Dedicated Freight Corridor on Indian Railways:
A Catalyst for Industrial Growth

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Prologue

The Golden quadrilaterals of the Indian Railways consisting of routes connecting the four metros and the diagonals carry over 55% of freight traffic. These routes are already oversaturated. Capacity constraints on these routes have had a major contribution to the loss of market share of Railways. There is an urgent need for augmentation of capacity on these routes. Environment considerations also indicate an increase in market share of railways.

The Dedicated Freight Corridor (DFC) project is the single largest project for augmenting rail infrastructure capacity in India. The project will require mobilization of a large work force of technical and skilled manpower in design and execution of the project. New techniques in all spheres like engineering, contracting, project management and financial modelling will have to be adopted apart from induction of modern railway technology in all aspects of rail infrastructure, rolling stock, operations and maintenance. Its completion will have a major impact on improving transportation infrastructure which will enhance India’s attractiveness in all sectors of the Industry served by the Eastern and Western Dedicated Freight Corridors.

Introduction

Subsequent to the adoption of economic liberalization policies by the Government of India, the nation has been witnessing a new growth scenario. Even after the economic meltdown of 2008, the recent high industrial growth rate indicates that the Indian industry is coming out of the distressed state. These have happened
as a result of an upswing in the production of the manufacturing sector that accounts for 80% of industrial output. Along with the manufacturing sector, mining and electricity sectors have also contributed to high rates of growth.

The improvement in industrial growth has come about as a result of measures taken by the government to support overall economic activity. The core infrastructure industry sector largely remained insulated from the economic crisis. The growth mainly came from cement, steel, coal and power sectors. The continued growth of Indian economy has created demand for additional capacity of freight transportation. This is likely to grow further in future.

The Indian Railway’s quadrilateral linking the four metros viz. Delhi, Mumbai, Chennai and Kolkata (Howrah), commonly known as the Golden Quadrilateral and its two diagonals viz. Delhi–Chennai and Mumbai- Howrah links, adding up to a total route length of 10,122 km, carry over 55% of revenue earning freight traffic of Indian Railways. The existing trunk routes of Howrah-Delhi on the East and Mumbai-Delhi in the West are highly saturated with line capacity utilization in excess of 100%. The rail borne container traffic is growing @16% per annum and additional container handling berths at JNPT, Mumbai and major ICDs in North India are expected to generate huge volumes of traffic.

**Loss of market share by Rail**

The share of railway transport in freight has been decreasing over the years. In 1950-51, the rail share of the freight market was 89%. This has come down to barely 30% in 2007-08. Rail and road modes together carry nearly 91% of the traffic in our country. The Report of the Rakesh Mohan Committee (July 2001) indicated that if proper inputs had gone into Indian Railways, its market share could have been to the tune of around 60%, resulting in an annual saving of Rs. 7,500 crore on HSD alone as rail transport is about 6 times more fuel efficient than road transport. Unfortunately, the effective budgetary support to Indian Railways has reduced over the years from 33% to 5% of Gross Traffic Receipts. On the other hand, roads and highways are constructed either on government funds or on substantial subsidy ranging upto 40%. For this reason, road transport sector gets preferential treatment over rail. Scenarios in UK, Switzerland and France are in sharp contrast where the government support is extended to railway systems ranging from 33% to 47 % of their respective revenues.

**Silver lining**

In the present environment of cut throat competition resulting from globalization policy, the Indian industry has realized the adverse impact of neglecting the Railways which is a more energy efficient mode of transport. The cost of transportation of raw materials and goods in our country is high in comparison to developed countries. The idea of road transport being cheaper than rail is gradually fading away and it is now evident that the tilted policy favouring road transport bears adverse results. The Eleventh
Five Year Plan indicates a significant change in the Railways’ investment strategy for capacity augmentation. So far, the emphasis has been on incremental capacity augmentation. A major policy shift has been observed with the announcement of construction of Dedicated Freight Corridors separating freight traffic from passenger traffic on trunk routes. Moreover, the Indian Railways (IR) has planned to increase the market share of freight traffic by improving the quality of service with reduction in transit time and better reliability. IR will also facilitate building of logistics parks, container and other freight terminals through public-private participation to further encourage the movement of commodities by rail.

