STRATEGIES TO INCREASE RAILWAY'S SHARE IN FREIGHT TRANSPORT IN INDIA

Terminal Operations and Development

Volume I

THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

STRATEGIES TO INCREASE RAILWAY'S SHARE IN FREIGHT TRANSPORT IN INDIA

Volume I: Terminal Operations and Development

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Abbreviations

AR	Arrival
CFTM	Chief Freight Traffic Manager
CR	Central Railways
CRT	Container Rail Terminals
DCM	Divisional Commercial Manager
DFC	Dedicated Freight Corridor
DL	Line Doubling
DME	Divisional Mechanical Engineer
DP	Departure
DRM	Divisional Railway Manager
ECoR	East Coast Railways
ER	Eastern Railways
FOIS	Freight Operation Information System
GC	Gauge Conversion
GCT	Gati Shakti Cargo Terminals
GCTO	Gati Shakti Cargo Terminal Operator
GDP	Gross Domestic Product
GS	Goods Sheds
HDN	High Density Network
HUN	Highly Utilised Network
IR	Indian Railways
NCR	North Central Railways
NER	North Eastern Railways
NIP	National Infrastructural Pipeline
NL	New Line
NR	Northern Railways
NRP	National Rail Plan
NTKM	Net Tonne Kilometres
OD	Origin-Destination
OHE	Over-head Equipment
PCCM	Principal Chief Commercial Manager
PCOM	Principal Chief Operations Manager
PFT	Private Freight Terminals
PL	Placement
PSU	Public sector undertaking
RB	Railway Board
RL	Release

RMS	Rake Management System
RO	Rationalisation Order
RR	Railway Receipt
SCR	South Central Railways
SECR	South East Central Railways
SER	South Eastern Railways
SGD	Railway Sidings
SR	Southern Railways
Sr DCM	Senior Divisional Commercial Manager
Sr DOM	Senior Divisional Operations Manager
SWR	South Western Railways
S&T	Signalling and Telecommunication
TAC	Terminal Access Charge
TC	Terminal Charge
TMC	Terminal Management Company
TMS	Terminal Management System
WCR	West Central Railways
WR	Western Railways

1 Introduction

1.1 Background

Indian Railways (IR) has been termed as backbone of the Indian economy and has a major contribution in facilitating transport for passengers as well as goods. Since the beginning of its operations, railways has had the highest share in the transportation of goods, raw materials and finished products to different parts of the country. The share of railways in goods transportation has declined from 85% in 1950–51 to 27–28% during 2022 (IR, 2022). With the development of the road sector, the feasibility of transporting goods by road has increased. Shorter transport time and the provision of end-to-end services by the road sector has surpassed the cost savings offered by railways. Railways has been constantly working upon increasing their capacity to facilitate smoother and faster freight movement, yet, IR is unable to meet the current demand of freight transport efficiently.

One of key hurdles preventing IR from realizing its immense potential in a growing economy is constrained handling capacity. At many of these clogged railway terminals, the infrastructure is stressed for handling bulk and bagged commodities and there is very little scope for augmentation of facilities at their present locations. The line capacity along certain critical corridors is also strained, creating bottlenecks in freight transportation. The capacity constraints at terminals and line infrastructure result in longer detention time and low speeds causing transit delays.

Although significant efforts have been made by IR to increase the line capacity by modernizing the tracks and doubling, there is lack of modernization of terminal infrastructure (e.g., terminal upgradation, mechanization) and assets to facilitate mechanized loading/unloading. Also, IR has not been able to keep pace with the rapidly changing demands of the logistics sector as a result of the proliferation of modern trade and e-commerce, and subsequent increase in non-bulk freight traffic. Despite improvement in the growth rate of freight, the market share of IR in freight transport has declined substantially. The creation of aequate capacity network was, therefore essential to meet the challenges in the growth of freight traffic (CAG, 2013).

1.2 Need of the Study

India, being a vast country with widespread industrial and agricultural clusters, exerts a greater need of moving goods to and from different parts of the country. The logistics sector holds the share of 14.4% in India's gross domestic product (GDP).[1] India moves around 4.6 billion tonnes of freight each year, out of that only 1.2 billion tonnes of freight is moved by railways. This makes up to around 27% of the total freight, which is a substantial decline particularly in the last three decades. Currently, IR is majorly involved in the transport of bulk commodities, losing almost all smalls traffic to road.

[1] Details Available at: <https://www.ibef.org/blogs/india-s-growing-logistics-sector#:~:text=India's%20logistics%20are%20estimated%20to%20account%20for%20about%2014.4%25%20of%20GDP.>

The key reasons behind the shift of freight movement to road are better operational feasibility and time savings. While the freight rates of IR are very competitive, technological and infrastructural upgradations in the railway systems will enable IR to attract more traffic towards rail.

While road transport offers convenient and comparatively better user-friendly freight movement, it contributes to air pollution, increased carbon emission and challenge to energy security as most of oil requirement are met through imports. It is estimated that, by selecting railways to move the freight saves around 80% of the carbon emissions that is otherwise generated by moving freight by road.[2] As envisaged in the country's Nationally Determined Contributions (NDCs) it is crucial to achieve 45% share of railways in freight transportation by 2030 to reach the goal of reducing carbon emissions to the level achieved in 2005.

In order to increasing freight loading of railways, terminal capacity enhancement work for freight terminals, along with line capacity augmentation efforts is crucial. Modernizing wagons to facilitate efficient mechanized loading-unloading activities and provision of robust infrastructure at freight terminals are vital aspects to look into.

1.3 Aim and Objectives

The overall aim of the study is to identify the key strategies to increase the modal share of railways in freight transportation in India. The first objective of the study is focused on understanding the capacity constraints experienced at the freight terminals as well as during freight movement. The key area of the report focuses on unloading terminals of IR. This report aims to understand the infrastructural and operational constraints relating to freight terminals of IR. The report attempts to identify the issues and the feasible solutions to optimize the freight terminal performance along with leaveraging private investments for increasing terminal capacity.

Aim: ***To analyze operational constraints at the station and terminal levels and to develop tools for quick identification and response to bottlenecks affecting freight movement***

Key Objectives:

- Analysis of terminal development policies of IR and existing profile of freight sector of railways
- Understanding the key reasons impacting the turnaround time of freight trains
  - To identify the constraints at in-route terminals
  - To identify the constraints in efficient freight handling at railway terminals
- Formulating regulatory and technical toolkit for freight terminal development and management

[2] Details available at: <https://www.uncrd.or.jp/content/documents/4952Background%20Paper%20(2)-EST%20Plenary%20Session%2011.pdf>

2 Rail Freight Handling by the Indian Railways

2.1 Freight Operations in the Indian Railways

Operating Department and Commercial Department are highly involved in carrying out freight transport operation. Railway Board is the central decision-making authority that lays out key rules and regulations regarding railway services. Member (Operation and Business Development), earlier known as Member (Traffic) is the key authority looking after the passenger and freight-related operations at the apex level, that is, Railway Board Additional Member of Traffic (Transportation) and Additional Member of Traffic (Commercial) look after the transportation and commercial functions of IR. Executive directors in the Directorates have specific responsibilities looking after functioning of passenger and freight- related policies and services and coordinating the different activities among the zonal railways.

At the zonal level, Principal Chief Operations Manager (PCOM) and Principal Chief Commercial Manager (PCCM) manage freight operations. Chief Freight Traffic Manager (CFTM) under PCOM plans and coordinates

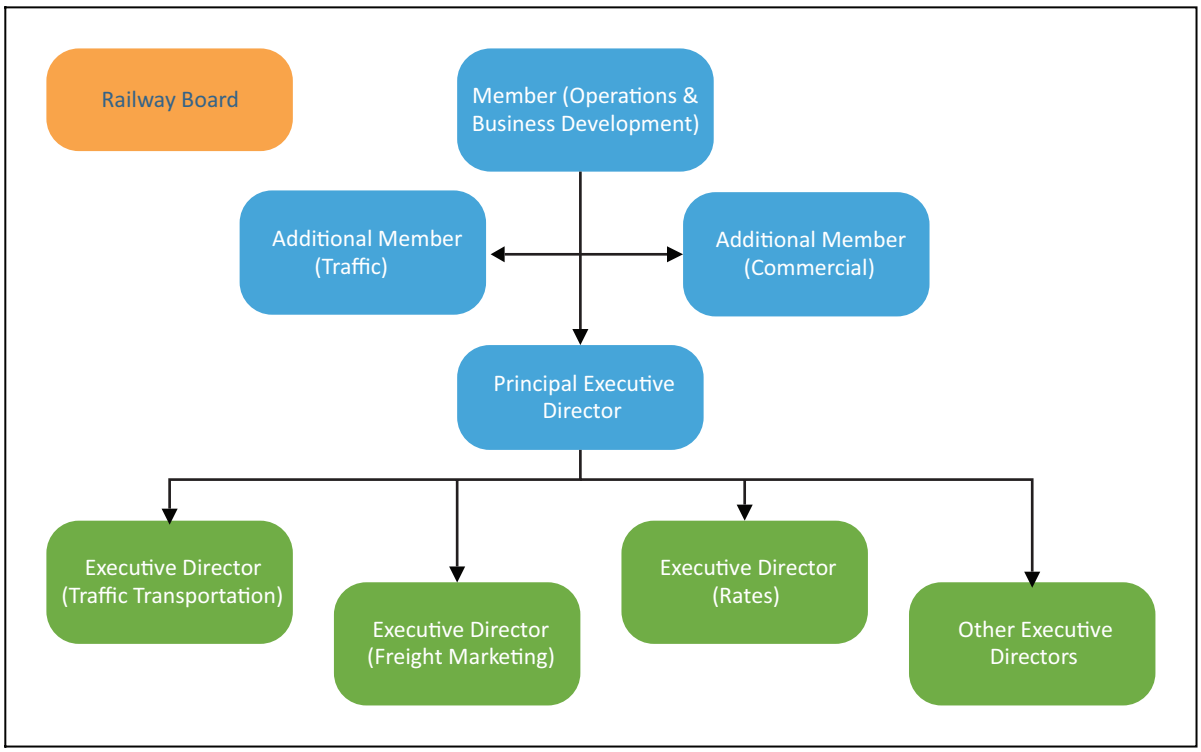


Figure 1: Freight management at IR

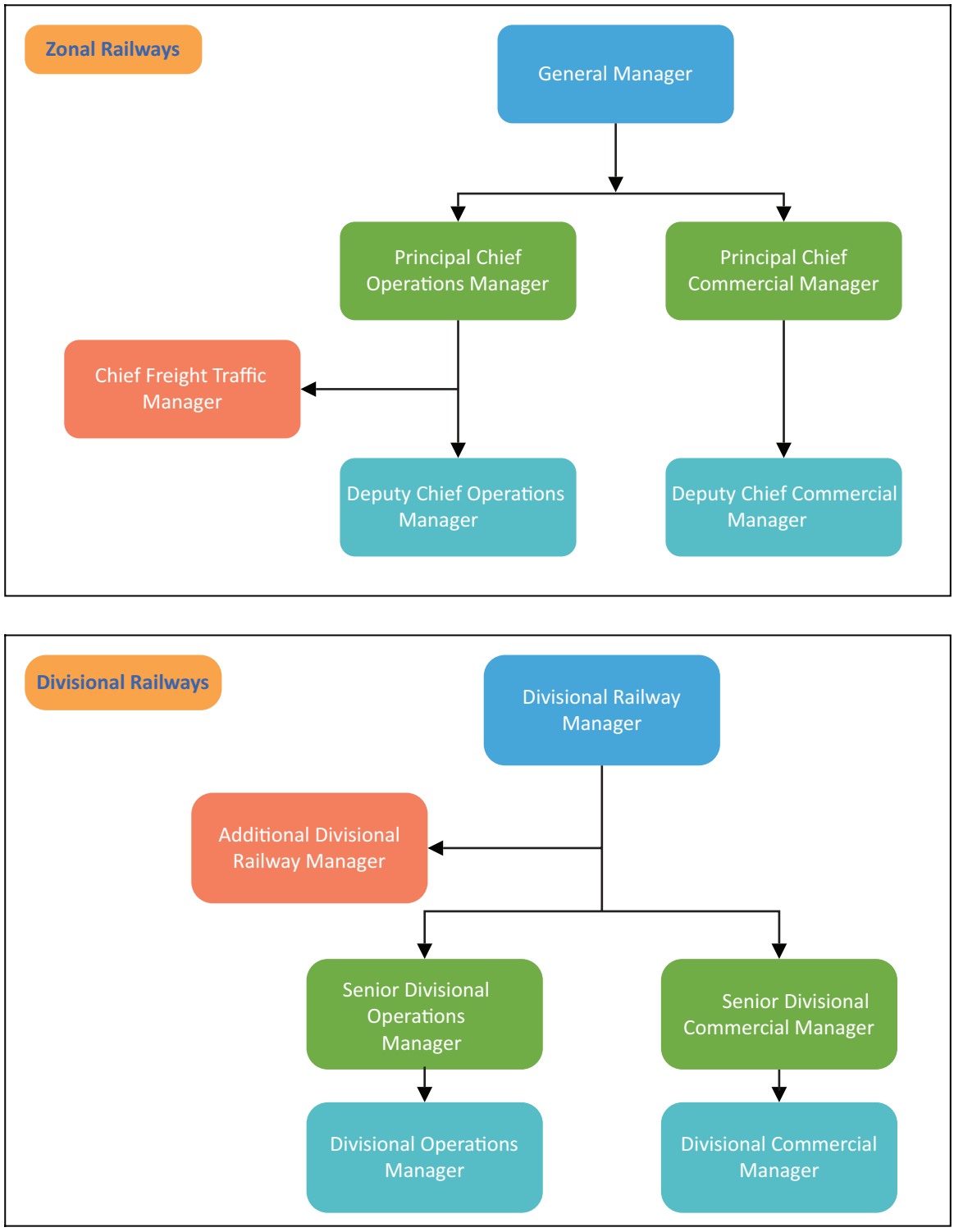


Figure 2: Zonal and divisional railways

freight operation in the Railways. At the divisional level, Senior Divisional Operations Manager (Sr DOM) and Senior Divisional Commercial Manager (Sr DCM) take care of the passenger and freight operations.

The Commercial Department is the marketing arm of IR, which works at the front end to develop and maintain customer relations. The Department manages commercial functions like booking of wagons (indents), acceptance and delivery of goods, and railway receipt (RR) generation. Freight Operation Information System (FOIS) plays a key role in the booking of freight trains, collection of freight charges, and generation of RR. The freight rates are also decided by the Commercial Department. The Operating Department works at the backend and is involved in route planning and freight carriage. The Department also undertakes the responsibility of rake placement and wagon supply.

The freight terminal is the key centre where commercial business is dealt with. The Goods Superintendent takes care of the commercial functions at the freight terminal.

2.2 Freight Monitoring and Handling by the Indian Railways

The consumer/consigner indents for a goods train with suitable wagons through FOIS/Freight Terminal. The Commercial Officer at the terminal looks after the train booking and RR generation and related activities. The aggregators/contractors are involved for loading the goods into the wagons. These activities are documented in Terminal Management System (TMS) in FOIS.

Once the goods are loaded in the train, the rake is transferred to the Rake Management System (RMS) in FOIS and its movement thereafter is controlled by the Operating Department that decides the most feasible route for the goods transport. Consigner has a choice to suggest the favourable route for goods movement, however, in majority of the cases, operationally feasible route is selected by the Department itself.

Once the goods reach the destination station, the rake is again transferred to TMS in FOIS to document and complete the commercial formalities. The goods are unloaded to the warehouse/vehicles with help of contractors/aggregators after obtaining the clearance from the Commercial Department.

In Figure 3, the activities marked in blue and orange are undertaken by Commercial and Operating Departments of the Indian Railways as a part of their freight services. The customer/private player is responsible for the activities in green. The customer is also responsible to undertake loading and unloading activities at the terminals, where they work closely with the Commercial Department.

2.3 Initiatives by the Indian Railways for Freight Management

IR has been constantly working on increasing the freight as well as passenger carrying capacity and providing connectivity to the farthest places. Taking cognizance of its declining share in freight movement, IR has taken multiple steps to make its services more attractive for customers. Electrification, doubling/quadrupling of lines, introducing high power engines, efficient wagon designs, etc., have helped IR to increase freight traffic over the years. Various studies, reports, and detailed action plans are laid out periodically to improvise the freight services.

Table 1 lists the key takeaways from recent studies and reports. Majority of the studies recommend that increasing efficiency and speed of freight trains by augmenting operational capacity could lead to an increase in movement of goods by rail.

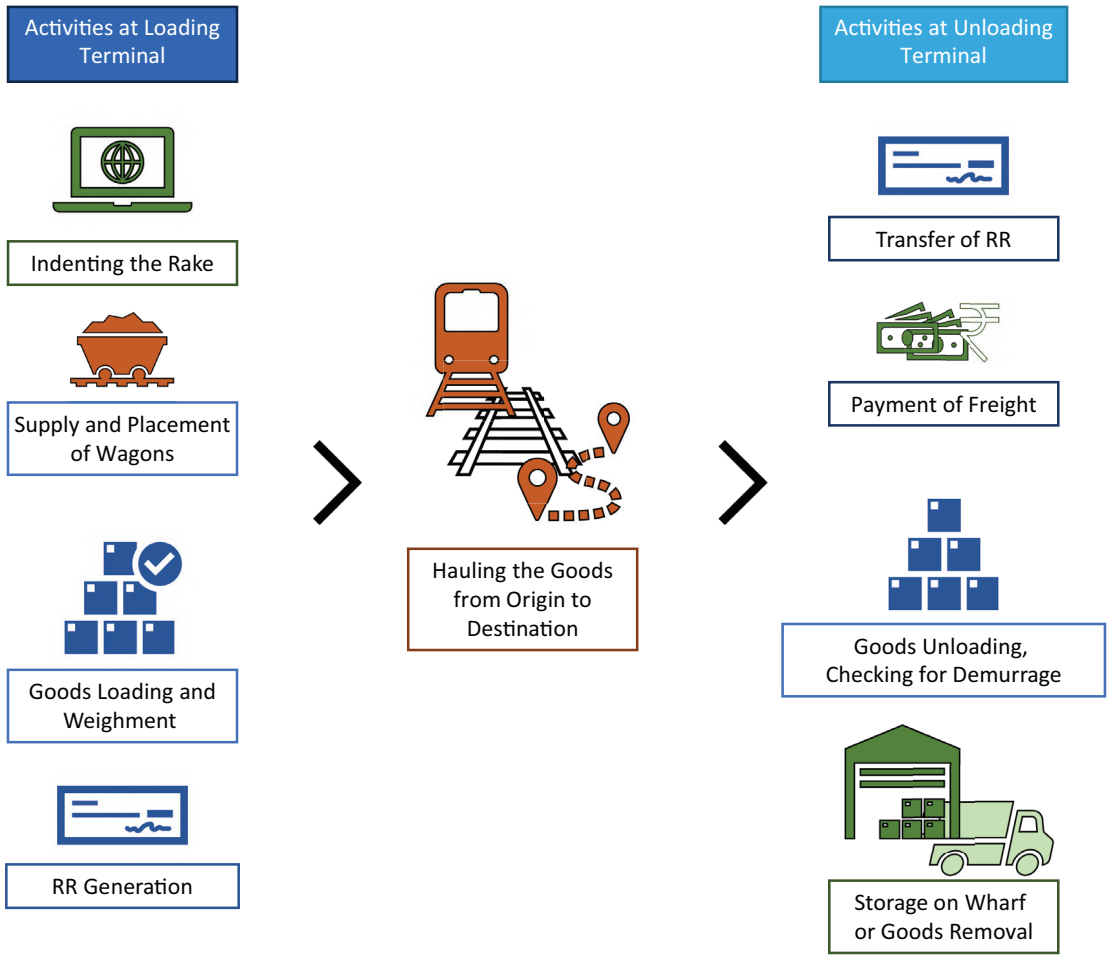


Figure 3: Freight movement on IR

Table 1: Key recommendations for rail freight in recent reports

Report	Key take-aways related to freight
Mission 3000 MT by 2027, 2022	» Focus on capacity enhancement works; including construction of new freight terminals, upgradation of existing goods sheds, and line capacity upgradation » Action plan for provision of adequate rolling stock and locomotives » Developing 100 Gati Shakti Cargo Terminals, as well as upgradation of terminal infrastructure of selected key freight terminals » Increasing commodity basket of railways

Report	Key take-aways related to freight
National Rail Plan, 2020	» Demand forecast till 2051 has been carried out for efficient planning » Focus on increasing operational capacities to meet increased demand by 2030 through line augmentation, dedicated freight corridors (DFCs), investment in rolling stock, updated signalling systems, and 100% electrification. » Aims to achieve average freight train speed of 50 kmph » To identify commodity-wise locations for multimodal freight terminals » Five DFCs are recommended based on rail network with freight share above 50%, out of which the construction of first two DFCs is on-going on » Eastern DFC » Western DFC » East-West DFC » North-South DFC » East Coast DFC
Dedicated Freight Corridor	» A key step by IR to facilitate faster movement of freight with optimum speed and timely delivery of goods » Full length Eastern and Western (EDFC & WDFC) DFCs are estimated to be completed in a couple of years » Four more DFCs are identified under the National Infrastructure Pipeline (NIP), which will provide dedicated freight connectivity on the golden quadrilateral routes. These are: » East-West DFC » North-South DFC » East Coast DFC » Southern DFC » The construction is aimed to be completed by 2051.
India Transport Report (volume 3), NTDPC, 2013	» Emphasis on capacity creation to achieve 50% share in freight transport by 2032 » Construction of DFC and logistics parks across key cities » Improved infrastructure and rolling stock design and specifications » Running of freight trains at 100 kmph » Constructions of corridors for heavy-haul operations » Running of trains on schedule and guarantee transit time » Emphasis on the need of public-private partnerships for development and operation of seamless freight handling systems
12th Five Year Plan, 2012-17	» Emphasis on capacity upgradation of railways to leverage a modal shift » Focusing on the need to scale up freight movement by railways, the plan notes that the transition to railways is crucial also from the energy security perspective. The energy intensity for rail freight is 0.81 MJ/tonne-km, whereas for road freight it is 1.6 MJ/tonne-km; which is almost double. » The Plan emphasized on the need for technological modernization and adequate funding. The plan has high hopes from the upcoming Dedicated Freight Project.

2.4 Current Statistics on Freight Handling

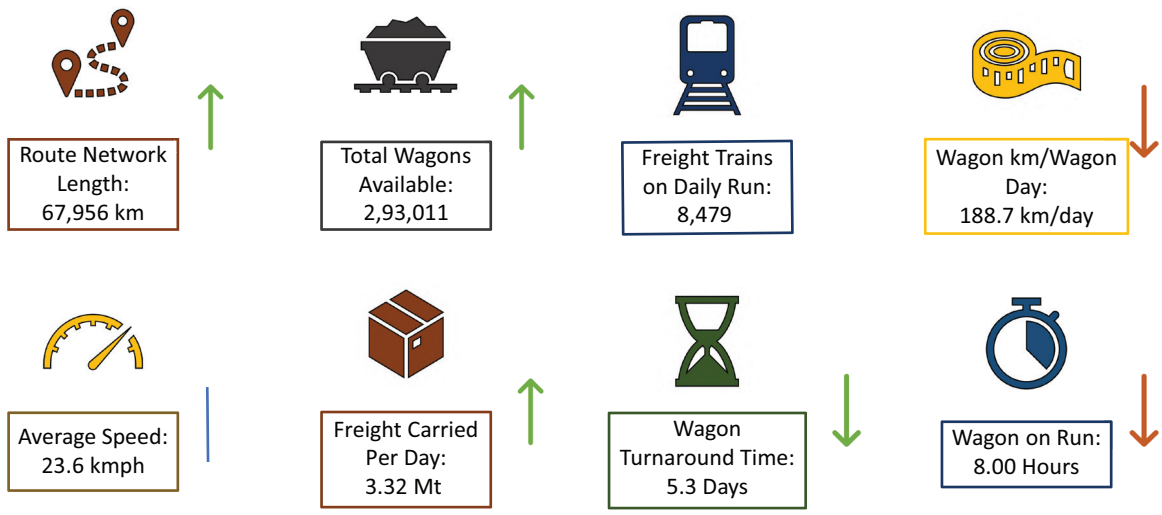


Figure 4: Freight handling infrastructure
Source: IR Annual Report and Accounts 2019-20, Compiled by TERI

2.4.1 Decadal Comparison

Indian Railways, being the primary mode of passenger and freight transport since years; has been constantly upgrading and expanding its network. The majority of railway network has been electrified and converted to broad gauge. The rolling stock is also being upgraded to meet the current freight demand. ***However, even with the noticeable increase in the railway infrastructure, no significant change in operational performance has been observed in the last decade; most of the operating indices have declined.***

Table 2: Infrastructure and performance parameters

Year	2009-10	2019-20	% Change
Route Length (km)	63,974.0	67,956.0	**6%**
Wagons (nos)	220,549.0	293,011.0	33%
Freight NTKM	600,548.0	707,665.0	**18%**
Wagon km per wagon day (broad gauge only)	263.2	188.7	**-28%**
NTKM per Wagon per day	9,222.0	7,057.0	**-23%**
Average freight train speed (broad gauge, electric only)	26.4	23.6	**-11%**
Wagon on run (hours run/day)	10.0	8.0	-20%
Wagon turn around in days (broad gauge)	4.95	5.3	**7%**

Source: IR yearbooks, analyzed by TERI

2.4.2 Freight Carried by the Indian Railways

Looking at the statistics, IR has experienced an increase in freight traffic since its operation and the freight loading has increased by three fold in last two decades. However, the growth of freight traffic on IR has largely stagnated in terms of transport output measured in net tonne kilometres (NTKM) in last few years.

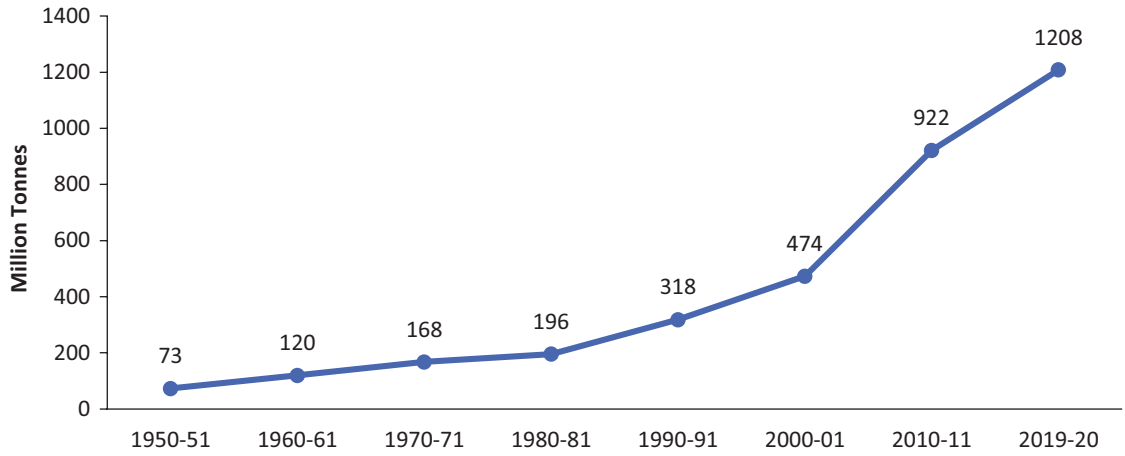


Figure 5: Freight transport output - decal growth
Source: IR Annual Report and Accounts, Compiled by TERI

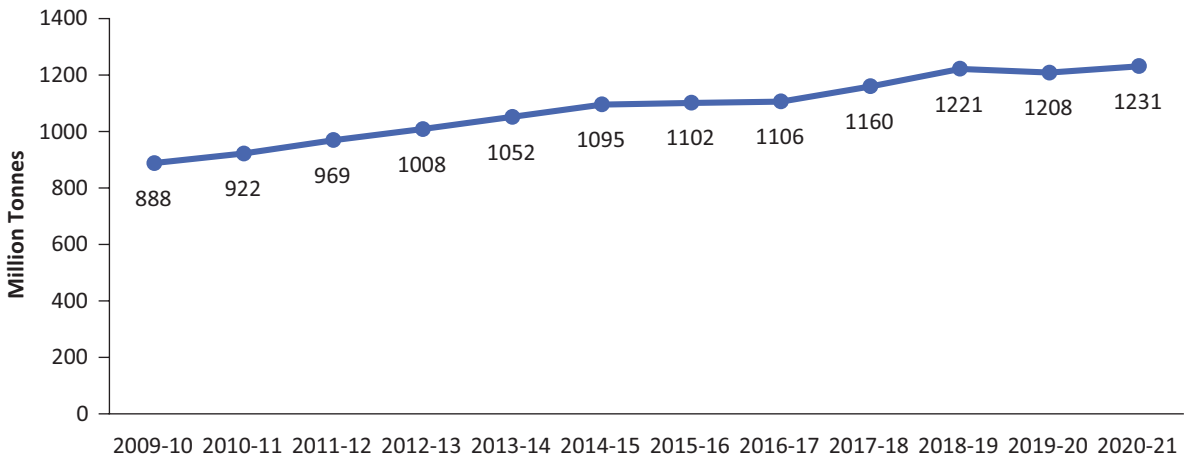


Figure 6: Freight transport output - last decade
Source: IR Annual Report and Accounts, Compiled by TERI

The freight NTKM has increased with freight loading. During the last decade, i.e. from 2009-10 to 2019-20, freight loading has increased by 36%. For the same decade, freight transport output measured in NTKM has increased by only 18%. These figures signify the need of focused attention to optimize the freight operation.

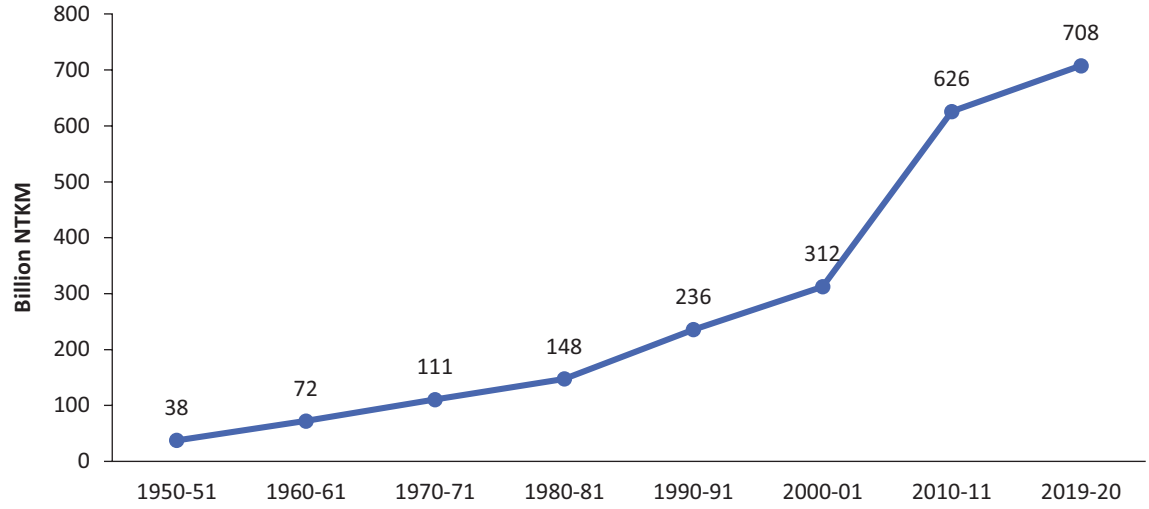


Figure 7: Freight NTKM - decadal growth
Source: IR Annual Report and Accounts, Compiled by TERI

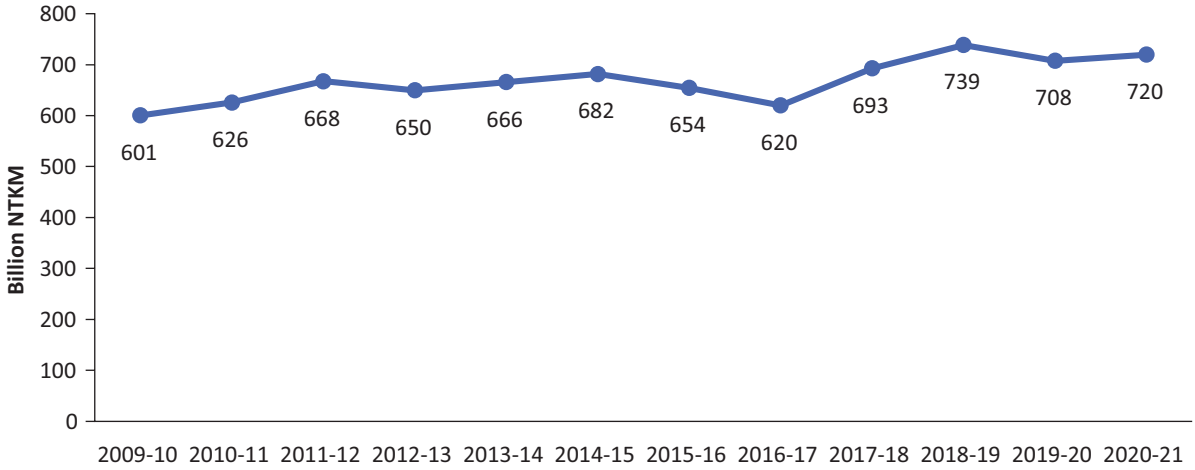


Figure 8: Freight NTKM – last decade
Source: IR Annual Report and Accounts, Compiled by TERI

2.4.3 Freight Speed, Turnaround Time and Wagon on Run Time

The constant efforts of IR for increasing the line capacity and terminal facilities have reduced the average turnaround[3] time of a wagon from 11 days to nearly 5–5.5 days. The wagon turnaround time has been 5 days for almost last decade. However, for the year 2021-22, the turnaround time has decreased to 4.74 days, reflecting increased efficiency. The increase in average freight train speed, facilitated by line capacity upgradation and efficient engines, has played a vital role in decreasing the turnaround time.

[3] Turnaround Time: The interval between two successive loadings, calculated from the time a wagon is placed for loading till the time it again becomes available for reloading is the actual turnround.

