Presentation on Dedicated Freight Corridors

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Indian Railways – An Overview

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Freight traffic (Million Tonne)

An increase of 400.3 MT over 50 years

An increase of > 600 MT in the last 15 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Freight Traffic (Million Tonne)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>73.2</td>
</tr>
<tr>
<td>1960-61</td>
<td>119.8</td>
</tr>
<tr>
<td>1970-71</td>
<td>167.9</td>
</tr>
<tr>
<td>1980-81</td>
<td>195.9</td>
</tr>
<tr>
<td>1990-91</td>
<td>318.4</td>
</tr>
<tr>
<td>2000-01</td>
<td>473.5</td>
</tr>
<tr>
<td>2015-16</td>
<td>1108</td>
</tr>
</tbody>
</table>
Freight Traffic: Roads overtake Rail
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In billion ton kms

Percent share by Road
Percent share by Rail
Mode Share in Freight Transport

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- **CHINA**
  - **Road**: 22%
  - **Rail**: 47%
  - **Water**: 30%
  - **AIR**: 1%

- **US**
  - **Road**: 37%
  - **Rail**: 48%
  - **Water**: 1%
  - **AIR**: 6%

- **INDIA**
  - **Road**: 57%
  - **Rail**: 36%
  - **Water**: 1%
  - **AIR**: 6%

**Emission g CO₂ equivalent per ton-km**
- **CHINA**: >1000
- **US**: 15
- **INDIA**: 28 (56% less than Road)

**Energy Consumption**
- **CHINA**: 75-90% less than Road
- **US**: 75-90% less than Road
- **INDIA**: 75-90% less than Road

**Unit Cost**
- **CHINA**: Rs 2 less per NTKM
- **US**: Rs 2 less per NTKM
- **INDIA**: Rs 2 less per NTKM

Source: Mckinsey: Building India: Transforming the nation’s logistics infrastructure
Mode share estimated for 2007
Freight movement – Rail vs Road

- McKinsey Study shows that transportation by Road is most economical for distances up to 400 km.
- As distance increases, Rail & Waterways become more economical.
- Almost 65% of India’s freight traffic comprise bulk commodities.
- More than 75% (in NTKM) transported over distances more than 400 km making transport by rail better.
# Projections of Total Freight Traffic

<table>
<thead>
<tr>
<th>Year</th>
<th>2012</th>
<th>2017</th>
<th>2022</th>
<th>2027</th>
<th>2032</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP growth Projections (Per cent)</td>
<td></td>
<td>6.9</td>
<td>8.0</td>
<td>8.5</td>
<td>9.0</td>
</tr>
<tr>
<td>Transport Elasticity</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freight Traffic (Billion NTKM)</td>
<td>2053</td>
<td>3056</td>
<td>4834</td>
<td>7856</td>
<td>13118</td>
</tr>
<tr>
<td>Modal Share Rail Freight (Assumption)</td>
<td>35</td>
<td>39</td>
<td>45</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Rail freight (Billion NTKM)</td>
<td>698</td>
<td>1070</td>
<td>1885</td>
<td>3535</td>
<td>6559</td>
</tr>
</tbody>
</table>

Source: National Transport Development Policy committee (NTDPC) 2014
High Density Corridor (Golden Quadrilateral + Diagonals)

Rail: 16% of route Km carries 52% of passenger & 58% of freight.

**CONCERNS**
- Falling market share (86% to 33%)
- Capacity constraints on high density network.
- Connectivity of ports to hinterland inadequate.
- Terminal facility’s inadequacy impedes traffic.
- High axle load operation essential for certain type traffic.
- High speed freight corridors not available. Average speed of freight train is only 26 kmph.
Western Corridor (1504 km)
Rewari-Vadodara (947 km)
Vadodara-JNPT (430 km)
Rewari-Dadri (127 km)

Eastern Corridor (1856 km)
Khurja-Bhaupur (343 km)
Bhaupur-Mughalsarai (402 km)
Khurja-Ludhiana (400 km)
Khurja-Dadri (47 km)
Mughalsarai-Sonnagar (126 km)
Sonnagar-Dankuni (538 km)
Design features leading to Energy Efficiency

Heavier Carrying Capacity & Long Haul

Height
(+66%)

Width
(+14%)

Container Stack
(Double)

Train Length
(Double)

Train Load
(> Double)

Indian Railway

DFC Routes

Western Corridor
Eastern Corridor

Increased track centre distance from 5.3 m to 6 m in DFC

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Design features leading to Energy Efficiency

- Heavier Axle Loads, Higher Speeds, Less Power Consumption

<table>
<thead>
<tr>
<th></th>
<th>Indian Railway</th>
<th>DFC Routes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Axle Load</strong></td>
<td>22.9 t / 25 t</td>
<td>25 t (Track Structure)</td>
</tr>
<tr>
<td>(+30%)</td>
<td></td>
<td>Bridges &amp; formation designed for 32.5 t</td>
</tr>
<tr>
<td><strong>Maximum Speed</strong></td>
<td>Predominantly 75 Kmph</td>
<td>100 Kmph</td>
</tr>
<tr>
<td>(+33%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average speed</strong></td>
<td>26.5 kmph</td>
<td>65 kmph</td>
</tr>
<tr>
<td>(+145%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gradient</strong></td>
<td>Upto 1 in 100</td>
<td>1 in 200</td>
</tr>
<tr>
<td>(easier)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Traction</strong></td>
<td>Electrical (25 kV)</td>
<td>Electrical (2 x 25 KV System)</td>
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<td></td>
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</tbody>
</table>
- No level Crossings over DFC network.
DFC – A GAME CHANGER IN TRANSPORT LOGISTICS

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• Faster, higher and longer due to higher speed, train load & throughput.