**Major constraints on existing railway network**

Under the present mixed traffic pattern, the railways find it difficult to carry even the existing freight traffic efficiently, not to mention inability to promote future growth of traffic to meet the demands of a developing economy. The routes, which are managed by multiple railway zones and divisions, suffer from severe bottlenecks at key junctions. At present, both passenger and freight services are run on the same track and there is a substantial speed differential between the two. Passenger trains are normally given preference in running. Also, while passenger trains run to a fixed schedule, freight trains have to find their passage in the leftover slots resulting in their slowing down considerably. As a result, valued customers of freight services cannot be offered guaranteed schedule and transit times for their goods.

**Need for Dedicated Freight Corridor (DFC)**

The growing demand for increase in freight transport capacity has led to the concept of tracks dedicated to freight services resulting in approvals for dedicated freight corridors along the Eastern and Western routes, in the first instance. The growing need for coal transportation to power plants all over the country, booming infrastructure construction and growing international trade require Dedicated Freight Corridors and the Government took the historic decision.

**Objectives**

The broad objectives of DFC are:

- Create additional rail infrastructure to cater to the increased levels of transport demand.
- Introduce time tabled freight services and guaranteed transit time.
- Segregate freight infrastructure for a focused approach to both passenger and freight business of Railways.
- Reduce unit cost of transportation by speeding up freight train operations, increasing axle loads and improvements in productivity.
- Increase rail share of freight market by providing customized logistics services.
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- Reduce emission of Green House Gases (GHGs) by encouraging a modal shift from road to rail.

Benefits

The major benefits that are likely to accrue from DFC are:

- Congestion at terminals and junction stations can be minimized.
- Detention time at terminals will reduce.
- Higher fuel efficiency due to seamless and unhindered movement.
- Reduced emission of GHGs.
- With double stack containers, the number of trains can be reduced by nearly half for the same throughput.
- Release of line capacity on the existing corridors, which will fulfill unsatisfied passenger demands. This will also lead to faster movement of passenger trains.
- Reduction in operating staff costs due to fewer stations and higher speeds.
- Increase in throughput due to higher axle loads.
- Unit cost of transportation will get reduced.

Association of RITES with the Project

In July 2005, RITES was entrusted with the Preliminary Engineering-cum-Traffic Survey (PETS) of both Eastern and Western Corridors spanning over a length of over 2,760km. On the Eastern sector, the study was for Sonnagar – Ludhiana section while on the Western sector, it was from JNPT, Mumbai to Dadri with a link to Tughlakabad, ICD. The Feasibility Report for both the corridors was submitted in January 2006. After the in-principal approval, Preliminary Engineering-cum-Traffic Survey (PETS) was taken up and the report submitted in January 2007. This report estimated a project cost of Rs.282 billion.

The Eastern Corridor is proposed to be connected to a Deep Sea Port in Kolkata region. Since the exact location of that Port is yet to be decided, this corridor has been proposed to be extended upto Dankuni for the present with ultimate connection to that Port. The Draft PETS Report for this extension, covering a length of over 520km, was submitted in 2009 and the work is estimated to cost Rs.75 billion.

Formation of DFCCIL

For planning and development, mobilization of financial resources, construction, operation and maintenance of Dedicated Freight Corridors, Ministry of Railways initiated action to establish a Special Purpose Vehicle (SPV) which led to the establishment of Dedicated Freight Corridor Corporation of India Limited (DFCCIL) in October 2006. This company is now actively engaged in the implementation of this project.
A. Eastern Corridor

Description of Project

From Sonnagar to Ludhiana

The Eastern Corridor includes a double track electrified corridor from Sonnagar on the East-Central Railway to Khurja on the North-Central Railway (820 km), Khurja to Dadri on North-Central Railway (46 km) and single electrified track from Khurja to Ludhiana (412 km) with sub-structure for double track on Northern Railway. The total length works out to 1,279 km through states of Bihar, Uttar Pradesh, Haryana and Punjab.

From Sonnagar to Dankuni

In the existing route from Sonnagar to Dankuni (516 km), there are double electrified tracks, triple electrified tracks (one up, one down and one reversible) and quadruple electrified tracks (two up and two down) in different stretches. The DFC Extension route falls under the jurisdiction of East-Central Railway from Sonnagar to Pradhankhanta (285 km) and on Eastern Railway from Pradhankhanta to Dankuni (237 km). The total length is 522 km through states of Bihar, Jharkhand and West Bengal. This will be an electrified, double track section.