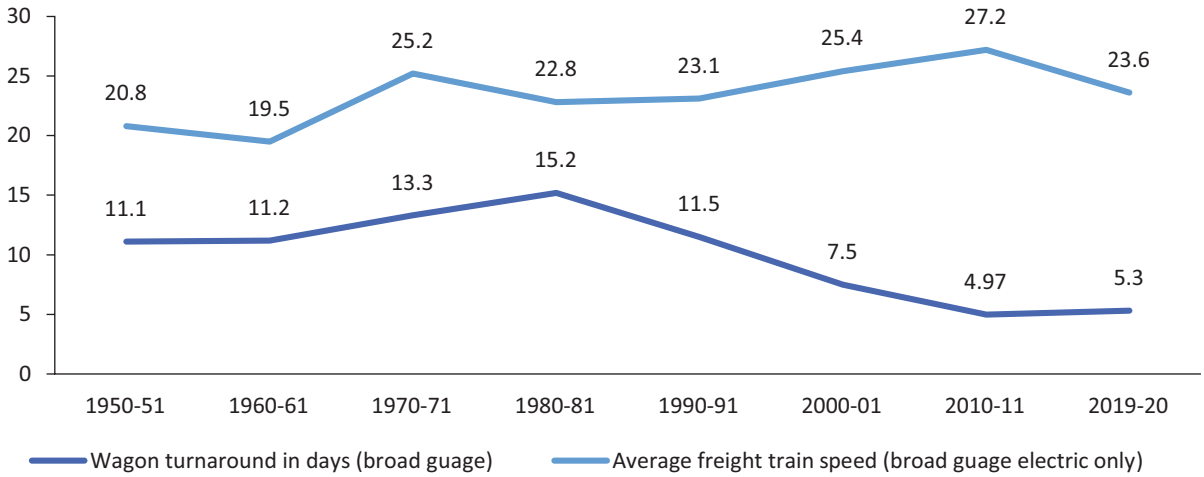


Figure 9: Freight train speed and wagon turnaround – decadal growth
Source: IR Annual Report and Accounts, Compiled by TERI

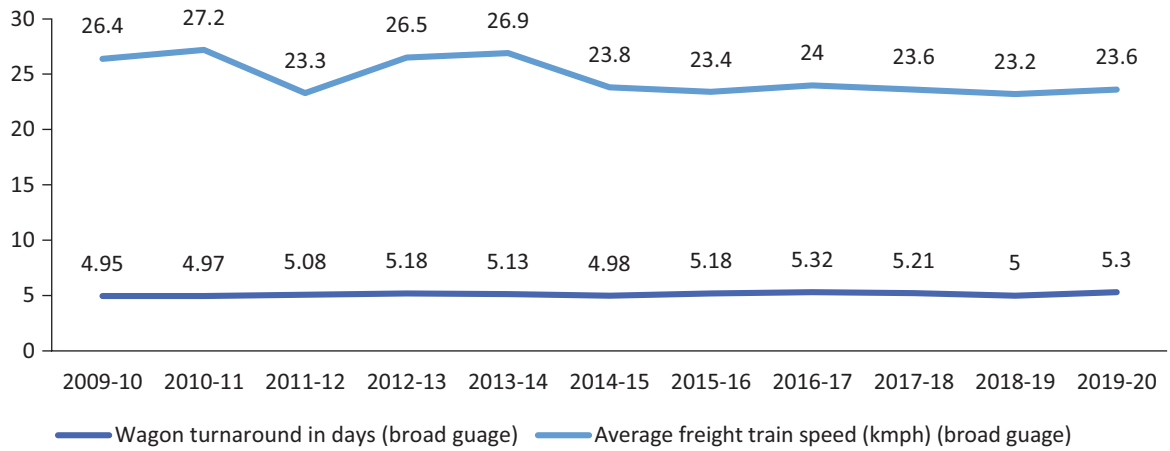


Figure 10: Freight train speed and wagon turnaround – last decade
Source: IR Annual Report and Accounts, Compiled by TERI

Due to mixed mode of operations, many times the freight trains are stabled on line to give way to passenger trains. The issue of in-route detention is particularly higher around the junction stations. Even when the speeds are increased, the in-route detention time increases the turnaround time of rakes.

Average wagon kilometre per wagon day was divided with average speed to obtain the total run time of a wagon. Starting from running for only 3 hours per day, the wagon on-run has increased to 8 hours per day. This indicated that rakes are stabled/detained for almost 16 hours for a day. There is an immediate need to devise strategies to decrease the detention time in order to optimizing the freight operations.

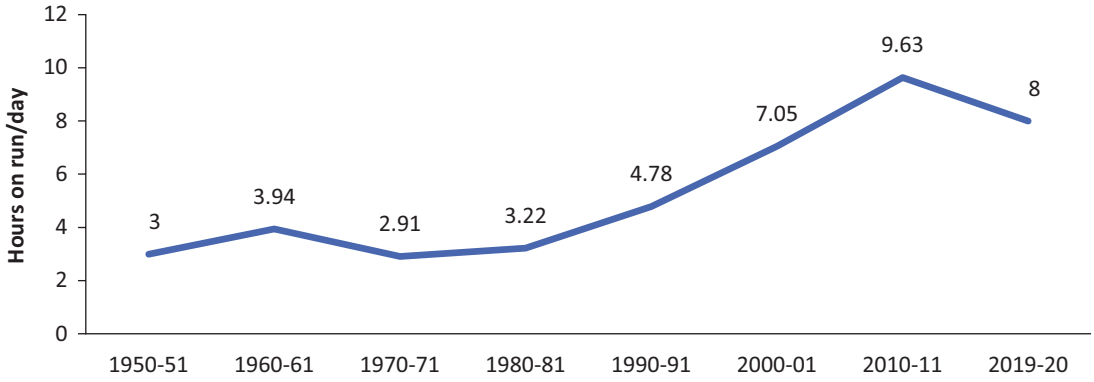


Figure 11: Wagon on run - decadal comparison

Source: IR Annual Report and Accounts, Compiled by TERI

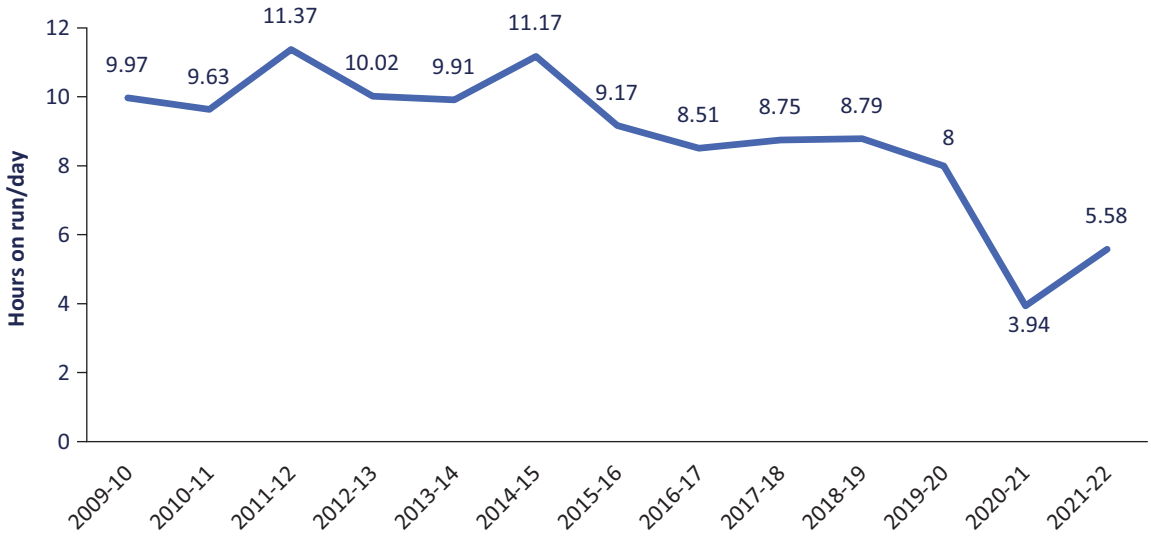


Figure 12: Wagon on run - last decade

Source: IR Annual Report and Accounts, Compiled by TERI

3 Freight Terminals of the Indian Railways

3.1 Freight Terminals

As shown in the Figure 13 transporting freight by railways includes multiple activities. To carryout loading and unloading activities efficiently, special freight terminals are developed on the IR network. The freight terminals are designed with specific planning measures like adequate space for loading/unloading goods, robust circulation area for freight vehicles, etc. to facilitate smooth goods handling. Many terminals also have the provision of mechanized systems for loading/unloading of goods.

The freight terminals in IR can be classified into two broad categories—terminals owned by IR and the terminals owned by private parties.[4] Railway owns two different types of terminals, goods sheds (GS) and railway siding. They are solely built and operated by IR only and can be accessed by any customer willing to use railways for transporting goods.

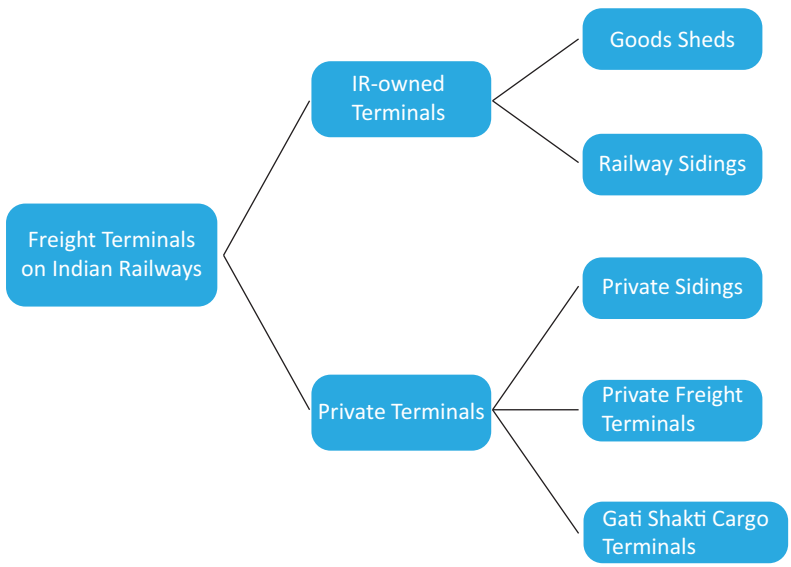


Figure 13: Type of freight terminal

Private freight terminals are developed under different policies and have distinct sharing of roles and responsibilities with IR. Broadly, private terminals are categorized into private sidings and Private Freight Terminals (PFT). These terminals majorly function under the Private Siding Policy[5] and Private Freight Terminal Policy.[6] Recently, IR has introduced two new polices on developing freight terminals with private

[4] Private party: The owner of private freight terminal or siding
[5] Freight Marketing Circular 11 of 2016. Details available at <https://indianrailways.gov.in/railwayboard/uploads/directorate/civil_engg/pdf/rly_sidings/siding_policy.pdf>
[6] Master Circular on PFT Scheme (2020). Details available at <https://indianrailways.gov.in/railwayboard/uploads/directorate/traffic_comm/Freight_Marketing_2020/PFT%20Master%20Circular.pdf>

investment, namely Development of Goods Sheds on Roadside Terminals[7] and Gati Shakti Cargo Terminals (GCTs)[8] in 2020 and 2021, respectively. GCT Policy now works as an overarching policy for private sidings and private freight terminals. Along with these terminals, special terminals like Container Rail Terminals (CRTs) and CONCOR terminals handle mostly containerized freight traffic. The current study does not cover these container terminals.

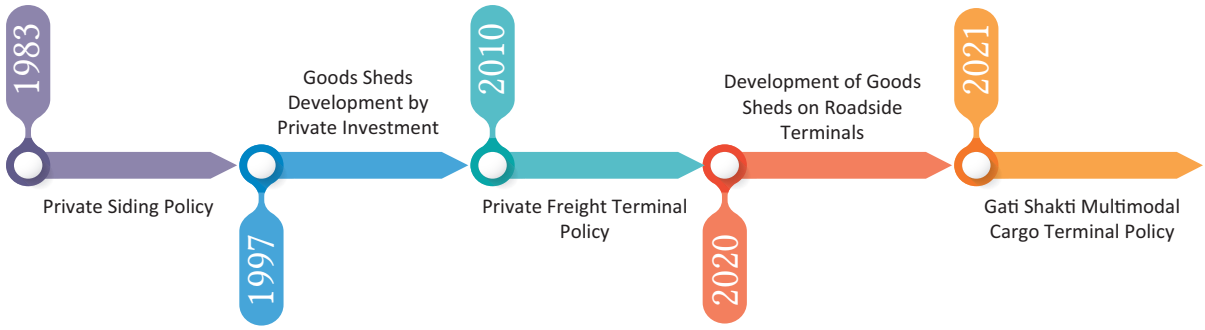
3.2 Terminal Development Policies

Different types of freight terminals are governed by separate policies formulated by Railway Board and zonal railways. Goods sheds are solely developed and managed by IR. However, realizing the potential of private investment in freight handling, IR has rolled out different policies—starting from Private Siding Policy (1983) to Gati Shakti Multimodal Cargo Terminal Policy (2021)—to augment private investment and operational efficiency for rail freight handling.

The Gati Shakti Multimodal Cargo Terminal Policy now works as an umbrella policy for all newly commissioned private siding and private freight terminals, and for old terminals also if they volunteer to migrate under the new policy.

The key polices have been discussed here while the division of roles and responsibilities for each type of terminal is explained in Annexure I: Terminal Development Policies.

3.2.1 Goods Sheds



3.2.1.1 Background and Key Features

Goods sheds are the freight terminals developed and maintained by IR on the land owned by them. Goods Sheds are the first freight terminals that facilitated the freight movement between different places. Goods sheds are the basic model of freight operation, where the Goods Superintendent looks after the commercial functions. The loading and unloading of goods is taken care of by third parties, majorly by contractors/ thekedars. Similarly, for majority of goods sheds, the first and last-mile freight vehicles are also mainly governed by contractors/*thekedars*. The key role of a consigner and/or consignee is indenting and monitoring freight loading in the case of loading terminal, and RR submission and unloading and removal of goods in case of unloading terminal.

[7] Freight Marketing Circular 20 of 2020. Details available at <https://indianrailways.gov.in/railwayboard/uploads/directorate/traffic_comm/Freight_Marketing_2020/FM%20Cir%2020%20of%202020%20-%20Devp%20of%20Goods%20sheds%20through%20Pvt%20Investment.pdf>

[8] Master Circular on Gati Shakti Multi-Modal Cargo Terminal (2021) Details available at <https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,555,862,1527>

3.2.1.2 SWOT Analysis of Goods Sheds

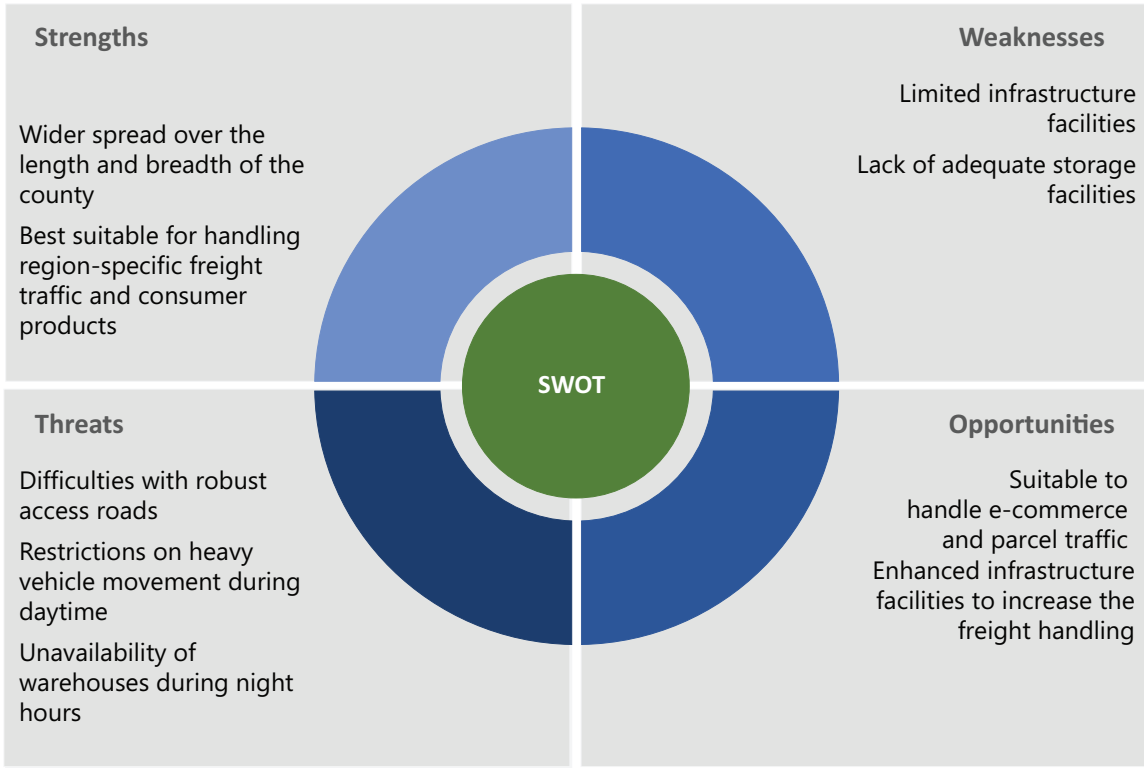


Figure 14: SWOT analysis of goods sheds

3.2.2 Private Siding Policy, 1983

3.2.2.1 Background and Key Features

The current policy on private sidings was introduced almost 40 years ago, which allows industries, mines, major production units and other bulk consumers to set up their own freight terminals for movement of raw materials and finished products.

Earlier, the Siding Policy also had the provision of railway sidings and assisted sidings. The railway sidings were developed and maintained by railways on railway land only. On the contrary, assisted sidings were developed on private land, where superstructure that is track, signalling, and other facilities on ground were constructed and maintained by IR on the land owned by the siding owner who also developed goods-handling facilities, etc. Currently, only private sidings are in operation and no more railway or assisted sidings are developed.

A private or industrial siding is a freight terminal developed at a distance from the main station/ goods shed. These sidings are generally open for all traffic, both inward and outward, and can be used by the siding owner, normally a bulk user of railway facilities. The siding owner has the facility to permit any other user to operate from his siding. A list of such sidings, together with the traffic for which each siding is open, as well as the siding charges that are to be levied is published by individual railway administrations.

3.2.2.2 Development of Infrastructure and Revenue Sharing

Private parties interested in availing railway services at their doorsteps should procure the land and develop required terminal and freight handling infrastructure at their own cost. The common user facilities, such as additional loop lines, V connections, crossing station, etc. are provided and maintained by IR. The maintenance of signalling and telecommunication (S&T) infrastructure and track infrastructure is done by the railways and the cost is recovered from the siding owner. Along with the freight, demurrage, and stabling charges, siding owners must pay siding charges as well.

3.2.2.3 Evolution of the Policy

The Private Siding Policy has undergone numerous changes, while keeping the core of the policy intact. The major changes in the policy are regarding levying of certain cost/charges, as indicated in Figure 15.

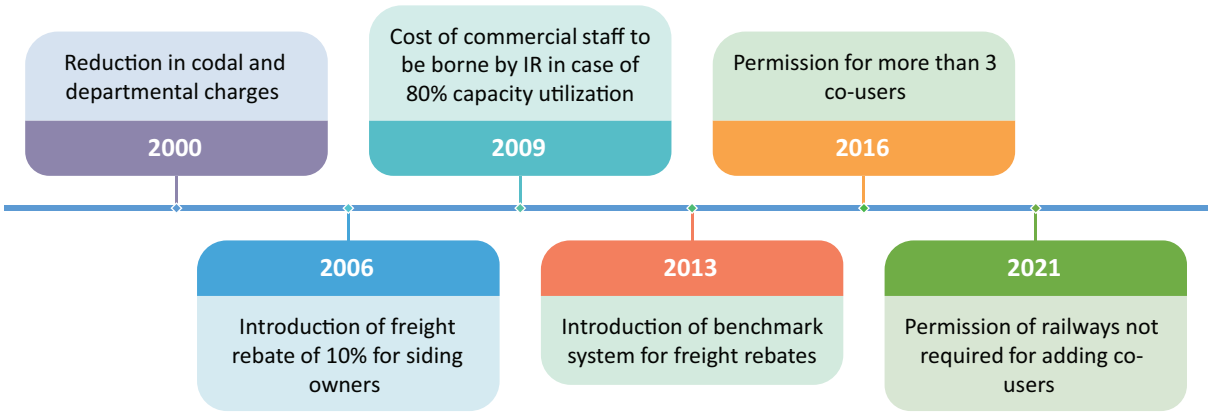


Figure 15: Evolution of the Private Siding Policy

3.2.2.4 Policy Impact

Several public sector undertakings (PSUs) and manufacturing units have developed private sidings for the movement of their raw materials and finished products. Currently[9], India has around 1179 private sidings, out of which 616 and 941 are operationally active for inward and outward traffic, respectively. Sidings contribute the largest share in freight incomes of IR. Private sidings alone handle around 70% of the total freight traffic of IR, in terms of tonnage and NTKM.[10]

The major reason behind wide adoption of the policy is the ease of freight movement from the source. For longer distances, the railway freight rates are more suitable and cheaper as compared to roadways, which encourages private players to opt for railways.

3.2.2.5 Constraints of the Policy

Private Siding Policy could act as a magnet to attract more freight traffic to railways due to ease of business. Yet, the Policy has not been adopted to realize its full potential. According to an earlier study of TERI (2017) about only 19 % of cement produced was from such cement plants which did have railway sidings. Cement being one of the major bulk commodities having a large share in freight transportation by railways, has experienced a decline in the previous years. As of 2018-19, only 28% of the total cement produced in India has been moved by railways.[11]

[9] As of August 2021
[10] Details available at <https://indianrailwayemployee.com/content/sidings-freight-traffic>
[11] Increasing Rail Share in Freight Transport in India – Working Paper: Cement (TERI,2019)

The key issues limiting the wider adoption of the policy are discussed as under.

Land Procurement

The area required for the development of siding is significantly large, and many times the process of procurement of land becomes relatively difficult, lengthy, and costly. Initially, railway land was easily available for developing private sidings and connectivity portions. Since last 10 years, however, it has been nearly impossible to find available railway land for freight terminal development. Non-availability of land at the desired location has discouraged many industries from setting up a private siding.

Higher Infrastructure Cost

Private players interested in availing siding facilities at their location must allocate substantial funds to develop the terminal and track infrastructure from the nearest serving station. The railway very often demands for all the freight-handling facilities to be developed at the siding regardless of the need for the same. The capital cost of infrastructure development along with the railway line for a basic freight terminal is around INR 20 crore, excluding the cost of land. The capital cost of developing the whole infrastructure, along with the above listed issues discourages private parties.

Complex Application Procedure

The application and approval procedure for the railway siding is very complex and lengthy. A considerable amount of time is spent to obtain the all necessary permissions, which demotivates the customers. In addition to that, high application charges, codal charges, departmental charges, and other associated cost significantly increase the cost.

3.2.3 Goods Sheds Development by Private Investment, 1997

3.2.3.1 Background and Key Features

Railways had introduced the policy for augmenting private investment for terminal development in 1997. The policy enabled the private parties to redevelop the terminal infrastructure such as full-length platform, covered shed and warehouses, goods-handling mechanism, pucca circulation area, and basic facilities for the labourers and staff. However, the policy provided that the developer would share the developed goods shed with other users without any discrimination.

3.2.3.2 Development of Infrastructure and Revenue Sharing

The capital cost of terminal infrastructure development was to be borne by private party and the provision of track infrastructure was to be taken care by the Railways.

Freight, demurrage, wharfage, and stabling charges are levied as directed in the engineering code. The private developer does not get any share in freight-handling/terminal management charges.

3.2.3.3 Constraints

The policy failed to take off as no incentives were provided to the private players to recover the capital cost of infrastructure development. it was rolled back in 2005.

3.2.4 Private Freight Terminal Policy, 2010

The Private Freight Terminal (PFT) Policy was introduced with the aim to stimulate development of privately owned freight terminals that are not on railway land for dealing with railway traffic—including parcel traffic and containers.

3.2.4.1 Background and Key Features

Launched in 2010, the PFT Policy is aimed at enabling rapid development of freight terminals to attract more traffic to railways. This policy enables the private parties to set up their own freight terminal on private land.

Initially, the Policy did not allow the handling of outward loading of coal and coke of 'D' priority and outward iron, iron ore, or iron ore pallet traffic; however, the later amendments have subsequently allowed the freight movement of iron, iron ore, and iron ore pallet traffic.[12]

3.2.4.2 Development of Infrastructure and Revenue Sharing

The terminal management company (TMC) should bear all the capital costs, including land procurement, development of terminal and related infrastructure from the take-off point.[13] The cost of common user facilities is also to be borne by the TMC. The Policy has provision of reimbursing the cost of common user facilities, but many TMCs have not received the amount spent even after the commissioning of the siding. The maintenance of track and overhead equipment (OHE) inside the PFT premises is to be taken care by TMC as well.

The charges pertaining to freight, demurrage, and stabling are levied as directed in the engineering code. TMC will have to bear the cost of one commercial staff per shift to carry out the railway functions. TMC can charge the users for the additional facilities they provide for freight handling.

3.2.4.2 Policy Evolution

In the last 11 years, the Policy has been revised 3 times and undergone 13 amendments. The periodic changes in the Policy focused on streamlining the process of setting up PFTs. Major changes focused on the finances of PFTs.

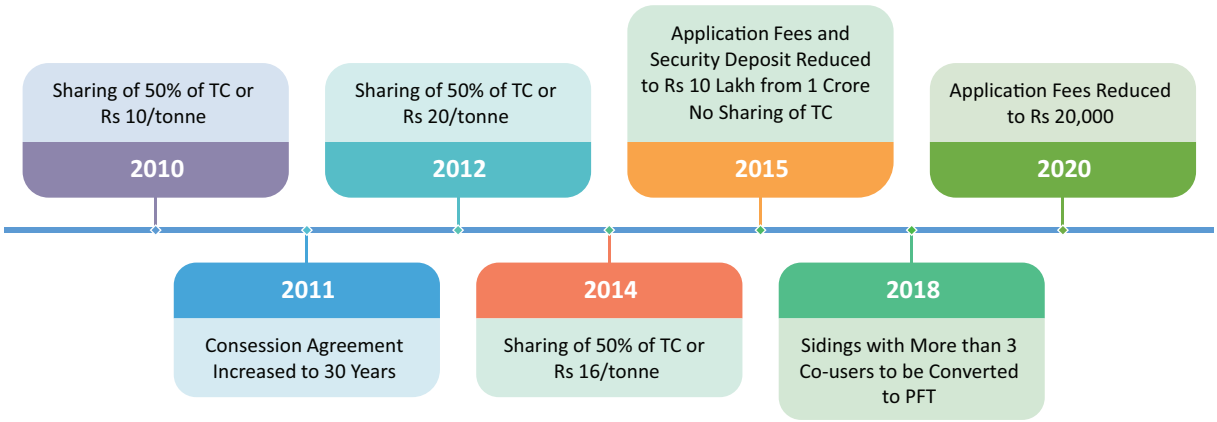


Figure 16: Evolution of Private Freight Terminal Policy

[12] 10.1 – Master Circular on Private Freight Terminal Scheme 2020
[13] Take-off Point: The last point and crossing at serving station through which the rolling stock can be diverted towards freight terminal

3.2.4.4 Policy Impact

As of August 2021, a total of 73 PFTs have been set up in different zones of IR and are contributing around 2% to the total freight business.

As per stakeholder interaction, PFTs played a key role in bring down the restrictions and detentions in particular divisions. It was emphasized that PFTs are highly efficient in freight management.

Though the PFT Policy showed slower adoption initially, the later amendments of the policy have attracted more private players to the business. The presence of PFTs and diversion of traffic to them has resulted in reduced restrictions.

3.2.4.5 Constraints

The PFT Policy has seen relatively slower adoption due to several inherent issues. The distinct constraints are discussed as under, while the general issues are listed at the end of the section.

Revenue and Charges (Section 8 of the Circular)

The codal charges[14] and departmental charges[15] required for setting up PFTs are significantly high and increase the capital cost notably. Though freight haulage is the responsibility of IR, however, it recovers the cost of maintenance of track, S&T, and OHE works and commercial staff from the TMC. In addition, majority of TMCs have not received their security deposit back on time. The Policy does not clearly mention all the charges leviable—which results in unforeseen charges.

3.2.5 Development of Goods Sheds at Small/Roadside Stations Through Private Investment, 2020

It aimed to augment terminal capacity through private participation.

3.2.5.1 Background and Key Features

The Policy on Development of Goods Sheds on Roadside Terminals allows the private parties to invest in developing new goods sheds at existing railway terminals or re-develop the existing goods sheds for better functioning. The party must develop the infrastructure for efficient loading/unloading of goods, such as covered platforms for full rake, pucca approach road and circulation area, warehousing/storage facilities, drainage, lighting and basic facilities for workers.

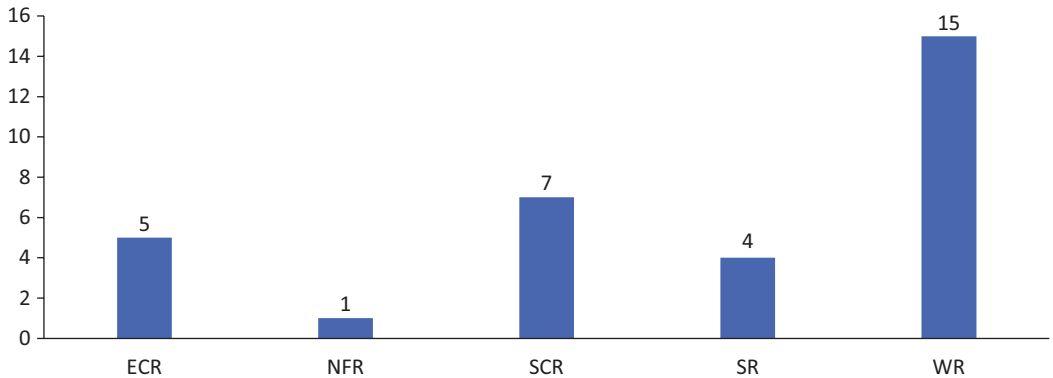


Figure 17: Major constraints in IR policies related to freight terminals

Source: IR

[14] Codal charges: These are recovered for the survey done by IR after the completion of terminal construction.
[15] Departmental charges: The charges recovered for utilisation of charged staff (both gazetted and non-gazetted) required for actual execution of work.

The facilities so developed will be common user facilities and each user will have equal right and opportunity to access these facilities. The private party should quote the desired share in terminal charge (TC) and terminal access charge (TAC) as a reimbursement for the investment made. The selection of the developer is done through a tender system. The party demanding the lowest share in TC and TAC is awarded the tender.

3.2.5.2 Development of Infrastructure and Revenue Sharing

The policy has provision for green field and brown field development, where, in both the cases, the ownership of land and railway terminal vests with the railways. The private party will bear all the cost of development, operation, and management of infrastructure facilities. The provision, operation and maintenance of track infrastructure will be undertaken by IR.

The freight, demurrage, stabling charges, etc., will be levied as directed in engineering code. The private party will get the share in TC and TAC. The private party can use the available space for setting up canteen, advertisement facilities to generate their own revenue from the same.

3.2.5.3 Policy Impact

The Policy was launched on 14 October, 2020; within one year of the launch, it received an encouraging response from private parties. As of July, 2021, different players had showed interest to develop 32 goods sheds in 5 zones, of which, a 'letter of acceptance' (LOA) has been issued for 12 terminals.

The private parties have offered 0–80% of sharing of TC and TAC to IR. The western region has received higher share of TC and TAC as compared to other regions.

3.2.5.4 Constraints

The duration of the work contract as per the Policy was initially kept at five years, but in January 2021, it was extended up to 10 years—which is to be decided by DRM on a case-to-case basis. This time-period is less than the efforts and cost a private party is investing and can be a demotivator for wider adoption.

3.2.6 Gati Shakti Multimodal Cargo Terminal Policy, 2021

This policy aims to promote the proliferation of new cargo terminals and improve existing cargo terminals to accelerate the growth in railway's cargo traffic.

3.2.6.1 Background and Key Features

Ministry of Railways launched the new Gati Shakti Multimodal Cargo Terminal (GCT) Policy on 15 December, 2021 as an overarching policy related to the Private Siding Policy and Private Freight Terminal Policy. This policy is applicable for all new PFTs and sidings, private terminals, and sidings under construction. The private terminals and sidings which are currently operational under the old policies can be migrated to GCT policy, if their owner wishes to do so.

The GCT Policy has addressed many of the issues faced by private players for developing rail freight terminals and has also brought the parity between private siding and PFT. The new policy has also allowed private players to lease railway land for constructing freight terminals.

It has also diluted the stringent eligibility criteria of old policies and any Indian citizen/registered company/ LLP/joint venture/partnership firms, or registered societies/trusts can apply for setting up a cargo terminal.

3.2.6.2 Development of Infrastructure and Revenue Sharing

The Gati Shakti Cargo Terminal Operator (GCTO) can set up a terminal on private land or on railway land (to be acquired or leased). The entire cost of developing the terminal and freight-handling mechanism—starting

from land procurement—is to be borne by the GCTO. The cost of track infrastructure from the take-off point is also to be borne by GCTO, while the maintenance of the same will be taken care by IR. The common user facilities at the serving station will be developed by IR at their own expenses.

Indian Railways will levy the freight, demurrage, and stabling charges as directed in the engineering code. Moreover, the GCTO can levy the suitable charges for the value-added services provided.

3.2.6.3 Constraints

Though GCT Policy is a good step towards bringing all privately owned freight terminals under one umbrella and has eased out many clauses of the PFT and the Private Siding Policy, there are still certain points that can be investigated.

Construction of Common User Facility (Section 5.2 of the Policy)

The GCT policy says that IR will provide the common user facilities to GCT at its own cost and DRM will make sure that it is provided timely. However, no certain time limit has been decided for the same. In such a case, there are high chances that GCTO will be ready to function, but the unavailability of common user facilities will result in delay.

The policy has also not clarified the source of finance/plan-head for planning and building the required infrastructure. The provision of these facilities is expensive and the policy must provide clear details regarding the finances.

Standard Station Layouts (Annexure C of the Policy)

The GCT policy has also included certain standard layouts for cargo terminals as reference. However, the purpose of easing the planning has not been achieved as the layouts provided do not indicate the locations of brake-van siding, weighbridge, and shunting line.

Inspection of Weighbridge (Section 15.7 of the Policy)

According to paragraph 15.7 of the GCT Policy, a nominated Senior Section Engineer/Carriage and Wagon (SSE/C&W) will conduct periodic inspections (once in a fortnight) of the weighbridge to ensure that it is being operated as per the prescribed norms and procedures. In addition, frequent joint inspection by Senior DME/C&W and Senior DCM, or by officers nominated by the IR, shall be conducted and inspection notes issued—preferably once in three months. Once the weighbridge is calibrated and certified by the Weights and Measures Department statutory for the prescribed period, frequent inspections are not required. Additionally, the cost of inspection need not be recovered from the GCTO.

Capital Cost of GCT (Section 5.1.3 of the Policy)

If the existing PFTs or Private Sidings want to migrate under GCT Policy, they have to transfer the ownership of the assets (track, OHE, and signalling equipment) created on railway land to railways for free of cost.

Infrastructure Development and Sharing (17.2.3 of the Policy)

If the connecting line is to be developed on railway land or the land acquired by railways, GCTO will bear the cost of infrastructure development on given land. However, the ownership of these assets will vest with railways. Railway may grant connectivity to other GCT taking off from the track passing over that land.

While these GCTOs are developing infrastructure, bringing additional traffic to railways and paying decided registration/development fees to railways; it should not demand the ownership of the infrastructure that GCTO has developed.

No Freight Rebates for GCT on Private Land

If the GCTs on railway land meet the benchmark traffic,[16] they will avail incentive equivalent to 5% of the land value. No such provision is made for GCTs on private land.

