri Jn	Tuli	22.05	NFR	TSK	AMGURI - TULI	2nd Line	-	-	-	-
Ledo	Tirap sdg	3.47	NFR	TSK	LEDO - TIRAP	Single Line	-	-	-	-
Makum Jn	Rupai	19.06	NFR	TSK	MAKUM - DANGARI	Single Line	-	-	-	-
Rupai	Dangari	13.20	NFR	TSK	MAKUM - DANGARI	Single Line	-	-	-	-
Jorhat Town	Mariani Jn	17.02	NFR	TSK	MARIANI - JORHAT TOWN - FURKATING.	Single Line	-	-	-	-
Golaghat	Jorhat Town	62.54	NFR	TSK	MARIANI - JORHAT TOWN - FURKATING.	Single Line	-	-	-	-
Furkating Jn	Golaghat	7.04	NFR	TSK	MARIANI - JORHAT TOWN - FURKATING.	Single Line	-	-	-	-
Tinsukia Jn	Makum Jn	11.50	NFR	TSK	NEW TINSUKIA - LEDO	Single Line	-	-	-	-
Makum Jn	Ledo	47.46	NFR	TSK	NEW TINSUKIA - LEDO	Single Line	-	-	-	-
Dhamalgaon	Dibrugarh	14.09	NFR	TSK	SIMALUGURI - DIBRUGARH	Single Line	-	-	2nd Line with Normal Signalling	-
Sibsagar Town	Dhamalgaon	68.03	NFR	TSK	SIMALUGURI - DIBRUGARH	Single Line	-	-	2nd Line with Normal Signalling	-
Simaluguri Jn	Sibsagar Town	16.82	NFR	TSK	SIMALUGURI - DIBRUGARH	Single Line	-	-	2nd Line with Normal Signalling	-
Sisibargaon	Dhamalgaon	31.26	NFR	TSK	SIMALUGURI - DIBRUGARH	Single Line	-	-	2nd Line with Normal Signalling	-
Sonipat	Gohana	38.94	NR	DLI	Adarsh Nagar Delhi - Panipat Jn	Single Line	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-	4th Line with TCAS Signalling
Anand Vihar Terminal	Sahibabad	4.61	NR	DLI	B panel - Sahibabad	4th Line	-	-	-	-
Sabji Mandi	Delhi Jn	1.76	NR	DLI	Delhi Jn, - Subzi Mandi	2nd Line	-	-	-	-
Delhi Jn	New Delhi	2.79	NR	DLI	Delhi Jn. - New Delhi	2nd Line	-	-	-	-
Shahdara Jn	Baghpat Road	32.71	NR	DLI	Delhi Shahdara - Shamli	2nd Line	-	-	-	-
Baghpat Road	Shamli	55.36	NR	DLI	Delhi Shahdara - Shamli	2nd Line	-	-	-	-
Daurala	Meerut City Jn	16.63	NR	DLI	Ghaziabad Jn - Khatauli	2nd Line	-	-	-	-
Meerut City Jn	Ghaziabad Jn	47.74	NR	DLI	Ghaziabad Jn - Khatauli	2nd Line	-	-	-	-
Khukrana Halt	Jind Jn	61.38	NR	DLI	Jind - Khukrana	Single Line	-	-	-	-
Muzaffar Nagar	Daurala	39.14	NR	DLI	Khatauli - Tapri	2nd Line	-	-	-	-
Tapri Jn	Deoband	27.34	NR	DLI	Khatauli - Tapri	2nd Line	-	-	-	-
Deoband	Muzaffar Nagar	24.02	NR	DLI	Khatauli - Tapri	2nd Line	-	-	-	-
Deoband	Roorkee	29.31	NR	DLI	Khatauli - Tapri	Single Line	2nd Line with Normal Signalling	-	-	-
Panipat Jn	Khukrana Halt	6.16	NR	DLI	Khukrana - Panipat Jn	Single Line	-	-	-	-

NODE_A	NODE_B	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	New Proposed Configuration 26	New Proposed Configuration 31	New Proposed Configuration 41	New Proposed Configuration 51
Lajpat Nagar	Patel Nagar	16.03	NR	DLI	Lajpat Nagar - Patel Nagar	2nd Line	-	-	-	2nd Line with TCAS Signalling
Kaithal	Narwana Jn	36.83	NR	DLI	Narwana Jn. - Kurukshetra	Single Line	-	-	-	-
Kurukshetra Jn	Kaithal	48.32	NR	DLI	Narwana Jn. - Kurukshetra	Single Line	-	-	-	-
New Delhi	Sabji Mandi	4.02	NR	DLI	New Delhi - Subzi Mandi	2nd Line	-	-	2nd Line with TCAS Signalling	-
H Nizamuddin Jn	Lajpat Nagar	2.36	NR	DLI	Nizzamudin - Lajpat Nagar(DAL)	2nd Line	-	-	-	-
H Nizamuddin Jn	okhla	3.93	NR	DLI	Nizzamudin - Okhla	4th Line	-	-	-	-
Lajpat Nagar	okhla	4.14	NR	DLI	Okhla - Lajpat Nagar	2nd Line	-	-	-	-
Pandu Pindara	Gohana	39.93	NR	DLI	Pandu Pindara - Khukrana Halt	Single Line	-	-	-	-
Patel Nagar	Rampura Cabin	2.58	NR	DLI	Patel Nagar - Rampura CABIN	2nd Line	-	-	-	-
Rampura Cabin	Adarsh Nagar Delhi	5.11	NR	DLI	Rampura CABIN - ADARSH NAGAR	2nd Line	-	-	-	-
Shamli	Tapri Jn	63.27	NR	DLI	Shamli - Tapri	2nd Line	-	-	-	-
Tapri Jn	Khanalampura west	4.15	NR	DLI	Tapri - Khanalampura	2nd Line	-	-	-	-
Saharanpur Jn	Tapri Jn	6.51	NR	DLI	Tapri - Saharanpur Jn.	Single Line	-	-	-	-
Tilak Bridge	Anand Vihar Terminal	8.76	NR	DLI	Tilak Bridge - B Panel	2nd Line	-	-	-	-
Amritsar Jn	Atari Jn	23.82	NR	FZP	Amritsar Jn. - Atari	Single Line	-	-	-	-
Amritsar Jn	Tarn taran	22.64	NR	FZP	Amritsar Jn. - Patti	Single Line	-	-	-	-
Tarn taran	Khem Karan	53.70	NR	FZP	Amritsar Jn. - Patti	Single Line	-	-	-	-
Joginder nagar	Baijnath Paprola	17.83	NR	FZP	Baijnath Paprola - Joginder Nagar	Single Line	-	-	-	-
Awantipura	Qazigund	39.07	NR	FZP	Banihal - Budgam	Single Line	-	-	-	2nd Line with Normal Signalling
Budgam	Srinagar	11.54	NR	FZP	Banihal - Budgam	Single Line	-	-	-	2nd Line with Normal Signalling
Batala Jn	Qadian	19.36	NR	FZP	Batala Jn. - Qadian	Single Line	-	-	-	-
Beas Jn	Goindwal Sahib	26.83	NR	FZP	Beas - Govindwal sahib	Single Line	-	-	-	-
Bharoli Jn	Pathankot Cantt	2.54	NR	FZP	Bharoli Jn. - Pathankot	2nd Line	-	-	-	2nd Line with TCAS Signalling
Baramula	Budgam	45.78	NR	FZP	Budgam - Baramulla	Single Line	-	-	-	-
Muktsar	Kot Kapura Jn	32.36	NR	FZP	Fazilka Jn - Kotkapura Jn	Single Line	-	-	2nd Line with Normal Signalling	-

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Fazilka jn	Muktsar	48.19	NR	FZP	Fazilka Jn - Kotkapura Jn	Single Line	-	-	2nd Line with Normal Signalling	-
Fazilka jn	Abohar Jn	42.15	NR	FZP	Firozpur Cantt Jn. - Fazilka Jn	Single Line	-	-	-	-
Ludhiana Jn	Moga	68.43	NR	FZP	Firozpur Cantt Jn. - Moga	Single Line	-	-	-	-
Moga	Firozpur Cantt Jn	54.42	NR	FZP	Firozpur Cantt Jn. - Moga	Single Line	-	-	-	-
Tarn taran	Goindwal Sahib	21.11	NR	FZP	Govindwal sahib - Tarantaran	Single Line	-	-	-	-
Suchi Pind Halt	Jalandhar Cantt Jn	3.69	NR	FZP	Jalandhar Cantt. - Suchi Pind	2nd Line	-	-	2nd Line with TCAS Signalling	-
Srinagar	Awantipura	22.48	NR	FZP	Jalandhar Cantt. - Suchi Pind	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	-
Kapurthala	Jalandhar city Jn	21.31	NR	FZP	Jalandhar City - Lohian khas	Single Line	-	-	-	2nd Line with Normal Signalling
Kapurthala	Lohian Khas Jn	30.30	NR	FZP	Jalandhar City - Lohian khas	Single Line	-	-	-	2nd Line with Normal Signalling
Jalandhar city Jn	Nakodar Jn	31.11	NR	FZP	Jalandhar city - Nakodar	Single Line	-	-	-	-
Hoshiarpur	Jalandhar Cantt Jn	37.61	NR	FZP	Jalandhar city - Nakodar	Single Line	-	-	-	-
Suchi Pind Halt	Jalandhar city Jn	3.00	NR	FZP	Jalandhar City - Suchi Pind	2nd Line	-	2nd Line with TCAS Signalling	-	-
Katra	Udhampur	24.72	NR	FZP	Jammu Tawi - Udhampur	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Udhampur	Jammu Tawi	52.64	NR	FZP	Jammu Tawi - Udhampur	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Baijnath Paprola	Jawalmukhi Road	50.24	NR	FZP	Jawalamukhi - Baijnath Paprola	Single Line	-	-	-	-
Lohian Khas Jn	Firozpur Cantt Jn	65.54	NR	FZP	Lohian khas - Firozpur cantt	Single Line	-	-	-	2nd Line with Normal Signalling
Nawanshahr Doaba Jn	Jaijon Doaba	31.00	NR	FZP	Nawanshahar - Doaba - Jaijon Doaba	Single Line	-	-	-	-
Nawanshahr Doaba Jn	Rahon	7.53	NR	FZP	Nawanshahar Doaba - Rohan	Single Line	-	-	-	-
Jawalmukhi Road	Pathankot Jn	81.60	NR	FZP	Pathankot - Baijnath Paprola	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
Bharoli Jn	Pathankot Jn	3.18	NR	FZP	Pathankot cantt - Bharoli Jn.	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Pathankot Cantt	Pathankot Jn	5.17	NR	FZP	Pathankot cantt - Pathankot Jn.	2nd Line	-	-	-	-

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Firozpur City Jn	Fazilka jn	84.57	NR	FZP	Patti - Khemkaran	Single Line	-	-	-	-
Phagwara Jn	Nawanshahr Doaba Jn	35.35	NR	FZP	Phagwara Jn. - Nawanshahar Doaba	Single Line	-	-	-	-
Nakodar Jn	Phillaur Jn	32.41	NR	FZP	Phillaur Jn - Lohian Khas Jn.	Single Line	-	-	-	2nd Line with Normal Signalling
Lohian Khas Jn	Nakodar Jn	31.63	NR	FZP	Phillaur Jn - Lohian Khas Jn.	Single Line	-	-	-	2nd Line with Normal Signalling
Mukerian	Pathankot Cantt	38.71	NR	FZP	Suchi Pind - Pathankot cantt	2nd Line	-	-	2nd Line with TCAS Signalling	-
Mukerian	Suchi Pind Halt	69.12	NR	FZP	Suchi Pind - Pathankot cantt	2nd Line	-	-	2nd Line with TCAS Signalling	-
Dera Baba Nanak	Verka Jn	44.91	NR	FZP	Verka Jn. - Dera Baba Nanak	Single Line	-	-	-	-
Akbarpur Jn	Tanda	16.13	NR	LKO	Akbarpur - Tanda	2nd Line	-	-	-	-
Daryapur Jn	Dalmau Jn	24.33	NR	LKO	Daryapur - Dalamau	Single Line	-	-	-	-
Masodha	Sultanpur Jn	51.74	NR	LKO	Faizabad - Sultanpur	Single Line	-	-	-	-
Phaphamau Jn	Prayag	6.55	NR	LKO	Phaphamau - Prayag	2nd Line	-	-	2nd Line with TCAS Signalling	-
Pratapgarh Jn	Phaphamau Jn	46.86	NR	LKO	Pratapgarh - Phaphamau	Single Line	-	-	-	-
Prayag	Allahabad Jn	6.28	NR	LKO	Prayag - Allahabad	2nd Line	-	-	2nd Line with TCAS Signalling	-
Sultanpur Jn	Chilbila Jn	36.07	NR	LKO	Sultanpur - Chilbila	Single Line	-	-	2nd Line with Normal Signalling	-
Rai Bareli Jn	AkbarGanj	46.49	NR	LKO	Sultanpur - Chilbila	Single Line	-	-	2nd Line with Normal Signalling	-
Sultanpur Jn	Amethi	30.75	NR	LKO	Sultanpur - Chilbila	Single Line	-	-	2nd Line with Normal Signalling	-
Utratia Jn	Alamnagar	18.41	NR	LKO	Utratia Jn. - Alamnagar	Single Line	-	-	-	-
Janghai Jn	Zafarabad Jn	46.97	NR	LKO	Zafrabad - Janghai	Single Line	-	-	-	-
Naimisarnaya	Sitapur City Jn	33.56	NR	MB	Balamau Jn. - Sitapur City	Single Line	-	-	-	-
Balamau Jn	Naimisarnaya	24.96	NR	MB	Balamau Jn. - Sitapur City	Single Line	-	-	-	-
Madhoganj	Unnao Jn	77.01	NR	MB	Balamau Jn. - Unnao Jn.	Single Line	-	-	-	-
Balamau Jn	Madhoganj	22.05	NR	MB	Balamau Jn. - Unnao Jn.	Single Line	-	-	-	-
Bulandshahr	Hapur Jn	41.14	NR	MB	Bulandshar - Hapur Jn.	2nd Line	-	-	-	-
Harduaganj	Bahjoi	68.56	NR	MB	Chandausi - Hardunaganj	2nd Line	-	-	-	-
Bahjoi	Chandausi Jn	16.58	NR	MB	Chandausi - Hardunaganj	2nd Line	-	-	-	-

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Bijnor	Muzzampur Narain Jn	24.80	NR	MB	Gajraula Jn. - Muzzampur Narain	Single Line	-	-	-	-
Gajraula Jn	Bijnor	70.97	NR	MB	Gajraula Jn. - Muzzampur Narain	Single Line	-	-	-	-
Hapur Jn	Meerut City Jn	29.24	NR	MB	Hapur Jn. - Meerut City	2nd Line	-	-	-	-
Raiwala jn	Haridwar	11.07	NR	MB	Haridwar - Raiwala Jn.	Single Line	-	2nd Line with Normal Signalling	-	-
Khurja Jn	Bulandshahr	22.74	NR	MB	Khurja - Bulandshar	2nd Line	-	-	-	-
Haridwar	Laksar Jn	26.76	NR	MB	Laksar Jn. - Haridwar	2nd Line	-	-	-	-
Najibabad Jn	Kotdwara	23.85	NR	MB	Najibabad Jn. - Kotdwara	Single Line	-	-	-	-
Dehradun	Raiwala jn	40.29	NR	MB	Raiwala Jn. - Dehradun	Single Line	-	-	-	-
Raiwala jn	Rishikesh	11.53	NR	MB	Raiwala Jn. - Rishikesh	Single Line	-	-	-	-
Raja Ka Sahaspur Jn	Sambhal Hatim Sarai	23.16	NR	MB	Raja Ka Sahaspur - Sambhal Hatim Sarai	Single Line	-	-	-	-
Chaneti	Ramganga Bridge	5.47	NR	MB	Ramganga Bridge - Bareilly Cantt.	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Abohar Jn	Hindumalkot	27.13	NR	UMB	Abhor - Sri Ganga Nagar	Single Line	-	-	2nd Line with Normal Signalling	-
Hindumalkot	Shri Ganganagar	25.30	NR	UMB	Abhor - Sri Ganga Nagar	Single Line	-	-	2nd Line with Normal Signalling	-
Chandigarh	Kalka	23.80	NR	UMB	Chandigarh - Kalka Jn.	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
Barnala	Dhuri Jn	31.11	NR	UMB	Dhuri Jn. - Bathinda Jn.	2nd Line	-	-	-	-
Bathinda Jn	Barnala	64.14	NR	UMB	Dhuri Jn. - Bathinda Jn.	2nd Line	-	-	-	-
Jakhal Jn	Sunam	37.21	NR	UMB	Dhuri Jn. - Jakhal Jn.	Single Line	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-	-
Sangrur	Dhuri Jn	15.08	NR	UMB	Dhuri Jn. - Jakhal Jn.	Single Line	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-	-
Sunam	Sangrur	12.92	NR	UMB	Dhuri Jn. - Jakhal Jn.	Single Line	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-	-
Solan	Kalka	24.16	NR	UMB	Kalka Jn. - Shimla	Single Line	-	-	2nd Line with Normal Signalling	-
Shimla	Solan	33.48	NR	UMB	Kalka Jn. - Shimla	Single Line	-	-	2nd Line with Normal Signalling	-
Ludhiana Jn	Malerkotla	44.71	NR	UMB	Ludhiana Jn - Dhuri Jn.	2nd Line	-	-	2nd Line with TCAS Signalling	-
Malerkotla	Dhuri Jn	16.56	NR	UMB	Ludhiana Jn - Dhuri Jn.	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	-