Alignment of the corridor is generally parallel to the existing tracks. However, due to non-availability of adequate space along the existing corridor, particularly near important city centres and industrial townships, the alignment of the corridor takes detours to bypass those. Since the origins and destinations of traffic do not necessarily fall on the DFC, a number of junction arrangements have been planned to transfer traffic from the existing Indian Railways corridor to the DFC and vice versa at the following locations: Sirhind, Rajpura, Kalanaur, Khurja, Daudkhan, Tundla, Bhaupur, Prempur, Naini/Cheoki, Jeaonathpur, Mughalsarai, Ganjkhwaja, Sonnagar, Gomoh, Andal-East and West and Dankuni. Besides these terminals and junctions, 62 crossing stations have been proposed at suitable intervals.

It has also been proposed to set up Logistics Parks near Ludhiana (Punjab), Kanpur (UP) and Durgapur (WB) which are proposed to be developed on the PPP mode.

Traffic Projection on Eastern Corridor

The traffic projected to move on the Eastern corridor in both directions consists of traffic whose origins and destinations mostly fall outside the DFC. In the up (UP) direction, between Dankuni and Ludhiana, traffic of coal, iron and steel etc. originating at different feeder lines will converge at Andal, Gomoh, Sonnagar and Kanpur and branch off at junction stations like Mughalsarai, Allahabad, Kanpur, Tundla, Dadri,
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Kalanaur, Rajpura, Sirhind and finally terminate at Dhandarikalan, the serving station for Ludhiana. In the down (DN) direction from Ludhiana to Dankuni, the traffic converges at Dhandarikalan, Dadri, Tundla, Kanpur, Allahabad, Andal and Gomoh and disperses from the corridor at junctions like Kanpur, Allahabad, Mughalsarai, Sonnagar, Gomoh, Andal and Dankuni. Notwithstanding the above, the projected traffic is envisaged to be rail-borne, beyond terminal stations of the DFC, and both originating and terminating traffic would move on the existing network of Indian Railways. The Eastern corridor is projected to cater to a number of traffic streams – coal for the power plants in the northern region of UP, Delhi, Haryana, Punjab and parts of Rajasthan from Eastern Coalfields, lime stone from Rajasthan to steel plants in the east in addition to other goods like finished steel, food grains, cement, fertilizers etc.

The total traffic in UP direction is assessed to go up from 38 million tonnes in 2005-06 to 117 million tonnes in 2021-22. Similarly, in the DN direction, the traffic level has been projected to increase from 14 million tonnes in 2005-06 to 28 million tonnes in 2021-22. Thus the incremental traffic over the base year of 2005-06 works out to 92 million tonnes. A significant part of this increase would get diverted to the DFC. By 2021-22, UP direction traffic on DFC is estimated to be 78.01 million tonnes and the DN direction traffic is estimated as 13.32 million tonnes.

**Traffic Projections on Eastern Route (in million tonnes/year)**

<table>
<thead>
<tr>
<th>Direction/ Commodity</th>
<th>2016-17</th>
<th>2021-22</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UP Direction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powerhouse Coal</td>
<td>81.52</td>
<td>89.02</td>
</tr>
<tr>
<td>Fertiliser Coal</td>
<td>1.90</td>
<td>1.90</td>
</tr>
<tr>
<td>Public Coal</td>
<td>3.55</td>
<td>3.88</td>
</tr>
<tr>
<td>Steel</td>
<td>13.13</td>
<td>14.63</td>
</tr>
<tr>
<td>Others</td>
<td>3.60</td>
<td>4.80</td>
</tr>
<tr>
<td>Logistic Park</td>
<td>1.20</td>
<td>2.40</td>
</tr>
<tr>
<td><strong>Total (UP Direction)</strong></td>
<td><strong>104.90</strong></td>
<td><strong>116.63</strong></td>
</tr>
<tr>
<td><strong>DOWN Direction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertiliser</td>
<td>3.00</td>
<td>3.15</td>
</tr>
<tr>
<td>Foodgrains</td>
<td>3.09</td>
<td>3.09</td>
</tr>
<tr>
<td>Cement</td>
<td>2.33</td>
<td>2.95</td>
</tr>
<tr>
<td>Limestone for Steel Plants</td>
<td>7.90</td>
<td>7.91</td>
</tr>
<tr>
<td>Salt</td>
<td>3.10</td>
<td>3.45</td>
</tr>
<tr>
<td>Others</td>
<td>3.60</td>
<td>4.80</td>
</tr>
<tr>
<td>Logistic Parks</td>
<td>1.20</td>
<td>2.40</td>
</tr>
<tr>
<td><strong>Total (DN Direction)</strong></td>
<td><strong>24.22</strong></td>
<td><strong>27.75</strong></td>
</tr>
<tr>
<td><strong>Grand Total (UP+DN)</strong></td>
<td><strong>129.12</strong></td>
<td><strong>144.38</strong></td>
</tr>
</tbody>
</table>
B. Western Corridor