3.3 Key Issues with Terminal Development Policies

The polices of IR on augmenting private investment for terminal development have major constraints, such as higher capital cost, complex approval processes, lack of availability of land and other resources near the rail-heads, etc. IR has actively updated the policies related to freight terminal development, yet there are certain issues that are still to be suitably addressed.

Longer Approval Time

The application and clearance procedure for freight terminal is lengthy and tedious. Mostly, the plans are directed to undergo number of iterations and the assets sit ideal for months due to delays in permission.

Centralized System

The delay in approval and other works is mainly due to the centralized nature of the approval system in IR. The GCT Policy has tried to decentralize majority of the functions at a divisional level, making the process faster and less cumbersome. However, it is crucial to concomitantly empower the divisional officers and delegate the required financial and administrative powers to them to carry out all these functions.

Higher Charges

Private parties must pay high codal charges in addition to departmental and general charges for developing the freight terminals. Higher charges increase the financial burden on the private parties, resulting in a lack of interest in developing the freight terminals. The GCT Policy has ruled out these charges to attract more players.

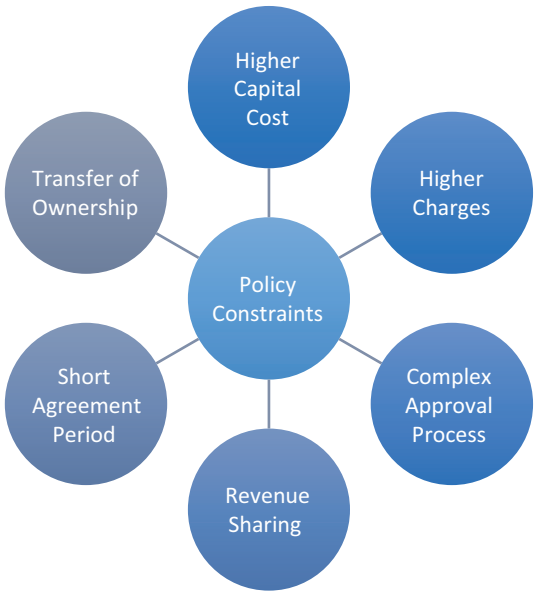


Figure 18: Open terminals for goods shed development

Source: TERI

[16] Section 16, schedule 2, GCT Policy 2021

Uneven Share of Responsibilities

Consultations with the stakeholders reflect the need for developing better business partnership models, as the current working models have uneven share of responsibilities, where the private investors bear all the risks. The revenue-sharing methods are frequently revised, affecting the financial viability of projects. Frequent and unilateral revision of policies by railways not only threatens the financial sustainability, but also sometimes results into loss in volume of business, leading to financial crises on the part of the private entrepreneur.

The GCT Policy has tried to address these issues, yet further rectifications are required.

3.4 Presence and Share of Freight Terminals

Goods sheds account for the highest numbers in freight terminals in India, followed by private sidings and PFTs. The GCT Policy received a nice response and 125 GCTs were proposed. As of February 2023, 25 GCTs have been sanctioned. As GCTs are relatively newer and less in numbers, they have not been included in the analysis.

As per IR data, total 2001 goods sheds, 1086 sidings, and 72 private sidings have been developed on the IR network. It is evident from the Figure 19 that the zones with higher concentration of agricultural, industrial, and mining activities have a higher number of freight terminals. Railways being the most efficient bulk freight carrier, has a wider network in production intensive areas.

To understand terminal capacity utilization in detail, TERI has classified the freight terminals into three categories: A, B, and C, representing the number of rakes handled annually by a particular terminal. Category A terminals handle more than 100 rakes per year, that is an average of 8 rakes per month. While Categories B and C terminals handle 50-100 and up to 50 rakes per year.

Ideally, a terminal with a single goods line can handle 10-15 rakes per month. Only 43% of goods sheds and 71% of sidings fall into Category A. Figure 20 shows that many of the freight terminals on the IR system are underutilized.

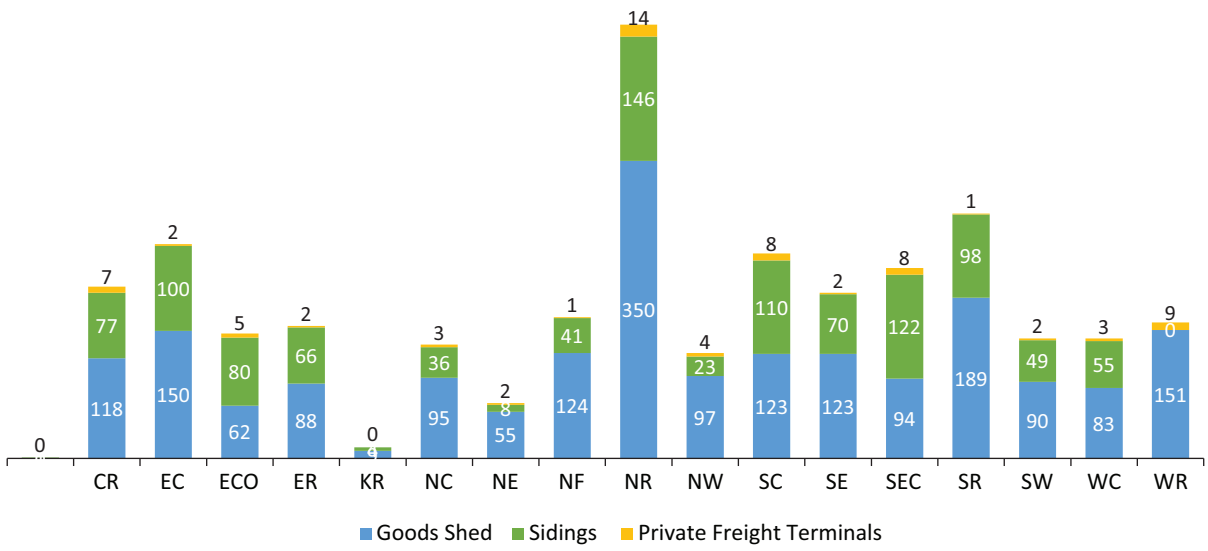


Figure 19: Regional distribution of freight terminals

Source: IR, Compiled by TERI

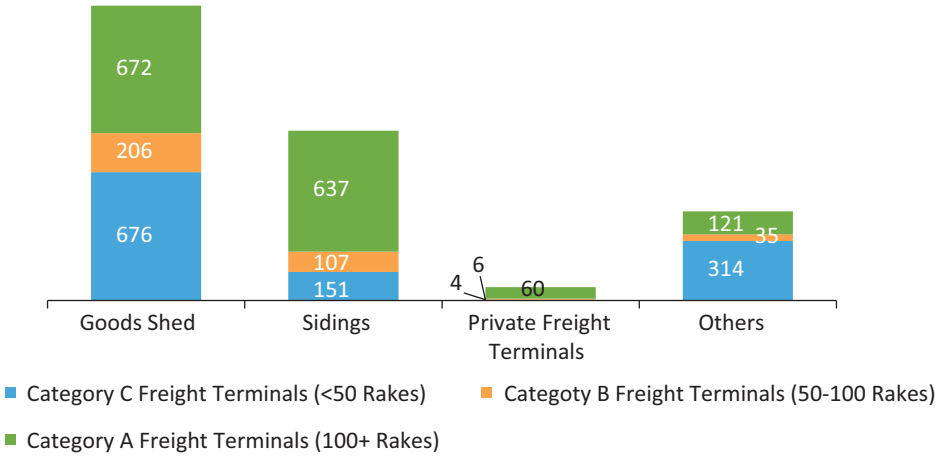


Figure 20: Freight terminal utilization

Source: IR, compiled by TERI

3.5 Freight Traffic

While the number of railway-owned goods shed is higher than sidings, sidings account for almost two-thirds of the traffic handled by railways, for outward and inward loading both. As sidings are majorly developed by key industries, mines, production units, and power houses, they have assured inward demand of raw materials and outward flow of commodities and finished goods. Thus, assured and concentrated demand of freight movement which is handled in private sidings surpasses the freight volumes handled in goods sheds.

Primarily, goods sheds are involved in the freight movement of agricultural commodities, cement, and consumer goods. Agricultural freight demand like fertilizer and food grain is often seasonal and increasing road connectivity has impacted the outward loading of food grains. The demand of cement also changes with the changing demand of the construction industry, but it has been one of the major inward commodities for goods sheds. Along with cement, other commodities like iron and steel also cater to construction and industrial demand via goods sheds. Thus, the quantum of goods handled at unloading goods sheds is slightly higher than that of loading goods sheds.

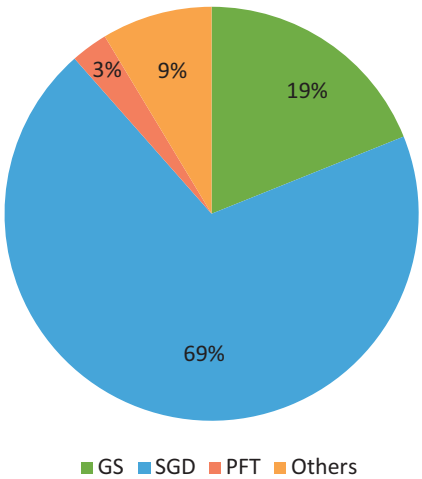


Figure 21: Share of terminals – outward traffic

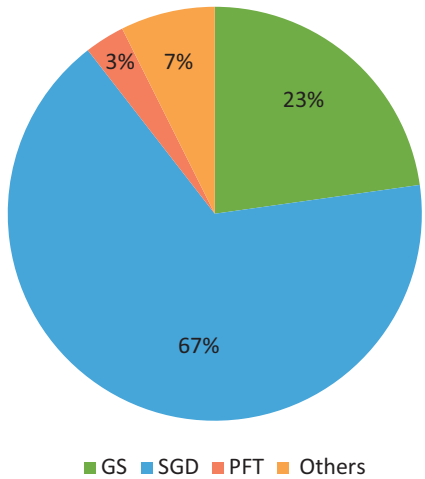


Figure 22: Share of terminals – inward traffic

Source: IR, compiled by TERI

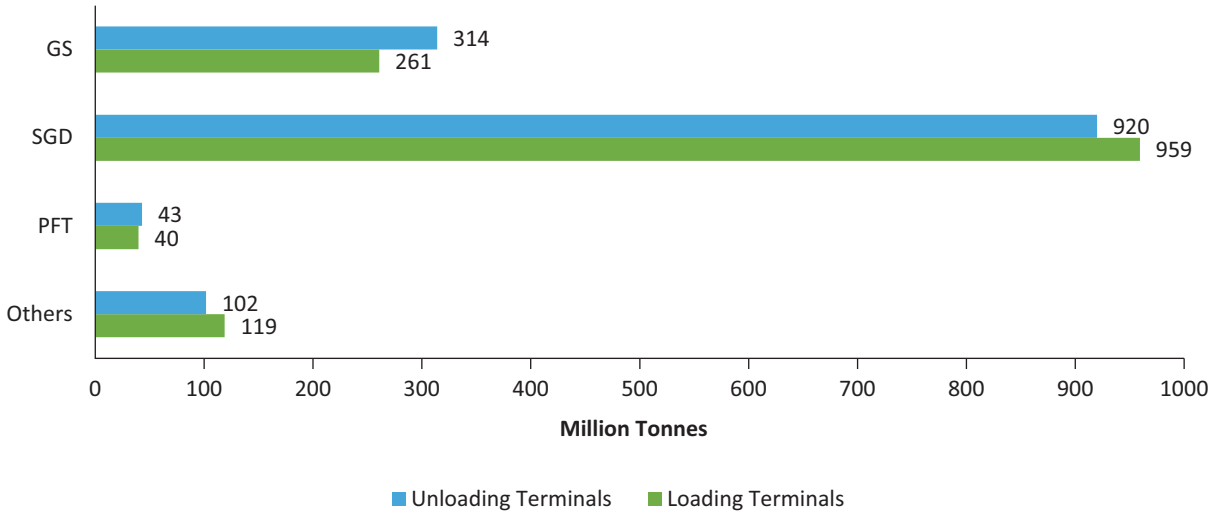


Figure 23: Tonnage handled

Source: IR, compiled by TERI

Key Inferences

While goods sheds have the highest share in number of freight terminals, private sidings lead in the volume of traffic handled. The higher share of freight traffic at private siding is mainly due to the assured need for freight movement and efficient freight-handling systems. PFTs also have a higher share in the freight movement as compared to goods sheds.

The significant gap in the number of goods sheds and the freight traffic handled by goods sheds indicates underutilization of the resources developed by IR. Several factors are responsible for smaller share of freight handling by goods sheds; a major reason being unavailability of suitable infrastructure. The smaller share of non-bulk traffic also results in underutilization of goods sheds.

3.6 Key Issues with Freight Movement by Railways

The increasingly robust connectivity provided by roadways has efficiently decreased the transit time. The time savings offered by roadways and assured delivery time is one of the key reasons behind the modal shift to roadways. The current average turnaround time of railways is 5.43 hours. However, as their movement is dependent on several factors, the goal of assured time delivery is not achieved by railways.

The turnaround time of railways can be explained as the time from wagon loading to the time when the wagon is available for the next loading cycle. Numerous factors affect the turnaround time, including infrastructural constraints.

In order to understand the key issues faced by railway freight terminals, detailed site visits and stakeholder consultation were undertaken. It was observed that several parameters—ranging from infrastructure to labour-related issues—hinder the optimum capacity utilization of freight terminals. The key constraints can be classified into two different categories: infrastructure-related issues and policy-related issues.

The subsequent chapters will discuss infrastructural issues in detail.

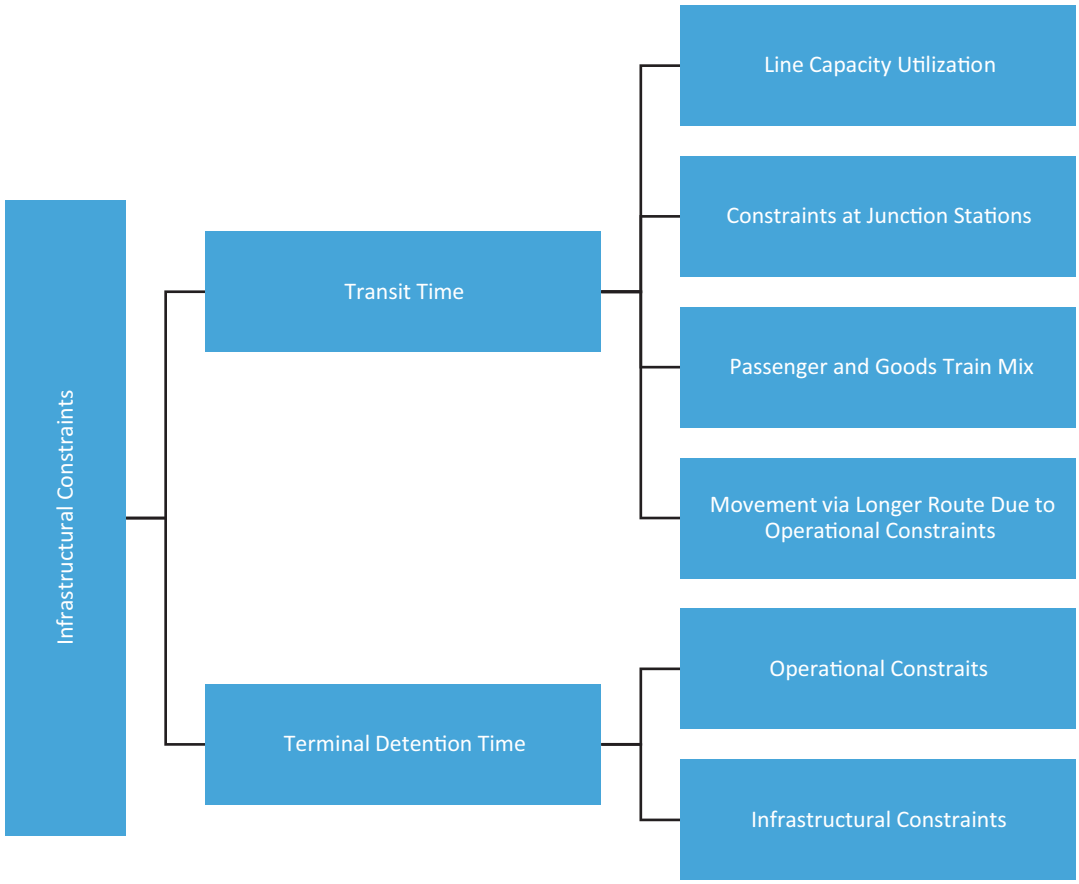


Figure 24: Key constraints for freight movement by railways

4 Constraints During Transit of Wagons

The turnaround time of a freight train depends on two key factors: transit time between originating and destination stations and terminal detention time. In order to optimize the turnaround time of rakes, it is crucial to decrease the transit time of freight trains. Increasing the speed of freight trains is a vital step to optimize the transit time.

Over the years, many infrastructural developments have been undertaken to increase the speed of freight trains. This includes construction of additional lines, provision bypass lines, and over bridges wherever required and construction of DFCs. However, the constantly increasing number of passenger trains and unsynchronized commissioning of infrastructure works offset the impact of capacity upgradation. As both freight and passenger trains use the same tracks on the IR's network, there is a mixed traffic regime at any given point of time. As things stand, goods trains are generally not allowed to take precedence over even the slowest moving passenger trains, which makes it difficult for the average speed of goods trains to increase in any appreciable manner. "Overall average speeds are weighted on the density of freight trains in respective sections with the respective sectional speeds, there is thus a need to address this issue of 'Low Average Speeds' in 'Dense' freight corridors." (IR,2017)

The transit time of any rake can be divided into two parts: wagon on run and when it is stationary. Operational issues like congestion at junction stations and interchange points between different zones and divisions, precedence to faster passenger trains result into frequent in-route detention and longer turnaround time. Terminal detentions for loading and unloading add to turn around time. Table 3 shows the decadal trend of change in wagon on run and when it is stationary. The stationary time for the rakes is double than the wagon on run time, pointing at the major constraint regarding the right of way for freight trains.

Table 3: Transit time – wagon on run and wagon when stationary

Year	Wagon km per wagon day	Average Speed (kmph)	Wagon on run (hour/day)	Wagons when stationary (hour/day)
1950-1951	62.3	20.8	3.00	21.00
1960-1961	76.9	19.5	3.94	20.06
1970-1971	73.4	25.2	2.91	21.09
1980-1981	73.4	22.8	3.22	20.78
1990-1991	110.5	23.1	4.78	19.22
2000-2001	179	25.4	7.05	16.95
2010-2011	262	27.2	9.63	14.37
2019-2020	181.5	23.6	8.00	16.00

Source: IR, Compiled by TERI

With an aim to overcome the constraints related to efficient movement of freight trains on important routes, rationalisation orders were rolled out. These orders mandate zonal railways to use alternate routes, which are normally longer in distance than the shortest route, to avoid such sections which have serious operational constraints. The utility of each rationalisation order requires periodic review as new infrastructure is getting commissioned on the IR network.

This chapter discusses the issues related to speed and transit time of freight trains.

4.1 Line Capacity Utilization

Daily 13,523 passenger and 9,146 freight trains move on the IR network (IR, 2020). Passenger trains account for 60% of the total trains on run. As these trains are always given precedence over freight trains, optimizing the travel time of freight trains is a difficult task.

For the years 2007-08 and 2008-09, 15% of the booked rakes were stabled and/or detained enroute due to non-availability of path and inadequate power (CAG, 2010).

Line Capacity

Line capacity of a section is defined as the maximum number of trains that can run in the section within 24 hours. A section is divided in block sections; the line capacity depends on the critical block section where the train takes maximum time to cover the entire block section. The more time taken to cross the critical block section less is the line capacity.

IR's network is divided into several sections which have varied capacities to deal with running of trains efficiently, and line capacity of the section gives a measure of it. IR has divided the freight track network into three classes based on the line capacity utilization of the given sections: high density network (HDN), highly utilized network (HUN), and others.

The HDN has seven key routes, connecting four metro cities – Delhi, Mumbai, Kolkata, and Chennai, as well as JNPT, Visakhapatnam, Simhachalam, and Gangavaram ports. The HDN largely resembles the golden quadrilateral and moves 41% of the freight traffic. The HUN comprises 11 routes, which provide feeder connectivity to HDN routes as well as connect key mines and production areas.

As, these networks connect key cities and freight nodes, these routes are carrying much more traffic than their designated capacity. Figure 25 indicates that HDN, having the share of only 16% in entire rail network length, carries 41% of the total freight traffic. The HDN and HUN jointly have the share of 51% in the network length, and handle 81% of the total freight traffic.

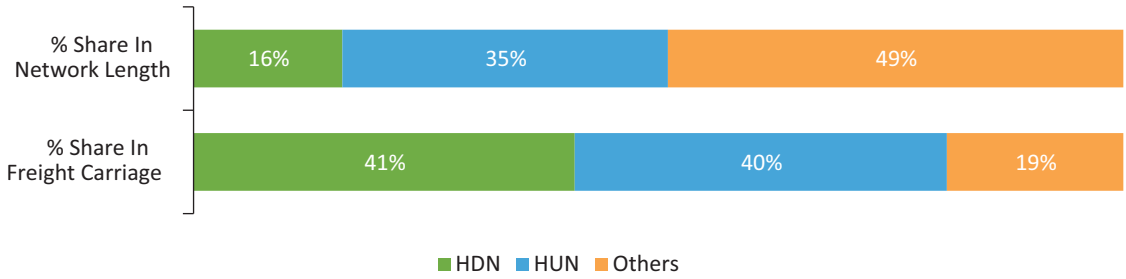


Figure 25: Rail network utilization for freight carriage

Source: NRP, compiled by TERI

"With more than 60% of routes being more than 100% utilized. In the last 64 years, while freight loading has grown by 1344% and passenger km by 1642%, the route kms have grown by only 23%." (Resurgentindia, 2021)

Eighty per cent of the HDN and 48% of HUN is overly utilized. NRP estimates that, by 2051, 57% of the network will exceed 1.5 times its capacity. An overly utilized railway network contributes in increasing the travel time. Many times, the rakes are diverted to move via longer routes of HUN or other networks instead of HDN for operational feasibility.

Key Inferences

It is crucial to undertake line capacity upgradation work on these saturated routes by adding new lines/bypass lines wherever required.

While discussing the issue with railway experts it was noted that the current capacity development works target a part of route which brings only a partial relief. It is suggested that entire route should be taken for augmentation of the capacity by undertaking all major and minor works that are critical for speedy movement of trains. For instance, adding full length loop lines, removing permanent speed restrictions, easing sharp curves that restrict the speed, redesigning station yards for permitting passage of through trains unhindered are equally important with major works of doubling of a line.

Increasing the line capacity of certain sections of the network does not always serve the purpose fully if other operational constrains are not resolved simultaneously. The operation constraints like transit delays at junction stations enroute have been discussed in the following sections.

4.2 Indian Railways' Initiatives to Upgrade Line Capacity

Along with laying of new additional lines, provision of automatic signalling, speed raising, smaller block sections, and introducing high power locomotives will also play an important role in optimizing the travel time of freight trains. Mission 3000 MT by 2027 has listed line capacity upgradation works of total 37,891 km network. A short summary of the proposed works is listed in the Table 4.

Table 4: Capacity upgradation works

Infrastructure Upgradation Work	Details
Commissioning of critical and super critical works	55 line capacity upgradation works
Priority works for capacity enhancement	327 line doubling (DL), new line (NL) and gauge conversion (GC) works
Coal-related works	19 DL/NL/GC works
Patch doubling	188 works
Automatic signalling works	26 works
Yard remodelling works	239 crucial yard remodelling works
Traffic facility works	75 traffic facility works
Traction upgradation	6 works
Speed raising	19 works

4.2.1 Dedicated Freight Corridor: An Attempt Towards Offering Better Speeds and Clear Paths

Dedicated Freight Corridor (DFC) is a mammoth initiative taken by IR to augment line capacity. As the dedicated lines for the movement of freight trains are developed, higher speed and less time for rake movement can be achieved. In addition to the dedicated freight lines, the corridors can carry higher load (up to 25T), along with the facility to carry double stack container trains on western DFC (WDFC).

Average Speed

Looking at the current average speeds, EDFC and WDFC offer the speeds of 45.62 kmph and 37.05 kmph, respectively for December, 2022. Whereas, the average freight train speed of the IR network for the same time period is 18.75 kmph.[17] Looking at the growth in IR's average speed for the last decade, no noticeable increase has been observed, as the benefits of the capacity upgradation work undertaken in the last decade have been majorly diverted to passenger trains.

The average speed of a freight train on DFC route is 40.7 kmph. DFC claims that more than 60% of the trains run on the average speed exceeding 80 kmph (DFC, 2022). The dedicated pathway and seamless passage of freight trains on DFC route result in better speed. Developing dedicated freight lines and bypass lines on the HDN can substantially increase the speed of the IR section.

Daily Average Train Runs

Though the construction of DFCs is not completed freight trains have started to move on the completed sections to avail better speeds and transit time. The average daily run count of freight trains on EDFC and WDFC, respectively is 107 and 67 for November, 2022 (DFC, 2022). Figure 27 represents the capacity utilization of DFC.

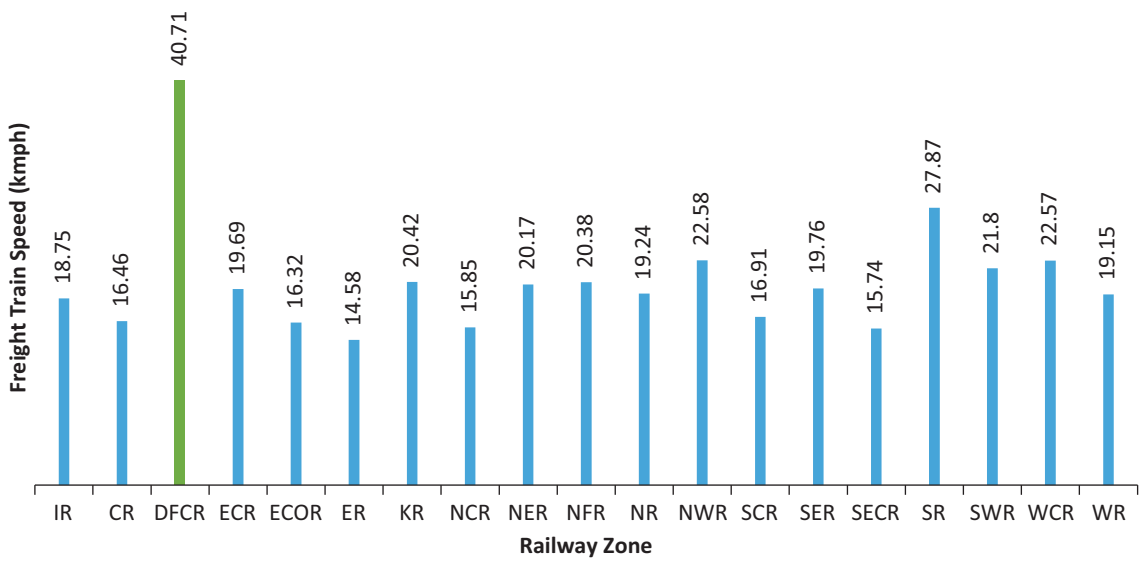


Figure 26: Freight train speeds on IR network

Source: CRIS, compiled by TERI

[17] CRIS

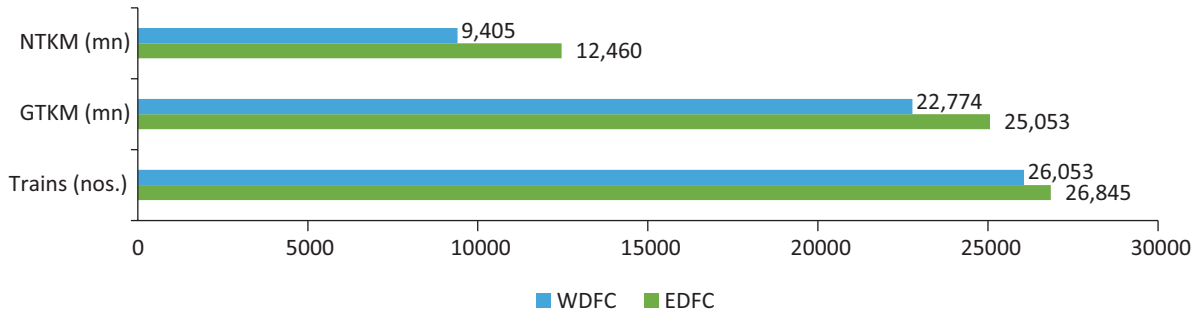


Figure 27: DFC performance

Source: DFC

Key Initiatives

Along with offering high load-bearing capacity and high speeds, WDFC runs double-stake container trains—hauling double amount of goods in the one run. The port connectivity coupled with the facility of running double-stake container trains may help shifting road container movements to railways.

WDFC also runs Ro-Ro service from Rewari to Palanpur. Trucks loaded with different goods are stacked on flat wagons and carried from origin to destination on the railway network. Ro-Ro service eliminates the need of first and last-mile connectivity, facilitating convenient transport. The second objective talks about the Ro-Ro service on DFC in detail.

A. P. Moller – Maersk recently flagged off the weekly dedicated container rake service named Pratigya Express from Sonipat Inland Container Depot (ICD) to APM Terminal Pipavav Port.[18] Pratigya Express commits to cover the said distance in 2.5 days, and will enable time bound loading in particular vessels at the port.

4.3 Constraints at Junction Stations

The railway stations where three or more lines diverge or converge are called junction stations. Such stations serve the purpose of connecting a section consisting a group of stations with another similar section. Junction stations cater to greater number of routes and trains, and often witness detention of trains for right of way. Often junction stations are provided with more lines to facilitate handling of a larger number of trains. Sometimes, the prioritization of passenger trains over freight trains results in rake detention of a freight train at a junction station for longer hours.

At present IR manages 709 junction stations that create complexity in the network as efficient management of rail movement in different directions is required. The increase in conflicts and

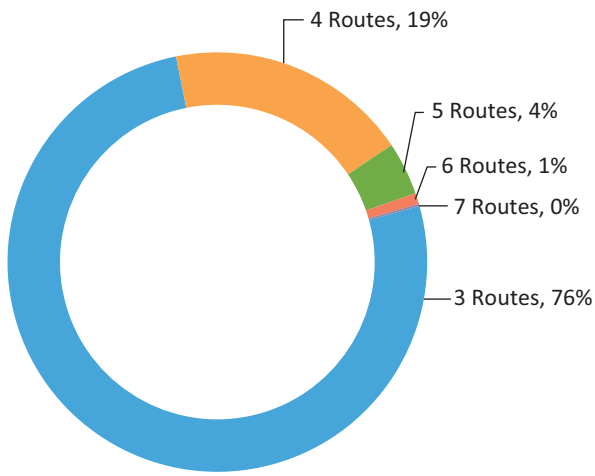


Figure 28: Junction stations on IR network

Source: NRP

[18] Details available at: <https://www.maersk.com/news/articles/2022/11/25/maersk-flags-off-pratigya-express-a-new-dedicated-weekly-rail-service>

complexity is proportional to growth of traffic volumes without commensurate development of infrastructure facilities. To address this problem on the network, enhancing the junction capacity is crucial for bringing about operational efficiency.

Out of 709 junction stations, 540 junctions connect with 3 routes, 133 stations connect with 4 routes, 29 stations connect to routes, 6 stations have 6 routes and 1 station is connected with 7 routes (IR, 2020). This adds up to 169 terminals are connected to 3 or more routes. If the operations at these terminals are not managed efficiently, they turn into major bottlenecks in freight movement.

As passenger trains are always given precedence over freight trains on IR network, the freight trains are frequently stabled and/or detained on the network, especially near junction stations. The graph shows the average speed freight trains for different months. It is evident that, detention decreases the average speed to half. Table 5 gives the zone-wise speeds with and without detention.

Table 5: Impact of stabling/detention on freight train speeds

Railway Zone	Jan-21		Apr-21		Jul-21		Dec-21	
	Speed without Stabling	Speed with Stabling	Speed without Stabling	Speed with Stabling	Speed without Stabling	Speed with Stabling	Speed without Stabling	Speed with Stabling
Overall IR Network	40.88	16.05	35.28	16.57	32.2	18.96	30.78	18.55
CR	42.5	17.8	48.47	17.24	48.25	16.48	47.29	16.39
DFCR	52.18	48.23	65.29	45.94	64.71	46.89	57.29	42.46
ECR	52.39	16.05	48.48	16.16	49.24	14.55	47.61	15.24
ECoR	43.74	13.43	44.28	13.95	39.5	12.6	44.85	14.89
ER	57.66	9.01	53.18	9.69	5.076	10.3	47.45	9.81
KR	49.52	27.27	50.35	23.31	49.21	24.91	44.99	20.71
NCR	44.89	19.03	43.88	18.52	48.13	16.96	45.49	13.43
NER	52.36	18.64	49.65	17.25	51.06	17.55	53.15	14.56
NFR	43.74	19.06	46.06	19.36	46.41	21.45	45.92	16.89
NR	45.03	15.17	46.17	16.58	48.09	16.25	27.9	16.12
NWR	43.93	26.98	45.26	18.56	47.76	22.96	44.86	18.29
SCR	49.38	15.92	48.86	15.65	46.51	15.63	28.2	15.2
SER	39.54	16.05	41.04	16.14	43.94	16.72	43.04	16.96
SECR	41.5	16.54	39.18	15.03	40.63	14.55	38.23	12.96
SR	48.23	25.25	48.77	25.62	49.58	23.03	48.19	25.12
SWR	52.82	12.84	52.94	12.16	51.98	15.58	51.78	13.01
WCR	55.34	20.61	57.21	21.95	59.8	21.05	55.89	20.11
WR	41.66	18.24	41.41	15.97	40.47	16.75	37.89	16.53

Source: IR

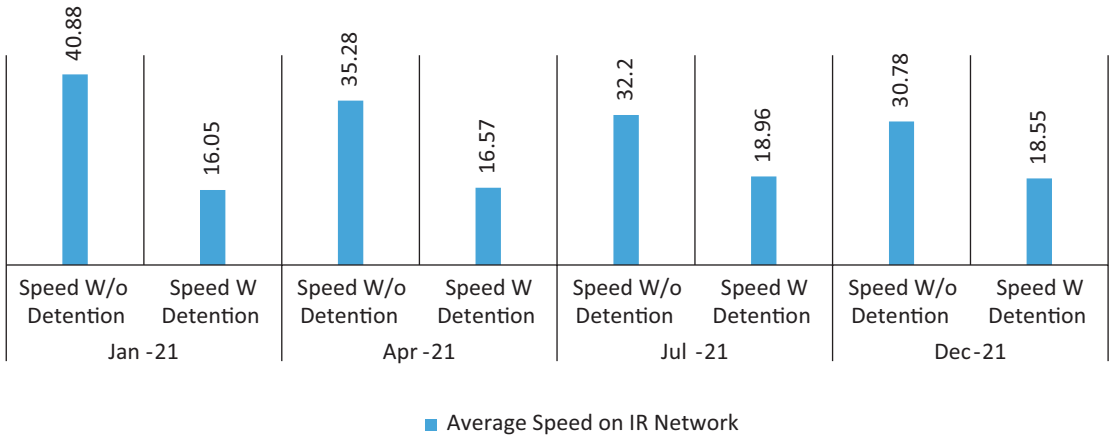


Figure 29: Impact of in-route detentions on freight train speeds
Source: Data from CRIS, Analysis by TERI

Junction capacity can be improved by bypasses and flyovers. A bypass allows goods train to bypass a busy junction station by laying a direct line between the last station before the junction station and the next station after the junction station. A bypass is laid mainly to avoid detention of trains at a junction station. A rail flyover serves a similar purpose as a bypass except that a grade separated movement avoids the surface crossings which makes the operations of trains over it more efficient.

