No.

MINISTRY OF RAILWAYS
GOVERNMENT OF INDIA

Dedicated Multimodal High Axle Load Freight Corridor with Computerised Control for Delhi-Mumbai and Delhi-Howrah in India

Study on Development of Intermodal Freight Transport Strategy

Final Report

March 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.
PACIFIC CONSULTANTS INTERNATIONAL

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PREFACE

At the Japan-India Summit Meeting in Delhi on the 29th of April 2005, eight-fold initiative for strengthening Japan-India Global Partnership was agreed by the Prime Ministers of both countries. Japan and Indian governments share the view that Japan's Special Terms for Economic Partnership (hereinafter referred to as "STEP") Scheme could be one of the effective means for carrying out large scale priority projects in infrastructure sector in India and confirmed their intention to examine the feasibility of the project, providing the inputs of Japanese technology and expertise.

In July 2005, The Government of India (hereinafter referred to as "GOI") officially requested the Government of Japan (hereinafter referred to as "GOJ") for Japan's technical cooperation to assist in the feasibility assessment of a high priority transport development initiative, the "Dedicated Multimodal High-axle Load Freight Corridors with Computerised Train Control System on Mumbai-Delhi and Delhi-Howrah" (hereafter referred to as the Project).

In response to the request from the GOI, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched in October 2005 a contact mission to collect and analyze the necessary information for the above mentioned Project. JICA and the Ministry of Railways (hereinafter referred to as "MOR") agreed that the feasibility study of the Project would be executed jointly. Based on the result of the preliminary study, the GOJ decided in November 2005 to conduct the feasibility study on the development of a multimodal high axle load freight corridor with computerised control for Delhi-Mumbai and Delhi-Howrah (hereinafter referred to as "the Study").

In February 2006, JICA dispatched the preparatory study team, and the Scope of Work of the Study and the Minutes of Meeting were signed and exchanged between MOR and JICA.

JICA selected and dispatched the Study Team in May 2006, which is headed by Mr. Minoru Shibuya of Nippon Koei Co., Ltd. and consists of Nippon Koei Co., Ltd., Japan Railway Technical Service, and Pacific Consultants International.

This report mainly discusses Intermodal Freight Transport Development Strategy, studied by the Intermodal Research Unit of the Study Team from May 2006 till the end of October 2006. Prior to implementation of the Study, the study group for evaluation of a large scale project, headed by Honorary Professor Yuzo Akatsuka of Toyo University, was set up and conducted a preliminary research and initiated the study approach, adopted by the Intermodal Research Unit. The result of the preliminary research is attached to this report. I would like to convey my appreciation to the members of the study group.

Finally, it is my hope that this report will contribute to the realization of the Project and I wish to express my sincere appreciation to all the officials and stakeholders for their generous cooperation to the Study.

March 2007

Kazuhisa Matsuoka
Vice-President
Japan International Cooperation Agency

March 2007

Mr. Kazuhisa Matsuoka

Vice-President

Japan International Cooperation Agency

Letter of Transmittal

Dear Sir,

We have the pleasure of submitting herewith the research report: "Dedicated Multimodal High-axle Load Freight Corridors with Computerised Train Control System on Mumbai-Delhi and Delhi-Howrah - Study on Development of Intermodal Freight Transport Strategy".

The research was undertaken from May 2006 to the end of October 2006 by the Intermodal Research Group, a special research unit on the intermodal freight transport development strategy in the Study Team. The Study Team, headed by Mr. Minoru Shibuya of Nippon Koei Co., Ltd., consists of Nippon Koei Co., Ltd., Japan Railway Technical Service, and Pacific Consultants International.

Prior to this research, a special academic group for a study on evaluation method of large-scale projects, headed by Honorary Professor Yuzo Akatsuka of Toyo University, was established and a preliminary study was made by this group. Following the suggestions and recommendations produced by this preliminary study, the Intermodal Research Group conducted a series of field surveys and data collection exercises and had discussions with relevant peoples on the intermodal freight transport development strategy. This research report compiled all of the research results by the intermodal research group in the Study Team.

We would like to express our sincere gratitude and appreciation to all the officials of your agency and the JICA Advisory Committee, the Ministry of Foreign Affairs, the Embassy of Japan in India, the Ministry of Railways as the counterpart agency, and to all of the counterpart personnel.

Yours faithfully,

Minoru Shibuya
Team Leader
The Study on Dedicated Multimodal High-axle Load Freight
Corridors with Computerised Train Control System on
Mumbai-Delhi and Delhi-Howrah

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Abbreviations

ADB	-	Asian Development Bank
AHP	-	Analytical Hierarchy Process
BCR	-	Benefit/Cost Ratio
BO(L)T	-	Build Operate (Lease) Transfer
CAGR	-	Compound Annual Growth Rate
CBA	-	Cost Benefit Analysis
CDM	-	Clean Development Mechanism
CER	-	Credit
CFS	-	Container Freight Station
CLW	-	Chittaranjan Locomotive Works
COMOW	-	Central Organization for Modernization of Workshops
CONCOR	-	Container Corporation of India Ltd
CORE	-	Central Organization for Railway Electrification
CRIS	-	Centre for Railway Information System
CST	-	Central Sales Tax
CY	-	Container Yard
DCT	-	Domestic Container Terminal
DFC	-	Dedicated Freight Corridor
DLW	-	Diesel Locomotive Works
DMW	-	Diesel-Loco Modernization Works
DPC	-	Dedicated Passenger Corridor
EIA	-	Environmental Impact Assessment
EIRR	-	Economic Internal Rate of Return
EMU	-	Electric Multiple Units
EU	-	European Union
FEU	-	Forty-foot Equivalent Unit
FIRR	-	Financial Internal Rate of Return
FOIS	-	Freight Operations Information Systems
FS	-	Feasibility Study
GAM	-	Goal Achievement Matrix
GDP	-	Gross Domestic Product
GHG	-	Green House Gas
GMB	-	Gujarat Maritime Board
GNI	-	Gross National Income
GOI	-	Government of India
GQ	-	Golden Quadrilateral
GSDP	-	Gross State Domestic Product
GVA	-	Gross Value Added
HDC	-	Haldia Dock Complex
HDS	-	Haldia Dock System
ICD	-	Inland Container Depot
ICF	-	Integral Coach Factory

IEE	-	Initial Environmental Evaluation
IO	-	Input Output
IR	-	Indian Railway
IRFC	-	Indian Railway Finance Corporation
IRR	-	Internal Rate of Return
IT	-	Information Technology
JBIC	-	Japan Bank for International Cooperation
JICA	-	Japan International Cooperation Agency
JNPCT	-	Jawaharlal Nehru Port Container Terminal
JNPT	-	Jawaharlal Nehru Port Trust
JV	-	Joint Venture
KDS	-	Kolkata Dock System
KoPT	-	Kolkata Port Trust
KPS	-	Kolkata Port System
KRCL	-	Konkan Railway Corporation Limited
LOS	-	Level of Service
M/M	-	Minutes of Meeting
MBPT	-	Mumbai Port Trust
MCA	-	Multi-Criteria Analysis
MCRS	-	Monte Carlo Risk Simulation
MDR	-	Major District Roads
MOL	-	Mitsui O.S.K. Lines, Ltd.
MRT	-	Mass Rapid Transit
MRVC	-	Mumbai Railway Vikas Corporation
NF	-	North Frontier
NHAI	-	National Highways Authority of India
NHDP	-	National Highway Development Program
NPM	-	New Public Management
NPV	-	Net Present Value
NSICT	-	Nhava Sheva International Container Terminal
NWDP	-	National Waterland Development Program
O/M	-	Operation and Maintenance
OD	-	Origin Destination
ODA	-	Official Development Assistance
OYWS	-	Own Your Wagon Scheme
P/L	-	Profit and Loss
PCU	-	Passenger Car Unit
POL	-	Petroleum Oil Lubricants
PPP	-	Public Private Partnerships
PPP	-	Purchasing Power Parity
PRCL	-	Pipavav Railway Corporation Ltd
PRSP	-	Poverty Reduction Strategy Paper
PSCT	-	Port Side Container Terminal
PSO	-	Public Service Obligation

PSU	-	Public Sector Undertaking
RCF	-	Rail Coach Factory
RDSO	-	Research Designs and Standards Organization
RTO	-	Regional Transport Office
RVNL	-	Rail Vikas Nigam Limited
RWF	-	Rail Wheel Factory
S/W	-	Scope of Work
SPV	-	Special Purpose Vehicles
SQI	-	Service Quality Intrusion
SRTUs	-	State Road Transport Undertakings
STEP	-	Special Terms for Economic Partnership
TEU	-	Twenty-foot Equivalent Unit
TKD	-	Tugklakabad
VAT	-	Value Added Tax
VOC	-	Vehicle Operating Cost
WB	-	World Bank

SUMMARY

1. INTRODUCTION

The intermodal research unit has recognized that there are four major research issues to be addressed in this study.

Issue 1: Establishment of inter-modal development scenario and strategies

Issue 2: Preparation of alternatives at conceptual planning level of detail

Issue 3: Development of evaluation methodology for large-scale infrastructure projects

Issue 4: Practical demand forecast model for the DFC with limited data

In addition to the above four issues, the intermodal research unit was requested to carry out a preliminary project evaluation on the three basic alternatives.

The research activities were commenced in May 2006 and completed by the end of October 2006. The following sections summarize several important findings related to the issues.

2. ESTABLISHMENT OF INTER-MODAL DEVELOPMENT SCENARIO AND STRATEGIES

The goal of this inter-modal system development should be a part of the integrated national logistics development strategies, in other words, it should not solely focus on development of railway along east and west corridors. A strategic scenario to develop the freight transport along the east and west corridors should be drawn up based on careful investigation on the latest technologies as well as progress of improvement of other modes of transport and associated systems.

In this context, the intermodal research unit did careful review of the past 5-year plans from the 1st to the current 10th plan. By this review work as well as supplemental surveys including a series of interviews with relevant peoples, the study team has recognized the role of the transport

sector in the context of the national development, the latest development policies of the highway, railway and port sectors and ICD (Inland Container Depot) in India as a foundation of the study. Detail of this research activities are described in Chapter 3 – 9 of this report. A brief summary of selected findings is given below.

- The government of India expresses her clear understanding about the importance of the rail systems. Especially for cargo transportation of longer-distances, the importance of the rail-based cargo transport systems is recognized in terms of its environment friendliness and its great capability of transporting huge amount of cargoes all over the India using its extensive network with reasonable costs. Regarding the cargoes of medium travel distances, there is an important understanding by the Indian government, that is, the rail-based system needs to be developed to compete the road-based transport systems, especially when transporting the bulk cargoes.

- A massive investment has been made to the highway development, especially focusing on the "Golden Quadrilateral" in India, prior to the rail-based system development. However, no significant improvement has been observed in the development of freight transporters. Still there are many small-scale or individual truck operators are dominant in the road-based land transport market and the necessity of integrating or organizing these operators into several large and modern organizations has been just recognized. At the same time, the less development of access roads (secondary road systems) to final destinations such as ICDs should be addressed as one of the weak points in the context of intermodal transport development. Without good access roads to the intermodal facilities such as ports and ICDs, the improved trunk road systems cannot achieve their expected objectives.

- The Indian Railways (IR), a government monopoly, has been suggested to improve its efficiency in producing the services. Mainly due to the "public service obligation (PSO)" policy, IR should follows by arranging the cross-subsidy from the earning of the freight business to the passenger rail transport services. However, it is understood that the PSO should remain as one of the important treatments for a while. At the same time it is understood that savings or additional profit to be generated by further improvement of freight services should be retuned to the freight service users by providing lower service fees (tariff).

- Participation of the private companies is encouraged, which may contribute to effective management and capacity improvement. It has been approved by the government to establish a special purpose vehicle/company (SPV) which becomes an umbrella agency of MOR, to achieve modernization of freight transport business, self-reliant accounting, private company's participation and accountability of the business.

- Container Corporation of India Ltd, (CONCOR), a business arm of IR, may need to improve the efficiency of her cargo transport services through encouraging participation of the private sector. One of the good examples can be referred from "Cargo Village and Logistics Parks". This plan encourages to develop new ICDs in metropolitan areas and generate the added value of ICD itself. A current trend shows that some private companies are very keen on investing construction of ICDs and operating by themselves.

- In the port development sector, there have been already many port improvement/expansion and new port construction projects at and near the existing international gateway port areas, namely Mumbai and Kolkata. However, for example, it is very likely that the port expansion in the Mumbai area will not be able to accommodate the container demand in near future. In parallel, Gujarat state is strongly promoting new port development, and many of them are initiated by the private sector including some international shipping companies. Accordingly it is important to provide good access in the form of both rail and road to these new ports in the Gujarat state as well as DFC trunk line to Mumbai. As far as efficiency of the cargo handling capability at the existing gateway ports, it seems the level of services is close to that of the advanced ports in other countries. Now the issue arises from the linkage or intermodality between the different modes of transport, i.e. between the railway and the container yard in terms of capacity gap as well as document transaction.

- TKD, the largest ICD in Delhi, has some serious problems. The volume of container traffic has exceeded its design capacity, hence, there observed a long truck waiting queue outside the area of TKD, causing serious traffic congestion problems. In accordance with the further demand increase, some other new ICD will be necessary in the Delhi and surrounding areas. Such ideas include development of the "Cargo Village and Logistics Parks" initiated by CONCOR and that of the Industrial Park at Neemrana (the feasibility study on the ICD development at Neemrana was conducted by JETRO). Such plans should be properly placed in terms of the city planning of the Delhi metropolitan area including arterial road development plans.

- The development and operation of ICD has been already open to the private sector. The current management and technical level of such ICDs like Dadri is very much appreciated. In this context, the public sector should play an important role in planning development of ICDs and providing necessary facilities such as roads and power and necessary actions to mitigate the environmental impacts. The private sector can improve the efficiency of ICDs through utilizing the advanced technology.

- Local governments along the DFC corridor are now competing each other in terms of industrial area development by taking an opportunity of DFC development. This may encourage to develop industrial areas in an appropriate and strategic manner with the provision of necessary facilities by the public sector. It should be noted that the concept of

"Hub & Spoke" is very important in developing DFC and associated ICDs and in selecting locations of industrial estates. In this context, it is recommended to consider the linkage between the DFC and industrial development in Task 2 study.

- The quality of land transport services in India is far below the standard expected by international companies. Especially, it should be noted that many Japanese manufacturing companies have serious difficulties in using the current local land transportation services, accordingly some companies have developed their own transportation systems by themselves. In fact, the quality of service is one of the important key factors to attract foreign investment. In this research study, preferred intermodal technology and associated equipment are presented as a good reference for future land transport development in India.

3. PREPARATION OF ALTERNATIVES AT CONCEPTUAL PLANNING LEVEL OF DETAIL

The DFC, due to its scale of development and complexity, requires careful investigation on many aspects ranging from engineering to financial and institutional ones before making a decision on the investment to the project. However, it is practically difficult to investigate all available alternatives at a feasibility study level of detail. Accordingly, major three alternatives at a conceptual level of detail are first studied, which include

- The development of a totally new, high-speed and totally independent rail system dedicated to the transport of cargoes;

- The development of a totally new passenger rail system development while the existing railway system will be rehabilitated and used as a dedicated rail-based freight transport system; and

- The incremental improvement of the current rail system. In this alternative, a series of bottlenecks will be eliminated via selective improvement projects but the main railway infrastructure and operations system remains in place.

Benefits and losses of these three alternatives, comparing to 'without case', were examined and a preferred alternative for each corridor was recommended.

The recommended alternatives will be further investigated by the engineering study team by paying attention to technical options in Task 2 of the study.

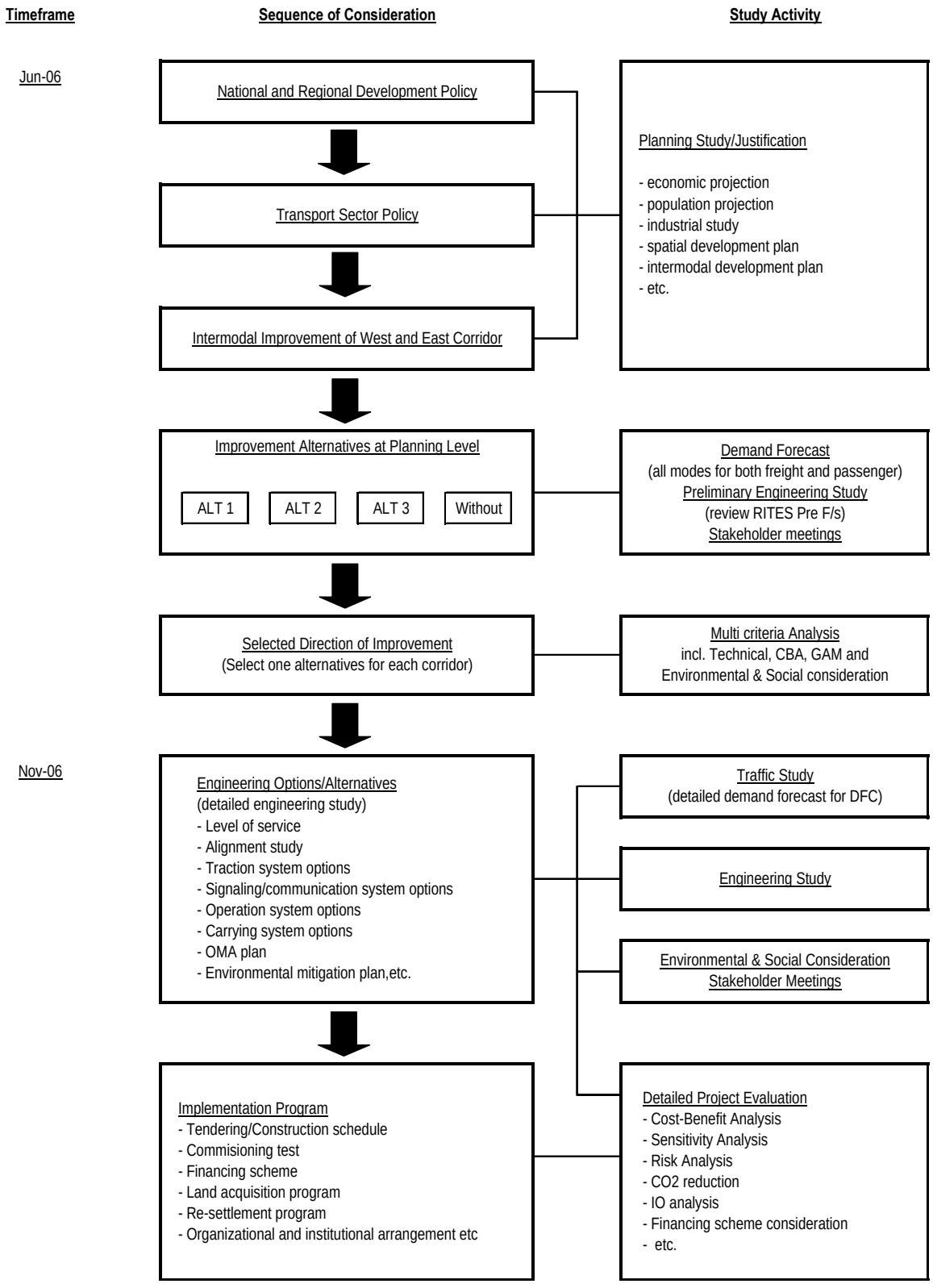


Figure 1 Recommended sequence of the study

4. METHOD OF PROJECT EVALUATION

The intermodal study unit made a careful review on the study that was done by the JICA advisory (senior) research members (headed by Prof. Akatsuka) prior to the DFC study. The study has suggested that it is very important to establish appropriate project evaluation methods that would be appreciated by international financing organizations such as ADB, WB and JBIC. Following this important suggestion, the intermodal study unit made a series of review work on project evaluation methods employed for large-scale infrastructure projects financed by those organizations in the past.

However, since the DFC project is an extremely huge project, considering that there would be many different opinions and aspects to be addressed, a multi-criteria evaluation method is proposed by the study unit in order to meet such requirements in addition to the conventional evaluation methods. This multi-criteria evaluation method is called the "Goal Achievement Matrix (GAM)". The study team employed this method in making the initial evaluation on the three alternatives.

In addition to the evaluation on the impacts of the project generated after the construction (during operation in its project life), the impact during the construction, namely, "multiplier effect" is also estimated by using inverse IO matrix of India. In fact the scale of DFC investment is very large, accordingly the macro economy of India will be very much affected by the DFC development.

5. PRACTICAL DEMAND FORECASTING MODEL DEVELOPMENT WITH LIMITED DATA

As fundamental information for forecasting the freight demand on the DFC corridors, a likely future socio-economic framework including population and gross domestic products was prepared first based on several projections done by international financing agencies and the planning agency of India. The development scenario suggests the economic growth of 7% p.a. for the next 20 years and the population of 1.6 billion in 2050, which becomes the largest population in the world followed by China.

The beginning of this research work examined a careful review on the demand forecast model developed by RITES for a pre-feasibility study for DFC (PETS1) and found some important implications for the tasks of the study unit as follows.

- The projection period for this DFC study should be 20-30 years, considering its scale of investment and its project life. Assuming the DFC project complete its construction work by 2011 and open to pubic in 2012, it is reasonable to set Year 2031/32 as the target year of the

DFC project, instead of Year 2021 set in PETS1 (as well as the Scope of Work agreed for this Study).

- RITES report (PETS1) might overestimate the traffic volume because the estimated figures were based on monthly traffic data of the busiest month. Thus, it was considered the baseline data should be revised, based on annual traffic data to avoid peculiar information.

- Regarding the bulk cargos, excluding coal and iron & steel, the growth rates applied to the freight projection by RITES, are considered slightly vague. Accordingly it was suggested that the growth rate of each commodity should be justified based on historical traffic trends and expected economic activities in future.

- Volume of container generation has statistically significant relationship with the scale of economy at the national level according to the past experience of so-called advanced countries. At the same time India has relatively short history in using the container cargo transport system, accordingly it is difficult to know robust trend from such limited time series data. In this context a cross section (country) analysis was employed to find useful relationship between macro social and economic indicators and the container cargo demand. That is, it was assumed that India would follow the experience of other economically developed countries in terms of containerization.

- The road transport sector has been becoming more competitive even in the long-distance freight transport market thanks to the recent significant achievement of highway network development. However, RITES study did not discuss the competition issue between the rail and road sector in their study. In light of this it was recommended to develop modal split models in order to discuss the issue in a more practical and precise manner. The research unit tried to develop such models based on the supplemental traffic survey and critical interviews with freight business entities.

- Regarding some medium-distance bulk cargo market, there would be a good reason for DFC to defeat the truck transport services if an effective intermodal system is established in this market. For example, food grains are possible target commodity for the rail based system to win.

6. PRELIMINARY PROJECT EVALUATION

As indicated in Figure 1, the intermodal research unit was expected to make an initial evaluation on the three alternatives during the research period (from May 2006 to the end of October 2006). The preliminary evaluation was made by employing the financial, economic and multi-criteria analysis (GAM). In conclusion, the totally new dedicated rail freight system was preferred for both of the corridors. However, the financial analysis and economic analysis gave a different

conclusion regarding the development priority of the two corridor, that is, the East corridor was preferred by the economic analysis, whilst the West corridor by the financial analysis. Then finally GAM suggested the West corridor should be developed first if such decision is required.

(1) Summary of the initial financial analysis

1. Without taking into account any capacity constraints or negative financial effects thereof, the ML Alternative can be considered as the best solution.

2. The ML Alternative will quickly reach the maximum line capacity. A considerable negative effect cause by the capacity constraint, that is not directly reflected in the financial analysis.

3. The Dedicated Passenger Corridor (DPC) Alternative is not an attractive alternative. Furthermore, the specific nature of this alternative generates in the long term future notable capacity constraints, which cannot meet the long-term development target of GOI.

4. The remaining and probably financially attractive solution must be the development of the DFC Alternative, where the construction of a new dedicated freight line allows the long-term growth of cargo traffic demand without serious capacity constraints. The transfer of major cargo transport to the dedicated line also maximizes the potential for growth of passenger traffic on the existing line. Consequently, all financial indicators for the DFC Alternative are notably better than those for the DPC Alternative.

Assuming the DFC Alternative is selected as preferred option, the *theoretically* best solution for meeting total traffic demand for both passengers and cargo would be to develop the East and West Corridors simultaneously, therewith maximizing the benefits for both passenger and cargo transport by rail over the entire corridor. However, financial constraints and technical and engineering limitations could force the Indian Government to decide for a two step approach, building first the dedicated freight line on one corridor, followed in a later stage by the construction of the new dedicated freight line on the remaining corridor. In this case the West Corridor, which mainly transports container cargos, could be given priority.

(2) Summary of economic analysis

The economic evaluation of the three alternatives undeniably identifies the DFC Alternative as the best solution to meet the future growth of cargo traffic demand along the two corridors. Both in terms of economic rates of return and total return, it is the DFC Alternative that outperforms the two other alternatives. The important economic benefits generated by the DFC Alternative become even more explicit if the economic evaluation is extended until the year 2050.

Looking at the two corridors separately, the DFC Alternative remains in each case the best solution to meet future cargo traffic growth. In terms of economic returns and rate of return, it is the East Corridor that is the better of the two, suggesting that the construction of the East Corridor should have priority over the construction of the West Corridor, a result that is opposite to the financial evaluation. However, it should be made clear that for the two corridors combined, both the financial and economic evaluation identify the DFC Alternative as the preferred option.

(3) Summary of GAM Analysis

As presented in Table 1, multi-criteria evaluation was examined by adopting the initial weighting of each of the decision factors

Unless giving more than 70% weight to the financial factors, all the results shows that the DFC Alternative as the preferred option. While in most cases the GAM results thus indicate, DPC Alternative is not appreciated. Putting the priority on financial aspects, the ML Alternative can show the best performance, but it will not contribute to the achievement of the long-term development target.

The GAM evaluation strongly advocates:

- That only the DFC Alternative is an attractive option to realize the Government's policy and that it is the only option to ensure that a major capital investment also brings benefits to the Indian citizens.

- That the DPC Alternative should certainly not be selected because the high capital cost of the project does generate only a low increase of cargo transport.

- That the ML Alternative displays the best financial results while presenting mixed results for the other indicators. If the financial resources are not available, strong results can be achieved with limited capital investments. But the results also suggest that these benefits remain limited.

Table 1 Weighting variations for sensitivity testing

	V1	V2	V3	V4
GAM evaluation indicators	**Weight**	**Weight**	**Weight**	**Weight**
Financial	**45%**	**70%**	**20%**	**33%**
- Capital Investment	7.50%	11.67%	3.33%	5.50%
- Revenues	3.75%	5.83%	1.67%	2.75%
- Financial return	11.25%	17.50%	5.00%	8.25%
- FIRR	22.50%	35.00%	10.00%	16.50%
Economic	**45%**	**20%**	**20%**	**33%**
- EIRR	12.9%	5.7%	5.7%	9.4%
- VOC improvement	4.9%	2.2%	2.2%	3.6%
- Travel time savings	4.9%	2.2%	2.2%	3.6%
- Cargo carrying capacity	11.3%	5.0%	5.0%	8.3%
- Additional cargo transported	11.3%	5.0%	5.0%	8.3%
Policy & Strategic	**10%**	**10%**	**60%**	**34%**
- 5 Year Plans	2.0%	2.0%	12.0%	6.8%
- Cargo transport benefits	2.0%	2.0%	12.0%	6.8%
- Cargo forced to alternative mode	2.0%	2.0%	12.0%	6.8%
- Reduction of road traffic	4.0%	4.0%	24.0%	13.6%

Table 2 summarizes each of the analyses.

Table 2 Summary of evaluation results

Evaluation factor	ML Alternative	DFC Alternative	DPC Alternative	Comments
Maximum Performance for cargo transport (year 2032 horizon)				
Capital investment (RS Cores)	4,659	26,635	30,552	For Infrastructure excluding rolling stocks
Cargo revenues (Rs Crores)	22,313	30,143	19,895	In the year of reaching maximum capacity
Cargo volume (Ton)	87,960,680	119,741,839	79,581,107	In the year of reaching maximum capacity
Ton Km (1000 Ton)	113,791,274	133,086,942	114,178,740	In the year of reaching maximum capacity
Capacity limitations (year)	2029	2038	2029	Year of reaching maximum capacity
Capacity difference (million ton)	(1,873)	Regarded as the maximum	(4,302)	Total period as compared to highest volume
Evaluation Indicators				
FIRR (project perspective)	45%	10%	7%	Strict vision without any assistance
FIRR (operator perspective)	positive revenues from 1st year	53%	39%	Assuming no pay-back of capital cost for infrastructure
EIRR (all parameters)	Negative revenues	10.1%	3.8%	Main focus on cargo transport performance
Economic revenues @ 6% RS Crores)	(4,325)	24,063	6,436	Main focus on cargo transport performance
GAM average rank (fixed)	2	1	3	Ranking based upon the ranking for each individual parameter
GAM average rank (calculated)	2	1	3	Ranking based upon calculated results

(4) Summary of Risk Analysis

The risk analysis was conducted for the DFC Alternative under the assumption that this alternative will be selected for implementation and the GOI by herself will invest on the Project and that both east and west corridor will be simultaneously improved.

The Monte Carlo Simulation method calculates the effect on the FIRR and EIRR when the project cost, freight demand and revenue are not attained as forecasted. It should also be noted that in this stage of the Project, a comprehensive Risk Analysis is not possible because many relevant sets of information were not available. But even the limited risk analysis of which the results gives some interesting indications. Further investigation is highly recommended in implementing such a huge project of DFC.

7. RECOMMENDATIONS

It is safe to say that the engineering study team should make further investigation on the DFC alternative rather than other two alternatives in the consequent study activities in Task 2. In the case that the two corridors cannot be developed at the same time, GAM finally suggested the West corridor should be developed first.

The result of the financial analysis suggests that, if the DFC along both east and west corridor cannot be developed simultaneously, the West Corridor could be given priority. And the economic analysis suggests that the construction of the East Corridor should have priority over the construction of the West Corridor, a result that is opposite to the financial evaluation. GAM analysis supports the West Corridor. This result shows that the West Corridor mainly transports rapidly increasing container cargoes and the freight demand along the West Corridor soon or later will reach it capacity.

In the following sections, some useful suggestions are summarized for further study.

7.1 Demand Forecast

(1) Issues to be addressed

Some of the limitation in the preliminary demand forecasting work by the intermodal research unit should be noted. First and foremost, as the demand forecast model, studied in this chapter, is based on state-wise analysis, it cannot provide the detailed information on the commodity flow, e.g., Station-to-station OD, which cannot allow the operation planner to study the optimal operation plan of DFC project.

Secondly, as the decent forecasting result requires reliable and up-to-date data, some of the freight information analyzed in this study are outdated, especially that on the freight surveys in 1987 and 1997.

Thirdly and lastly, justification of port selection of the container cargos should be examined, since container traffic production/attraction was estimated under no-capacity-constraint assumption.

The modal split model in this Study also has some limitations: For instance, the model encompass the level of service of the line-hole transport but limits to include the service level of the access/egress (e.g., the travel time from ICD to consignee).

(2) Necessary improvements

Accordingly, the implications for Task 2 Study, we suggest, are noted below:

- Freight demand forecasting analysis in the next phase should focus on more detailed OD according to the subject to be analyzed, which can allow engineers to do the more detailed engineering study.

- In Task 2 Study, data updating will be required. One of the essential information can be obtained from the Total Transport Systems Study, of which the survey is now being carried out by the Planning Commission, GOI.

- The port and ICD development plans, including conceptual plans, in India should be carefully reviewed and the capacity, which determines the container throughput at each port/ICD, should be studied in view of both efficiency and physical capacity improvements (e.g., efficiency improvement in loading and unloading cargo and the expansion of container berth).

- The modal split model should be reviewed by obtaining sufficient amount of traffic information, including the level of service of line-hole transport and access/egress. To be specific, the supplemental freight survey, which interviews the port/ICD operators and transporters, should be taken into account in order to obtain the sufficient LOS data of the access/egress transport.

- Regarding bulk cargos, there seems no chance to transfer such cargo like coal and ore, from rail transport to road transport, because the origin (production) and destination (consumption) of those commodities is rigid usually connected by rail, while road transport can be more competitive when transporting food-grain. In that sence, the establishment of modal split model should be carefully examined in Task 2 Study.

7.2 Project Evaluation

The intermodal study unit has suggested a step-wise evaluation and the first step evaluation (①) was explored to conduct the preliminary evaluation at the conceptual level. In Task 2 Study, more precise evaluation (② and ③) will be required to examine the feasibility of the Project.

① Preliminary evaluation to select a preferred project scheme from the three alternatives;

② Precise project evaluation at a feasibility study (FS) level of detail, with more accurate information produced by the engineering study; and

③ Detailed project evaluation to investigate the project implementation scheme including funding structure, financing scheme, project implementation schedule. The risk analysis should also be performed in this stage.

Accordingly, the alternatives, in terms of its technical options for the DFC, should be examined through financial and economic analysis. Appropriate project evaluation methods that would be appreciated by international financing organizations should be employed, as discussed in Chapter 12 and 13.

At the same time it should be noted that the evaluation should be performed for two different sets of the project components, namely, the rail segment itself and the freight transportation system of the entire corridor from the ports to final destination as indicated in Figure 2.