Description of Project

The feasibility study for the Western Corridor from J.N. Port to Dadri was undertaken for the two options viz. (i) J.N. Port – Vadodara – Ratlam – Kota - TKD along Delhi-Mumbai Rajdhani route and (ii) J.N.Port – Vadodara – Ahmedabad – Palanpur – Phulera – Rewari – TKD – Dadri. The alignment via Ahmedabad – Palanpur was recommended for construction due to the fact that traffic movement will be much more on this alignment, as major traffic nodes such as ports of Mundra, Kandla, Pipavav, Hazira (under development) on the coast of Gujarat and other traffic nodes (Ahmedabad, Rajkot) will be better served besides other considerations beneficial to DFC. This was accepted and accordingly PETS was carried out for this route.

The proposed route is 1,483 km long from JNPT terminal yard near Mumbai to Dadri via Vadodara – Ahmedabad – Palanpur – Phulera – Rewari. The alignment passes through six states of Maharashtra, Gujarat, Rajasthan, Haryana, Delhi and Uttar Pradesh and seven railway divisions of Mumbai CST, Mumbai Central, Vadodara, Ahmedabad, Ajmer, Jaipur and Delhi which fall under Central, Western, North Western and Northern railway zones. In addition, a 32 km long single line connection from proposed Pirthala Junction Station (near Asaoti on Delhi – Mathura line) to Tughlakabad has been proposed.

Along most of the length of the corridor, the alignment is parallel to the existing railway track, but diversions have become unavoidable in a number of stretches for reasons such as avoiding heavily built-up areas as well as other technical and land acquisition constraints. A total of nine junction stations and three terminal stations have been proposed at Vasai Road, Gothangam, Makarpura, Sabarmati, Palanpur, Marwar, Phulera, Rewari and Pirthala – junction stations and JNPT, Dadri and Tughlakabad – terminal stations. In addition, 32 crossing stations have been proposed at suitable intervals.

Navi Mumbai (Maharastra), Vapi (Gujarat), Ahmedabad (Gujarat), Gandhidham (Gujarat), Jaipur (Rajasthan) and NCR (Delhi) have been identified for setting up Freight Logistics parks. These may also be developed on Public Private Partnership (PPP) mode as in the case of the Eastern Corridor.

Traffic Projection on Western Corridor

The traffic on the Western Corridor mainly comprises containers from JNPT and Mumbai Port in Maharastra and ports of Pipavav, Mundra and Kandla in Gujarat destined to various ICDs located in northern India, particularly those at Tughlakabad, Dadri and Dandharikalan. Other commodities are POL, fertilizers, food grains, salt, coal, iron, steel and cement. The share of container traffic is expected to progressively increase and is assessed to reach a level of about 80% by 2021-22. In absolute terms, by this horizon year, it is estimated that this corridor will handle 5.29 million TEUs of container traffic. Other commodities are projected to increase from 23 million tonnes in 2005-06 to 40 million tonnes in 2021-22. The Western DFC has two broad streams of traffic, one, between the terminal nodes at either end, i.e. J.N.Port and
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Delhi/Ludhiana, and the other, the traffic entering from branch line feeder routes at the various junction points enroute. With some variations in numbers, this phenomenon is applicable to both directions of movement. Major commodities moving in the DN direction include containers, POL, fertilizers, coal, salt and cement. Except container traffic, which originates from J.N. Port, other commodity streams join the route at different inter-connectivity points from Vasai Road to Palanpur. Substantial streams of container traffic from Mumbai, Hazira, Pipavav, Kandla and Mundra ports will also join the DFC at Vasai Road, Gothangam, Sabarmati and Palanpur. Commodities moving in the UP direction mainly comprise containers, food grains, POL, cement, fertilizers, general goods and empties. Here, end-to-end traffic is primarily of containers. Other streams join at different points from Rewari to Makarpura (Vadodara). Substantial part of container traffic will also dissipate enroute at different ports of Gujarat.