Two hundred and twenty-two rail flyovers and by-passes are proposed in the NRP based on the inputs from zonal railways. As mentioned in Table 4, 75 traffic facility works are proposed under 'Mission 3000 Mt by 2027'.

4.3.1 Junctions and Sections of Sluggish Mobility

The average speed of freight train on IR network comes to around 25 kmph. However, some sections experience low-freight train speeds of around 10 kmph. The railway board undertook a detailed study on capacity generation and utilization under DFC. As a part of the study, the sections having freight train speeds lower than 10 kmph were identified and examined. It was identified that delayed project implementation of the doubling and electrification and inadequate connectivity in the hinterland are the key factors affecting the freight train speeds and smooth interchanges (Kumar, 2017). Mixed mode of operation, sectional congestion due to inherent high density, and crew and loco shortage are the key reasons for sluggish mobility (IR, 2017).

TERI undertook analysis of key junctions and investigated two such sections from ECR to understand the reasons for slower speeds.

4.3.1.1 Average Speed and Detention Time at Key Junctions

To understand the detention at junction stations, TERI analyzed the entry and exit time of trains at given junction sections. The key junctions on the Howrah – Delhi route (HDN1) were selected for the analysis. The Table 6 enlists the basic characteristics of the junction stations. All the junction stations are connecting 3 to 4 routes.

Table 6: Inroute detention at junction stations

Junction	Son Nagar (ECR)	Deen Dayal Upadhyay (ECR)	Prayagraj (NCR)	Kanpur (NCR)	Tundla (NCR)
Routes Connected at Junction	**3**	**4**	**4**	**4**	**3**
Type of Main Line	Triple Electric Line	Double Electric Line towards Prayagraj (A route)	Triple Electric Line	Quadruple Electric Line	Double Electric Line
Selected Section for the Study	Bagaha Bishnupur-Son Nagar-Dehri-on-Son	Ganj Khwaja-Junction Hut (DDU)-Pt Deen Dayal Upadhyay Jn-Block Hut 'B'-Jeonathpur	Naini-Prayagraj-Subedarganj	Chandari-Kanpur Goods Marshaling Yard-Govindpuri-Panki Dham-Bhaupur	Hirangaon-Tundla-Mitawali
Distance of the Section (km)	13.62	14.9	11.7	24.69	15.37
Number of Trains Studied	97	285	640	95	97
Average Detention (hh:mm)	**1:03**	**7:30**	**1:56**	**6:59**	**1:05**
Average Speed for the Section (kmph)	**13.62**	**2.13**	**11.70**	**4.12**	**15.37**
Minimum Detention (hh:mm)	00:55	00:54	00:46	1:10	00:45
Maximum Detention (hh:mm)	06:23	11:53	06:11	13:36	08:53

Source: CRIS, TERI analysis

The difference between the entry and exit time of the train for the given junction section was obtained to identify the hours spent at the junction section. The analysis reflects that for Mughal Sarai and Kanpur, the average time to cross 15-kilometre section is 7-7.5 hours. The sectional speed decreases to 2.13 kmph and 4.12 kmph from the national average of 25 kmph. For other junction section as well, the average speeds have decreased to less than half of the national average.

Looking at the last two columns, one can understand that, these sections have the required facilities to pass the train in around one hour. However, due to frequent detention and prioritization of passenger rakes, the maximum and average time for passage is very high.

4.3.1.2 Pradhankunta-Dhanbad-Gomoh–Gaya Section

The railway section Pradhankunta – Dhanbad – Gomoh – Gaya is one key route connecting with Eastern Railways, as well as provides connectivity to a number of Coal and Mineral Sidings. Dhanbad, Gomoh, and Gaya being the key junction stations, suffer from longer inroute detentions of freight trains. Similar analysis was undertaken to understand the average inroute detentions at junction stations.

Three of the junctions suffer detentions ranging from 3-6 hours to cross 10 km stretch. For Gomoh, minimum detention time is 2 hours, emphasizing on critical need of intervention.

Pradhankunta – Gomoh Section

To understand the constrains at Gomoh - Pradhankunta section, the control charts were studied. Looking at the control chart from Sindri Town (SNDT) to Dugda (DDGA), it is observed that the movement of trains at Gomoh and Pradhankunta section is considerably slow. The Figure 30 shows the control chart of the mentioned section.

Control Chart

The daily train movement on any given section is recorded in control charts. These charts are like x-rays of the railway network and helps to identify the sections where the train speeds are considerably low.

Suppose a train is moving from station A to the station G and passes via stations B, C, D, E and F, the control chart traces the exact time at which the train passes from each station. The distance between the stations is noted on y-axis and the time on x-axis.

Thus, the slope gives the speed of trains. For the sections where the slope is low, some constraint exists.

Table 7: Junction detentions at Dhanbad, Gomoh, and Gaya

Junction	Dhanbad (ECR)	Gomoh (ECR)	Gaya (ECR)
Routes Connected at Junction	3	4	3
Selected Section for the Study	Chhota Ambana - Dhanbad - Tetulmari	Matari - Gomoh - Nimighat	Bandhua - Gaya - Kastha
Distance of the Section (km)	9.13	10.36	8.44
Number of Trains Studied	43	43	43
Average Detention (hh:mm)	**4:43**	**6:36**	**3:43**
Average Speed for the Section (kmph)	**1.98**	**1.59**	**2.34**
Minimum Detention (hh:mm)	0:47	2:10	1:05
Maximum Detention (hh:mm)	13:47	10:16	9:27

Source: CRIS, TERI Analysis

Table 8: Number of trains passing via Gomoh-Pradhankunta

Section	Daily Average Coaching Trains	Daily Average Freight Trains
Gomoh – Dhanbad	27.29	23
Dhanbad - Pradhankunta	33.14	20.3

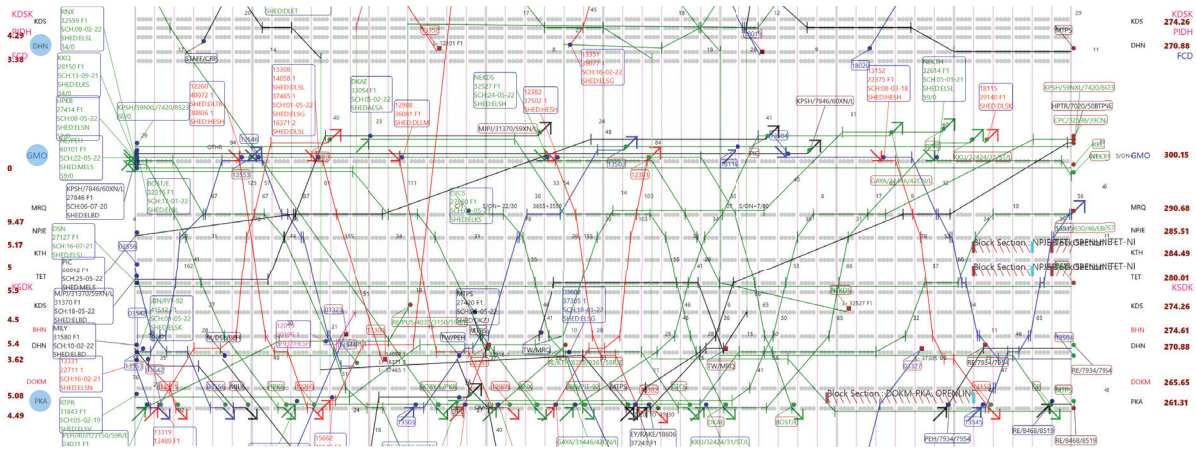


Figure 30: Control chart Gomoh-Pradhankunta section

Discussion with railway officials at Dhanbad revealed that heavy converging traffic at the junction stations reduces the speeds of freight trains to 6-10 kmph, while the same trains run at 40-42 kmph from Gomoh onwards to Mughal Sarai. Provision of additional lines/bypass lines may help improve the speed of freight trains.

Bandhua – Gaya Section

Bandhua (BNF) is located near Gaya in the Dhanbad division of East Central Railways. The railway lines coming from Gaya and Kuil meet at this station, and further procced towards the Dhanbad-Howrah route. Therefore, BNF is connected with four lines on one side, and then it converges all the traffic in to two lines going towards Howrah.

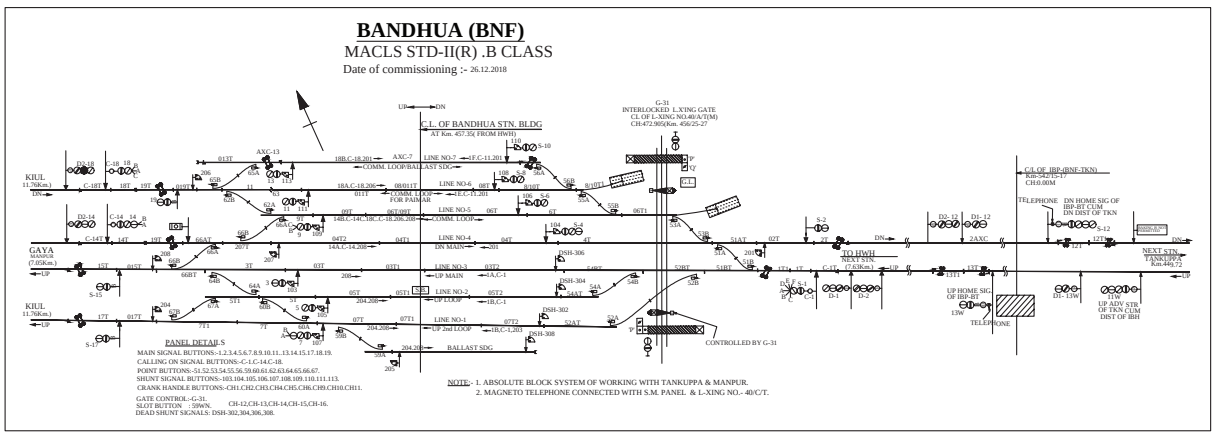


Figure 31: Bandhua station

Source: ECR Railways[19]

[19] Details available at: <https://ecr.indianrailways.gov.in/uploads/files/1658479106360-BANDHUA-.pdf>

The section Koderma - Gomoh – Dhanbad caters to the high demand of coal rakes and experiences a heavy traffic flow as mentioned in Table 9. As Bandhua has limited lines, incidents of rake inroute detentions for the want of free passage were frequent.

Table 9: Train flow at Bandhua section

Section	Average Coaching Trains (Daily)	Average Freight Trains (Daily)
Koderma – Bandhua	25	40
Bandhua - Manpur	25	34

Source: IR, Compiled by TERI

To avoid the congestion at Bandhua, a bypass flyover was opened for the use in 2019. The construction of the bypass enhanced the divisional interchange. "It has been observed that as the size of the network and interconnections increase, even adding small interventions and links at crucial locations may have multiplier effect on network capacity and efficiency." (IR, 2022)

Table 10: Divisional interchange at BNF

Year	To Dhanbad (DHN)	To Danapur (DNR)	Total
2019-20	5.24	5.01	10.25
2020-21	7.11	5.88	12.99
2021-22	9.39	7.83	17.22

It is also seen from the analysis that transit through more complex and bigger junctions is arduous and time consuming. In such a situation construction of bypass lines or flyovers in each directions appears to be inescapable.

4.4 Movement via Longer Route for Operational Feasibility: Rationalisation of Routes

The traffic directorate of IR as per the power vested under the Section 71 (Power to Give Direction to Certain Goods) of the Railways Act, issues rationalisation orders to regulate the freight movement on certain corridors on operational grounds. Rationalisation can be explained as re-routing of the freight traffic on the shortest route to a different route in order to avoid the over utilized line sections. The key motive of rationalisation orders is to optimize line capacity utilization across the Indian railway network. Insufficient and heavily utilized line infrastructure, requirement of reversal, sharp curvatures, and high gradients are some of the key drivers of the rationalised routes.

Apart from the issues related to line infrastructure and capacity, the railway divisions around key mines and industrial clusters are required to prioritize the movement of essential commodities like coal, iron and steel, and cement. The prioritization is aimed at tuning the rail movement with its predominant loading and mining cycles.

As the rationalisation orders mandate the freight trains to move via longer routes, a higher freight is charged from the customers. In many cases, as the train takes a longer route, the travel time is increased and the goods take longer time to reach destination. Some rationalisation orders, therefore, have the potential to cause a modal shift to other modes of transport.

Additionally, if higher revenue is realized by carrying goods by a longer route that has been rationalised there is no incentive for railways to augment the capacity of the shorter route. It is noted that some of the rationalisation orders have been continued for long time and rationalised route has become a preferred route. The purpose of rationalisation of route is to give relief for the congested route temporarily till the capacity improvements are made. However, majority of the rationalised routes are in practice since years.

4.4.1 The Trend of Rationalisation Orders

The rationalisation orders from 2006 onwards were analysed in detail to understand the pattern behind them. Since 2006, six rationalisation orders have been rolled out in the years 2006, 2008, 2010, 2011, 2012, and 2014. Periodic amendments to add/modify routes have been made to all these orders. Currently, the rationalisation order of 2014 along with all its amendments is in force.

Looking at the trend of rationalisation orders, it is observed that very few of the rationalised routes have been de-rationalised in last two decades. Over the years, rationalisation orders have experienced the addition of new routes. Ideally, the number of rationalised routes should be decreasing along with an increase in infrastructure capacities.

The analysis shows that IR has adhered to certain rationalisation orders, which essentially avoid the heavy passenger traffic of large cities. For example, in the initial rationalisation orders of 2006 and 2008, the emphasis was to run freight trains avoiding the heavy passenger traffic from major cities like Delhi and Cuttack. The later amendments or new rationalisation orders do not have any further edits or provisions for the same. However, rationalisation orders on certain routes of Central, Northern, and Southern railway have gone through many iterations to improve their overall effectiveness.

South East Central Railways (SECR), South Eastern Railways (SER), Eastern Railways (ER), East Coast Railways (ECoR), North Central Railways (NCR), and Northern Railways (NR) have three or more rationalised routes. These zones encompass key mines, industrial clusters, as well as ports. In addition to that, difficult terrain and congested junctions have resulted in a greater number of rationalisation orders.

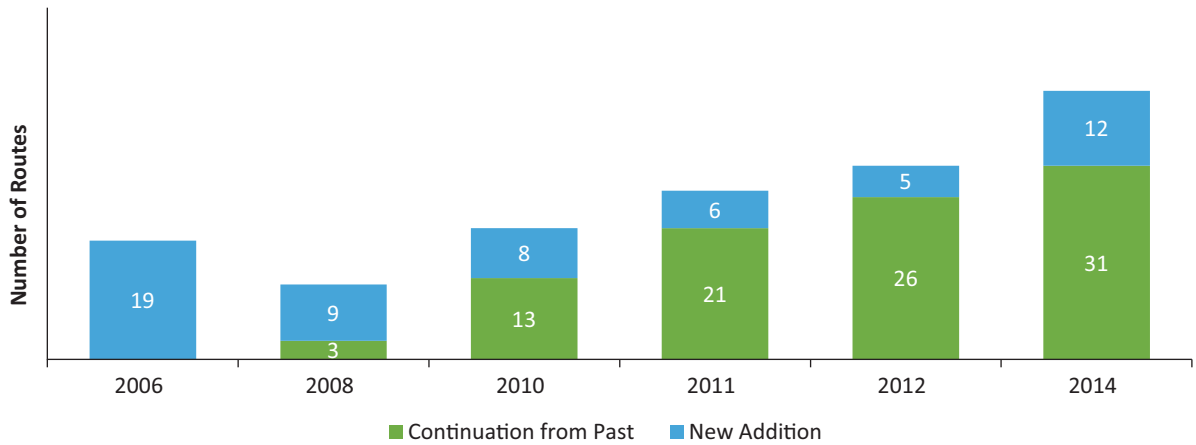


Figure 32: Rationalisation orders: 2006 to 2014

Source: IR, Compiled by TERI

4.4.2 Rationalisation Order, 2014

Currently, the rationalisation order of 2014 along with all its amendments is in practice. A detailed analysis of the rationalisation orders was carried out to understand the key constraints and the scope of de-rationalizing some of the orders. It was observed that, out of the 21 rationalised routes mentioned in the rationalisation order of 2010, 17 (80%) are continued till date. Looking at the longer timeline, 21% of the rationalised routes currently in practice date back to 2006. Only 29% of the rationalisation orders have been introduced in and after 2014.

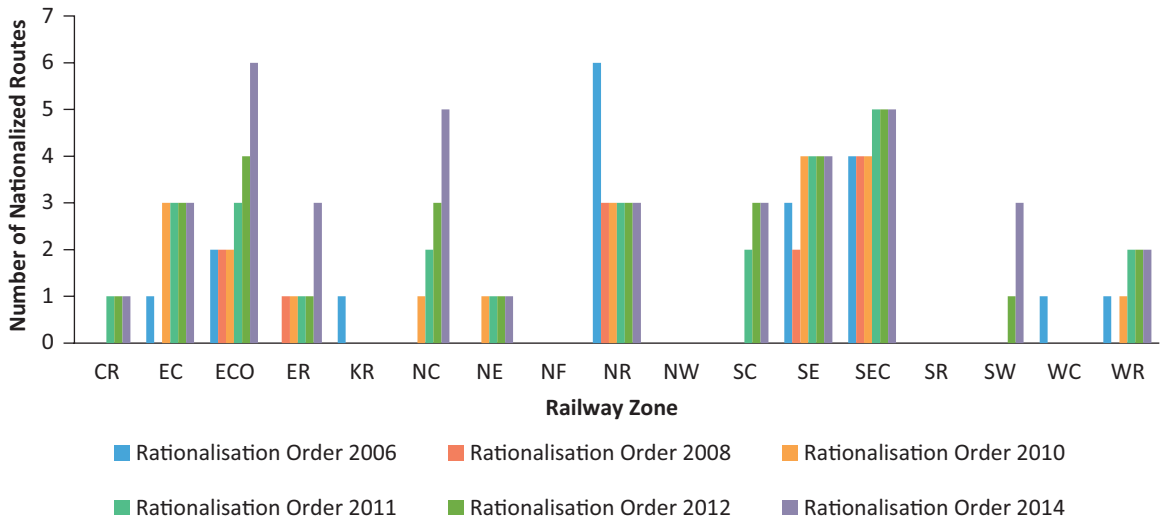


Figure 33: Rationalisation orders – zonal distribution

Source: IR, compiled by TERI

The rationalisation order of 2014 along with all its amendments has listed 48 routes, out of which 4 routes have been de-rationalised recently. The remaining 44 orders were studied in detail to understand the need for the rationalisation orders.

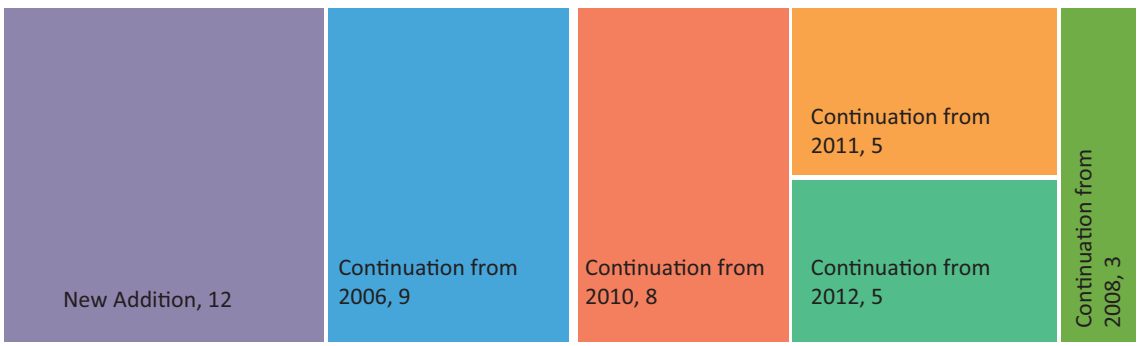


Figure 34: Rationalisation order of 2014

Source: IR, compiled by TERI

The remaining 44 orders can be further categorized into three broad categories: orders imposed due to capacity constraints; orders for the routes prioritized for a certain commodity; and orders to maintain the loading cycle of mine/industry. The detailed analysis incorporates the change in distance, line capacities of the shorter and rationalised route, and the quantum of the commodity being affected.

These routes were studied in detail to understand the change in distance and key possible reason behind any rationalisation order. The rationalisation orders were assessed based on the following parameters:

- *Change in the Distance:* Difference in the distance between the original/shortest route and the rationalised route
- *Line Capacity:* Difference in the line capacity utilization of the critical sections[20]
- *On-ground Application:* Assessing the number of rakes moving via the rationalised route

Railway Board has recently updated the Rationalisation Order on 28 July, 2023, incorporating many positive changes. The previous section highlights the analysis till December, 2022. The updated rationalisation orders are given in Annexure 2.

4.4.3 Key Examples

While understanding the rationalisation orders in detail, it was observed that certain sections/routes are being avoided in more than one rationalisation order. If the IR network is divided in two parts: North and South, it can be observed that there are only 3–4 key nodes that connect both the parts. These sections are Katni/Bina–Itarsi, Anupur–Bilaspur, Tatanagar–Kharagpur, and, Durg/Raipur–Titlagarh. While studying the rationalisation orders in detail, it is observed that these sections face the key constraints. Also, many sections like Chopan–Chunar have high gradient/difficult terrains and/or have longer block lengths; leading to rationalizing the route.

Majority of the routes is avoided due to capacity constraints, which includes single line or non-electrified sections, sections with high gradient, sections requiring reversal, and the sections having high passenger traffic.

Rationalisation Order 1.1: Central Railways

The Rationalisation Order 1.1 mandates the movement of the fertilizer traffic from Hubli division to central railways via longer route of Ratnagiri-Roha instead of Kulem-Castle Rock-Londa. To move the fertilizer from rationalised route, the rake has to cover additional 500 km distance; which also has slower speeds as compared to the shortest route.

The rake movement data from Zuari (ZCS) to Miraj (MRJ) was obtained to understand the on-ground differences on both the routes. It was observed that, the rakes moving via Londa took 17-28 hours to reach Miraj, whereas the rakes moved via the rationalised route (Ratnagiri-roha) took 56-70 hours to reach the same destination. Even the average freight train speed for the rationalised route was slower than that of shorter route.

Fertilizer traffic is a seasonal traffic, and only 110 rakes have moved to CR from Hubli division for the year 2021-22. For such small traffic, customer pays higher freight and gets very delayed delivery.

[20] Critical Section here are identified as the patches of the route which are being avoided via rationalised route.

Rationalisation Order 3.1: East Central Railways

This rationalisation order directs the coal loading trains to move via the longer route of Singrauli-Katni to avoid Chopan-Chunar section. Earlier, the Chopan-Chunar section was single non-electrified line, which has been upgraded to electrified double line (certain sections are under upgradation). In addition to the ongoing doubling work, longer block length adds to the average transit time of freight trains.

For the given OD pair majorly coal traffic is moved, accounting for around 6000 coal rakes during 2020-21. It is observed that if the traffic is moved via the rationalised route, distance is increased by 350 km. However, for the study period of six months, for coal haulage between Dudhichua Waterfall Siding (DWWS) and M/S Meja Urja Nigam Ltd (MUNU), no rakes were moved via the rationalised route. Thus, customers end up paying higher charges, whereas the rakes are travelling lesser distance.

Rationalisation Order 11.4: South East Central Railways

This rationalisation order mandates the movement of coal traffic from SECR, SER, and ECR to the destinations on CR, SCR, and SR from Nagpur-Balharshah instead of Gondia-Chanda Fort. The key traffic on the section is coal, moving around 4600 coal rakes per year. The rerouting of the traffic increases the travel distance by 95 km, which could be avoided by using the shortest route.

Gondia-Chanda fort electric line has been commissioned for traffic use 3-4 years ago only. The purpose of developing this line was to reduce the travel time and facilitate faster freight movement of traffic between Gondia, Raipur, and Bilaspur towards destinations south of Balharshah. As the rationalisation order even after electrification of Gondia–Chanda Fort route requires to move the traffic from the longer rationalised route, optimum utilization of the developed infrastructure is not achieved. The line capacity of the shorter route is less as it is electrified single line. The route can be utilized to facilitate the unidirectional movement of freight traffic.

4.4.4 Key Inferences

Purpose of Rationalisation Orders

The key purpose of rationalisation order is to increase the operational feasibility of railways and offer better transit times. Imposing rationalisation orders on the sections which are undergoing long construction and maintenance work is justified. Even avoiding high urban/city traffic and reversal issues without experiencing substantial increase in travel time and distance appears justified.

In many cases, even after the capacity upgradation work has been carried out, the routes are not de-rationalised; and the traffic continues travel by the rationalised section. Immediately after the completion of the capacity upgradation works, rationalisation orders must be modified.

Impact on Travel Time and Travel Distance

Most of the rationalisation orders have resulted in an increase in travel distance by 30–60%, resulting in higher freight and higher transit time. In such cases, the customer may think about better alternatives for freight transport. Instead of increasing the operational feasibility, the rationalisation orders may induce a modal shift for certain routes and commodities.

For each origin-destination (OD) falling under the ambit of rationalisation orders, irrespective of the travel route, the freight is charged as per the rationalised route. As distances in the rationalised routes are longer, the customer ends up paying more. In addition to that, the customer also suffers a longer travel time due to largely covering a longer distance.

Comparison of Speed

While analysing the average speed of rakes hauled via rationalised route and the other route on the same OD, it is observed that, for 50% of the ODs pairs, the speed of rationalised section is lower than that of another route. Even for the ODs which have experienced the higher speed on rationalised routes, the increase in speed is not more than 20% except for two ODs.

In such cases, where the rationalised does not offer any substantial benefit in terms of distance, travel time, or speed; the legitimacy of these orders is suspected.

Impact on Small Traffic

Many rationalisation orders are rolled out for seasonal and comparatively smaller traffic like fertilizers and food grains in some divisions. Customer has to pay higher freight and still the deliveries take longer time. Route rationalisation for such commodities, which can be easily moved via roadways has a greater potential of modal shift.

Practical Applicability of Rationalisation Orders

Rake movement on 31 identified ODs was monitored for a period of six months (April – September 2022). For only 7% ODs, all the rakes were moved via the rationalised routes. Moreover, for almost 50% ODs, no rakes were moved via the rationalised route.

It is high time for IR to investigate the practical application of rationalisation orders and discard the non-useful rationalisation orders.

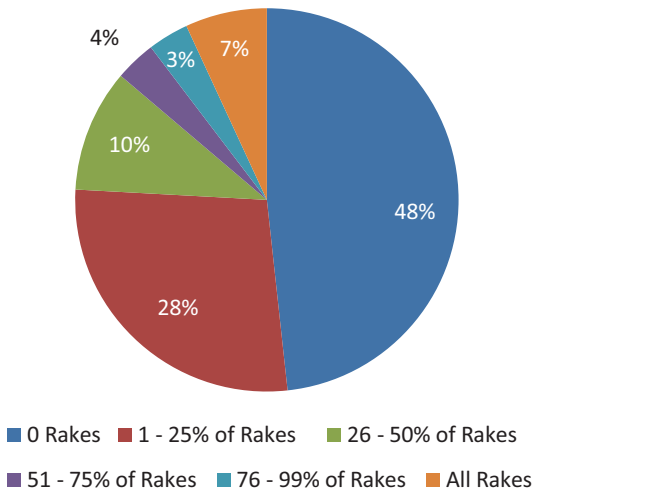


Figure 35: On-ground application of rationalisation orders

Source: TERI analysis

4.4.5 Key Recommendations

De-rationalisation of Routes

The foregoing analysis indicates that rationalisation of routes in the current form has a limited utility but a great irritant for the customers who pay much more than the normal freight charges and at the same time the transit time for the goods is more than what would have been by the shortest route.

The railways should have a fresh look on the utility of each rationalisation orders. Certainly, the continuance of most of the rationalisation orders for years and even decades are neither justified nor defendable. When most

of the rationalised routes are not utilised as mentioned in the rationalisation order they seem to merely act as a source to charge more revenue.

It is also a fact that actual distance travelled by freight trains is roughly 15% more than the charged distance. In other words the actual movement of goods is generally by longer route than the route for which the freight charges were paid. Apparently, the charged route, that shortest route is, sometimes, not feasible operationally forcing the railways to take a longer but operationally feasible route. This may also help the shippers to get their goods earlier than the time taken if moved by the charged route.

It is therefore suggested that instead of defining rationalised routes and charging higher freight from customers, railways may bring the concept of charging and carrying the goods by a preferred route. A preferred route between a pair of origin and destination or clusters of origins and destinations can be predefined which is also made known to the shipper. From time to time railways may review the preferred routes based on the operational changes that take place in the network. This concept which is transparent is a win-win situation both to the railways and shippers as the railways gets freight charges as per carried route and the shippers get value for the money by getting their goods in least possible time. Also with such a practice, freight will be charged on the actual distance travelled, and customer will not have to suffer higher costs.

It is a high time that railway should desist from the using authority of route rationalisation which does not look appropriate in current times and becomes a great irritant to the shippers to such an extent that they migrate to other competitive modes of transport that are more beneficial to them.

Prioritising Line Capacity Upgradation

The key reason for route rationalisation is the line capacity constraints faced in certain sections. Undertaking the required capacity upgradation works (like line doubling/tripling, provision of bypass and crossovers, ROBs, and efficient signalling systems) will optimize the transit time and facilitate railways towards being more consumer centric while simultaneously addressing line capacity constraints.

5 Constraints at Terminals

Terminal detention time comprises three activities: arrival to placement (AR-PL), placement to release (PL-RL), and release to departure (RL-DP). It is observed that, the terminal detention time for the unloading terminal is generally higher by almost 1.5 hours than that of the loading terminal; as shown in Figure 36. While comparing the terminal detention time of loading and unloading terminals, it is observed that the AR-PL and RL-DP times for both the terminals are similar. The key difference in time is due to the difference in PL-RL time.

For loading terminals, around 45–50% of the total terminal detention time is spent during PL-RL, which accounts for undertaking loading activities. Whereas for unloading terminals the share of PL-RL, i.e., unloading activity is nearly 57–66%. Longer unloading time reflects on the constraints in unloading operation and terminal infrastructure.

These charts signify that loading terminals are more efficient than unloading terminals when it comes to PL-RL time. Terminal detention can be greatly reduced if PL-RL time is reduced for unloading terminals. Also, the RL-DP time is relatively higher than AR-PL. This could be due to unavailability of loco/crew/signal. Better planning may help in curtailing the additional delays and enhancing the operations.

Constraints with unloading terminals many a times lead to imposition of restrictions. For cases where heavy traffic is booked for a particular unloading terminal and the terminal is not able to handle the same, restrictions are imposed for further loading. In such cases, freight traffic for that location is either diverted to another terminal or is carried by road. It is important to understand the restrictions, causes, and potential impact to undertake focused works to resolve this issue.

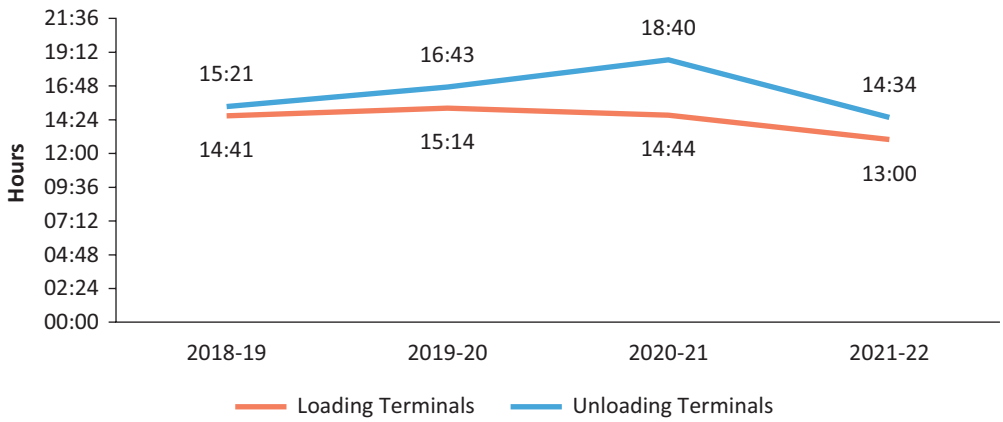


Figure 36: Terminal detention time (hh:mm)

Source: IR, compiled by TERI

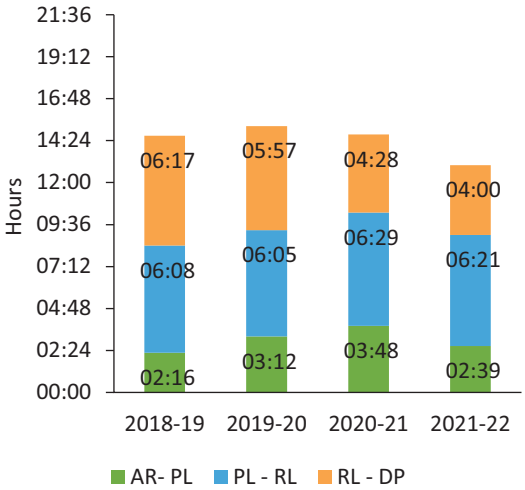


Figure 37: Terminal detention time – loading

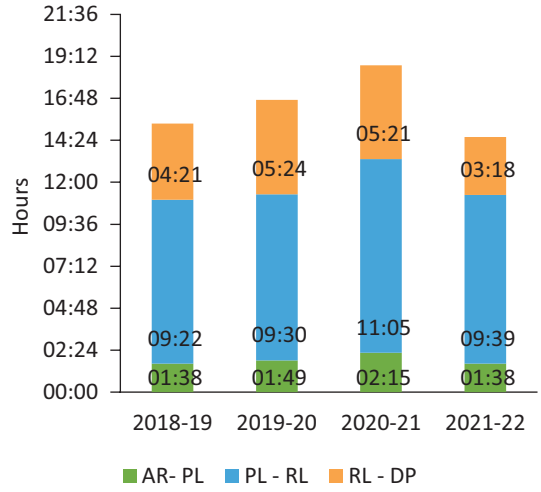


Figure 38: Terminal detention time – unloading

Source: IR, compiled by TERI

Along with restrictions, demurrage is a regulatory mechanism of railways to ensure timely loading/unloading of goods to/from the rake. Based on the type of wagon and mode of loading/unloading activity, each rake is assigned a permissible free time. In normal conditions, the loading/unloading activities are to be completed within a permissible free time. For some cases, where loading/unloading time exceeds permissible free time, consignee/consigner must pay the penalty charges as mentioned in IR circulars on imposition of demurrage. The time for loading/unloading generally does not account for the constrains of individual freight terminal except a few large steel plants and other bulk users. It is important to note here that the limited loading/unloading efficiency could be due to terminal constraints. Sometimes, in many cases, the customer may pay demurrage due railways' inefficiency. The field commercial officers have discretion to waive full or a part of demurrage but normally any waiver of demurrage is seen as showing undue favours to the customer and it is discouraged.