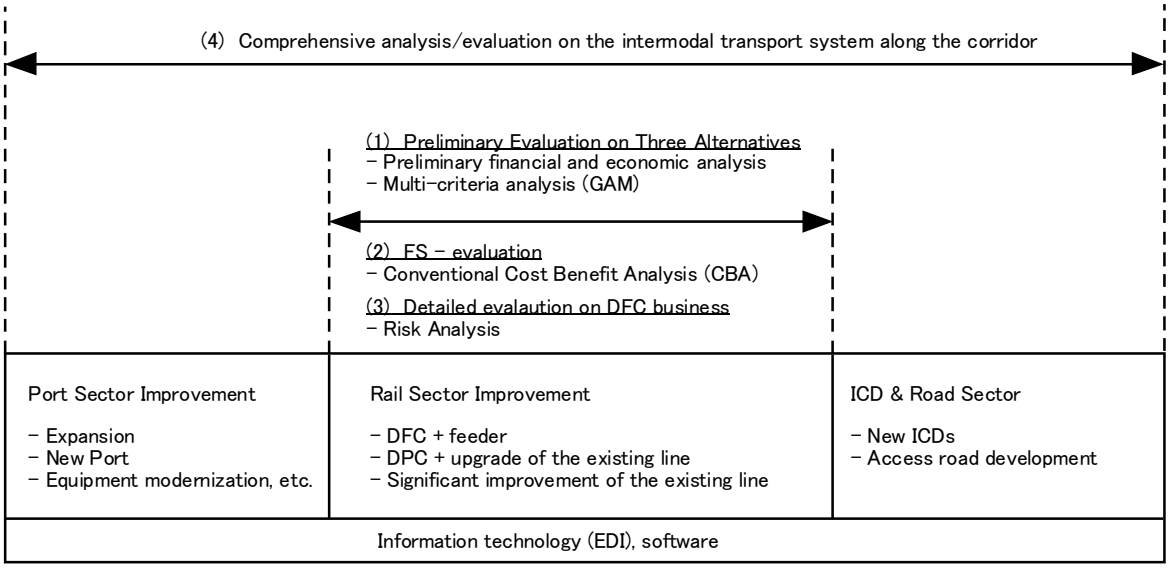


Figure 2 Objectives of the Project Evaluation

The preliminary project evaluation (1) has been already carried out by the intermodal study unit as explained in this report. The engineering study team is expected to do the following two

evaluation/analysis, namely, (2) Detailed project evaluation (conventional CBA analysis with accurate information) and (3) Detailed project analysis on the DFC business to find a better project implementation scheme in term of business structure and financing. In addition to the analysis on the rail segment, (4) a comprehensive evaluation on the whole intermodal system including associated development of ports, ICDs, and access roads should also be performed to insure the overall benefit of the intermodal development project including DFC.

In terms of the methodology, it is suggested to evaluate the alternatives of the Project based on the conventional economic and financial analysis. However, it should be noted that there is a growing demand for extended consideration to such aspects as natural and social environment and poverty reduction, and therefore, the multi-criteria evaluation method can be a solution to evaluate the Project in various viewpoints. This Study introduced GAM and proved it especially effective in comparing alternatives of different development concepts at the initial evaluation stage. The multi-criteria evaluation method should be applied to more detailed evaluation in Task 2 Study. The stakeholder meeting will provide a good opportunity to justify the project impact in terms of social environment and poverty reduction.

The past experiences suggest that the demand forecast tends to be overestimated and the project feasibility should be examined based on the different development scenarios. In order to foresee the impacts of such uncertainties in the development of DFC, this Study conducted the Risk Analysis for the DFC Alternative. The Risk analysis is also effective for further study on the project implementation scheme by changing several financial factors such as interest rates and revenue.

Also, the study on evaluation for the previous infrastructure projects showed that the economic impact generated during the construction of the projects were not always estimated. Considering the scale of the investment to the DFC Project, this Study estimated the impacts during operation (multiplier effect), utilizing the input-output table. The same application to estimate multiplier effect on the Project should be made during the detailed project evaluation and a comprehensive evaluation on the whole intermodal system.

The idea of the benefit generated by the DFC project is shown in Figure 3. As the DFC provides additional cargo carrying capacity, associated facilities such as ports, ICDs and roads should be improved in an integrated manner. The benefit would be observed in two terms, namely, time & cost saving and the capacity expansion.

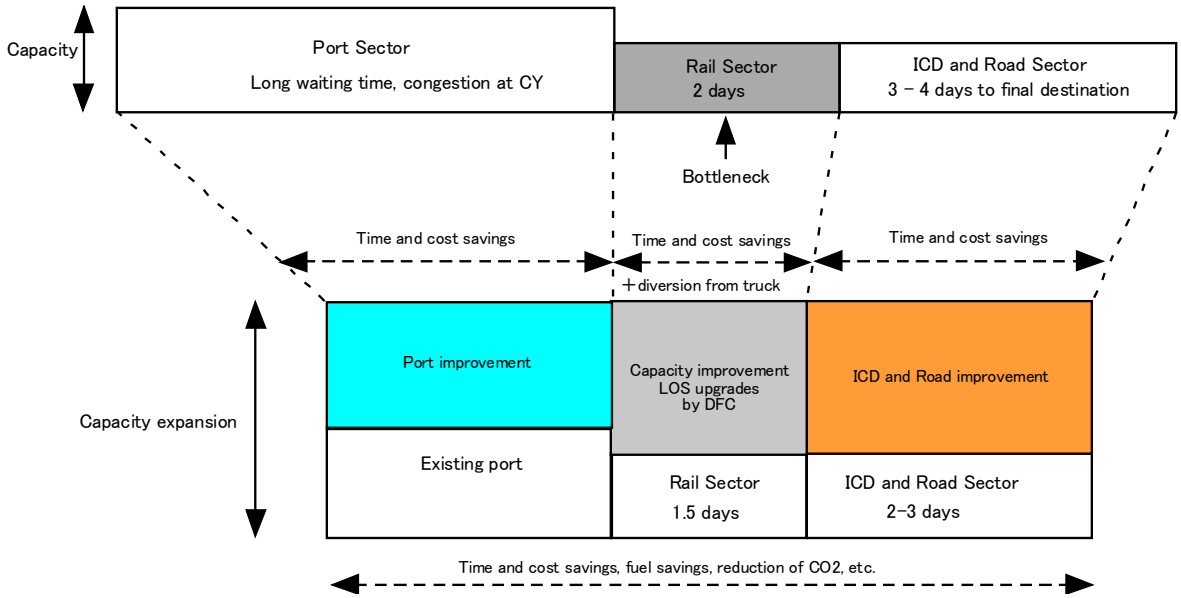


Figure 3 Benefit of the DFC Project

7.3 Intermodal Development

The trunk transport systems such as inter-state highways, and the Dedicated Freight Corridor Project are in progress. In addition, some important improvements at major intermodal points such as port improvement in Mumbai area, new port development in Gujarat state, and IDC development projects by private sectors in Delhi metropolitan area are to be made in near future. However, some minor but very necessary improvement such as access road to ICDs and arterial road network development in the urbanized areas is far below the expectation to develop effective freight transport services. Intensive use of information and communication technology in the field of freight transport business is also rapidly developing through the private sector's participation. In light of this situation, it is highly recommended to study city planning, arterial road development plans and industrial estate development plan of each state along the DFC corridor, and to review more detailed design of the DFC, such as the location of the stations along the DFC.

Regarding the intermodal transport technology, mainly the cases practiced in Europe were introduced and compared to those in India, suggesting the intermodal development policy. Further case study should be made with special attention to Japanese technologies, including that are developed by JR and are expected to contribute to the intermodal development in India.

CHAPTER 1 STUDY OUTLINE

1.1 BACKGROUND

With 63,000 kilometer long rail routes, IR transported by the end of the decade (year 1999 volumes) some 475 million tons of freight[1] and some 4,411 million passengers[2]. IR is historically a passenger-oriented organization and in freight was until recently focusing the long haul of bulk commodities. But at the beginning of the 21st century, growth of IR stagnated as compared to the development of the economy. The average growth of 3% of IR passenger and freight transport was far from matching the average growth of the Indian economy.

India is one of the fast growing economies in the world, with a growth in GDP of 7.5% in the year 2004 and 8.1% in the year 2005[3] and is expected to remain very strong[4]. India is leading the economic growth in the East Asian region and accounts for approximately 70% of the region's output[5]. India's Tenth Five-Year Plan, covering the years 2002/3 to 2006/7, set forward some ambitious economic goals concentrated around a projected annual economic growth of around 8% over that period[6].

According to World Bank experts, ensuring and sustaining such ambitious economic growth will require substantial investments in 3 principal domains which are infrastructure, human development and rural livelihoods and on the participation of the private sector in the development of the necessary infrastructures (World Bank Strategy Paper, p 13). The Bank therewith reiterated its opinion expressed in the year 2002 transport sector report that poor transport has become a major hinder for economic growth. India's transport system, especially surface transport has serious deficiencies and services are highly inefficient by international standards, generating losses estimated to be as high as 120-300 billion Rupees (equivalent to US$2.6-6.5 billion) a year[7]. With an expected traffic demand increasing 10% annually, the existing railway network is not capable of fulfilling this demand and in

1 Yash Pal Kedia: " Restructuring Indian Railways" in: " India's Transport Sector, the Challenges Ahead" Volume 2, Background Papers; The World Bank Group, Energy and Infrastructure Sector Unit, South Asia Region, May 10, 2002

2 Jit Sondhi: "Railways" in: " India's Transport Sector, the Challenges Ahead" Volume 2, Background Papers; The World Bank Group, Energy and Infrastructure Sector Unit, South Asia Region, May 10, 2002, (footnote 39)

3 Asian Development Bank: "Basic Statistics – 2006", ADB, Economic and Research Department, 2006. The World Bank sets year 2004 GDP at 8.5% with an expected average growth of 6.9% till the year 2008.

4 World Bank "Global Economic Prospects – 2006", IBRD / The World Bank Group, Development Prospects Group, 2006, p 2

5 World Bank *World Development Indicators – 2005*, IBRD / The World Bank Group, Development Data Group of the World Bank's Development Economics Vice Presidency, 2005, Chapter 5: Economy

6 World Bank *Country Strategy Paper for India*, IBRD / IFC / The World Bank Group, India Country Management Unit, South Asia Region, September 2004, p 8

7 World Bank *India's Transport Sector: The Challenges Ahead*; the World Bank Group, 2002 Volumes 1, p13

particular the rail links in the quadrilateral show a constant over-utilization of nominal capacity.

Major investments will be necessary if the transport sector will become a stimulator of growth rather than a hindrance. In particular the Indian Railways, a key component in social and economic development in the past, will have to undergo a major rehabilitation and transformation process at each structural level. "*If IR is to survive as an ongoing transportation organisation it has to modernize and expand its capacity to serve the emerging needs of a growing economy. This will require substantial investment on a regular basis for the foreseeable future*"[8].

The Project will undoubtedly contribute to the rehabilitation of IR and could open the way for a major transformation process for IR's freight transportation business where innovation, efficiency and transport integration are key development components. With its realization, the Project will also become a major contributor to further economic development of the country.

1.2 STRATEGIC INTERMODAL STUDY

Given the scale and urgency of the Project, the Project might need financial assistance from the international donor organizations such as WB, ADB and JBIC. In the project appraisal process of the donor organizations, justification of the Project is an indispensable condition for financial assistance and should therefore be clearly proven.

Estimations of future transport demand and a comprehensive project evaluation with different alternatives are key factors in the project justification process.

Considering the above situation, JICA decided to establish a special study team called the Intermodal Research Group in the Study Team with the following objectives:

1. To establish a comprehensive scenario for the rail-based transport capacity enhancement and a set of strategies for intermodal freight transport system development in India; and

2. To establish an appropriate project evaluation framework, including demand forecast, for the project evaluation of the Project which shall be accepted by international donor agencies.

A comprehensive rail-based intermodal development scenario and a set of development strategies will be established as a basis for finding useful or worthwhile alternative project(s) to be investigated by the engineering study team during the next phase of the Study. This rail-based intermodal system development should be a part of an integrated national logistics development strategy. In other words, it should not be an independent or a separate project.

For this purpose and as a first phase of the Study, a strategic development scenario will be elaborated and several rail-based logistics improvement alternatives prepared for the Project.

For each of the alternatives under the selected development scenario, a conventional financial and economic feasibility study will be complemented by employing a multi criteria evaluation method and detailed risk assessment.

[8] Rakesh Moham Committee: *The India Infrastructure Report – Policy Imperatives for Growth & Welfare*, Rakesh Mohan Expert Group on Commercialisation of Infrastructure Project, 1996; Executive Summary Hihglights

1.3 MAJOR STUDY ISSUES AND REPORT ORGANOIZATION

1.3.1 Major Study Issues

Prior to the detailed engineering study in Task 2, the intermodal research group is expected to study the following four major issues.

Issue 1: Establishment of DFC based inter-modal development scenario and strategies

As an overall framework for the consequent feasibility study to be done by the engineering study team, a comprehensive rail-based inter-modal development scenario and a set of development strategies should be established. This is a very important task in order to find useful alternative projects to be investigated by the engineering study team and at the same time to avoid unnecessary or meaningless alternatives to complete the study as scheduled.

This research issue includes following sub-issues to be addressed:

- Development goal of this rail-based intermodal freight transport system development should be a part of the integrated national logistics development strategy, in other words, it should not be an independent or separate project from improvement of other modes of transport system.

- In order to place this rail-based intermodal freight transport system properly as a part of the comprehensive logistics system for users, a strategic development scenario should be selected from likely development scenario alternatives.

- Under this selected development scenario, several rail-based logistics improvement projects (several sets of projects) shall be prepared.

- As for the selected alternative, a set of development strategies shall be prepared.

Issue 2: Alternatives at conceptual planning level of detail

As discussed briefly in the previous section, several alternatives shall be prepared under a set of common development goals. A “without” case should be prepared as a reference in order to make a conventional financial and economic appraisal. The without case is the case where no significant improvements are made in the rail sector except periodic maintenance work for keeping the current level of service. (other parts of the transport systems such as roads can be improved under the selected development scenario).

There are three alternatives that will be investigated and compared with the “Without” case as follows.

- A totally new dedicated rail freight transport system development (high-speed and totally independent rail-based freight transport system);

- A totally new passenger rail system development (the existing system shall be used as a dedicated rail-based freight transport system);

- Incremental improvement of the current rail system (a series of bottler neck improvement projects);

Each of these alternatives can have different structural designs in terms of engineering or technology, making the selection process complex and with a high level of risk. This means there will be thousands of alternatives if we do not decide a proper direction for alternative development at this conceptual level of detail. In light of this recognition, the research group tries to select one from the above mentioned alternatives at the conceptual level based on the preliminary demand forecast and other evaluation measures to identify one proper direction.

Consequently alternatives under the framework of the selected development concept will be prepared at a feasibility study level of detail by the engineering group in Task 2.

Issue 3: Development of evaluation methodology for large-scale infrastructure projects

(1) Economic Appraisal

Economic impacts of the project can be measured at two project stages separately, namely, a multiplier effect during the construction period, and the impacts of the improved rail asset during operation. The multiplier effect is estimated by using the latest inverse input-output (IO) matrix of the construction sector of India. Whilst, the impact of the asset shall be measured based on rail users' benefit (generalized cost saving of freight), non-rail users' (=truck users) benefit (=alleviation of traffic congestion, energy saving), and rail operators' benefit (net profit during the operation period).

As mentioned a conventional cost benefit analysis (CBA) will be made by comparing the incremental costs and benefits generated by the project implementation. The "incremental" means difference between the condition of "With" and "Without" project.

(2) Financial Evaluation

The objective of the financial analysis is a detailed quantitative evaluation of the project's ability to compensate its prospective lenders and financial sponsors. The terms of reference prepared for the business plan development study[9] by RITES indicates that the preferred implementation choice should be for the India National Railway as the responsible public sector agency to take complete charge of the construction and leave the option of admitting private sector participation as a special purpose vehicle (SPV) to relieve some of the public sector's financial burden and to take advantage of private-sector commercial practices in the management and operation. Accordingly, for the financial analysis, the Base Case should be a scenario in which the project is carried out as an all public-sector investment and operation, and then variety of cases in terms of equity participation and revenue sharing should be discussed. For example, financing for the Base Case is sourced through a mix of a loan or loans from Japan Bank for International Cooperation (JBIC) and other financing agencies for the foreign currency portion of the project capital cost, and issuance of India Rupee denominated bonds for the local currency portion. An alternative scenario of a Public-Private-Sector Partnership in investment and operation ("PPP Case") also needs to be discussed.

Research Item 4: Practical demand forecast model for the DFC with limited data

The research group is requested to review the demand forecast method used for the previous rail studies in India as well as other similar studies in other countries. It is expected for the

[9] Developing Business Plan for Ministry of Railways for the Proposed High Axle Load Dedicated Rail Freight Corridors, Bid Document (February 2006)

research group to establish an internationally acceptable demand forecast procedure for this particular project.

In addition to the above four issues, the intermodal research unit is requested to carry out a preliminary project evaluation on the three basic alternatives.

1.3.2 Report Organization

Following this Chapter 1, Chapter 2 provides an overview of the study methodology employed in this research.

Chapter 3 discusses past and present transport policies focusing on the 5-year development plans.

Chapter 4 summarizes the socio-economic development framework including population and gross domestic products.

Chapter 5 briefly discusses the rail transport sector's issues based on several policy papers, past 5-year plans and the statistics. As one of the unique policies assigned to Indian Railways, it is noted that the public service obligation (PSO) policy should remain, at the same time efficient rail business development is required by inviting private sector.

Chapter 6 addresses the road sector as a competitor of the IR as well as the important facility for the development of intermodal transportation system along the two corridors. For example, access roads to ICDs in major urban centers are important for the development of effective rail-based intermodal transport systems.

Chapter 7 describes the current and future plan of port and ICD. The ports in Maharashutra, Gujarat, and West Bengal are very important especially for DFC.

Chapter 8 summarizes the problems and issues to be addressed for the improvement of intermodality along the two corridors based on the discussions made through Chapter 2 to 7.

Chapter 9 develops a preliminary strategy for the intermodal freight transport systems based on the summary given in Chapter 8.

Chapter 10 investigated the preliminary feasibility study (PETS 1) undertaken by RITES first, then proposes an improved method for demand forecasting. With updated socio-economic indicators and newly proposed methodologies, updated demand forecast is provided.

Chapter 11 discusses a preliminary project evaluation on the three alternatives that are prepared at a conceptual level of detail. Even with the provisional information of each alternative, a preliminary cost-benefit analysis (CBA) is made. In addition to the conventional evaluation method, a multi criteria analysis called Goal Achievement Matrix: GAM) is used to produce the final recommendations. Besides, a risk analysis is made as a necessary tool to be used in Task 2 study.

Chapter 12 makes a comprehensive review of the past project appraisals on large-scale infrastructure projects that are supported by international financing agencies such as WB, ADB, and JBIC. The information summarized in this chapter is a reference for further discussion on the project evaluation of this DFC project.

Chapter 13 summarizes a recommended project evaluation method based on the discussions made in Chapter 12. In addition to the conventional project evaluation method, use of I-O matrix for DFC project is briefly discussed.

Chapter 14 finally summarizes the recommendation of this study for further work in Task 2.The engineering study team is expected to follow the recommendations.

As appendices, a preparatory study undertaken by JICA, headed by Honorary Professor Yuzo Akatsuka of Toyo University, is attached.

It should be noted that the research activities by the intermodal research group were commenced in June 2006 and completed by the end of October 2006.

CHAPTER 2 STUDY APPROACH

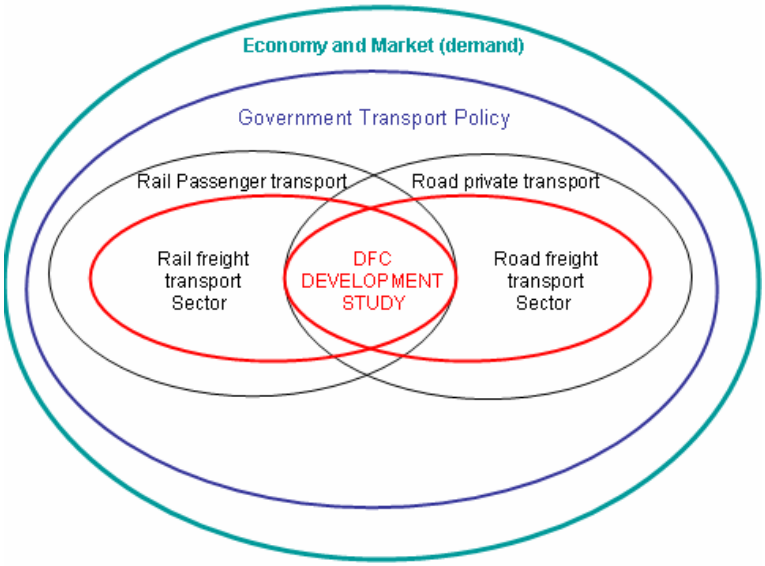
2.1 INTRODUCTION

The intermodal research group evaluates the different alternatives for the Project on the basis of two main issues, which are:

1. The framework conditions of the Project; and
2. The intermodal aspect of the Project.

The framework conditions and the intermodal aspects both are important components in the evaluation process as they define the long-term sustainability of the planned DFC transport system, and are therewith the basis for an argued selection of the best alternative.

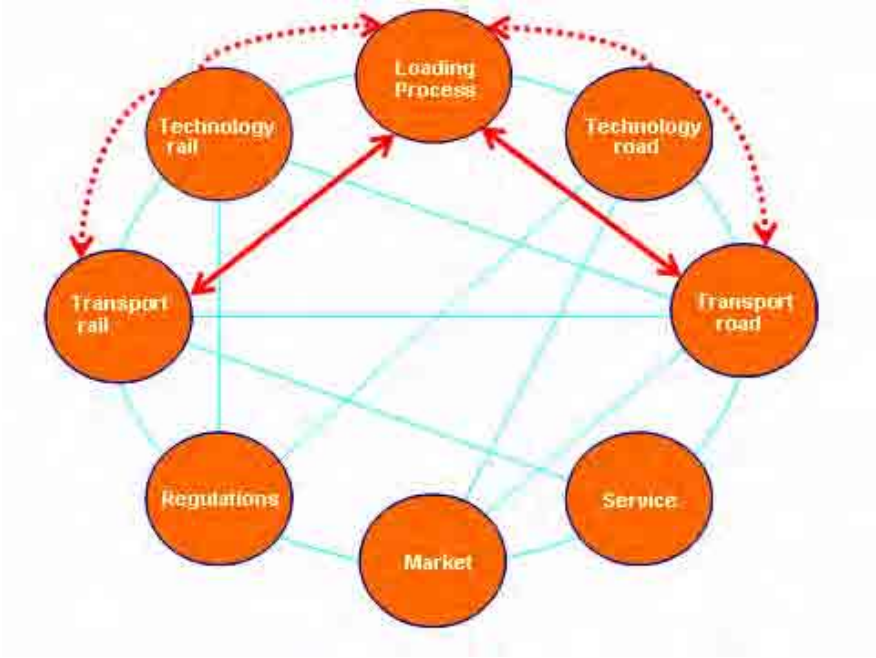
Considering the Indian Government's policy objectives and of the goal of the DFC Project, the Intermodal Study needs to use a realistic Study Framework, defined by sector and market realities as well as global trends in transport and technology and the interaction between passenger and cargo transport as visualized in Figure 2.1.



Source: JICA Study Team

Figure 2.1 Study Framework

The acceptance of above Framework leads to the identification of an overall Study Perspective that harmonizes the DFC concept and design with modern logistics visions where the efficiency of transport is defined by its operations from origin to destination. The viability and validity of the DFC is investigated in light of rail and road transport supply, the contribution of transshipment facilities in facilitating road and rail integration and the technologies used to improve service quality and transport efficiency in this study, see next Figure 2.2.



Source: JICA Study Team

Figure 2.2 The Study Perspective

Intermodal road/rail cargo transport and in particular the movement of containers consists of complex physical movements of cargo along roads and railways, a movement defined by road and rail technologies and the way the goods are loaded and unloaded (including transshipment).In that light, the Study needs to be conducted along a twofold perspective:

1. The ***conditions of physical movement*** (red arrows) which include the transport via road and rail and the loading and unloading processes at terminals; and

2. The ***technological conditions*** (red dotted arrows) which define the capability and quality of the physical movement and handling / storage of goods in terminals / warehouses, both in time and costs.

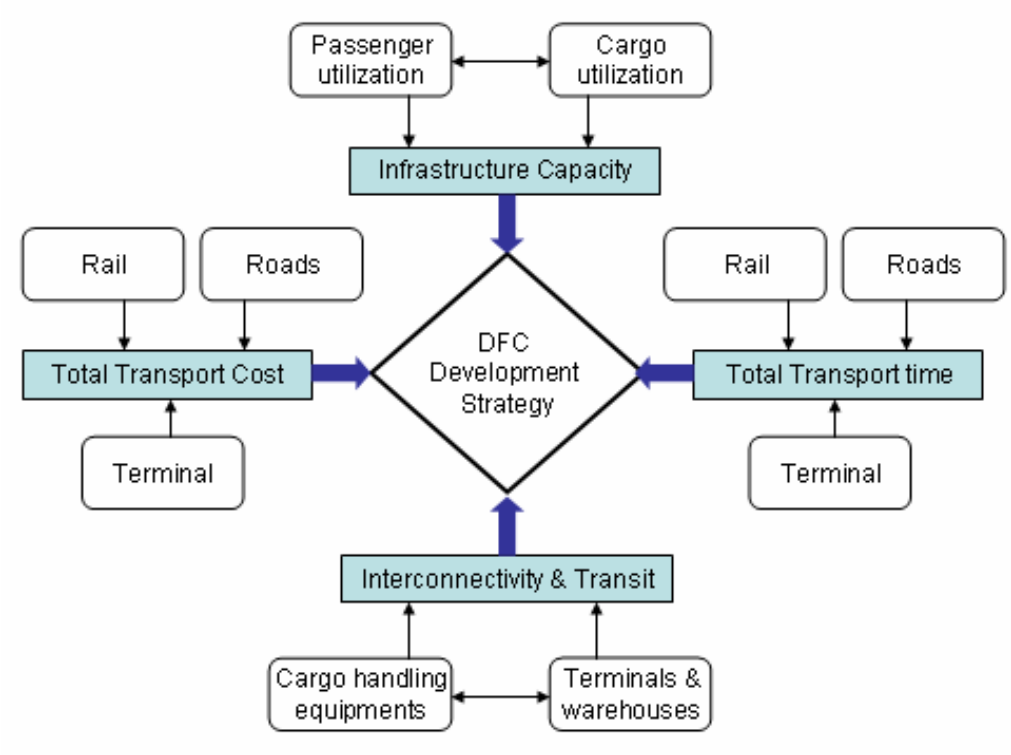
But the above perspective translates concretely into four major framework factors which are paramount for the Study (see Figure 2.3):

1. Real cargo transport capacity;

2. Interconnectivity and transit;

3. Total transport time; and

4. Total transport cost.



Source: JICA Study Team

Figure 2.3 Study Framework

One of the prime guidelines for comparing the different alternatives is that this evaluation is based upon realistic parameters which reflect as much as possible market reality. This is true for each of the four main components of the DFC Development Strategy:

- The real capacity of the rail infrastructure is defined by its use. Mixed traffic will leave less capacity available for the transport of cargo than a rail corridor dedicated to cargo, while new and state-of-the-art infrastructure will allow higher capacity than old less reliable infrastructure;

- The efficiency of railway freight transport is not defined solely by the movement of that cargo along the railway line, but is determined by the transit time of cargo from origin to destination. For that reason, interconnectivity and transit activity is equally important and should be considered as a full part of the railway system; and,

- As for the efficiency, the cost and time of rail-based cargo transport is the combination of the time and cost of all individual activities along the transport chain. This means that the time and cost of the physical movement of cargo along the railway line should be added to the time and cost of the road transport to bring the cargo to and transport it away from the railway terminal(s) and of the time and cost of the cargo handled at / stored in transit points.

The detailed approach within above explained general framework is described in the next paragraph.

2.2 METHODOLOGY

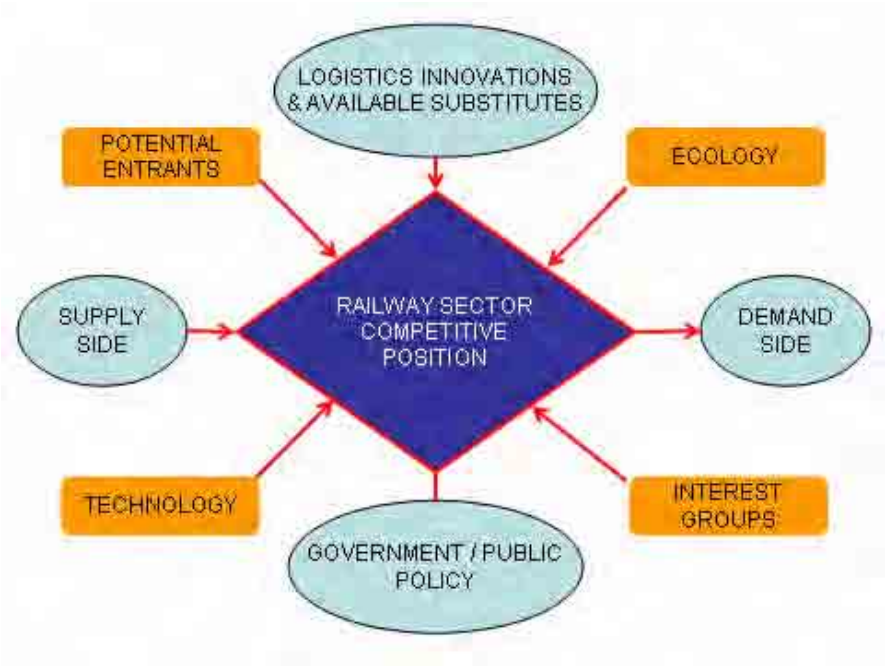
The approach for the evaluation of alternatives consists of four sequential steps:

1. Review of framework conditions ;
2. Cargo transport forecasts for the DFC corridor ;
3. Comparative analysis of the DFC alternatives; and
4. The intermodal strategy: Maximizing capacity utilization.

The approach for each of the individual steps is explained in detail in the following sections.

2.2.1 Analysis of framework conditions

The analysis of the framework conditions for the Project concentrates on the position of dedicated railway freight services from a competitive and demand-driven perspective, as presented in Figure 2.4.



Source: JICA Study Team

Figure 2.4 Competitive Market for Rail Freight Services

The competitive framework of the planned dedicated rail freight service is determined by four main market forces: supply, demand, government policy and available innovations and substitutes. This competitive environment is also indirectly influenced by four other important elements: technology, potential entrants (private sector participation), environmental issues (ecology), and finally interest groups (forwarders, shippers, etc.).

An analysis of these forces will ascertain the critical issues pertaining to the new rail freight service and will enable to identify the necessary (core) competences needed to rival competitors, in particular road haulage.

This due-diligence investigation includes the study of:

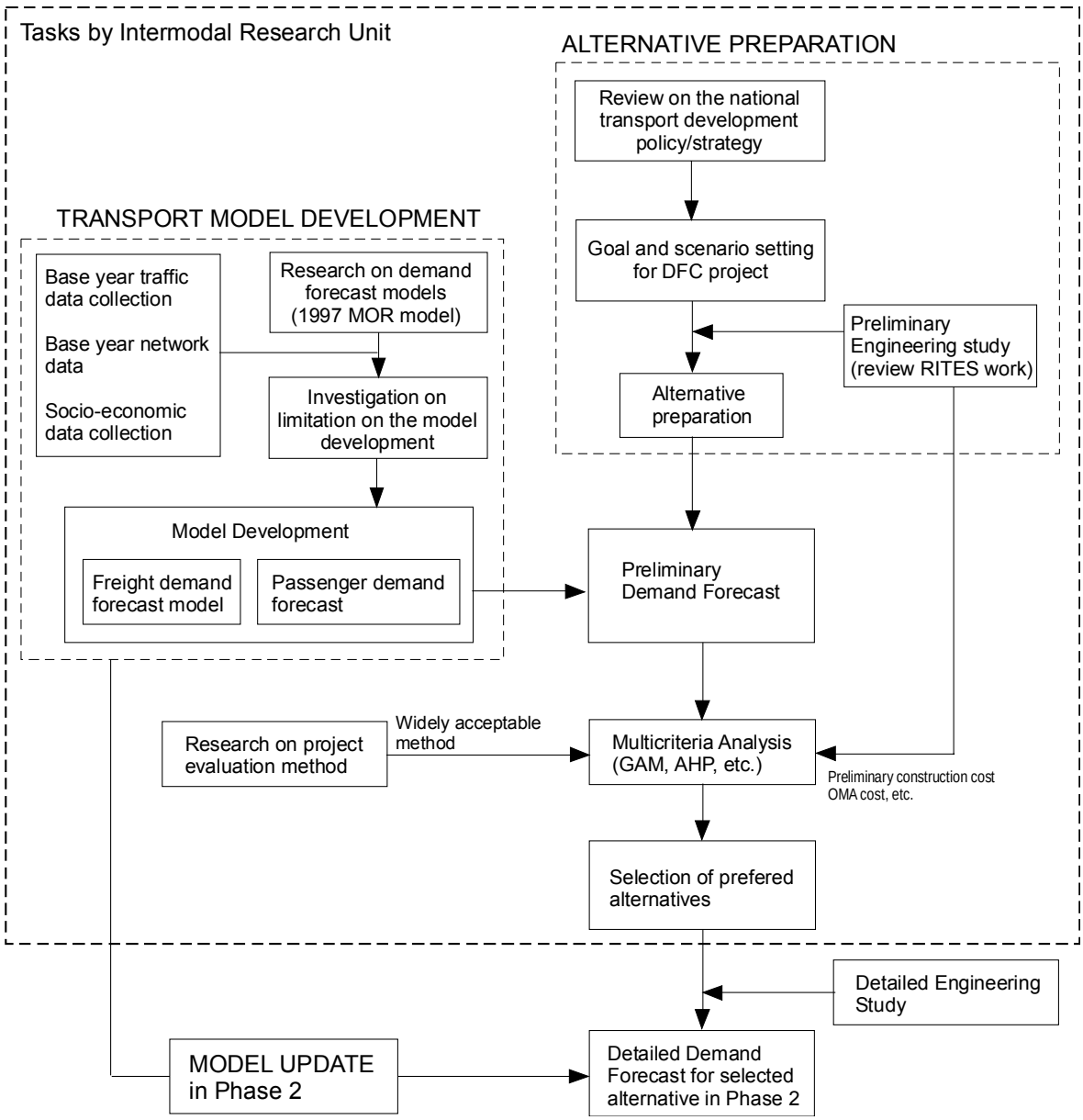
- Policy conditions
    - transport legislation, rules and regulations;
    - government (transport) policy;
- Supply side conditions (the Indian Railways)
    - Analysis of passenger and cargo rail services;
    - Study of IR assets, organizational structure, management capabilities and human resources;
    - IR businesses strategies and planned developments;
    - Assessment of IR applied information technology for management and control;
- Demand side conditions (transport market and economic activity)
    - Domestic and international transport markets;
    - Key production and consumption centers;
    - Existing and potential customers;
- Alternatives and innovations
    - Road transport sector;
    - New transport services (demand and supply vision).