### Traffic Projections on Western Route (in million tonnes/year)

<table>
<thead>
<tr>
<th>Commodity</th>
<th>2016-17</th>
<th>2021-22</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UP Direction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertilizer</td>
<td>1.461</td>
<td>1.613</td>
</tr>
<tr>
<td>POL</td>
<td>1.712</td>
<td>1.891</td>
</tr>
<tr>
<td>Cement</td>
<td>0.227</td>
<td>0.289</td>
</tr>
<tr>
<td>Salt</td>
<td>0.666</td>
<td>0.735</td>
</tr>
<tr>
<td>Food grains</td>
<td>5.128</td>
<td>5.662</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>0.826</td>
<td>0.957</td>
</tr>
<tr>
<td>Iron and Steel</td>
<td>0.027</td>
<td>0.034</td>
</tr>
<tr>
<td><strong>Total (UP Direction)</strong></td>
<td><strong>10.047</strong></td>
<td><strong>11.181</strong></td>
</tr>
<tr>
<td><strong>DN Direction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td>6.637</td>
<td>8.759</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>5.328</td>
<td>5.883</td>
</tr>
<tr>
<td>Food grains</td>
<td>0.201</td>
<td>0.221</td>
</tr>
<tr>
<td>Cement</td>
<td>1.611</td>
<td>2.056</td>
</tr>
<tr>
<td>Iron &amp; Steel</td>
<td>0.615</td>
<td>0.784</td>
</tr>
<tr>
<td>Salt</td>
<td>2.858</td>
<td>3.155</td>
</tr>
<tr>
<td>POL</td>
<td>5.078</td>
<td>5.607</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1.930</td>
<td>2.237</td>
</tr>
<tr>
<td><strong>Total (DN Direction)</strong></td>
<td><strong>24.256</strong></td>
<td><strong>28.702</strong></td>
</tr>
<tr>
<td><strong>Grand Total (UP+DN)</strong></td>
<td><strong>34.303</strong></td>
<td><strong>39.884</strong></td>
</tr>
</tbody>
</table>

### Containers (In million TEUs)

<table>
<thead>
<tr>
<th></th>
<th>2016-17</th>
<th>2021-22</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UP Direction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Stack</td>
<td>1.505</td>
<td>1.591</td>
</tr>
<tr>
<td>Double Stack</td>
<td>0.871</td>
<td>1.534</td>
</tr>
<tr>
<td><strong>Total (UP Direction)</strong></td>
<td><strong>2.376</strong></td>
<td><strong>3.125</strong></td>
</tr>
<tr>
<td><strong>DN Direction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Stack</td>
<td>1.408</td>
<td>1.437</td>
</tr>
<tr>
<td>Double Stack</td>
<td>0.884</td>
<td>1.555</td>
</tr>
<tr>
<td><strong>Total (DN Direction)</strong></td>
<td><strong>2.292</strong></td>
<td><strong>2.992</strong></td>
</tr>
<tr>
<td><strong>Grand Total (UP+DN)</strong></td>
<td><strong>4.668</strong></td>
<td><strong>6.118</strong></td>
</tr>
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</table>
Feeder Routes

Both the rail corridors have been planned with an axle load of 32.5t for bridges and sub-structures and 25t for track structure with a design speed of 100 km/h. Since part traffic will originate and terminate on existing railway network, it has been decided to upgrade the feeder routes of the proposed DFC for 25t axle load. The bridges falling on these routes will also be upgraded suitably. The total approximate lengths of such feeder routes to be upgraded are 2,082km and 2,632km on Eastern and Western Corridors respectively.

Signalling and Telecommunication

Automatic Signalling with 2km spacing between signals has been adopted for Dankuni-Sonnagar-Khurja section of the Eastern Corridor including Khurja-Dadri link. The single line section from Khurja – Ludhiana will also have automatic signalling but with Absolute Block System. The Western Corridor too will have automatic signalling. Independent OFC system will be used for traffic control communication and also for GSM-R communication network. GSM-R system will be adopted for mobile train radio communication.

Traction

On Indian Railways, 3 systems of Electric Traction are in vogue, viz. 1500 V DC system in and around Mumbai, 25kV Booster Transformer (BT) system in most of the electrified routes and 2x25kV Auto Transformer (AT) system in Katni-Anuppur-Bilaspur section. The DC system is now almost obsolete due to high currents resulting in heavy OHE and its support structures, large voltage drops and fire hazards associated with high currents. The 25kV system is employed as a rule unless high power demand associated with heavy trains or high speed trains necessitate 2x25kV AT system. Because of heavy train requirements on the Eastern Corridor, 2x25kV AC traction system with Auto Transformers has been adopted. The Western Corridor will be on diesel traction.