While restrictions denote the congestion at unloading terminals, pending indents reflect the congestion at loading terminals. Each consigner books his demand for rakes (via RMS in FOIS) and this process is called indenting a rake. Despite adequate overall availability of wagons on the system, availability could be a constraint in certain areas with high loading demand. For example, cement clusters in West Central and South East Central Railways there is perennial shortage of wagons at the desired time which works as a push factor for customers to move away from railways to other modes of transport.

Restrictions, demurrage, and pending indents, thus, provide a detailed idea of terminal condition and management. These factors are also key irritants for the customers and levers of modal shift. This chapter talks about pending indents and restrictions. The demurrage policy is discussed in Chapter 13 of the study.

5.1 Pending Indents

The procedure of booking the rake for goods movement by the consigner is called indenting. Indent demand is handled at the divisional level, where the Senior DOM along with the control office under his jurisdiction look after the daily position of indents and allot the rakes on availability of empties. According to the Railways Act, 1989, the supply of rakes is regulated by the schedule of preferential traffic. The commodities falling in the higher categories enjoy precedence over the commodities in other categories.

With increase in demand, IR keeps augmenting their rolling stock. In addition, policies like 'General Purpose Wagon Investment Scheme' and the provision of 'design your own wagon' facilitates availability of the wagons required. Currently, 3,18,896 wagons are facilitating freight transport on the IR network (Railways, 2023).

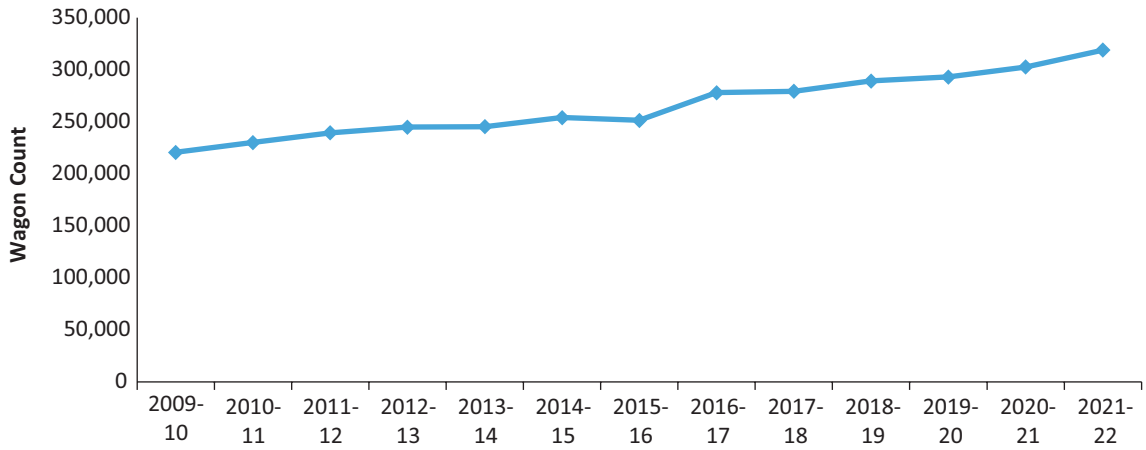


Figure 39: Wagons on IR network

Source: IR, compiled by TERI

5.1.1 Pending Indent

Though IR is constantly investing in more rolling stock, indent demand is often not met within the desired time. When the wagon demand raised by the customer is not served, the number of wagons that remain to be served are termed as pending indents. The CAG (2015) also reported that IR has a shortage of rakes with respect to demand.

The issue of pending indent is confined only to certain regions/terminals, irrespective of division and zone and is specifically noticeable in loading areas. The freight terminals near key production centres, raw material loading areas, and/or mines, face these issues related to pending indents more prominently. The terminals from ECR, ECoR, SECR, etc., face higher issues.

5.1.2 Current Situation

Pending Indents: 2011–13

Apart from ER, WCR, ECR, and NCR, all the zonal railways could meet at least 95% of the indent demand. Whereas for the mentioned zones, the demand supply ratio is around 78–87% (CAG, 2014). During the year 2011-13, SWR failed to provide the NMG rakes on time; which eventually resulted in cancellation of indents. IR lost freight traffic amounting for INR 2.28 crore for the same (CAG, 2014).

Pending Indents: 2022

With an aim to understand the situation of pending indents on the IR system, the number of pending indents for different months was obtained from CRIS. The key loading zones of IR, SECR, ER, ECoR, ECR, and CR lead the highest number of pending indents. WR, SER, and NFR also have substantial number of pending indents with respect to the remaining railway zones. Zonal distribution of pending indent emphasizes the need for enhanced rolling stock management, as well as the need to procure more wagons.

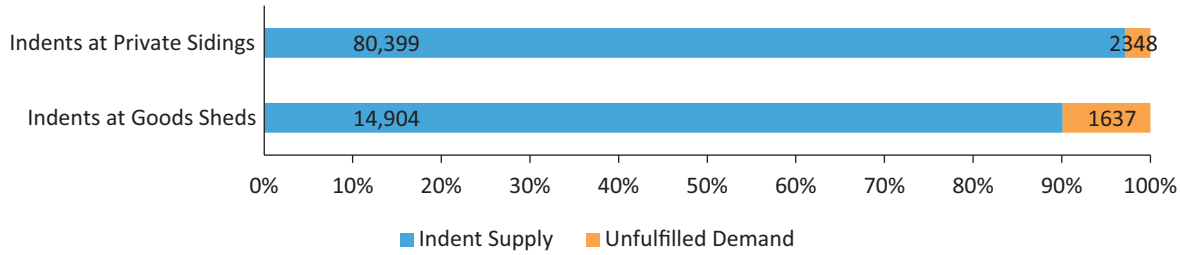


Figure 40: Indent supply for 2011–13

Source: CAG 2013, compiled by TERI

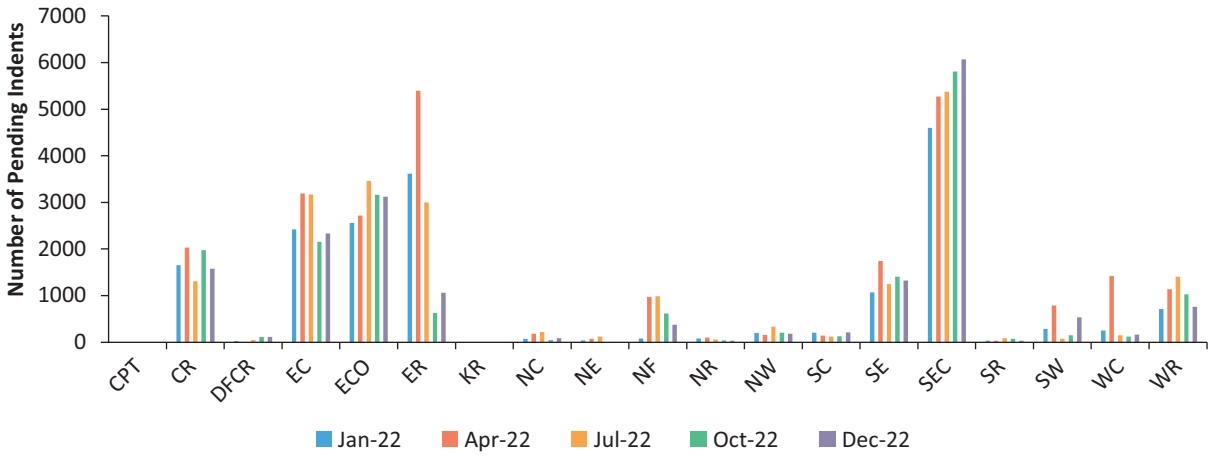


Figure 41: Status of pending indents (zone wise)

Source: CRIS, compiled by TERI

Though coal has the largest share in the commodity basket of IR, railway struggles with meeting the demand of adequate wagon supply for transporting coal. As coal is captive traffic of IR and using other modes of transport for coal is difficult, the inability of railways to timely meet indent demand has the potential to lead to slow modal shift to alternate methods for coal transport.

Similarly, food grains have the third highest pending indents. Food grains are a bulk commodity, thus, transporting through railways is relatively easier. However, the constant struggle to meet wagon demand at the desired time may nudge the shift to roadways.

Apart from coal and food grains, commodities like Iron ore, cement, clinker, pol, automobile, steel, fertilizer, and minerals face the frequent issues related to pending indents.

Key Terminals

Out of all the terminals having an issue of pending indents, 35 terminals have a total of more than 100 pending indents for five months. This means, on an average, 20 indents are pending per month; the key commodity of such pending indents is coal. Being the key loading points, sidings experience higher issues about pending indents.

The port sidings of Dhamra and Paradip ports are also facing the issue of pending indents. Moreover, demurrage charges at the ports are very high. In case of pending indents, when the customer suffers the port demurrage charge due to unavailability of rakes on desired time, they are triggered to explore other modes of freight transport to save the high demurrage cost.

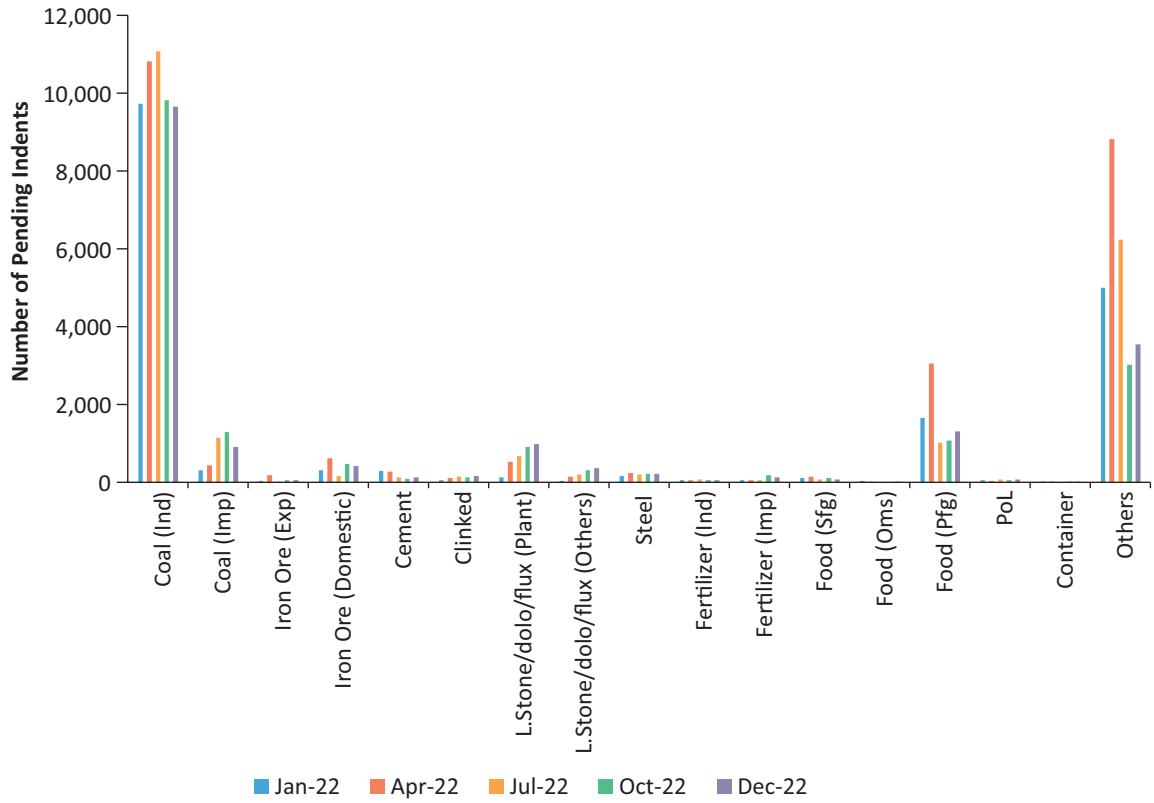


Figure 42: Commodity-wise pending indent

Source: CRIS, compiled by TERI

The list of all 35 siding, with pending indents for the given five months is given in Annexure III: Terminal-wise Pending Indents.

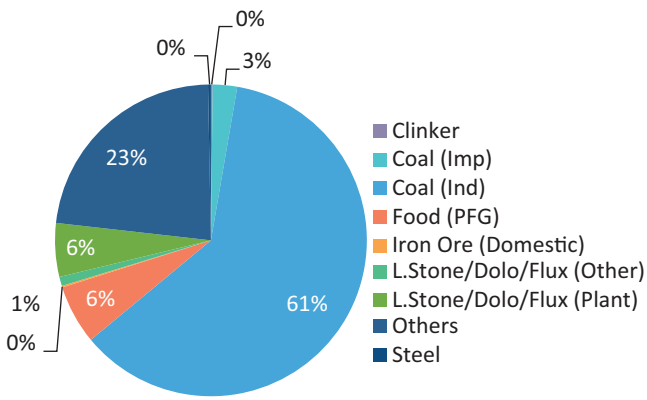


Figure 43: Pending indents – commodity

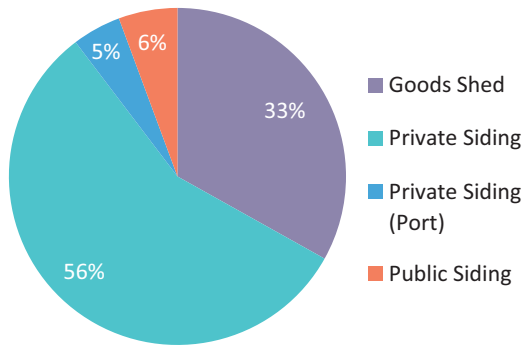


Figure 44: Pending indents – terminal type

Table 11 lists the terminals having highest cumulative pending indents for five months. Majority of the traffic is captive traffic of IR. Failing to cater to this demand may result in loss of revenue earning traffic.

Table 11: Top 10 terminals with highest pending indents

Railway Zone	Terminal Code	Freight Terminal	Commodity	Pending Indents for Five Months
CR	MTY	Multai	Food (PFG)	1,177
ECOR	CBSP	GCB Siding Paradeep Port	Limestone Dolo/ Flux (Plant)	1,244
ECR	DNCS	M/S Dhamra Port Company Siding	Coal (Imp)	1,863
SECR	BUA	Baradwar	Limestone/Dolo/ Flux (Plant)	2,510
ER	BPSH	Bharhava Public Siding	Stone	3,274
CR	WANI	Wani	Coal (Ind)	4,832
ECOR	BBMT	M/S Balaram Siding of M/S MCL	Coal (Ind)	8,092
ER	ASN	Asansol	Sand	8,513
ECR	DNCS	Dhori NSD Colliery Siding Phusro	Coal (Ind)	11,664
SECR	GPCK	Gevra Project Colliery	Coal (Ind)	19,695

5.1.3 Inferences

Key Reason

The key reasons for high pending indent could be the lack of adequate terminal infrastructure, traffic congestion, or other exigencies at major trunk routes, and limited rolling stock. Slower loading procedures and long time for weighment processes also increase terminal detention time and hamper loading activities.

The long pending indents for a substantial period reflect the inability of railways to meet the freight traffic demand. When railway rakes are not available on time, to fulfil the freight demand, the customer may think of opting for other modes of freight transport. Delayed availability/non-availability of rakes many times cause high port demurrage, loss of business, and/or loss of beneficial market prices for the customer. Thus, the issue of pending indents may result in gradual modal shift.

Along with the unavailability of wagons, terminal operations also contribute to the issue of pending indent. Many times, the wagons are indented based on the demand generated in mines/production unit, but the loading procedure is not efficient enough to complete the loading in desired time. Poor loading infrastructure and procedure, unavailability of loco/crew to dispatch the loaded rake, etc. result into longer waiting times for empty rakes.

When the customer fails to load/unload freight on time, demurrage charges are levied by railways. Wagon registration fees is forfeited as a penalty when the customer fails to load the traffic. However, there is no system of reverse penalty for IR, if it fails to provide wagons at the desired time.

How to Regularize?

IR needs to study the terminals with high pending indents to understand the root cause of the issue. Augmenting the rolling stock, coupled with efficient rake management at the divisional level, may help minimizing the pending indents.

For cases where IR is not able to provide the wagons on time, certain discount should be given to the customer to ensure fairness.

5.2 Restrictions

5.2.1 Background

While pending indents reflect the operational inefficiency of loading terminals, restrictions reflect the operational inefficiency of unloading terminals. When a terminal is experiencing high demand and inflow of rakes over its handling capacity, the given terminal is restricted for further loading until the pending rakes are cleared. In simple words, until the terminal is ready again to handle the inward traffic, the customers cannot choose the said terminal as a destination. In such cases, the traffic either gets diverted to another nearby terminal or gets shifted to road. In a way, greater the days of restrictions, greater is the possibility of a modal shift.

The operating department of zonal railways identifies the terminals experiencing higher demand. Further, after examining the parameters like rakes on hand, rakes in pipeline, and releasing capacity, restrictions are imposed either by zone or railway board.

While it is frequently discussed that there is not enough traffic to optimally utilize the railway infrastructure, restrictions highlight the fact that freight traffic on the railway system is available, but it is not able to move due to infrastructural constraints. If these issues regarding terminal infrastructure and optimized handling are not timely addressed, the traffic demand may shift to another terminal or to other modes of transport.

Figure 45 shows total days of restrictions aggregated over the terminals facing restrictions. The recent years have experienced very high days of restrictions, ranging from a total of 11,000 to 8,500 days of restrictions.

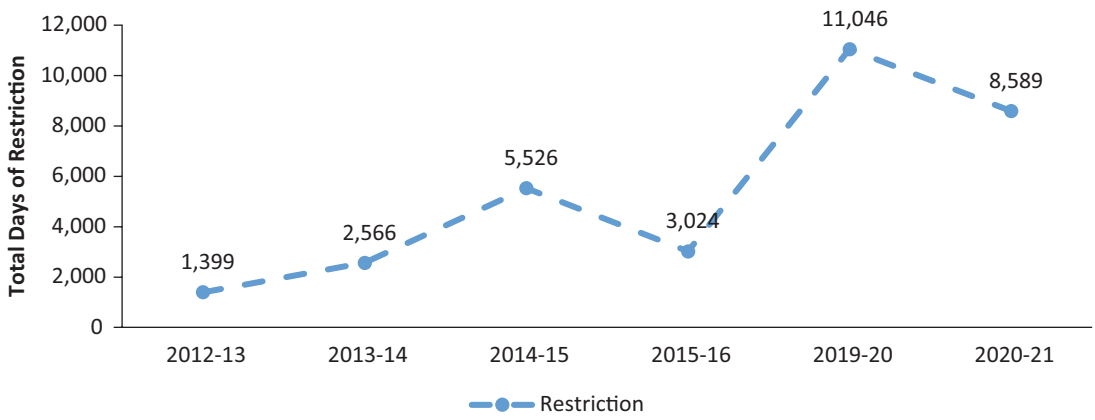


Figure 45: Restrictions – trend

Source: TERI

Unlike pending idents, restrictions have a smaller bandwidth of highest and lowest restrictions. Figure 46 indicates the zone-wise restrictions, reflecting the high infrastructural constrains in ECoR, ECR, ER, and SER zones. All the other railway zones also experience restrictions for 200–400 days a year. This signifies the need for nationwide interventions to bring down such restrictions.

The goods sheds hold the largest chunk of restrictions, reflecting the need of capacity upgradation at unloading terminals. Mechanized-handling facilities and trained labour at private freight terminals and sidings are required to ensure timely unloading and evacuation of goods.

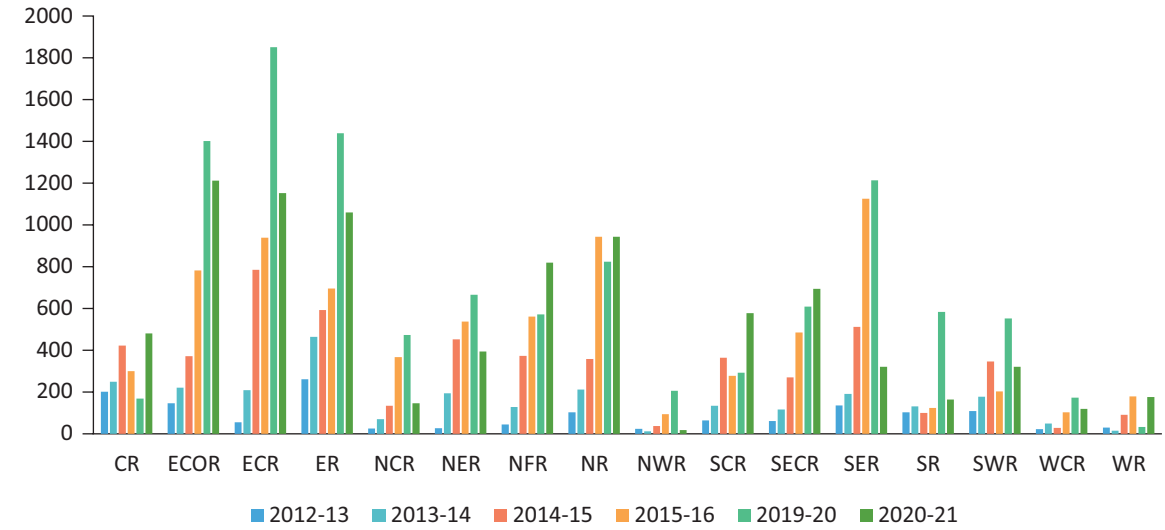


Figure 46: Restriction trend – zone wise

Source: TERI

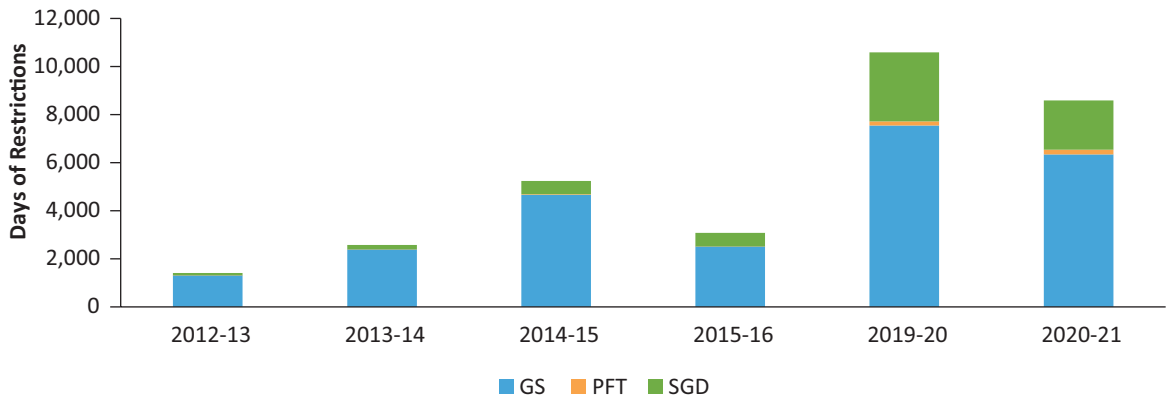


Figure 47: Restriction trend – terminal type wise

Source: TERI

5.2.2 Detailed Analysis of Restrictions: 2019–20

TERI analysed IR's restriction data of 2019–20 to understand the nature and pattern of restrictions for different types of freight terminals. It is observed that majority of the restrictions are imposed on GS—its share being 63% of the total restrictions, followed by 36% restrictions on sidings, and 1% on PFTs.

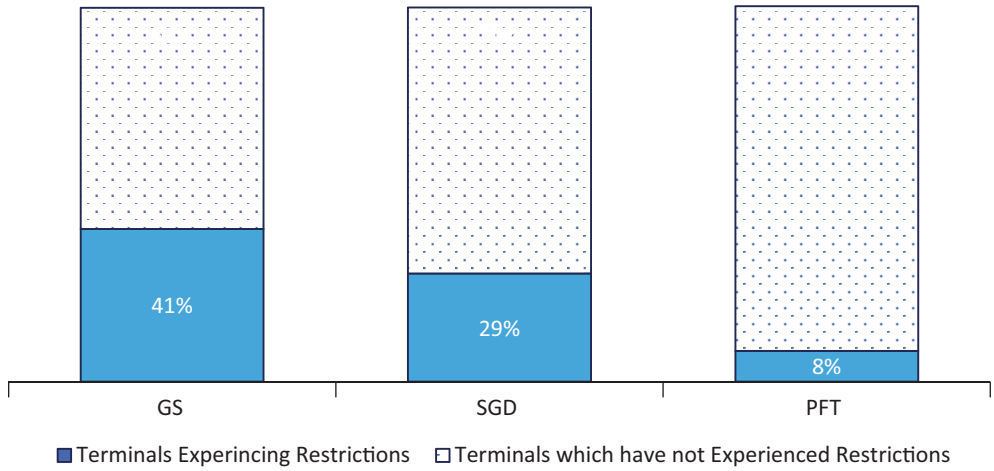


Figure 48: Restrictions – share of terminals experiencing restrictions

Source: Indian Railways, TERI Analysis

Looking at the share of the terminals that experienced restrictions, 41% of goods sheds have experienced restrictions in 2019–20. A higher share of goods sheds experiencing restrictions reflects the constraints with goods handling at railway terminals. Private sidings also have significant numbers of terminals experiencing restrictions.

5.2.3 Why Restrictions Take Place?

While imposing restrictions on any terminal, IR also takes note of the reasons for imposing restrictions. When analysing the reason sheet of IR, it is seen that the reason for majority of the restrictions is poor release of inward consignments and a heavy pipeline. When the terminal is unable to unload the goods and clear the wharf and line for further unloading (in reasonable time), the constraint is termed as poor release. Heavy pipeline denotes greater number of rakes booked for the given destination, beyond its handling capacity.

The poor release points at the inefficiency of the unloading terminal to clear goods within free time. However, there could be multiple reasons ranging from infrastructural constraints to labour issues. High inflow beyond the handling capacity also results in poor release. A heavy pipeline denotes the high demand for an unloading terminal and reflects the need for another line or alternate terminal.

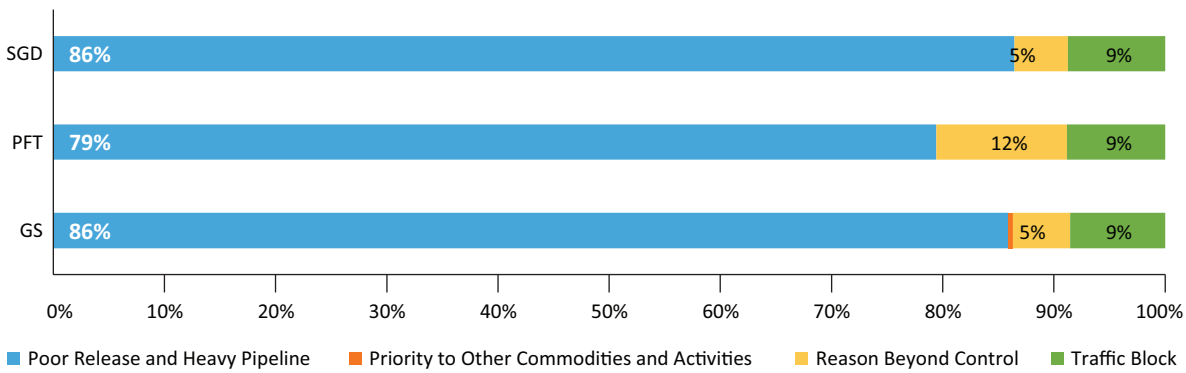


Figure 49: Restrictions – reason

Sometimes, precedence given to a particular commodity, as well as traffic block due to construction and maintenance work also results in restrictions. Extreme weather conditions and festivals also occupy a small share in restrictions; these are categorized as 'reason beyond control'.

As Figure 49 denotes, all types of terminals have a similar share of reasons for restrictions. However, PFTs have the lowest share of poor release and heavy pipeline, signifying efficiency in terminal operations.

Though the study has categorized only four reasons for restrictions, a range of factors affect the terminal operation and result into restrictions on ground. To understand the key constraints at an unloading terminal, a detailed study based on stakeholder consultation and site visits was undertaken.

5.2.4 Identification of Key Constraints

Methodology

The primary analysis of restriction data for 2019–20 revealed that majority of the terminals are restricted for less than 10 days in a year, holding a 44% share. However, 23% terminals are restricted for more than 30 days in a year, which clearly has a negative impact on the freight business of railways.

A mixed approach of analytical shortlisting and stakeholder consultation was taken up. The terminals were shortlisted based on the following criteria:

- *Total days of restrictions*: The terminals experiencing greater number of restrictions
- *Seasonality of restrictions*: The terminals were divided into two groups: terminals experiencing restrictions across the year, and terminals experiencing restrictions in particular months/season. The restriction data of previous years was also taken into consideration
- *Reasons for restrictions*: The key reasons for the restrictions were also studied; the terminals experiencing restrictions due to construction and maintenance work were not included.

After initially shortlisting terminals based on the data sets, the list was discussed with different zonal and divisional railway officials to shortlist key representative terminals and some special case terminals. Detailed stakeholder consultations and site visits were undertaken to study these terminals in detail.

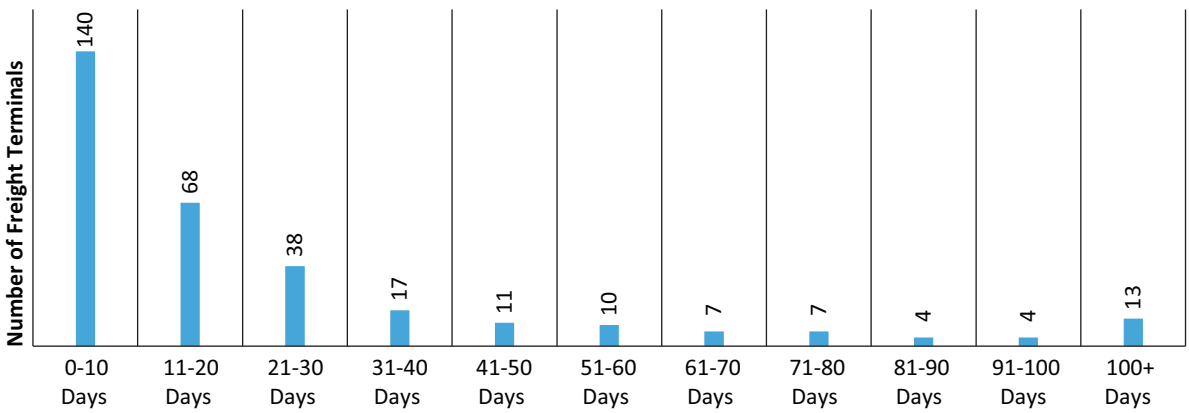


Figure 50: Restriction – distribution based on days

Source: TERI

5.2.5 Indicators for Terminal Performance

TERI undertook detailed site visits and stakeholder consultations to understand the key factors limiting the terminal efficiency and freight handling. A wide array of factors including infrastructural and ecosystem issues have significant impact on the goods handling and terminal detention time. These factors eventually lead to restrictions.

It is crucial to identify the core issue for each freight terminal in orders to improve the terminal efficiency. Table 12 enlists key indicators to identify weak aspects of freight terminal, along the measure to identify the problem.

Table 12: Terminal performance indicators

Indicator	Value/Condition	Possible Reason
Capacity utilization is high: Number of rakes handled per line per month	>15 rakes per line per month	High capacity utilization Need for another line/alternate goods shed
Longer arrival to placement time and/or longer release to departure time	>1 hour	Need for shunting
		Placement in spurs
		Non-electrified terminal
		Occupied wharf line
Longer placement to release time	Beyond permissible free time + 2 hours	Occupied wharf line
		Low efficiency and cooperation of manual labour
		Placement at odd hours
		Poor infrastructure (open wharf, uneven and poor circulation area, poor access road, limited lighting, lack of adequate storage space)
Longer wharfage time	Beyond free time + 2 hours	Lack of adequate storage/warehousing facilities
		Low efficiency and cooperation of manual labour
		Restriction on the movement of freight vehicles
		Limited availability/unavailability of warehouses in vicinity
		Connectivity with market place/highways

5.2.5.1 High Capacity Utilization

On an average, one full length line can handle 15 rakes per month. Table 13 enlists some of the key terminals having more than 50 days of restrictions for the year 2019–20. It is observed that majority of terminals are handling more than 20 rakes per line per month. In addition to that, these terminals are dealing with a set of diverse commodities, which might contribute to operational difficulties. Moreover, the key reason for restriction listed for these terminals is 'poor release and heavy pipeline' signifying the overutilization of terminal capacity.

'IR envisioned that terminals handling more than 30 rakes per month should have at least three lines for goods operation.' (CAG, 2010)

Rake Handling Capacity

Most of the freight terminals are operational only during daylight, i.e., for 12–14 hours a day. Maximum permissible free time for unloading is 9 hours, but the average unloading time taken by freight terminals (2020 –21) is 13.5 hours. Thus, one line can unload one rake per day. However, other factors like slower evacuation, unavailability of full-length wharf, and weather and labour constraints result in optimally handling only 15 rakes per line per month.

Table 13: Terminal restrictions and number of lines for 2019-20

Terminal	Total Days of Restriction	Number of Times Restriction Imposed	Average Days of Restriction for Each Time Restriction Is Imposed	Average Rakes Handled per Line per Month	Number Of Commodities
Sarai (SAI)	210	52	4.0	19	17
Nimpura Goods Shed Complex (NKKH)	135	51	2.6	31.5	16
Chhapra Gramin (CHPG)	123	44	2.8	20	12
Cossimbazar (CSZ)	117	45	2.6	28	9
Purnia (PRNA)	111	34	3.3	37	12
Kalaikunda (KKQ)	100	45	2.2	19	6
Shivpur (SOP)	92	33	2.8	26	13
Naugachia (NNA)	86	41	2.1	24	13
Dauram Madhepura (DMH)	83	40	2.1	24	12
Tiruppur (TUP)	80	22	3.6	16	10
Farrukhabad (FBD)	65	32	2.0	16	12
Bijapur (BJP)	62	21	3.0	17	11
Tapsi (TOP)	61	35	1.7	31	6
New Alipur (NACC)	58	28	2.1	20	2
Jamui (JMU)	58	31	1.9	24	9
Balasore (BLS)	57	29	2.0	16	12
Dadballapur (DBU)	52	27	1.9	19	6
Bhadrak (BHC)	51	23	2.2	15	9

Source: IR, TERI analysis

For many high demand consumption centres, the average inward demand is much higher than the planned capacity. Once the terminal starts handling more than 12-13 rakes per line per month, they must start planning for an additional line or an alternate goods shed. For the cases where excess land is not available with railways, an alternate goods shed at the nearest station/place needs to be encouraged. It is highly important to consult all the customers before finalizing a new location to ensure the willingness to shift traffic to another place. IR has rolled out a policy circular proposing alternate goods shed for such high demand terminals.