This first phase of the Intermodal Study, where the framework conditions of transport in general and the implementation of the DFC in particular are investigated, which will lead to an in-depth understanding of the potential and of the competitive capacity of the new IR service.

This information is also valuable input for the assessment of the risks and benefits of the planned DFC development.

2.2.2 Cargo transport forecasts

The traffic modeling and forecasting, performed in the context of the Intermodal Study is part of the more comprehensive traffic forecasting effort for the Project, as can be seen in Figure 2.5 hereafter.



Source: JICA Study Team

Figure 2.5 Approach for traffic forecasting

The entire forecasting process focuses on the selected alternative and the demand that have to be met by the DFC service. The final estimations will be the outcome of fine-tuning the preliminary demand forecasts with the results of the detailed engineering study in Task 2,

using the forecasting model that will be adapted accordingly. However, the largest part of the forecasting process is done during the Task 0.

A detailed forecasting effort of rail freight cargo movements per commodity has recently been completed by RITES in the context of the pre-feasibility study (PETS 1) for the two Dedicated Freight Corridors and constitute a strong basis for estimating future traffic for the different development alternatives investigated in underlying Intermodal Study.

But contrary to the RITES forecasts, the intermodal research group investigates different development alternatives with alternative-specific characteristics, requiring more *realistic* traffic forecasts that consider the particularities of each alternative. For that reason, the RITES forecasts needs to be adjusted for the Intermodal forecasting effort.

In a first step, the results of the RITES forecasts were reviewed and when possible / necessary updated with the most recent available information, paying particular attention to replace economic and rail traffic numbers with the most recent values available. As part of this review, the rail freight share was compared with road-based cargo transport on the corridor to have a view on the modal split along the corridor.

In addition to the review and update of the RITES statistics, new information regarding the rail-based freight and passenger movement of year 2004/2005[1] was available for updating the demand forecast for DFC in the intermodal study (Phase 1). This information includes origin and destination stations of the IR freight and passenger trains running in all India with information of volume of commodities by type and passengers. The research group has developed the latest (base-year) rail-based freight OD matrices by type of commodity and a passenger OD matrix based on this information, which were also useful in reviewing the RITES statistics.

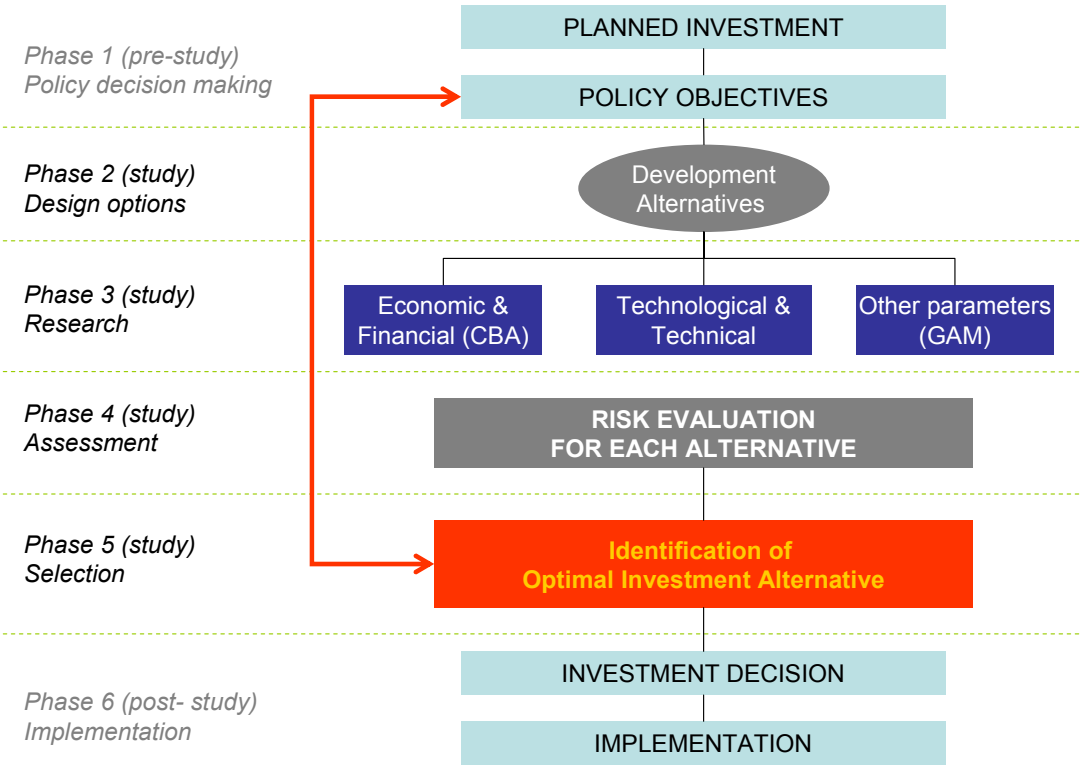
For the bulk cargo, the demand forecasts (future OD matrices) of no constraints, which means the demand does not varies in accordance with the level of services, were prepared based on these latest rail-based base-year OD matrices.

As for the container cargo, it should be noted that one of the important factors influencing the demand is the development and / or improvement of highways and other road infrastructure along the DFC corridor, generating shifts in modal split. Changes in modal split will affect the rail traffic forecasts as they will capture a different share of the market. The impact of road network improvements should not be underestimated because the share of railways in freight transport continues to decline and the majority of demand increase is captured by the road transport sector that is capable of offering a more reliable, flexible and effective service, therewith better meeting market demand and generating savings in transport cost and time. Preliminary modal split model analysis was made through developing modal split models in Task 0 study. At the same time, target figures of CONCOR were also reviewed through comparison between the figures produced by the model. A more comprehensive traffic forecast model will be developed in Task 2.

[1] The information was given to the study team by Centre for Railway Information Systems (CRIS)

2.2.3 Comparative analysis

The evaluation of different Project alternatives is an important part of the investment's decision-making lifecycle, from its conception to its implementation as is demonstrated in Figure 2.6.



Source: Study Team, based upon Pettit & Pullar (2001)

Figure 2.6 GAM in the project lifecycle

A large-scale (public) investment process can be divided into 3 main stages each further separated in different phases. The first pre-study stage is the political process, in which a particular investment / project is proposed in support of achieving a number of (investment-related) policy objectives. In the final phase of the process life-cycle a policy decision is taken and the project can be realized. This decision is based upon the outcome of Task 2, the study phase, in which is the project's viability is investigated.

The Task 2 consists of different sequential research activities. First, the possible alternatives to realize the project are identified and its general structure specified. Next, each alternative is investigated in detail for three major impacts, namely financial and economic impacts, technical and technological impacts / conditions and the non-monetary impacts. But the project and each alternative individually are also confronted with pitfalls which create uncertainty about a successful implementation. The uncertainty of a successful project realization is the final element that requires in-depth research and is done by means of Risk Analysis.

The role of the intermodal research group is to study in detail each of the alternatives and via comparative, multi-dimensional analysis identify the best solution. Given the scope and scale

of the Project and the considerable size of the capital investment, the selection of the best alternative cannot be done on the basis of a single evaluation methodology, but requires the study of a wide range of quantifiable and non-quantifiable decision factors, including the implementation risk. Each analysis requires its specific research methodology to assess for each alternative the contribution to achieving the set-forward Project objectives.

For that reason, the comparative analysis proposed in the Study combines different evaluation methods with each focusing a particular set of above-identified study facets that need to be investigated. The comparative analysis consists of respectively:

1. *Cost Benefit Analysis* : to evaluate the financial and economic effects of each alternative;

2. *Goal Achievement Matrix* : to evaluate non-quantifiable and qualitative elements of each alternative;

3. *Risk Analysis* : to evaluate the risks attached to the implementation and assess the impact of changing assumptions on the outcomes of the analyses.

(1) The Cost Benefit Analysis

Because it is widely recognized that the provision of a high-quality transport system plays a crucial role in long-term sustainable economic development, the Cost Benefit Analysis (CBA) is an effective technique for evaluating the DFC alternatives as it identifies the costs and benefits for each alternative without possible distortions generated by weighting or quantifying efforts for non-quantifiable variables[2].

A Cost Benefit Analysis (CBA) is a means-end assessment defined by economic circumstances and where the investment is decided upon the conditioned evaluation cycle where input generates a result.

The costs include development costs and operations & maintenance (OM) costs. Benefits which can be expected by the implementation include but are not exclusively related to savings in travel time and distance, provision of higher quality traffic services and improvement of area attractiveness. The cost benefit analysis follows a conventional discounted cash flow methodology, comparing project benefits and project costs.

For each alternative, the Economic Internal Rate of Return (EIRR), the Net Present Value (NPV), the Benefit/Cost Ratio (BCR) and the pay-back period will be computed.

The formula of EIRR is shown below:

$$\sum_{t=1}^{n} \frac{Benefits_t}{(1+r)^t} = \sum_{t=1}^{n} \frac{Inv.\ cost_t + OM\ cost_t}{(1+r)^t}$$

where:

$Benefits_t$	:	Benefits in year t
$Inv.\ cost_t$	:	Investment cost in year t
$OM\ cost_t$	:	Operation and Maintenance costs in year t
n	:	Calculation period

[2] See for example, World Bank, *Sustainable Transport: Priorities for Policy Reform*" World Bank Policy Paper, Washington, D.C. (1996)

t	:	Year t (from 1 to n)
r	:	Value of EIRR

EIRR means the value, which will satisfy the above formula.

The goal of the Net Present Value (NPV) is to define the value created from an investment, using the discount rate or the opportunity cost of capital to reduce the expected free cash flows and the project's terminal value (end of year) NVP:

$$\sum_{t=1}^{n} \frac{\text{Benefits}_t}{(1+D)^t} - \sum_{t=1}^{n} \frac{\text{Inv. cost}_t + \text{OM cost}_t}{(1+D)^t}$$

where:

Benefits_t	:	Benefits in year t
Inv. cost_t	:	Investment cost in year t
O/M cost_t	:	Operation and Maintenance costs in year t
n	:	Calculation period
t	:	Year t (from 1 to n)
D	:	A specific discounted rate

Finally, the formula of B/C Ratio is shown below:

$$\sum_{t=1}^{n} \frac{\text{Benefits}_t}{(1+D)^t} \Big/ \sum_{t=1}^{n} \frac{\text{Inv. cost}_t + \text{O/M cost}_t}{(1+D)^t}$$

The CBA follows the economic rationale which implies a constant approach to investments where the preference for one or another alternative is consistent with maximizing utility. It is a means-end thinking defined by economic and financial conditions. In this economic approach, (public) investments are decided solely upon the conditioned evaluation cycle where input generates a result and given a certain input available, a certain result can be expected, for example maximizing welfare given a certain income distribution. The CBA upholds the principle that a final calculated recommendation can only be made on the basis of a numerical (formal) evaluation that uses mathematical algorithms without any distorting interventions.

While the CBA provides detailed information on many monetary and quantifiable aspects of the proposed investment, it could overlook non-quantifiable and/or intangible elements that are relevant for the decision-making process. It is therefore prudent and argued by many experts to combine different evaluation techniques, thus maximizing the volume and quality of available information. Such integrated technique to evaluate large-scale investments combines economic principles with the thinking of "citizen participation" and generates valuable results on the contribution of investments to the nation's economic growth and societal wealth combined. This information enables decision-makers to formulate a reasoned decision under consensus conditions, rather than according to sometimes society-wise questionable economic rationales. For that reasons, the Goal Achievement Matrix will complement the study of costs and benefits.

(2) Goal Achievement Matrix

In line with the European Guide for evaluating large-scale infrastructure investments[3], the comparative analysis will also include an analytical section that complements the evaluation of costs and benefits and where non-quantifiable variables are taken into consideration via a multi-criteria analysis (MCA). In this section, the non-quantifiable variables will as much as possible be "…*identified, quantified and given a realistic monetary value, if possible. If this is difficult or impossible this costs and benefits should be quantified at least in physical terms for a qualitative appraisal.*"[4] The qualitative appraisal will be made using a recognized multi-criteria analysis (MCA) tool, the Goal Achievement Matrix (GAM).

The Goal Achievement Matrix (GAM) is a multi-criteria analysis technique developed in the 1960's and generally accepted as a suitable process for evaluating large-scale investments. The GAM approach is implemented in several countries. Some examples are:

- "Queensland Transport Strategic Plan 1999-2003"; Corporate Strategy and Performance Branch, Corporate Governance Division, Queensland Transport.
- "Creating a Beautiful National Land with Safety and Vitality"; National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport, Japan (2001).
- "Tasman Highway Transport Planning Study - Hobart Airport to Esk Main Road"; Department of Infrastructure, Energy and Resources, Transport, State Government of Tasmania (1998).
- "City Development Strategy and City Assistance Program" Kathmandu Metropolitan City, Nepal (2000, with financial support of the World Bank).
- "Transport Plan 2001-2002" Westminster City Council - Department of Planning and Transportation; prepared by the London Bridges Engineering Group (2002).
- "Transportation Master Plan and Feasibility Study of Urban Transport Projects in Greater Cairo Region in the Arab Republic of Egypt Phase I & II "; Higher Committee for Greater Cairo Transport Planning Egypt, Japan International Cooperation Agency – JICA (2002).
- "West Bay Area Transport Study" Urban Planning and Development Authority (UPDA), State of Qatar (2006)

The GAM / MCA approach compares the alternatives by investigating degree of their variables in terms of contribution to the Project objectives, whether these variables are quantifiable or non-quantifiable. GAM thus provides a more elaborated argumentation for policy makers regarding the reasons for selecting the recommended alternative and therewith complements the CBA-based assessment of the monetary effects. Contrary to the CBA, the GAM process allows for the weighting of evaluation criteria to ensure that those considered most "important" are given a suitable and equitable evaluation. It permits sensitivity testing of the different alternatives against one or more specific criteria and thus allows assessing the level to which any particular alternative contributes in achieving the Project objective(s). GAM can thus be considered a useful and complementary tool for the consideration of

[3] See for a detailed description : *Guide to cost-benefit analysis of investment projects*, Evaluation Unit of DG Regional Policy, European Commission, 1987, revision

[4] *Guide to cost-benefit analysis of investment projects,* 1987, revision, p 31, *cit*

investments whose benefits and costs are not all quantifiable in monetary values and are therefore unable to be included in the CBA.

GAM (and other similar MCA techniques) loosens the means-end relationship of economic (welfare) theory applied in the CBA and introduces more comprehensive intangible and/or non-quantifiable variables as well as welfare distribution effects into the equation. However, entirely replacing the economic rationale of CBA by the supportive rationale of GAM would be dangerous because reliability conflicts could arise as there "*... is nothing in the GAM providing the planners with a foundation for questioning ... results and criticising ... allocation of public means. Yet ... an allocation of investment funds ...*" does not always has an economic rationale and might be guided by personal agendas[5]. GAM should therefore be used in complement with the CBA to investigate decision factors not analyzed during the CBA.

Given the size and complexity of the DFC project the classic GAM approach will be adapted and implemented as a *sequence-based* GAM that analyses the different alternatives in two analytical sections:

1. ***Service Quality Intrusion (SQI) – evaluation***: This evaluation supports the premise that the development of the DFC will contribute to develop efficient (intermodal) transport and increase the overall competitiveness of railway (container) transport.

2. ***Failure Risk – evaluation***: in which a ***basic assessment*** is made ***of the main risks*** that could lead to a failing of meeting the Project objectives. The individual components of alternatives are each investigated in terms of impediments and benefits to meet the Project goals and objectives.

Normally, the technical variables should also be evaluated in the context of GAM. But all technical components are subject of a very detailed engineering study in the second part of this Study and it is therefore considered unnecessary to perform in this phase of the Study a tentative evaluation in which technical conditions for each of the alternatives are reviewed at a more or less generic level.

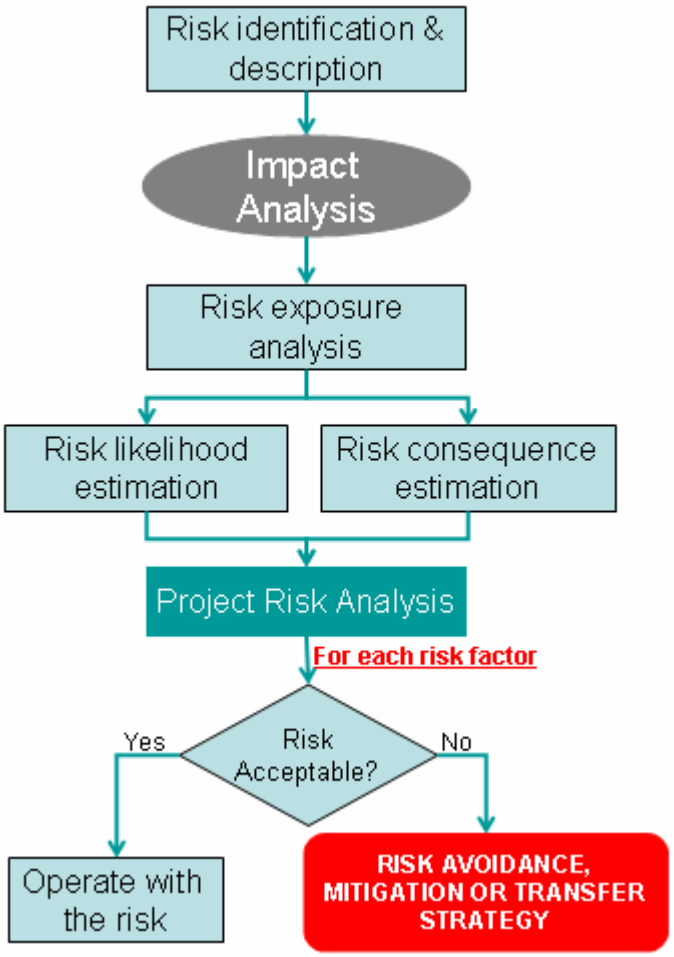
While the Failure Risk – evaluation allows the identification and evaluation of a number of implementation risks for each alternative, the size of the DFC project requires a more comprehensive risk assessment in which variations in implementation conditions, market structures, traffic assumptions and other elements are investigated in detail and its effects analyzed. For that, a due-diligence Risk Analysis is required.

(3) Due-diligence Risk Analysis

Introducing the DFC at a certain moment in time is a very significant action and is confronted with substantial risks because of the uncertainty of demand, market structures and operational system capacity. Without knowing all details of the risks related to the implementation for each the different alternatives, a sustainable recommendation regarding the best alternative will remain unsubstantiated. A detailed risk analysis for all critical success-factors is therefore imperative.

The due-diligence risk analysis will be conducted according to the methodological approach visualized in Figure 2.7.

[5] Tom Sager, 2003, p 9 *cit*



Source: Study Team

Figure 2.7 Risk analysis as part of a project risk strategy

The risk analysis for the DFC involves several sequential and inter-related steps. After the identification of all risk factors, their evaluation starts with determining their relative impact on the outcome, in other words, estimate the consequences of the risk occurring. Once the impacts are estimated, the exposure to the risk of each alternative, the likelihood of each risk factor to happen need to be evaluated and the impact of the risk on the Project investigated.

A critical part in the risk analysis is undoubtedly to determine the impact of occurring risk factors for each alternative. This impact can be estimated by changing the critical assumptions and variables that will consequently generate impact-determined results. The detailed study of the impacts for the DFC transport system will be conducted using both Single Point analysis and Monte Carlo Risk Simulation (MCRS). The "experimentally" or single point risk calculations allows guided sensitivity testing of particular variables while the MCRS evaluates the risk using a probability distribution and has therewith a more realistic approach to risk impact.

The Single Point risk assessment involves changing manually all the critical assumptions and variables in the Excel spreadsheet and redoing all calculations for each of the changes. This approach provides a detailed insight in the effects of a particular variation of one specific variable but does not give any information regarding the range of possible changes or the effects of changes occurring simultaneously for several variables. To assess these risks, a

more elaborated technique is required, one of which is the Monte Carlo Risk Simulation (MCRS).

The MCRS technique refers to a risk assessment method whereby all possible results for one or more values are computed by recalculating the data over and over again, each time using different random sets of values in association with probability distributions of each of the risk values. The computer will implement all valid combinations of the selected values of input variables to simulate all possible outcomes, thus computing hundreds or thousands of "what-if" analyses during one simulation. MCRS thus comprehensively assesses project implementation risks for an uncertain situation via quantifying all possible values a risky variable could take and determining the relative likelihood of each value. The risk analysis is therewith based upon a set of arguments that specify a range of actual values and distribution of probabilities and is more useful as the single point risk assessment.

The impact assessment will focus four fundamental risks groups:

- Cost risk, risks of exceeding initial cost estimates;
- Revenue risk, depending on traffic volumes and revenue yields;
- Capacity risks, generated by fluctuations in operational true capacity of the infrastructure; and
- Demand risk, the major uncertainty when developing transport infrastructure and a reason of many failures in major development projects.

Once the impacts known, the risk assessment will be done using a weighting for each of the three risk components as demonstrated in Table 2.1.

Table 2.1 Risk assessment

Risk assessment*			**Score**	**Level**
Exposure (E)	*Likelihood (L)*	*Consequence (C)*	E x L x C	**Extreme** > 20 **High** > 10 **Medium** 3 – 10 **Low** < 3
Continued (10)	Almost certain (1.0)	Catastrophic (20)		
Frequent (6)	Likely (0.6)	Major (10)		
Occasionally (3)	Possible (0.3)	Moderate (5)		
Infrequently (2)	Unlikely (0.1)	Minor (2)		
Rarely (1)	Rare (0.05)	Insignificant (1)		

* Value between brackets is an imaginary score for each of the weights

If the risk is not acceptable, risk control strategies will be proposed which can be grouped in 3 categories:

1. Elimination of the risk (*avoidance strategy*);
2. Reduction of the risk (*mitigation strategy*); or
3. Engineering or administrative measures to control the effects of the risk (*transfer strategy*).

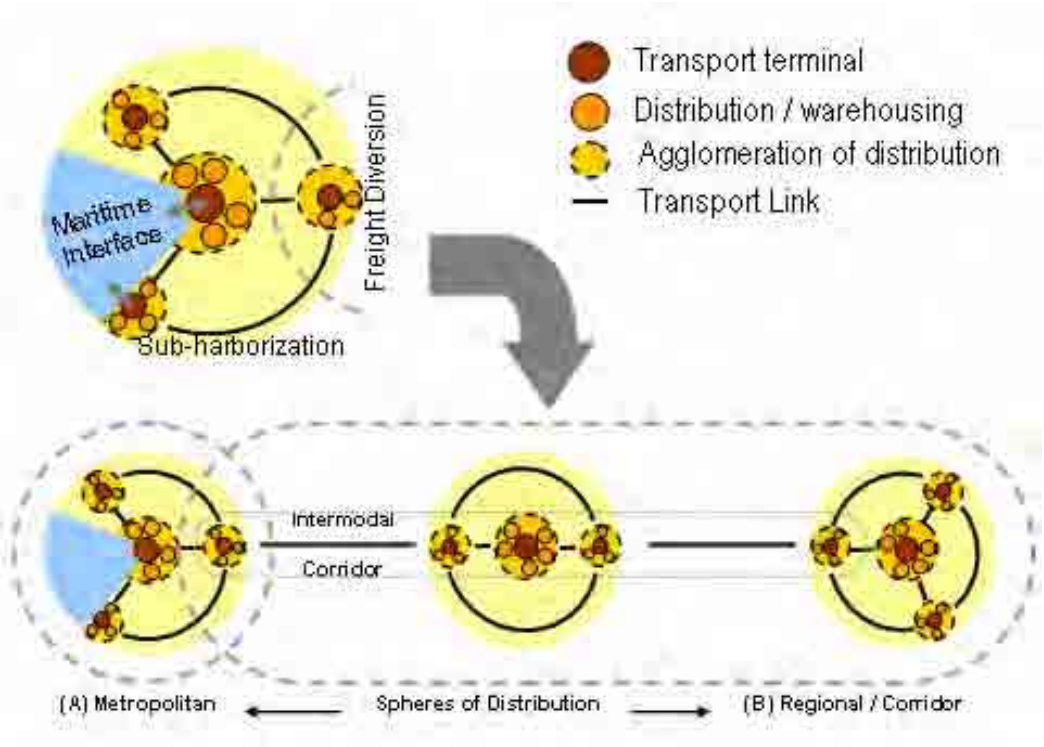
2.2.4 The intermodal strategy: Maximizing capacity utilization.

As a final part of the Study, the investigation focuses on how intermodal transport methods can contribute to maximizing the utilization of DFC capacity.

Several network development approaches exist that deal with the intermodal approach to origin-destination transport of goods. These different approaches each have particular demands in terms of infrastructure hardware, freight handling equipment and flow management software.

The Project will uphold the *Corridor Approach* where freight is moved from origin to destination and the interference on the movement of goods and the flexibility of alternative routing is minimized. The corridor approach therewith aims at maximizing cargo throughput speed and minimizing transportation costs.

In that context, the role of the intermodal terminal is critical and multi-functional, as demonstrated in Figure 2.8 hereafter.



Source: Rodrigue, Jean-Paul (2003) *Freight Gateways, Corridors and Distribution Centers: The Logistical Integration of BostWash*; paper presented at 2003 Conference of the Association of American Geographers, New Orleans, USA

Figure 2.8 Corridor Vision for the Project

For the DFC corridor and the planned block-train (or termed unit-train) freight transport approach the primary terminal is the port, linking land transport with maritime transport. Due to port congestion and consequent time delays and costs, "sub-harborization" could be considered where terminal operations are moved outside the port perimeter. The terminal will function as a final hub and organize the on-time flows for loading and unloading vessels in the port.

From this main terminal hub, the corridor-based intermodal freight flows start and terminate. Block-trains transport the freight (in most cases containers) along the corridor to and from different terminals with their independent spheres of distribution and finally to a regional destination terminal for further hinterland distribution. The latter form of distribution generally follows the "hub and spoke" distribution system.

Studying for the DFC the intermodal requirement needs to incorporate a wide range of inter-related issues as visualized in Figure 2.9 hereafter.

Of course, many of the above identified components of intermodal transport cannot be investigated in the context of the DFC Study and are for the identification of the best alternative irrelevant.

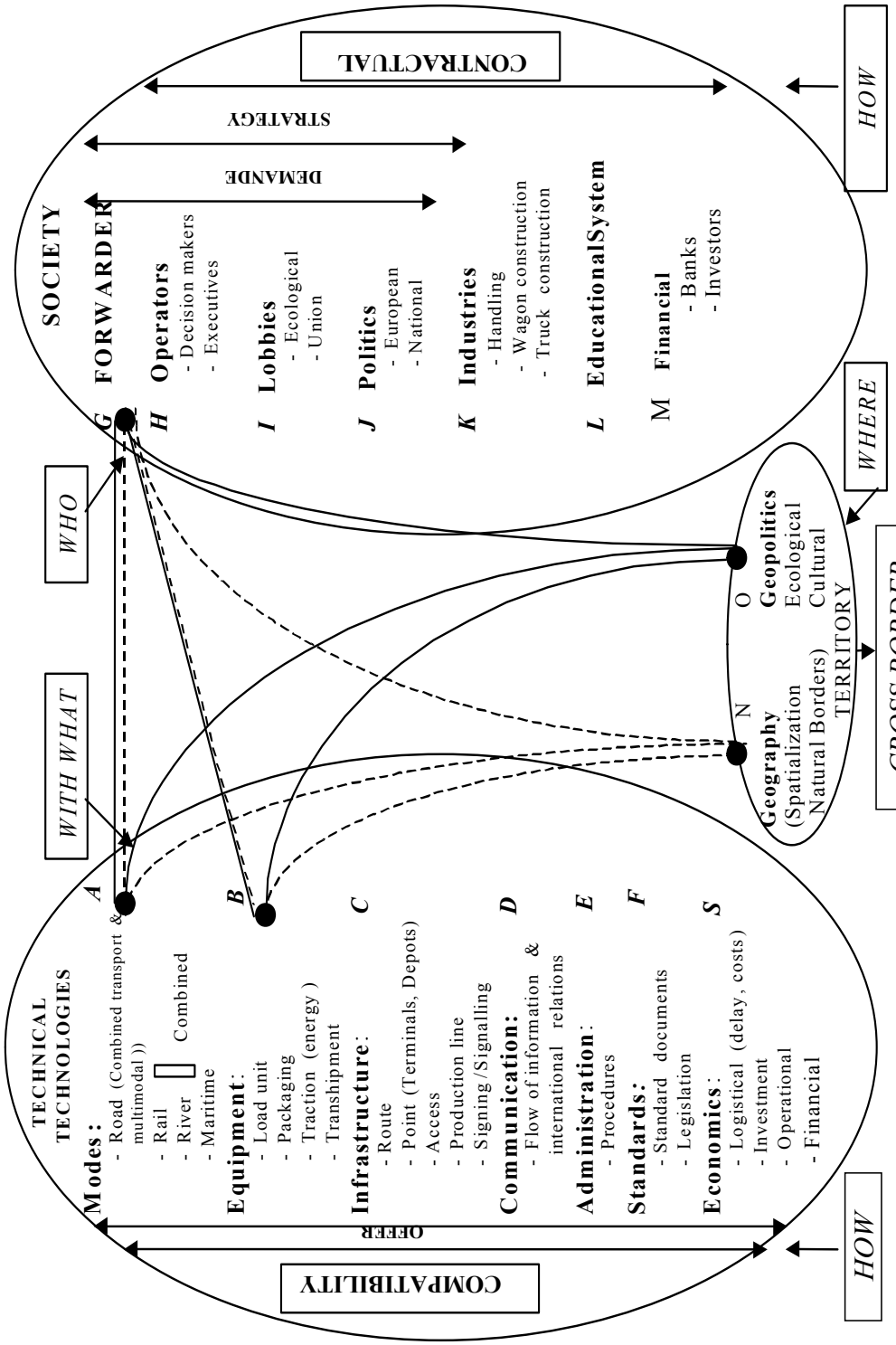
But 3 important issues will be investigated as they directly or indirectly influence the functioning of the DFC. These issues are:

1. The port as critical node in the land – maritime link;

2. Intermodal rail / road terminals as efficiency bottlenecks; and

3. IT for increased efficiency and control.

Developing a modern intermodal freight transport vision for the DFC corridor will undoubtedly offer decision-makers a relevant framework of thinking that will allow maximizing the utilization of the newly generated capacity along the DFC corridor while simultaneously balancing this development with the societal needs of mobility and quality of life.



Source: Study Team

Figure 2.9 Inter-related impact factors for intermodal freight transport

CHAPTER 3 TRANSPORT POLICY REVIEW

3.1 INTRODUCTION

In 1995, the World Bank wrote in its Transport Sector Review Report that the Indian transport sector will have to face two categories of changes: "*The first category are those that require or induce transport sector change in response to the Government's proclaimed national reform initiatives. These are: (i) the deregulation and expansion of foreign trade, (ii) the privatization and deregulation of domestic industry, and (iii) the reduction of government subsidies. The second categories of issues are those that require or induce transport sector change in response to exogenously imposed demographic and technological changes. These are: (i) a growing population, (ii) increasing urbanization, (iii) technological change and obsolescence, and (iv) energy, the environment and other externalities. Taken together these are a formidable list of forces which the transport sector must somehow accommodate now and in the long term.*"[1]

But the Bank simultaneously recognized that at the time the Report was written, much had been done by the Indian Government to meet the ever growing demand for passenger and cargo transport, in particular with major sector reforms and modern transport legislation. It was in the field of infrastructure that the least progress had been made and where private participation remained almost absent. The Report was also critical about the service quality of freight transport by the railway and port sectors, services which were considered inefficient and very costly as compared to neighbouring countries. In its year-2004 Country Strategy Paper, the World Bank praised the Indian Government with the developments in a wide range of social and economic areas and with the pace of the Country's progress. The Bank in particular recognized the strong contribution of the Government's ambitious economic reform plan in place since 1991 and implemented via sequential Five Year Plans.

Around the same period, in 2003, the Asian Development Bank (ADB) recognized the important efforts of government which translated into the present industrial successes. But simultaneously, the ADB stressed the importance of rectifying remaining imbalances in a wide range of issues, one of which being the development of infrastructure, where success varies from very successful (telecommunications) and almost no positive evolution (railways sector reforms)[2].

The ADB is in particular very positive about the poverty alleviation goals as set forward by the Indian Government in the Tenth Five Year Plan and the effort to effectively monitor progress by means of "good governance" (page 7). In the 10th plan, the development of

[1] World Bank: *India Transport Sector: Long Term Issues*; March 16, 1995; Infrastructure Operations Division, Country Department – India, South Asia Regional Office, Introduction

[2] Asian Development Bank: *Country Strategy and Program – India*, CSP IND 2003-10, April 2003, p 2 – 3, Box 1

infrastructure is considered a part of the high growth aims that will contribute to reduce poverty (page 8) and ADB plans to support this effort while putting this aid into a specific more integral development context: "The ADB program will emphasize investments in publicly provided infrastructure such as upgrading / rehabilitating road systems, water transport, railways, hydrocarbons, and power, where investment will be directed to removing key bottlenecks where private investment is not forthcoming. Physical investments will also be combined with policy reforms and capacity building, which are as important as physical investment in improving infrastructure … ADB's strategy will focus on promoting an enabling environment for private sector development through (a) financial sector interventions to improve financial intermediation and resource mobilization; (b) policy reforms to remove impediments to private investment, domestic and foreign; (c) investment in public infrastructure, which also facilitates private investment; (d) public-private partnerships; and (e) investments in private sector projects." [3]

In terms of infrastructure development, ADB has a particular interest in the development of road infrastructure although none of the ADB road projects will actually create new roads. ADB assistance to the road sector will focus on the rehabilitation and upgrading of existing road infrastructure, the improvement of management systems, stimulation of private sector participation and other initiatives that increase the utilization of available capacity (page 24). Although the level of assistance to the railway sector is not as high as for the road sector, the ADB technical assistance program aims at upgrading railway operations and increase safety via the implementation of the Sector Development Reform Program. The focus in the assistance will be on completing a wide range of project already long overdue rather than investing in new developments.