Maximum Moving Dimension (MMD)

In the year 1913, a uniform Schedule of Dimensions was formulated for Broad Gauge and issued by Railway Board. Subsequently, in 1922 and again in 1929 attempts were made to liberalize these for induction of wider bodied stock and to cater for electrification. But this could not proceed further due to financial constraints. The low productivity of IR freight stock is attributable, amongst others, to the adoption of severely restrictive moving dimensions, along with a relatively low axle load, larger wheel diameter and a coupling height of 1105 mm. The table below indicates the ratios of maximum height and width to gauge for some of the railway systems in the world. It is seen that these ratios for IR’s BG network are the lowest.
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<table>
<thead>
<tr>
<th>Railway</th>
<th>Track gauge (mm)</th>
<th>Ratio of max. ht. from Rail level to gauge</th>
<th>Ratio of max. width to gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>1435</td>
<td>3.1</td>
<td>2.12</td>
</tr>
<tr>
<td>UIC</td>
<td>1435</td>
<td>3.0</td>
<td>2.20</td>
</tr>
<tr>
<td>South Africa</td>
<td>1067</td>
<td>3.72</td>
<td>2.86</td>
</tr>
<tr>
<td>Botswana</td>
<td>1067</td>
<td>4.40</td>
<td>3.60</td>
</tr>
<tr>
<td>Kenya</td>
<td>1000</td>
<td>4.11</td>
<td>3.04</td>
</tr>
<tr>
<td>Tanzania</td>
<td>1000</td>
<td>3.40</td>
<td>2.73</td>
</tr>
<tr>
<td>India (MG)</td>
<td>1000</td>
<td>3.43</td>
<td>2.74</td>
</tr>
<tr>
<td>India (BG)</td>
<td>1676</td>
<td>2.54</td>
<td>1.96</td>
</tr>
</tbody>
</table>

The Dedicated Freight Corridor now provides Indian railways an opportunity to adopt liberalized Moving Dimensions. The criteria for determining the Maximum Moving Dimensions for the Dedicated Freight Corridors encompass the following:

- Facilitate Double Stack container operation especially on the route connecting the ports of Western India with Northern India.
- Facilitate ‘Roll-On Roll-Off’ (RO-RO) operations to decongest the highways and reduce the overall cost of transportation in the country.
- Facilitate autorack wagon movement for passenger cars from manufacturing units to distribution centres and ports.
- Provide reasonable amount of inter-operability between the Freight Corridors and the existing network.

The maximum height requirement would be for double stack container operation and tri-level autoracks. Apart from these, RO-RO wagons and freight stocks of high productivity such as BOXN type open/gondola wagons, covered general service BCN type wagons, commodity specific covered hoppers, open hoppers etc. with increased width and higher axle load will be introduced on Dedicated Freight Corridors and feeder routes. These will result in quantum jump in pay load per train.

As single stack containers are planned on Eastern corridor, it has been decided by the Railway Board that the vertical height of MMD on eastern corridor will be 5100 mm. This has been raised to 7100 mm on the Western corridor to cater for double stack containers. The width of the MMD has been taken as 3660 mm for both the corridors.
Minimum Track Spacing

Indian Railway’s Schedule of Dimension provides 5.3m track centre for BG tracks. To accommodate wider stocks, minimum track centre for DFC has been stipulated as 6.0m. In most of the cases where DFC runs parallel to the existing track, a minimum spacing of 7.0m has been stipulated between DFC and adjoining track to accommodate OHE equipment and longitudinal drains.

Rolling Stock

Studies have shown that with the increase in axle load, the payload to tare ratio improves. This is because the tare weight of the wagon does not go up in the same proportion as the gross weight or axle load. A higher axle load results in higher Pay to Tare ratio, even though the basic wagon design and construction style remains unchanged. The axle loads of 30t and 32.4t are now well established on railway systems in North America, South Africa and Australia. A few other countries in Europe have also opted for 30t axle load. Since the technology for high axle load operations has matured and it gives substantially higher throughput, it would be advantageous to go for 32.5t axle load. The present maximum axle load permitted on Indian railways is 22.9t. From the consideration of interoperability with the existing system, 25t axle load has been adopted initially for rolling stocks on freight corridor and 32.5t axle load for designing bridges and track sub-structures to take care of future requirements.