For the terminals where heavy seasonal traffic flow results in restrictions, adequacy of warehousing space and labour availability needs to be investigated first. Additional loop line near the goods shed can also be developed to stable the excess rakes awaiting placement.

5.2.5.2 Longer Arrival to Placement Time and/or Longer Release to Departure Time

In ideal conditions, rake placement can be completed within 30 minutes if the facility of direct placement is available. However, the average arrival to placement time for freight terminals is around 1.5–2 hours.

For freight terminals where direct placement of rake is not possible, the terminal detention time is prolonged as indirect placement requires more time and energy. Multiple reasons could be responsible for indirect placement of rakes; including non-availability of shunting neck/shunting line, placement in spurs or in batches, change of locomotive and/or crew, or even uncleared wharf. Such constrains also impact the release to departure time and result in a longer detention time.

Non-electrified Terminal

Majority of the IR network has been electrified. However, many freight terminals have not facilitated the requirements of electrified loco movement. In such terminals, a special diesel locomotive must be arranged from the serving station to facilitate the placement of freight trains on a freight terminal.

As a first step to eliminate the need for shunting, all the freight terminals (except where consignment dealings require crane handling) must be electrified or top-wired. In the meantime, a dedicated shunting engine may be considered for the freight terminals handling more than 15 rakes per month.

Shunting and Availability of Shunting Line/Neck

For the terminals where direct placement is not possible, the rakes are pulled by train engine, or a separate shunting engine for rake placement. Frequently, when a separate shunting line or shunting neck is not available, the main line is used for placement. The mainline can only be used when any passenger train is not scheduled, which often is a very limited time period. In such cases, the rake waits for a longer time for placement and departure and the turnaround time is increased.

Availability of shunting line or full-length shunting neck considerably reduces the time required for placement and removal of rakes.

Shunting for Placement

Shunting can be defined as an activity of placing the rake at goods wharf for loading/unloading by same train engine or attaching a special/different engine.

Generally, a different diesel engine is utilized for placement when the freight terminal is not electrified, or when the length of the loading/unloading line is less than full rake. Shunting by different engine is also required to carry out indirect placement.

Placement in Spurs

Many terminals on IR system have half-length or smaller wharfs. To carry out loading/unloading activities at such terminals, the rakes need to be cut into 2-3 small

rakes and them placed on the spurs; which requires more time and energy. For the terminals where a shunting engine and crew is not available locally, they often must wait for the same.

Some terminals do not have the provision of direct placement and the shunting neck is also not adequate. The rake placement takes considerably longer time as they must wait for a suitable time to use the mainline for placement.

For the terminals experiencing higher traffic, extending the unloading line and wharf to cover the full length can be undertaken, if the land is available. Development of freight terminals with full lines to accommodate placement of full rakes needs to be encouraged for all new terminals.

Occupied Wharf Line

For the terminals having goods unloading and evacuation constraints, rakes spend longer time on the wharf beyond the permissible free time. In such cases, the other rakes must wait at the loop lines, or stabling lines for need of room. Such frequent incidents often result in restricting a particular terminal for loading.

Timely unloading and evacuation of goods need to be prioritized. Availability of adequate stabling lines and loop lines may help in easing line congestion.

Availability of Stabling and Loop lines

For the terminals experiencing high restrictions, one key reason could be heavy pipeline. Unavailability of additional stabling and/or loop line results in blocking the railway line.

Poor crew and shunting engine management: Cossimbazar (CSZ)
Cossimbazar is an interesting terminal to understand the impact of crew management on the movement of freight trains. The crew base point for Cossimbazar is Naihati, which is at distance of around 6 hours. Mostly, the crew and the engine are indented at the probable time of rake release only. However, it takes 6 hours for any crew member to reach and by the time the rake starts its journey, their shift comes to end. A similar issue is faced when the rake must be placed on the goods unloading line from loop line. This not only increases the turnaround time of rakes, but also delays rake placement.

Such issues can be avoided by facilitating stationing of crew members at intermediate station.

Unavailability of shunting neck: Muktapur (MKPR)
Muktapur is a railway goods shed located in the Sonpur division of East Central Railways. MKPR serves the bulk traffic requirement of the city and handles around 18–20 rakes per month. MKPR has only one unloading line and is not directly connected with the mainline from either side. As a shunting neck is not available, all rakes are placed using the mainline. Due to high frequency of passenger trains, the placement and release of rakes generally takes around 2 hours. Unavailability of shunting neck results in considerably higher turnaround times.

Optimizing rake placement: BCC Siding, Kalamboli
BCC siding at Kalamboli deals with bulk cement traffic and uses direct discharge wagons (BCCW) for cement unloading. As only two wagons can be unloaded simultaneously, the rake needs to be cut into two parts and wagons need to be placed and moved frequently. This operation needs two shunting engines, or wagon moving mechanism to operate efficiently. The siding has developed a pully system to move the wagons on the unloading lines to maximize the efficiency and at the same time eliminate the dependency on locomotive.

Occupied wharf delaying placement: Dankuni (DKAE)

Dankuni goods shed of Howrah division, Eastern Railways is one of the important freight terminals handling around 100 rakes/month. Dankuni handles a good share of international traffic, which is either forwarded to Bangladesh, or is shipped from ports. DKAE has six unloading lines in total, with two lines having double-sided wharf. Dankuni deals with a range of commodities—starting from food grains and sugar, to cement and coal.

Due to limited availability of labours and warehouses during the night and/or restrictions on port, often the unloaded goods are not cleared from the wharf. Many times, the dealers use wagons/wharf as storage spaces to avoid the heavy charges of warehousing. In such cases, the placement of new rake/ the unloading of goods from newly placed rake suffers.

Provision of warehouses/storage spaces at such terminal becomes important to fully utilize the goods shed capacity.

For terminals with higher demand and/or slower unloading procedure, the next rake arrives at the terminal before the current rake is dispatched. If an adequate number of stabling lines or loop lines are not available, the new incoming rakes need to be stabled before the freight terminal, which may occupy another loop line or a main line. If the passenger platform is located on the loop line, incoming rake needs to be stabled on the main line causing operation problems.

5.2.5.3 Longer Placement to Release Time

IR has released a detailed list of permissible free time for loading and unloading, based on the wagon type and loading/unloading method used. The average permissible free loading and unloading time for manual operations is around 6 hours and 9 hours, respectively. For the year 2020–21, average loading time and unloading time on the IR system was 13 and 14.5 hours respectively, which is higher than the permissible free time. Longer loading/unloading time reflect the constraints in terminal operations and infrastructure.

Several factors—ranging from infrastructure to labour—contribute to longer placement to release time. Also, the freight terminals and loading/unloading procedure is where the customers are directly connected with railways and their operations. Poor management and poor state of infrastructure often lowers the reputation of railways as a proactive transport service provider.

Poor Terminal Infrastructure

The poor condition of terminal access road, circulation area, and wharf contribute to increase in average handling time. Congestion at the entry/exit point of the terminal also results in a slower evacuation process.

For the terminal to operate 24*7, the provision of adequate lighting is a prerequisite. Many terminals do not have adequate lighting covering the entire wharf. Labourers face difficulties in efficiently carrying out loading/ unloading activities in dark hours.

Out of all the freight terminals visited, more than 50% of the terminal had poor state of terminal infrastructure. It is very crucial to provide all weather approach road and circulation area, covered wharf, adequate lighting, and labour facilities, to ensure an efficient unloading process.

Limited availability of stabling lines: Hazaribagh Town (HZBN)

Hazaribagh works as a goods shed and a serving station to the coal siding of NTPC, Banada. NTPC Siding Banada is one of the efficient coal loading sidings and loads around 20 rakes per day. HZBN goods shed also handles around 15 rakes per month. Along with up and down direction mainline, HZBN has one goods shed line and two stabling lines.

As the traffic movement is very high, the stabling lines are mostly occupied with the coal rakes. Sometimes, when rake/wagons are sick, it gets difficult to manage the passenger traffic. In addition, the rakes are stabled at additional loop lines at other nearby stations.

For such busy goods sheds, provision of adequate stabling lines, loop lines, and sick lines becomes crucial.

Availability of additional loop line: Cossimbazar (CSZ)

Cossimbazar is a goods shed located in the Sealdah division of Eastern railways. Due to high traffic flow and limited labour working hours, the rakes are often waiting in line for want of room. As Cossimbazar and its nearby station Benapol has adequate loop lines, the rakes are stabled in order to avoid restrictions.

Figure 51: Poor wharf and circulation area

Source: Author

Occupied Wharf

Covered wharf and dedicated space for goods storage is required at every terminal. Due to restrictions on freight vehicle movement during peak hours in majority of the cities, it is difficult to evacuate the goods at the same time the rake is placed. For such cases, the goods are generally stacked on wharf where warehousing is not available. Unless the goods are removed from the wharf, unloading activities from the new rake cannot start.

In many cases, the private player uses the wharf as their storage space, as wharfage charges are relatively less than the cost of warehousing. These issues not only decrease terminal efficiency, but also result in demurrage for upcoming rakes.

Developing adequate storage space at the terminals will eliminate the need of stacking goods on the wharf.

Placement at Odd Hours

Labour force at majority of the IR goods sheds work up to 18:00 hours. Many times, when the rakes are placed for unloading after 16:00 hours, the labours will either start unloading on the next day, or will unload half goods on the same day and half on the other. At many terminals, labour leave early if the rake has not arrived by afternoon.

Figure 52: Poor wharf conditions

Source: Author

Rake placement before afternoon can be prioritized. Also, advance, and accurate intimation of time of rake placement may also help in efficient labour management.

Low Efficiency and Productivity of Labour

At present, the Indian logistics system is heavily dependent on manual labour. The manual labour in India has a diverse set of limitations, ranging from their working pattern to working hours.

Most of the terminals on the IR systems are notified as 24-hour-working terminals. However, labour availability at majority of the goods sheds is limited to daylight hours only. The labours in eastern and northern part of the

Poor wharf and circulation area: Cheoki (COI), Sarai (SAI), Dankuni (DKAE), Dhori (DSN) and Taloja (TPND)

Majority of the goods sheds have very poor wharf and circulation areas. Due to lack of proper landscaping and drainage systems, most of the terminals face the issue of water logging during monsoon. Additionally, leftover commodities are not cleared in time.

Even where wharf and circulation areas are redeveloped, adequate measures have not taken to ensure the quality of infrastructure. Cheoki (COI) goods shed of Allahabad division has recently redeveloped the wharf and circulation area. They have used railway sleepers for strengthening the circulation area, but water logging is observed as proper levelling has not been done. At Sarai (SAI) goods shed of Sonpur division, sand was used to level the circulation area, which has made the working environment very miserable.

Taloja goods shed of Central railways has been recently redeveloped by DFC. It has a robust elevated wharf and circulation area. Such provision improves the efficiency of freight handling and also help create a positive view regarding railway freight handling.

Poor access road: Case study of Kishanganj (DKZ) and Mulund (MLND)

Similar issues are prevalent in the condition of access road. Apart from having a poor condition, issues like encroachment and small/limited space for the movement of the traffic results not only results in stressful and unpleasant experience of drivers but also frequent breakdowns of trucks. Poor access road infrastructure also lowers the speed of trucks, extending the time taken for travel.

country do not work beyond sunset due to safety concerns; whereas, the Mathadi labours in Mumbai area stop operating after 20:00 hours as per their laws.

Labour unions and syndicates often do not allow any new workers to join the labour force, to continue their monopoly at the goods sheds. For multi-line goods sheds, limited availability of labours often increases the average terminal detention time.

Delay beyond permissible free time for loading and unloading activities increases the turnaround time of rolling stock, decreasing the earning potential of railways. Railway officials need to be in constant touch with the labour unions to resolve such issues. Provision of adequate labour facilities like canteen, washroom, and restroom may result in increased productivity of labours. At the same time, mechanized unloading systems can be planned to speed up the unloading process.

One key concern of the labours is the unavailability of basic facilities, like canteen, restrooms, and drinking water. The labours usually work in harsh conditions, which is hard and painstaking requiring special skills. Provision of such basic facilities will increase the ease of working and improved positive work environment. The provision of these facilities will also enable the workers to work till late hours/during night, as they can sleep/rest at the freight terminal and go back to their place in the morning.

The provision of dedicated merchant rooms also eases the operations and goods handling for the merchants is a positive step towards customer satisfaction.

Labour Issues

Eastern Railways

Many regions that Eastern Railways serve, share the border with Bangladesh. The non-urban areas have greater probability of any illegitimate activities; hence, police and BSF patrolling is high. At many terminals, the local labourers are not available and the labour comes from small villages located at 70–80-kilometre distance. These labourers prefer to leave the goods shed before it gets dark, so that they can reach their place safely, without any interceptions from the police/BSF, or anti-social elements. The labour syndicates in the Eastern region are so strong that customers/IR cannot arrange any other labourers to work at the same goods shed. Though the Sealdah division has started a special MEMU train—to facilitate safe and secure carriage for labours working at goods shed—desired level of results has not been achieved. In such cases, provision of authorization letter may help in resolving the conflict with police/BSF. Also, while developing new freight terminals, a professional approach can be taken to erase the syndicate system by mechanising the loading and unloading systems.

East Central and North Central Railways

The ECR and NCR Railways also suffer from strong labour unions and Naxalite activities. The long distance between the goods sheds and villages leads to limited working hours. Moreover, the labour contractors and freight vehicle contractors do not allow any new labours or freight vehicles to operate.

At Naraynpur Anant (NRPA), even when the inward freight arrival is very high, the contractor does not allow any additional labour or vehicle to operate and takes longer time to evacuate all the goods from the terminal. Many cement companies are regularly paying demurrage due to this issue.

Central Railways

The labourers working at goods shed of Central Railways are mainly Mathadi labourers. They are comparatively more dedicated and efficient in carrying the out loading/unloading activities. However, as their labour union rules mention the working hours till 8 pm, they do not work beyond sunset. In addition to that, they also do not allow any other labour set to work at the goods shed. This results into longer terminal detention time.

Figure 53: Unhygienic working conditions

Source: Author

Figure 54: Labour facilities

Source: Author

Facilities for labour and merchant: Narayanpur Anant (NRPA), Taloja (TPND) and Cheoki (COI)

Provision of basic facilities for labour generates a greater sense of ownership in them and a healthy relation is maintained. Labourers carry out the intensive work of handling heavy consignments and if customers/officers desire quick loading/unloading of goods, they also need to work for extended hours. Provision of basic facilities like drinking water, washroom, canteen and shelter to rest is, therefore, vital. At majority of the goods sheds, the provision of basic facilities is not prioritized and labourers take shelter under the rakes and trees. A similar situation is faced by merchants/customers. Very few terminals have the provision of a small and decent merchant room.

At Narayanpura Anant (NRPA) a decent room with shelves and fans has been recently developed for the labour. Many goods sheds, like Cossimbazar (CSZ), Cheoki (COI), Dankuni (DKAN), etc., have open shades as a labour facility.

A merchant room is also available at the Cheoki goods shed, but merchants prefer to sit near the rakes to deal with goods as it is located at a far distance.

At the terminals of Central Railways, fully functional labour rooms and merchant rooms are available. They also have the provision of lockers.

5.2.5.4 Longer Wharfage Time

In case the goods are not directly unloaded in the transport vehicles, they are stored on the wharf or in a warehouse (if available). Majority of goods sheds do not have the facility of warehouses and the goods are unloaded either directly to the vehicles, or are stored on the wharf.

As railways charges demurrage for longer occupancy of rolling stock, wharfage is charged in case of longer occupancy of wharf. The unavailability of warehouses and restricted (or slower) movement of freight vehicles in the city/town often results in longer wharfage time. Unless the wharf is cleared the new rake cannot be placed for unloading, increasing the terminal detention time.

Restriction on the Movement of Freight Vehicles in the City

Cities are expanding at an exponential rate; thus, the freight terminals developed at the outskirts of a city are now a part of city limits and often a part of residential areas. At many places, freight terminals are in dense market areas. Such freight terminals often suffer from issues related to congestion and restricted movement of heavy freight vehicles. In addition, frequent movement of heavy freight vehicles rapidly deteriorates the road condition. Without reconditioning and maintenance, for the considerable time of the year, these roads remain in a miserable condition. The freight terminals located in small towns and villages are also deprived of *pucca* roads for the movement of heavy freight vehicle.

Limited availability of transport vehicle: Naraynpur Anant (NRPA)

Naraynpur Anant is an important unloading goods shed located near Muzaffarpur. Along with the goods shed, two other sidings are also operational at this site. Many times, when the arrival of goods is high, 3–4 rakes are simultaneously placed for unloading. The local fleet of trucks is not sufficient to remove all the goods in time. As a result, it becomes a challenge to unload all the rakes in the permissible free time, or even any time near it. However, as the vehicle union is strong, they do not permit any road vehicles' operators outside their union to operate. Here, the limited availability of trucks to cater high arrivals results in longer terminal detention time.

Connectivity with Key Market Places and Highways

Apart from the road condition, an easy and faster connectivity with key production/consumption centres as well as highways is important.

While planning a freight terminal, connectivity to warehouses and key road networks are important attributes. Planning of freight terminals should also involve discussion and consultation with all stakeholders; it will result in maximizing the benefits for all.

Lack of Adequate Storage/Warehouse Space

Limited availability of transport vehicles and warehouses in the city, especially during the night, results in slower removal of goods from the freight terminal. For the terminals where a dedicated storage space is not available, the wharf is occupied for a longer time and restricts the placement of new rake.

For loading terminals, many times the consigner aggregates the goods in parts, which requires more time. As warehousing facility is not available at the terminal, the consigner indents the rake and partially loads the goods, taking longer time. The provision of a 24-hour-working warehousing facility at the terminal, as well as in the vicinity, is crucial.

Central Rail Warehousing Corporation

With an aim to provide Multimodal Logistics to the trade and support Indian economy in reducing logistics cost, Central Warehousing Corporation launched 'Central Rail Warehousing Corporation' or CRWC in 2019. Currently, CRWC is operational at 20 locations, facilitating goods handling at railway freight terminals. In order to improve the efficiency, CRWC has also incorporated mechanised goods handling facilities at certain terminals. Majority of these terminals have experienced increase in traffic after inception of warehousing facilities.

Unavailability of warehouse: Dankuni (DKAE), Cheoki (COI), and Shakur Basti (SSB)

Dankuni is one of the largest terminals of ER handling around 100 rakes per month. Though the terminal has eight goods handling lines, no dedicated warehouse/storage space is available to store the unloaded goods. Limited availability of warehouses and freight vehicles in the night results in idling the loading/unloading operation during these hours. Due to restrictions on heavy freight vehicle movement in certain parts of the city, loading/unloading activities are slower during the day. As a warehousing facility is not available at the freight terminal, the terminal detention time increases, often resulting in levy of demurrage charges as well.

Cheoki majorly works as an unloading terminal, but loading of food grains also takes place during certain months. As warehousing facility is not available at the terminal, the full rake load of food grains is brought to the terminal by trucks once the rake is placed for loading. It is nearly impossible to load the full rake with manual labour amid issues like limited working hours and restrictions on heavy vehicle movement. Generally, around 30–36 hours are taken to load one full rake. The provision of adequate warehousing space could enable faster loading of goods.

Shakur Basti cement siding is one of the key fright terminals catering the cement demand of National Capital Region. As the terminal handles a large number of cement rakes and evacuation of cement is based on market demand, adequate warehouses are built along the wharf to store the cement. As the rake arrives, all the cement bags are unloaded in the warehouses and are transported to the consumption centre as and when required. The provision of warehouse also eliminates the externalities of day-time restrictions on freight vehicle movement in the city.

Congestion at entry-exit of the terminal: Cossimbazar (CSZ) and Sarai (SAI)

Cossimbazar has a single entry-exit point for freight vehicles. This point also opens at one of the key junctions which is also the only railway crossing of the city. The evacuation of goods during peak hours becomes very difficult, as freight vehicles get stuck in a jam. The situation worsens when the freight vehicles need to cross the railway crossing. Limited availability of vehicles adds to the problem, as the same vehicle must return to the goods shed (crossing all the traffic) to load another set of goods.

The goods shed at Sarai has a dedicated road for the entry and exit of freight vehicles. However, the newly introduced goods line cuts right at the beginning of the entry/exit point of the approach road. When a full-length rake is placed and the engine is still attached, the rake blocks the entry/exit of road vehicles to the loading/unloading area.

Restrictions on freight vehicle movement: case study of Kishanganj (DKN)

The Kishanganj goods shed is located right at the centre of a key market area in Delhi. The goods dealt at Kishanganj have their primary production/consumption centre nearby. However, difficulty of business comes with the heavy congestion and restricted movement of heavy freight vehicles during the day.

5.2.6 Inferences

While recent development plans under 'Mission 3000 MT' and the Gati Shakti Policy envisage the green field development for around 100 freight terminals across the country, it is also important to upgrade the existing terminals to utilize the existing infrastructure created. At least, the capacity upgradation works for Category A terminals (terminals handling more than 100 rakes per year) needs to be considered on priority.

At many places it was noted that even though the budget for infrastructure upgradation works for freight terminals is allocated, priority is given to passenger-related works. In such cases, the allocated budget either lapses or gets utilized for passenger amenities. Adequate attention must be given to these issues.

It is crucial to facilitate all-weather infrastructure at freight terminals to increase their business potential. Goods sheds cater to freight demands of many cities and towns, and upgrading their capacity to handle small and parcel traffic has the potential to increase freight loading on railways.

In addition to infrastructural upgradation, constant communication with key freight players in the area through zonal and divisional offices will accelerate the business potential.

6 Toolkit for Terminal Development and Management

India has one of the largest railway networks in the world, which has played a crucial role in the country's development. The network length of 67,956 km[21] connects key ports, industrial areas, mines, and consumption centres. Railways has been the key mobilizer of raw materials and resources to cater to the development demand.

Turnaround time plays a key role in estimating IR's capacity to cater to the freight demand in India. As the turnaround time decreases, the rolling stock becomes available for the next loading in lesser time. This eventually increases the number of trips made by same rolling stock, ultimately resulting in increasing freight traffic and revenue. Out of the total turnaround time, the rakes spend around 35% of their time as terminal detention and 65% as transit time.

During this study, the team visited around 20–25 terminals in different zones of IR to understand in detail the issues related to freight terminals. Visiting different terminals helped understand the diversity and versatility of the challenges faced by different terminals. It was observed that several parameters affect the functioning of a freight terminal and, hence, a detailed and holistic approach is required to revamp the freight terminal infrastructure and operation.

With an aim to provide a comprehensive study, TERI has developed a detailed toolkit addressing freight terminal issues along with a model terminal rating system.

6.1 Scope of the Toolkit

Key focus of the toolkit is primarily on the goods sheds developed and managed by IR. However, the observations and learnings can be utilized for upgrading private freight terminals and sidings as well. The indicators discussed will also help in planning new freight terminals.

6.2 Identification of the Constraints

All the goods terminals have different working environment and hence, encounter different problems. Chapter 5 of the report has enlisted and discussed the key issues and constraints faced at freight terminals. A solution that can work as a fix for all the terminals does not exist. However, this section tries to list all the different issues that the team has come across during the study. The suitable solutions are also discussed briefly.

[21] Details available at: <https://ircep.gov.in/AboutUs.html>

6.2.1 High Capacity Utilization

Ideally, one goods line can handle around 15 rakes/month. For high consumption areas, where higher number of rakes are being handled per line, frequent incidents of restrictions take place. It is important to assess the capacity utilization of such terminals and provide additional lines/alternate terminals, or alleviate goods handling capacity to avoid restrictions.

IR has also rolled out a policy to incentivize the use of alternate terminals located in the vicinity of a busy goods shed. Commercial circular 127 of 2020[22] lists the busy goods shed and suggested alternate goods shed in the vicinity. IR had identified and launched a list of 20 goods sheds that will be provided with an alternate freight terminal for efficiently handling the freight demand of the city/region.

Table 14: High capacity utilization

Parameter	Value/Condition	Comments/Suggestion
Average rake handled per line per month	> 15	More lines need to be provided. If adequate space is available, lay more lines. In other cases, nearby alternate goods shed can be proposed.
Average rake handled per line per month	< 15	Terminal infrastructure including wharf, and unloading and evacuation need to be focused upon.

6.2.2 Shunting

Limited sidings on IR facilitate direct placement. Shunting is generally required in nearly all sidings. As IR has undertaken pan-India electrification, most of its locomotives hauling freight trains are electric. The placement in electrified sidings is often done by the train engine; but for the non-electrified terminals and terminals with indirect placement (or spur placement), an additional shunting engine is required. Many times, the shunting engine is not readily available at the freight terminal.

Such incidences considerably increase the placement time, resulting in a higher terminal detention time.

Table 15: Shunting

Parameter	Value/ Condition	Comments/Suggestion
Terminal electrification	Not electrified	Electrification/top wiring of all the freight terminals (except for the terminal with crane operation) should be undertaken on a priority basis.
Availability of shunting engine at freight terminal	Not available at freight terminal	For the terminals experiencing more than 15–20 rakes/month, placing shunting engine at the freight terminal may be considered to optimize the terminal detention time. For the terminals with spurs, availability of shunting engine at the terminal speeds up the process. If it is not possible to have a dedicated engine at the goods shed, effort should be made ensure availability of shunting engine before the inward train arrives at the terminal if train engine cannot be used for shunting.

[22] Details available at: <https://digitalscr.in/bzadiv/circulars/commercial_circulars/uploads/127%20Policy%20for%20alternative%20goods%20shed%20of%202020.pdf>

Parameter	Value/ Condition	Comments/Suggestion
Rake placement	Shunting required	Full length shunting neck must be provided to leverage faster placement (if land is available).
Wharf length	Half-length or smaller wharf	Expanding the wharf length to accommodate full rake is advisable (if land is available).

6.2.3 Longer Placement to Release Time

Direct rake placement/release does not take place at many terminals. The need for shunting, cutting the rake, etc., increases the rake placement and release time. Longer placement/release time impacts terminal efficiency and contributes to increased turnaround time.

Table 16: Indirect placement

Parameter	Value/Condition	Possible Reason	Comments/Suggestion
Arrival to placement time	> 1 hour	Occupied wharf line	Speedup unloading and evacuation process
Arrival to placement/ unloading to release time	>1 hour	Spur placement	Provision of full-length lines will save time and energy
Arrival to placement/ unloading to release time	>1 hour	Indirect placement and shunting requirement	Provision of adequate shunting neck
Unloading to release time	>1 hour	Unavailability of engine/crew at given time	Advance intimation for the release of rake may be sent to the concerned terminal to arrange the locomotive in time

6.2.4 Slower Unloading/Evacuation Process

Longer terminal detention time is the key contributor to higher turnaround time of freight trains, and lack of robust commercial infrastructure is the underlying reason for the same. Majority of the freight terminals owned by IR have very poor wharf, circulation area, and related infrastructure. High dependency on the labour also contributes to longer loading and unloading times. The detailed issues regarding commercial infrastructure and related services are discussed as under.

It is important to note here that almost all the goods sheds on the IR system face high infrastructural constraints when it comes to wharf, circulation area, and approach road.

Freight terminals are the first place which connect the railways to the customers, as loading/unloading operation is amongst the key activities involving the customers. Apart from optimizing the turnaround time, the provision of robust and easy to handle infrastructure at terminals is crucial to maintain the trust of customers.

Table 17: Poor terminal infrastructure

Parameter	Possible Reason	Comments/Suggestion
Poor access road	Ownership of the access road lies with the city/state government, and its maintenance is mostly ignored. The constant movement of heavy vehicles also requires better maintenance efforts.	Railway authorities and city/state government must work as a team to develop and maintain better quality of access roads as well as efficient connectivity. A special benchmarking standard for access roads needs to be developed and maintained.
Poor circulation area	Regular movement of heavy freight vehicles easily wears down the circulation area.	Adequate space and robust infrastructure must be provided to ensure the smooth movement of heavy freight vehicles from both the sides.
Poor wharf	Constant movement of the heavy freight vehicles rapidly deteriorates wharf condition. Poor wharf restricts the efficient loading/ unloading procedure.	All goods sheds must provide all weather robust and preferably covered wharfs.
Lightening	Lack of adequate lighting restricts the night-time loading/unloading activities.	Provision of adequate light masts is required.
Availability of merchant rooms	Considered as a non-priority	Merchant rooms needs to be provided to leverage better business management from the terminal itself.
Labour facilities	Considered as a non-priority	Provision of adequate labour facilities not only helps in leveraging night-time unloading/ loading, it also creates a sense of ownership in workers and promotes a healthy work environment.

6.2.5 Unloading Process

The unloading activities in goods sheds are majorly undertaken manually by labours. Limited working hours and capacity constraints often result in exceeding the permissible free unloading time.

6.2.6 Availability of Storage Space

Covered wharf and dedicated space for storing goods is required at every terminal. Due to restrictions on freight vehicle movement during peak hours in most cities, it is difficult to evacuate the goods at the same time the rake is placed. For such cases, the goods are generally stacked on wharf where warehousing facilities are not available. Unless the goods are removed from the wharf, unloading activities from the new rake cannot start.

In many cases, the private player uses the wharf as their storage space, as the wharfage charges are relatively lesser than the cost of warehousing. Such issues not only decrease the terminal efficiency, but also result in demurrage for upcoming rakes.

Table 18: Unloading procedure

Parameter	Possible reason	Comments/Suggestion
Loading/Unloading processes		
Manual Loading/ Unloading	High dependency on manual labour; labour limitations results in longer loading/unloading times.	Certain mechanized techniques should be deployed in order to speed up the loading/ unloading procedures.
Labour-related issues		
Availability of labours	Unavailability of adequate number of labours. Labour lobbies/syndicates/ unions do not allow private labours to work on railway goods sheds. Limited number of labours require longer time to complete the loading/ unloading processes.	Decreased labour dependency will help reducing the loading/unloading time. Formalizing labour unions/syndicates/lobbies and finding a common ground of operation, which benefits labours, consignees, and railways, needs to be developed.
Limited night time working	Labours do not work after dark due to safety reasons or to abide union rules.	For the Northern and Eastern regions, where safety is the key concern, labour can be provided with identity cards or authorization letters by local railway authorities. Co-ordination and negotiations with labour unions are required to leverage night-time working at other places. Timetabled or assured placement time of rakes will help labours to plan their night working days and help in optimizing the turnaround time.

Table 19: Availability of storage space

Parameter	Possible reason	Comments/Suggestion
Availability of storage space at freight terminal	Limited availability of storage space and covered wharf limits the loading/unloading activities to direct transfer of goods (between the truck and the wagon) increasing terminal detention.	Developing a dedicated storage space and covered wharf allows 1–2 rake load goods to be stacked at the freight terminal. This can leverage continuous loading/ unloading of goods, irrespective of availability of freight vehicle.

6.2.7 Ecosystem Parameters

The external factors like, availability of heavy freight vehicles and warehouses, connectivity with key places, etc., also play a crucial role in enabling the timely evacuation of goods from the freight terminal. Addressing these issues will result in optimizing the terminal operation.

Table 20: Ecosystem parameters

Parameter	Possible Reason	Comments/Suggestion
Congestion/ Restriction at access road	Often, the access road directly merges with the passenger/city traffic, causing congestion. Sometimes, poorly planned freight terminal layout requires road vehicles to cross the railway lines. The traffic is blocked when a rake is placed, or the rake is split to facilitate passage of road movement through a particular line, causing unnecessary delays.	While planning the freight terminal, the location of access roads should be carefully crafted. An additional traffic signal can be planned in coordination with civil authorities to regulate the traffic movement.
Restriction on heavy freight vehicle movement in the city	Majority of the tiers 1 and 2 cities have restrictions on freight vehicle movement during day time/peak hours, resulting in slower loading/unloading activities when adequate storage space is not available at the freight terminal.	Provision of adequate storage space at freight terminal to leverage full day loading/unloading activities. Dedicated road routes connecting freight terminals to key consumption centres, allowing all-day freight vehicle movement. Increasing the free time for freight vehicle movement in the city.
Connectivity with highways and key production/ consumption centres	The authorities are working in isolation.	Divisional and zonal railways may constitute a committee onboarding city-state level planning authority, as well as industrial and logistics experts to plan an efficient logistics ecosystem.
Availability of transport vehicles	Like labour syndicates, the number of freight vehicles working for freight terminals at many places are fixed, and new players are not welcomed. Limited availability of transport vehicle increases the terminal detention time, as well as wharfage time.	Regular interactions with merchant associations and transporters should be done, so that enough operators and road vehicles are available to evacuate the freight transported by railways in rakes.
Availability of Warehouses/ Godowns in town	Mostly, in small towns or at very busy consumption centres, the warehouses in the city are not available. Also, the wharfage charges are relatively cheaper than warehousing charges. Many consignees prefer to pay higher demurrage charges and wharfage charges, increasing the turnaround time of railways. Many warehouses are not operational at night, limiting night time loading/unloading.	Along with developing adequate storage space at freight terminals, adequate warehouses should be planned in terminal vicinity as well as key consumption areas. The warehouses must be operational 24*7 to ensure smooth logistic movement and optimal utilization.

6.3 Terminal Rating System

The discussions in the previous chapters have emphasized on the fact that, there are number of parameters which affect the functioning of freight terminals. Even when the terminal infrastructure is robust, the issues with approach road and connectivity might discourage the customers. Similarly, at many places the labour issue results in the decline of the traffic. To optimize the freight operations, the terminals and freight handling system needs to be examined holistically, evaluating all the different parameters.

With an aim to objectively assess the functioning of freight terminals, a detailed and exhaustive list of indicators has been developed. As discussed in the previous section, the indicators incorporate the different stages of freight operation—starting from rake placement to goods loading/unloading and evacuation.

Each terminal on the IR system has different characteristics and faces diverse issues. Based on site visits and stakeholder consultation, a comprehensive list of indicators has been developed, which tries to cover majority of the issues. The given indicator list may help divisional and zonal railways to identify key bottlenecks at a given terminal and plan further strategy to improve the freight operations.

6.3.1 Terminal Rating System for Railways

Table 21 enlists all the parameters and the assessment sheet can be accessed here. The assessment sheet is also attached in the Annexure IV: Terminal Rating System.

Most (if not all) of the information about the listed parameters is available with railway's information management systems (like FOIS) and other applications hosted by CRIS. It is advisable to input information and numbers from online applications as much as possible, in order to ensure the authenticity of the data.

Once all the terminals are rated on the given parameters, the terminals with a low rating may be picked up for detailed intervention and may be considered for the capacity upgradation work. Periodic upgradation of the data will also help to plan upcoming works. For example, if a particular terminal underwent resurfacing of wharf in 2019, the online rating system would draw attention to the need of resurfacing in 2024.

In later stages, IR may also try to incorporate more parameters in their online information system. Online updating and direct linking to terminal rating system will also push the divisional railways to carry out better quality of upgradation and maintenance work.

IR/CRIS may also think of developing a live interactive dashboard: to update and maintain all the data for freight terminals at one place. Such dashboards may help to evaluate and compare the terminal operations. They may also be utilized as a critical decision-making tool for terminal redevelopment/modification.