According to ADB, actions have been taken to improve the supporting role of transport infrastructure, still much needs to be done to expand capacity, improve transport policy and minimize adverse social and environmental impacts.

ADB sees five specific issues influencing the Indian transport sector over the next years.

"Five long-term trends are obvious:

- International experience indicates that, once the economy enters an accelerated growth period, demand for freight and passenger transport service grows faster than GDP. In India, demand elasticity of the transport services over the economic growth ranges from 1.2 to 1.4. Assuming that for the next 5 years India's economy grows at the same pace as for the last 10 years (i.e. 6-7%), the demand for transport is projected to grow at 8-9%. This means more investment will be needed in transport than in other economic sectors.

- Road transport is expected to increase its modal share. The ongoing National Highway Development Program (NHDP) will significantly boost the road transport industry, enabling truckers to cover a longer distance in one trip. Four-lane divided highways will allow greater use of multi-axle vehicles with operating costs less than half of those of medium-sized rigid trucks.

- The decline in the market share of railways will continue until Indian Railways has implemented its reform plans to establish a commercial orientation.

[3] ADB: *Country Strategy and Program – India*, 2003, p 16

- Inland Water Transport (IWT) offers a low-cost alternative to other modes for selected market segments such as bulk cargo. IWT consumes the least amount of energy per ton km, which is important since India is a substantial net importer of oil. If necessary investments are made in navigation aids, warehousing / transhipment facilities, and fleet modernization, IWT could attract perhaps 2% of freight traffic (20 billion ton km).

- In the long run, the dominance of road transport has to be changed in favour of a modally balanced transport system, particularly since road transport services are more polluting and less energy-efficient than railways and IWT. While per capita car ownership is low, once average income passes a threshold, car ownership will increase rapidly, leading to serious problems of congestion."[4]

ADB and World Bank stress in a similar voice the need for a balanced, multi-modal transport system, supported by an efficient transport policy that guides the sector in its important role of economic and social catalyst.

In line with donor expectations, the transport sector continues to be an issue of particular attention in the Indian Government's Five-year Plans, recognizing that a "... *efficient transport system is a prerequisite for sustained economic development. It is not only the key infrastructural input for the growth process but also plays a significant role in promoting national integration, which is particularly important in a large country like India.*"[5] For the long-term future, public decision makers are aware that "... *an efficient transport network becomes all the more important in order to increase productivity and enhancing the competitive efficiency of the economy in the world market. The transport system also plays an important role of promoting the development of the backward regions and integrating them with the mainstream economy by opening them to trade and investment.*"[6]

In the context of the underlying Study and the future development of the Dedicated Freight Corridor, the critical question is how the government "translates" this vision into realistic action and to what level this action is in line with the needs and requirements of modern transport and logistics.

3.2 INDIA VISION 2020

With its Vision 2020[7], the Indian Government recognizes the important economic and social changes generated by the continued globalization and is convinced that … "Technology, organisation, information, education and productive skills will … play a critically decisive role in governing the future course of development."[8] Achieving this development for the country will require massive social investments to reduce poverty; to increase access to modern health care; to develop a modern education system accessible to all; to eradicate illiteracy and stimulate computer literacy and IT capability, etc.

The economic and social situation of India by the year 2020 will be impressive, as clearly demonstrated in the next Table 3.1.

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4 ADB: *Country Strategy and Program – India*, 2003, p 111

5 Tenth Five Year Plan 2002 – 2007, Chapter 8.3 Transport, par 8.3.1, p. 931

6 Tenth Five Year Plan, Chapter 8.3 Transport, par 8.3.1, p. 931

7 Report of the Committee on India Vision 2020, Planning Commission, Government of India, New Delhi, December 2002

8 India Vision 2020, p 2, Summary and Overview

Table 3.1 Vision 2020 Objectives

Parameter	India Present	India 2020
Population (million)		
Total population	1,010	1,331 (1.39% increase p.a.)
Dependency ratio (non working to working age)	67%	46%
Health		
Life expectancy	64	71+
Infant Mortality (per 1000)	71	20
Child malnutrition (% of children under 5)	45%	Nil
Public expenditure on health (% GNP)	0.8%	3.4%
Education		
Literacy Male	68%	100%
Literacy Female	44%	100%
Teacher Pupil ratio	1:42	1:20
Public expenditure on Education (%GNP)	3.2-4.4	8
Employment		
Unemployment Rate (% of lab force)	7.3%	Nil
Employment in IT		4-6 million new jobs
Urbanisation		
Urban Population share	25.5%	40%
Transport		
Freight traffic		5500 billion ton km (5 fold increase)
Railway freight traffic		Six fold increase
Passenger traffic		Four fold increase (More travel by Air than Rail between Metropolitan Cities)
Air Pollution		
Carbon Monoxide	11.33	13.27 (0.7% increase p.a.)
Sulphur Dioxide	1.38	2.47 (2.6% increase p.a.)
Particulate	13.93	2.83 (almost eliminated)
Land Use (Million Hectares and share of total)		
Agriculture	142 (45.9%)	142 (45.3%)
Forest	71 (23%)	83 (26.6%)
Settlement & Industry	21 (6.8%)	26 (8.4%)
Wasteland	64 (20.7%)	50 (16.2%)

Source: On the basis of India Vision 2020

The foci for India's development by the year 2020 are:

- A country with a striving economy;
- Equitable distribution of income;
- Control of it's demographic explosion through guided urbanization;
- Strengthening human resources with education for all; and,
- A healthy population with generalized access to basic services.

But human, social and economic development needs to be complemented with supporting infrastructures such as energy, communications and transport. The vision 2020 acknowledges the critical role of the supporting infrastructures and identifies transport as catalyst for economic and social progress.

The Vision 2020 stresses the progress made over the last fifty years in developing the passenger and freight transport system of India: "India's network of roads, railways, air services and ports is one of the largest in the world… Over the last 50 years, the … volume of railway freight has increased five-fold and passenger kilometres nearly seven-fold. The length of surfaced roads has multiplied nine-fold. The number of goods vehicles has increased 40-fold … The tonnage of freight handled by the nation's expanding system of major and minor ports has grown more than 16-fold. … Currently, about 800 billion tonne km of freight and 2,300 billion passenger km are handled by the transport system, with the total transport demand growing at around 10 per cent a year for the past decade."[9]

The arguments in Vision 2020 originate from a detailed transport sector review, commissioned by the Planning Commission in preparation of the Vision 2020 document.[10] One of the key points in the transport sector review focuses on the unequal growth of road and railway transport. This unequal growth was estimated by the author as represented in the following Table 3.2. Both for the transport of passengers and freight, the growth of the road sector's share has been impressive. While in the fifties, rail had almost 3 times the road volume for passenger transport and 9 times for cargo transport, in the year 2000, the number of railway passengers dropped to one quarter of the volume on the road, and the railway cargo volume declined to one third of total cargo transported by road.

Table 3.2 Growth of Road Traffic and Modal Shares

	1950-51	1960-61	1970-71	1980-81	1990-91	1999-00
Passenger kms (Billion)						
Rail	66	78	118	209	296	428
Road	23	57	169	407	859	1,659
Total	89	135	287	616	1,155	2,087
Freight kms (Billion)						
Rail	44	88	127	159	243	302
Road	5	27	77	145	503	800
Total	49	115	204	304	746	1,102

Source: Mahesh Kapoor: *Vision 2020 Transport*, Oct 2002, p 14

The relative share of railways in total freight and passenger traffic declined dramatically over the last 50 years in India from 90% to 25% of total cargo transport, contrary to the impressive increase of the road sector from 12% to 60% of total freight transport[11].

The Vision 2020 Transport review explicitly expressed its concern that in spite of the important growth of the transport sector, the present capacity will be far from sufficient to meet future demand for passenger and cargo transport. The "*...volumes of demand will be very high with a increase for both railways and road transport requiring not only massive investments but other actions, covering pricing policies, customer focus, terminal*

[9] India Vision 2020, p 64; the estimates differ slightly from the 870 billion ton km and 2,450 billion passenger km as suggested in *India's Transport Sector, the challenges ahead*; World Bank Group, 10 May 2002

[10] Vision 2020 Transport, prepared for the Planning Commission by Mahesh Kapoor, October 2002

[11] India Vision 2020, p 65

management, safety, transit times, organizational and other changes to provide adequate and efficient services for meeting the demand will be a main concern."[12]

This situation is even more dramatic in light of the expected explosion in cargo transport with total freight traffic likely to reach between 5,500 and 10,000 billion ton-km by the year 2020[13]. The railway sector faces a large number of challenges in terms of cargo transport[14]:

- The total ton-km transported will increase three to six-fold by the year 2020, far exceeding the capacity of the railway network;
- Changed production structures with a focus on minimizing non-productive inventories generate new logistics needs where smaller consignments with higher value become both time and cost sensitive;
- Innovative logistics will require traditional transporters to change their offer and embrace value-added services that meet an increasingly complex demand;
- Changing production systems and commercial visions as well as increasing public and societal pressures generate renewed attention for alternative transport modes to replace the transport of cargo by road, but to translate this attention into concrete benefits will require the alternative transport modes transforming their present single-mode transport offer into a highly efficient, very reliable and less costly integrated and multi-modal transport service.

The Vision 2020 transport stresses the important role of multi-modal transport and of containerization, supported by modern technology applications and a new transport policy stemming from an integrated and modern vision on transport[15]. Terminals will need to be capable of providing both rail and road services and its positioning organized according to the hub and spoke concept.

The report made it very explicit that there is a real need for a more comprehensive effort in terms of infrastructure investments:" *To meet the transport needs of the future, investment requirements will increase to levels three to four times higher in real terms form the present levels. The financing of this level will be a massive task. While the government will continue to be a major source of funds for infrastructure, internal generation of resources by the sector itself will have to increase. Pricing of transport services and reduction in the costs will have to play a much bigger role than in the past. A larger role of the private sector is also visualized*."[16]

Vision 2020 is very clear regarding the future of transport and fully supports the opinions expressed in Vision 2020 Transport: "*While the progress made in the transport sector has been significant, it has not been able to meet the growing demand, particularly in the last decade … A huge increase in demand for both railways and road transport will require not only massive investments but also modification in pricing policies, increasing customer focus, improved terminal management, enhanced safety, reduced transit times, and other*

12 Mahesh Kapoor: *Vision 2020 Transport*, Oct 2002, p 18
13 Vision 2020 Transport, Mahesh Kapoor, October 2002, p 21
14 Vision 2020 Transport, Mahesh Kapoor, October 2002; maintained in India Vision 2020 and also made explicit in the year 2002 Rakesh Mohan Committee Report on the Indian Railways
15 Vision 2020 Transport, Mahesh Kapoor, October 2002, p 26-27
16 Vision 2020 Transport, Mahesh Kapoor, October 2002,, p 31

changes required to provide adequate and efficient services for meeting the growth in demand and public expectations."[17]

So does the Tenth Five Year Plan conceptualized during the same period translates this vision into concrete action?

3.3 THE FIVE YEAR PLANS

3.3.1 The previous plans

In March 1950, the Planning Commission was established with the aim of promoting the welfare of the Indian people. A particular objective of the Planning Commission was a rapid rise in the standard of living of the people by efficient exploitation of the resources of the country, increasing production, and offering opportunities to all for employment in the service of the community[18]. The realization of the Planning Commission's objectives is to be achieved via the implementation of sequential Five Year Plans during which particular needs are identified and actions proposed to satisfy these needs.

In line with the country's needs, the first Five year Plans, roughly till the beginning of the nineties, focused on agricultural production and other basic problems related to the development of an under developed economy, in particular utilizing more effectively the potential resources available to the community, the development of human faculties and the building up of an institutional framework adequate to the needs and aspirations of the people[19]. Transport in these first Five Year Plans was viewed in light of realizing the social objectives and not as a single sector or service with its proper deficiencies and requirements which needs to be addressed. This approach was clearly expressed in the First Five Year Plan: "The pattern of the transport system in the country will undergo substantial changes 'as the various agricultural and industrial programmes included in the Five Year Plan are progressively implemented … To cope with the problem, the probable points of increasing demand for transportation facilities should be known in order either to provide the necessary facilities or to relieve the strain on the system by diverting traffic elsewhere."[20]

The First Five Year Plan focused on the rehabilitation and expansion of capacity of the railway network, of the shipping sector and the Indian ports. The strong relationship of the transport infrastructure with the support of the agricultural and industrial development was most clearly expressed in respect of developing the road network in India: "Priority in the development of roads has to be determined in relation to plans of development in other spheres in the light of national and local resources and needs. Roads which assist production, and especially agricultural production, should have a high priority in existing conditions." [21] At the same time, the policy makers recognized the existence of an emerging road transport sector and specified that the role of the State in organizing the sector should be amplified to ensure financial strength and operational efficiency.

The Second Five Year Plan recognized that much remained to be done to achieve the full rehabilitation of the Indian transport sector and expressed its commitment to achieving that goal. But at the same time, the Second Five Year Plan goes one step further and plans a

[17] India Vision 2020, p 66
[18] First Five Year Plan, Introduction
[19] First Five Year Plan, Chapter 1
[20] First Five Year Plan, Chapter 31 Transport and Communications, Introduction
[21] First Five Year Plan, Chapter 31 Transport and Communications, Section 5, Roads (par 69)

major expansion of the transport network to support the future development of the heavy industries in the country. "The essence of the situation is that heavy demands are likely to be made on all the transport services during the next five years. It is proposed to review the programmes for transport and communications from year to year so that, wherever necessary, additional steps can be taken to ensure that transport bottle-necks do not jeopardise the implementation of plans in other sectors."[22]

The approach initiated in the Second Five Year Plan was sustained during the Third Five Year Plan and puts particular attention to the creation of an integrated long-term plan and development strategy for the transport sector and the role of each of the transport modes in the realization of that strategy. The focus of attention remains on the development of the railway sector, but this focus should not be detriment to the development of the road transport sector. The Third Plan has a clear vision on the development of the transport sector and argues that, "… while there is a general shortage of transport in the country today … this will not necessarily preclude competition between rail and road transport over certain routes and in respect of certain commodities … It is clear, however, even at this stage … that the railways in preparing detailed plans for increasing line capacity over various sections of the railway system will have to take account of the possible future development of road transport in the regions concerned."[23]

The Fourth Five Year Plan reviewed all achievements during the first three plans and concluded that transport "… has a crucial role in economic development … Investments in transport have long gestation periods and are often large and lumpy. It is necessary not only to make careful and realistic assessment of transport requirements in advance, but also to review them continually so that suitable adjustments are made from time to time. The problem is to avoid economic losses which might arise either because of transport bottlenecks for want of adequate provision or because of unutilised facilities created in excess of requirements."[24] The fourth plan argued that the careful monitoring of transport development needs would be continued to further strengthen and ensure the supporting role of the transport sector to the economic development of India. The fourth plan in particular proposes many infrastructure and equipment rehabilitation programs for rail, road, inland waterways, ports and airports to upgrade the networks and services to meet modern international standards.

In the Fifth Five Year Plan, the focus was on fiscal, monetary and administrative measures to curb rising inflation and bring back in line the balance of payments[25]. The final version of the Fifth Five Year Plan had to be postponed till the financial and economic situation somewhat stabilized around 1975-76. The development of the transport sector remained on the agenda but was downscaled consequence of economic and financial pressures[26]. The main goal of the 5th plan for the transport sector was the continuation and / or completion of ongoing initiatives while the start of new comprehensive programs was not envisaged for any of the transport modes. However, the Fifth Five year Plan would be considered as one of the reasons for the present financial problems of IR as the plan included a substantial increase in staff payments.

With the Sixth Five Year Plan, the transport sector receives again the attention it deserves as catalyst for economic development: "Transport, in India, plays a crucial role in ensuring

22 Second Five Year Plan, Chapter 21, Transport, Introduction
23 Third Five Year Plan, Chapter 28, Transport and Communications, Coordination of Transport, Approach in the Third Plan (par 12)
24 Fourth Five Year Plan, Chapter 15, Transport and Communications (par. 15.3)
25 Fifth Five Year Plan, Chapter 1, A Review of the Economic Situation
26 Fifth Five Year Plan, Chapter 5, Section 6 – Transport and Communications

sustained economic growth and is vital for the development of the various segments of the economy. The need for according high priority to the transport sector flows virtually from the 'size of this country as well as from the geographical dispersal of its natural resources."[27] For the first time, a Five Year Plan recognizes the real complexity of the transport sector and its inter-relationship with industrial and economic development and emphasizes "… the need for transport infrastructure, especially the more vital sectors of it like railways, ports and roads, being allowed to develop in a manner commensurate with the growth of the economy, particularly of segments within a high transport coefficient, and to have, as far as possible, certain amount of flexibility in investment planning to avoid its becoming a serious bottleneck in the development of the economy."[28]

The 6th plan underlines the goal expressed in the Third Five Year Plan to approach the development of the transport sector from an integrated planning perspective and says that "… balanced attention would be given to various, and sometimes competing, segments of transport like freight and passenger traffic, industrial and agricultural needs, rural and urban requirements etc. Special emphasis will need to be given to provision of transport facilities at reasonable cost to remote and isolated areas like the North Eastern Region and Andaman and Nicobar Islands, etc." [29]

For the first time, the importance of the transport infrastructure for the transport of goods and the possible benefits of containerization were explicitly recognized: "In a situation of scarce resources, while the needs of freight traffic will have higher priority, the minimum requirements of passenger traffic will also be catered to for avoiding serious inconvenience to the travelling public … One of the most remarkable changes in international transportation technology in the last two decades has been the spectacular growth of containerization … It has therefore become imperative for India to develop container handling facilities … The full benefits of containerization are achieved only when complete door to door operations from origin to destination are arranged. While this may be difficult to realize in the near future in India, it is proposed to proceed in respect of containerization in three stages as under:

i. Movement of containers to and from Indian ports where containers would be retained and cargo stuffed and destuffed. This would be purely port-oriented arrangement.

ii. Movement of containers to and from Inland Container Depots (ICDs.). This would involve coordinated transport and procedural arrangements.

iii. Introduction of door to door containers from origin to destination.

The main objectives of the Sixth Five Year Plan in respect of container traffic would be (a) to enable the four main ports, viz., Bombay, Cochin, Madras, Haldia to handle gearless ships, (b) to develop facilities for handling cellular ships at Madras and at the proposed Nhava Sheva port, (c) to encourage inter-modal transport of containers by barge, rail and road in Calcutta/Haldia complexes and (d) to set up three Inland Container Depots at Delhi, Ahmedabad and Bangalore on a priority basis."[30]

With the fixation of above objectives, modern transport was introduced in India and the trend was set for the development of intermodal transport chains, focusing on the main cargo corridors. Once again, the 6th plan stressed the need for an integrated transport policy in

[27] Sixth Five Year Plan, Chapter 17 – Transport
[28] Sixth Five Year Plan, Chapter 17 – Transport (par 17.8)
[29] Sixth Five Year Plan, Chapter 17 – Transport (par 17.17)
[30] Sixth Five Year Plan, Chapter 17 – Transport (par 17.18 – 17.27)

which the focus is on the elimination of bottlenecks, to complete ongoing works, to realize a better coordination between modes and to achieve a better utilization of existing capacity.

This new vision has been made very explicit in the Seventh Five Year Plan with the preparation of the transport sector for the year 2000, because it "… is envisaged, the transport infrastructure would be radically different by 2000. A well-integrated, multi-modal system relying increasingly on emerging technologies will be an essential element of the transport scenario. The magnitude of the demand for other modes of transport would be substantially increased. While railways and roads would continue to be the dominant modes of transport, supplementary modes of transport such as civil aviation, coastal shipping, inland waterways and product pipelines would play an increasing role in the country's transport systems in the future. "[31]

But the transport sector still lacks sufficient capacity: "Despite an impressive growth in the spread of the transport network, a large number of villages in the country still lack road connections. It has been estimated that at the end of the Sixth Plan, about thirty six per cent of the villages remained without a road link and around sixty-five per cent without all-weather access roads. Notwithstanding the continued expansion that has taken place, the capacity of the entire transportation system including the road network continues to fall short of demand for transportation. Capacity constraints have been felt in several areas. These constraints in the Railways have led to movement of bulk commodities like coal, over long distances, by road, at high cost to the economy. The road system too is under heavy strain. Inadequacy of capacity and substandard infrastructure have led to excessive transit delays, fuel wastage and higher operating costs. Seaborne traffic also has faced constraints, as port infrastructure modernisation has lagged behind changes in shipping technology and cargo handling methods. Several ports suffer from draft limitations as well. These are some of the areas where position would be rectified to the extent feasible in the Seventh Five Year Plan."[32]

The multi-modal perspective also leads to a clearer vision on the actual role of in particular rail and road freight transport lacking this modern vision: "Rail and Road Transport are the dominant modes and would remain so in the foreseeable future. There has, however, been a marked shift in their relative shares in the total traffic … This continuing shift is essentially attributable on the one hand to the rail capacity constraints and on the other, to the extension of road network and the inherent advantage of road in handling non-bulk traffic. Ideally, the Railways should have adequate capacity to clear all train and wagon load traffic for long and medium leads particularly for bulk commodities while the road transport would cater essentially for small lot short haul traffic for which it is the more efficient mode."[33] But before any real modal restructuring can be pursued, it is imperative to deal with "… transport infrastructure that is burdened with over-aged and obsolete assets and the backlog of replacements has now assumed enormous proportions." [34] But this situation has some positive side: "The massive scale of replacements, however, provides an opportunity for the introduction of new technologies and the much-desired modernisation of infrastructure. In fact, in several areas, upgrading goes hand in hand with replacements. Accordingly, replacements would be vigorously pursed in the Seventh Plan." [35]

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[31] Seventh Five Year Plan, Chapter 2, section Transport (par 2.71 – 2.72)
[32] Seventh Five Year Plan, Chapter 8 – Transport (par 8.3 – 8.4)
[33] Seventh Five Year Plan, Chapter 8 – Transport (par 8.5)
[34] Seventh Five Year Plan, Chapter 8 – Transport (par 8.7)
[35] Seventh Five Year Plan, Chapter 8 – Transport (par 8.8)

In the Eight Five Year Plan, the substantial efforts of transforming the transport sector towards a modern and integrated transport system have been applauded. But there "… is considerable scope for further improvement of productivity levels in almost all modes of transport, essentially, on the basis of modernisation and up gradation and improvement in the output levels of manpower and equipment. The transport system carries excessive manpower in relation to requirements. In several areas like ports, road transport, shipping etc. the present manning scales are disproportionately high. While pursuing the process of up gradation of technology, it will also be necessary to take complementary steps to redeploy all the manpower available after fresh training."[36]

In addition to the traditional needs for the transport sector – completing projects, replacing old infrastructure and equipments, developing an integrated transport policy and improve capacity utilization – the 8th plan expands the needs to modern requirements such as container transport, information technology, and for the first time a real attention to human expertise.

Two new very important elements emerged in the Eight Five Year Plan, although at that time limited to the road sector:

1. The need to coop with the limited financial resources of government and the possibility of inviting the private sector in the development of infrastructure; and

2. The urgent need for Research and Development to meet the urgent needs of a modern road transport sector.

With the Ninth Five Year Plan, the government recognized that there is still much to be done and that words alone are not enough. "A comprehensive policy package is necessary to address the diverse issues facing the transport sector. It is imperative to strengthen the Indian railway system in its reach and capacity so that it effectively links the distant parts of the country, helps to develop the economic potential of the backward areas and carries the bulk of the nation's long or medium haul traffic. Similarly, the road network needs to be expanded and strengthened to improve accessibility of the hinterland, especially the rural areas and to facilitate the integration of the isolated parts of the country. The length and breadth and the quality of the highways must be improved greatly as part of a national grid to provide for speedy, efficient and economical carriage of goods and people … The capacity of the ports in terms of their berths and cargo handling equipment needs to be vastly improved to cater to the growing requirements of the overseas trade. The shipping industry needs to be enabled to carry higher shares of the seaborne trade in indigenous bottoms … Conditions need to be created to ensure full utilisation of the capacities created in the public sector with large investments made in the past."[37]

But in spite the many positive developments and the gradual creation of a modern vision on transport, the reality of the sequential plans is different. Although the share of transport in GDP grew constantly and the capital investments also increased in real terms, the share of transport investments as part of public spending declined dramatically as is shown in Table 3.3. The issue will be discussed in more detail further in section 3.4.

[36] Eight Five Year Plan, Chapter 9 – Transport (par 9.1.11 – 9.1.12) [orthographic errors have not been corrected)
[37] Ninth Five Year Plan, Chapter 7 – Transport and Communications, part 7.1: Transport (par 7.1.23)

Table 3.3 Transport sector as share of public spending

Five Year Plan	I	II	III	IV	V	VI	VII	VIII
Share	22.1	23.5	23.1	16.0	14.1	13.0	13.5	12.9

Source: World Bank, Transport Sector review, 2002

Given the needs of India for a modern and efficient transport system as expressed by the different donor organizations and the Government's opinion expressed in Vision 2020, does the Tenth Five Year Plan continues on the same line as the previous nine plans or is there a notable change that could brake the existing trend and give transport the incentives it deserves.

3.3.2 The Tenth Five Year Plan

Donor organizations like the World Bank and ADB pledged their support in realizing the goals set forward the Tenth Five Year Plan. The commitment of all parties to realizing the plan is driven by the notion that a secure development for India can only be guaranteed in the long term through a major reduction of social inequality, the first of the eight Millennium Development Goals[38]. The Indian government is well aware of existing social imbalances and the need to tackle these as a firm priority: "The Tenth Plan provides an opportunity, at the start of the new millennium, to build upon the gains of the past and also to address the weaknesses that have emerged. There is growing impatience in the country at the fact that a large number of our people continue to live in abject poverty and there are alarming gaps in social attainments even after five decades of planning. To meet this challenge squarely, the Tenth Plan must learn from past experience. It must strengthen what has worked well, and at the same time also avoid repeating past mistakes. There must be willingness to modify policies and institutions based on past experience, keeping in mind the changes that have taken place in the Indian economy and in the rest of the world."[39]

As an overall strategic approach to transport, no significant changes can be observed. "Considering India's continental size, geography and resource endowment, it is natural that the Indian Railways should have a lead role in the transport sector, not to mention other considerations such as greater energy efficiency, eco-friendliness and relative safety."[40] But as in each of the recent plans, the continued decline of the sector is mentioned together with the overemphasis on passenger transport in detriment of cargo transport. As in the previous plans, the need for urgent counter-measures echoed, in particular the urgent termination of ongoing measures and a better allocation of financial resources to high priority projects, e.g., in the Golden Quadrilateral. On the other hand, the growth of the rail transport sector needs to be supported by better and enlarged road infrastructure and more comprehensive reorganization of the sector. A more detailed analysis of the tenth plan shows a better balanced vision on how the sector should grow forward, as discussed hereafter.

The tenth plan intends to build upon the achievements of the ninth version and correct wherever necessary the plan of action in particular regarding the development of the railway sector: "Considering the inadequacies and imbalances in the transport system, the Ninth Plan

[38] See for a recent update on the Goals: *The Millennium Development Goals Report, Report 2005*; United Nations, New York, 2005. Although the results towards achieving the Millennium Development Goals are mixed, India scored well in particular in poverty reduction.

[39] Tenth Five Year Plan 2002/3 – 2006/7; Chapter 1, p 7, par 1.25

[40] Tenth Five Year Plan 2002/3 – 2006/7; Chapter 1, p 20, par 1.90

envisaged a comprehensive package to address various transport sector issues. It emphasised the need for improving the capacity and quality of the transportation system through technological up gradation and removing distortions in the intermodal mix by evolving a rational tariff and investment policy. It also laid stress on improvement of the self-financing capacity of this sector and on the need for ensuring an improved transport system to provide speedy, efficient, safe and economical carriage of goods and people. While the achievement of objectives and targets set for some subsectors, particularly roads and ports, have been encouraging, the progress in the case of others has not been as good. This is particularly true of railways where shortfalls in achievement of physical and financial targets as well as policy objectives are anticipated. The Tenth Plan has to address these shortcomings and also reinforce the achievements."[41]

The aim of the Tenth Five Year Plan is to improve intermodal complementarities and competitiveness while solving capacity constraints of both the railway and road sectors generated by previous policies or lack of such. The Tenth Five Year Plan's objectives for the transport sector can be resumed as follows[42]:

(i) "Meeting the transport demand generated by higher growth of gross domestic product (GDP).

(ii) Ensuring transport growth in a manner that all regions of the country participate in the process of economic development and is paid special attention to integrating remote regions such as the North-East into the economic mainstream.

(iii) Capacity augmentation, quality and productivity improvements through technology up gradation and modernisation.

(iv) Emphasis on higher maintenance standards so as to reduce need for frequent reconstruction of capacity.

(v) Higher generation of internal resources and increased private sector participation in providing transport services.

(vi) Increase in overall economic efficiency by bringing in competition into the provision and maintenance of transport infrastructure and services wherever possible.

(vii) Higher emphasis on safety, energy efficiency, environmental conservation and social impact.

(viii) Developing an optimal inter-modal mix, where each mode operates efficiently and according to its comparative advantage, and complements services provided by other modes of transport."

(1) Railways

Railways continue to be considered the prime transport mode for a wide range of social, economic and political reasons, in spite of its existing deficiencies. And the deficiencies remain important as is made very clear in the tenth plan.

[41] Tenth Five Year Plan, Chapter 8 – Transport; p. 931, par 8.3.4
[42] Tenth Five Year Plan, Chapter 8 – Transport; p. 935, par 8.3.18

After completing the Ninth Five Year Plan, the objectives in terms of passenger transport volumes were largely achieved while these for cargo transport fall short, mainly due to the economic slow-down observed during that period. The ninth plan also applauded the performance increase of Indian Railways both in capacity utilization and manpower productivity. But in spite of the positive evolutions, the Tenth Five Year Plan argued the "…need for a strategic shift in the objectives of the Railways so that it can regain some of the market it has lost over the past few decades to other competing modes of transport. In the light of massive investment taking place in the highway and pipeline sectors, the Railways must reorient their objectives in order to cope with a more competitive market."[43] This transformation should be achieved via a more customer-responsive and market-reactive organization that is capable of responding more efficiently and effectively to changes in market structures or customer demand. For that, the "…thrust has to be on modernisation and technological up gradation of the Railway system, particularly along the Golden Quadrangle and its diagonals." [44]

But as for many years before, the Tenth Five Year Plan complained again about the lack of a comprehensive and sector stimulating policy, seriously distorting a possible healthy growth of the Indian Railways. Urgent and corrective measures are once again requested, dealing with following important issues:

1. *Rationalization of Railway Tariffs*: in particular eliminating the artificial overcharging of freight transport to subsidize passenger transport;

2. *Achieving an increased share in freight transport*: increasing the historic 3-4 per cent annual growth rate of railway freight transport through improved quality of services, higher speeds and better interconnectivity;

3. *Technological upgrading*: necessary in all spheres of railway activity, including tracks (defect detection), locomotives, wagons, Electric Multiple Units (EMU), coaches, with the aim of improving both quality and efficiency. Particular attention will in this aspect be paid to Information Technology (IT) in the freight section, where this aspect has until now not been satisfactory.

4. *Investment strategy*: a substantial improvement is envisaged in this area with the objective of a better correlation between the investment and the improvement of capacity and service efficiency. In particular, the Tenth Five Year Plan aims at the implementation of the recommendations by the Rakesh Mohan Committee.

5. *Project completion*: As in several previous plans, the need to finalize ongoing project is stressed. Echoing the Ninth Five Year Plan, the tenth plan emphasizes the need for prioritization of the ongoing projects and a better budget allocation focusing high-result projects.

The Tenth Five Year Plan presents a number of new and important initiatives that could be highly beneficial for the competitive position of the Indian Railways. The first initiative is the explicit focus on railway activities in the Golden Quadrilateral, responsible for over 25% of all transport activity, complemented with the plan to develop adequate terminal facilities. A second initiative is the plan to reduce operating costs, one of the major burdens of the railway sector. Reduction of operating costs would liberate resources which could be invested in the realization of the objectives of the Tenth Five Year Plan (increased

[43] Tenth Five Year Plan, Chapter 8 – Transport; p 937 (par 8.3.27)
[44] Tenth Five Year Plan, Chapter 8 – Transport; p 938 (par 8.3.28)

self-financing capacity). The tenth plan also recognizes the urgent need for organizational restructuring of the Indian Railways.

To better organize public funding and the participation of the State Governments, the use of Special Purpose Vehicles (SPV) will be increased to realize critical developments. Finally, the concept of p*articipative project funding* is introduced by which the private sector will be invited to increase its participation. Until now, the responsiveness of the private sector remained limited in the two major public private development schemes, the BO(L)T (Build Operate (Lease) and Transfer) and the OYWS (Own Your Wagon Scheme).

The overall aim of all these reforms, if implemented, is to improve the total volume of cargo transported via rail from 489 million tons in 2002-3 to 624 million tons by the year 2006/7 (323 billion ton-km to 396 billion ton-km).

(2) Road Sector

The past strong development of the road infrastructure is applauded in the Tenth Five year Plan and the further targeted development of the infrastructure is recommended. In the 25 point plan in this respect, there is a particular attention to the integration of the road network with the railway sector (point 17, 18 and 19). The development of the road network should be continued in consultation with the development of the railway network, the road network should provide an efficient alternative when there is no rail available and finally the road and rail networks should be integrated to provide feeder and final distribution services and efficiently serve smaller ports and inland depots.