Presently, flat bed wagons (BLC design) are being used on the Indian railway for container traffic. A train load hauls 45 wagons with 2 TEUs per wagon; thus 90 TEUs per train. The wagon has a low floor height of 1009 mm. Use of flat bed wagons for double stack containers gives a straight increase of 100% in throughput in terms of TEUs. On the other hand, well type wagons will have a floor height of 400mm, but the throughput increase will be only around 40-45% even with articulated bogies. However, with flat wagons there is an increase in the loaded height, and consequently higher centre of gravity. RDSO had conducted oscillation trials of double stack containers, each of 9’6” height, on BLC (axle load 22.0t) wagon up to a trial speed of 110 kmph. After those trials, commercial speed has been fixed at 100 and 90 km/h with loaded and empty containers respectively. Keeping safety in view in conjunction with increase in throughput for the DFC, Railway Board has decided to operate double stack containers on well wagons.

Freight stocks for non-containerized traffic such as minerals, ore, food grain, fertilizer, cement, steel products, POL and other traffic like RO-RO and auto car wagons are:

- Coal – Open gondola type similar to BOXN.
- Cement, food grain, fertilizer etc. in bags – Covered box type similar to BCNA.
• POL – Tank wagon BTFLN.
• Finished steel products – Flat type similar to BRNA.
• Automobile cars – Auto racks.
• Road lorries – RO-RO wagons.

Technical and Social Challenges

• Land acquisition for any purpose is a challenging task in India and DFC is not an exception. Wherever major diversions have been proposed, land acquisition will be required. Land acquisition may also be required along parallel stretches if existing ROW is not wide enough to accommodate DFC tracks. This may be a difficult and time-consuming task.

• Construction of bridges, ROBs and flyovers for DFC may necessitate a number of speed restrictions on the existing rail route, affecting existing operations.

• All level crossings with TVUs 50,000 or more are proposed to be converted to ROBs/RUBs. In detour portions, Road-over-bridges (ROBs)/Road-under-bridges (RUBs) have been provided for all road crossings. Wherever feasible, RUBs have been preferred even if it results in higher embankments since these are cheaper and find greater acceptance from local population.

• Extension of existing level crossings will involve crossing with at least four lines. Introduction of additional trains will lead to longer periods of closure of gates resulting in long waiting periods for road users. To obviate the possibility of accidents, a synchronized system will have to be developed.

• Replacement of level crossings with ROBs will cause hardship to local population as they may have to travel long distances to cross the tracks and would also have to negotiate steeper grades with their livestock and non-motorized transport.

• In urban areas, acquisition of land for construction of new ROBs/RUBs as well as for extension of existing ROBs/RUBs to accommodate additional tracks of DFC will pose major problems due to existence of buildings, structures and habitation nearby. Some roads may also need diversion or relocation. Providing connection to new ROBs from existing road network will require detailed planning.
For load transfers from and to DFC and existing line, junction stations on DFC have to be connected to existing rail network. This, at the construction stage, will require non-interlocking of existing yards which, in turn, will involve speed restrictions, affecting existing operations.

**Target for commissioning**

Both the DFC corridors are to be constructed simultaneously and it is envisaged that the corridors will be fully operational over their entire length by early 2017.

**DFC : A Catalyst for Industrial Growth**

DFC is the Indian Railways’ most ambitious project ever. Though express-ways are an alternative for transporting goods, there is still no other option for transporting bulk/heavy raw materials such as coal and steel than through railways. The dedicated freight corridors are expected to act as a catalyst for economic growth and encourage value-added services such as the creation of logistics parks and industrial hubs along their routes. However, in order to take advantage of this opportunity, states have been advised to make serious and definitive improvements in improving its infrastructure, particularly power and transportation.

The 1,483-km long Dedicated Freight Corridor along the Western alignment is expected to go into operation by 2013. In this case, however, development along the route will not wait for completion of the line, but will simultaneously see the DMIC (Delhi Mumbai Industrial Corridor) taking shape to utilise the high speed rail network to transport finished goods to Mumbai or other west coast ports for exports, and elsewhere in the vast Indian sub-continent.

**Industrial Corridors**

A 150-km broad swath on both sides of the proposed rail corridor, which is proposed to be developed as the “industrial corridor”, will, in the first phase of its implementation, see the creation of four industrial nodes – Palanpur-Mehsana, Ahmedabad-Dhoera, Vadodara-Ankleshwar and Bharuch-Dahej – while two more such nodes will be established between Surat and Hazira, Valsad and Umargam in the second phase. It is proposed to develop these industrial nodes as “global manufacturing hubs”.