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Bhanupali	Una Himachal	25.53	NR	UMB	Nangaldam - Una	Single Line	-	-	-	2nd Line with Normal Signalling
Patiala	Dhuri Jn	52.08	NR	UMB	Patiala - Dhuri Jn.	2nd Line	-	-	-	-
Rajpura Jn	Patiala	25.34	NR	UMB	Rajpura Jn. - Patiala	2nd Line	-	-	-	-
Rupnagar	Bhanupali	46.21	NR	UMB	Rupnagar - Nangaldam	Single Line	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling
Morinda	Rupnagar	24.69	NR	UMB	Sirhind Jn. - New Morinda	Single Line	-	-	2nd Line with Normal Signalling	-
Sirhind Jn	Fatehgarh Sahib	4.71	NR	UMB	Sirhind Jn. - New Morinda	Single Line	-	-	2nd Line with Normal Signalling	-
Fatehgarh Sahib	New Morinda Jn	17.03	NR	UMB	Sirhind Jn. - New Morinda	Single Line	-	-	2nd Line with Normal Signalling	-
Mavli Jn	Chittaurgarh jn	70.97	NWR	AII	CHITTORGARH - UDAIPUR CITY	2nd Line	-	-	-	2nd Line with TCAS Signalling
Mavli Jn	Udaipur City	42.59	NWR	AII	CHITTORGARH - UDAIPUR CITY	2nd Line	-	-	-	2nd Line with TCAS Signalling
Daurai	Madar	10.10	NWR	AII	DAURAI - MADAR (Bye - Pass)	Single Line	-	-	-	2nd Line with Normal Signalling
Dungarpur	Banswara	88.24	NWR	AII	Dungarpur - Banswara	Single Line	-	-	-	-
Pushkar Terminus	Madar	24.87	NWR	AII	MADAR - PUSHKAR	2nd Line	-	-	-	-
Mavli Jn	Bari Sadri	81.62	NWR	AII	MAVLI - BARI SADRI	Single Line	-	-	-	-
Marwar Jn	Nathdwara	128.68	NWR	AII	MAVLI - MARWAR	Single Line	-	-	-	-
Nathdwara	Mavli Jn	15.01	NWR	AII	MAVLI - NATHDWARA	Single Line	-	-	-	-
Shamlaji Road	Himmatnagar Jn	41.95	NWR	AII	UDAIPUR CITY - HIMMATNAGAR	Single Line	-	-	-	2nd Line with Normal Signalling
Dungarpur	Shamlaji Road	51.01	NWR	AII	UDAIPUR CITY - HIMMATNAGAR	Single Line	-	-	-	2nd Line with Normal Signalling
Udaipur City	Dungarpur	110.44	NWR	AII	UDAIPUR CITY - HIMMATNAGAR	Single Line	-	-	-	2nd Line with Normal Signalling
Hansi	Bhiwani Jn	36.26	NWR	BKN	BHIWANI - HISAR	2nd Line	2nd Line with TCAS Signalling	-	3rd Line with TCAS Signalling	-
Hisar Jn	Hansi	23.35	NWR	BKN	BHIWANI - HISAR	2nd Line	2nd Line with TCAS Signalling	-	3rd Line with TCAS Signalling	-
Hansi	Rohtak Jn	66.76	NWR	BKN	BHIWANI - HISAR	Single Line	2nd Line with TCAS Signalling	-	3rd Line with TCAS Signalling	-
Bhiwani Jn	Rohtak Jn	48.38	NWR	BKN	BHIWANI - ROHTAK	2nd Line	-	-	-	-
Suratpura Jn	Hanumangarh Jn	173.98	NWR	BKN	HANUMANGARH - SURATPURA	2nd Line	-	-	-	-

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Bhiwani Jn	Charkhi Dadri	27.55	NWR	BKN	JHARLI - BHIWANI	2nd Line	2nd Line with TCAS Signalling	-	3rd Line with TCAS Signalling	-
Lalgarh Jn	Phalodi Jn	157.69	NWR	BKN	LALGARH - PHALODI	2nd Line	-	-	-	-
Bikaner Jn	Ratangarh jn	135.50	NWR	BKN	RATANGARH - BIKANER	2nd Line	-	-	-	-
Ratangarh jn	Sardarshahar	46.53	NWR	BKN	RATANGARH - SARDARSHAR	2nd Line	-	-	-	-
Charkhi Dadri	Rewari Jn	54.93	NWR	BKN	REWARI - JHARLI	2nd Line	2nd Line with TCAS Signalling	-	3rd Line with TCAS Signalling	-
Mahendragarh	Rewari Jn	49.94	NWR	BKN	REWARI - SADULPUR	2nd Line	-	-	-	-
Loharu Jn	Mahendragarh	41.10	NWR	BKN	REWARI - SADULPUR	2nd Line	-	-	-	-
Sadulpur Jn	Loharu Jn	49.47	NWR	BKN	REWARI - SADULPUR	2nd Line	-	-	-	-
Sarupsar Jn	Anupgarh	55.28	NWR	BKN	SARUPSAR - ANUPGARH	2nd Line	-	-	-	-
Shri Ganganagar	Sarupsar Jn	116.30	NWR	BKN	SARUPSAR - SRIGANGANAGAR	Single Line	-	-	-	-
Shri Ganganagar	Hanumangarh Jn	66.61	NWR	BKN	SRIGANGANAGAR - HANUMANGARH	Single Line	-	-	-	-
Biradhwal	Suratgarh TPS	16.69	NWR	BKN	SURATGARH - LALGARH	2nd Line	-	-	-	-
Sarupsar Jn	Suratgarh Jn	21.32	NWR	BKN	SURATGARH - SARUPSAR	2nd Line	-	-	-	-
Sikar Jn	Ringas Jn	51.24	NWR	JP	RINGAS - SIKER	2nd Line	-	-	-	-
Jaipur Jn	Sanganer	12.64	NWR	JP	SAWAIMADHOPUR - JAIPUR	2nd Line	-	-	-	-
Sawai Madhopur Jn	Sanganer	118.32	NWR	JP	SAWAIMADHOPUR - JAIPUR	2nd Line	-	-	-	-
Churu Jn	Sikar Jn	89.12	NWR	JP	SIKAR - CHURU	2nd Line	-	-	-	-
Jhunjhunu	Sikar Jn	64.46	NWR	JP	SIKER - LOHARU	2nd Line	-	-	-	-
Jhunjhunu	Loharu Jn	57.63	NWR	JP	SIKER - LOHARU	2nd Line	-	-	-	-
Barmer	Munabao	118.40	NWR	JU	BARMER - MUNABAO	2nd Line	-	-	-	-
Luni Jn	Marwar Jn	71.92	NWR	JU	LUNI - MARWAR	2nd Line	-	-	-	-
Merta Road Jn	Merta City	14.72	NWR	JU	MERTA ROAD - MERTA CITY	2nd Line	-	-	-	-
Phalodi Jn	Jaisalmer	156.06	NWR	JU	PHALODI - JAISALMER	2nd Line	-	-	-	-
Phulera Jn	Degana Jn	108.26	NWR	JU	PHULERA - DEGANA	2nd Line	-	-	-	-
Pipar Road Jn	Bilara	41.55	NWR	JU	PIPAR ROAD - BILARA	Single Line	-	-	-	-
Pushkar Terminus	Merta City	58.86	NWR	JU	Pushkar Terminus - MERTA CITY	Single Line	-	-	-	-

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Rai Ka Bagh	Phalodi Jn	134.11	NWR	JU	RAI KA BAG - PHALODI	2nd Line	-	-	-	-
Barmer	Samdari Jn	129.03	NWR	JU	SAMDARI - BARMER	2nd Line	-	-	-	-
Bhimavaram Jn	Gorintada	24.18	SCR	BZA	Bhimavaram - Narsapur	2nd Line	-	-	-	-
Gorintada	Narasapur	5.50	SCR	BZA	Bhimavaram - Narsapur	2nd Line	-	-	-	-
Bhimavaram Jn	Nidadavolu Jn	46.78	SCR	BZA	Bhimavaram - Nidadavolu	2nd Line	-	-	-	-
Gudivada Jn	Bhimavaram Jn	65.74	SCR	BZA	Gudivada - Bhimavaram	2nd Line	-	-	-	-
Kakinada Town	Kottapalli	45.04	SCR	BZA	Kakinada - Kotipalli	Single Line	-	-	-	-
Kommarapudi	Krishnapatnam Port	28.78	SCR	BZA	Kommarapudi - Krishnapatnam Port	2nd Line	-	-	-	-
Samalkot Jn	Kakinada Town	12.10	SCR	BZA	Samalkot - Kakinada	2nd Line	-	-	-	-
Kakinada Town	Kakinada Port	3.28	SCR	BZA	Samalkot - Kakinada	2nd Line	-	-	-	-
Renigunta	Gudur Jn	83.16	SCR	GKL	Gudur - Renigunta	2nd Line	-	3rd Line with TCAS Signalling	-	-
Kalluru Jn	Guntakal Jn	40.23	SCR	GKL	Kalluru - Guntakal	2nd Line	-	-	-	-
Kadapa	Viyalpad	122.06	SCR	GKL	Kapada - Viyalpad	Single Line	-	-	-	2nd Line with Normal Signalling
Tirupati	Pakala	42.18	SCR	GKL	Katpadi - Pakala - Tirupati	2nd Line	-	-	-	2nd Line with TCAS Signalling
Renigunta	Tirupati	9.43	SCR	GKL	Tirupati - Renigunta	2nd Line	-	-	-	2nd Line with TCAS Signalling
Vejandla	Guntur Jn	11.98	SCR	GNT	Guntur - Tenali	2nd Line	-	-	-	-
Tenali Jn	Vejandla	13.61	SCR	GNT	Guntur - Tenali	2nd Line	-	-	-	-
Nadikudi Jn	Macherla	34.72	SCR	GNT	Nadikude - Macherla	Single Line	-	-	-	-
Tenali Jn	Repalle	32.43	SCR	GNT	Tenali - Repalle	Single Line	-	-	-	-
Devarkadra	Krishna	63.93	SCR	HYB	Devarkadra - Krishna	Single Line	-	-	2nd Line with Normal Signalling	-
Gadwal Jn	Raichur Jn	54.73	SCR	HYB	Gadwal - Raichur (New Line)	Single Line	-	-	-	-
Jankampet Jn	Bodhan	20.50	SCR	HYB	Jankampet - Bodhan	Single Line	-	-	-	-
Sitaphalmandi A	Sitaphalmandi B	1.07	SCR	HYB	Malkajgiri - Moula Ali Cord line	2nd Line	-	-	3rd Line with TCAS Signalling	-
Malkajgiri Jn	Moula Ali Cord Line Station Bypass	3.23	SCR	HYB	STPD 'A' - STPD - 'B'	2nd Line	-	-	2nd Line with TCAS Signalling	-
Pimpalkuti	Adilabad	20.86	SCR	NED	Adilabad - Pimpalkuti	Single Line	-	-	-	-
Dinagaon Halt	Aurangabad	57.55	SCR	NED	Aurangabad - Jalna	Single Line	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-	-
Jalna	Dinagaon Halt	5.39	SCR	NED	Aurangabad - Jalna	Single Line	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-	-

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Parbhani Jn	Jalna	114.07	SCR	NED	Jalna - Parbhani	Single Line	2nd Line with Normal Signalling	-	-	-
Aurangabad	Rotegaon	61.23	SCR	NED	Manmad - Aurangabad	Single Line	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-	-
Rotegaon	Ankai	37.29	SCR	NED	Manmad - Aurangabad	Single Line	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-	-
Adilabad	Mudkhed Jn	162.08	SCR	NED	Mudkhed - Adilabad	Single Line	-	-	-	-
Parli Vaijnath	Parbhani Jn	63.36	SCR	NED	Parbhani - Parli - Vaijnath	Single Line	-	-	2nd Line with Normal Signalling	-
Parbhani Jn	Purna Jn	28.80	SCR	NED	Parbhani - Purna	2nd Line	-	-	2nd Line with TCAS Signalling	-
Washim	Karanja	59.72	SCR	NED	Washim - Badnera	Single Line	-	-	-	-
Akanapet	Medak	15.38	SCR	SC	Akanapet - Medak	Single Line	-	-	-	-
Bhadrachalam Road	Pandurangapuram	24.92	SCR	SC	BhadrachalamRd - Manuguru	Single Line	-	-	-	2nd Line with Normal Signalling
Pandurangapuram	Manuguru	24.13	SCR	SC	BhadrachalamRd - Manuguru	Single Line	-	-	-	2nd Line with Normal Signalling
Bhadrachalam Road	Kowur	150.29	SCR	SC	BhadrachalamRd - Manuguru	Single Line	-	-	-	2nd Line with Normal Signalling
Karepalli Jn	Bhadrachalam Road	39.25	SCR	SC	BhadrachallamRd - Karepalli	Single Line	-	-	2nd Line with Normal Signalling	-
Hussain Sagar Jn	Hyderabad	4.70	SCR	SC	Hussainsagar - Hyderabad	2nd Line	-	-	-	-
Jaggayyapeta	Mellacheruvu	23.96	SCR	SC	Jaggayapet - Mattampalli	Single Line	-	-	-	-
Mettampalle	Mellacheruvu	12.81	SCR	SC	Jaggayapet - Mattampalli	Single Line	-	-	-	-
Dornakal Jn	Karepalli Jn	15.16	SCR	SC	Karepalli - Dornakal	Single Line	-	-	2nd Line with Normal Signalling	-
Karepalli Jn	Singareni Collieries	10.30	SCR	SC	Karepalli - Singareni	2nd Line	-	-	-	-
Karimnagar	Lingampet Jagityal	48.01	SCR	SC	Karimnagar - Lingampet Jagityal	Single Line	-	-	-	-
Metpally	Lingampet Jagityal	29.27	SCR	SC	Karimnagar - Lingampet Jagityal	Single Line	-	-	-	-
Metpally	Nizamabad	65.92	SCR	SC	Karimnagar - Lingampet Jagityal	Single Line	-	-	-	-
Humnabad	Khanapur Jn	37.53	SCR	SC	Khanapur - Homnabad	Single Line	-	-	2nd Line with Normal Signalling	-
Manikgarh Jn	Gadchandur	28.47	SCR	SC	Manickgarh - Gadchandur	Single Line	-	-	-	-
Motumari Jn	Jaggayyapeta	25.94	SCR	SC	Motumari - Jaggayyapet	Single Line	-	-	-	-

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Peddapalli Jn	Karimnagar	34.94	SCR	SC	Peddapalli - Karimnagar	Single Line	-	-	2nd Line with Normal Signalling	-
Siddipet	Manoharabad	71.89	SCR	SC	Peddapalli - Karimnagar	Single Line	-	-	2nd Line with Normal Signalling	-
Siddipet	Sircilla	35.31	SCR	SC	Peddapalli - Karimnagar	Single Line	-	-	2nd Line with Normal Signalling	-
Ammuguda Halt	Sanathnagar	12.29	SCR	SC	Sanatnagar - Moulaali Byepass	Single Line	-	-	-	-
Ammuguda Halt	Moula Ali Cord Line Station Bypass	5.08	SCR	SC	Sanatnagar - Moulaali Byepass	Single Line	-	-	-	-
Vikarabad Jn	Zahirabad	58.61	SCR	SC	Vikarabad - Parlivaijnath	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Khanapur Jn	Bidar	14.65	SCR	SC	Vikarabad - Parlivaijnath	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Zahirabad	Bidar	31.87	SCR	SC	Vikarabad - Parlivaijnath	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Latur Road Jn	Khanapur Jn	98.14	SCR	SC	Vikarabad - Parlivaijnath	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Lohardaga	Korba	7.89	SECR	BSP	BILASPUR- URKURA	Single Line	-	-	2nd Line with Normal Signalling	-
Jharsuguda Road Jn	Lb	8.81	SECR	BSP	IB - JHARSUGUDA ROAD	Single Line	-	-	-	-
Gondia Jn	Balaghat Jn	39.71	SECR	NGP	GODHANI CHORD CABIN - KAUMANA	Single Line	-	-	2nd Line with Normal Signalling	-
Wadsa	Nagbhir Jn	28.31	SECR	NGP	GONDIA - BALAGHAT	2nd Line	-	-	-	-
Babupeth	Nagbhir Jn	108.11	SECR	NGP	GONDIA - BALAGHAT	Single Line	2nd Line with Normal Signalling	-	-	-
Gondia Jn	Wadsa	102.73	SECR	NGP	GONDIA - BALAGHAT	2nd Line	-	-	-	-
Kanhan Jn	Ramtek	22.72	SECR	NGP	GONDIA - BALLARSHAH	2nd Line	-	-	-	-
Balaghat Jn	Katangi	47.32	SECR	NGP	KACHHPURA - NAINPUR	Single Line	-	-	-	-
Tumsar Road Jn	Tirodi	46.65	SECR	NGP	KANHAN - RAMTEK	Single Line	-	-	-	-
Katangi	Tirodi	13.08	SECR	NGP	KANHAN - RAMTEK	Single Line	-	-	-	-
Bhilai	Ahiwara Mines	19.06	SECR	R	BHILAI - AHIWARA	Single Line	-	-	-	-
Raipur Jn	Abhanpur Jn	27.71	SECR	R	DALLIRAJHARA - BHANUPRATAPPUR	Single Line	-	-	2nd Line with Normal Signalling	-
Chamuria	Dhamtari	25.59	SECR	R	DALLIRAJHARA - BHANUPRATAPPUR	Single Line	-	-	2nd Line with Normal Signalling	-