Table 21: Parameters for terminal rating

Key activity	Parameter
Terminal information	Average rakes handled per line per month
	Traffic flow
	No. of lines available
	Distance form national/state highway
	Distance from district road
	Distance from main market
	Seasonality of freight terminal

Key activity	Parameter
Operational infrastructure and related parameters	Rake placement
	Length of shunting neck
	Average placement time (from arrival at the station to placement at g/s)
	Availability of shunting engine
	Availability of additional loop lines/stabling lines
	Totally electrified goods shed
	Wharf length
	Average placement to release time
	Average release to dispatch time
	Longer wharf occupancy hindering further unloading
	No. of yard derailments
Commercial infrastructure and related parameters	Wharf condition
	Circulation area
	Approach road
	Lightening
	Last maintenance done for approach road
	Frequency of cleaning leftover goods of loose commodities
	Last wharf and circulation area maintenance
	Average wharfage time
	Loading/unloading mechanism
	Operational hours of goods shed
	Separate entry and exit for freight vehicles
	Availability of warehouse
	Availability of in-motion weighbridge
	FOIS updating system: manual/automatic
	Availability of basic facilities for labour
	Availability of basic facilities for merchants
Freight ecosystem related parameters	Nature of labour
	Nature of aggregators
	Operating hours of freight vehicles
	Availability of warehouses in the city
	Loading terminals–connectivity to the production house/mines/key markets Unloading terminals–connectivity with highways and consumption centres
	Loading terminals–distance from key source Unloading terminals–distance from storage place
	Congestion at entry/exit of freight terminal

6.3.2 Customer Satisfaction Survey

For any business the customer satisfaction is an essential measure of its success. While detailed assessment for the railway officials is devised, the incorporation of customer reviews/point of view will help to validate the information regarding freight terminals. In addition to that, the customer satisfaction survey will also provide a detailed idea regarding major pain points for the customers. ***'IR focuses more on increasing productivity of assessts, but customer satisfaction is not taken into the account.'*** (CAG, 2015)

IR/FOIS may use customer satisfaction surveys for specific terminals, or for railway operations in general, on a yearly basis. The survey questions may be focused on terminal infrastructure and the freight services provided by railways. Annexure V: Customer Satisfaction Survey has listed out detailed parameters.

Table 22: Customer satisfaction survey

Key concern	Parameter
User experience (terminal specific)	Advance intimation on arrival of rake for loading/unloading
	Wharf condition
	Condition of circulation area
	Approach road
	Adequate lighting
	Availability of labour for loading/unloading
	Availability of storage space to stack goods
	Availability of merchant room
	Availability of basic facilities for labour
	Road connectivity to/from freight terminal
	Extent of restrictions at freight terminal
Satisfaction survey (overall experience)	How would you rate your booking experience?
	How would you rate cooperation of railway commercial staff?
	How would you rate terminal infrastructure?
	How satisfied are you with the rolling stock provided?
	How would you rate the delivery time of railways? (reliability)
	How would you rate the rake tracking/tracing system?

6.3.4 Sample Assessment

Based on site visits and stakeholder consultations, 16 freight terminals were assessed on the listed parameters. As the parameters are grouped based on the different operations, it may help the officials to understand the major pain points, so that focused actions can be undertaken to enhance the efficiency of the terminal.

For each parameter listed in Table 21, an objective rating indicator has been developed to rate the parameter from 1-10. For an example, if the average placement to release time for the terminal is 15 hours, the terminal shall be awarded 7 points.

Table 23: Terminal rating system - Sample assessment

Rating	1	2	3	4	5	6	7	8	9	10
Average placement to release time	More than 24 hours		12-24 hours in addition to permissible free time		6-12 hours in addition to the permissible free time		2-6 hours in addition to the permissible free time		2 hours in addition to the permissible free time	Within permissible free time

Such indicators are listed for each parameter. And further, activity-wise points can be accumulated, and their percentage score can be noted out of 100. As shown in the Figure 55, Red to Green colour coding shall be given to highlight key area that needs attention.

6.4 Developing World-class Terminals

Historically, railways have been the key transporter for goods since industrialization. Railways have been the preferred mode for freight transport, especially for long haul and/or bulk transport. With the growth of road sector, freight transport has been dominated by road sector. But railways continue to hold a significant share in global freight movement. In addition to the advantages of distance and volume, railway is much more energy efficient with low carbon emission mode of transport.

Railway freight terminals are the key nodes to facilitate the freight transport from one point to another. The basic service performed by railway freight terminal is the loading/unloading of goods. Many terminals also serve as intermodal terminals, facilitating exchange of goods between different modes like road-to-rail, rail-to-road, ship-to-rail, or rail-to-ship.

6.4.1 What are World-class Terminals?

When discussing world-class or ideal freight terminals, it is important to note that there cannot be a standard layout or design for the development of these terminals, as each one is unique. The terminal can be termed as word class when:

- It offers seamless transfer of goods between wagons within a reasonable timeframe
- The arrival and departure of goods to and from the terminal remains trouble free, convenient, and quick
- The safety and security of goods are ensured during handling operations and storage within the terminal
- The air pollution arising out of handling operation remains within prescribed limits and adequate waste disposal methods are in place.

The design features of a goods terminal will change according to the type of commodities and wagons being handled at the given terminal. The operational efficiency and reduced terminal detention is the key indicator of efficient/world-class terminals.

In a world of modern logistics, railway organizations need to focus more on understanding the needs of specific customers for whom rail has a competitive advantage and should offer a range and quality of services that fit specific customer needs.

		Operational Parameters		Commercial Parameters				Ecosystem Parameters		
Terminal Name	**Scale of Freight Terminal**	**Rake Placement**	**Placement to Dispatch**	**Loading/ Unloading Infrastructure**	**Loading/ Unloading Process**	**Storage and Evacuation**	**Value-added Services**	**Understanding and Coordination with Stakeholders**	**Freight Ecosystem in the City**	**Overall Performance**
Number of Parameters Considered	**7**	**6**	**5**	**7**	**3**	**4**	**2**	**2**	**5**	**41**
Cossimbazar	50%	67%	60%	41%	37%	65%	50%	40%	32%	50%
Dankuni	74%	65%	58%	64%	50%	63%	45%	45%	44%	57%
Shakurbasti	32%	80%	60%	74%	27%	78%	90%	45%	66%	67%
Mulund	30%	53%	68%	29%	30%	38%	70%	70%	30%	45%
Taloja	30%	62%	64%	93%	30%	63%	95%	75%	66%	69%
Kalamboli GS	52%	73%	54%	40%	43%	63%	40%	55%	56%	54%
MILK PFT	54%	38%	66%	60%	37%	23%	80%	60%	50%	50%
Hajaribag	44%	65%	66%	64%	23%	63%	20%	35%	28%	51%
NTPC Siding Banada	52%	63%	80%	89%	100%	85%	100%	100%	100%	94%
Dhori NSD Colly Siding	42%	38%	80%	80%	87%	40%	100%	100%	80%	70%
Cheoki	50%	65%	68%	54%	33%	63%	50%	45%	40%	54%
Sarai	72%	57%	68%	56%	50%	63%	70%	35%	48%	56%
Harauli Fatehpura	26%	63%	78%	86%	43%	40%	60%	50%	56%	64%
Karpoorigram	54%	33%	58%	39%	37%	38%	10%	70%	42%	41%
Narayanpura Anant	62%	57%	66%	61%	33%	63%	70%	35%	48%	56%
Muktapur	48%	32%	60%	37%	40%	33%	10%	45%	36%	38%

Figure 55: Sample terminal assessment

In addition to basic/essential functions of railway terminals, additional facilities play a key role in attracting more traffic to these terminals. The ease of goods handling is one of the important factors for the growth of railway freight. In the era of multimodal and e-commerce traffic, easy first- and last-mile connectivity is equally important.

This section looks into the key aspects which should be looked into while planning a freight terminal to develop it as a world-class terminal.

Basic/Essential Functions	Additional Services
» Full length lines » Loading/Unloading facilities » Adequate storage space for goods » Adequate circulation area » Easy entry and exit to the terminal	» Mechanized handling of goods » First/last-mile solutions » Labour facilities » Warehousing facilities » Facilities for merchents/service providers » Packaging solutions and services » Sorting facilities for parcels

Figure 56: Terminal functions

6.4.2 Rail Infrastructure

6.4.2.1 Terminal Location

Freight terminals are generally developed in the close proximity of industrial/production units, logistics hubs, ports, and consumption centres. The new terminals for the consumption centres can be developed in the outer city area to avoid the issues of congestion. Few key points for choosing the location are:

Proximity with:
» Mines, industrial and production units
» Special economic zones, logistics and parcel hubs
» Warehouses of e-commerce and 3PL
» Hinterland access

Availability of:
» Robust all weather road network
» Connectivity with key highways, central business districts, and warehouses
» 24*7 electricity and water connection
» Warehouses and specialized storage spaces (for bulk, bagged, parcel, etc.)
» Continuous and preferably increasing loading

6.4.2.2 Railway Lines

The terminal capacity or the quantum of goods handled by a rail freight terminal is determined by the number of loading/unloading lines available. Currently, on an average one full length line can handle around 15 rakes a month at unloading terminals due to uncertain and random arrivals of rakes. In case of loading terminals, if it is well managed and regular arrival of goods is assured, it may go up to 25 rakes a month. If equipped with mechanized handling systems, the handling capacity of a terminal further increases.

Based on the current freight demand and future projections, the number of lines shall be designed. In addition to required number of lines, stabling lines or loop lines shall be provided to ensure efficient handling of rakes due to uncertain and random arrival, particularly in busy season. It is crucial to estimate the adequate number of lines, as it is difficult to make frequent additions once the terminal has been built.

6.4.2.3 Terminal Layouts

Terminal layouts are also very subjective in nature. Based on the type of commodity and wagons used, the layouts can be planned. However, some necessary provisions for all the terminals are as follows:

» Full length lines
» Direct placement facilities
» Fully electrified siding, except for the line handling crane consignments
» Full length shunting neck for placement and drawl of rakes without interfering with main line movement
» Engine-escape line as required
» Weigh bridges for loading terminals can be planned
» Separate and dedicated entry-exit of goods vehicles
» Dedicated storage space/warehouses packaging plants, bottling plants, etc., if required
» Both side wharfs to accelerate loading/unloading

In the general practices, the railway terminals are planned horizontally; laying two or more parallel lines and providing wharf in-between. These types of layouts are well suitable for handling truck-train traffic, i.e., while exchanging the mode of transport at terminals.

Rodrigue (2020) emphasizes on the efficient coordination among different terminal operations since delay/ glitch in one operation will impact the others. His book has divided the rail freight terminal into six components as shown in Figure 57.

Intermodal yard is the core of terminal where loading/unloading takes place. The length of yard must accommodate a full-size rake to facilitate efficient loading/unloading. The area should be robust enough to handle the movement of heavy equipment and vehicles.

Storage area acts as a buffer between the road and rail. The storage area must be vast enough to ensure sufficient storage.

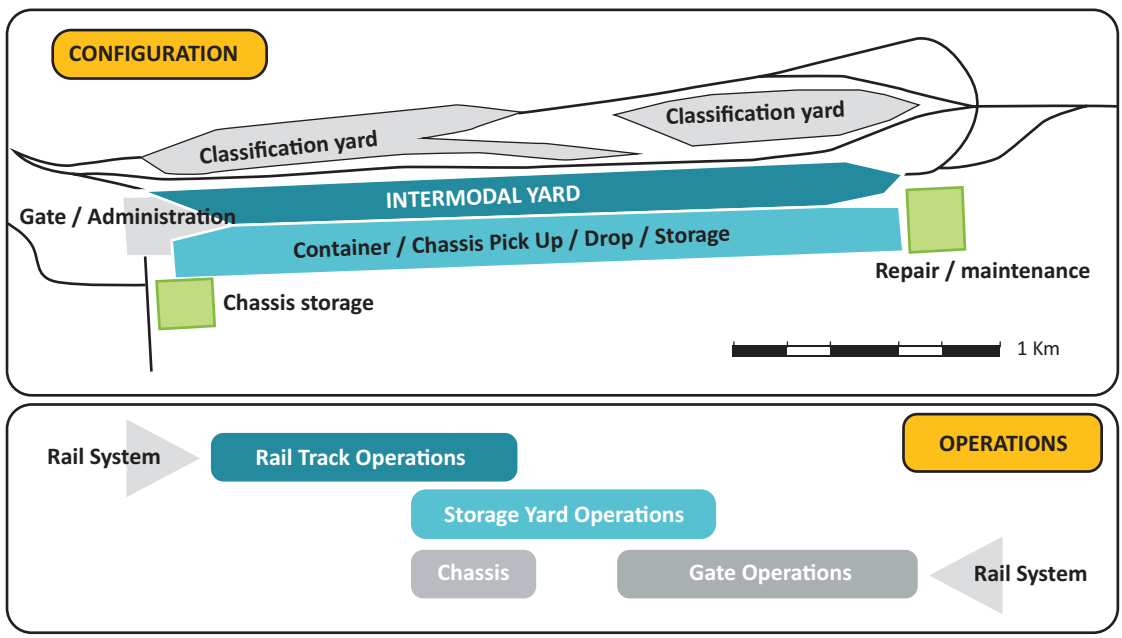


Figure 57: Sample rail freight terminal

Source: Transport Geography

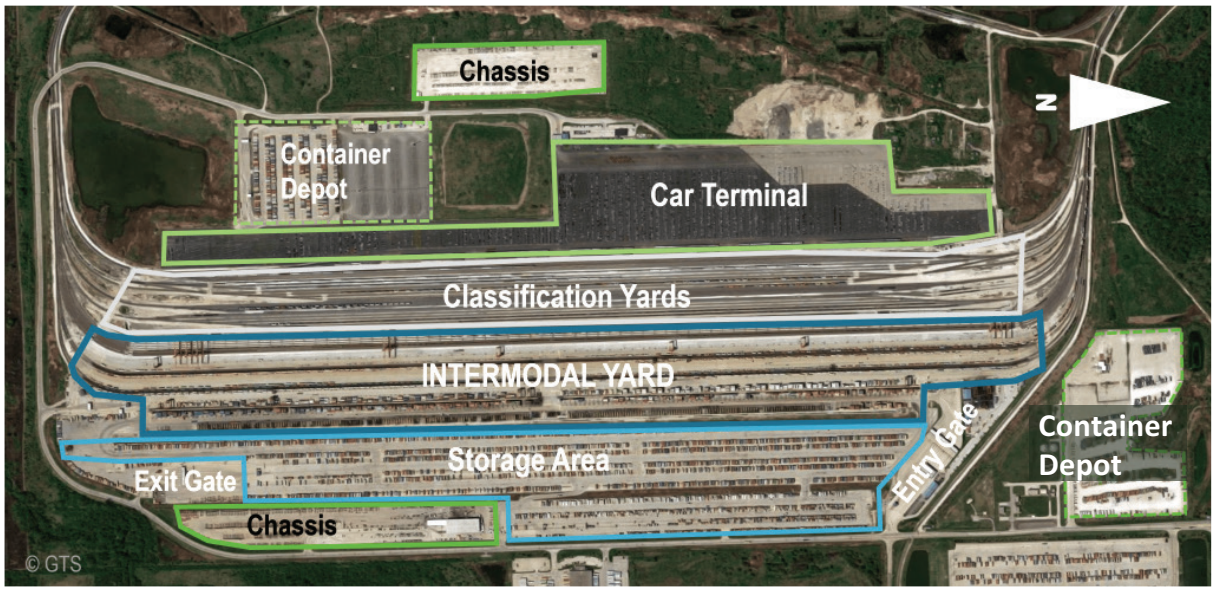


Figure 58: BNSF Logistics Park, Chicago

Source: Rodrigue (2020)

Classification yard mainly works as a place to facilitate the gathering and sorting of freight wagons, whenever needed. Shunting and loco exchange will take place at this location. Chassis storage works as a resting place of heavy machines such as reach stackers and gentries. Repair/maintenance area undertakes regular maintenance of heavy-duty vehicles and machines on the terminal. The classification yards have been given up on IR as the need for breaking up or sorting of wagons have been eliminated with the adoption of only rake movements. To ensure integrity of a rake, it is necessary to have a full length handling line with adequate wharf space on either side for movement of mechanized handling equipment and space for stacking of material. Intermodal yard works as receiving and dispatch yard, could have one or more line.

Gates regulate the entry/exit of freight vehicles. To simplify the process, ideally entry and exit gates are separated.

While planning larger terminals, where multiple commodities are being handled, and the terminal is also offering the loading, sorting, packaging, or bottling of loose commodities, different layouts can be explored. As shown in Figure 59, a freight terminal is planned with three spurs, handling three different types of traffic. Based on the goods handling mechanism, different lines are placed and the vehicle circulation plan has been made.

Using similar approach, freight terminals can be planned, where one line is used for direct loading of loose commodities, one is facilitating the loading/unloading of containers, one is handling bagged commodities, and one is directly connected with sorting hub to sort and dispatch the parcels and so on. The Mundra Port developed by Adani also follows the similar approach, where they handle different goods at different locations to maximize the operational efficiency (see Figure 60).

Including multiple commodities and different handling processes might result in very complex terminal planning and operation at first, but eventually, such terminals will ensure the optimum usage of rail infrastructure and facilitate greater business.

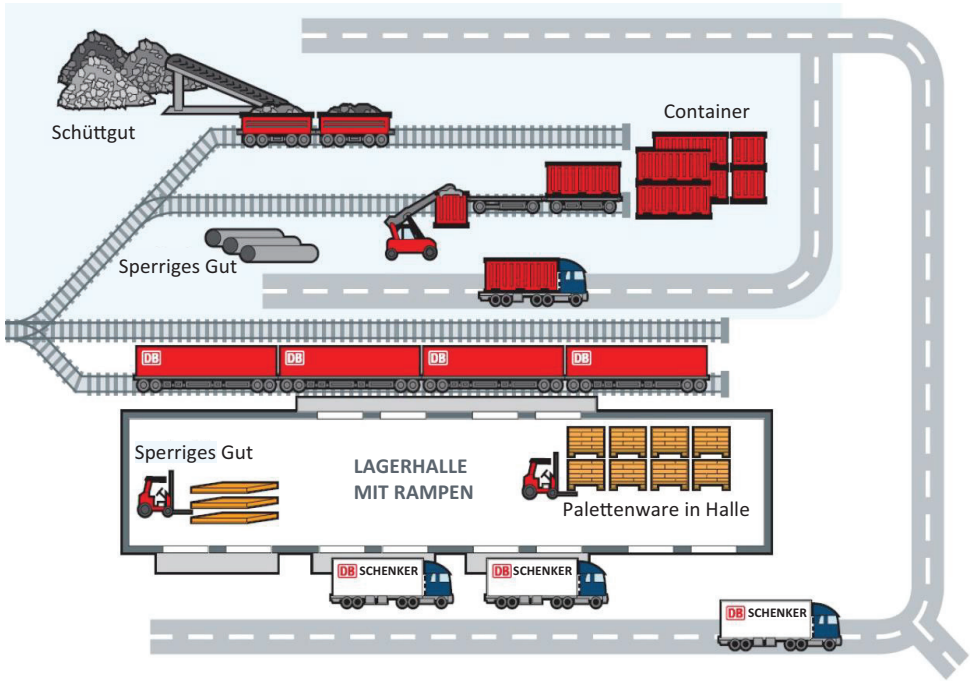
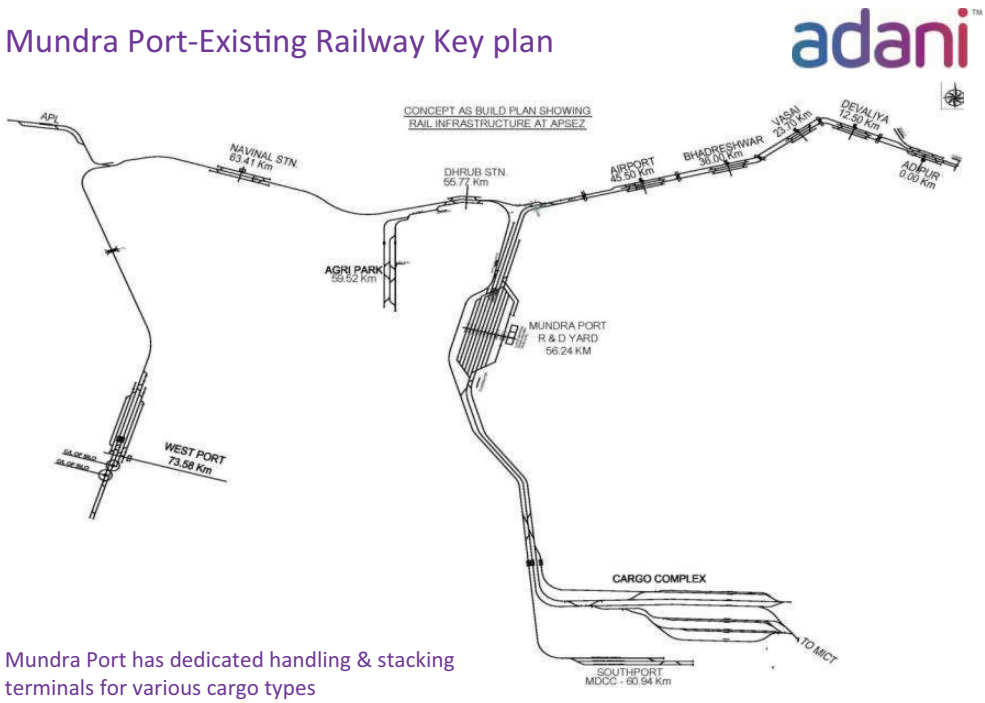


Figure 59: Indicative terminal layout

Source: DB Cargo



Planning and operation of freight terminals for large industrial units

Figure 60: Mundra Port layout

Source: Adani

6.4.3 Terminal Infrastructure

Terminal infrastructure is one of the very crucial aspects of rail freight system, as the infrastructure condition plays a vital role in optimizing the terminal detention time.

6.4.3.1 Pre-requisite Infrastructure

As discussed on the terminal layout, adequate space planning is crucial. In addition to that the wharf and circulation areas shall be designed in a way that it facilitates smoother exchange of goods.

Wharf

» The wharf shall be designed based on the type of commodity and wagons being used
» For the direct transfer of goods from vehicle to wagon, rail level wharf can be planned. For the commodities, where the goods will be first consolidated at the terminal and then loading procedure will take place; elevated wharf with sufficient storage spaces can be planned
» It is crucial to provide covered wharf to protect the goods in different weather conditions

Storage Area/Warehouses

» The specified warehouses shall be planned to store different goods
» For loading terminals for loose bulk commodities, silos can be developed to facilitate the direct loading to wagons. Similar systems can be developed for unloading terminals as well.
» For bagged consignments, warehouses with flexible conveyor belts can be designed to facilitate faster goods handling
» It is crucial to provide covered warehouses/storage spaces to ensure the safety of goods
» Lightening and ventilation should be planned efficiently

Basic Amenities

» The terminal should be equipped with terminal control and management centre to manage the rake movement as well as terminal operations
» Robust internet connection and easy access to required softwares
» Designated merchant rooms for their operation at terminals
» Adequate resting facilities for labourers
» Easy access to drinking water, washrooms, and canteen

6.4.3.2 Cleaning and Maintenance of Assets

Many times, while undertaking loading/unloading operations, commodities are spilled over the tracks and wharf. This spillage of commodities does not only create the unhealthy working conditions, but may also lead to derailments. It is very important to ensure the deep cleaning of tracks and wharf regularly for the safety and hygiene concerns.

The wharf, circulation areas, and access roads get worn out frequently due to continuous movement of heavy vehicles. Periodical resurfacing and maintenance shall be undertaken to maintain smooth operations.

6.4.3.3 Other Facilities

» The terminals shall be equipped with early intimation facility to plan the loading/unloading procedure and goods evacuation well in advance
» The terminal operators may also provide first- and last-mile connectivity to nearby industrial/logistics units
» The terminal may also provide spur lines to logistics units or industries, and run time tabled trains to collect less than rake load traffic, and then transport it to destinations; similar to two/multi-point rakes

6.4.4 Loading/Unloading Procedures

6.4.4.1 Goods Handling and Wagon Design

While freight transport through railways cannot eliminate the multiple handling for all places, IR can ensure the smoother transition of goods from vehicles to wagons. Swap body container wagons can be introduced to existing railway wagons. These wagons used are different in design in a way that, they can be easily transported from the industry to railway terminal, and can be used in rail as well as road systems.

Based on some international practices, some suggestions for the wagon design and goods handling practices are discussed as under.

Bagged Commodities and Parcels

Currently, all the bagged commodities and parcels are primarily transported in box wagons. On majority of terminals, the loading/unloading operations for box wagons are manual. At certain places, conveyor belts are used to accelerate the loading/unloading of bagged commodities. However, narrow doors of these wagons limit the efficiency of loading/unloading procedures.

Figure 61: Box wagon (1)

Source: DB Cargo

Many international operators use box wagons with sliding doors, to ensure smoother and faster loading/unloading of bagged goods. Small bags/parcels can be clubbed and converted into relatively large pallet size. Forklifts can be then used to carry out loading/unloading operations. As the pallet size is maximized and operations are mechanized the terminal detention time can be brought down significantly. Wagons developed by Rail Cargo Group facilitate loading/unloading operations from above as well as sides, making them suitable for different types of goods handling.

Currently, at many freight terminals in India only, mechanized practices are being used. Deployment of conveyor belts to facilitate loading/unloading of bagged commodities is one of the widely used practices. But the current wagon and terminal design are not suitable for 100% mechanized handling, manual operations still consist 40–50% of work along with conveyor belts. The conveyor belts are useful when the vehicle/storage space is located at the significant distance from wagon, where belts are used to cover the distance and loading/unloading is undertaken manually. At some places, while unloading, the bags are opened, goods pass through sieve and then with the help of conveyor belt, the loose commodity is loaded in the trucks.

Continuous and 24*7 availability of transport vehicles is crucial to efficiently use these systems.

Loose Commodities

When dedicated line is developed to carry out loading/unloading operations of loose commodities, constructing silos for bulk operation maximizes the efficiency. Currently, at many places in India only such systems are utilized. Loading of coal and minerals through conveyor belts, loading of food grains and fertilizer through silos, loading/unloading of cement through BCCW wagons, tippling mechanism for unloading, etc.

Cover wagon class Habb

Covered wagon class Hbb

Figure 62: Box wagon (2)

Source: Rail Cargo Group

In addition to such operations, swap body containers, which can be transferred to trucks for first- and last-mile connectivity can be added to existing wagon population. Such type of wagons can be specifically useful for the industries which have relatively smaller traffic and/or diverse locations to cater to.

Tankers, Liquids

Currently, tank wagons are used in India to facilitate the bulk transport of liquids. The main drawback of these types of wagons is that they require specific loading/unloading infrastructure. The customers, who do not have specially designed sidings/freight terminals cannot use railways to transport their liquids.

Specialized swap body containers can be used by such industries, where the loading/unloading of liquid commodities can be undertaken at the industrial/logistics unit, and the intermediate transport is facilitated by railways.

Figure 63: Swap body wagons for loose commodities

Source: Mobiler-Logistik

Figure 64: Swap body liquid container

Source: DB Cargo

Flexitank container

Tank container

Figure 65: Flexitank container

Source: Felxitank

Another design is flexitank containers. These containers are durable, bag-type containers made of rubber or polypropylene fabric which facilitate transport of chemical liquids and liquid foodstuff.

Automobile Transport

In addition to NMG rakes, high-capacity rakes can be introduced to facilitate the efficient movement of automobile traffic. DB Cargo offers double decker wagons to transport vehicles. However, for Indian weather conditions, open wagons are not suitable for automobile transport. Covered wagons with higher capacity, like BCACBM wagons shall be used.

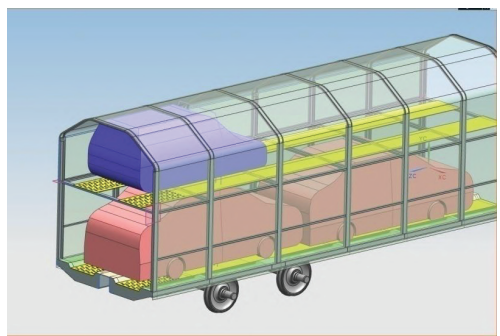


Figure 66: BCACBM wagons

Source: Indian Railways

In addition to the efficient wagons, suitable terminals to facilitate easy and fast loading/unloading of vehicles, multiple ramps can be provided to decrease the terminal detention time.

Figure 67: Automobile wagons

Source: DB Cargo

6.4.5 Environment, Health, and Safety

6.4.5.1 Mitigation of Dust Pollution

» Dedicated dust control plan shall be developed for the terminals handling loose commodities
» Provision of hoods, and dust collection machines shall be ensured
» Periodic water sprinkling to commodities like coal should be undertaken
» High facades shall be developed to control dust from contaminating nearby areas
» Labourers shall be provided with suitable masks while working with loose commodities

6.4.5.2 Compliance with Green Building Standards

» The terminals can be developed in accordance with green building standards like GRIHA or IGBC
» Optimum utilization of resources like energy and water shall be ensured
» The small machines and vehicles can be run on electric batteries instead of conventional fuels
» Rail freight terminals have a lager land area, and rooftops of warehouses, wharfs, office units can be utilized to harness solar energy

6.4.5.3 Vehicle and Goods Circulation Plan

» A detailed vehicle and goods circulation plan shall be developed to optimize the terminal operations
» The circulation plan will not only ensure the efficient movement of vehicles and goods, but will also protect from potential accidents at terminals

7 Key Messages and Recommendations

At about 120,000 track km, the Indian Railways (IR) has one of the largest rail networks in the world and is often termed as the backbone of India's transport system. Historically, the IR has been the main mode of moving freight traffic in India, almost 85% of freight traffic was transported by rail in 1950. However, this trend has seen a major reversal over the years with the growth of trucking industry and road transport.

The declining share of the IR in freight movement has been largely attributed to capacity constraints of railways to carry additional traffic. For the last two decades, there has been an emphasis on capacity augmentation, that is, construction of dedicated freight corridors, provision of doubling and additional lines on important routes, construction of new lines, unification of gauge, electrification of routes, etc. There have been increased investments, especially in the last decade aimed at capacity augmentation, modernization of assets and enhancing safety of operation. As a result of constant efforts by the IR, the freight transport output for 2022–23 reached a remarkable 903 billion NTKM. However, true potential of railways has not yet been realized.

The study looked into the key hurdles related to terminal development policies, freight terminals (especially goods sheds) as well as in-route terminals where generally operational constraints cause delays to goods trains during transit.

7.1 Key Messages

7.1.1 Terminal Development Policies Yet to Reach their Potential

Apart from operating its own goods sheds, railways have a policy of providing private sidings to the bulk rail users for carriage of minerals, raw materials, and finished products. Over a decade back, railways introduced a concept of private freight terminals, constructed, maintained and operated by the private sector dealing with multiple commodities on similar lines as railway-owned goods sheds. This concept has been further strengthened with policy of Gati Shakti Multimodal Cargo Terminals introduced in 2021. These policies provided opportunity to the private sector to invest in freight terminals, which generally are more efficient than the rail-owned terminals. However, the high capital cost of infrastructure development, land availability, long and complex application/approval procedures, and lack of adequate incentives have inhibited the involvement of private players in terminal operations in a large number. Business-friendly policies with sharing of cost, responsibility and risks would encourage the private sector to develop sidings and terminals that would go a long way to increase railway's share in freight business.

7.1.2 Freight Terminals Are Underutilized

Rail freight terminals are capital intensive and on an average one-line terminal can handle 15 rakes per month, resulting into handling 180 rakes per year. Looking at the current throughput of railway freight terminals, only 47% of terminals handle more than 100 rakes per year. It is also observed that sidings, which account for 34% of the total freight terminals, handle 68% of the total freight traffic. Goods sheds, which constitute 63% of freight terminals, only account for 21% of the traffic. This signifies the underutilization of the capacity that has been created.

During the last decade (2010–20), significant increase in the physical infrastructure of railways like track length (5%) and rolling stock (27%) has been observed, along with the increase in freight NTKM (13%). However, operational efficiency indicators such as average speed, wagon kilometres per wagon day, and wagon on run time have declined.

7.1.3 Longer Turnaround Times Due to Frequent Stabling and Detentions

The IR has been constantly working on increasing line capacity to facilitate smooth freight movement across the network. Frequent stabling of freight trains for the priority movement of passenger trains has resulted into decreasing the freight train speeds by 50%.

In addition to that, freight trains face very long detentions (2–6 hours on an average) while passing through key junction stations, which substantially increases their turnaround time. It is high time to identify the constrained junctions and redevelop the station yards in a manner that allows for uninterrupted and faster passage of through freight trains.

7.1.4 Rationalisation Orders often Work as Means of Additional Revenue Generating Mechanism Instead of Optimizing Haulage

With an aim to optimize the utilization of network capacity, the IR has been empowered to rationalise the routes for carriage of goods from time to time. Rationalisation orders mandate specific routes for carriage of goods keeping in view of operational feasibility. The rationalised routes are mostly longer and consequently the customer pays more freight for carriage by rationalised routes. It has been seen that for majority of cases, rationalised route is not being followed and trains are operated by the normal route. The customers are disadvantaged in two ways, first, they pay more by longer rationalised routes and second, movement by rationalised routes takes longer time. Continuance of rationalisation orders for decades, results in diversion of goods traffic to road. In the customer's perception, rationalisation orders are used for charging more freight than otherwise due, and this perception gets strengthened when there is an inordinate delay in augmenting the line capacity on the normal routes.

7.1.5 High Terminal Detention Time Indicates Inefficient Terminal Operations

Terminal detention time also plays a key role in increasing total turnaround time. Inefficient handling of goods at loading and unloading terminals often hampers the regular process of loading/unloading and results in imposition of restrictions. A number of limitations like, indirect placement or placement in spurs, manual handling of goods, poor condition and maintenance of goods wharf and circulation area, lack of storage space and basic amenities, restrictions on vehicle movement, etc., contribute to longer terminal detention time. Such constraints not only

impact the railway's performance, but also creates the negative impression on the customers. A comprehensive planning and upgradation works are needed to ensure efficient terminal operations.

Railways levy penalty, demurrage on shippers if wagons are detained beyond permissible time to control wagon detention as it is their responsibility to complete loading/unloading of goods in time. Recently, the railways have prescribed very stiff penalties and any waiver of the demurrage charges is strongly discouraged. In reality, often, the detention to wagons are beyond the control of the shippers due to labour unions, limited working hours, reluctance in working during night and resistance to bring new set of labourers, etc. The demurrage charges have become a great irritant to the shippers. Mechanization of handling activities will go a long way to control the detention at the terminals.

Railways has laid out a detailed action plan to achieve loading of 3000 MT by 2027, and they are constantly upgrading their freight marketing policies to boost investments and loading. While, railways have realized the importance and potential of efficient freight ecosystems for focussed investment, more attention will help in increasing the railway's share in freight movement. Based on the study, the following recommendations are given below for consideration.