The development aims for the road network of the future require significant funds and for that reason, a much higher participation of the private sector is desired. Until present, the participation of the private sector in BOT schemes for road development has been limited, in particular due to the high uncertainty of revenues on the basis of the toll system. More innovative schemes that include higher revenue guarantees for the private sector seem to receive a more positive response and this possibility should be further explored.

In spite of the rapid increase of cargo and passenger transport on the roads, a wide range of measures are necessary to improve quality and efficiency of transport services of operators. "The freight operation in the country is almost wholly owned and operated by private operators. The State Road Transport Undertakings (SRTUs) of Jammu and Kashmir, Manipur, Mizoram, Sikkim and Tripura provide freight services in a limited way with the small number of trucks they own. The truck fleet strength of the Corporations/ Undertakings was estimated at 671 at the end of Annual Plan 2001-02. The number, however, is depleting rapidly for the want of adequate funds for replacement of over-aged vehicles. The number of registered goods motor vehicles has grown from 82,000 in 1951 to 25.29 lakh in 1998. The bulk of the freight traffic services is operated by individual owners with one to three trucks. Such truck operators are estimated to be handling over 80 per cent of the freight traffic. The share of transport companies and agencies is less than 20 per cent."[45] But the focus in this chapter is on passenger transport and real measures to improve the service quality of the road cargo transport sector are not made explicit in the Tenth Five Year Plan and only some general observations are made regarding the way the sector could improve its efficiency and effectiveness, in particular via scale improvements: "In the road transport freight segment, it is necessary for State Governments to take action for enabling the creation of cooperatives of

[45] Tenth Five Year Plan, Chapter 8 – Transport; p 960 (par 8.3.109 – 110)

small truck operators. These cooperatives could link up with large undertakings to reduce their cost and improve fleet utilisation." [46]

(3) Ports

Importance for the development of the DFC is the future development of the port sector. The results of the Ninth Five Year Plan indicated that capacity is no longer a constraint and the Tenth Five Year Plan therefore aims to target port productivity rather than port capacity. And the tenth plan recognizes that a lot needs to be done: "Although productivity in terms of ship turnaround time, waiting time and average ship berth day output has slightly improved over the last decade, the performance continues to be modest when compared with generally accepted international standard and performance of regional ports."[47]

Efficiency improvements will also be realized via the participation of the private sector in port management and operations as a result of increased competition among port operators for the provision of different port services. Private Sector Participation will also mobilize adequate resources for capacity increases and to introduce the latest technologies in port management and operations.

One particular aim is the establishment of *gateway ports* following recent examples such as Dubai, Singapore or Colombo. The main role of the gateway ports of India is to improve the efficiency of container handling and to establish a rail/road land bridge from these ports to the vast Indian hinterland.

Many other initiatives are foreseen to make the ports more attractive, such as better tariff structures, EDI, more efficient customer services, better hinterland connections using all modes of transport (road, rail and inland waterway) and the increased use of modern information technology such as VTMS, EDI and container handling information exchanges.

The Tenth Five Year Plan builds upon the most recent plans, pointing out the same problems and stressing the needs for similar measures to improve the situation. But contrary to the previous plans, the Tenth Five Year Plan argues more explicitly the need for several modern development components such as

1. A new transport policy that eliminates policy deficiencies and better integrates the plans of both the Nation and the different States to ensure a more effective budget allocation;

2. A balanced and integrated development of all transport modes taking into account the factual results in terms of increased traffic volume or service efficiency when allocating scarce financial resources;

3. A more explicit focus on the traffic system of the Golden Quadrilateral to better cover present and future traffic demand density;

4. The need for technological innovation in management and operations at all levels of the transport system, with a particular focus on the use of information.

5. An adequate strategy to increase the participation of the private sector in the development of transport infrastructures;

[46] Tenth Five Year Plan, Chapter 8 – Transport; p 963 (par 8.3.122)
[47] Tenth Five Year Plan; Chapter 8 – Transport; p 967 (par 8.3.147)

6. A concrete plan for sector reforms where old inefficient systems and organizational structures have to be replaced by smaller and modern managerial and operational concepts.

The mid-term review of the Tenth Five Year Plan expressed an overall satisfaction with the interim results of the plan but noted at the same time that much needed to be done of the set-forward targets are to be reached in 2007: "The picture emerging from the appraisal is mixed. The economy is doing well in many areas and these gains need to be consolidated but there are also important weaknesses, which, if not corrected could undermine even the current performance level."[48] The picture of achievements is indeed mixed as regards infrastructure development and therewith reflects the situation as it was for most previous Five Year Plans: "The Mid Term Appraisal clearly reveals that infrastructure is a major weak spot which, if corrective steps are not taken, will prevent the economy from transiting to higher rates of growth."[49] One important issue in the general remarks regarding infrastructure development is the ongoing problem of dealing with private sector participation. There is a consensus that private sector participation is needed and should be increased if the goals of the Tenth Five Year Plan are to be met but the reality is that the private sector continues to be reluctant to invest in Indian infrastructure and no tangible progress has been made in spite the call in the Tenth Five Year Plan for in-depth reforms in this area. The mid-term review needed again to express the urgency of establishing a sustainable framework for the development of public private partnerships in infrastructure development.

The troubles related to private sector participation reflect upon the results achieved in the transport sector although the results are very promising in terms of freight transport. Growth of freight transport in the railway sector is even ahead of the 5% target and is at present at 6.8% but capacity constraints remain an important impediment for a continued accelerated growth and the report recommends stepping up the participation of the private sector in both infrastructure development and operations via SPV or BO(L)T schemes. In spite the positive trend in rail freight traffic, "… there is still considerable scope for regaining the traffic lost by the Railways. Therefore, the Railways need to continue their efforts to win back more bulk traffic from the road sector. Apart from this Railways would need to attract non-bulk high rated traffic also. There is a need for dedicated freight corridors on selected high density corridors. This would help in meeting long term requirements of movement of freight traffic more efficiently. An accelerated programme of containerization could also contribute towards increasing the share of Railways in non - bulk traffic."[50]

The road sector's progress is behind the targets in terms of infrastructure development and rehabilitation, consequence of both administrative procedures and poor performance of contractors. Only the ten port connectivity projects, all developed via SPV and are all BOT schemes, are all scheduled to be completed by December 2007 and thus offer satisfactory results. One important problem in the development of new road infrastructure is the lack of funds and the participation of the private sector therefore needs to be encouraged and increased.[51]

Overall results for the transport sector are positive but much needs to be done to achieve the final year 2007 goals laid down in the Tenth Five Year Plan. For railways, the way forward

[48] "Mid-term Appraisal of the Tenth Five Year Plan (2002 – 2007); Planning Commission, Part I – Overview and Priority Areas for Action; p 1

[49] "Mid-term Appraisal of the Tenth Five Year Plan (2002 – 2007); Planning Commission, Part I – Overview and Priority Areas for Action; p 12 Infrastructure Development

[50] Mid-term Appraisal, Chapter 9 – Transport and Communications, p 280 (par 9.1.16)

[51] Mid-term Appraisal, Chapter 9 – Transport and Communications, p 285 (Box 9.1.3)

concentrates on the corridor view complemented by a wide range of measures to increase efficiency and quality; for the road sector, more and better roads are needed but this can only be achieved via private sector participation; ports need to be more competitive and cost effective, a goal that only can be reached if the participation of the private sector in management and operations is increased.

CHAPTER 4 SOCIO-ECONOMIC DEVELOPMENT FRAMEWORK

4.1 INTRODUCTION

Freight transportation demand is generated by consumption and (intermediate) production activities, each having particular demands and requirements in terms of transport time, costs, reliability and other important efficiency criteria. To evaluate transport demand from production side, a review of major agricultural and industrial production in India and its locations are a solid indicator, while the assessment of transport demand generated by consumption predominantly is defined by the major cities and population concentrations.

The next paragraphs will provide a brief overview of following issues respectively:

- The present and future demographic situation
- Major economic indicators
- Population, production and transport demand

4.2 INDIAN DEMOGRAPHIC EVOLUTION

Table 4.1 hereafter provides an overview of past and expected population growth for India.

Table 4.1 Demographic evolution in India 1950 to 2050 (Population '000, rate%)

Year	Population	Year	Population	Period	Growth Rate
1950	359	1996	946	1950-1960	1.92
1960	434	1997	964	1960-1970	2.23
1970	541	1998	983	1970-1980	2.30
1980	679	1999	1,001	1980-1990	2.14
1990	839	2000	1,019	1990-2000	2.14
1991	856	2010	1,181	2000-2010	1.50
1992	872	2020	1,332	2010-2020	1.07
1993	892	2030	1,449	2020-2030	0.85
1994	910	2040	1,534	2030-2040	0.57
1995	928	2050	1,592	2040-2050	0.37

Source: Central Statistical Organisation, World Bank

Between the years 1950 and 2000, the Indian population has tripled from 360 million persons to over one billion inhabitants. The estimates above suggest that over the same period in the future (from the year 2000 to the year 2050), total population in India will increase with fifty per cent to just over one and a half billion people, therewith becoming the country with the highest population in the world and preceding China with nearly 200 million persons[1] (see Table 4.2).

Table 4.2 Countries with highest population

Rank	Country	Population (millions)
Year 2005		
1	China	1,304
2	India	1,104
3	United States	296
4	Indonesia	222
5	Brazil	184
6	Pakistan	162
7	Bangladesh	144
8	Russia	143
9	Nigeria	132
10	Japan	128
Year 2050		
1	India	1,628
2	China	1,437
3	United States	420
4	Indonesia	308
5	Pakistan	295
6	Brazil	260
7	Nigeria	258
8	Bangladesh	231
9	Dem. Rep. of Congo	183
10	Ethiopia	170

Source: Population Reference Bureau, 2005 World Population Data Sheet

The forecasted population increase in Table 4.1 is a conservative estimate as the population figure in Table 4.1 is lower than those of the Table 4.2. According to the most recent population estimates of the Indian Central Statistics Organization, the total population in the year 2001 is estimated at 102.9 Crore[2&3]. India's percentage population growth is not as spectacular as in Pakistan and is somewhat higher as in Bangladesh, although by the year 2050 the gap will be nearly bridged see Table 4.3 hereafter.

[1] See also : United Nations: *World Population Prospects – 2004 Revision* Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2005

[2] A Crore is part of the Indian numbering system and is equivalent to ten million (7 zeros)

[3] *Statistical Pocket Book – India 2004*; Central Statistics Organization; Ministry of Statistics and Program Implementation, 2005; PCSO.5-2004(E) 1050-2005 DSK-III; *India in Figures – 2005*: Central Statistics Organization; Ministry of Statistics and Program Implementation, 2006

Table 4.3 Percentage growth rate for selected countries

Period	India	Pakistan	Bangladesh
1950-1960	1.9	2.4	1.8
1960-1970	2.2	2.7	2.1
1970-1980	2.2	2.6	2.7
1980-1990	2.1	2.9	2.2
1990-2000	1.7	2.1	1.8
2000-2010	1.3	1.9	1.5
2010-2020	1.1	1.5	1.2
2020-2030	0.8	1.2	0.9
2030-2040	0.6	0.9	0.7
2040-2050	0.5	0.6	0.5

Source: Colorado State University (http://www.cs.colostate.edu/~malaiya/india.html)

Table 4.4 provides a distribution of the years 1991 and 2001 population in India over the different State Union Territories.

Taking a total population of over 50 million persons as reference, following territories are important in light of passenger and cargo transport demand (ranked according to total population):

1. Uttar Pradesh 166,052,859 persons
2. Maharashtra 96,752,247 persons
3. Bihar 82,878,796 persons
4. West Bengal 80,221,171 persons
5. Andhra Pradesh 75,727,541 persons
6. Tamil Nadu 62,110,839 persons
7. Madhya Pradesh 60,385,118 persons
8. Rajasthan 56,473,122 persons
9. Karnataka 52,733,958 persons
10. Gujarat 50,596,992 persons

All 10 territories are entirely or partly included in the Golden Quadrilateral and will be directly or indirectly served by the Dedicated Rail Freight Corridor as well as the Golden Quadrilateral Highway Network (see Figure 4.1).

The Golden Quadrilateral is the largest highway development project of India, planned to connect India's four key economic hubs, Delhi, Kolkata, Mumbay and Chennai via a four to six lane highway totaling 5,846 kilometer in length at a cost of some 12.3 billion dollars (1999 prices). The development of the Golden Quadrilateral National Highway Network is near completion and will, together with the planned DFC, provide an efficient infrastructure network for the transport of passengers and cargo in these highly populated regions.

Table 4.4 Population distribution over the territory (1991 – 2001)

State/Union Territory	1991			2001		
	Male	Female	Person	Male	Female	Person
Andhra Pradesh	33,724,581	32,783,427	66,508,008	38,286,811	37,440,730	75,727,541
Arunachal Pradesh	465,004	399,554	864,558	573,951	517,166	1,091,117
Assam	11,657,989	10,756,333	22,414,322	13,787,799	12,850,608	26,638,407
Bihar	45,202,091	41,172,374	86,374,465	43,153,964	39,724,832	82,878,796
Chhatisgarh	-	-	--	10,452,426	10,343,530	20,795,956
Goa	594,790	575,003	1,169,793	685,617	658,381	1,343,998
Gujarat	21,355,209	19,954,373	41,309,582	26,344,053	24,252,939	50,596,992
Haryana	8,827,474	7,636,174	16,463,648	11,327,658	9,755,331	21,082,989
Himachal Pradesh	2,617,467	2,553,410	5,170,877	3,085,256	2,991,992	6,077,248
Jammu & Kashmir	4,014,100	3,704,600	7,718,700	5,300,574	4,769,343	10,069,917
Jharkhand	-	-	--	13,861,277	13,048,151	26,909,428
Karnataka	22,951,917	22,025,284	44,977,201	26,856,343	25,877,615	52,733,958
Kerala	14,288,995	14,809,523	29,098,518	15,468,664	16,369,955	31,838,619
Madhya Pradesh	34,267,293	31,913,877	66,181,170	31,456,873	28,928,245	60,385,118
Maharashtra	40,825,618	38,111,569	78,937,187	50,334,270	46,417,977	96,752,247
Manipur	938,359	898,790	1,837,149	1,207,338	1,181,296	2,388,634
Meghalaya	907,687	867,091	1,774,778	1,167,840	1,138,229	2,306,069
Mizoram	358,978	330,778	689,756	459,783	431,275	891,058
Nagaland	641,282	568,264	1,209,546	1,041,686	946,950	1,988,636
Orissa	16,064,146	15,595,590	31,659,736	18,612,340	18,094,580	36,706,920
Punjab	10,778,034	9,503,935	20,281,969	12,963,362	11,325,934	24,289,296
Rajasthan	23,042,780	20,963,210	44,005,990	29,381,657	27,091,465	56,473,122
Sikkim	216,427	190,030	406,457	288,217	252,276	540,493
Tamil Nadu	28,298,975	27,559,971	55,858,946	31,268,654	30,842,185	62,110,839
Tripura	1,417,930	1,339,275	2,757,205	1,636,138	1,555,030	3,191,168
Uttar Pradesh	74,036,957	65,075,330	139,112,287	87,466,301	78,586,558	166,052,859
Uttaranchal	-	-	--	4,316,401	4,163,161	8,479,562
West Bengal	35,510,633	32,567,332	68,077,965	41,487,694	38,733,477	80,221,171
Andaman & Nicobar Islands	154,369	126,292	280,661	192,985	163,280	356,265
Chandigarh	358,614	283,401	642,015	508,224	392,690	900,914
Dadra & Nagar Haveli	70,953	67,524	138,477	121,731	98,720	220,451
Daman & Diu	51,595	49,991	101,586	92,478	65,581	158,059
Delhi	5,155,512	4,265,132	9,420,644	7,570,890	6,212,086	13,782,976
Lakshadweep	26,618	25,089	51,707	31,118	29,477	60,595
Pondicherry	408,081	399,704	807,785	486,705	487,124	973,829
TOTAL TERRITORY	39,230,458	407,072,230	846,302,688	**531,277,078**	**495,738,169**	**1,027,015,247**

Source: Central Statistical Organisation Ministry of Statistics and Programme Implementation; Government of India: "Selected socio-economic statistics 2002"; 2004

Source: JICA Study Team

Figure 4.1 Golden Quadrilateral and the territories

Thanks to a constant and strong economic performance and a particular attention in the various Five Year Plans for the less fortunate parts of the population, the social situation in India has demonstrated a constant improvement, as can be noted in Table 4.5.

The reduction of poverty is, together with the size of the country's population, a very important component for the assessment and / or evaluation of the transport sector. The less the population is poor, the higher the purchasing power and therewith the higher the need for transport and its related infrastructure. While in the beginning of the seventies, over 50% of the Indian population, over 320 million persons, was considered poor, the percentage was brought down to below 25% by the end of the century and is expected to drop below 20% by 2007. In consumption terms, this means that some one hundred million consumers are added for which goods need to be produced and transported for consumption.

Table 4.5 Evolution of key poverty indicators for India

Year	Poverty ratio (%)			Number of poor (million)		
	Rural	Urban	Combined	Rural	Urban	Combined
1973-74	56.4	49	54.9	261.3	60	321.3
1977-78	53.1	45.2	51.3	264.3	64.6	328.9
1983	45.7	40.8	44.5	252	70.9	322.9
1987-88	39.1	38.2	38.9	231.9	75.2	307.1
1993-94	37.3	32.4	36	244	76.3	320.3
1999-00	27.1	23.6	26.1	193.2	67.1	260.3
2007*	21.1	15.1	19.3	170.5	49.6	220.1

* Poverty projection for 2007
Source: Based upon the Tenth Five Year Plan, Vol. 1

4.3 MAJOR ECONOMIC INDICATORS

"The single-most important feature of our post-colonial experience is that the people of India have conclusively demonstrated their ability to forge a nation united despite its diversity, and to pursue development within the framework of a functioning, vibrant and pluralistic democracy … The Tenth Five Year Plan (2002-07) has been prepared against a backdrop of high expectations arising from some aspects of the recent performance. GDP growth in the post-reforms period has improved from an average of about 5.7 per cent in the 1980s to an average of about 6.1 per cent in the Eighth and Ninth Plan periods, making India one of the ten fastest growing countries in the world … Traditionally, the level of per capita income has been regarded as a summary indicator of the economic well being of the country, and growth targets have therefore focused on growth in per capita income or per capita GDP … [and] the Tenth Plan should aim at an indicative target of 8 per cent average GDP growth for the period 2002-07."[4]

Economic growth of India has indeed been impressive and the country has, together with China, become one of the most important areas for Foreign Direct Investment (FDI) in the world of today. The following Table 4.6 hereafter provides the evolution of some main economic indicators since the year 2000.

Since the nineties, the Indian economy has demonstrated a constant average growth of 6% per annum between the years 1990 and 2000, and of 6.2% per year from the year 2000 till the year 2004[5]. This growth was in particular driven by the service sector that showed over these periods a growth of 8% and 8.2% respectively, while the growth rate of agriculture declined with 1%, manufacturing with 0.5% and the industry remained stable. The above table 3.7 clearly demonstrates a progress in most indicators. Annual GDP growth has been strong after a weaker period during the turn of the century and some interesting evolutions can be observed on the basis of above table. The share of Agriculture in GDP is declining, from 24.6% in the year 2000 to just over 21% by the year 2004. At the same time, the share of the industry and in particular of services has grown, from 26.6% to 27.1% for the former and from 48.8% to 51.7% for the latter.

4 Tenth Five Year Plan, Chapter 1 – Perspective, Objectives and Strategy (par 1.2 – 1.22)
5 World Development Indicators – 2006; The World Bank, Chapter 4 – Economy, table 4.1 (growth of output)

Table 4.6 Main economic indicators

Main economic indicator	2000	2003	2004
GNI, Atlas method (current US$)	455.6 billion	570.3 billion	673.2 billion
GNI per capita, Atlas method (current US$)	450	540	620
GDP (current US$)	457.4 billion	600.6 billion	691.2 billion
GDP growth (annual %)	3.9	8.6	6.9
Inflation, GDP deflator (annual %)	3.8	3.2	5.3
Agriculture, value added (% of GDP)	24.6	22.8	21.1
Industry, value added (% of GDP)	26.6	26.4	27.1
Services, etc., value added (% of GDP)	48.8	50.7	51.7
Exports of goods and services (% of GDP)	13.9	14.9	19.1
Imports of goods and services (% of GDP)	14.6	16.4	22.5
Gross capital formation (% of GDP)	22.7	23	24.1
Revenue, excluding grants (% of GDP)	12	11.9	12.6
Cash surplus/deficit (% of GDP)	-3.9	-3.7	-3.6

Source: World Bank: *World Development Indicators database*, April 2006

With adding only 21% value to GDP in the year 2004, some 58% of the population depends on its output. The volatility of its performance is in particular due to its dependence upon favorable monsoons. India is the largest producer of tea, jute and jute like fibers. Cattle account for the largest share of livestock and the country is the largest milk producer worldwide, while it is the world's second rice and third cereal producer. Even with an accelerated agriculture growth to 4%, the share of agriculture in total GDP is likely to reduce further as the industrial and certainly the service sectors will continue to show a high growth. Industrial production in India remains at a stable 26-27% of GDP. One of the critical challenges facing Indian economic policy consists in devising strategies for sustained industrial growth and the Tenth Five Year Plan foresees many measures to strengthen industrial output. The textile industry is the largest and with the planned modernization & consolidation, the Indian government aims creating a globally competitive textile industry, favored by the phasing out of quota regimes since Jan 1st 2005. The automobile sector also demonstrated continued strength while the pharmaceutical industry and IT are major growth sectors for India.

Finally, the service sector has maintained a steady growth pattern since 1996, except into a fall in 2000-01. Trade hotels, transport & communications witnessed the highest growth in 2004, followed by financial services (With a overall growth rate of (6.4) % and community, social & personal services (5.9)% of all the three sectors, services have been the highest contributor to total GDP growth rate with 51.7% of GDP, up from 48.8% in the year 2000. But contrary to most parts of the developed world where employment in the service sector rose faster than its share of output, there has been a relatively slow growth of jobs in the Indian service sector, mainly due to the rise in labor productivity in information technology that is dependent on skilled labor. IT services, in particular the outsourcing of business, have been growing rapidly and are expected to continue rising, making India a major exporter of software services and software workers.

The constant positive evolution of the Indian economy not only generated a percentage reduction of inhabitants living below the poverty line, but also positively reflected on the income of the Indian population. According to recent UNDP and World Bank estimates, the GDP per capita expressed in purchasing power (PPP$) has shown a constant positive

evolution since 1975, rising from $420 in 1975 to $2,670 in the year 2002. Since the turn of the century, the Gross National Income (GNI) per capita increased from $450 in the year 2000 to $620 in the year 2004 (in current prices) which translates in a growth of purchase power from $2,400 in the year 2000 to $2,880 in the year 2003 (in current PPP$).

But for the Indian government, the level of economic progress is not sufficient and the aim of the government in the Tenth Five Year Plan is to achieve and maintain an average eight per cent annual growth of the economy and doubling the per capita income over the next ten years (between the years 2002 and 2012): "During the past two decades, India has no doubt been one of the ten fastest growing economies in the world, but we cannot be content with that. The Tenth Plan aims to take the country even further ahead, potentially to become the fastest growing country by the end of the Plan period. …The tone was set by the Prime Minister two years ago when he asked the Planning Commission to examine the feasibility of doubling the per capita income of the country in ten years and of providing 100 million work opportunities over the same period. … It was suggested that although the objective of doubling the per capita income was feasible in the ten year time frame, it may be preferable to settle for an intermediate target of 8 per cent per annum average growth rate for the Tenth Plan period, with a further acceleration during the Eleventh Plan." [6]

However, aiming for an eight per cent and higher growth rate during the Tenth and Eleventh Five Year Plan will require a substantial and sustained effort. During the year 2003, the achieved growth rate was slightly above 8%, but again dropped below 7% for 2004 (6.9%). Historically, the Indian economy has steadily increased since 1979 with an average growth of 5.7% per year in the 23-year growth record. Since India's external crisis was under control in 1994, the Indian economy posted an excellent average GDP growth of 6.8% since that date. But in comparison to many East Asian economies and with China in particular Indian growth still lags behind in spite of these positive numbers. Furthermore, the prospect of achieving an 8% growth during the Tenth Five Year Plan and an ever higher growth during the Eleventh Five Year Plan remains doubtful. The Asian Development Bank, in its latest report on the state of the economy, forecasted for India a growth of 6.1% in the year 2006 and a 7% growth for the year 2007, this below the government's 8% target.[7]

All donor organizations as well as the Indian Government agrees that there is a real need to sustain the present economic growth through as social efforts towards the less favored portions of the Indian population: "The development process must therefore be viewed in terms of the efficiency with which it uses an economy's productive capacities, involving both physical and human resources, to attain the desired economic and social ends (and not just material attainment). To this end, it is absolutely essential to build up the economy's productive potential through high rates of growth, without which we cannot hope to provide expanding levels of consumption for the population. However, while this is a necessary condition, it is not sufficient in itself. It becomes imperative, therefore, to pursue a development strategy that builds on a policy focus for exploiting synergies between economic growth, desirable social attainments and growing opportunities for all. Such a strategy must have at its heart a commitment to widen and deepen the participation of people in all decisions governing economic and social development."[8] In other words, future economic growth needs to be an economic growth with a "human face". [9]

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6 Tenth Five Year Plan, Preface, p 4

7 Asian Development Outlook – 2005; Part II, Economic trends and prospects in developing Asia : South Asia – INDIA: table 2.15

8 Tenth Five Year Plan, Chapter 1 – Perspectives, Objectives and Strategy (par 1.4)

9 Asian Development Outlook – 2005; Part II, Economic trends and prospects in developing Asia : South Asia – INDIA: Macroeconomic Policy Developments

But even if economic growth upholds a human face, there is a need for basic underlying developments, one of which is the rapid development of the infrastructure in line with economic and social needs[10]. "The transport system in India has not been able to keep pace with these developments and considerable effort is required to correct the shortcomings." [11]

In that respect, ADB noted that in spite of a constant growth of the economy, the "…current rates of both private and public infrastructure investments have been well below target. The key problem in attracting adequate private capital in infrastructure is the lack of appropriate risk allocation between creditors and investors. One such crucial risk originates in the fact that lenders are paid only from the cash flow generated by an infrastructure project, and they have limited options if investments fail to provide the expected returns because of a shift in policy parameters. Moreover, infrastructure projects usually have long gestation periods and there is usually a maturity mismatch between loans and returns. Developing a domestic market for long-term securities is therefore critical for infrastructure financing. ADB's recent issue of domestic currency long-term bonds is an important step in this direction." [12]

The issue of long-term bonds to secure private sector participation is undoubtedly an interesting development which should be investigated in detail in the context of the development of the dedicated freight corridor for railway cargo transport in the Golden Quadrilateral.

4.4 CONSUMPTION, PRODUCTION AND TRANSPORT DEMAND

As has been frequently highlighted in above paragraphs, transport is a key component for economic growth and social welfare. This relationship has been formally recognized in the Tenth Five Year Plan where the government aims to stimulate targeted investments in infrastructure development to support both the increase in growth and welfare.

To investigate the relationship between consumption, (industrial) production and the need for transport (infrastructure), a more detailed study per State is required in which a comparative evaluation is made of the GSDP (Gross State Domestic Product), the GSDP per capita (which is an indicator of the purchase power of households) and the size of the population (which is an indicator of the potential consumption market)[13].

Table 4.7 hereafter provides a more detailed and recent estimate of the present population (2006) for the different territories. The different territories have been ranked from the State with the highest population down to the one with the lowest population.

[10] Tenth Five Year Plan, Chapter 8 – Transport (par 8.3.1)

[11] Tenth Five Year Plan, Chapter 8 – Transport (par 8.3.2)

[12] Asian Development Outlook – 2005; Part II, Economic trends and prospects in developing Asia : South Asia – INDIA: Outlook for 2005-2007 and medium-term trends

[13] ANNEX 1 provides a detailed overview of these three indicators for each state for the period 1993/4 till 2005/6 (as much as information is available): Source: Central Statistical Organisation Ministry of Statistics and Programme Implementation; Government of India

Table 4.7 Ranked overview of population per Territory

Rank	State/Union Territory	Total population
1	Uttar Pradesh	178,829,000
2	Maharashtra	100,670,000
3	Bihar	88,687,000
4	West Bengal	81,989,000
5	Andhra Pradesh	80,042,000
6	Madhya Pradesh	64,988,000
7	Tamil Nadu	64,388,000
8	Rajasthan	60,802,000
9	Gujarat	52,840,000
10	Karnataka	51,817,600
11	Orissa	38,409,000
12	Kerala	33,072,000
13	Assam	28,811,000
14	Jharkhand	28,558,000
15	Punjab	25,076,468
16	Haryana	22,513,000
17	Chattisgarh	21,800,000
18	Delhi	14,940,000
19	Jammu & Kashmir	11,124,000
20	Uttranchal	8,863,000
21	Himachal Pradesh	6,617,000
22	Tripura	3,258,000
23	Meghalaya	2,429,000
24	Manipur	2,418,100
25	Nagaland	2,149,029
26	Goa	1,435,000
27	Arunachal Pradesh	1,133,000
28	Chandigarh	1,021,000
29	Pondicherry	984,500
30	Mizoram	913,000
31	Sikkim	570,000
32	A & N Islands	367,000

Source: JICA Study Team, on the basis of Central Statistical Organisation Ministry of Statistics and Programme Implementation; Government of India

As compared to the year 2001 census results, some minor changes have occurred and the number of people has increased with several million persons, but the overall fact remains that the top ten territories are directly or indirectly connected to the Golden Quadrilateral (see Figure 4.1 above):

1. Uttar Pradesh from 166,052,859 to 178,829,000 persons
2. Maharashtra from 96,752,247 to 100,670,000 persons
3. Bihar from 82,878,796 to 88,687,000 persons
4. West Bengal from 80,221,171 to 81,989,000 persons
5. Andhra Pradesh from 75,727,541 to 80,042,000 persons
6. Madhya Pradesh from 60,385,118 to 64,988,000 persons

7. Tamil Nadu from 62,110,839 to 64,388,000 persons
8. Rajasthan from 56,473,122 to 60,802,000 persons
9. Gujarat from 50,596,992 to 52,840,000 persons
10. Karnataka from 52,733,958 to 51,817,600 persons

The rapid growth of the population is a first important factor arguing for an increase in infrastructure investments to accommodate fast growing demand. But deciding solely on the size of the population would be an over-optimistic approach as still many people live in poverty and cannot afford high levels of consumption. Most but not all of above ten states also score well in terms of economic productivity (GSDP), as can be observed in following Table 4.8.

Table 4.8 Latest available GSDP (Gross Domestic Product per State)

Rank	State/Union Territory	GSDP (RS lacs)
1	Maharashtra	33,314,532
2	Uttar Pradesh	23,567,832
3	Andhra Pradesh	22,589,200
4	West Bengal	18,972,764
5	Tamil Nadu	18,892,107
6	Gujarat	16,735,600
7	Karnataka	13,249,773
8	Rajasthan	10,873,402
9	Madhya Pradesh	10,792,635
10	Kerala	10,053,108
11	Punjab	8,835,134
12	Delhi	8,382,475
13	Haryana	8,300,254
14	Bihar	6,279,201
15	Orissa	5,763,803
16	Assam	4,711,333
17	Jharkhand	4,368,748
18	Chattisgarh	3,854,897
19	Himachal Pradesh	2,238,245
20	Jammu & Kashmir	2,077,254
21	Uttranchal	1,692,168
22	Goa	965,664
23	Chandigarh	730,605
24	Tripura	660,107
25	Pondicherry	645,669
26	Meghalaya	526,308
27	Nagaland	474,860
28	Manipur	406,245
29	Arunachal Pradesh	226,229
30	Mizoram	219,313
31	Sikkim	153,053
32	A & N Islands	114,565

Source: JICA Study Team, on the basis of Central Statistical Organisation Ministry of Statistics and Programme Implementation; Government of India

The ten economically most productive States in India are also the most populated, with the exception of Bihar (only 15th in the list per GSDP) that is replaced by Kerala as tenth in the list of most productive states.

1. Maharashtra 33,314,532 RS lacs
2. Uttar Pradesh 23,567,832 RS lacs
3. Andhra Pradesh 22,589,200 RS lacs
4. West Bengal 18,972,764 RS lacs
5. Tamil Nadu 18,892,107 RS lacs
6. Gujarat 16,735,600 RS lacs
7. Karnataka 13,249,773 RS lacs
8. Rajasthan 10,873,402 RS lacs
9. Madhya Pradesh 10,792,635 RS lacs
10. Kerala 10,053,108 RS lacs

Kerala is the smallest of India's Territories, approximately 1% of the country's territory but houses over 33 million persons (3.4% of India's total population), therewith ranking 12th in Table 4.8. Due to its natural beauty, the State is one of India's most interesting tourist destinations and the flourishing tourism industry is the primary reason why the smallest of India's Territories generates the tenth largest GSDP.

Nine out of ten States are included both in the list of most populated States and in the list of economically most productive States in terms of GSDP. The final question is how that reflects in the financial strength of individual households, expressed in GSDP per Capita, provided in Table 4.9.

Kerala, with the tenth highest GSDP and in spite its small geographic size an important size of population scores eleventh in the ranking of GSDP per Capita, demonstrating that many people directly benefit from the positive impact of tourism in that region. Its socio-economic profile is one of the most stable, with a 12th position in the population ranking, a 10th position for GSDP and a 12th position in terms of wealth distribution expressed in GSDP per Capita.