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Durg Jn	Maroda	9.90	SECR	R	DURG - MARODA	Single Line	-	-	2nd Line with Normal Signalling	-
Maroda	Bhilai	9.58	SECR	R	MARODA - DALLIRAZRA	Single Line	-	-	2nd Line with Normal Signalling	-
Maroda	Dalli Rajhara	76.04	SECR	R	MARODA - DALLIRAZRA	Single Line	-	-	2nd Line with Normal Signalling	-
Raipur Jn	Srona	6.87	SECR	R	RAIPUR - SARONA	2nd Line	-	4th Line with TCAS Signalling	-	-
Urkura	Raipur Vizainagaram Hut	4.59	SECR	R	URKURA - RAIPUR STORE DEPOT - RAIPUR VIZAINAGRAM HUT	Single Line	-	-	-	-
Joychandipahar	Adra Jn	4.47	SER	Adra	ADRA - JOYCHANDIPAHAR	2nd Line	-	-	-	-
Anara Jn	Rukni Jn	7.72	SER	Adra	ANARA - RUKNI	2nd Line	-	-	-	-
Bhojudin Jn	Talgoria Jn	11.85	SER	Adra	BHOJUDIH - MOHUDA	2nd Line	-	-	-	-
Mahuda Jn	Talgoria Jn	10.75	SER	Adra	BHOJUDIH - MOHUDA	2nd Line	-	-	-	-
Kotshila Jn	Bokaro Steel City Jn	28.91	SER	Adra	BOKARO STEEL CITY - KOTSHILA	2nd Line	-	-	-	-
Talgoria Jn	Bokaro Steel City Jn	37.60	SER	Adra	BOKARO STEEL CITY - TALGORIA	2nd Line	-	-	-	-
Damodar Jn	Kalipahari	12.11	SER	Adra	DAMODAR - KALIPAHARI	2nd Line	-	-	-	-
Damodar Jn	Radhanagar	8.28	SER	Adra	DAMODAR - RADHANAGAR	Single Line	-	-	-	-
Sanka	Joychandipahar	6.93	SER	Adra	JOYCHANDIPAHAR - SANKA	2nd Line	-	-	-	-
Phulwartanr	Mahuda Jn	6.55	SER	Adra	MOHUDA - GOMOH	Single Line	2nd Line with Normal Signalling	-	-	-
Phulwartanr	NSC Bose Jn Gomoh	13.84	SER	Adra	MOHUDA - GOMOH	Single Line	2nd Line with Normal Signalling	-	-	-
Rajabera	Bokaro Steel City Jn	10.48	SER	Adra	RAJABERA - BOKARO STEEL	2nd Line	-	-	-	-
Ramkanali Jn	Chourashi	6.95	SER	Adra	RAMKANALI - CHOWRASHI	Single Line	-	-	-	-
Barabil	Bolanikhadan	6.44	SER	CKP	BARABIL - BOLANIKHADAN	2nd Line	-	-	-	-
Barabil	Barajamda jn	8.76	SER	CKP	BARAJAMDA - BARBIL	2nd Line	-	-	-	-
Barajamda jn	Gua	7.52	SER	CKP	BARAJAMDA - GUA	Single Line	-	-	-	-

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Bimalgarh Jn	Kiriburu	38.71	SER	CKP	BIMLAGARH - KIRIBURU	2nd Line	-	-	-	-
Kandra Jn	Gamharia Jn	8.93	SER	CKP	KANDRA - GAMHARIA	2nd Line	-	-	-	-
Noamundi	Barajamda jn	14.35	SER	CKP	NOAMUNDI - BARAJAMDA	2nd Line	-	-	-	-
Padapahar Jn	Noamundi	2.70	SER	CKP	PADAPAHAR - NOAMUNDI	2nd Line	-	-	-	-
Rourkela Jn	Birmitrapur	26.69	SER	CKP	ROURKELA - BIRMITRAPUR	2nd Line	-	-	-	-
Aunlajori Jn	Tatanagar Jn	54.14	SER	CKP	TATA - BADAMPAHAR	Single Line	-	-	-	-
Badampahar	Aunlajori Jn	33.81	SER	CKP	TATA - BADAMPAHAR	Single Line	-	-	-	-
Andul	Baltkuri	7.81	SER	KGP	ANDUL - BHATTANAGAR	2nd Line	-	-	-	-
Baltkuri	Bhattanagar	2.72	SER	KGP	ANDUL - BHATTANAGAR	Single Line	2nd Line with Normal Signalling	-	-	-
Jaleshwar	Digha	41.30	SER	KGP	Jaleshwar - DIGHA	Single Line	-	-	-	-
Gokulpur	Nimpura Jn	10.07	SER	KGP	NIMPURA - GOKULPUR	Single Line	-	-	-	-
Panskura Jn	Tamluk Jn	23.96	SER	KGP	PANSKURA - HALDIA	2nd Line	-	-	-	2nd Line with TCAS Signalling
Tamluk Jn	Haldia	46.26	SER	KGP	PANSKURA - HALDIA	2nd Line	-	-	-	2nd Line with TCAS Signalling
Buramara PH	Baripada	23.18	SER	KGP	RUPSA - BANGRIPOSI	Single Line	-	-	-	-
Baripada	Rupsa Jn	50.72	SER	KGP	RUPSA - BANGRIPOSI	Single Line	-	-	-	-
Bangriposi	Buramara PH	14.61	SER	KGP	RUPSA - BANGRIPOSI	Single Line	-	-	-	-
Santragachhi Jn	Amta	41.53	SER	KGP	SANTRAGACHI - AMTA	2nd Line	-	-	-	-
Kulgachia FS	Amta	12.52	SER	KGP	SANTRAGACHI - AMTA	Single Line	2nd Line with Normal Signalling	-	-	-
Santragachhi Jn	Shalimar	4.54	SER	KGP	SHALIMAR - SANTRAGACHI	2nd Line	-	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling	4th Line with TCAS Signalling
Tamluk Jn	Kanthi	61.61	SER	KGP	TAMLUK - DIGHA	2nd Line	-	-	-	-
Kanthi	Ramnagar	24.41	SER	KGP	TAMLUK - DIGHA	2nd Line	-	-	-	-
Ramnagar	Digha	8.13	SER	KGP	TAMLUK - DIGHA	2nd Line	-	-	-	-
Muri Jn	Tiruldih	30.36	SER	RNC	CHANDIL - MURI	2nd Line	-	-	-	-
Tiruldih	Chandil Jn	27.27	SER	RNC	CHANDIL - MURI	Single Line	2nd Line with Normal Signalling	-	-	-
Arakkonam North Cabin	Melpakkam	3.16	SR	MAS	Arakkonam North Cabin - Melpakkam	2nd Line	2nd Line with TCAS Signalling	-	-	-

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Chengalpattu	Kanchipuram	35.76	SR	MAS	Chengalpattu Jn. - Arakkonam Jn.	2nd Line	-	2nd Line with TCAS Signalling	-	-
Kanchipuram	Takkolam	20.28	SR	MAS	Chengalpattu Jn. - Arakkonam Jn.	2nd Line	-	2nd Line with TCAS Signalling	-	-
Takkolam	Arakkonam	6.44	SR	MAS	Chengalpattu Jn. - Arakkonam Jn.	2nd Line	-	2nd Line with TCAS Signalling	-	-
Chennai Beach	Chennai Egmore	4.29	SR	MAS	Chennai Beach - Chennai Egmore	4th Line	-	4th Line with TCAS Signalling	-	-
Royapuram	Chennai Beach	1.23	SR	MAS	Chennai Beach - Royapuram	4th Line	4th Line with TCAS Signalling	-	-	-
Chennai Beach	Tambaram	28.95	SR	MAS	Chennai Beach - Tambaram (Suburban)	2nd Line	-	-	-	-
Chennai Fort	Velachery	17.56	SR	MAS	Chennai Beach - Velachery (MRTS)	2nd Line	-	-	-	-
Chennai Beach	Chennai Fort	1.42	SR	MAS	Chennai Beach - Velachery (MRTS)	2nd Line	-	-	-	-
St Thomas Mount	Velachery	4.05	SR	MAS	Chennai Beach - Velachery (MRTS)	Single Line	2nd Line with Normal Signalling	-	-	-
Veysarpadi	Korukkupet	2.61	SR	MAS	Korukkupet - Vyasarpadi	2nd Line	-	-	-	-
Washermanpet	Royapuram	1.00	SR	MAS	Royapuram - Washermanpet.	4th Line	-	-	4th Line with TCAS Signalling	-
Villivakkam	Annanagar West	4.28	SR	MAS	Villivakkam - Annanagar	Single Line	-	-	-	-
Washermanpet	Basin Bridge	1.84	SR	MAS	Washermanpet - Basin Bridge Jn.	2nd Line	-	-	-	-
Korukkupet	Washermanpet	1.07	SR	MAS	Washermanpet - Korukkupet.	2nd Line	-	-	2nd Line with TCAS Signalling	-
Veysarpadi	Washermanpet	2.87	SR	MAS	Washermanpet - Vyasarpadi.	2nd Line	-	-	4th Line with TCAS Signalling	-
Dindigul	Palani	57.91	SR	MDU	Dindigul Jn. - Palani	Single Line	-	-	2nd Line with Normal Signalling	-
Manamadurai Jn	Sivaganga	20.29	SR	MDU	Karaikkudi Jn. - Manamadurai	Single Line	-	2nd Line with Normal Signalling	-	-
Sivaganga	Karaikkudi	40.98	SR	MDU	Karaikkudi Jn. - Manamadurai	Single Line	-	2nd Line with Normal Signalling	-	-
Madurai Jn	Manamadurai Jn	46.58	SR	MDU	Madurai - Manamadurai Jn.	Single Line	-	-	-	-
Madurai Jn	Aruppukkottai	50.51	SR	MDU	Madurai Jn - Aruppukkottai	Single Line	-	-	-	-

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Manamadurai Jn	Ramanathapuram	60.36	SR	MDU	Manamadurai Jn. - Rameswaram	Single Line	-	-	-	-
Ramanathapuram	Pamban	43.01	SR	MDU	Manamadurai Jn. - Rameswaram	Single Line	-	-	-	-
Pamban	Rameshwaram	10.73	SR	MDU	Manamadurai Jn. - Rameswaram	Single Line	-	-	-	-
Aruppukkottai	Manamadurai Jn	44.55	SR	MDU	Manamadurai Jn. - Virudunagar Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Virudunagar Jn	Aruppukkottai	22.05	SR	MDU	Manamadurai Jn. - Virudunagar Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Milavittam	Aruppukkottai	83.73	SR	MDU	Milavittam - Aruppukkottai	Single Line	-	-	-	2nd Line with Normal Signalling
Palani	Udumalaipettai	34.22	SR	MDU	Palani - Pollachi Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Udumalaipettai	Pollachi Jn	28.85	SR	MDU	Palani - Pollachi Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Kollam Jn	Punalur	43.33	SR	MDU	Punalur - Kollam Jn.	Single Line	-	-	-	-
Punalur	Sengottai	47.25	SR	MDU	Sengottai - Punalur	Single Line	-	-	2nd Line with Normal Signalling	-
Tenkasi Jn	Sengottai	8.02	SR	MDU	Tenkasi Jn. - Sengottai Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Tirunelveli Jn	Tenkasi Jn	71.05	SR	MDU	Tenkasi Jn. - Tirunelveli	Single Line	-	-	-	-
Tirunelveli Jn	Tiruchendur	60.95	SR	MDU	Tirunelveli Jn. - Tiruchendur	Single Line	-	-	-	-
Vanchi Maniyachchi Jn	Milavittam	23.48	SR	MDU	Vanchi Maniyachchi Jn. - Tuticorin.	2nd Line	-	-	-	-
Milavittam	Tuticorin	7.44	SR	MDU	Vanchi Maniyachchi Jn. - Tuticorin.	2nd Line	-	-	-	-
Tenkasi Jn	Sivakasi	96.65	SR	MDU	Virudunagar - Tenkasi Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Sivakasi	Virudunagar Jn	23.91	SR	MDU	Virudunagar - Tenkasi Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Pollachi Jn	Kinattukadavu	19.69	SR	PGT	Kinattukkadavu - Pollachi Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Thokur	Mangalore Jn	14.65	SR	PGT	Mangaluru Jn. - Thokur	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Netravathi	Mangalore Central	3.70	SR	PGT	Netravati - Mangaluru Central	2nd Line	-	-	-	-
Palakkad Jn	Palakkad Town	4.14	SR	PGT	Palakkad Town - Palakkad Jn.	Single Line	-	-	-	-

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Palakkad Town	Kollengode	18.76	SR	PGT	Pollachi Jn. - Palakkad Town.	Single Line	-	-	-	2nd Line with Normal Signalling
Kollengode	Pollachi Jn	34.50	SR	PGT	Pollachi Jn. - Palakkad Town.	Single Line	-	-	-	2nd Line with Normal Signalling
Shoranur Jn	Angadipuram	27.31	SR	PGT	Shoranur Jn. - Nilambur Road	Single Line	-	-	-	-
Angadipuram	Nilambur Road	37.87	SR	PGT	Shoranur Jn. - Nilambur Road	Single Line	-	-	-	-
Podanur Jn	Coimbatore Jn	5.94	SR	SA	Coimbatore Jn. - Podanur Jn.	2nd Line	-	-	2nd Line with TCAS Signalling	-
Coimbatore Jn	Coimbatore North Jn	2.84	SR	SA	Coimbatore North Jn. - Coimbatore Jn.	2nd Line	-	-	2nd Line with TCAS Signalling	-
Coimbatore North Jn	Mettupalaiyam Jn	32.44	SR	SA	Coimbatore North Jn. - Mettupalayam	Single Line	-	-	-	-
Coonoor	Udagamandalam	15.80	SR	SA	Coonoor - Udagamandalam	Single Line	-	-	-	-
Coimbatore North Jn	Irugur	15.31	SR	SA	Irugur Jn. - Coimbatore North Jn.	2nd Line	-	-	2nd Line with TCAS Signalling	-
Mettupalaiyam Jn	Coonoor	18.34	SR	SA	Mettupalayam - Coonoor	Single Line	-	-	-	-
Omalur	Mettur Dam	28.06	SR	SA	Omalur - Mettur Dam	2nd Line	-	-	-	-
Kinattukadavu	Podanur Jn	18.28	SR	SA	Podanur Jn - Kinattukkadavu	Single Line	-	-	2nd Line with Normal Signalling	-
Villupuram	Tiruppadirippuliyur	42.88	SR	TPJ	Villupuram - Cuddalore Port Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Tiruppadirippuliyur	Cuddalore Port Jn	3.84	SR	TPJ	Villupuram - Cuddalore Port Jn.	Single Line	-	-	2nd Line with Normal Signalling	-
Villianur Halt	Villupuram	29.69	SR	TPJ	Villupuram - Puducherry	Single Line	-	-	-	-
Puducherry	Villianur Halt	7.61	SR	TPJ	Villupuram - Puducherry	Single Line	-	-	-	-
Kottayam	Chengannur	33.77	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2nd Line with TCAS Signalling	-	-
Chengannur	Kayankulam Jn	20.08	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2nd Line with TCAS Signalling	-	-
Piravam Road	Vaikam Road	5.91	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2nd Line with TCAS Signalling	-	-