• Quantum jump in transportation capacity: 120 trains each way will ease pressure on road and help environment.

• Connectivity to major ports of Gujarat & Maharashtra.

• Released capacity on IR will help meet passenger demand fully and raise speed of trains.

• Strengthening “Make in India” Initiatives by improving logistics and development of an ancillary Rail equipment industry.

• Development of industrial hubs.

• Employment generation: estimated 1,84,439 Man years during construction.
Climate Change Initiatives
Climate Change Initiatives

GHG Emission Analysis
- GHG Abatement Levers
- Road Map for implementation

Climate Screening
- CC Parameters integrated in design

Energy Optimization
- Driver Advisory System
- Offsite Energy Efficiency Measures
GHG Analysis Methodology

- Identification of GHG emission sources for
  - Baseline
  - DFC
  - Construction

- Collection & Assimilation of Data From DFCC.IR, sector experts & other public domain sources.

- Analysis of GHG Emissions – Baseline, construction & operation of DFC
  - Calculation in accordance with WBCSD/ISO Standards
  - Projections for 30 year

- Assessment of GHG Emission trends from various components of DFC.

- Assessment of GHG emission potential during construction of DFC

- Identification of GHG Emission Reduction Measures

- Development of CDM Methodologies

- Projection of baseline emissions from current transport operations
- Projection of emissions during operation phases of DFC
- Emissions during Construction of DFC
- Identification of GHG Abatement levers
- Development of CDM Methodologies.

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Green DFC - to save 457 million-tonne CO$_2$ over 30 years period.

Source: Report on ‘Green House Gas Emission Reduction Analysis for DFC’ by Ernst & Young

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Energy Optimization study

Three stage Implementation

- Study of energy optimization options - Driver Advisory System (EDFC 2)
- Pilot Project to implement the recommendations, and
- Scale up during operation

Offsite EE and RE Initiatives

Anticipated Energy Savings

- Around 6% through operations and
- Around 30% in offsite activities
Climate change will modify the risk of weather induced impacts on infrastructure which challenge design rules & procedures.

### Climate Screening of EDFC

<table>
<thead>
<tr>
<th>Climate Considerations</th>
<th>Recent Variability and change</th>
<th>Future Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Precipitation</td>
<td>Flooding</td>
</tr>
<tr>
<td>Strategic Considerations</td>
<td></td>
<td></td>
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<tr>
<td>Location</td>
<td></td>
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<tr>
<td>Service Life (Duration)</td>
<td></td>
<td></td>
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<tr>
<td>Soft components</td>
<td></td>
<td></td>
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<tr>
<td>Hard components &amp; Structural design</td>
<td></td>
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<tr>
<td>Redundancy</td>
<td></td>
<td></td>
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<tr>
<td>Non climate stressors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induced impacts, co benefits, and its benefits</td>
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<td></td>
</tr>
</tbody>
</table>

- The project has low risk to the present conditions and a potential risk to all future projections.
- No scope adjustments required.

- 5 Climate factors
  - Temperature
  - Flood
  - Wind
  - Precipitation
  - Earthquake

- 7 Project considerations
  - Moderate Flood Risk

- Integrated in DB contract for potential future risk
For Eastern Dedicated Freight Corridor (EDFC) from Mughalsarai to Sahnewal (Ludhiana) conducted for the first time in India.

- Condition of **Valued Environmental Components (VECs)** such as Habitat, Ecosystem, Natural processes, Socio economic & Cultural aspects) of identified hotpots assessed.

- analyzing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and natural environment

- Proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible.

The project will lead to Sustainable development
Climate Change Initiatives

- Setting of Dedicated Social and Environment Management unit (SEMU) to oversee the implementation of Social and Environmental Safeguards.
- Plantation of more than 150,000 trees already completed

**DESIGN INTERVENTIONS**

- Installation of 645 kWp solar Power plants over DFC network.
- Procurement of 10% energy from Renewable sources.
- Locomotives with Regenerative Braking.
- Green Building construction for OCC.
- Deployment of Green Energy for emergency lighting load.
- Use of BEE endorsed Star labeled products.
- Transformers being procured on Life cycle Costing

**Green Corridors of the future**
Mechanised Track Laying - First time use of Track Construction Machines

- Ballast Laying, Sleeper & Track Laying, Tamping, Welding & De-Stressing

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Monitoring of progress of work by Drone
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Rail Welding and Handling - Making Long Welded Panels (250 m) using Flash Butt Welding

Flash Butt Welding

Minimal Logistic & Re-Handling of LWRs

Mammoth Rail stacking Yard at Bhagega

Quality Control

Welds quality ensured to Factory Standards

Ultrasonic Flaw Detection - Stringent quality control

Flange & Web Testing

Rail Head Testing

NTC machine handles both LWRs and Sleepers in BRN Wagons
Mass Production

Extensive use of Precast technology

- Spans of Major Bridges - Post tensioned or Pre tensioned beams
- Casting Yards dedicated to a particular type of beams
- All Minor bridges of Box segment type

Standardised Bridge designs

- Standardised Pier cross sections – Enables optimization of Formwork
- Standardised Pile Diameter
- Standardised Box Segments

Mass Production

- 8 Precast RCC Box Yards
- Mechanised handling methods
- Least Labor Oriented
- Cost effective and control on wastage

Better Quality & Finish along with enhanced Construction Speed
Automated Sleeper Production for Quality & Delivery through Long Line Technology

Production @ 10,000 Sleepers/Bay (Line)/Month
(Max Capacity 50,000 sleepers /month/ plant)

Complete Automation provides better Quality, Finish and Higher Production Rate
Thank You