Table 4.9 GSDP per Capita

Rank	State/Union Territory	GSDP/cap in RS
1	Chandigarh	71,558
2	Goa	67,294
3	Delhi	56,108
4	Pondicherry	42,540
5	Haryana	36,869
6	Punjab	35,233
7	Himachal Pradesh	33,826
8	Maharashtra	33,093
9	Gujarat	31,672
10	A & N Islands	31,217
11	Kerala	30,398
12	Tamil Nadu	29,341
13	Andhra Pradesh	28,222
14	Sikkim	26,851
15	Karnataka	24,294
16	West Bengal	23,141
17	Nagaland	22,096
18	Meghalaya	21,668
18	Mizoram	21,668
20	Tripura	20,261
21	Arunachal Pradesh	19,967
22	Uttranchal	19,092
23	Jammu & Kashmir	18,674
24	Rajasthan	17,883
25	Chattisgarh	17,683
26	Manipur	16,800
27	Madhya Pradesh	16,607
28	Assam	16,353
29	Jharkhand	15,298
30	Orissa	15,006
31	Uttar Pradesh	13,179
32	Bihar	7,080

Source: JICA Study Team, on the basis of Central Statistical Organisation Ministry of Statistics and Programme Implementation; Government of India

But overall, the ranking per State in terms of GSDP per Capita demonstrates a very different result as the ranking in terms of size of population or economic productivity:

1. Chandigarh 71,558 in RS
2. Goa 67,294 in RS
3. Delhi 56,108 in RS
4. Pondicherry 42,540 in RS
5. Haryana 36,869 in RS
6. Punjab 35,233 in RS

7. Himachal Pradesh 33,826 in RS
8. Maharashtra 33,093 in RS
9. Gujarat 31,672 in RS
10. A & N Islands 31,217 in RS

The ten States with the highest standard of living in India include only the State of Maharashtra (ranked 8th) that also appears in the top-ten of States with the highest population and with the highest economic production. This is somewhat logical as the GSDP per Capita is statistically calculated by dividing the GSDP with the size of its population, penalizing States with a large population even when these States have a good economic productivity. "Extreme poverty is concentrated in rural areas of the northern poverty-belt states, including Bihar, Madhya Pradesh, Uttar Pradesh and West Bengal, while income growth has been most dynamic in other states, urban areas and the service sectors. … State inequalities interact with gender- and income-based inequalities … Four states account for more than half of child deaths: Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh … These states also are marked by some of the deepest gender inequalities in India. Contrasts with Kerala are striking. Girls born in Kerala are five times more likely to reach their fifth birthday, are twice as likely to become literate and are likely to live 20 years longer than girls born in Uttar Pradesh."[14] All mentioned states score very poorly in terms of GSDP per Capita but are highly populated areas with an overall strong GSDP (except Bihar). The top-ten performers on terms of GSDP per Capita each have very particular characteristics which undoubtedly contribute to their strong score.

Chandigarh is known for its high standard of living with a Human Development Index (HDI) of 0.674, well above the South-Asian average of 0.628[15]. In terms of economic performance, the State ranks 23rd in the table 3.9, this with a total population reaching just over 1 million people, therewith ranking 28th in above table 3.8. In addition to its attractive city design[16], Chandigarh knows a strong growth in the field of information technology (IT), further fueled with Chandigarh Technology Park where many multinational companies like Infosys or EDC have set up IT centers. This positive growth is further stimulated by the many Indians from Delhi who build second residencies or relocate to Chandigarh, attracted by the beauty of the city, its clean air, its calm living conditions and many professional opportunities. This situation not only provides high level employment to many professionals but also helps in increase the economy and quality of life in the city.

The conditions for Goha are very similar to the one of Chandigarh except that its main economic driver is not information technology or a magnificent city but tourism and exceptionally attractive beaches. Goha, known as the "Pearl of the Orient" is a tourism paradise and the tourism sector is at the basis of the State's high standard of living. Goha with just over 1.4 million inhabitants is the State with the lowest population in India (ranked 32) but ranks 22nd in terms of GSDP.

Pondicherry is very similar to Goha. This restored, attractive, former French colony emanates a Mediterranean aura and is therewith a small and quiet enclave of Tamil Nadu. With its chic streets, elegant houses, ornamental gardens and many attractive festivals,

[14] Human Development Report – 2005", UNDP, New York, 2005; p 30-31, box 1.3

[15] India as a whole ranks 127th in the HDI year 2003 ranking, with a HDI index of 0.602. The best performer in Asia, Sri Lanka, has a HDI index of 0.751. See for more details: "Human Development Report – 2005"

[16] The city was founded just after the independence, designed by the famous designer Le Corbusier

Pondicherry attracts many wealthy tourists, making it a prime source of income. With the size of its total population below 1 million persons (ranking 29th), it ranks 25th in terms of GSDP, trailing not so far behind Goha and Chandigarh.

Himachal Pradesh also flourishes thanks to its well developed tourism sector. With a total population of just over 6.6 million persons (ranking 21st) it scores relatively well in terms of GSDP ranking 19th. With its high mountains and snow-covered peaks combined with green hills and slopes and quiet little resorts, Himachal Pradesh is undoubtedly India's most favorite Himalayan destination.

A different case is Delhi, with a population of nearly 15 million people and a GSDP of over 8 million RS lacks. This Union Territory ranks eighteenth in terms of population size and twelfth in economic terms (in real monetary values, Delhi is very close to the numbers 11 and 10 in that ranking). Delhi is not only the country's administrative capital, but is also rapidly growing to become a world economic center, presently housing corporate offices for more than 12% of the *S&P CNX 500* conglomerates. Its service sector accounts of over 75% of its GSDP and its highly skilled workforce is a major reason why many multinationals in the information, telecommunication and banking sector open high profile braches in the capital of India.

As a last example, the situation for Maharashtra is considered as case combining tourism with industrial components as key for its success. Maharashtra, the third largest state in India was previously known as Bombay State. Mumbai, the State's capital, is the most affluent and industrialized city in the country today, also well-known for it film industry. Mumbai is not only a prime (maritime) gateway for the country but is also a major tourist attraction point. Mumbai is after Kolkata the second cultural centre of India and complements Maharashtra's tourism offer of beautiful forts, caves, temples, cities, wildlife sanctuaries, bird sanctuaries etc.

The ten richest States and Territories have many similarities, and not only in terms of economic prosperity. One major socio-economic component confirms the positive tone of the development performance and positive image of these States, that component is poverty. Poverty is low in most of the ten States / Territories with a high standard of living as can be seen Table 4.10.

Seven out of the ten States / Territories that are in the top ten in terms of GSDP per Capita, have a poverty percentage that positions itself in the bottom ten of the ranked list. Six out of these high income states have a poverty level below ten per cent of its total population. Gujarat, still part of the bottom ten in table 3.11, has a poverty percentage of 14%, while the last three States / Territories that are part of the top ten of high income States, A & N Islands, Podicherry and Maharasthra have respectively 20.9%, 21.7% and 25% of their population living below poverty. The relatively poor score Maharasthra (as compared to the majority of high income States) can be explained by the fact that this State has the second largest population and the highest GSDP but handicapped by the size of its population, scores only 8th in the list of ten best high income states, in terms of GSDP per Capita at a notably distance from the top three. The A & R Islands score with 20.9% relatively badly but are therefore somewhat in line with their tenth place in the top 10 of high income States. The only "special" case is Pondicherry, which is the State with the fourth highest income but has over 25% of its population living in poverty, probably a consequence of the upper class orientation of its tourism sector and the incentives to attract FDI.

Table 4.10 Poverty in the States (% of State population)

Rank	State/Union Territory	%
1	Orissa	47.15
2	Bihar	42.6
3	Madhya Pradesh	37.43
4	Sikkim	36.55
5	Assam	36.09
6	Tripura	34.44
7	Meghalaya	33.87
8	Arunachal Pradesh	33.47
9	Nagaland	32.67
10	Uttar Pradesh	31.15
11	Manipur	28.54
12	West Bengal	27.02
13	Maharashtra	25.02
14	Pondicherry	21.67
15	Tamil Nadu	21.12
16	Andaman & Nicobar Islands	20.99
17	Karnataka	20.04
18	Mizoram	19.47
19	Dadra & Nagar Haveli	17.14
20	Andhra Pradesh	15.77
21	Lakshadweep	15.6
22	Rajasthan	15.28
23	Gujarat	14.07
24	Kerala	12.72
25	Haryana	8.74
26	Delhi	8.23
27	Himachal Pradesh	7.63
28	Punjab	6.16
29	Chandigarh	5.75
30	Daman & Diu	4.44
31	Goa	4.4
32	Jammu & Kashmir	3.48
	TOTAL India	26.10

Source: JICA Study Team, on the basis of Selected Socio-economic Statistics – India, 2002, Central Statistical Organisation Ministry of Statistics and Programme Implementation; Government of India.

CHAPTER 5 INDIAN RAILWAYS

5.1 INTRODUCTION

The Indian Railways (IR) is the first and largest transport organization in India, governing the largest rail network in Asia and the second largest in the world. IR runs on average eleven thousand trains per day, of which 7,000 are passenger trains and approximately 5,000 are destined to the transport of cargo. The total track length is 108,706 km of which 86,526 km are broad gauge, 18,529 are meter gauge and 3,651 are narrow gauge. Some 25% of the network is electrified. The organization employs over 1.5 million people and is therewith the largest employer in the country.

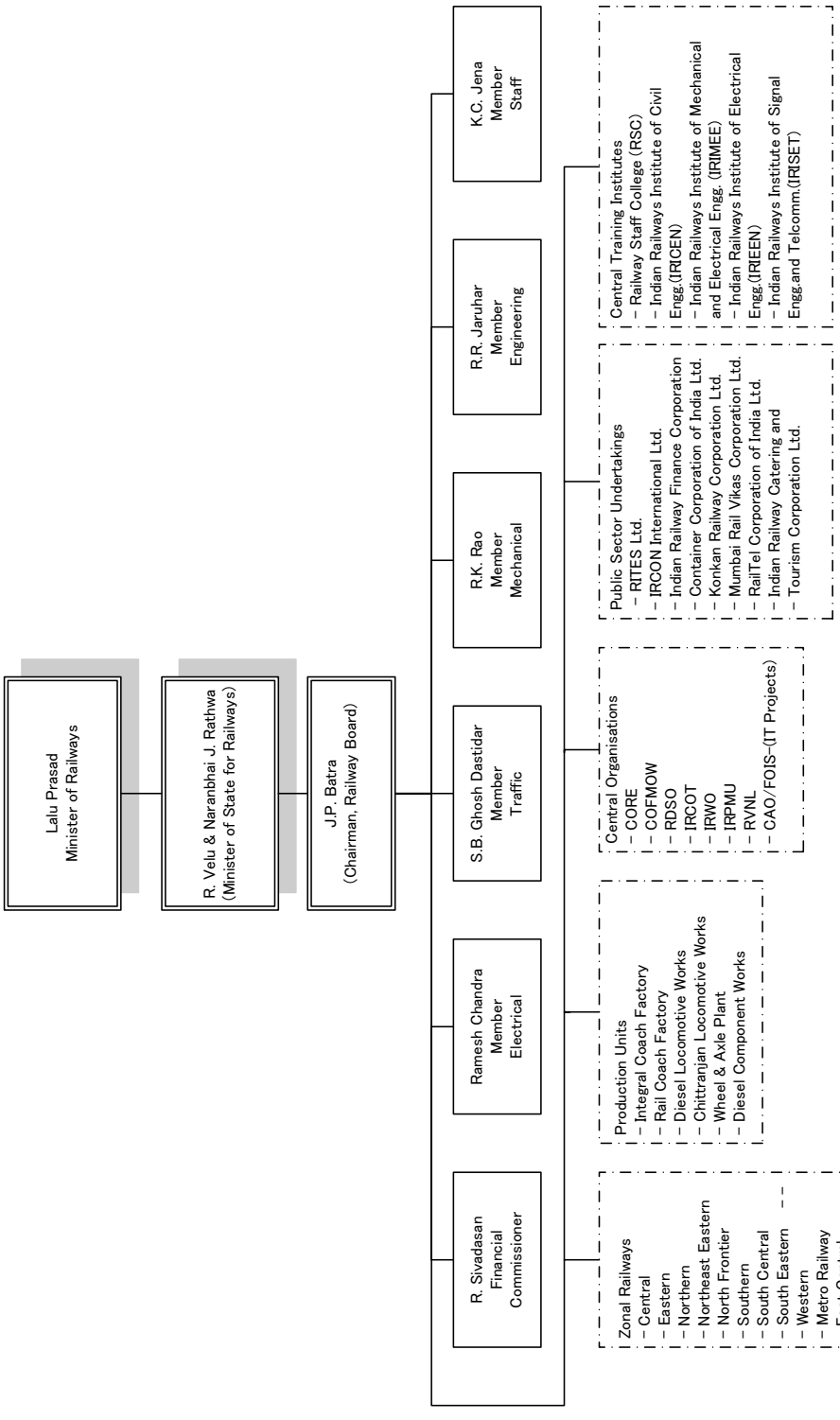
Indian Railways is under the responsibility of the Minister for Railways and managed by the Railway Board. Indian Railways is geographically divided in different operating zones and includes also several production and operating units as well as Public Sector Undertakings (PSU), as demonstrated in Table 5.1.

Table 5.1 Organizational Structure of IR

Zonal Railways	New Zonal Railways	Production Units	Other Units	Public Sector Undertakings
- Central Railway	- East Central Railway	- Chittaranjan Locomotive Works	- NF Railway (Construction)	- IRCON
- Eastern Railway	- East Coast Railway	- Diesel Locomotive Works	- MetroRail (Kolkata)	- RITES
- Northern Railway	- North Central Railway	- Integral Coach Factory	- Central Organisation for Railway Electrification	- CRIS
- North Eastern Railway	- North Western Railway	- Rail Coach Factory	- Rail Vikas Nigam Ltd.	- CONCOR
- North East Frontier Railway	- South Western Railway	- Rail Wheel Factory	- Directorate General	- IRFC
- Southern Railway	- West Central Railway	- Deisel-Loco Modernisation Works	- RDSO	- KRC
- South Central Railway	- South East Central Railway		- Railway Staff College	- IRCTC
- South Eastern Railway			- CAO(R)	- RCE
- Western Railway			- Central Organisation for Modernisation of Workshops	- MRVC

Source: Indian Railways (http://www.indianrailways.gov.in/)

An assembled view on the IR organization structure is provided in Figure 5.1 on the following page.



Source: made by the consultants based on http://www.rb.railnet.gov.in/

Figure 5.1 Structure of the Indian Railways

In the year 2002, for the 150th anniversary of the Indian Railways, the Ministry of Railways published its Status Paper on Indian Railways[1], in which some interesting observations could be read: 89% of its freight traffic is contributed by eight major commodities, viz. coal, fertilizer, cement, petroleum products, foodgrain, finished steel, iron ore and raw material to steel plants, which constitute the core sector of the economy. The balance 11% is 'other' commodity moving in bulk and in containers … 60% of the originating passengers travelling by rail are suburban in the cities of Mumbai, Calcutta, Chennai and ring railway of Delhi. 13% comprise commuters travelling in other cities of the country. The remaining 27% are long distance passengers. However, in terms of passenger kilometer, the suburban passengers account for only 20% … The suburban passengers though 60% in terms of volume contribute only 10% to the passenger revenue. On the other hand, the upper class travellers though comprise less than 1% of originating passengers, account for around 20% of the passenger revenue."[2]

One of the most important contributions of the Status Paper is that it not only highlighted the many positive achievements of the Indian Railways, both in terms of PSO (public service obligation) but also in terms of commercial developments. The Paper also argued for a more comprehensive and in-depth review of operations and structures that could allow the railways to recapture some of the lost market share, in particular in terms of cargo transport[3]. These reflections and recommendations are very similar to the issues raised in the Tenth Five Year Plan as well as in the year 2002 Rakesh Mohan Committee Report discussing the key financial issues involving the future of the Indian Railways.

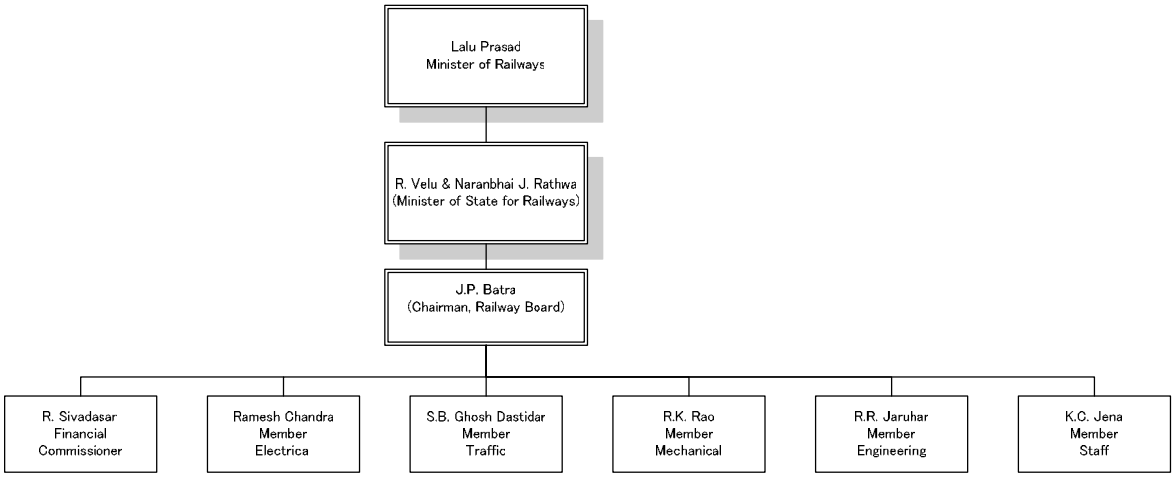
The government is convinced that there is a bright future ahead and that with a strong will and true commitment, the tide can be turned for the Indian Railways: "The decline in Railways' share of transport in the case of cement, petroleum and iron and steel has been largely on account of Railways' competitive weakness in the face of challenges from other modes of transport viz. road, pipeline, coastal shipping, etc. The change in the profile of the economy has also contributed towards the decline in the Railways' share of transport market … The following strategies have been formulated to win back traffic to the Railways:

- Marketing for non-bulk, non-block rake, and high value traffic.
- Flexibility in rating by way of innovative variations to the schemes for station-to-station rates and volume discounts.
- Facilitating private participation in creation of warehousing at existing railway terminals.
- Formulating schemes for terminal service providers at railway goods sheds." [4]

1 "Status Paper on Indian Railways; Issue and Options"; Government of India, Ministry of Railways, May 2002.
2 Status Paper on Indian Railways, Chapter 1, section 1.2: Overview (par 1.2.2 – 1.2.4)
3 Status Paper on Indian Railways, Chapter 3 "Major Initiatives Taken and Basic Issues Involved"
4 Status Paper on Indian Railways, Chapter 2, section 2.2: Freight Business Loss of market share (par 2.2.2 – 2.2.3)

5.2 INDIAN RAILWAYS: STRUCTURE

The Indian Railways (IR) is governed by the Government of India, Ministry of Railways. The ministerial responsibility is embodied by the Minister of Railways and two Ministers of State for Railways. The management of IR is under the responsibility of the Railway Board, see Figure 5.2.

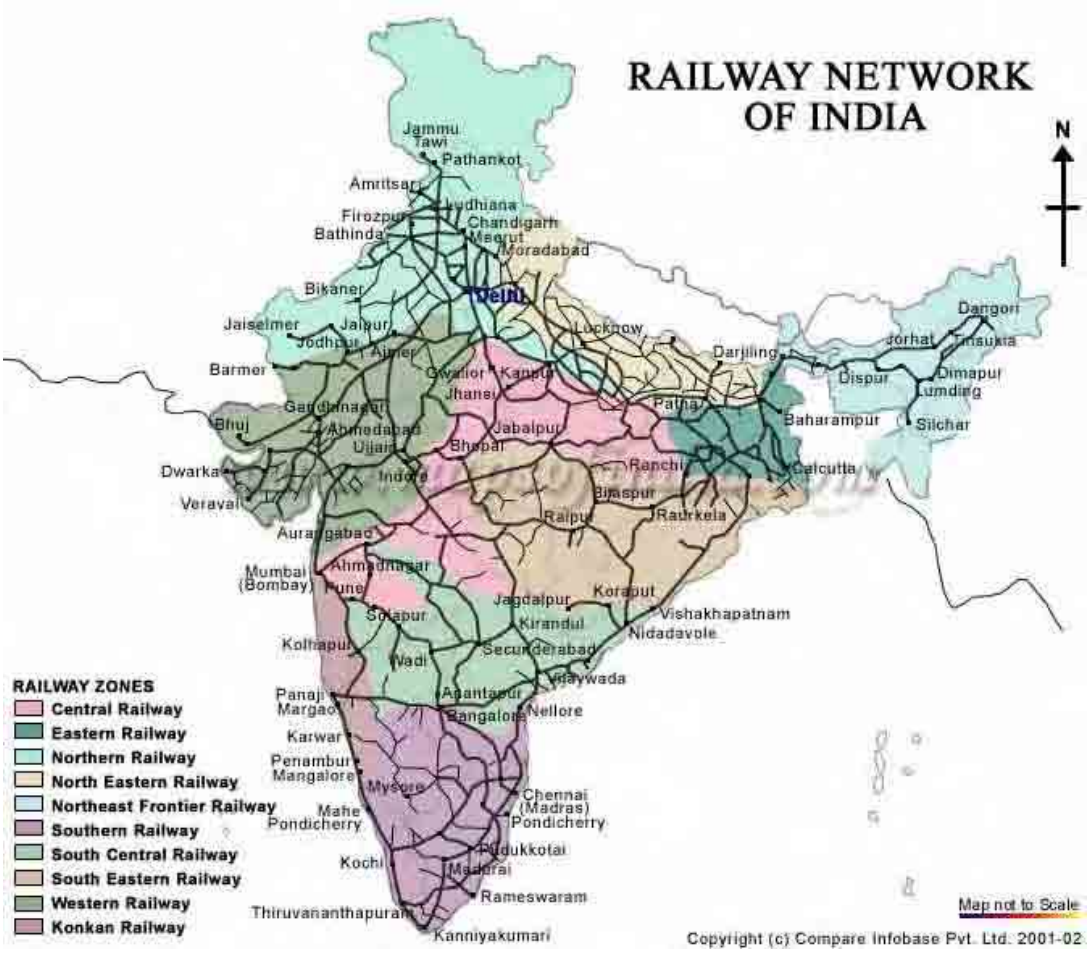


Source: Ministry of Railways, see http://www.indianrailways.gov.in/ (situation on 15/08/2006)

Figure 5.2 IR Management structure

The classic railway business of cargo and passenger transport was until the end of the nineties spread over different zones (see Figure 5.3). the different zones are:

- Central Railway
- Eastern Railway
- Northern Railway
- North Eastern Railway
- North East Frontier Railway
- Southern Railway
- South Central Railway
- South Eastern Railway
- Western Railway



Source: Compare Infobase, (year 2001-2002 situation)

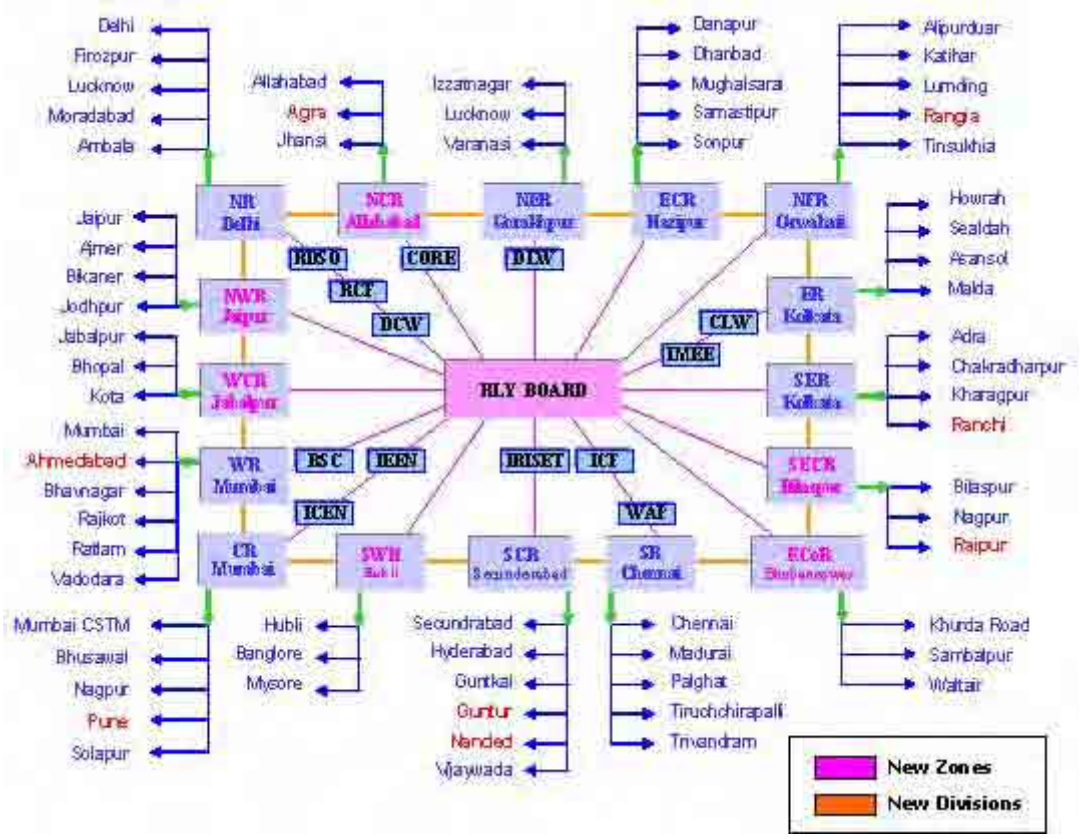
Figure 5.3 IR Zonal Railways until the end of 1990s

The Konkan Railway in above figure is a special case and is discussed further in this paragraph.

The above geographic structure was changed by the end of the nineties and following new zones and divisions added to the existing system:

- East Central Railway
- East Coast Railway
- North Central Railway
- North Western Railway
- South Western Railway
- West Central Railway
- South East Central Railway

The year 2006 structure of the network is demonstrated in Figure 5.4.



Source: Ministry of Railways, see http://www.indianrailways.gov.in/ (situation on 15/08/2006)

Figure 5.4 Geographical distribution of railway network

In addition to traditional intercity long-distance passenger railway services and cargo transport, urban passenger transport is one of many activities of IR that has emerged as complementary business, generally organized as a Government of India Undertaking, also known as Public Sector Undertaking (PSU). The most important PSU of IR are:

- **Centre for Railway Information System (CRIS)** In 1986, the Ministry of Railways established the Centre for Railway Information Systems (CRIS) to implement the in 1982 decided Freight Operations Information Systems (FOIS). CRIS would be an umbrella for all computer activities on Indian Railways (IR). The Centre started functioning from July 1987 as an autonomous organization.

- **Container Corporation of India Ltd, (CONCOR)** was incorporated in March 1988 under the year 1956 Companies Act, and commenced operation from November 1989 taking over the existing network of 7 Inland Container Depots from the Indian Railways. The company develops multimodal logistics services for India's containerized transport, offering customers the advantages of direct interaction and door to door services.

- **Indian Railway Catering and Tourism Corporation Ltd (IRCTC).** The Ministry of Railways had set up IRCTC in 1999 to function as an extended arm of IR to upgrade and manage the catering and hospitality services at stations, on trains and other locations and to promote domestic and international tourism through

development of budget hotels, special tour packages, improving information availability, commercial publicity, and a global reservation system.

- **Indian Railway Finance Corporation (IRFC)** is the financial arm of the Ministry of Railways with prime objective to borrow money on the national and international markets for Indian Railways. IRFC has set exemplary standards in low-cost commercial borrowing in India and abroad. The IRFC is managed by officers of Indian Railways Account Service (IRAS).

- **IRCON International Limited (IRCON)** is a central Public Sector Enterprise under the 1956 Companies Act, established to utilize IR expertise in helping Developing Nations install and maintain their own railways and to execute railway projects for private sector. The Company's specializes in Railways, Railway Electrification, Signal and Telecommunication, construction of roads, highways, commercial, industrial and residential complexes, airport runways, airport constructions, leasing of locomotives, mass rapid transit system etc. The Company has completed 280 major infrastructure projects in India and 90 projects across the globe in 21 different countries.

- **Konkan Railway Corporation Ltd** is a Government of India Undertaking. On July 19, 1990, Konkan railway Corporation Limited (KRCL) was incorporated as a public limited company under the Companies Act to construct and develop the Konkan Railway line, connecting Mumbai, the commercial capital, and Mangalore in western India.

- **Mumbai Railway Vikas Corporation Ltd (MRVC Ltd)** is a PSU under the Ministry of Railways, incorporated under Companies Act. Its equity capital is shared between Ministry of Railways (majority shareholder) and the Government of Maharashtra with the objective to implement the Rail Component of an integrated rail-cum-road urban transport project called Mumbai Urban Transport Project (MUTP). Today, MRVC not only executes railway development projects but is also involved in the further planning and development of Mumbai Suburban Rail system, which caters each day over 6 million persons.

- **RAILTEL Corporation of India Ltd.** Was established in September 2000 as a Public Sector Undertaking under the Ministry of Railways to commercialize and exploit (idle) Railways' communication assets. RailTel will modernize the existing infrastructure and increase its capacity to offer efficient communication facilities to the Railways as well as for commercial purposes.

- **RITES Ltd.** is a Government of India Enterprise (PSU) established in 1974 under the Indian Railways. RITES Ltd. is a multi-disciplinary consultancy organization in the fields of transport, infrastructure and related technologies. The company employs over 2,000 persons among which more than 1,200 specialists in the fields of engineering, management and planning.

- **Pipavav Railway Corporation Ltd. (PRCL)** is a joint venture between the Indian Railways and the Gujarat Pipavav Port Ltd with the objective to develop, maintain and operate the 271 kilometer long railway line connecting the Port of Pipavav to Surendranagar Junction of the Western Railway. PRCL is the first Public - Private Partnership in rail transportation and obtained the status of a Railway Administration, under the 1989 Railway Act.

IR also operates other Units outside its group of Public Sector Undertakings, among which:

- **Northeast Frontier Railway (NF Railway)** is one of the sixteen Zonal Railways working under Railway Board of the Ministry of Railways and is situated in the Northeast Region of the Country touching the states of Bihar, West Bengal, Assam, Nagaland, Arunachal Pradesh, Manipur, Mizoram & Tripura.

- **Metro Railway Kolkata** is the first underground Metro Railway in India spanding over a length of 16.45 Km. The metro was constructed progressively from 1972 to 1995.

- **Central Organisation for Railway Electrification (CORE)** was established in 1979 in Allahabad as a separate but centralized organization to be in charge of the railway electrification projects all over India. The target for 10th Five year Plan is to electrify 1,800 route km. During the first four years of 10th Five Year Plan some 1,449 route km have been completed and the target for financial year 2006-2007 is fixed as 360 km.

- **Chittaranjan Locomotive Works (CLW)**: started production on 26th January 1950, the day when India became Republic. It is at present one of the largest Electric Locomotive manufacturer in the world. The initial product was the Steam Locomotive but now manufactures electric locomotives (25 kv ac loco with three phase ac drive, 25kv ac locomotive with dc drive). CLW also manufactures AC & DC Traction motors, Switch gears/Control gears, Bogies cast & fabricated, Wheel sets & Steel casting

- **Diesel Locomotive Works (DLW)**: was set up in 1961 as a green-field project in technical collaboration with ALCO/USA and started full-scale production in January 1964. In October 1995, DLW signed a "Transfer-of-Technology Agreement" with General Motors to manufacture state-of-the-art high traction AC-AC diesel locomotives. DLW has grown into a flagship company of Indian Railways offering a complete range of flanking products in its area of operations.

- **Integral Coach Factory (ICF)**: Construction of railway coaches commenced in March 1952. Starting with a humble beginning of about 350 coaches per year, ICF has grown into a production capacity of more than 1000 coaches annually. Through the years, ICF has manufactured many types of coaches with the maximum number of different types ever produced in one year was in the year 2000 – 2001 with 32 different types. ICF employs more than 13,000 people many of them living in the ICF-township that consists of 3,000 residential quarters with schools, auditoria, stadium, recreation facilities and hospital.

- **Rail Coach Factory (RCF)**: was established in 1986 as a coach manufacturing unit of Indian Railways. RCF has manufactured around 16,000 passenger coaches of 51 different types including Self Propelled passenger vehicles which constitutes over 35% of the total population of coaches on Indian Railways. RCF is at the threshold of setting an all time record by manufacturing more than 1,400 coaches during the Financial Year 2005-06. RCF is equipped with CAD centre and CNC machines to undertake design and manufacture of bogies, shell (both with Stainless Steel and Corten Steel), FRP interiors as per customer's requirement.

- **Rail Wheel Factory (RWF)**: RWF was set up to make wheels, axles and wheelsets for the Indian Railways to substitute the import of these equipments. The idea for the

establishment of RWF came in 1978 and the factory was built with World Bank assistance. Production was inaugurated on the 15th of September 1984.

- **Diesel-Loco Modernisation Works (DMW)**: formerly Diesel Component Works (DCW) is located in the state of Patiala. Diesel-Loco Modernisation Works was setup in the year 1981 to extend the service life of ALCO Diesel Locomotives and to significantly raise the level of their availability. The work force of DMW totals 3,894 staff, supervisors and officers and is a self sufficient organization spread over a self contained township area of 537 acres with 1,714 Quarters, a 50 bed hospital with all modern facilities, a golf course and other sports and recreational facilities. DMW has with its own stores, Accounts, Personnel engineering, security and medical staff on its payroll.

- **Research Designs and Standards Organisation (RDSO)** was established in January 2003 under Ministry of Railways at Lucknow by joining into one organization the Central Standards Office (CSO) and the Railway Testing and Research Centre (RTRC). RDSO was established to develop safe, modern and cost effective Railway technology complying with Statutory and Regulatory requirements, through excellence in Research, Designs and Standards and Continual improvements in Quality Management System to cater to growing demand of passenger and freight traffic on the railways.

- The **Railway Staff College** was founded in 1930 at Dehradun and shifted to Vadodara, in 1952. The College provides specialized training and education to all levels of IR officers, from probationers to General Managers.

- **Central Organisation for Modernisation of Workshops (COMOW)**, was founded in 1979.