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Vaikam Road	Kottayam	24.44	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2nd Line with TCAS Signalling	-	-
Ernakulam C Cabin	Piravam Road	28.06	SR	TVC	Ernakulam 'C' Cabin. - Kayankulam Jn. (Via Kottayam)	2nd Line	-	2nd Line with TCAS Signalling	-	-
Ernakulam Jn	Ernakulam C Cabin	1.53	SR	TVC	Ernakulam Jn. - Ernakulam 'C' Cabin	3rd Line	-	-	-	-
Ernakulam Jn	Cochin Harbour Terminus	8.02	SR	TVC	Ernakulam Jn. - Kochi Harbour Terminus	Single Line	-	-	-	-
Ernakulam Town	Ernakulam C Cabin	1.26	SR	TVC	Ernakulam Town - Ernakulam 'C' Cabin	3rd Line	-	-	-	-
Punkunnam	Guruvayur	20.04	SR	TVC	Punkunnam - Guruvayur	Single Line	-	-	-	-
Kaladi	Angamali for Kaladi	9.08	SR	TVC	Thrisur - Ernakulam Town 2	Single Line	-	-	-	-
Arsikere jn	Hassan Jn	46.49	SWR	MYS	Arsikere - Hassan	Single Line	-	-	-	-
Shivamogga Town	Birur jn	62.22	SWR	MYS	Birur - Shimoga	2nd Line	-	-	-	-
Chitradurg	Rayadurg	97.22	SWR	MYS	Chikjajur - Raydurga	Single Line	-	-	-	2nd Line with Normal Signalling
Chikjajur jn	Chitradurg	32.86	SWR	MYS	Chikjajur - Raydurga	Single Line	-	-	-	2nd Line with Normal Signalling
Davangere	Chitradurg	58.95	SWR	MYS	Davangere - Chitradurg	Single Line	-	-	-	-
Hassan Jn	Mysuru Jn	116.78	SWR	MYS	Hasan - Mysore	Single Line	-	-	-	-
Sakleshpur	Hassan Jn	41.16	SWR	MYS	Hassan - Sakleshpur	Single Line	-	-	-	-
Sakleshpur	Chikkamagaluru	46.57	SWR	MYS	Kadur - Chikmagalur	2nd Line	-	-	-	-
Chikkamagaluru	Kadur jn	44.66	SWR	MYS	Kadur - Chikmagalur	Single Line	2nd Line with Normal Signalling	-	-	-
Mysuru Jn	Nanjangud	24.41	SWR	MYS	Mysore - Nanjangud	Single Line	-	-	-	-
Subrahmanya Road	Sakleshpur	53.63	SWR	MYS	Sakaleshpur - Subramanyaroad	Single Line	-	-	-	2nd Line with Normal Signalling
Shivamogga Town	Talguppa	97.43	SWR	MYS	Shimoga - Talguppa	Single Line	-	-	-	-
Shravanabelagola	Hassan Jn	41.22	SWR	MYS	Shravanabelagola - Hassan (RG - 1in100)	Single Line	-	-	-	-
Mangalore Jn	Subrahmanya Road	85.21	SWR	MYS	Subramanya Road - Padil	Single Line	-	-	-	2nd Line with Normal Signalling
Tumakuru	Chitradurg	133.84	SWR	MYS	Tumakuru - Chitradurg	Single Line	-	-	-	-
Dharmavaram Jn	Penukonda Jn	40.97	SWR	SBC	Baiyyappanahalli - Bengaluru	2nd Line	2nd Line with TCAS Signalling	-	-	3rd Line with TCAS Signalling

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Dharmavaram Jn	Sri Sathya Sai Prasanthi Nilayam	33.11	SWR	SBC	Bengaluru - Baiyyappanahallli	2nd Line	-	-	-	-
Sri Sathya Sai Prasanthi Nilayam	Penukonda Jn	20.65	SWR	SBC	Bengaluru - Baiyyappanahallli	2nd Line	-	-	-	-
Bangarapet	Kolar	16.60	SWR	SBC	Dharmavaram - Penukonga via SSPN	Single Line	-	-	-	-
Kolar	Srinivaspura	27.31	SWR	SBC	Kolar - Chikballapur	Single Line	-	-	-	-
Srinivaspura	Chikballapur	58.51	SWR	SBC	Kolar - Chikballapur	Single Line	-	-	-	-
Chikballapur	Yelahanka	45.62	SWR	SBC	Mysuru - Bengaluru	2nd Line	-	-	-	-
Bangarapet	Marikuppam	15.23	SWR	SBC	Penukonda - Dharmavaram via NGM	2nd Line	-	-	-	-
Yesvantpur	Banaswadi	10.10	SWR	SBC	Penukonda - Dharmavaram via SSPN	2nd Line	-	-	-	-
Banaswadi	Baiyyappanahalli	6.13	SWR	SBC	Penukonda - Dharmavaram via SSPN	Single Line	2nd Line with Normal Signalling	-	-	-
Nanjangud	Chamarajanagar	34.77	SWR	SBC	Penukonda - Yelahanka	Single Line	2nd Line with Normal Signalling	-	-	-
Yelahanka	Baiyapannahalli ABC	14.61	SWR	SBC	Yelahanka - Baiyyappanahalli via CSDR	2nd Line	-	-	-	2nd Line with TCAS Signalling
Yesvantpur	Yelahanka	10.57	SWR	SBC	Yelahanka - Baiyyappanahalli via CSDR	2nd Line	-	-	-	2nd Line with TCAS Signalling
Hindupur	Someshwara	28.83	SWR	SBC	Yelahanka - Penukonda	2nd Line	-	-	-	2nd Line with TCAS Signalling
Someshwara	Yelahanka	54.81	SWR	SBC	Yelahanka - Penukonda	2nd Line	-	-	-	2nd Line with TCAS Signalling
Penukonda Jn	Hindupur	37.20	SWR	SBC	Yelahanka - Penukonda	2nd Line	-	-	-	2nd Line with TCAS Signalling
Bengaluru city	Yesvantpur	5.34	SWR	SBC	Yelahanka - Penukonda	2nd Line	-	-	-	2nd Line with TCAS Signalling
Shravanabelagola	Kunigal	67.01	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Chikbanavar	Solur	31.78	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Pavagada	Rayadurg	114.73	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Madakasira	Tumakuru	81.22	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling

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Pavagada	Madakasira	17.67	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Kunigal	Solur	26.95	SWR	SBC	Yeshwanthpur - LOGH - Yelahanka	Single Line	2nd Line with Normal Signalling	-	-	2nd Line with TCAS Signalling
Bagalkot	Vijayapura	95.72	SWR	UBL	Bagalkot - Vijayapura	2nd Line	-	-	-	-
Bagalkot	Kudachi	129.43	SWR	UBL	Bagalkot - Vijayapura	Single Line	2nd Line with Normal Signalling	-	-	-
Ballari Jn	Rayadurg	52.30	SWR	UBL	Ballari - Rayadurga	Single Line	2nd Line with Normal Signalling	-	-	-
Gadag Jn	Bagalkot	93.10	SWR	UBL	Gadag - Bagalkot	2nd Line	-	-	-	2nd Line with TCAS Signalling
Chikkabenekal	Ginigera	68.72	SWR	UBL	Ginigera - Chikkabenekal	Single Line	-	-	-	-
Raichur Jn	Ginigera	111.37	SWR	UBL	Ginigera - Chikkabenekal	Single Line	-	-	-	-
Hosapete Jn	Vyasa Colony	13.33	SWR	UBL	Hosapete - Swamihalli	Single Line	-	-	-	-
Vyasa Colony	Gunda Road	3.76	SWR	UBL	Hosapete - Swamihalli	Single Line	-	-	-	-
Gunda Road	Yeshwantnagar	21.69	SWR	UBL	Hosapete - Swamihalli	Single Line	-	-	-	-
Kotturu	Amaravathi Colony Jn	65.58	SWR	UBL	Kottur - Amaravathi colony	Single Line	-	-	-	2nd Line with Normal Signalling
Ranjithpura	Torangallu Jn	21.90	SWR	UBL	Toranagallu - Ranjitpura	2nd Line	-	-	-	-
Gunda Road	Kotturu	52.97	SWR	UBL	Vyasa colony - Kottur	Single Line	-	-	-	2nd Line with Normal Signalling
Dum Dum Jn	Ballygunge Jn	12.97	t	t	Dum Dum Jn - Ballygunge Jn	4th Line	-	-	-	-
Bir	Khirkiya	34.94	WCR	BPL	ET - KNW	2nd Line	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling	-	-
Talvadya	Bir	19.10	WCR	BPL	ET - KNW	2nd Line	2nd Line with TCAS Signalling	3rd Line with TCAS Signalling	-	-
Maksi Jn	Shajapur	27.66	WCR	BPL	MAKSI - RUTHIYAI	Single Line	-	-	2nd Line with Normal Signalling	-
Biyavra Rajgarh	Ruthiyai jn	77.20	WCR	BPL	MAKSI - RUTHIYAI	Single Line	-	-	2nd Line with Normal Signalling	-
Shajapur	Biyavra Rajgarh	89.05	WCR	BPL	MAKSI - RUTHIYAI	Single Line	-	-	2nd Line with Normal Signalling	-
Bhopal jn	Biyavra Rajgarh	105.71	WCR	BPL	MAKSI - RUTHIYAI	Single Line	-	-	2nd Line with Normal Signalling	-
Rewa	Satna Jn	49.99	WCR	JBP	REWA - SATNA	2nd Line	-	-	-	-
Rewa	Singrauli Jn	166.56	WCR	JBP	Rewa - Singrauli Jn	Single Line	-	-	2nd Line with Normal Signalling	-

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Bhuj	Ajnar	42.26	WR	ADI	Adipur - Bhuj	Single Line	-	-	-	-
Ajnar	Adipur Jn	7.15	WR	ADI	Adipur - Bhuj	Single Line	-	-	-	-
Vijapur	Adraj Moti	40.16	WR	ADI	Adraj Moti - Vijapur	Single Line	-	-	-	-
SBT A Cabin	Ahmedabad Jn	5.10	WR	ADI	Ahmadabad - SBTA	3rd Line	-	3rd Line with TCAS Signalling	-	-
Ahmedabad Jn	Asarva	2.55	WR	ADI	Ahmedabad - Asarva	Single Line	-	-	-	2nd Line with Normal Signalling
Asarva	Nandol Dahegam	26.55	WR	ADI	Asarva - Nandol Dahegam	Single Line	-	-	-	2nd Line with Normal Signalling
Chandlodiya	Khodiyar Jn	9.80	WR	ADI	Chandlodiya - Khodiyar	2nd Line	-	-	-	-
Gandhinagar Capital	Kalol Jn	19.91	WR	ADI	Gandhinagar - Kalol	Single Line	-	-	-	-
Himmatnagar Jn	Khed Brahma	54.79	WR	ADI	Himmatnagar - Khedbramha	Single Line	-	-	-	-
Kharaghoda	Jhund Jn	22.87	WR	ADI	Jhund - Kharaghoda	Single Line	-	-	-	-
Katosan Road Jn	Kalol Jn	37.37	WR	ADI	Katosan Road - Kalol	Single Line	-	-	-	2nd Line with Normal Signalling
Khodiyar Jn	Gandhinagar Capital	12.70	WR	ADI	Khodiyar - Gandhinagar	2nd Line	-	-	-	-
Mahesana Jn	Ranuj Jn	25.74	WR	ADI	Mahesana - Patan	Single Line	-	-	-	-
Patan	Ranuj Jn	13.36	WR	ADI	Mahesana - Patan	Single Line	-	-	-	-
Mahesana Jn	Taranga Hill	56.54	WR	ADI	Mehsana - Taranga Hill	Single Line	-	-	-	-
Nandol Dahegam	Himmatnagar Jn	58.81	WR	ADI	Nandol Dahegam - Himmatnagar	Single Line	-	-	-	2nd Line with Normal Signalling
Naliya	Bhuj	99.62	WR	ADI	New Bhuj - Naliya	Single Line	-	-	-	-
Ranuj Jn	Chanasma	12.87	WR	ADI	Ranuj - Chanasma - Katosan Road	Single Line	-	-	-	-
Katosan Road Jn	Chanasma	51.84	WR	ADI	Ranuj - Chanasma - Katosan Road	Single Line	-	-	-	-
Sabarmati Jn	Asarva	9.03	WR	ADI	Sabarmati - Asarva	Single Line	-	-	-	-
Sabarmati Jn	Kalol Jn	20.20	WR	ADI	Sabarmati - Kalol	Single Line	-	-	-	-
Sabarmati Jn	SBT A Cabin	1.45	WR	ADI	SBTA - Sabarmati	2nd Line	-	-	2nd Line with TCAS Signalling	-
Ambliyasan Jn	Vijapur	41.40	WR	ADI	Vijapur - Ambliyasan	Single Line	-	-	-	-
Katosan Road Jn	Mahesana Jn	26.51	WR	ADI	Viramgam - Mahesana	Single Line	-	-	-	2nd Line with Normal Signalling
Viramgam Jn	Katosan Road Jn	37.87	WR	ADI	Viramgam - Mahesana	Single Line	-	-	-	2nd Line with Normal Signalling
Chalthan	Bhestan	13.67	WR	BCT	Bhestan - Chalthan(Bypass)	2nd Line	-	-	-	-

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Bilimora Jn	Waghai	61.71	WR	BCT	Billimora - Waghai	Single Line	-	-	-	-
Anand Jn	Petlad Jn	21.98	WR	BRC	Anand - Khambhat	Single Line	-	-	-	-
Petlad Jn	Tarapur	14.00	WR	BRC	Anand - Khambhat	Single Line	-	-	-	-
Tarapur	Khambhat	16.64	WR	BRC	Anand - Khambhat	Single Line	-	-	-	-
Jhagadiya Jn	Rajpipla	41.99	WR	BRC	Ankaleshwar - Rajpipala	Single Line	-	-	-	-
Ankleshwar Jn	Jhagadiya Jn	20.85	WR	BRC	Ankaleshwar - Rajpipala	Single Line	-	-	-	-
Samni Jn	Bharuch Jn	22.56	WR	BRC	Bharuch - Dahej	Single Line	-	-	-	2nd Line with Normal Signalling
Samni Jn	Dahej	39.70	WR	BRC	Bharuch - Dahej	Single Line	-	-	-	2nd Line with Normal Signalling
Chhuchhapura Jn	Chhota Udepur	49.37	WR	BRC	Chhuchhapura - Chhota Udepur	Single Line	-	-	2nd Line with Normal Signalling	-
Chhuchhapura Jn	Tankhala	36.90	WR	BRC	Chhuchhapura - Tankhala	Single Line	-	-	-	-
Miyagam Karjan Jn	Choranda Jn	8.45	WR	BRC	Choranda - Miyagaon Karjan	Single Line	-	-	-	-
Choranda Jn	Moti Koral	18.05	WR	BRC	Choranda - Moti Koral	Single Line	-	-	-	-
Dabhoi Jn	Chandod	16.87	WR	BRC	Dabhoi - Chandod	Single Line	-	-	-	-
Dabhoi Jn	Chhuchhapura Jn	21.39	WR	BRC	Dabhoi - Chhuchhapura	Single Line	-	-	2nd Line with Normal Signalling	-
Sevaliya	Timba Road	3.30	WR	BRC	Godhra - Sevaliya	2nd Line	-	-	-	-
Timba Road	Godhra Jn	24.38	WR	BRC	Godhra - Sevaliya	2nd Line	-	-	-	-
Jambusar Jn	PratapNagar	52.41	WR	BRC	Jambusar - Pratapnagar	Single Line	-	-	2nd Line with Normal Signalling	-
Kanjari Boriyavi Jn	Vadtal Swaminarayan	5.72	WR	BRC	Kanjari Boriyavi - V's'narayan	Single Line	-	-	-	-
Kosamba Jn	Umarpada	60.11	WR	BRC	Kosamba - Umarpada	Single Line	-	-	-	-
Choranda Jn	Malsar	29.21	WR	BRC	Malasar - Choranda	Single Line	-	-	-	-
Miyagam Karjan Jn	Dabhoi Jn	32.79	WR	BRC	Miyagam Karjan - Dabhoi	Single Line	-	-	2nd Line with Normal Signalling	-
Modasa	Nadiad Jn	104.47	WR	BRC	Nadiad - Modasa	Single Line	-	-	-	-
Nadiad Jn	Petlad Jn	35.64	WR	BRC	Nadiad - Petlad	Single Line	-	-	-	-
Bochasan Jn	Bhadran	7.95	WR	BRC	Petlad - Bhadran	Single Line	-	-	-	-
Petlad Jn	Bochasan Jn	13.17	WR	BRC	Petlad - Bhadran	Single Line	-	-	-	-
PratapNagar	Dabhoi Jn	26.76	WR	BRC	Pratap Nagar - Dabhoi	Single Line	-	-	-	-
Jambusar Jn	Samni Jn	24.29	WR	BRC	Samni - Kavi	Single Line	-	-	2nd Line with Normal Signalling	-
Jambusar Jn	Kavi	26.41	WR	BRC	Samni - Kavi	Single Line	-	-	2nd Line with Normal Signalling	-