Involving about a dozen SEZs (Special Economic Zones) each in Phase I and Phase II, it will usher in an era of unprecedented growth in the beneficiary States – the NCR, Haryana, Uttar Pradesh, Rajasthan, Gujarat, Madhya Pradesh and Maharashtra.
Dedicated Freight Corridor on Indian Railways: 
A Catalyst for Industrial Growth

Being developed entirely in the joint sector, with participation of large industrial houses such as Reliance, etc., the proposed SEZs will also have six logistics parks, including container depots. The western sector will have four – at Navi Mumbai, Ahmedabad, Vapi, and NCR (Rewari) – while two will come up on the eastern sector near Ludhiana and Kanpur, owned and managed by DFCC, again as joint ventures.

Approval has been given for setting up of 26 new SEZs. Fortunately, the ones in the DMIC appear, so far, to be on course and are likely to be operational as per the schedule.

Western Corridor

The beneficiaries of the western freight corridor project include power houses, mines, ports, industrial installations, manufacturing units, agricultural sector, services sector and the people of Gujarat, Maharashtra and Rajasthan.

The DFC project is an important part of “Delhi-Mumbai Industrial Corridor (DMIC) initiative”, which is an Indo-Japanese collaborative project for comprehensive infrastructure development to create India’s largest industrial belt zone by linking the industrial parks and ports of the six States between Delhi and Mumbai to promote foreign export and direct investment, particularly those in Japan.

Under the DMIC initiative, the idea is to create industrial parks and logistics bases with well-developed infrastructures in the 150 km stretch on either side of the Western Corridor.

DMIC Corporation has ambitious plans to set up a 4,000-MW power plant, three greenfield ports and six airports. It will also link 10 cities with an over 10 lakh (1 million) population, including Faridabad, Surat, Delhi, Greater Mumbai, Meerut, Jaipur, Ahmedabad, Pune and Nasik.

Eastern Corridor

With the almost simultaneous completion the Eastern Dedicated Rail Freight Corridor in the next 4 years, experts feel that there would be an unprecedented scope for industrial growth. More so as out of the 1,256-km long corridor from Ludhiana to Kolkata, 1,002 km would run through Uttar Pradesh itself, cutting across industrial clusters like Saharanpur, Meerut, Aligarh, Hapur, Khurja, Tundla, Kanpur and Allahabad.

As the eastern and western freight corridors will meet at Dadri, it would provide an immense opportunity. With about 32 pairs of goods trains set to run in the dedicated eastern tracks daily, the corridor will act as a big boost for carrying goods, both raw and finished directly from industrial link clusters to the sea gateways of Mumbai and Gujarat, thereby reducing both time and cost. Reduction in costs would
also be ensured as transportation would be done by double stack trains, which would carry double the tonnage of a normal train, thus translating into lower freight cost per tonne.

Advantages

By establishing a dedicated freight corridor, better efficiency can be achieved. Intensive monitoring for timely delivery, increase in trailing load of trains, claim-free movement of goods, improved services such as refrigerated containers for perishable goods, etc., can be provided.

Tremendous commercial advantages will accrue to the nation and the railways when the dedicated freight corridor is operationalised. However, for a developing country like India with limited capital resources, government investment in a solely commercial proposal is debatable. But a dedicated freight corridor would also be consistent with the social objectives of the country. Subsidized passenger fares for the majority of the economically-backward masses should be viewed against the concomitant creation of jobs along the length and breadth of the country in the public and private sectors. Heavy capital expenditure on new tracks will boost the country’s iron and steel, cement, locomotive and various other ancillary industries. Private investment will add to the assets of the country; it will homogenize and accelerate the development of the country. The resultant reduced road haulage will in turn reduce the oil pool deficit of the country, saving precious petroleum and equally precious forex reserves. Reduced road traffic and installation of electric traction along corridor will also reduce the pollution levels in the country.

Conclusion

The creation of the Dedicated Freight Corridor will put Indian Railways at par with some of the best freight railway systems in the world. Once the DFC Project is completed, the running of passenger and freight trains along the two corridors will be by and large segregated, each having separate time table, running at higher speeds, in a more environment friendly manner, and providing a lower per unit cost of transportation for freight. Further, its catalytic action for India’s industrial growth will be invaluable.

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There exist limitless opportunities in every industry. Where there is an open mind, there will always be a frontier.

– Charles F. Kettering

Waste neither time nor money, but make the best use of both. Without industry and frugality, nothing will do and with them everything.

– Benjamin Franklin