In light of the present Project, one very important business activity formally established in January 2003 is **Rail Vikas Nigam Limited (RVNL)**, a *Special Purpose Vehicle (SPV)* created to undertake project development, mobilization of financial resources and implementation of projects with the objective of *strengthening the Golden Quadrilateral and establish efficient port connectivity*. Its primary mandate is the implementation of National Rail Vikas Yojana (NRVY). The NRVY was installed in the year 2002 as a non-budgetary financing program for the development of the Indian Railways. The financing program consists of a total capital injection of Rs 15,000 crore over 5 years. The main investment targets are[5]:

- Strengthening of the Golden Quadrilateral to enable Railways to run more long-distance mail/express trains and freight trains at a higher speed of 100 kmph, at a cost of Rs. 8,000 crore;

- Strengthening of rail connectivity to ports and development of multimodal corridors to hinterland, at a cost of Rs. 3,000 crore;

- Construction of four mega bridges — two over the River Ganga, one over River Brahmaputra, and one over the River Kosi — at a cost of Rs. 3,500 crore;

- Accelerated completion of last mile and other important projects, at a cost of Rs. 763 crore.

[5] Prime Minister's speech on Independence Day of 15/08/2002

NRVY will find its resources via various funding options from external multilateral agencies like the World Bank or the Asian Development Bank. But the NRVY also intends stimulating private sector participation via various investment and development models such as Build-Own-Transfer (BOT), Joint Ventures, SPV with equity participation by strategic and financial investors, lending from bankers and financial institutions, borrowing from the private markets (domestic and foreign), etc.

In his year 2005 Independence Day speech, the Prime Minister emphasized the progress in this respect and argued for a continued effort to achieve the set-forward goals: "In order to ensure that our economic growth does not slow down, it is necessary to have strong infrastructure. Economic growth is intrinsically linked to the availability of infrastructure. Railways, roads and electricity are important elements of infrastructure. In order to improve our railways, a rail modernization programme has been prepared so that our railways become one of the best in the world. A dedicated freight corridor is being developed between Delhi-Kolkata and Delhi-Mumbai by investing over Rs. 25,000 crore rupees."[6]

5.3 INDIAN RAILWAYS: TRAFFIC

"In India the railways have been losing freight business to roadways, although less rapidly than in advanced countries. Railways retain their relative advantage mainly in natural resource and intermediary goods markets in which there are large volume movements and relatively low value-to-weight ratios and tend to lose it as the value-to-weight ratios of manufactured commodities increases unless they can provide high quality container services particularly on medium and long hauls. In order to retain and even increase market share the Railways need to be repositioning itself all the time in order to meet the challenge of competition from the road sector."[7]

But recently, the downward trend seems to have stopped undoubtedly in part because of a renewed "… focus of the Railway Ministry on efficiency, customer care, and commercial principles … aimed at reversing this trend. The recent turnaround in railway operations suggests that Indian Railways are poised for rapid growth in capacity expansion." [8]

This paragraph examines traffic volumes for passenger and freight transport, the focus being on the latter one. This traffic review will further concentrate on the Golden Quadrilateral and in particular on rail freight movements along the proposed eastern and western corridors of the planned Dedicated Freight Corridor.

The need to recapture lost market share is indeed a high priority. Not only has the financial performance of the sector deteriorated dramatically in recent years[9], but the actual total market share of the railways has fallen dramatically over the last 30 years, as can be clearly seen in Table 5.2 and Figure 5.5.

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6 Prime Minister's Speech Independence Day year 15/08/2005

7 Report of the Task Force: The Delhi-Mumbai & Delhi-Howrah Freight Corridors; The Secretariat for the Committee on Infrastructure Planning Commission, Government of India; p 6

8 Report of the Task Force: The Delhi-Mumbai & Delhi-Howrah Freight Corridors; The Secretariat for the Committee on Infrastructure Planning Commission, Government of India; p 3 – Preface

9 Status Paper on Indian Railways, Chapter 2 "Issues and Options", Section 2.1 "Status" section 2.1 Financial Health

Table 5.2 Market share of railways

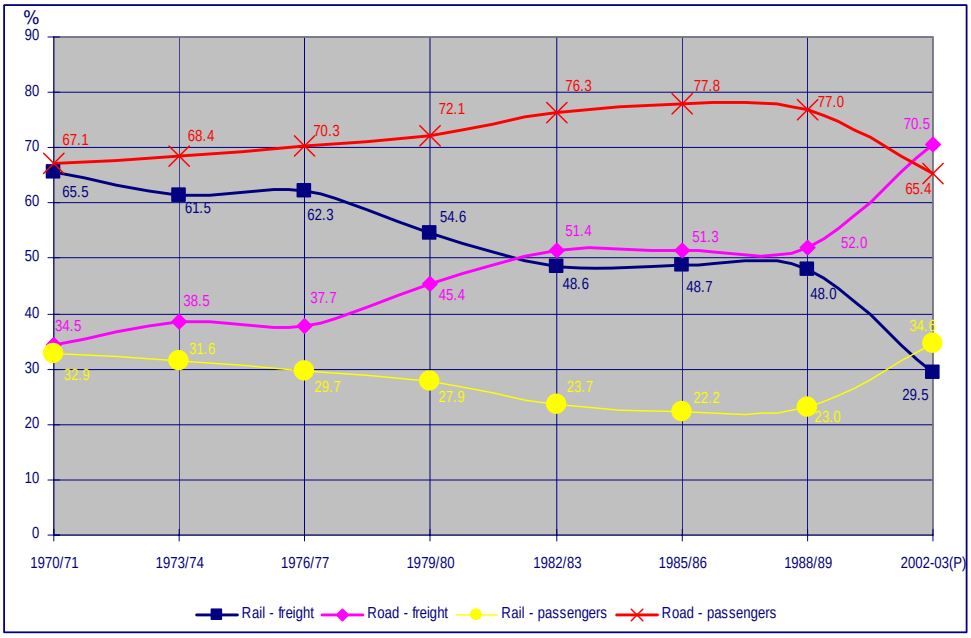
1. Freight Traffic (ton-km, per cent)								
Year	1970/71	1973/74	1976/77	1979/80	1982/83	1985/86	1988/89	2002-03(P)
Rail	65.5	61.5	62.3	54.6	48.6	48.7	48.0	29.5
Road	34.5	38.5	37.7	45.4	51.4	51.3	52.0	70.5
2. Passenger Traffic (passenger-km, per cent)								
Year	1970/71	1973/74	1976/77	1979/80	1982/83	1985/86	1988/89	2002-03(P)
Rail	32.9	31.6	29.7	27.9	23.7	22.2	23.0	34.6
Road	67.1	68.4	70.3	72.1	76.3	77.8	77.0	65.4

Source: JICA Study Team on the basis of: Teri Energy Data Directory Yearbook 2002/03 (970/71 to 1988/89), JICA Study Team (1996/97), CMIE (Centre for Monitoring Indian Economy), Basic Statistics Relating to the Indian Economy, MOR, 1998 Status Paper on Indian Railways, MOF, 1999 Economic Survey

The decline is all the more dramatic for cargo transport in particular given the important volumes of bulk cargoes transported in India, cargoes highly suitable for transport by rail as shown in Figure 5.5.

Railway passenger transport has changed dramatically since the end of the sixties but the trend seems to be changing at the turn of the century. In 1970, the share of railway traffic was 33% while the roads accounted for 67% of traffic. This distribution changed dramatically in the mid-eighties with the roads reaching over 77% of total traffic while the share of railway passenger traffic had shrunk to below 23%. But in the year 2002-03, the railway share of passenger traffic has climbed to over 34%, regaining some 12% of traffic from the road sector that declined from over 77% to just above 65%. But this gain is somewhat artificial as it is not generated by traditional railway passenger services, as was made clear in the year 2002 Status Paper for Indian Railways. According to the analysis in the Status Paper, much of the positive evolution of passenger transport by rail is the consequence of the success of the suburban railway systems build during the last decade. At present, 60% of the passengers traveling by rail are suburban travelers in the cities of Mumbai, Calcutta and Chennai and on the railway network around Delhi.

The decline of railway performance was even more explicit for cargo transport. In the seventies, the railways catered for over 54% of all cargo transport but that position declined rapidly, from 65% in 1970 to 54% in 1979. Two years later in 1982, roads overtook the railways in cargo transport share and obtained 51.4% of all cargo transport compared to the railways for whom the share slipped to 48.6%. This decline continued over the years to the present situation where the road sector is responsible for more than two thirds (70.5%) of all terrestrial cargo transport and the railways transporting not even one third (29.5%).



Source: JICA Study Team's estimate on the basis of: Teri Energy Data Directory Yearbook 2002/03 (970/71 to 1988/89), JICA Study Team (1996/97), CMIE (Centre for Monitoring Indian Economy), Basic Statistics Relating to the Indian Economy, MOR, 1998 Status Paper on Indian Railways, MOF, 1999 Economic Survey

Figure 5.5 Passenger and freight traffic evolution road compared to rail

Table 5.3 describes in detail of railway performance between the years 1950 and 2001.

Railway traffic growth was strong across all segments till the end of the eighties, when the tides gradually changed. Railway cargo transport almost quadrupled between the year 1950 and the year 1990 with a particularly remarkable increase in the eighties. The growth of passenger transport was equally spectacular, although the intensity was slightly lower with the volumes tripling between the years 1950 and 1990. From the year 1990 on, growth was below the double digit growth levels in earlier years. The Table 5.4 thus demonstrates a constant growth of railway traffic in India, both for passenger and cargo transport and both for total traffic as revenue-earning traffic but also shows that that growth is slower from 1990 on. When comparing these numbers with the data in Table 5.3, it can be noted that this slowdown coincides with the gradual rise of the road sector's share, in particular in cargo transport where the road sector since the middle of the eighties has overtaken the first place from railways and increased its share in passenger transport, although for the latter, the positive impact of several urban railway developments becomes evident in the year 2002.

Table 5.3 Railway performance 1950 – 2000

	1950-51	1960-61	1970-71	1980-81	1990-91	1995-96	2000-01
Originating traffic (million tons)							
Revenue-earning	73.2	119.8	167.9	195.9	318.4	390.7	473.5
Total traffic	93	156.2	196.5	220	341.4	405.5	504.2
Goods carried (billion ton-km.):							
Revenue-earning	37.6	72.3	110.7	147.7	235.8	270.5	312.4
Total traffic	44.1	87.7	127.4	158.5	242.7	273.5	315.5
Earnings from goods carried (Rs crore)	139.3	280.5	600.7	1,550.9	8,247	14,972.8	23,045.4
Average lead :all goods traffic(Km.)	470	561	648	720	711	675	626
Average earnings per ton-km(paise)	3.2	3.9	5.4	10.5	35	55.4	73.8
Passengers originating (million)	1,284	1,594	2,431	3,613	3,858	4,018	4,833
Passenger kilometers (billion)	66.5	77.7	118.1	208.6	295.6	342	457
Passenger earnings (Rs crore)	98.2	131.6	295.5	827.5	3,144.7	6,124.5	10,515.1@
Average lead: passenger traffic (km.)	51.8	48.7	48.6	57.7	76.6	85.1	94.6
Average earnings per Passenger-kilometer (paise)	1.5	1.7	2.5	4	10.6	17.9	22.9

Source: Ministry of Railways @ Includes Metro Railway/Kolkata's earnings.

Table 5.4 depicts recent railway performance and confirms the trends observed in previous Tables and figures.

Table 5.4 Railway performance 1990 - 2005

	1990-91	**2000-01**	**2001-02**	**2003-04**	**2004-05**
ACTUAL VALUES					
Passenger (Billion kilometers)	300	460	490.9	540	580
Freight (Billion ton kilometers)	240	320	336.4	380	410
Passengers carried (Billion)	3.86	4.83	5.09	5.1	5.38
Goods carried (Billion ton)	0.34	0.5	0.52	0.56	0.6
Earnings (Rs. Billion)					
Passenger	31.45	104.83	111.96	132.6	140.71
Freight	82.47	230.45	245.86	274.03	304.89
Average earning per passenger per km (Paise)	10.6	22.9	22.7	24.5	24.4
Average earning per ton per km (Paise)	35	73.8	73.8	71.9	74.8
PERCENTAGE GROWTH					
Passenger (Billion kilometers)		35%	6%	9%	7%
Freight (Billion ton kilometers)		25%	5%	11%	7%
Passengers carried (Billion)		20%	5%	0%	5%
Goods carried (Billion ton)		32%	4%	7%	7%
Earnings (Rs. Billion)					
Passenger		70%	6%	16%	6%
Freight		64%	6%	10%	10%
Average earning per passenger per km (paise)		54%	-1%	7%	0%
Average earning per ton per km (paise)		53%	0%	-3%	4%

Source: JICA Study Team on the basis of Central Statistics Organisation: *India in Figures – 2005* and Ministry of Railways

As above Table clearly demonstrates, railway traffic has performed relatively well between the years 1990 till 2000. The Table also shows that there is a clear distinction to be made in the growth patterns for actual volumes transported and the earnings related to that volume, growth for the latter being on average the double of the former. Given the annual growth in transport demand of some 10% per annum the growth in railway traffic both for cargo and passengers stays below the demand. The Table finally demonstrates a more stable growth for cargo transport as for passenger traffic both in terms of earnings as actual volumes.

For the Dedicated Freight Corridor Study, cargo traffic requires particular consideration as this evaluation will provide valuable information in terms of developing the DFC. The next section will therefore concentrate on railway cargo transport.

5.4 INDIAN RAILWAYS: PERFORMANCE

5.4.1 Introduction

The turn of the century also marked a notable turn in the vision of railway performance inside many government bodies. While the first Five Year Plans still considered IR a strategic asset with no need for financial management, the Tenth Five Year Plan and the Vision 2020 – transport, together with many other expert documents such as the Rakesh Mohan Committee Report, expressed a strong need for stringent organizational reforms and financial responsibility.

The Indian Railways undoubtedly requires a drastic overhaul in order to become more competitive and improve its service and transport offer, a process that only recently began. Building upon the efforts of his predecessor, Mr Nitish Kumar, and pursuing an innovative and modern vision of railway transport, the current Minister for Railways, Mr Lalu Prasad, transformed during the last two years the Indian Railways into a profitable and record-setting organization. Presenting the year 2006-07 budget, the Minister highlighted a number of remarkable achievements, proving the positive effects of his reorganization efforts:

- Cash reserves have reached Rs11,000 crore as compared to just Rs350 crore during the year 2001 when it had to defer dividend payments.

- Internal net cash flows before dividend to the government during the current year 2005-06 is expected to be close to Rs11,000 crore.

- Gross revenues of Rs 59,978 crore and total operating expenses of Rs 38,300 crore for 2006-07 resulting in a surplus of Rs14,293 crore –or over US$3 billion– after providing for pensions and depreciation, but before dividend. This projected growth can truly be marked as an achievement in corporate performance.

The initiatives explained in the year 2006-07 budget clearly demonstrate the will of the Railway Minister to convert the Indian Railways into a competitive and financially healthy organization, paying the necessary attention to costumer needs without forgetting its public service obligation (PSO) of providing transport to all, even in more remote areas of the country: “In my view, improvements can only be brought about by raising the quality of services, reducing unit costs and sharing the resultant gain with customers. Therefore, instead of following the beaten path, we decided to tread a new one.”[10]

[10] Speech of Shri Lalu Prasad Introducing the Railway Budget 2006-07 on 24th February 2006, paragraph 2

5.4.2 Past performance: Focusing the wrong problems

The recent efforts and demonstrated financial, managerial and operational achievements of IR suggest that the company is at last on its way of becoming a real corporate organization, far from the money consuming entity it was few years ago. Indeed, it was not as far back as in the year 2001 that the Railway Minister in its year 2002 Status Paper had to admit that "… although the resilience of this great organization has seen it through difficult times, the challenges that lie ahead are such that new strategies, which require firm resolve and a highly focused approach, are called for."[11]

And innovation and strategic change were necessary considering the poor financial performance of IR at that time: "Until 1998-99, the Railways had been generating net surplus. But owing to the implementation of the recommendation of the Fifth Pay Commission, Railway finances have deteriorated very sharply. The wage and pension liability has nearly doubled to Rs.19,000 crore since 1996-97. Outstanding from the SEBs have grown to Rs.1,865 crore. Simultaneously, lease payments to IRFC have more than doubled to Rs.3,041 crore since 1995-96. As a result, IR had to defer payment of dividend partially during the years 2000-01 & 2001-02. The operating ratio has also worsened. However, on account of the various initiatives taken by IR in the last one year, it is expected to improve to 94.4% this year. It also plans to meet the dividend liability in full during this year."[12]

Indeed, since the introduction of the Five Year Plans, railway financing and performance have always been a problem area where reorganization plans were drawn; estimates put forward and investments allocated but with hardly any effect on the continuously worsening situation of IR.

Many reasons could be invoked for the degrading situation of the railways in spite of the efforts put forward in the five year plans, but at least one remarkable evolution in the railway support is that the financial support decreased while the situation of IR worsened, as can be seen in Table 5.5.

Table 5.5 IR Support in the Five Year Plans

Five Year Plan	Total Outlay (Rs. in Crore)	Transport Sector (Rs. In crore)	Railways (Rs. in crore)	Transport Sector Outlay as % of total Plan outlay	Railways Outlay as % of total Plan outlay	Railways Outlay as % of Transport Sector Outlay
1 to 4	30,988	6,039	3,200	19.5	10.3	53.0
5	28,991	4,078	1,523	14.1	5.3	37.3
6	109,292	13,841	6,555	12.7	6.0	47.4
7	218,729	29,548	16,549	13.5	7.6	56.0
8	434,100	53,966	27,202	12.4	6.3	50.4
9	859,200	121,037	45,413	14.1	5.3	37.4

Source: Status Paper on Indian Railways May 2002, section 2.1.10 Table 2.3

[11] "Status Paper on Indian Railways; Issue and Options"; Government of India, Ministry of Railways, May 2002, Chapter 1 – Introduction paragraph 1.1

[12] Status Paper on Indian Railways; 2002, Chapter 2. Section 2.1 Status – Financial health; paragraph 2.1.1

The reduction in public financial support saw an increased use of private capital and internal resources to finance the development of the Indian railways, as can be seen in following Table 5.6. The Table clearly demonstrates the increase in market borrowing and the use of internal resources from the Seventh Five Year Plan on, this in spite the relatively high share of the total transport budget the railways obtained during that Plan, a share of 56% of the transport budget which was never that high.

Table 5.6 Financial resources generation for IR per origin

Plan	Budgetary support from GOI		Internal resources		Market borrowings through IRFC		BOLT/OYW		Total	CAGR percentage per annum
	Amount	%	Amount	%	Amount	%	Amount	%		
I (51-56)	142	33.6	280	66.4	-	-	-	-	422	
II (56-61)	576	55.2	467	44.8	-	-	-	-	1,143	22.1
III (61-66)	1,140	67.7	545	32.3	-	-	-	-	1,785	9.3
IV (69-74)	1,031	72.2	397	27.8	-	-	-	-	1,528	(3.1)
V (74-78)	1,141	74.8	384	25.2	-	-	-	-	1,625	1.6
VI (80-85)	3,802	57.7	2,783	42.3	-	-	-	-	6,685	22.4
VII (85-90)	6,940	41.9	7,089	42.8	2,520	15.2	-	-	16,649	20.0
VIII (92-97)	7,311	22.6	18,830	58.3	5,565	17.2	596.0	1.8	32,400	10.0
IX (97-02)	15,472	33.3	16,352	35.2	13,523	29.1	1,058.0	2.3	46,502	7.5
Details of the IX Plan										
1997-8	1,992	24.2	3,452	41.9	2,236	27.1	559.0	6.8	8,332	
1998-9	2,185	24.7	3,455	39.0	2,941	33.2	276.0	3.1	8,953	7.5
1999-0	2,588	28.6	3,550	39.2	2,785	30.7	134.0	1.5	9,155	2.3
2000-1	3,269	34.8	3,229	34.4	2,818	30.0	79.0	0.8	9,494	3.7
2001-2	5,438	50.1	2,666	24.6	2,743	25.3	10.0	0.1	10,956	15.4
2002-3	5,390	43.7	3,940	32.0	3,000	24.3	-	-	12,430	13.5

Source: G. Raghuram & Krishnan Venkataraman *Public Expenditure Accountability of the Indian Railways*; Indian Institute of Management – Ahmedabad; IIMA Working Paper nr 2002-09-09.
CAGR – Compound Annual Growth Rate / BOLT – Build Operate Lease Transfer / OYW – Own Your Wagon scheme / IRFC – Indian Railway Finance Corporation / GOI – Government of India

The Table 5.6 clearly demonstrates the important decrease in budgetary support with the level of support in the Ninth Five Year Plan returned to the same percentage as the level of support during the First Five Year Plan. It is also clear that that this important decrease in public support has to be compensated with financing from other sources and given that the internal resources of IR are limited as a consequence of its financial difficulties, other sources had to be tapped, explaining the important increase in market borrowing and the introduction of private capital via BOLT and OYW (Own Your Wagon) schemes.

But the percentage decrease in support for the railways should not be put forward as the sole or principal argument for the continued decline of the sector. Other factors undoubtedly contributed as was made clear in the Rakesh Mohan Committee Report on the Indian Railways. According to the Report, the decline of IR is due to a combination of factors and a series of development in the 1990s. A first major reason is internal to the railways, where a tradition has been build that railways are essential to the nation and should offer a public service for all. The need for subsidies in this field emerges predominantly for low class services and suburban rail services. This concept is know as Public Service Obligation (PSO) and financing the PSO was done by cross subsidizing from the (profit making) rail freight

and to a lesser extent from upper class passenger fares. Maintaining highly unprofitable services and financing these with the surplus of profit-making activities has of course a negative impact on the overall financial results of the organization. The pressure became even more insupportable when economic reforms in the nineties increased the external pressure on IR, generated in particular by the road sector who responded more efficiently to the mounting pressure of industries to reduce overall costs, in particular in the field of transport.

The year 2002 Status Report was very clear on the consequences of the PSO: "It has been estimated that social service burden to the organization amounted to about Rs.3282 crores in 2000-01. The main components of losses on social service obligations are:

- Essential commodities carried below cost;
- Some passenger and other coaching services;
- Operation of uneconomic branch lines;
- New lines completed with negative rate of return.

Till now the Railways have been regarded both as a vehicle of socio-economic development and a commercial enterprise. By and large, Indian Railways have performed this dual role well. However, it is becoming unsustainable day by day. It has now started affecting the financial health of Railways and its capacity to generate adequate surplus for investment in capacity build up and for renewal and replacement of assets."[13]

A further important factor was the investment and infrastructure development policy related to the railways, which saw an escalation of unprofitable projects escalating over the years, putting unnecessary pressure on the finances of IR. The Rakesh Mohan Committee Report in particular warned against the continued realization of infrastructure projects for political (and other) reasons that consume too much internal resources and increase costs, outstripping the revenues generated by a constantly declining growth. This is particularly true in the freight transport business. A large part of this situation is a consequence of an outdated organizational structure and operational ethic which undervalues accountability at every level of the organization. Ancient corporate structures and principles also lead to a poor productivity in spite of constant rises in employee costs (accounting for about 50% of costs. The Fifth Five Year Framework is by many considered a key turning point, causing further financial instability as it implemented a 33% increase in staff wages at the time of the Asian economic crisis[14].

As can be noted in Table 5.7, IR performance substantially deteriorated during the turn of the century although it is expected that the situation will improve, in particular once the effects of the ongoing reform program will become more evident as achieved improvements over time will increase efficiency, productivity and consequently corporate profitability.

[13] Status Paper on Indian Railways May 2002, section 2.1.2

[14] Asian Development Bank: Report and Recommendation of the President to the Board of Directors on a Proposed Loan and Technical Assistance Grant to India for the Railway Sector Improvement Project; November 2002, doc nr RRP IND 36317; par 65

Table 5.7 IR performance résumé

(in Rs million)	Actual				Forecast				
	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
Income Statement Items									
Operating Revenue	296,190	329,390	348,804	378,380	406,456	441,268	470,485	506,564	546,364
Operating Expenses	278,380	309,100	347,000	362,930	384,140	410,364	433,849	463,670	496,137
(Depreciation)	11,550	16,700	23,010	20,000	19,000	20,000	21,000	23,000	25,000
Operating Income	17,810	20,290	1,804	15,450	22,316	30,904	36,636	42,894	50,227
Balance Sheet Items									
Current Assets	30,190	42,275	37,544	40,738	38,252	46,211	49,270	53,049	57,216
Fixed Assets	392,810	430,274	464,483	478,841	510,233	542,103	585,283	632,607	695,931
Capital-At-Charge	257,800	296,553	326,619	341,619	356,619	371,619	386,619	401,619	416,619
Retained Earnings	183,179	174,795	173,579	181,205	192,662	218,273	249,548	286,116	338,640
Financial Ratios									
Operating Ratio (%)	90	89	93	91	90	88	88	87	86
ROCE (%)	9	6	2	5	6	7	8	8	9
Return on Fixed Assets (%)	7	7	2	5	6	8	8	9	9

Source: Asian Development Bank: Report and Recommendation of the President to the Board of Directors on a Proposed Loan and Technical Assistance Grant to India for the Railway Sector Improvement Project; November 2002, doc nr RRP IND 36317; p 16 Table 3

The net revenues of IR demonstrated an important decline in fiscal year 2000-01 and are only gradually recovering. But as can be noted in the forecasts of the Asian Development Bank, there is optimism about the future revenue stream of the largest undertaking in India. This optimism is reflected in the Operating Ratio, which is expected to decrease to 86%, therewith expressing a regaining of sustainable financial strength of IR[15].

The recent positive evolution of IR, both in terms of financial efficiency demonstrates clearly that competitiveness and good financial performance is not determined by government support, but is the outcome of good corporate governance, supported by Innovative managerial and operational strategies that focus on market conditions and customer needs as is confirmed in next section.

5.4.3 Recent performance, innovation and responsiveness

Compared to the above constant decline of railway performance, Minister Lalu Prasad's overview of recent performance is all the more encouraging: "the Railways' output has been record breaking. The growth in freight loading is 10% and in freight revenues it is over 18%. Based on the trends up to now, the freight loading target is being increased from 635 mt to 668 mt and the goods revenues target from Rs. 33,480 cr to Rs. 36,490 cr. Thus, Railways would achieve incremental freight loading of 111 mt in two years itself, which will be 133% higher as compared to the incremental loading of 83 mt of entire Ninth Five Year Plan period. Tenth Plan targets of 624 mt loading and 396 billion tonne kilometers have been surpassed one year in advance. Sir, I not only hope but firmly believe that we would surpass

[15] The Operating Ratio is calculated as operating expenses divided by its operating revenues. So the lower / smaller the ratio, the better the performance and the greater the organization's ability to generate profit if revenues decrease

the Tenth Five Year Plan's incremental target of 63 billion ton-km for freight business by over 200%."[16]

The positive evolution is also reflected in the strong financial performance over the last year, and which in 2005 approached closely ADB forecasts, see Table 5.8.

Table 5.8 IR performance résumé (2003-2005 published)

Item	unit	2003-04	2004-05
Revenues	Rs. Crore	42,904.94	47,370.21
Expenses	"	39,482.21	42,758.88
Misc. transactions	"	1,055.76	662.21
Net revenue (before dividend)	"	4,478.49	5,273.54
Rate of return on capital	Percent	7.99	8.89
Dividend on capital	Rs. Crore	3,387	3,199.31
Shortfall(-)/Excess(+)	"	(+)1,091.41	(+)2,074.23

Source: IR, Yearbook 2004-2005

As compared to the ADB forecasts for 2005, actual revenues (excluding miscellaneous transactions) were higher as the ADB estimates while the real expenses remained below these estimates with a similar level of divergence. Increased revenues and reduced expenses increase the net revenue, allowing IR to raise dividend payments in 2005 as compared to 2004 and offer a better rate of return on capital. This positive trend differs strongly from the year 2001 situation where dividend payments had to be suspended.

And with his year 2006-07 budget, the Minister intents to continue on the same path and even increase the quality of the railway offer. Following are some of the highlights of the planned initiatives under that budget:

- Dedicated multimodal high axle load freight corridor with computerised control on Western and Eastern routes at an estimated cost of Rs 22,000 crore.

- Container freight trains by private companies to start next month, except double-stack high capacity container trains. In February 2006, already 14 applicants have deposited the registration fee and will be permitted to run container trains.

- No increase in passenger or freight rates but on the contrary a Dynamic Pricing Policy for freight as well as passenger, for peak and non-peak seasons, premium and non-premium services, and for busy and non-busy routes, therewith better reflecting actual demand structures and supported by the introduction of bulk and loyalty discounts on freight rates.

- Reduction in AC class passenger fares between 10-18 per cent to take on competition from low cost airlines.

- New air-conditioned low fare trains top be launched on a trial basis in 4 routes. Fares to be 25 per cent cheaper than current AC III Tier rates.

[16] Speech of Shri Lalu Prasad Introducing the Railway Budget 2006-07 on 24th February 2006, Section on the Financial Turnaround of Indian Railways, paragraph 3

- 55 new train services to be launched during the next financial year, including 14 new daily services.

- 1100 km of new lines in 14 sections to be completed next year. Doubling of lines for 435 km.

- A number of initiatives to provide more facilities at stations and inside trains including better designed stations, ATM's at stations, automated ticketing machines, modern coaches etc.

The turnaround policy of the Railway Minister is undoubtedly successful for cargo transport: "In the current year, we are fast moving towards establishing a new record of loading 668 million tonnes, with a historic growth of 11%. This is the second consecutive year when we have increased our market share with a growth rate higher than the growth rate of the economy. This record breaking performance has been possible through reduction in wagon turn round time and through additional loading of 4 to 8 tonnes per wagon. This has enabled an increase of 100 mt in our loading capacity and generation of over Rs.5,000 cr in freight revenues. "[17]

A more efficient and market-responsive budgeting policy undoubtedly contributed to this success, a budget policy that is summarized by the Minister as follows: "In my view the basic "mantra" for success in a competitive market is not increasing tariffs, but reaching the benefits of reduced costs to customers." [18]

Also the performance of Public Sector Undertakings (PSU) contributes to the success of Indian Railways: "The performance of Public Sector Undertakings has been satisfactory during the year 2004-05 also. During 2004-05, Indian Railway Finance Corporation registered a turnover of Rs. 1959 cr, posted a net profit after tax of Rs. 405 cr and paid a dividend of Rs. 115 cr. Container Corporation of India Limited registered a turnover of Rs. 2052 cr with a net profit of Rs.429 cr and paid a dividend of Rs.94 cr. IRCON International Ltd. has registered a turnover of Rs.1014 cr with a net profit of Rs. 62 cr and paid a dividend of Rs.20 cr. RITES Ltd. registered a turnover of Rs.240 cr with net profit of Rs. 41 cr and paid a dividend of Rs.12 cr. IRCTC earned incomes of Rs.128 cr as against Rs.70 cr during the previous year and posted a net profit of Rs. 5 cr. RailTel Corporation of India registered a revenue of Rs. 65 cr against Rs. 26 cr in the previous year. RVNL incurred an expenditure of Rs. 393 cr on capital account on works in progress. The total revenues of KRCL have increased from Rs. 245 crores to Rs. 288 crores showing on increase of 18% compared to the previous year." [19]

A particularly important issue for the development of efficient cargo transport by rail is the present Project and "… it is now proposed to construct Dedicated Multimodal High Axle Load Freight Corridor with computerised control on Western and Eastern routes at an estimated cost of Rs. 22,000 crores. In the first phase of the Eastern Corridor Project, a separate freight corridor will be built from Ludhiana to Sonnagar via Ambala, Saharanpur, Khurja and Allahabad. The primary feeder routes from Sonnagar to Durgapur via Gomoh, Sonnagar to Tatanagar via Garhwa Road and Barkakana to Bokaro via Chandrapura will be

[17] Speech of Shri Lalu Prasad Introducing the Railway Budget 2006-07 on 24th February 2006, Section on the Financial Turnaround of Indian Railways, paragraph 3

[18] Speech of Shri Lalu Prasad Introducing the Railway Budget 2006-07 on 24th February 2006, Section on the dynamic pricing policy, paragraph 112, see also following sections for details on the policy for freight and passenger rates and fares

[19] Speech of Shri Lalu Prasad Introducing the Railway Budget 2006-07 on 24th February 2006, Section on the Public Sector Undertakings, paragraph 66

upgraded in order to carry heavier trains of coal and steel traffic. It will also be extended upto ports in West Bengal as per traffic needs. The primary feeder routes will be converted to dedicated freight corridor at the appropriate time. The Western Corridor will start from Jawaharlal Nehru Port and will be routed via Vadodara, Ahmedabad, Palanpur, Jaipur and Rewari to Tuglakabad and Dadri. Both the corridors will be joined by a link between Dadri and Khurja. The feeder routes of the Western Corridor connecting ports of Gujarat will be upgraded. Hon'ble Prime Minister would be inaugurating these projects soon." [20]

But there is still much to be done if railways will take back from the road sector a relevant portion of its historic share in total transport volumes. In particular in the domain of cargo transport and more specifically for container transport, the construction of dedicated railway corridors is only a part of the solution: "Rail linked container depots and integrated logistic parks will have to be created to make the new container policy successful and increase railways' share in non-bulk freight business. Railways have enough land in its goods sheds, which could be made use of for this purpose. In this regard, we would encourage creation of such facilities under public-private partnership schemes by making a transparent policy in a short time. With the help of this policy, we would be able to mobilize sizeable investments in container depots and container wagons." [21]

The future looks bright when the Railway Minister concluded his presentation of the Budget with the words: "I would like to assure the House that we will be continuously striving to meet the expectations of public by constantly improving railway services…"[22]. At present, some growth trends in different activities of the Indian Railways have generated the first signs of a financial turnaround. But sustainability is needed to ensure that both shareholder and customer benefits are maximized. The only way to achieve this is via a continued and in-depth *internal productivity benchmark* to reduce costs and increase revenues.

[20] Speech of Shri Lalu Prasad Introducing the Railway Budget 2006-07 on 24th February 2006, Section on the Construction of Freight Corridor, paragraph 78

[21] Speech of Shri Lalu Prasad Introducing the Railway Budget 2006-07 on 24th February 2006, Section on Record Braking Output in Freight Business, paragraph 21

[22] Speech of Shri Lalu Prasad Introducing the Railway Budget 2006-07 on 24th February 2006, Conclusion, paragraph 130

CHAPTER 6 THE ROAD TRANSPORT SECTOR

6.1 INTRODUCTION

Faced by many challenges, an even bigger challenge for the Indian Railways will be to sustain the present positive results via constant market responsiveness and increased competitiveness. Achieving concrete results at this level will require an intermodal vision of railway services both at the level of management and operations and continued efforts will be necessary as modal competition is strong, in particular from the road sector.