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Anand Jn	Sevaliya	51.18	WR	BRC	Sevaliya - Anand	2nd Line	-	-	-	-
Vishvamitri Jn	PratapNagar	4.06	WR	BRC	Vadodara - Pratap Nagar	Single Line	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling	-
Bochasan Jn	Vasad Jn	25.73	WR	BRC	Vasad - Kathana	Single Line	-	-	-	-
Bochasan Jn	Kathana	16.40	WR	BRC	Vasad - Kathana	Single Line	-	-	-	-
Ningala	Botad Jn	17.74	WR	BVP	Botad - Dhola	Single Line	-	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling
Dhola Jn	Ningala	24.32	WR	BVP	Botad - Dhola	Single Line	-	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling
Khijadiya Jn	Dhasa Jn	26.51	WR	BVP	Dhasa - Khijadiya	Single Line	-	-	-	2nd Line with Normal Signalling
Kanalus Jn	Khambhaliya	28.02	WR	BVP	Dhasa - Rajula Road	Single Line	-	-	-	-
Dhasa Jn	Rajula Jn	95.33	WR	BVP	Dhasa - Rajula Road	Single Line	-	-	-	-
Khambhaliya	Okha	113.72	WR	BVP	Dhasa - Rajula Road	Single Line	-	-	-	-
Dhasa Jn	Dhola Jn	23.65	WR	BVP	Dhola - Dhasa	Single Line	-	-	2nd Line with Normal Signalling	-
Dhola Jn	Sihor Gujarat Jn	29.15	WR	BVP	Dhola - Sihor	Single Line	-	-	-	2nd Line with Normal Signalling
Jetalasar Jn	Junagadh Jn	26.38	WR	BVP	Jetalsar - Junagarh	Single Line	-	-	-	2nd Line with Normal Signalling
Wansjaliya Jn	Jetalasar Jn	90.85	WR	BVP	Jetalsar - Wansjaliya	Single Line	-	-	-	2nd Line with Normal Signalling
Junagadh Jn	Veraval Jn	81.74	WR	BVP	Junagarh - Veraval	Single Line	-	-	-	-
Kanalus Jn	Wansjaliya Jn	70.21	WR	BVP	Kanalus - Wansjaliya	Single Line	-	-	-	2nd Line with Normal Signalling
Amreli	Khijadiya Jn	16.62	WR	BVP	Khijadiaya - Visavadar	Single Line	-	-	-	-
Visavadar jn	Amreli	74.42	WR	BVP	Khijadiaya - Visavadar	Single Line	-	-	-	-
Khijadiya Jn	Kunkavav	34.13	WR	BVP	Khijadiya - Jetalsar	Single Line	-	-	-	2nd Line with Normal Signalling
Kunkavav	Jetalasar Jn	44.29	WR	BVP	Khijadiya - Jetalsar	Single Line	-	-	-	2nd Line with Normal Signalling
Prachi Road Jn	Delvada	49.72	WR	BVP	Prachi Road - Delvada	Single Line	-	-	-	-
Kodinar	Prachi Road Jn	25.36	WR	BVP	Prachi Road - Kodinar	Single Line	-	-	-	-
Rajkot City	Jetalasar Jn	77.98	WR	BVP	Rajkot - Jetalsar	Single Line	-	-	-	2nd Line with Normal Signalling
Rajula City	Pipavav Port	19.21	WR	BVP	Rajula City - Pipavav	Single Line	-	-	-	-
Mahuva	Rajula Jn	30.97	WR	BVP	Rajula Road - Mahuva	Single Line	-	-	-	-
Rajula Jn	Rajula City	7.61	WR	BVP	Rajula Road - Rajula City	Single Line	-	-	-	-
Botad Jn	Sabarmati Jn	169.26	WR	BVP	Sabarmati - Botad	Single Line	-	-	-	-

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Sihor Gujarat Jn	Bhavnagar Terminus	20.19	WR	BVP	Sihor - Bhavnagar	Single Line	-	-	-	2nd Line with Normal Signalling
Sihor Gujarat Jn	Palitana	27.90	WR	BVP	Sihor - Palitana	Single Line	-	-	-	-
Botad Jn	Surendranagar Jn	76.88	WR	BVP	Surend'nagar - Botad	Single Line	-	-	2nd Line with Normal Signalling	-
Prachi Road Jn	Talala Jn	19.92	WR	BVP	Talala - Prachi Road	Single Line	-	-	-	-
Talala Jn	Veraval Jn	24.62	WR	BVP	Talala - Veraval	Single Line	-	-	-	-
Veraval Jn	Somnath	4.47	WR	BVP	Veraval - Somnath	Single Line	-	-	-	-
Junagadh Jn	Visavadar jn	42.10	WR	BVP	Visavadar - Junagarh	Single Line	-	-	-	-
Visavadar jn	Talala Jn	46.37	WR	BVP	Visavadar - Talala	Single Line	-	-	-	-
Wansjaliya Jn	Porbandar	33.37	WR	BVP	Wansjaliya - Porbander	Single Line	-	-	-	-
Maliya Miyana Jn	Dahinsara Jn	24.63	WR	RJT	Dahinsara - Maliya Miyana	Single Line	-	-	-	-
Dahinsara Jn	Navlakhi	18.33	WR	RJT	Dahinsara - Navlakhi	Single Line	-	-	-	-
Hapa	Jamnagar Jn	7.20	WR	RJT	Hapa - Jamnagar	2nd Line	-	-	-	-
Jamnagar Jn	Kanalus Jn	26.89	WR	RJT	Jamnagar - Kanalus	2nd Line	-	-	-	-
Jamnagar Jn	Windmill	1.79	WR	RJT	Jamnagar - Windmill	Single Line	-	-	-	-
Kanalus Jn	Sikka	15.02	WR	RJT	Kanalus - Sikka	Single Line	-	-	-	-
Rajkot City	Hadmatiya	39.46	WR	RJT	Rajkot - Hapa	2nd Line	2nd Line with TCAS Signalling	-	3rd Line with TCAS Signalling	-
Hadmatiya	Hapa	37.40	WR	RJT	Rajkot - Hapa	2nd Line	2nd Line with TCAS Signalling	-	3rd Line with TCAS Signalling	-
Surendranagar Jn	Dhrangadhra Jn	33.68	WR	RJT	Surend'nagar - Dhrangadhra	Single Line	-	-	-	-
Morbi Jn	Wankaner Jn	27.65	WR	RJT	Wankaner - Dahinsara	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Dahinsara Jn	Morbi Jn	26.64	WR	RJT	Wankaner - Dahinsara	Single Line	-	-	2nd Line with Normal Signalling	2nd Line with TCAS Signalling
Bhopal jn	Bairagarh	9.88	WR	RTM	Bairagarh - Bhopal	3rd Line	3rd Line with TCAS Signalling	-	-	-
Dhar	Chhota Udepur	152.69	WR	RTM	Chhuchhapura - Chhota Udepur	Single Line	-	-	2nd Line with Normal Signalling	-
Indore jn	dewas jn	38.53	WR	RTM	Dewas - Indore	2nd Line	-	2nd Line with TCAS Signalling	-	-
dewas jn	Maksi Jn	36.54	WR	RTM	Dewas - Maksi	Single Line	-	2nd Line with Normal Signalling	-	2nd Line with TCAS Signalling
Dhar	Dahod	116.47	WR	RTM	Dhar - Dahod	Single Line	-	-	2nd Line with Normal Signalling	-
Ujjain Jn	Fatehabad Chandrawatiganj Jn	22.51	WR	RTM	Fatehabad - C'gunj - Ujjain	2nd Line	-	-	-	-

NODE_A	NODE_B	Line Length in KM	Zone	Division	Section	Configuration after completion of Works as per Pink Book	New Proposed Configuration 26	New Proposed Configuration 31	New Proposed Configuration 41	New Proposed Configuration 51
Sehore	Maksi Jn	104.10	WR	RTM	Maksi - Bairagarh	2nd Line	2nd Line with TCAS Signalling	-	-	-
Bairagarh	Sehore	27.86	WR	RTM	Maksi - Bairagarh	2nd Line	2nd Line with TCAS Signalling	-	-	-
Nagda JN	Ujjain Jn	55.95	WR	RTM	Nagda - Ujjain	2nd Line	2nd Line with TCAS Signalling	-	-	-
Rau	Tihi	8.69	WR	RTM	Rau - MHOW	2nd Line	-	-	-	-
Dhar	Tihi	44.94	WR	RTM	Rau - MHOW	Single Line	2nd Line with Normal Signalling	-	-	-
Ujjain Jn	dewas jn	40.31	WR	RTM	Ujjain - Dewas	Single Line	-	-	-	2nd Line with TCAS Signalling
Ujjain Jn	Maksi Jn	41.07	WR	RTM	Ujjain - Maksi	2nd Line	2nd Line with TCAS Signalling	-	-	-

ANNEXURE 19.1: Age Profile of existing Wagon Fleet of IR

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Open wagon											5,313	5,313	5,313	5,313	5,313	5,313	5,313	5,313	5,313	5,313
Covered wagon						398	398	398	398	398	398	398	398	398	398	398	398	398	398	398
Tank wagon	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222
Container wagon						540	540	540	540	540	540	540	540	540	540	540	540	540	540	540
Flat wagon						271	271	271	271	271	271	271	271	271	271	271	271	271	271	271
Brake Van						75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
TOTAL	222	222	222	222	222	1,432	1,432	1,432	1,432	1,432	6,745	6,745	6,745	6,745	6,745	6,745	6,745	6,745	6,745	6,745

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Open wagon	2,205	1,694	2,062	1,147	3,097	3,367	5,874	5,405	5,343	5,755	5,768	10,356	6,571	3,450	6,431	8,167	10,160	4,786	5,350	8,541	1,58,652
Covered wagon	3,393	2,535	4,024	4,546	3,510	3,277	2,614	4,742	3,822	6,686	8,039	3,906	7,136	3,075	3,006	2,512	851	1,233	3,713	2,648	81,237
Tank wagon	526	219	239	274	222	218	421	838	813	327	666	1,253	365	767	114	13	11	-	133	137	11,999
Container Wagon	-	26	75	200	285	276	501	2,780	3,314	1,876	1,516	1,212	1,063	651	1,300	2,288	1,074	1,299	2,432	2,624	32,894
Flat wagon	962	512	178	355	859	288	501	699	1,654	186	-	1,279	1,435	1,117	69	352	176	597	866	360	16,515
Brake Van	38	312	-	121	59	116	165	237	316	768	650	351	325	267	232	81	52	100	155	186	5,660
TOTAL	7,086	4,986	6,577	6,522	7,973	7,426	9,911	14,463	14,945	14,829	15,988	18,006	16,569	9,059	10,919	13,331	12,271	7,915	12,494	14,309	3,01,296

ANNEXURE 21.1: Annual Capital Expenditure Requirement in INR crores (2022-2031)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total*
DFC	15,172	15,654	16,137	16,619	17,102	17,584	18,066	18,549	19,031	11,928	1,73,428
HSR	50,420	53,366	56,312	59,258	62,204	65,150	68,096	71,042	73,988	51,724	6,36,770
Core Track Infrastructure	38,323	46,571	46,571	43,135	27,844	14,272	14,272	14,272	15,899	20,439	3,00,244
Freight Terminals	1061	1560	1560	1352	1040	832	832	832	541	291	10,402
Passenger Terminals	10,863	10,863	10,863	10,863	10,863	3,235	3,235	3,235	3,235	3,235	70,490
Wagons	7,813	7,813	7,813	7,813	7,813	9,307	9,307	9,307	9,307	9,307	85,600
Coaches	24,235	24,235	24,235	24,235	24,235	11,277	11,277	11,277	11,277	11,277	1,77,560
Locomotives	30,867	30,867	30,867	30,867	30,867	13,009	13,009	13,009	13,009	13,009	2,19,380
Total	**1,78,754**	**1,90,929**	**1,94,358**	**1,94,142**	**1,81,968**	**1,34,666**	**1,38,094**	**1,41,523**	**1,46,287**	**1,21,210**	**16,73,874**

*Technical consultants have assumed some investment in FY2021. The figure is summation of investments required for the period FY21-FY31

ANNEXURE 21.2: Decadal Capital Expenditure Requirement in INR crores (2031, 2041 and 2051)

	2021-31*	2032-41	2042-51	Total
DFC	1,73,428	40,050	16,522	2,30,000
HSR	6,36,770	4,75,680	3,83,350	14,95,800
Core Track Infrastructure	3,00,244	2,17,557	1,64,472	6,82,272
Freight Terminals	10,402	-	-	10,402
Passenger Stations	70,490	9,324	4,041	83,855
Wagons	85,600	86,572	1,26,481	2,98,653
Coaches	1,77,560	85,436	1,13,782	3,76,778
Locomotives	2,19,380	1,89,140	2,35,718	6,44,238
Total	**16,73,874**	**11,03,759**	**10,44,366**	**38,21,998**

*Technical consultants have assumed some investment in FY2021. The figure is summation of investments required for the period FY21-FY31

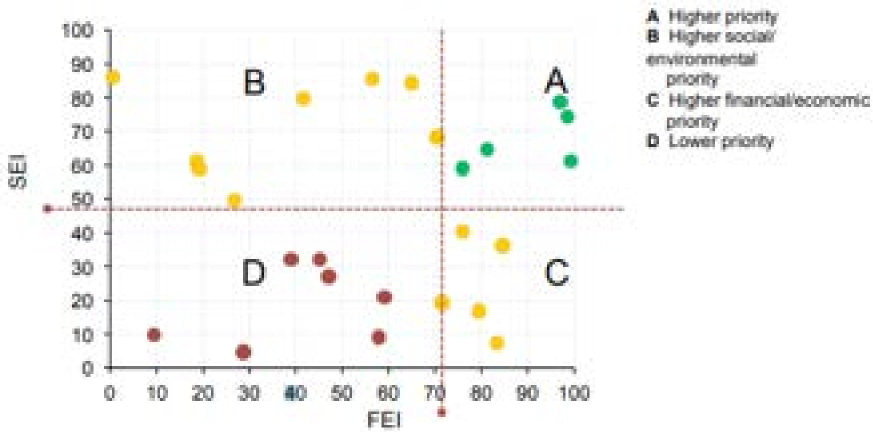
ANNEXURE 21.3: Infrastructure Prioritization Framework (IPF)

Infrastructure Prioritization Framework (IPF) helps inform decisions on which infrastructure projects to prioritize based on multiple criteria that consider project outcomes along two dimensions – social-environmental and financial-economic.

IPF focuses on development of a composite indicator to synthesize, simplify and appropriately represent more complex information sets. Statistical methods are used to combine indicators into social-environmental index (SEI) and financial-economic index (FEI) scores.

IPF allows for consideration of two aggregated index values as opposed to an individual mapping of a multitude of base indicators across projects. To account for the difference in importance between the two indexes, budgetary constraints are calculated for each Index separately based on historical budgetary allocation trends between the categories. Finally, the budget limit (dotted line in figure below), is placed at the point where the lowest scoring project within the individual index can be fully funded.

Figure A-1: Illustrative Infrastructure Prioritization Matrix from Infrastructure Prioritization Framework Summary, World Bank Public---Private Partnerships CCSA March 2016



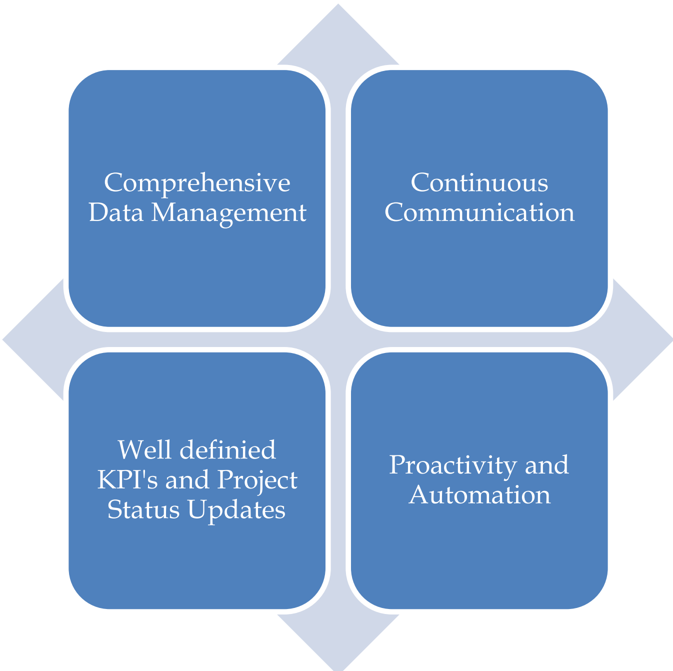
Quadrant A represents high-priority infrastructure projects that score high on both Indexes and are therefore expected to be prioritized for implementation. On the other hand, those in Quadrant D are those scoring poorly on both indexes and should therefore be low priority. Quadrants B and C represent projects that score well on only one index and can be considered as medium priority projects.

Source: "Marcelo, Darwin; Mandri-Perrott, Cledan; House, Schuyler; Schwartz, Jordan. 2016. Prioritizing Infrastructure Investment : A Framework for Government Decision Making. Policy Research Working Paper;No. 7674. World Bank, Washington, DC. © World Bank. https://openknowledge.worldbank.org/handle/10986/24511 License: CC BY 3.0 IGO."