7.2 Recommendations

7.2.1 Cost Sharing for Terminal Development

One of the key reasons for slower uptake of private sidings, private freight terminals, and Gati Shakti cargo terminals is the high capital cost involved in freight terminal development. Developing a sharing mechanism for capital cost may result into wider adoption of such policies. For example, railways may take responsibility of providing rail super structure, and private player may develop the terminal infrastructure similar to the earlier concept of assisted sidings. Since land is a very scarce resource now, wherever railway land is available, it should be leased to the private sector for development of sidings/terminals. As it has been seen most of the goods traffic originates and terminates at sidings, proactive siding and terminal policies based on sharing of costs and risks will help the railways to expand its captive customer base where bulk customers are incentivized to develop their own facilities.

Key industrial and production centres as well as logistics and parcel hubs, automobile hubs, etc., which have relatively smaller but diverse traffic can be targeted for such development. Railways may extend the line infrastructure to such places, and then assist the private sector to develop freight terminal catering to freight transport needs of multiple units, which normally offer less than a truck load. This will permit railways to penetrate in non-bulk commodities with the help of aggregators.

7.2.2 Focussed Attention on Constraints at Junction Stations

The issue of in-route detention is prominent around the junction stations, as numerous passengers as well as freight trains have to pass the same junction. While a number of line capacity upgradation works have been listed under 'Mission 3000 MT' by 2027, it is also crucial to pay attention to the issue of long detentions at junction stations. Providing bypass lines and railway over bridges could be one of the solutions. The important consideration should be for an uninterrupted movement of through freight trains. These are least cost options for capacity expansion but help in improving the transit times of goods trains in a big way. There is no unique solution applicable to all in-route junction stations as each of them is different in terms of land availability and physical features. However, a focussed effort and remodelling of station need to be undertaken to resolve the issue regarding detentions at junctions at the earliest.

7.2.3 Relooking Rationalisation Orders

The empowerment of railways to rationalise routes was aimed at easing the operational constraints of the IR and providing efficient haulage. However, it is seen that even after the line capacity is augmented on the shorter routes and the trains are operated by that route, the freight is continued to be charged by longer rationalised route.

Almost all the rationalised routes offer longer transit time along with higher freight as the customers are charged based on the distances according to rationalisation orders. Today, when the railways face a stiff competition from road, rationalisation of routes has lost its relevance. Also, when a route is rationalised, there is no immediate need and incentive to augment capacity or resolve the constraints on the regular route.

In almost all the cases, the trains are operated by the operationally feasible routes irrespective of the rationalisation of routes but the freight is charged as per the rationalised route.

It is important to have a fresh look on the desirability of rationalisation of routes. Railways should re-examine all the rationalisation orders afresh and keep only those one which are unavoidable and all the goods are carried by that route.

It is suggested that railways should introduce a concept of 'preferred routes' between the clusters of originating stations and destinations. A preferred route is the route by which the goods are carried and charged except in the extreme circumstances of interruption on the route and the goods are diverted by the alternative routes temporarily. This will bring more transparency on carriage of goods and railways will be able recover its actual cost of carriage to a very large extent.

7.2.4 Focussed Attention on Freight Terminals

Most freight terminals on the IR network are in need of infrastructure upgradation in order to work efficiently. The key reason for a longer terminal detention time is poor infrastructure and inadequate handling capacity. The provision of all-weather robust wharf, circulation area, and approach road is a must for any freight terminal to work efficiently. The provision of an adequate and covered storage space and lighting, labour facilities, and merchant rooms should also be prioritized.

Railways are not able to provide adequate funds for undertaking terminal infrastructure upgradation works due to competitive demands for resources for other developments. However, utilization of this meagre allocation of funds for terminal facility upgradation is unsatisfactory in the absence of focussed attention. Shortage of funds as well as capacity to undertake terminal development works has led to various policies and schemes by the IR to encourage private participation for development of freight terminals. Initially, there was encouraging response from private sector but it could not be sustained in the long run necessitating revision of policies frequently.

It is a high time to pay focused attention on freight terminal operations and infrastructure, which could be achieved by leveraging required institutional arrangements. Under Gati Shakti, division level Gati Shakti units have been developed in certain divisions to supervise the infrastructure development work. Such units should also be entrusted with finding out the solutions to ensure efficient operation of terminals along with infrastructure upgradation within the divisions.

7.2.5 Exploring Opportunities of Mechanized Handling

Manual handling of goods has many limitations and results in high terminal detention. The use of mechanized handling of goods will maximize the efficiency of the terminal to a great extent. Use of conveyor belts, fork lifts, etc., for bagged consignment and direct discharge wagons for bulk commodities should be promoted.

The current wagon and wharf design is not very suitable for mechanized handling. The IR may take up pilot projects in association with established handling organizations and freight operators to design and build suitable systems to enable mechanized goods handling. The wagon design and corresponding terminal design development may be initiated for improving the terminal productivity and efficiency.

7.2.6 Operator-based System for Goods Handling

One of the key constraints for efficient terminal management is limited labour availability, control of labour unions, etc. The customers, most of the time, are helpless but will have to pay demurrage due to limited labour supply.

An operator-based goods handling system can be encouraged, where each terminal has a terminal operator, who looks after the loading/unloading activities. The responsibility of loading/unloading goods to/from rake will rest with operator, and in cases of demurrage, the operator will be held responsible for paying the same. Such a system will have a better hold over labourers and the terminal operations will be optimized. There will also be an incentive for him to mechanize the handling operation. A suitable policy for appointing terminal operators for terminals which deal with more than 15 rakes a month may be prescribed.

7.2.7 Streamlining Institutional Structure for Terminal Development

Currently, the division is responsible for terminal operation but have neither financial resources nor the capacity to develop infrastructure at terminals. The allocation of funds for terminal development is far below the requirement. For major works, there is a need to have sanction of zonal railways and Railway Board. On account of poor facilities, The Government has sanctioned INR 6715 crore for Traffic Facilities – Yard Remodelling and Other Works (plan head 16) in Financial Year 2023–24 on Indian Railways.

It is suggested that the Divisions should be properly strengthened to sanction their own terminal development works and complete the work as per requirement. They should be also empowered by enabling policies to involve private sector I terminal development and management.

7.2.8 Terminal Rating System

Each terminal on the IR system faces unique issues and requires a customized approach for their resolution. Periodic maintenance works are also required to ensure the quality of infrastructure.

Developing a web-based system to periodically rate terminals on the comprehensive list of parameters (infrastructure condition, terminal detention, demurrage and wharfage, etc., will help to identify the key terminals and constraints to focus for upgradation. An objective system will help to quickly identify the key issues and will help the decision makers to plan works and finances well in advance.

Along with a terminal rating system, customer satisfaction surveys can be undertaken to understand their perception and needs for terminal infrastructure and operation.

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Annexures

Annexure I: Terminal Development Policies

Particular	Private Siding	Private Freight Terminal	Road Side Goods Shed	Gati Shakti Cargo Terminal
		Basic Information		
Aim of the Policy		Enable rapid network of freight terminals and achieve modal shift to railways	Augment Terminal Capacity by Private Investment	Proliferation of New Cargo Terminals and Improve Existing Cargo Terminals
Nodal Officer	Chief Transport Planning Manager (CTPM)	Chief Transport Planning Manager (CTPM)		Divisional Railway Manager (DRM)
Coordinating Officer	Construction Stage: CTMP; After Notification: CCM (FM)	Construction Stage: CTPM; After commissioning: CCM (FM)		Construction Stage: Sr DOM; After Commissioning: Sr DCM
Coordinating Officer at RB	Construction: Executive Director (Civil); Throughout the functioning: Executive Director (Marketing)	Executive Director (FM)		
Total Days required for Approval	8 months	8 months		3-4 Months
Agreement		30 years	Years	35 Years
Authorized Users	Mainly for End-user, Co-user facility can be setup; If port-siding any number of users can be permitted	TMC has powers to decide and change the list of authorized users, RA has to be informed	Anyone	GCTO Decides,

Particular	Private Siding	Private Freight Terminal	Road Side Goods Shed	Gati Shakti Cargo Terminal
Commodities Permitted		All traffic excluding coal and coke under 'C' priority		All Traffic
Right to Access	Siding owner and authorized co-users	TMC has right to decide users of PFT, however no restriction can be levied on the usage of common user facilities	All the facilities shall be used as common user facilities, No priority preferences	
Construction and Maintenance of Freight Terminal				
Capital Cost	Party	To be borne by TMC	Party	GCTO
Land Ownership	Party	TMC	IR	GCTO (IR if land on lease)
Railway Land on Lease	Can be given to government departments/PSUs for siding			Available
Capital Cost of Traffic Facilities (Common Infrastructure)	Fully borne by IR	IR will reimburse the cost		IR
Rail Connectivity till Serving Station		To be provided by PFT owner		GCTO
Electrification within the Premises	Party			GCTO
Provision of S&T, OHE till takeoff Point		Taken care by IR		GCTO
In-motion electric weighbridge	To be provided by Party	To be provided by TMC		To be provided by GCTo (mandatory if outward loading)
Responsibility of Maintenance		As per Private Siding Policy	Party has to take care of	

Particular	Private Siding	Private Freight Terminal	Road Side Goods Shed	Gati Shakti Cargo Terminal
Maintenance and Operation of Assets including staff cost	To be borne by IR	As per Private Siding Policy (IR)		GCTO
Gauge conversion cost	To be borne by Party	As per Private Siding Policy (TMC)		NA
OHE Maintenance cost	To be borne by Party	As per Private Siding Policy (TMC)		IR and GCTO
Maintenance of Civil Engg Assets	To be done by party, Supervision charge to be paid to IR	As per Private Siding Policy (TMC & IR)		GCTO
Maintenance of S&T Assets	To be maintained by IR at their own expanse	As per Private Siding Policy (IR)		IR and GCTO
Maintenance of S&T Assets inside PFT/Siding	To be done by Party	As per Private Siding Policy (TMC)		GCTO
Inspection and Supervision Charge	To be paid by Party	As per Private Siding Policy (TMC)		GCTO
Charges and Fees				
Application Fees	20,000 rs	20,000 rs		20,000 rs
Security Deposit		1 lakh		10 lakh
Codal Charges	4% of estimated project cost	Not defined		No Codal Charges
Bank Guarantee for any default		Bank Guarantee of 20 lakh		No Departmental Charges
Departmental Charges	If Railway constructs: 12.5%; Party: 6.25%; Approved consultant (expt. OHE): 4%; Approved consultant: 6.25% (% of completion cost of project)	As per Engineering Code	No departmental charges to be levied on construction	
Freight Charges		To be paid to IR by customer	To be paid to IR by customer	To be paid to IR by customer
Demurrage Charges		To be paid to IR by TMC	To be paid to IR by customer	To be paid to IR by GCTO
Wharfage Charges		No wharfage charges	To be paid to IR by customer	NA

Particular	Private Siding	Private Freight Terminal	Road Side Goods Shed	Gati Shakti Cargo Terminal
Charges for Value Added Services		Can be collected from users by TMC		Can be collected from users by GCTO
Terminal Charges	Not applicable in Private Sidings	To be paid to IR by customer		To be paid to IR, will be transferred back to GCTO
Terminal Access Charges				Not applicable
Shunting Charges		To be paid to IR by TMC		To be paid to IR by GCTO
Stabling Charges		To be paid to IR by TMC		To be paid to IR by GCTO
Freight Discount	10% discount on outward traffic to the party bearing cost of work for maximum period of 10 years or till the cost is recovered	No discounts		No Discount
Incentive		No Incentives	Share in Terminal Charge or Terminal Access Charge for a Period not Exceeding 10 years	If benchmark is surpassed for GCT developed on railway land, incentive worth 5% of land licence fees
Tax Liabilities		To be taken care by TMC	Party has to take care of	GCTO will take care
Commercial Staff	Party shall bear the cost of one commercial staff	TMC shall bear the cost of one commercial staff		IR will take care

Annexure II: Rationalisation Orders

Sr No	From	To	To be Routed via	Comments
Central Railways				
1.1	All fertilizer traffic from Hubli Division of SWR, KRCL and Palghat Division of Southern Railway	Destinations on and via Central Railway for which shortest route is via Kulem–Castle Rock–Londa (Electrified Double Line, Work Ongoing)	Ratnagiri–Roha (Electrified Single–Double Line)	Change in distance is higher, to avoid the high gradients on Kulem–Castle Rock–Londa as well as to utilize line capacity of Konkan Railways
Eastern Railways				
2.1	All coal traffic (Originating from any Railway)	For destinations on North Western Railway for which the shorter route is via DDU–JAB–AGA–MTJ (Electrified Double Line)	DDU–MZP–JAB–IDH–BTE–BKI (Electrified Double Line)	To avoid the reversal at Alwar, the Change in distance is small
2.2	Coal traffic from Pirpainti (PPT)/ Pirpainti coal loading siding (PCLS) of Eastern Railway	Destinations for which shortest route is via Kiul–Luckeesarai–Rampur–Dumra (Electrified Double Line)	Gumani–Andal–Pradhankunta (Electrified Double Line)	Single line rail bridge at Kuil is the constraint
2.3	Jute traffic booked from BLY/BHAE	All destinations on ECOR, SER, SECR, SR, and SWR for which shortest route is via BTNG-ADL	BDC-SKG-KPK	Capacity constraints, substantial increase in distance
2.4	All traffic originating from ASN division (Except MDP-MMD section)	Destinations of ECR, NCR, NR, NER, and NWR for which shortest route is via MDP-MMD-KQR (Single Line Section)	To be routed via JMT-SLS-PKA-KQR	Capacity constraints, substantial increase in distance
East Central Railways				
3.1	Coal loaded from NCL sidings and goods sheds located between Billi Jn – Mahadiya and Karaila Road – Shakti Nagar sections of ECR and Mahadiya - Gajara Bahara section of WCR	All destinations on North Western Railway and Northern Railway (except destinations on Lucknow and Moradabad div) for which shortest route is via Chopan– Chunar (Electrified Double Line, Work Ongoing)	Singrauli–Katni–Murwara–Gwalior (Electrified Double Line, Work Ongoing)	High gradient of Chopan–Chunar section, and long length of the block sections in Chopan–Chunar section makes operations difficult
3.2	Coal loaded from NCL sidings and goods sheds located between Billi Jn – Mahadiya – Gajara Bahara and Karaila Road – Shakti Nagar	All destination of Jhansi div, Agra div and Chheoki–Manikpur section of Allahabad div for which shortest route is via Chopan–Chunar (Electrified Double Line, Work Ongoing)	Singrauli–New Katni Jn (Electrified Double Line, Work Ongoing)	High gradients of Chopan–Chunar section, and long length of the block length sections in Chopan–Chunar section makes operations difficult

Sr No	From	To	To be Routed via	Comments
3.3	All coal traffic from Pathardih	All destinations on East Central railway and via Mughalsarai for which shortest route is via Bhojudh–Gomoh (Electrified Single–Double Line)	Pathardin–Pradhankunta–Gomoh (Electrified Single–Double Line)	Gomoh is a busy junction and passenger train movement is also high
	East Coast Railways			
4.1	All goods traffic	Stations reached via Cuttack except stations on Nergundi–Cuttack–Paradeep section (Electrified Double Line)	Barang–Kapilas Road–Byepass avoiding Cuttack (Electrified Double Line)	To avoid the passenger traffic at Cuttack
4.2	Coal traffic from Paradeep port	To TISCO/TWS in SER	Jakhapura–Jaroli (Electrified Double Line, Work Ongoing)	Minor increase in distance
4.3	Traffic originating from Dhamra Port	Destinations for which shortest route is via Jakhapura–Angul–Sambalpur city except for destinations on Sambalpur division of ECoR (Electrified Double Line) (Electrified Double Line)	Bhadrak–Nimpura (Electrified Double Line)	Infrastructural constraints at Sambalpur, High difference in distance on rationalised route
4.4	All traffic to and from NALCO/DMNJ	Stations for which shortest route is via Kottavalsa – Korapur and vice versa (Electrified Double Line, Work Ongoing)	VZM–RGDA–SPRD and vice versa (Electrified Double Line)	Koraput line is prioritized for Steel traffic
	Northern Railways			
5.1	All goods traffic	Destinations for which shortest route is via DLI/NDLS	DSJ	To avoid city traffic
5.2	All freight traffic	For which shortest route is via Alam Nagar - Lucknow - Utraitia & vice-versa	Alam Nagar - Transport Nagar - Utraitia & vice-versa	To avoid city traffic
	North Central Railways			
6.1	Coal traffic from eastern railway, east central railway, south eastern railway and east coast railway	Destinations for which shortest route is via Pt Deen Dayal Upadhyay Jn – Yamuna bridge – Mathura Jn – Palwal (Electrified Double Line)	Pt Deen Dayal Upadhyay Jn – Ghaziabad - Dadri(Electrified Double Line)	To avoid reversal at busy junction Mathura
6.2	All traffic routed via Bandikul	Destinations on North Eastern and terminals on Farukhabad – Shikohabad sections of NCR	Achnera–Kasganj (Electrified Single–Double Line)	Operational Constraints at Agra–Bandikui

Sr No	From	To	To be Routed via	Comments
6.3	All traffic routed via Bandikul	Destinations on NEFR	Achnera–Kasganj–Bara Banki (Electrified Single–Double Line)	Operational Constraints at Agra–Bandikui
6.4	All iron or steel traffic from ER, SER, ECoR, and ECR	To destinations of northern railway for which shortest route is via Yamuna Bridge – Agra city – Raja ki Mandi (Electrified Double Line)	To be routed via Dadri (Electrified Double Line)	Minor derouting for operational feasibility
North Eastern Railways				
7.1	All goods traffic from stations of ER, ECR, SER and ECoR and vice versa	Destinations on CR, NR, NCR, NER, WR and WCR and vice versa for which the shortest route is via Mughalsarai–Varanasi–Madhosingh–Allahabad city (Electrified Double Line)	Mughalsarai–Mirzapur–Allahabad (Electrified Double Line)	To avoid reversal at Allahabad junction
North Western Railways				
8.1	Coal traffic routed via MTJ-AWR	Suratgarh Thermal Power Station (Electrified Single–Double Line)	PWL–TKD–SSB–ROK–JHL–KZW–HMH (Electrified Single–Double Line)	To avoid reversal and junction at Mathura
8.2	All goods traffic except to destinations on (Moradabad division of NR) and (Moradabad -Ramnagar section and Rampur-Kathgodam section of Izzat Nagar division of NER) and (Coal traffic from WR to Prayagraj div on NCR)	Destinations for which present shortest route is KTWS–RGS–FL–PNU and vice versa (Electrified Single–Double Line)	To be routed via KTWS–AELN–PNUN–PNU and vice versa on all stations between AELN and PNUN of WDFC route (Electrified Double Line)	WDFC offers better speeds
South Central Railways				
9.1	Traffic moving via SNF-CHZ or vice versa	Destinations for which the shortest route is via Secunderabad (Electrified Double Line)	SNF–CHZ chordline (Electrified Double Line)	To avoid city traffic
9.2	All traffic originating on KRCL, CR, SCR, SWR, and SR	Destinations on North East Frontier Railway, North Eastern Railway and Samastipur and Sonepur div of East Central Railway for which shortest route is via Bilaspur–Jharsuguda (Electrified Double Line)	Itarsi–Bina–Jhansi–Kanpur–Lucknow–Gorakhpur (Electrified Double Line)	Capacity constraint on Itarsi–Katni–Mughalsarai route and the higher change in distance on rationalised route
9.3	All traffic	Destinations for which shortest route is via Motumari – Vishnupuram – Bibbinagar and vice versa (Electrified Single Line)	Kondapalli–Kazipet or vice versa (Electrified Double Line)	Capacity constraints on single line section of Guntur–Bibinagar

Sr No	From	To	To be Routed via	Comments
9.4	All coal traffic originating from locations in Secunderabad divisions for which the shortest route is via Nandyal–Yerraguntla	Rayalaseema Terminal power plant siding, Muddanuru (Electrified Single Line)	Nandyal–Dhone–Pendekallu-Gooty-Muddanuru (Electrified Double Line)	Minor change in distance
South Eastern Railways				
10.1	Iron ore traffic originating from Kiriburu-Bondamunda and Bursuan-Bimalgarh sections	BKEC/BSCS/BKSC	Nawagaon–Hatia–Muri (Electrified Double Line, Work Ongoing)	Minor increase in distance
10.2	All traffic from all railways	From which shortest distance is Kharagpur – Gokulpur via Girimaidan (Electrified Double Line)	Via Nimpura–Gokulpur (Electrified Double Line)	Minor increase in distance to avoid Kharagpur coaching yard
10.3	All traffic originating from DPS-JRLI section	BSCS for which shortest route is CNI-PRR (Doubling going on)	CNI-MURI (Electrified single line)	To avoid ongoing doubling, minor increase in the distance
10.4	Coal traffic originating from JSRY-MFSJ section of SER and HGR-JSG section of SECR	Power houses falling on NCR, NR, and NWR for which shortest distance is via NKJ	BRKA	Capacity constraints, substantial increase in distance
South East Central Railways				
11.1	Coal traffic from Bilaspur and Raipur div of SECR	Destinations on Bina–Itarsi section in Bhopal Div of WCR and destinations on CR and passing through CR for which shortest route is via NKJ–JBP (Electrified Double Line)	New Katni Jn – Bina Jn (Electrified Double Line)	To facilitate dedicated services to cement sidings on NKJ–JBP and to avoid reversals on the shorter route
11.2	Coal from Korea - Rewa coal field of Bilaspur Div of SECR	Stations on southern and south–central railway and stations on Mumbai div of western railways	Via Katni Marwara – Bina–Khandwa–Bhusaval (Electrified Double Line)	To facilitate dedicated services to cement sidings on NKJ–JBP and to avoid reversals on the short route
11.3	All goods traffic originating on main line of Bilaspur Div Jharsuguda–Durg and Uslapur including all branch line connected on this section	Stations on Vadodara, Rajkot and Ahmedabad div of western railways	Nagpur–Bhusawal–Jalgaon–Surat (Electrified Double Line)	Capacity constraints on Bilaspur–Annupur–Katni Rote
11.4	Coal traffic from and to SECR, SER, ECR	Destinations on CR, SCR and SR for which shortest route is via Gondia–Chanda Fort and vice versa	Nagpur–Balharshah (Electrified Double Line)	Capacity constraints, substantial increase in distance
11.5	Clinker, Fly ash and slag traffic originating from SECR	Destinations falling on DDU and DNR divisions for which shortest route is via JSG	NKJ	Shorter Route

Sr No	From	To	To be Routed via	Comments
11.6	Coal traffic originating from SECR	Destinations falling on Narkher - Badnera section of CR for which shortest route is via Nagpur - Wardha - Badnera	Godhani - Narkher	Shorter Route
		South Western Railways		
12.1	All traffic originating/ terminating and passing through SWR	Having shortest route via Byppanahalli–Omalur or vice versa (Electrified Double Line, Work Ongoing)	Byppanahalli–Tirupati or vice versa(Electrified Double Line)	Minor increase in distance and to avoid single line diesel section
		Western Railways		
13.1	Coal traffic from western railways	Destinations on Allahabad division on North Central Railway for which shortest route is via BKI-BTE	WDFC route (PNUN-AELN)	DFC offers better speed
13.2	All traffic from WR except the traffic originating from Ratlam–Chanderia section of Ratlam division	Destination on Moradabad div of NR, Moradabad–Ramnagar section and Rampur–Kathgodam section of Izzat Nagar division of NER for which the shortest route is via PTR (Electrified Double Line)	Bandikui–Achnera–Mathura (Electrified Single–Double Line)	Shorter route
		Bangladesh Traffic		
14.1	All traffic passing via Dumdum Jn	To Benapole for which the shortest route is via Barasat–Bangaon (Electrified Double Line)	Naihati–Ranaghat–Bangaon (Electrified Single–Double Line)	To avoid suburban traffic

Annexure III: Terminal-wise Pending Indents

Terminal	Clinker	Coal (IMP)	Coal (IND)	Food (PFG)	Iron Ore (Domestic)	L.Stone/ Dolo/Flux (Other)	L.Stone/ Dolo/ Flux (Plant)	Others	Steel	Grand Total
Gevra project colliery			19,695							19,695
Dhori NSD Cilliery Siding Phusro			11,664							11,664
Asansol								8,513		8,513
M/S Balaram siding of M/S MCL			8,092							8,092
Wani			4,832							4,832
Bharhava public siding								3,274		3,274
Baradwar						698	2510			3,208
M/S Dhamra port company siding		1,863					238			2,101

Terminal	Clinker	Coal (IMP)	Coal (IND)	Food (PFG)	Iron Ore (Domestic)	L.Stone/ Dolo/Flux (Other)	L.Stone/ Dolo/ Flux (Plant)	Others	Steel	Grand Total
GCB siding paradeep port							1244			1244
Multai				1177						1177
Jhajha Ballast Siding								1103		1103
Linga				962						962
Chinchvad								891		891
Pandabswar public siding								885		885
Private siding of m/s utkal alumina internatioal ltd								770		770
Kasbe sukene								757		757
Ramtek				688						688
Garha goods shed				634						634
Karad								386		386
Pure-jambad colliery siding			371							371
Parasia				334						334
Jeypore				280						280
Badlghat				234						234
Nimcha colliery siding			206							206
Kaipadar road								179		179
Bankola sdg			161							161
M/S indus udhyog and and infrastructure pvt	133									133
NMDC ironore loading deposit siding					120					120
Nalco siding at Damanjodi								117		117
Tata steel ltd									117	117
Khagaria				104						104
Paradeep port through distance siding							104			104
Jindal steel and power ltd									100	100
Pahaleja				100						100

Terminal	Clinker	Coal (IMP)	Coal (IND)	Food (PFG)	Iron Ore (Domestic)	L.Stone/ Dolo/Flux (Other)	L.Stone/ Dolo/ Flux (Plant)	Others	Steel	Grand Total
Purshottampur ocp			100							100

Annexure IV: Terminal Rating System

Parameters	Information Available on	1	2	3	4	5	6	7	8	9	10	Marks Obtained	Maximum Marks Available	%
Scale of Freight Terminal														
Average rakes handled per line per month	FOIS	0–5		5-7		7–10		10–15		>15				
Traffic flow	FOIS	Decline in traffic more than 20% in last 5 years		Decline in traffic by 20% in last 5 years		Steady traffic (0–5% increase)		5-20% increase in traffic in last 5 years		> 20% increase in traffic in last 5 years				
No. of lines available	Offline (Site)	1 line		2–4 lines		4–6 lines		6–8 lines		> 8 lines				
Distance form national/state highway	Offline (Site)	> 30 km		21–30 km		11–20 km		6–10 km		< 5 km				
Distance from district road	Offline (Site)	> 30 km		21–30 km		11–20 km		6–10 km		< 5 km				
Distance from main market	Offline (Site)	> 20 km		16–20 km		11–15 km		6–10 km		< 5 km				
Seasonality of freight terminal	FOIS	Traffic experienced only for one season (up to 4 months)				Traffic experienced for 5–10 months				Traffic experienced through-out the year				
Total												0	70	0%
Operational Parameters														
Rake Placement														

Rake placement	Offline (Site)	Indirect placement using main line	Indirect placement with half shunting neck available	Indirect placement with full length shunting neck available	Single side direct placement	Both side direct placement			
Length of shunting neck	Offline (Site)	No shunting neck available		Half length		Full Length			
Average placement time (Arrival at the station to placement at g/s)	FOIS	> 120 minutes	60–120 minutes	30–60 minutes	5–30 minutes	Immediate placement			
Availability of shunting engine	Offline (Site)	Available at distance >5 km		Available at distance <5 km		Available at g/s			
Availability of additional looplines/stabling lines	Offline (Site)	No spare line available			1 full length line available	2 or more lines available			
Goods shed totally electrified	Offline (Site)	Not Electrified		Partially electrified		Fully Electrified			
Total								0	60	0%
Placement onwards										
Wharf length	Offline (Site)	< 15 wagon capacity spurs	15–25 wagon capacity spurs	1 Half length	>= 2 Half length	Full length			
Average placement to release time	FOIS	More than 24 hours	12–24 hours in addition to permissible free time	6–12 hours in addition to the permissible free time	2–6 hours in addition to the permissible free time	2 hours in addition to the permissible free time	Within permissible free time		
Average release to dispatch time	FOIS	> 120 minutes	60–120 minutes	30–60 minutes	5–30 minutes	Immediate dispatch			

Longer wharf occupancy hindering further unloading	Offline (Site)	>10 incidents per month		5–10 incident per month		<5 incidents per month			
No of yard derailments	Offline (Site)	>4/year	3/year	2/year	1/year	Nil			
Total							0	50	0%
Commercial Parameters									
Loading/Unloading Infrastructure									
Wharf condition	Offline (Site)	Wharf with Potholes, uneven surface and craters	Kuccha Wharf	Railway Sleepers/ Bricks	Pucca RCC/ Concrete rail-level wharf	Elevated high-level covered wharf			
Circulation area	Offline (Site)	Very congested circulation area	Doable circulation area, kuccha	Small circulation area	Moderate circulation area, Pucca	Adequate robust circulation area			
Approach road	Offline (Site)	Very poor road with potholes	Single lane kuccha road	Single lane pucca road	Double lane pucca road	All weather broad RCC road			
Lightening	Offline (Site)	No lights available		Partial lightening		Adequate lightening available covering whole area			
Last maintenance done for approach road	Offline (Site)	More than 4 years	Between 3–4 years	Between 2–3 years	Between 1–2 years	Within one year			
Frequency of cleaning of leftover goods of loose commodities	Offline (Site)	>24 months	Once in 12–24 months	Once in 6–12 months	Once in 1–6 months	Monthly			
Last wharf and circulation area maintenance	Offline (Site)	More than 4 years	Between 3–4 years	Between 2–3 years	Between 1–2 years	Within one year			
Total							0	70	0%
Loading/Unloading Process									
Average wharfage time	Offline (Site)	> 48 hours	36–48 hours	24–36 hours	Upto 24 hours	Less than a day			

Loading/ unloading mechanism	Offline (Site)	Manual		Mixed		Mechanised			
Operational hours of goods shed	Offline (Site)	Operational only during day time		Operational for 15–24 hours		24 hours operational			
Total							0	30	0%
Storage and Evacuation Related Infrastructure and Services (Ancillary)									
Separate entry exit for freight vehicles	Offline (Site)	Not Available				Available			
Availability of warehouse	FOIS	No warehousing facility at terminal	Open space available to stake 1 rake load	Warehousing space for less than a rake load available	Warehousing space for 1 rake load is available	Warehousing space for 2 rake load is available			
Availability of in motion weighbridge	FOIS	Not available				Available			
FOIS updating system: Manual/ automatic	FOIS	Manual updating				Automatic updating			
Total							0	40	0%
Value Added Services									
Availability of basic facilities for labour	Offline (Site)	No facilities available	Drinking water and washroom available	Open labour shed with washroom and drinking water available	Covered labour shed with washroom and drinking water available	Labour restroom with canteen, washroom, and lockers available			
Availability of basic facilities for merchants	Offline (Site)	No facilities available		A small space available		Fully functional merchant room available with telephone, fax, and internet connection			
Total							0	20	0%

Eco-System Parameters									
Soft Parameters									
Nature of labour	Offline (site)	1	3	5	7	10			
Nature of aggregators	Offline (site)	1	3	5	7	10			
Total							0	20	0%
Freight related services in the city									
Operating hours of freight vehicles	Offline (site)		Restricted during day time			24 hours permitted			
Availability of warehouses in the city	Offline (site)	No warehousing facility available nearby	Warehousing facility available at little distance	Available during day time only	Available for 15–24 hours	24 hours available			
Loading terminals – Connectivity to the production house/mines/key markets Unloading terminals – connectivity with highways and consumption centers	Offline (site)	Kuccha road connected with market	Kuccha road connected with district road as well as key market place	Kuccha road connected with state and national highway as well as key market places	Pucca road connected with district road as well as key market places	Pucca road connecting with national and state highway as well as key market places			
Loading terminals – distance from key source unloading terminals – distance from	Offline (site)	Available during day time only		15–24 hours available		24 hours available			
Congestion at entry/exit of freight terminal	Offline (site)	High and permanent congestion		Moderate congestion		No congestion			
Total							0	50	0%
Grand Total							0	410	0%

Annexure V: Customer Satisfaction Survey

Parameters	1 2	3 4	5 6	7 8	9 10
User Experience					
Advance Intimation on Arrival of Rake for Loading/ Unloading	In withthin less than 3 hours of arrival time	4 - 10 hours before arrival	10 - 17 hours before arrival	18 - 23 hours before arrival	24 hours before arrival
Wharf Condition	Wharf with Potholes, uneven surface and craters	Kuccha Wharf	Railway Sleepers/Bricks	Pucca RCC/ Concrete rail-level wharf	Elevated high-level covered wharf
Condition of Circulation Area	Very congested circulation area	Doable circulation area, kuccha	Small circulation area	Moderate circulation area, Pucca	Adequate robust circulation area
Approach Road	Very poor road with potholes	Single lane kuccha road	Single lane pucca road	Double lane pucca road	All weather broad RCC road
Adequate Lighting	No lights available		Partial lighting		Adequate lighting available covering whole area
Availability of Storage Space to Stack Goods	No warehousing facility at terminal	Open space available to stake 1 rake load	Warehousing space for less than a rake load available	Warehousing space for 1 rake load is available	Warehousing space for 2 rake load is available
Availability of Merchant Room	No facilities available		A small space available		Fully functional merchant room available with telephone, fax and internet connection
Availability of Basic Facilities for Labour	No facilities available	Drinking water and washroom available	Open labour shed with washroom and drinking water available	Covered labour shed with washroom and drinking water available	Labour restroom with canteen, washroom and lockers available
Road Connectivity to/from Freight Terminal	Kuccha road connected with market	Kuccha road connected with district road as well as key market place	Kuccha road connected with state and national highway as well as key market places	Pucca road connected with district road as well as key market places	Pucca road connecting with National and State Highway as well as key market places

Parameters	1	2	3	4	5	6	7	8	9	10
Extent of Restrictions at Freight Terminal	More than 20 Days of Restriction in a Year		15 - 20 Days of Restriction in a Year		10 - 15 Days of Restrictions in a Year		5 - 10 Days of Restrictions in a Year		0- 5 Days of Restrictions in a Year	
Total										
Perception Survey										
How would you rate your booking experience?	1	2	3	4	5	6	7	8	9	10
How would you rate cooperation of railway commercial staff?	1	2	3	4	5	6	7	8	9	10
How would you rate Terminal Infrastructure?	1	2	3	4	5	6	7	8	9	10
How satisfied are you with the rolling stock provided?	1	2	3	4	5	6	7	8	9	10
How would you rate the delivery time of Railways? (Reliability)	1	2	3	4	5	6	7	8	9	10
How would you rake tracking/ tracing system?	1	2	3	4	5	6	7	8	9	10
Total										
Grand Total										

This report is part of a larger study 'Strategies to Increase Railway's Share in Freight Transportation in India'. The study has identified and discussed three key aspects concerning the growth of the freight business: Terminal Development and Operations, Freight Marketing Policies, and Rail Freight Tariff Policies.

Rest of the reports, policy briefs, and opinion pieces can be accessed using the given link/QR code: https://www.teriin.org/project/strategies-increase-railways-share-freight-transportation

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