ANNEXURE 21.4: Potential enablers for enhancing project monitoring and control

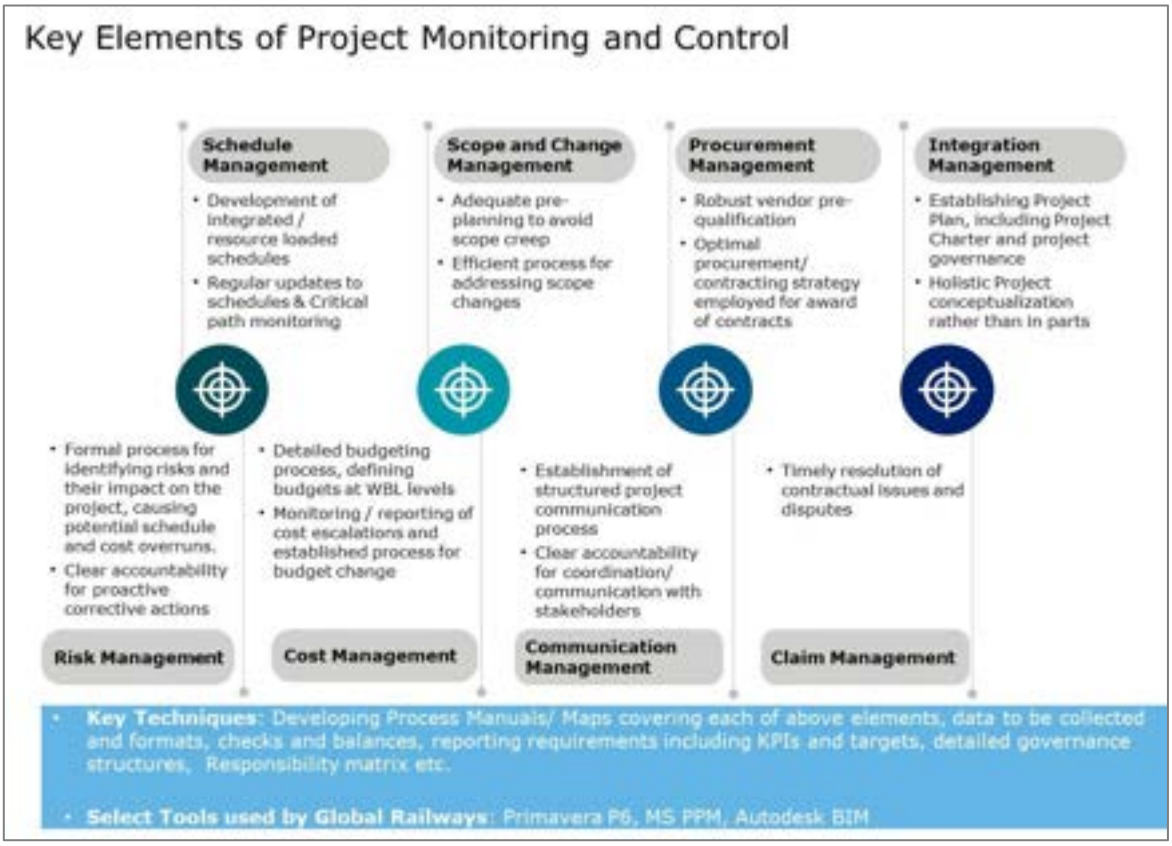
Robust and effective project monitoring and control can be enabled through:

- **Comprehensive Data Management**: Standardized procedures for data capture, documentation and dissemination are key to keeping an accurate record of events in the project lifecycle for reference.
- **Continuous Communication**: Setting a regular cadence on communication focused on facts allows for all stakeholders to be apprised of the progress across work streams.
- **Well-defined KPI's and Project Status Updates**: Well-defined KPIs that enhance insight into the current progress, combined with regular project status updates will allow for the project management teams to assess risks and remain on target.
- **Proactive Management and Integration of Automation**: Through proactively addressing any risks or concerns that have been identified through the other factors, the project management team can minimize the risk of delays or cost overruns. An integration of automation in labour intensive tasks where possible also reduces the chance of human error whilst saving time and money.



Leveraging state of the art methods for project monitoring, collaboration and execution

Infrastructure organizations including global railways have increasingly relied on state of the art methods comprising various tools and techniques for monitoring and controlling their investment projects. These tools and techniques not only helps in bringing transparency and accountability of various activities, but also brings in predictability by automating and supporting infrastructure program through their lifecycle.



It would be important for such tools to be used/ institutionalized across IR through dedicated setups and governance mechanisms at all levels viz. apex, zonal as well as divisional.

ANNEXURE 21.5: Illustrative scenario analyses of potential revenue unlock through increase in rail modal share of freight transportation

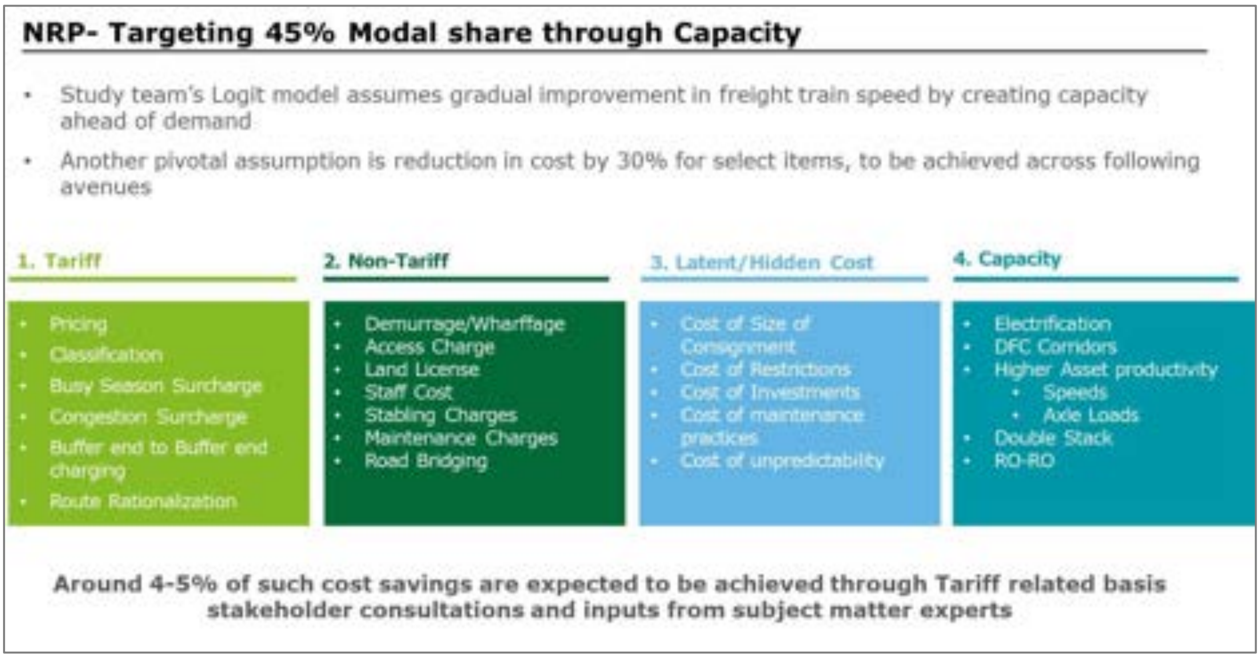
As presented earlier under this study, a Binary Logit Model was developed to analyse potential freight movement over rail with reference to the two major parameters of overall logistics time and cost.

The Model's projections of future rail traffic were further analyzed to assess corresponding trends that may emerge with respect to potential freight revenues. All analyses presented in this Annex have considered 2018 (and prevailing rail tariffs) as the base/ reference. This single base/ reference period approach also enables a comparative assessment of the impact on freight revenues in an operational construct where all other constraints/ factors remain constant.

Two scenarios were developed/ analysed to study the potential freight revenue impact – with an intent to also study/ account for any potential tariff reductions that may be considered by IR to support/ facilitate such modal shift.

- **Scenario 1**: Tariff at the same levels as in 2018 (no increase);
- **Scenario 2**: Tariff considered at a one-time discount of 5% on 2018 tariff levels in 2026 and continued as such thereafter (IR may considered such a reduction in tariffs in future as part of consolidated set of initiatives to promote modal shift and in response to market dynamics/ response in future.)

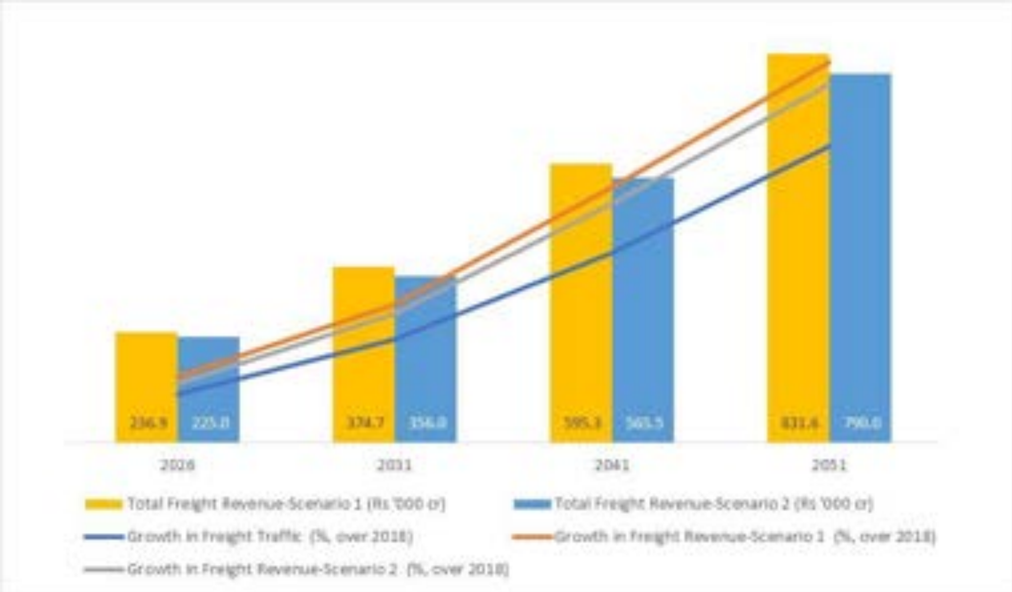
Exhibit 8: Key factors to effect rail modal shift of freight traffic



Given the nature of proposed initiatives and expected time required for their implementation and impact on revenues, the analysis was undertaken starting horizon year 2026 – by which year, the modal shift strategies are expected to bear impact.

The exhibit below presents the freight revenues for the cardinal years under these scenarios – estimated with reference to 2018 tariffs.

Exhibit 9: Estimated freight revenues and freight tonnage on account of increase in rail modal share of freight traffic



Source: Consultants' analyses

Table A-2: Freight tonnage and estimated revenues under scenarios 1 & 2

Commodity		2026	2031	2041	2051
BOG	Tonnage (MTs)	242	567	966	1,419
	Revenue-Scenario 1 (INR Crs)	39,775.24	84,552.05	1,36,341.17	1,95,609.13
	Revenue-Scenario 2 (INR Crs)	37,786.48	80,324.45	1,29,524.11	1,85,828.67
Cement	Tonnage (MTs)	288	405	686	1,079
	Revenue-Scenario 1 (INR Crs)	27,053.02	40,070.38	67,933.60	1,07,063.58
	Revenue-Scenario 2 (INR Crs)	25,700.37	38,066.86	64,536.92	1,01,710.40
Coal	Tonnage (MTs)	810	1,050	1,455	1,577
	Revenue-Scenario 1 (INR Crs)	94,572.80	1,27,125.19	1,76,675.52	1,95,815.00
	Revenue-Scenario 2 (INR Crs)	89,844.16	1,20,768.93	1,67,841.74	1,86,024.25
Containers	Tonnage (MTs)	132	234	374	610
	Revenue-Scenario 1 (INR Crs)	8,460.61	16,513.15	29,423.63	45,139.73
	Revenue-Scenario 2 (INR Crs)	8,037.58	15,687.50	27,952.45	42,882.74
Fertilizer	Tonnage (MTs)	87	113	174	256
	Revenue-Scenario 1 (INR Crs)	8,678.64	11,928.69	18,494.50	27,041.86
	Revenue-Scenario 2 (INR Crs)	8,244.71	11,332.26	17,569.77	25,689.77
Foodgrain	Tonnage (MTs)	103	127	165	225
	Revenue-Scenario 1 (INR Crs)	15,255.80	18,706.89	24,951.17	32,891.50
	Revenue-Scenario 2 (INR Crs)	14,493.01	17,771.54	23,703.62	31,246.92
POL	Tonnage (MTs)	84	179	264	630
	Revenue-Scenario 1 (INR Crs)	8,170.15	24,798.54	62,305.42	1,14,056.31

Commodity		2026	2031	2041	2051
	Revenue-Scenario 2 (INR Crs)	7,761.64	23,558.62	59,190.15	1,08,353.49
Iron Ore	Tonnage (MTs)	202	289	435	652
	Revenue-Scenario 1 (INR Crs)	12,136.20	19,365.16	31,895.97	45,975.94
	Revenue-Scenario 2 (INR Crs)	11,529.39	18,396.90	30,301.17	43,677.14
Pig Iron and Steel	Tonnage (MTs)	108	147	221	318
	Revenue-Scenario 1 (INR Crs)	18,490.25	25,900.24	38,303.69	55,174.37
	Revenue-Scenario 2 (INR Crs)	17,565.73	24,605.23	36,388.50	52,415.65
Raw Material for Steel	Tonnage (MTs)	42	55	83	120
	Revenue-Scenario 1 (INR Crs)	4,297.44	5,757.93	8,939.92	12,807.74
	Revenue-Scenario 2 (INR Crs)	4,082.57	5,470.03	8,492.92	12,167.35
All Freight	Tonnage (MTs)	2,096	3,167	4,823	6,885
	Revenue-Scenario 1 (INR Crs)	2,36,890.15	3,74,718.22	5,95,264.59	8,31,575.16
	Revenue-Scenario 2 (INR Crs)	2,25,045.64	3,55,982.31	5,65,501.36	7,89,996.40

Notes:

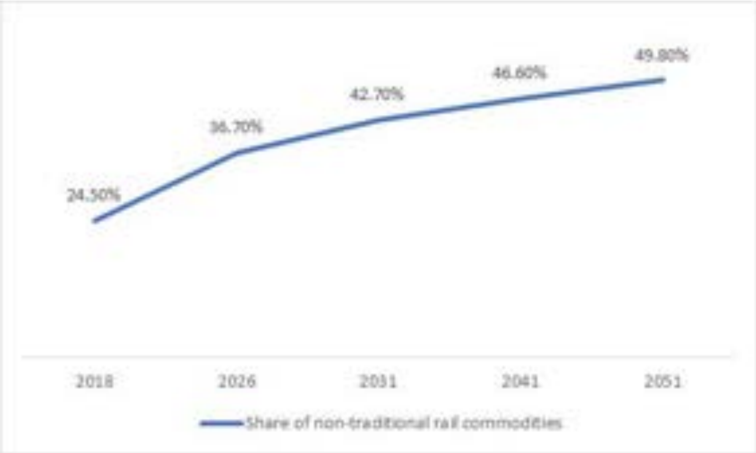
- 2018 Rail Freight Tariffs were sourced from Indian Railway's Rate Circulars 19 of 2018 (No.TCR/1078/2018/15) and 20 of 2018 (No. TC-1/2014/302/02).
- The following Rate Classes were assumed for various commodities: BOG- Class 100; Cement- Class 140A; Coal- Coal and Coke Tariff; Class 145A; Containers-FAK Haulage rates (20-26 Tons slab for Exim containers and 190-20 Tons slab for domestic containers); Fertilizer- Class 130A; Foodgrain- Class 130A; Iron ore- Class 165; Pig Iron and Steel- Class 165; POL- Class 180A; RM For Steel- Class 150
- For Balance Other Goods, extent of cargo containerization factors for various years were assued as following:

	2021	2026	2031	2041	2051
Containerization Factor	30%	31%	35%	42%	50%

- Average cargo weight for containers was assumed as 15.5 Tonnes for conversion of tonnes into TEUs.

The analyses reveal that with increase in rail modal share over time, incremental revenue earned is likely to be proportionately greater than the incremental increase in freight traffic volumes for Indian Railways. This is on account of changes in the profile of freight traffic on the IR system. As shares of higher rated commodities like steel and cement increase on the rail system, the corresponding increase in revenue leads to an enhanced revenue per tonne impact.

Exhibit 10: Expected share of non-traditional commodities in the enhanced freight traffic



Source: Consultants' Analyses/ Logit Model output

Further, specific to segments like 'Balance other Goods' which present maximum potential for modal shift to rail, focus on containerization of cargo can result in application of higher Freight All Kind (FAK) Container haulage charges for a larger bouqet of goods within the segment. This, in turn, could result in a disproportionate increase in revenue over traffic volumes (as can be seen from the much higher increase in BOG revenues as compared with volumes starting in 2026 in the above above).

The proposed infrastructure development, strategies, product development, pricing and policy interventions to increase rail modal share have been presented earlier in this report, and could create an environment to facilitate IR having a traffic mix and base with higher per unit revenue than that presently existing.

ANNEXURE 21.6: Summary of key terms of wagon ownership policies

Particulars	LWIS	GPWIS	LSFTO	AFTO	CTO
Policy no./Date	2016/TC(FM)/4/12(LWIS) 02.07.2018 Policy merged with LSFTO and discontinued w.e.f. 25/06/2020	2018/TC(FM)/04/01 26.04.2018 Last updated 0n 30/06/2020	2020/TC (FM)/04/02 16.03.20 Modified from earlier SFTO policy	2017/TC(FM)/4/12 19.04.2018	Original – Gazette notification 26/11/2006 Circular updates on rates, terminal access, hub spoke etc. from time to time
Type of Wagons	– HCW – Payload to be 2T > than existing 25/22.9 T designs – SPW – For specific commodity or group of commodities	– GPW (BOXN, BCN etc.)- – SPW to be excluded	– Applicable IRS designs or new designs approved by RDSO	– Any existing IRS (BCACBM) – New wagon designs	– BLCA/B, BLCA/BM, BLLA/B, BLLA/BM, BFK – New 25T BLC
Who can participate?	– End Users – LSP – exclusive for EU – WLS – for lease to EU Note-seems to indicate that leasing companies cannot procure for lease to LSPs. This should be specifically permitted as well.	– End Users- including PSUs, Port owners, Mine owners etc. – LSPs – WLS	– Registered Company / JV / Partnership / PSU – In area of Transport / Ports / WH / CTO / Manufacturing / WLS – Net Worth 50 crore or Turnover of 75 crore – No Change of Control for one year – after which with IR approval	– Registered Company / JV / Partnership / PSU – In area of Transport / Ports / WH / CTO / Manufacturing / WLS – Net Worth 20 crore or Turnover of 30 crore – No Change of Control for one	– Registered Company / JV / Partnership / PSU – In area of, Transport / Ports / WH / CTO / Manufacturing / WLS – Net Worth/Turnover 100 – Must have access to a rail terminal

Particulars	LWIS	GPWIS	LSFTO	AFTO	CTO
				year – after which with IR approval	own or with agreement – No Change of Control for one year – after which with IR approval
Maintenance	– IR - on payment – Haulage for maintenance to be paid by IR – 4% maintenance spares + BV to be procured	– IR as per agreement to be executed – 7500 km BPC – Haulage for maintenance to be paid by IR – 4% maintenance spares + BV to be procured	– IR – own cost (except for special requirements) – Haulage for maintenance to be paid by IR – 4% maintenance spares + BV to be procured	– IR – own cost – Haulage for maintenance to be paid by IR – 4% maintenance spares + BV to be procured or pay haulage charge – Standard warranty clause	– IR - on payment (5% of IR Haulage charge) – Haulage for maintenance to be paid by IR – 4% maintenance spares + BV to be procured – Standard warranty clause
Commodities	– Coal/Coke and Ores and minerals restricted – Alternative commodity other than permitted can be allowed if produced/consumed by LWIS customer		– System of categories ended – Bulk Fertiliser, Bulk Cement, Fly Ash, Bulk Chemicals, Petrochemicals-LDO, CBFS, LSHS, HPS, VGO, LVFO, LSFO, RCO, LPG, Caustic Soda, Liquid Ammonia, Bulk Alumina, Steel,	– Pass Cars, 2W, 3W, trucks, CKD – Auto ancillaries in return direction	– Containers (FAK) – Notified commodities (CCR) – Coal/Coke and ores are restricted.

Particulars	LWIS	GPWIS	LSFTO	AFTO	CTO
			Molasses, Edible Oil, Bulk Food grain.		
Terminals	– Pvt Sidings – Rly GS – COM/CCM Approval – Fixed route approval – can be changed	– Pvt Sidings – Rly GS – COM/CCM Approval – Fixed route approval can be changed with IR approval – No stabling on IR network	– Pvt Sidings – Rly GS – COM/CCM Approval – Fixed route approval – can be changed	– Pvt Sidings – Rly goods sheds	– Container Terminals (ICD) – Rly goods sheds – CRT – PFT – Private Sidings (with Co use permission)
Fees	– No Registration Fee	– No Registration Fee	– No Registration fee	– 3 crores (from 5 crore earlier).	– Cat. I - 50 crore (NCR-JNPT) / Cat. II, III, IV - 10 crore (other routes)
Freight Charged	– HCW-12% off base freight for 20 years – SPW-15% off base freight for 20 years – 0.5% further in case HCW is more than 2T for every additional tonne – No Empty charge – 50% if Empty lead is greater than loaded lead	– 10% on base for 15 years capped by lease to IRFC – No Empty charge if rake moved as per circuit	– SPW-12% off base freight for 20 years – HCW-2% extra off base freight for each 10% increase in throughput, subject to max. of 10% – No Empty charge – 50% if Empty lead is greater than loaded lead – 10% discount for commodity other than registered for	– As per Haulage Charge notified – Full rake charged even if one wagon is loaded – For return trip, charge separately for loaded and empty	– As per Haulage Charge notified for FAK (different slabs than Goods tariff) – Notified commodities – Container Class Rate = 15% below FAK, 20% for Coils

Particulars	LWIS	GPWIS	LSFTO	AFTO	CTO
			loading in empty direction		– 50 or more containers for CCR to apply
Approval Process	– NOC from COM – define commodity, no. of rakes, type of wagon, terminals, route – 10 days – Final Approval from EDFM-RB – Agreement with PCCM – valid for codal life of wagon – Commercial Notification on commissioning of rake/s – Agreement to be signed in 6 months – rakes to be procured within one year	– Apply to EDFM – define rakes, wagon type, route, circuit – Min one rake – Approval in consultation with TT – Agreement with PCCM within 6 months of approval	– Apply to EDFM-min 3 rakes – CCCM-FM of concerned railway to issue notification and sign CA	– Apply to EDFM-min 3 rakes – Submit 1% of Fee – CCCM-FM of concerned railway to issue notification and sign CA	– Apply to EDFM- – CCCM-FM of concerned railway to issue notification and sign CA – Follow IMC/Private siding process for terminal development
Operations	– Indent to be placed by user – Terminal Access, Detention and Ground charges for use of Terminal as per extant IR policy	– Indent to be placed by user – Pre-approved circuits – 6 months at a time – Circuit approval by RB – Rly can use rake to return load – for this, the rebate	– 35 Year Concession Agreement – Terminal Access, Detention and Ground charges for use of Terminal as per IR policy	– 20 Year Concession Agreement – extendable to codal life of wagon – Can start operations from first rake induction	– 20 Year Concession Agreement – extendable by 10 years – Can start operations from first rake induction

Particulars	LWIS	GPWIS	LSFTO	AFTO	CTO
		will be given to Wagon owner – Third party cargo permitted with approval		– Terminal Access, Detention and Ground charges for use of Terminal as per IR policy	– No limit to number of trains – Terminal Access, Detention and Ground charges for use of Terminal as per IR policy

ANNEXURE 21.7: Summary of terms and conditions of policies related to development of new terminals and use of existing terminals

	Development of New Terminals		
	Private Sidings	Private Freight Terminal (PFT)	ICDs / Container Terminals
Policy No. and Date	– Master -99/TC(FM)/26/1/Pt.-II – Dated-22.08.16	– Master-2018/TC(FM)/14/14 – Dated-23.06.2020	
Eligibility and Coverage	– Meant primarily for end users – Multiple co-users can be permitted with specific permission from concerned rail officials	– Any company including existing siding owners – Private Sidings, Railway Goods Sheds, ICDs excluded – Cannot be developed on Rail land except for connectivity – Existing Private Sidings / Container Terminals can be converted to 'brownfield PFT' with multiple co-users	– Container Traffic – CTO *(some non-CTO were permitted to retain terminals basis earlier permissions for private terminals)* – Automobile and ancillary traffic (permitted subsequently) – Container terminal can convert to PFT to handle other traffic
Fees	– INR 20,000 with application – 3% of anticipated cost as codal charges – Departmental charges – cost of tools & plant & supervision – 6 ¼ % for own construction, 12 ½ % for IR construction – Cost of commercial staff to be reimbursed to IR	– INR 20,000 with application – INR 20,000 refundable deposit – *(This is reduced from earlier fee of 10 L)*	– Included in CTO fee
Approval Process and Timelines	– Total project time – 7 months for approvals – 12-25 months for construction	– As per private siding policy	– As per private siding policy

	Development of New Terminals		
	Private Sidings	**Private Freight Terminal (PFT)**	**ICDs / Container Terminals**
Commodities & Wagons	– No restrictions – except in case terminal is specifically notified for commodities/wagons	– All commodities – Coal in category 'C' excluded – All Wagon Types – *(earlier charge of 5 crore for handling Iron Ore/Pellets has been removed)*	– All Containers, Automobile wagons – Basis PFT if converted
Operations	– Engine on Load working	– Authorised users to be notified by TMC – 24 hrs working – Full rake handling capacity – Stabling charges for non-acceptance of rakes – In-motion weighbridge (only where there is outward traffic)	
Commercial Terms	– 10% discount on freight handled in case PFT agrees to pay for capital cost of common user facilities – Land Lease (@ 6% per annum of market value of land-escalating @7% per annum) cum private siding agreement	– 10% discount on freight handled in case PFT agrees to pay for capital cost of common user facilities *(taken from Private Siding agreement)* – 30-year agreement to be signed – Pre-paid freight to IR on through distance basis – Cost of commercial staff to be reimbursed – Demurrage as per extant rules (for IR wagons) – No wharfage	
Capital Expenditure	– All capital cost from take-off to be borne by siding owner	– Provide facilities for staff and crew	

	Development of New Terminals		
	Private Sidings	**Private Freight Terminal (PFT)**	**ICDs / Container Terminals**
and Maintenance	– Siding owner to bear all cost in case of mid-section take-off/station – 5% extra distance for Y take off – Maintenance of common facilities /assets and staff cost to be borne by IR – No land licence for any common user facilities – All maintenance of assets outside common area to be done by siding owner- pay inception charges to IR	– Construction - as per Private Siding Policy	

	Use of Existing Terminals		
	CRT	**Auto Hub**	**Goods Shed Development**
Policy No. and Date	– Master: TC-1/2014/302/2 – Dated 07/04/2015	– Master – 2009/TC(FM)/14/2 – Dated: 16.06.2010	– Master-2020/TC(FM)/14/08 – Dated: 14/10/2020
Eligibility & Coverage	– All CTOs permitted – Category III GS – automatic permission for all types of operations (chassis + LOLO) – Category II & I – Chassis permission by default; COM/CCM permission for LOLO operations – *Access to locations has been liberalised over time*	– Auto-OEM, SIAM, AFTO licensee – 20 crore Turnover – Can be used for AUTO traffic only	– All rail users can invest in development / upgrading of goods sheds

	Use of Existing Terminals		
	CRT	Auto Hub	Goods Shed Development
Commercial Terms	– TAC charged @ 1,60,000 for every rake (in+out) *(50% discount on this rate will be applicable for category III goods sheds)* – Number of private trains not counted to categorise GS for permission, but will be counted for detention and ground rent charging – Detention and ground use as per demurrage and wharfage rules – 24 hours working, but now 50% of night working allowed as free – No Commercial plots to be given for permanent storage of cargo/containers – 24 hours free advance stacking and 20% of rate for stacking up to four days basis permission from concerned officials	– Direct application to Zonal Railway for approval – Facility to be operational in 1 year from approval – Land given for 7 years as per Land Licence rules (@ 6% per annum of market value of land-escalating @7% per annum)	– Share in Terminal Access Charges upto 5 years basis lowest share bid to be awarded – Facility development as per existing IR codes/norm – Land for storage /stacking can be given as per land lease rules
Operations	– IR interests should not be harmed – Railways will get priority in handling – Among CTOs to work as common user facility on FIFO – 9 hours free – 24 hours working – 2 weeks' notice to shut down	– Must be a common user facility – Facilities for loading and unloading to be given by IR at associated goods sheds on FIFO – non-exclusive basis – Land can be used for rail borne traffic only	– Facilities to be common user with no special rights to developer – IR to take ownership and maintenance

ANNEXURE 21.8: Common User Policy Framework

The following is a proposed draft policy proposal on appointment of terminal management companies for Common User Rail Terminals.

Definitions:

Terminal Management Company (TMC): An agency that is provided management rights to "**publicly owned"** land (mostly in the form of existing goods sheds) to operate rail connected terminal/s for receiving and dispatching trains and handling of cargo or containers carried on such trains.

Terminal User: Indian Railways or any rail operator (including Container Train Operator, Special Freight Train Operator, Automobile Freight Train Operator or any other private train operator), who has executed a concession agreement for operation of trains with Indian Railways or the owner of any private train who is licensed to operate trains based on existing rail polices.

Publicly Owned Land: Any land that is owned by the Government of India or any agency owned or controlled by Government of India or that has been acquired through the land acquisition policy in the "public interest". Such land, if operated or handed over to any agency, government or private for management as a rail accessed terminal, should be covered under this policy for use as a "common user" facility.

Common User Terminal: Any rail terminal that is developed on "**publicly owned"** land under licensing or any other arrangement. Such a terminal will permit access rights to all trains operated by Terminal Users under license from Indian Railways to TMC's rail linked terminals.

Trains: Trains handled at common user terminals will include but not be limited to container trains, automobile trains, and any other special freight trains or general-purpose wagon trains operated either by concession operators/private owners, or directly by Indian Railways.

Scope of the Policy:

The scope of this policy would include provision of Terminal Management services on an exclusive basis by a TMC. Such services would include rail access and related services like Terminal Handling, Storage, First & Last mile transport, value addition etc. in consideration for **a common Public Tariff for services offered**.

Key Terms and Conditions for Common User Access:

1. TMC will be responsible for providing the terminal infrastructure developed on "public land" including terminal handling equipment and warehousing facilities at all terminals covered under the definition of "Common User Terminals".

2. There will be no separate access charges levied by the Indian Railways on the Trains handled at these terminals.

3. TMC will have the rights to levy and shall retain full amount collected for various applicable terminal charges like Terminal Handling and Terminal Service Charges including Wharfage, Ground Rent and any other existing levies not relating to rail haulage charges as per its public tariff and taxes thereon.

4. The TMC will have only one public terminal tariff.

5. The TMC may offer discount schemes on its public tariff, but these cannot be specific to a customer or Terminal User and must be transparent and in the form of policy applicable to any user which fulfills the criteria for being eligible for such discounts.

6. The TMC shall not impose any restriction on a Terminal User on the booking of cargo/containers from the Common User Terminal.

7. The trains will be accepted and handled at the terminals on a Non-Discriminatory FIFO basis.

Bidding Process and Revenue Model:

Existing railway goods sheds can be offered to the private sector for operations through a bidding process in the following manner:

1. IR will calculate the average traffic (in terms of tonnes handed) at a location and use these numbers to form the baseline for minimum traffic commitment by potential bidders.

2. The bidder will be required to commit that he shall pay to IR a value determined by multiplication of baseline traffic with a sum of INR 10 per tonne.

3. A value equivalent to 3 months minimum guaranteed traffic will be deposited to IR as security under the policy

4. Bidder will bid in addition a value of INR "x" per tonne handed (in terms of inward and outward booked volume) at the identified location.

5. Annual Price increase on bid value shall be linked to the "All India Commodity Wholesale Price Index (WPI)" of the corresponding preceding period of 12 Months subject to maximum cap of 8%.

6. Agreement to be at least 15 years at a time, with a provision for exit with six months' notice. Railways can ask for exit only in cases of force majeure or violation of terms of agreement, and not merely on commercial grounds.

7. TMC to be permitted to add any value to the facility such as paving, warehousing, improvement on access roads, lighting etc. Plan for the same to be approved by IR, but within a specified time frame.

8. Any modifications on common user rail facilities that impact capacity, handing etc. to be done through a DPR approval process, and the TMC will be entitled to a reimbursement of these expenses through a 10% discount on freight for execution of such facilities.

ANNEXURE 21.9: Identified TAZs and individual development cost estimates

S.no	TAZ	Development year	Capital expenditure (INR cr)
1.	Mumbai City	2026	20,789
2.	Thane	2026	6,340
3.	Haora (Howrah)	2026	5,138
4.	New Delhi	2026	3,557
5.	Chennai	2026	2,573
6.	Patna	2026	2,535
7.	Hyderabad	2026	1,707
8.	North Twenty-Four Parganas	2026	1,640
9.	Hugli (Hooghly)	2026	1,444
10.	Lucknow	2026	1,268
11.	South 24 Parganas	2026	1,139
12.	Bangalore	2026	998
13.	Pune	2026	990
14.	Ahmadabad (Ahmedabad)	2026	935
15.	Surat	2026	773
16.	Nadia	2026	706
17.	Raigad	2026	550
18.	Paschim Medinipur	2026	484
19.	Kanchipuram (Kancheepuram)	2026	470
20.	Thiruvallur (Tiruvallur)	2026	281
21.	Jaipur	2031	1,120
22.	Rohtas	2031	920
23.	Munger	2031	881
24.	Varanasi	2031	846
25.	Darbhanga	2031	845
26.	Kanpur Nagar	2031	683
27.	Gaya	2031	654
28.	Hazaribagh	2031	642
29.	Saran	2031	640
30.	Muzaffarpur	2031	629
31.	Gorakhpur	2031	610
32.	Ranchi	2031	576
33.	Bhopal	2031	557
34.	Kathgodam	2031	530
35.	Agra	2031	478
36.	Gurgaon	2031	459
37.	Valsad	2031	453
38.	Ghaziabad	2031	436
39.	Buldana (Buldhana)	2031	428
40.	Paschim Bardhaman	2031	422

S.no	TAZ	Development year	Capital expenditure (INR cr)
41.	Vadodara	2031	421
42.	Ernakulam	2031	413
43.	Purba Barddhaman (Burdwan)	2031	385
44.	Palghar	2031	324
45.	Krishna	2031	323
46.	Bilaspur	2031	322
47.	Nagpur	2031	313
48.	Kollam	2031	292
49.	Chittoor	2031	291
50.	Guntur	2031	283
51.	Bhagalpur	2041	533
52.	Purnia	2041	512
53.	Allahabad	2041	488
54.	Dhanbad	2041	467
55.	Jodhpur	2041	464
56.	Bareilly	2041	423
57.	Raipur	2041	416
58.	Purbi Singhbhum (East Singhbhum)	2041	409
59.	Kota	2041	402
60.	Mathura	2041	382
61.	Moradabad	2041	379
62.	Jhansi	2041	359
63.	Jabalpur	2041	351
64.	Khordha	2041	332
65.	Ganganagar (Sri Ganganagar)	2041	328
66.	Meerut	2041	316
67.	Ambala	2041	310
68.	Visakhapatnam	2041	302
69.	Durg	2041	295
70.	Palakkad	2041	263
71.	Jalgaon	2041	247
72.	Murshidabad	2041	238
73.	Kannur	2041	232
74.	Vellore	2041	222
75.	Kozhikode	2041	219
76.	Thanjavur	2041	219
77.	Coimbatore	2041	216
78.	Gwalior	2051	311
79.	Gonda	2051	275
80.	Saharanpur	2051	268
81.	Ratlam	2051	258
82.	Kheda	2051	232

S.no	TAZ	Development year	Capital expenditure (INR cr)
83.	Nashik	2051	221
84.	Amritsar	2051	212
85.	Karnal	2051	211
86.	Bharuch	2051	210
87.	Rohtak	2051	207
88.	Mysore	2051	192
89.	Ludhiana	2051	191
90.	Birbhum	2051	187
91.	Solapur	2051	185
92.	Puruliya (Purulia)	2051	181
93.	East Godavari	2051	180
94.	Dharwad	2051	178
95.	Sri Potti Sriramulu Nellore	2051	174
96.	Gulbarga	2051	168

ANNEXURE 21.10: Financing Requirements for DFCs

Table A-3: DFC Financing Requirement (till 2051)

S No.	DFC Name	Start	End	Length (km)	Phasing (Project gets operational)	Cost (INR Cr)
1	Eastern DFC – II	Sonnagar	Dankuni	515	2031	20,600
2	East Coast DFC	Kharagpur	Vijayawada	1,265	2031	50,600
3	East West DFC (and EDFC connectors)	Palghar	Dankuni	2,013	2031	80,520
4	North South DFC - I	Itarsi	Chennai	1,206	2041	48,240
5	North South DFC – II	Palwal	Itarsi	751	2051	30,040
Total						2,30,000

Source: Consultant's Analyses

Table A-4: DFC Investment Phasing (in INR Cr)

	2031	2041	2051
Construction of DFC (in INR Cr)	1,51,720	48,240	30,040

Source: Consultant's Analyses

Table A-5: Phasing assumptions for DFCs (till 2051)

Year	2031		2041		2051		Grand Total (in INR Cr)
	Phasing (%)	Cost (in INR Cr)	Phasing (%)	Cost (in INR Cr)	Phasing (%)	Cost (in INR Cr)	
2021	5%	7586					7586
2022	10%	15172					15172
2023	10%	15172	1%	482			15654
2024	10%	15172	2%	965			16137
2025	10%	15172	3%	1447			16619
2026	10%	15172	4%	1930			17102
2027	10%	15172	5%	2412			17584
2028	10%	15172	6%	2894			18066
2029	10%	15172	7%	3377			18549
2030	10%	15172	8%	3859			19031
2031	5%	7586	9%	4342			11928
2032			10%	4824			4824
2033			9%	4342	1%	300	4642
2034			8%	3859	2%	601	4460
2035			7%	3377	3%	901	4278
2036			6%	2894	4%	1202	4096
2037			5%	2412	5%	1502	3914
2038			4%	1930	6%	1802	3732

Table A-5: Phasing assumptions for DFCs (till 2051)							
Year	2031		2041		2051		Grand Total (in INR Cr)
	Phasing (%)	Cost (in INR Cr)	Phasing (%)	Cost (in INR Cr)	Phasing (%)	Cost (in INR Cr)	
2039			3%	1447	7%	2103	3550
2040			2%	965	8%	2403	3368
2041			1%	482	9%	2704	3186
2042					10%	3004	3004
2043					9%	2704	2704
2044					8%	2403	2403
2045					7%	2103	2103
2046					6%	1802	1802
2047					5%	1502	1502
2048					4%	1202	1202
2049					3%	901	901
2050					2%	601	601
2051					1%	300	300
Total		**151720**		**48240**		**30040**	**230000**

Source: Consultant's Analyses

ANNEXURE 21.11: PPP Models for DFCs

Table A-6: DBFMT and DBFMT-Annuity Models		
Parameter	**DBFMT Model (Design, Build, Finance, Maintain and Transfer)**	**DBFMT – Annuity Model**
Concession Design	• Concessionaire to design and build the project as per design and performance parameters set by DFCCIL/ IR • Approvals (design or otherwise) to be provided by competent authority (e.g. CRS, RDSO, third party agencies etc.) which would be detailed out in the concession agreement • Land acquisition to be carried out by DFCCIL/ IR at its own cost • Concessionaire to maintain the assets throughout its concession period as per the conditions laid down in the Concession Agreement • Transfer of assets by the Concessionaire to DFCCIL at the end of concession period • Concession period – typically between 20 to 30 years	• All points similar to DBFMT Model
Revenue Model	• There could be various models for revenue generation to the Concessionaire. Couple of these are discussed below: • Track access regime: DFCCIL, in future, creates a track access regime wherein train operators (whether it is Indian Railways or Private Operators) are charged track access fee based on usage of the network. This track access charge would essentially need to be formulated in a manner that it is able to fund the capital expenditure, cost of operations and maintenance along with an industry accepted profit margins for the Concessionaire. Globally, this is the most widely used method • **Revenue share:** In this model, DFCCIL would share a portion of the revenue generated from the apportioned freight traffic usage on the DFCCIL network.	• In the DBFMT – Annuity Model, the key difference would be that the traffic risk would not be passed on to the Concessionaire. The Concessionaire would recover its money from pre-defined annuity payments (typically structure over 15 years of operations in roads and highways sector) from DFCCIL.

Table A-6: DBFMT and DBFMT-Annuity Models

Parameter	DBFMT Model (Design, Build, Finance, Maintain and Transfer)	DBFMT – Annuity Model
Bid parameters	• Lowest grant or highest premium	• Lowest ask for annuity
Major Risks with Private Sector	• Construction Risk • Maintenance Risk • Financing Risk • Traffic Risk	• Construction Risk • Maintenance Risk • Financing Risk
Enablers Required	• Track access regime to be set up • Ensuring level playing field for both IR as well as private freight trains • Transparent and easy to understand modal concession agreement • Need for independent regulatory mechanism • Efficient allocation of risks	• Transparent and easy to understand modal concession agreement • Efficient allocation of risks

ANNEXURE 21.12: Financing Requirements for HSRs

Table A-7: HSR Financing Requirement (till 2051)

HSR Project Name	Project length (km)	Phasing	Estimated capital cost (Cr)
Delhi Varanasi via Ayodhya	855	2031	1,71,000
Varanasi to Patna	250	2031	50,000
Patna to Kolkata	530	2031	1,06,000
Delhi Udaipur Ahmedabad	886	2031	1,77,200
Hyderabad to Bangalore	618	2041	1,23,600
Nagpur to Varanasi	855	2041	1,71,000
Mumbai to nagpur	789	2051	1,57,800
Mumbai to Hyderabad	709	2051	1,41,800
Patna to Guwahati	850	2051	1,70,000
Delhi to Amritsar via Chandigarh	485	2051	97,000
Amritsar - Pathankot - Jammu	190	2051	38,000
Chennai to Mysuru via Bangalore	462	2051	92,400
Total	7479	Total	14,95,800

Source: Consultant's Analyses

Table A-8: HSR Investment Phasing (in INR Cr)

	2031	2041	2051
Construction of HSR (in INR Cr)	5,04,200	2,94,600	6,97,000

Source: Consultant's Analyses

Table A-9: Phasing assumptions for HSRs (till 2051)

Year	2031		2041		2051		Grand Total (in INR Cr)
	Phasing (%)	Cost (in INR Cr)	Phasing (%)	Cost (in INR Cr)	Phasing (%)	Cost (in INR Cr)	
2021	5%	25210					25210
2022	10%	50420					50420
2023	10%	50420	1%	2946			53366
2024	10%	50420	2%	5892			56312
2025	10%	50420	3%	8838			59258
2026	10%	50420	4%	11784			62204
2027	10%	50420	5%	14730			65150
2028	10%	50420	6%	17676			68096
2029	10%	50420	7%	20622			71042
2030	10%	50420	8%	23568			73988
2031	5%	25210	9%	26514			51724
2032			10%	29460			29460
2033			9%	26514	1%	6970	33484
2034			8%	23568	2%	13940	37508
2035			7%	20622	3%	20910	41532

Year	2031		2041		2051		Grand Total (in INR Cr)
	Phasing (%)	Cost (in INR Cr)	Phasing (%)	Cost (in INR Cr)	Phasing (%)	Cost (in INR Cr)	
2036			6%	17676	4%	27880	45556
2037			5%	14730	5%	34850	49580
2038			4%	11784	6%	41820	53604
2039			3%	8838	7%	48790	57628
2040			2%	5892	8%	55760	61652
2041			1%	2946	9%	62730	65676
2042					10%	69700	69700
2043					9%	62730	62730
2044					8%	55760	55760
2045					7%	48790	48790
2046					6%	41820	41820
2047					5%	34850	34850
2048					4%	27880	27880
2049					3%	20910	20910
2050					2%	13940	13940
2051					1%	6970	6970
Total		**504200**		**294600**		**697000**	**1495800**

Source: Consultant's Analyses

ANNEXURE 21.13: List of PPP Projects in Core Track Infrastructure

Table A-10: List of PPP Projects - Track Infrastructure							
#	**Project name**	**Cost (in INR Cr)**	**Kms**	**Status**	**Completion**	**Model**	**Implementing Agency**
1	Mundra Port Line /WR/Gujarat	150	54	Completed	2003	NGR	Full Funding by Port/ NGR
2	Mundra Port Double Line /WR/Gujarat	250	54	Completed	2012	NGR	Full Funding by Port/ NGR
3	Bhadrak – Dhamra Port New Line /ECoR/ Odisha	760	64	Completed	May,2011	NGR	Full Funding by Port/NGR
4	Tuna Port /WR/ Gujarat	142	17	Completed	July,2015	NGR	Full Funding by Port/NGR
5	Surendernagar -Pipavav (GC) / WR/ Gujarat, PRCL	373	271	Completed	March, 2003	JV	Pipapav Rail Corp Ltd (PRCL)/ (MoR - 50%, GPPL 38.78%, IL&FS - 6.12%, GIC 2.5%, NIA 2.5%)
6	Hassan-Mangalore (GC) SWR/Karnataka, HMRDC	293	183	Completed	May, 2006	JV	Hassan Mangalore Rail Development Corp Ltd (HMRDC) - (MoR -40%, GoK-40%, KRIDE – 2%, New Mangalore port trust 9%, MEL – 9%.)
7	Gandhidham-Palanpur (GC) WR /Gujarat, Kutch Rly Corp Ltd	550	301	Completed	Nov. 2006	JV	Kutch Railway Co Ltd, (RVNL-50%, Kandla Port – 26%, Govt of Gujarat –4%, Mundra Port – 20%.)
8	Bharauch-Dahej (GC) /WR/ Gujarat, BDRCL	395	63	Completed	March, 2012	JV	Bharuch Dahej Rail Co Ltd (BDRCL); (RVNL –35.46%, GMB -- 11.51%, Dahej SEZ Ltd-. -6.45%, GNFC- 8.72%, Adani Petronet Dahej Port -- 11.17%, Hindalco

Table A-10: List of PPP Projects - Track Infrastructure							
#	**Project name**	**Cost (in INR Cr)**	**Kms**	**Status**	**Completion**	**Model**	**Implementing Agency**
							8.72%, Jindal Rail Infrastructure- - 6.45 %, GIDC - 11.51 %)
9	Krishnapatnam - Venkatachalam – Obulavaripalle (NL) /SCR/ A.P., KRCL	1993	113	Completed	Jul-19	JV	Krishnapatnam Rail Co Ltd (KRCL); (RVNL- 49.76%, Sagarmala Development Corp Ltd – 20 %, Krishnapatnam Port Company Ltd- 12.96%, Govt. of A. P- 5.60%, NMDC Ltd- 6.40%, Brahamani Industries- 5.28%.)
10	Haridaspur-Paradip (1996-97) (NL) /ECoR/ Odisha; HPRCL	2681	82	Completed	Aug-20	JV	Haridaspur Paradip Railway Co Ltd (HPRCL); (i) RVNL-.38.62% ii) GoO, 22.49% iii) Paradip Port Trust- 10.56%, iv) Essel Mining, 4.73 %, v) JSPL 0.79%, vi) Rungta Mines Ltd- 4.73%, vii) OMC 14.64%, viii) MSPL- 2.36% ix) SAIL 0.79%. x) IDCO. 0.30%)
11	Manpur-Tilaiya-Bakhityarpur section/ ECR/Jharkhand, Bihar/ (Electrification) (14-15)	140	132	Completed		Customer funded	
12	Lalitpur-Udaipura /NCR/U.P./ (Electrification (15-16)	48	32	Completed		Customer funded	

Table A-10: List of PPP Projects - Track Infrastructure							
#	Project name	Cost (in INR Cr)	Kms	Status	Completion	Model	Implementing Agency
13	Balgona-Katwa Section /ER /W. Bengal/ GC (07-08)	595	26	Completed		Customer funded	
14	Khandwa-Nimar Kheri /WR/M.P.// GC (08-09)	487	51	Completed		Customer funded	
15	Hotgi- Kudgi section/SWR /Karnataka (Doubling) (14-15)	946	134	Under implementation		Customer funded	
16	Bhaktiyarpur Flyover including 3rd Line/ECR/Bihar / (07-08)	252	24	Under implementation		Customer funded	
17	Anugul – Sukinda (NL) /ECoR/ Odisha, ASRL	1921	104	Under implementation		JV	JV Company, Angul Sukinda Railway Ltd (ASRL); (i) RVNL- 31.5%, ii) Jindal Steel & Power -10% iii). Govt. of Odisha-. -21.3%, iv) OMC-- 10.5%, v) IDCO. - 7%, vi) CONCOR. -26%)
18	Kharasia-Dharamjaigarh – Ghargoda-Donga Mahua, (NL) And Dharmjaygarh - Korba /SECR/ Chhattisgarh, CERL	4209	238	Under implementation		JV	JV Company, Chhattisgarh East West Railway Ltd (CERL) (IRCON-26%, SECCL-64%, Govt. of Chhattisgarh-10%)
19	Gevra Road-Pendra Road (NL) / SECR/ Chhattisgarh, CEWRL	4970	135	Under implementation		JV	JV Company, Chhattisgarh East West Railway Ltd (CEWRL) (IRCON-26%, SECCL-64%, Govt. of Chhattisgarh-10%)

Table A-10: List of PPP Projects - Track Infrastructure							
#	**Project name**	**Cost (in INR Cr)**	**Kms**	**Status**	**Completion**	**Model**	**Implementing Agency**
20	Rowghat-Jagdalpur (NL) (95-96) / ECoR / Chhattisgarh, BRPL	2600	140	Under implementation		JV	JV Company, Bastar Railway Pvt Ltd (BRPL) (Govt. of Chhattisgarh - 10%, NMDC-52%, SAIL-12%, IRCON-26%)
21	Angul- Balram – Jarapada, inner corridor of **MCRL**	1600	64	Under implementation		JV	JV Company, Mahanadi Coal Rail Ltd (MCRL); (MCL 64 %, IRCON 26 % & State of Odisha 10 %)
22	Shivpur-Kathautia (17-18) /NL / ECR, JCRL	1799	49	Under implementation		JV	JV Company, Jharkhand Central Railway Ltd (JCRL); (CCL-64%, IRCON-26%, Govt of Jharkhand – 10%)
23	Digni – Jaigarh Port (NL) /KRC/ Maharashtra, JDRL	771	35	Under implementation		JV	JV Company, Jaigarh Digni Railway Ltd (JDRL); (Konkan Rly Co Ltd-26%, JSWJPL-63%, MMB-11%)
24	Hamarpur-Rewas Port (2015-16) /CR/ NL / Maharashtra	349	26	Under implementation		JV	JV Company having equity as RVNL-26% Rewas Port-74%
25	New Bhubaneswar - Astrangra Port; ECoR/NL/ Odisha	1310	75	In principal approval		NGR	
26	Bhimnath-Dholera Rail Link; WR/ Gujarat/ N L	252	27	In principal approval		NGR	Non-Governmental Railway (JV of DMIDC and Govt of Gujarat)
27	Chhara Port Connectivity WR/ Gujarat/ NL	351	20	In principal approval		NGR	

Table A-10: List of PPP Projects - Track Infrastructure							
#	**Project name**	**Cost (in INR Cr)**	**Kms**	**Status**	**Completion**	**Model**	**Implementing Agency**
28	Hazira Port / (Sayan/Kim) (NL) / WR/ Gujarat	734	47	In principal approval		NGR	
29	Nargol Port Connectivity NL/ WR/ Gujarat	82	11	In principal approval		NGR	
30	Roha – Dighi	724	34	In principal approval		JV	JV model (RVNL lead partner)
31	Indore – Manmad New Line Project	9968	358	In principal approval		JV	JV Model (IPRCL lead partner)
32	Subaranrekha port connectivity			In principal approval		NGR	

Source: Consultant's compilation, Railway Board