Different growth rates for freight transport could be observed between rail and road during the period 1967-87, rates averaging 3.3% per annum for the former and 8.8% for the latter. In the nineteen eighties, the road sector took over the first place from railways as principal transporter of goods. But in spite of the constantly growing share of the road sector in cargo transport, the sector is far from an example of competitiveness and much of its growth has been a consequence of the decline of railway sector performance: "Support for overlooking the reality of the current modal split has been the general feeling that road transport is energy intensive, polluting and unsafe. And, since all the road freight operations and most of the passenger operations are in the private sector, that profit maximization overrides social concerns. Furthermore, a technology based on the combustion of imported fossil fuels is in the long run fundamentally unsound. All of this was good reason to give roads and road transport a low priority in the overall scheme of things and to give rail investments such as gauge conversion and electrification a high priority. This is reflected in the Eighth Plan document. The problem here is that most future gauge conversion and single line electrification investments, even with the most generous assumptions concerning benefits have economic returns less than 10 percent, whilst the road investments show returns as high as 40 percent. Private shippers stubbornly prefer the polluting, energy intensive, unsafe road technology because it gives them the one thing the railways are unable and/or unwilling to i.e. dependable, customer-responsive service."[1]

The government's policy in favor of railway utilization, did not lead to the conclusion that there was "…evidence to suggest that gross macro distortions of the freight transport subsector of India have resulted from Indian central planning … There are numerous reason for this positive development in India of which the most important has been the relatively large share of GDP in private hands, the steady expansion of the road system, and the privatization and deregulation of trucking."[2].

[1] World Bank: *India Transport Sector: Long Term Issues*; March 16, 1995; Infrastructure Operations Division, Country Department – India, South Asia Regional Office, p 6 par 12

[2] World Bank: *India Transport Sector: Long Term Issues*; March 16, 1995; Infrastructure Operations Division, Country Department – India, South Asia Regional Office, p 3 par 7

Independent of the quality of services or the actual performance of the road transport sector, it can be noted that the road sector in India competes on markets which generally are recognized to be captive markets for railways. "Forty-six percent of the freight vehicles on the HDC road system were travelling in excess of 500 kilometers. Twenty-six percent were travelling in excess of 1000 kilometers. The argument in the Expressway Study is that this long-haul high value truck traffic is the natural market for the expressway system. The argument can as easily be made that it is the natural market for a high-quality domestic rail container operation offering scheduled, or at least predictable, services … Both arguments are somewhat sterile in that extreme congestion prevails in the HDCs of both modes … and neither can hope to provide more capacity or better quality services in the near future without major investments and/or major changes in operational policies".[3]

As in many other countries, the road sector has been benefiting from a particularly favorable treatment that allowed the sector to develop without carrying the burden of ancient obligations, outdated management structures and public service obligations that wage upon operational efficiency and financial stability. Also the Indian road sector has been subject to such favorable treatment, in particular when dealing with infrastructure developments. Road infrastructure was developed mostly without any obligations of the sector to repay the investments, e.g. via toll or other levy, while benefiting from the improvements. This contrary to the railway sector that has the burden of PSO obligated to offer low-cost non-profitable services or maintain loss-making lines operational.

However, this argument should not be brought forward without any consideration of the role of road infrastructure in India. The Indian government considers road infrastructure a key factor of social development, poverty reduction and connectivity to remote areas of the Country and this is reflected in the distribution of financial resources over the different types of roads rather on the basis of geographic arguments than functional arguments: "The aggregate length of roads has increased eightfold, but traffic has increased almost twentyfold. The length of national highways has increased only 1 percent a year, and the length of state highways has increased 1.8 percent a year. Investments in road development in India have emphasized secondary or local roads rather than arterial highways. Arterial highways receive 20 percent of total road expenditures, although the country's national highways carry 40 percent of India's road traffic. Expenditures on national highways also declined from 1.4 percent of the total plan during the 1950s to 0.6 percent today."[4]

6.2 ROAD INFRASTRUCTURE DEVELOPMENT

The road network transport has substantially grown in the last 50 years, from 400,000 km in 1951 to 3,300,000 by 2000. In that year, the length of the National Highways was 52,000 km; of the State Highways 1,280,000 km; of District Roads and other roads and village roads some 29,20,000 km and of Urban Roads 200,000 km.

According to the Tenth Five Year Plan, the total length of the National Highways equals 58,112 km and although they cover only 1.7% of the total network, they carry about 40% of road-based traffic. State Highways and Major District Roads are the secondary system with a total length of 1,24,300 km providing linkages with the National Highways and landmark destinations such as important towns, tourist destinations and minor ports. MDRs run within the district and provide interconnectivity between areas of production and markets and

[3] orld Bank: *India Transport Sector: Long Term Issues*; March 16, 1995; Infrastructure Operations Division, Country Department – India, South Asia Regional Office, p 7 par 14

[4] orld Bank: "India: Country Framework Report for Private Participation in Infrastructure", World Bank and Public-Private Infrastructure Advisory Facility; March 2000; p 33

connects rural areas to the district headquarters and to the State and National Highways. The secondary network carries some 40% of traffic and covers 12% of the total road network of India. Finally, the rural roads complete the network and by linking rural areas to the secondary and primary network are a key component of rural development and contribute significantly to productivity, economic growth and employment in remote areas, having therewith a significant impact on poverty reduction.

In relation to the planned development of the dedicated rail freight corridor, the National Highways are the most important competitors to the railway transport system. The other classes of roads are less important, although their relevance varies according to different parameters, such as whether they connect to major production or consumption areas; whether they connect to ports or other relevant transport infrastructure or whether they assure the connectivity of inland terminals and depots (this can also be a rural road)

The growth and improvement of the NH-network has been spectacular over the last 50 years, as demonstrated in Table 6.1.

Table 6.1 Development of the National Highway network in India (1950 – 2001)

Period	Total Length (km)	Widening to two lanes (km)	Widening to four lanes (km)	Strengthening of pavement (km)	Major Bridges (Nos)
1947-1969	24,000	14,000	Nil	Nil	169
1969-1990	33,612	16,000	267	9,000	302
1990-2001 (08/2001)	58,112	3,457	1,276	7,000	87
Total		33,457	1,543	16,000	558

Source: Tenth Five Year Plan, Chapter 8, Table 8.3.12

But in spite of these achievements, several stretches of the NH-network are under considerable pressure due to capacity constraints and many more investments are needed to prepare the network for future traffic, as demonstrated in Table 6.2.

Table 6.2 Capacity improvement needs for the NH-network

Category	Length to be covered	Amount required (Rs. Crore)
Widening from single lane to two lanes	22,522 km.	28,150.00
Improvement of two lane roads: a) Strengthening weak pavement b) Widening to 4 lanes/6 lanes	19,250 km. - 22,000 km	14,450.00 - 88,000.00
Construction of expressways	2,000 km	16,000.00
Construction of access controlled bypasses (average 20 km length of bypass @Rs. 7.5 crore per km.	60 Nos	9,000.00
Construction of bridges	210 Nos	425.00
Rehabilitation of bridges	425 Nos	320.00
Miscellaneous (Missing links, Road safety etc)	Lump-sum	8,000.00
Total :		**1,64,345.00 (Say Rs.1,65,000.00 crore)**

Source: Tenth Five Year Plan, Chapter 8, Table 8.3.13

As part of the NH-network development and improvement efforts, the National Highways Development Project (NHDP) is undoubtedly the most important initiative. The NHDP in is located in the Golden Quadrilateral consists of a 5,846 km long network that connects the four metropolitan cities of Delhi, Mumbai, Chennai and Kolkata, and a 7,300 km North-South and East-West corridor connecting respectively Srinagar-Kanyakumari and Silchar- Porbandar. The realization of the project was delegated to the National Highways Authority of India (NHAI) who will invest Rs.54,000 crore (US$ 12.317 billion at 1999 prices) to complete the project.

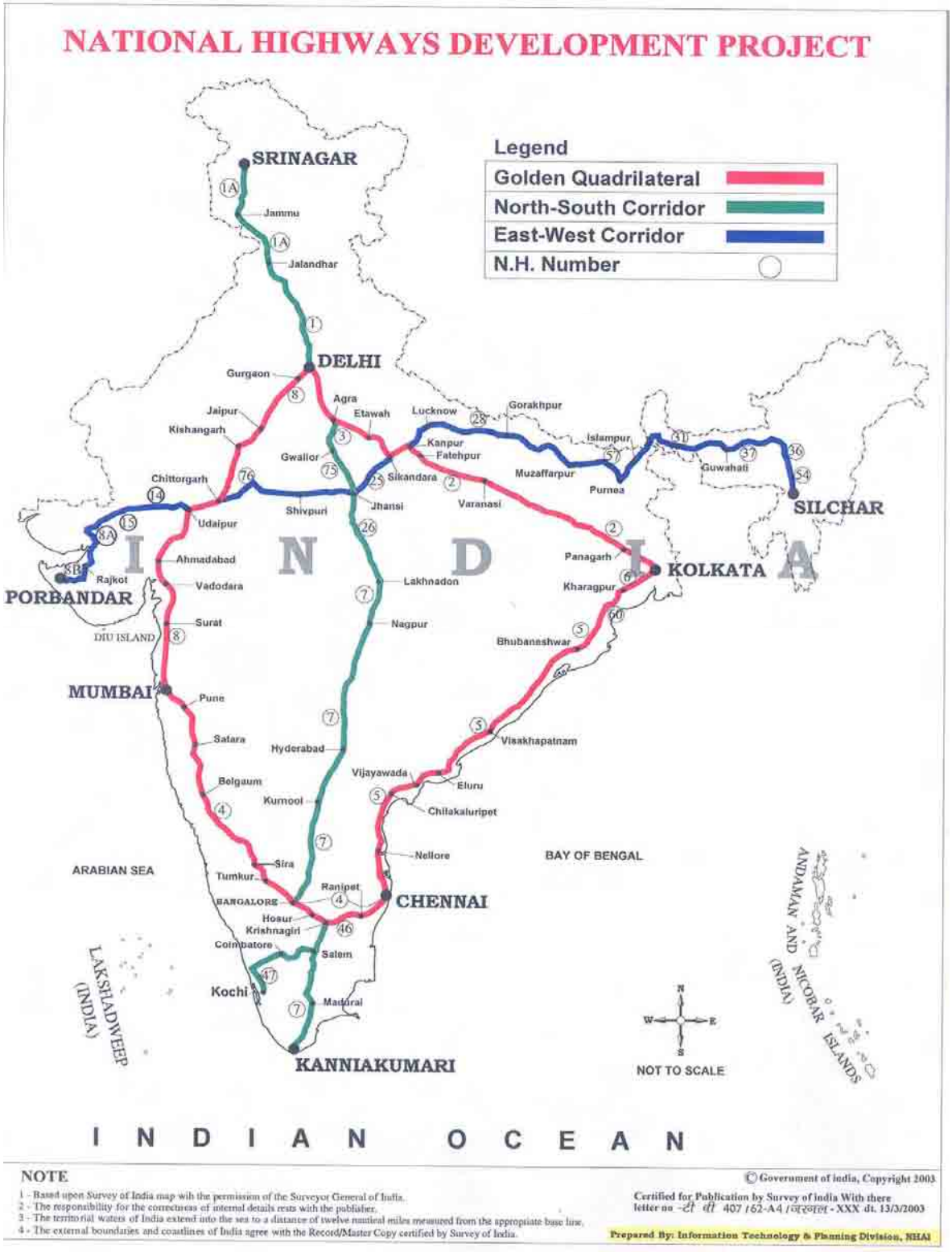
The present status of the development is presented in Table 6.3.

Table 6.3 Status of the NHDP as of 31st of July 2006 (contracting basis)

	GQ	**NS - EW Ph. I & II**	**NHDP Phase IIIA**	**NHDP Total**
Total Length (Km.)	5,846	7,300	4,015	17,161
Already 4-Laned (Km.)	5,415	836	30	6,281
Under Implementation (Km.)	431	5,057	1,090	6,578
Contracts Under Implementation (No.)	36	137	17	190
Balance length for award (Km.)	-	1,306	2,889	4,195

Source: NHAI

The National Highway Development Project network is visualized in next Figure 6.1.



Source: Information Technology and Planning Division, NHIA

Figure 6.1 National Highway Development Project

The Highway development in the Golden Quadrilateral is close to completion albeit behind the original December 2003 completion date. A closer look to the actual progress demonstrates that in spite all contracts have been awarded, physical completion of the works will require some additional time. In total, some 8% of total construction remains to be completed, in particular on the Delhi-Kolkata corridor where just over 80% of all works are completed, compared to over 92% on all other corridors, as can be seen in Table 6.4.

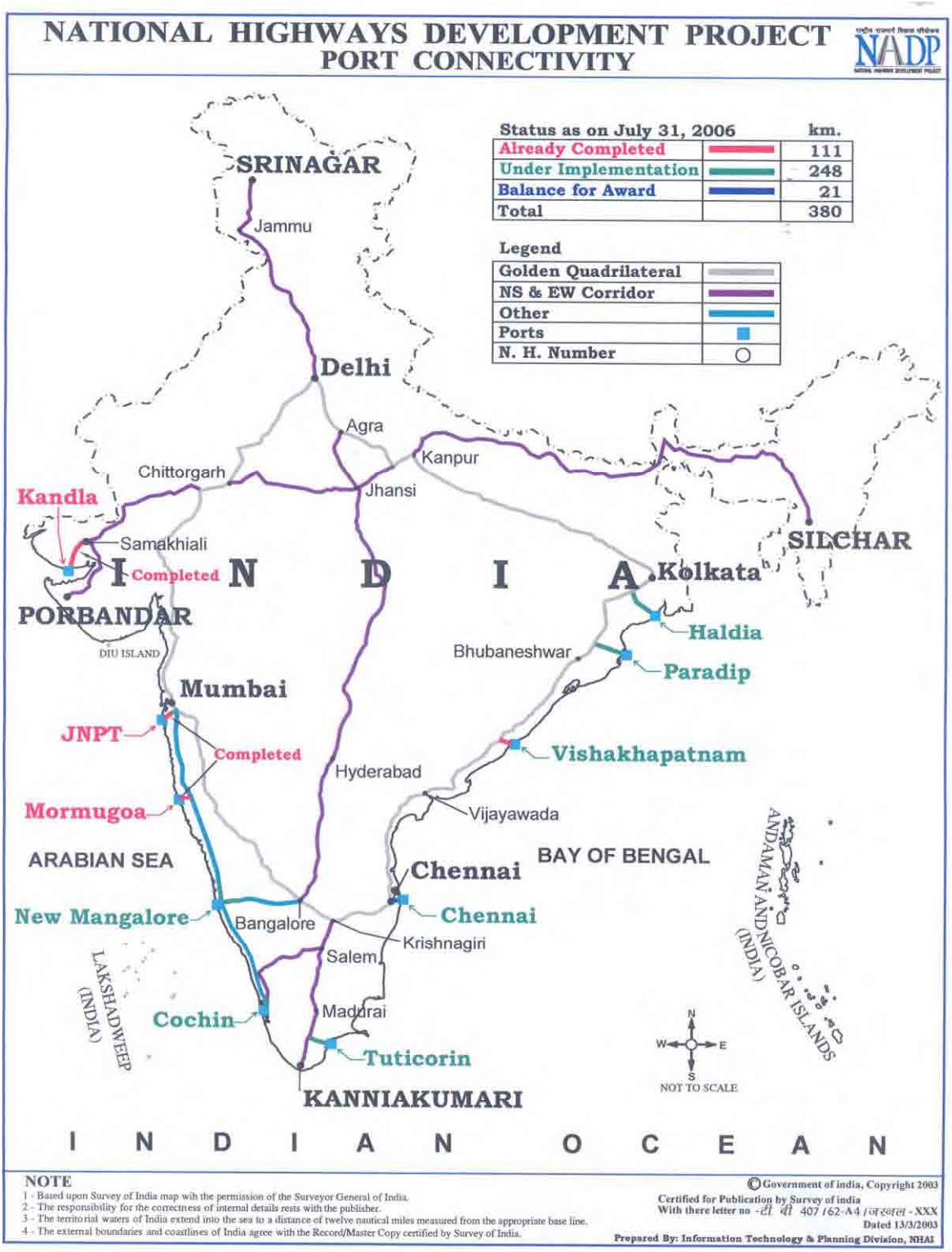
Table 6.4 Status of the GQ section of NHDP as of 31st of July 2006 (construction basis)

CORRIDOR AND ITS TOTAL LENGTH (in km)	Cumulative length completed in km (in %)		Cum % progress of contracts under implementation	
	By end of last month	By end of month under report	By end of last month	By end of month under report
DELHI-MUMBAI [1419 KM]	1419 (100%)	1419 (100%)	-	-
MUMBAI-CHENNAI [1290 KM]	1224 (94.88%)	1224 (94.88%)	76.47% (for 442 km)	77.36% (for 442 km)
KOLKATA- CHENNAI [1684 KM]	1551 (92.10%)	1551 (92.10%)	66.67% (for 365 km)	66.49% (for 365 km)
DELHI-KOLKATA [1453 KM]	1215 (83.62%)	1221 (84.03%)	67.22% (for 874 km)	68.25% (for 874 km)
TOTAL GQ [5846 KM]	5409 (92.5%)	5415 (92.6%)	69.63% (for 1681 km)	70.57% (for 1681 km)

Source: NHAI

There still remains over 1,300 km of network to be contracted for the NS and EW corridor highways, making it almost certain that the December 2007 deadline cannot be met and the physical completion will be delayed in the future. Given that considering that in July 2002, some 5,812 km still needed to be awarded and that 4 years later, still 1,300 km remains for contracting, it can be estimated that in an optimistic scenario, awarding of all contracts can be realized by the December 2007 deadline, but as for the situation in the Golden Quadrilateral, the awarding of contracts does not imply that the physical construction will be completed soon. In spite of these delays, the NHAI launched in 2005 part A of Phase III that consists of upgrading and conversion to 4 lanes of 10,000 km of selected high-density corridors of the NH-network at an estimated total cost of Rs. 55,000 crore (US$ 12.544 billion at 2005 prices).

As part of the NHDP, the port connectivity is a second important component that will contribute to more efficient cargo transport by road. The port connectivity projects as part of the NHDP are visualized in Figure 6.2.



Source: Information Technology and Planning Division, NHAI

Figure 6.2 National Highway Development Project – Port connectivity projects

At present, only 21 km remains to be awarded while approximately 1/3rd of the total 380 km port connection has been completed and upgraded to 4 lanes while 248 km or approximately 2/3rd is under construction, see Table 6.5.

Table 6.5 Port Connectivity projects program progress

Status	
Total Length (Km.)	380
Already 4-Laned (Km.)	111
Under Implementation (Km.)	248
Contracts Under Implementation (No.)	8
Balance length for award (Km.)	21

Source: NHAI

Contrary to the railway infrastructure network where the development of the QC freight corridor still needs to start, the highway network is close to completion. However, maximizing the potential benefits of the highway network for freight will not only be served by the improvement of port connectivity, but will also require a more efficient connectivity to the inland container depots (ICD) and other major cargo handling facilities. At present, much of the potential gains of the highway development program are lost due to poor end-line road connectivity at key interchange points. The Tughlakabad terminal in Delhi is a perfect example thereof.

Tughlakabad is one of 7 terminals operated by CONCOR in the Northern Region, together with the terminals in Moradabad, Kanpur, Agra, Gwalior, Panipat, and Ballabhgarh. The main international services from the region run in the form of high speed freight trains linking the major export and import centers of the region with the Gateway container terminals of Mumbai area located at JNPT, NSICT and MBPT. CONCOR also operates long distance services between Delhi-Chennai, Delhi-Bangalore Delhi-Kolkata and Delhi-Mumbai, combined comprising the main domestic traffic streams in the region.

The ICD at Tughlakabad was commissioned in 1993 and has become the flagship terminal of the company. With a theoretical handling capacity of almost 250,000 TEUs per annum and equipped with modern handling equipment and facilities such as gantry cranes, reach stackers, concrete block paving etc., the terminal presently handles over 450,000 TEU per year, see Figure 6.3.

Source: JICA Study Team

Figure 6.3 Tughlakabad ICD handling & shunting yard

But in spite of this exemplary track record and its modern and highly efficient terminal operations, services are hampered by difficult accessibility and very poor gateway conditions due to poor maintenance of rural roads as can be noted in Figure 6.4.

Source: JICA Study Team

Figure 6.4 Access road and gateway operations

But in spite "… many remaining impediments, mainly concerning the existing infrastructure, India has achieved a highly competitive, low-cost road freight transport industry for basic services, with highway freight rates among the lowest in the world … and indeed surprisingly low given the operating conditions in India."[5]

[5] World Bank; "India - Road Transport Service Efficiency Study"; Energy & Infrastructure Operations Division, South Asia Regional Office; November 1, 2005; Report nr Report No. 34220-IN; Chapter 1: The Trucking Industry, p. 7, par 1.

6.3 ROAD FREIGHT TRANSPORT SECTOR

In the mid-eighties, the road sector overtook the railway sector in the transport of goods and at present is responsible for over 70% of all goods transported. One of the reasons already stated above is the inefficiency of the railway sector to offer a modern and customer-oriented service. Another long standing problem is the inflated tariff structures of rail freight transport, until recently used to cross-subsidize the PSO obligation of IR. But one important reason is also that the services offered by the Indian road freight transport sector are one of the cheapest in the world, as demonstrated in Table 6.6.

Table 6.6 Cost profile of Indian road freight transport sector

Country	Average cost per ton km (US$)
Pakistan	0.015 – 0.021
India	0.019 – 0.027
Brazil	0.025 – 0.048
United States	0.025 – 0.050
Central Asian republics	0.035 – 0.085
Australia	0.036
China	0.040 – 0.060

Source: World Bank; "India - Road Transport Service Efficiency Study"; table 1.1., taken from Clell Harral, Ian Jenkins, John Teny, Richard Sharp, The Efficiency of Road Transport in India: The Trucking Industry, WB Background Paper, 2003.

Contrary to the railway sector, government involvement in the road transport sector is limited since the Motor Vehicle Act of 1988 by which the regulations were harmonized across the States and the liberalization of the sector was initiated.

The trucking sector of India is at present highly fragmentized and almost entirely operated by the private sector. More than 75% of the truck operators have less than 5 trucks and only 6% of the transport companies have 20 trucks or more. Even large transport companies resort to hiring of trucks from the small truck operators[6]. Several large State Road Transport Undertakings had a combined fleet had a fleet of 1,16,000 vehicles on the 31st of March 1999, but their continued and growing financial losses[7] will gradually make more and more private operators enter the market and the States may downscale or abandon their activities in the future[8]. In 2002, the Tenth Five Year Plan gave substantially different impression of the role of SRTUs: "The State Road Transport Undertakings (SRTUs) of Jammu and Kashmir, Manipur, Mizoram, Sikkim and Tripura provide freight services in a limited way with the small number of trucks they own.…"[9]

The road transport sector includes three major players:

- *Transporters:* are trucking companies which solicit freight, largely on an annual price quote basis, bill, collect, and carry the accounts receivable, are responsible for cargo loss and damage claims and other customer service functions. Some of the

6 Vision 2020 – Transport, p 15
7 Vision 2020 – Transport, Annex 5
8 Vision 2020 – Transport, p 15
9 Tenth Five Year Plan, Chapter 8 – Transport, p 960, par 8.3.109

larger companies like the Transport Corporation of India (TCI) own a fleet of trucks and often operate warehouses and terminals.

- *Truck Operators* are owner-operators typically owning one or a very small fleet of trucks, which usually are financed by high-leverage debt. They usually drive the main truck and the other drivers are family members or are personally known to the owner. These people virtually live in the truck and are paid either an agreed percent of the revenue or a flat amount.

- *Brokers, Agents* have the relations with the truck operators and provide those operators to the transporters. They play a necessary role in India because they act as a quality control on the reliability of the truck operator and a means of facilitating prompt loading by the operators.

The road transport sector is structured around the truck operators and even the large companies use these small truck operators for their intercity transportation. The role of the brokers and agents is important in this perspective. With limited means of assessing a truck operator's performance, transporters, who are responsible for cargo loss and damage, assess the reliability of truck operators via the brokers or agents. The latter also seek out loads and back-loads to minimize the impact of the current surplus of truck in the Indian freight market. "All three groups are working in a market-determined revenue sharing cooperation. This is the way the deregulated Indian freight market has organized itself. Given the very low freight rates, one has to conclude it is an effective industry structure."[10]

Freight transport rates are published daily and are market driven. On average, the published rates represent the upper level of actual rates as they depend upon negotiations between transporter and shipper / broker, but in the high agricultural season, these rates could rise up to 50% above average. Table 6.7 provides an example of the year 2003 rates, and remarkable is the difference between the truck km rate and the ton km rate, a difference due to frequent overloading of trucks.

Table 6.7 Average freight rates for key destinations (year 2002 for 9 ton truck)

From	To	Freight Rate (Rs./truck)	Distance Km	Freight Rate (Rs./truck km)	Freight Rate (Rs./ton km)
Delhi	Mumbai	12,000-12,600	1,408	8.74	0.97
Delhi/	Kolkata	14,400-15,000	1,474	9.97	1.11
Mumbai	Delhi	14,000-15,000	1,408	10.30	1.14
Mumbai	Kolkata	22,000-23,500	1,987	11.45	1.27
Mumbai	Chennai	14,500	1,367	10.61	1.18
Chennai	Delhi	25,020	2,095	11.94	1.33
Average				10.50	1.17

Source: World Bank; "India - Road Transport Service Efficiency Study"; Table 1.2;

The low cost of freight road transport on average generates a low profit margin for both transporters and truck operators, with many bankruptcies as a direct consequence and an on-average poor service quality as indirect effect. One of the reasons why the trucking business is so successful at present is due to the still large volume of low-value bulk commodities transported in which they can compete with the railway sector on the basis of

[10] World Bank; "India - Road Transport Service Efficiency Study"; 2005; Chapter 1: The Trucking Industry, p. 9, par 1.10.

prices. But in terms of high-value cargo or time-sensitive container traffic, the service levels of the road sector are far below minimum standards, offering opportunities for the railway sector to recapture lost markets.

An advantage that is frequently invoked to explain the preference for road transport over railway transport is transit times. An average trip between Delhi and Mumbai (1,408 km) would take 3 days and from Delhi to Bangalore (2,019 km) between 4 and 5 days[11]. Also here, the road sector scores poorly, mainly due to the many road checkpoints. Consequently, a average truck in India runs between 60,000 km and 100,000 km per year, needing 2 drivers and one helper, this compared to a 2 driver truck in the US that would run 400,000 km per year.[12]

The structure of the road transport sector and its efficiency is also defined by its vehicle fleet. Truck drivers use predominantly 2- and 3-axle rigid trucks with open top freight box with low cubic capacity that reflects the market of predominantly heavy, often unpackaged commodities that need to be transported. These trucks are old and of low-tech design with limited horsepower. Their share in the Highway freight transport market reaches 75% of all trucks, as demonstrated in Table 6.8.

Table 6.8 Vehicle Fleet for Highway road freight transport market

Vehicle Type	PCU	% vehicles	Average daily traffic (vehicles)		Average daily traffic (PCU)		Proportion trucks
Motor Bike	0.5	15%	2,100	(15%)	1,050	(4%)	
Car (New)	1	20%	2,800	(20%)	2,800	(11%)	
Car (Old)	1	10%	1,400		1,400	(5%)	
Bus	**2.5**	**8%**	**1,120**	**(8%)**	**2,800**	**(11%)**	
Truck (Light)	**2**	**5%**	**700**	**(5%)**	**1,400**	**(5%)**	**13%**
Truck (2 axle)	**3**	**30%**	**4,200**	**(30%)**	**12,600**	**(48%)**	**75%**
Truck	**3.5**	**4%**	**490**	**(3.5%)**	**1,715**	**(6.5%)**	**9%**
Truck (multi axle)	**4**	**2%**	**210**	**(1.5%)**	**840**	**(3.2%)**	**4%**
Total motorized		*93%*	*13,020*	*(93%)*	*24,605*	*(94%)*	
Bicycles	0.5	5%	700	(5%)	350	(1.3%)	
Others	4.5	2%	280	(2%)	1,260	(4.8%)	
Total non-motorized		7%	980	(7%)	1,610	(6%)	
Total all vehicles		100%		14,000		26,215	

Source: World Bank; "India - Road Transport Service Efficiency Study"; Table 1.5

Reviewing the above opinion of the World Bank, it looks as if the Bank considers the Indian road sector of low cost but highly ineffective, outdated and not adapted to the needs of modern high-value and containerized transport, a growing market segment also in India.

The World Bank's opinion is a reflection of the opinion of the Indian Government that has also been reiterated in many Five Year Plans although in a more moderate form.

[11] World Bank; "India - Road Transport Service Efficiency Study"; p 13
[12] World Bank; "India - Road Transport Service Efficiency Study"; p 17

In the Tenth Five Year Plan, the government confirmed most of above identified deficiencies of the road sector and proposed concrete measures to encourage higher capacity and better technology vehicles so that development of road freight transport operations could grow in line with the development of high quality roads. The Plan also plans to encourage the use of low tare weight multi-axle commercial goods vehicles to reduce road damage and most of all the Plan recommends to rationalize the motor vehicle tax regime across States. The Tenth Five Year Plan argues that in "… the road transport freight segment, it is necessary for State Governments to take action for enabling the creation of cooperatives of small truck operators. These cooperatives could link up with large undertakings to reduce their cost and improve fleet utilisation."[13] In other words, the Indian Government identified, prior to the year 2005 World Bank Report, the need for sector rationalization and corporate enlargement in order to increase the investment capacity for modern and more efficient equipment and technologies.

6.4 CONTRIBUTING TO RAILWAY DEVELOPMENT

The size of India, both geographically and population wise, is a benefit for economic growth as it offers many opportunities for industrial production and human expertise. But at the same time its size is an impediment because vast amounts of financial resources are required to develop and update its (transport) infrastructure to meet the demand that is generated by that same economic growth.

The detailed review of the framework conditions, albeit limited to the railway and road freight transport sector, made clear that at present the transport sector as a whole is behind the economic growth of India and its infrastructure as well as its service levels are incapable of meeting present and future demand,

In terms of infrastructure, the development process is ongoing at various levels. In particular within the Golden Quadrilateral and in the main ports of the Country, modern road infrastructure is close to completion.

But the focus in infrastructure development is on major network structures and smaller road connections are often forgotten although it are these segments that in many cases guarantee intermodal connectivity. These critical final segments of the transport chain are mostly State or rural roads which are not part of National development programs and therefore remain inadequate to provide the necessary capacity. As weak link in the transport chain, these small roads become therewith important impediments to the realization of truly efficient transport infrastructure. If the positive development of the road sector is to be maintained in the long term future, this issue will have to be addressed and structures introduced that guarantee maintenance and capacity of these roads.

In terms of sector reorganization, progress is much slower, success less evident and solutions more complicated. The road sector will soon have the a modern road network infrastructure of 4 lane highways but will still lack modern equipments and up-to-date expertise to use this valuable tool efficiently. If no drastic measures are taken, the sector will remain dominated by many independent truckers that are illiterate, have low professional skills and know-how. The will continue to use outdated, badly maintained and low-capacity vehicles, imply poor corporate management or have no management at all.

[13] Tenth Five Year Plan, Chapter 8 – Transport, p 963, par 8.3.122

Existing overcapacity and subsequent low prices, combined with the slow progress in the transport of containerized high-value goods are at present favoring road transport. But with the further expansion of the Indian economy, the transport characteristics will irrefutably align with the rest of the world and without comprehensive sector reforms and innovation, the road sector will lose out of many opportunities which might be captured by the railway sector.

Expertise and efficiency development is much higher for the railway sector. In spite its negative legacy, the Indian Railways are in the forefront of innovation, far ahead of the road sector. Information technology and increasingly modern equipment is introduced in railway operations to facilitate cargo and document handling procedures and to increase the speed of cargo and passenger throughput in stations, depots terminals etc.

And although lagging behind, is at the verge of developing dedicated freight corridors that will allow more rapid and efficient transport of cargo between production centers and gateways. If the time to develop the necessary infrastructure is wisely used to update and rationalize railway tariff structures and the operating cost structures, and at present it is done so, the railways could once again become the backbone of (cargo) transport in modern India.

At present, immense efforts are made and resources allocated to create the adequate transport infrastructure. But updating the transport infrastructure is not sufficient to provide India with an efficient freight cargo transport sector. At least as important as infrastructure creation is the swift realization of more comprehensive sector reforms that transform both the railway sector and the road sector into twenty first century sectors that are capable to efficiently and effectively meet the demand of a constantly and frequently changing global economy in which India will become one of the major players.

The present situation of the Indian transport sector and its expected evolution towards a modern and efficiently integrated transport system calls for an intermodal approach with initiatives that maximize the benefits of each sector and eliminate the hindrances so that the system as a whole is capable to offer a modern and cost-efficient transport service that is a strong support to further sustainable economic growth of India.

CHAPTER 7 TRANSPORT SUPPLY – THE PORT AND INLAND CONTAINER DEPOT

7.1 PORT

7.1.1 Introduction

1) Major Ports in India

India lies on an important and historical East-West trade route which links the Far-East and Europe and it has a coastline of about 5,600km. Such geographic advantages have contributed to the historical development of India's international seaborne trades. At present there are 12 major ports (see Table 7.1) and 185 minor and intermediate ports that are supporting the East-West trade as well as local coastal transport.

The 11 major ports, except Gujarat Pipavav Port Trust, were established under the Union List of the Indian Constitution as statutory bodies (Trusts) administered by the Government of India under Indian Port Act, 1908 and the Major Port Trust Act, 1963. Whilst the Pipavav Port is managed and operated by a private firm.

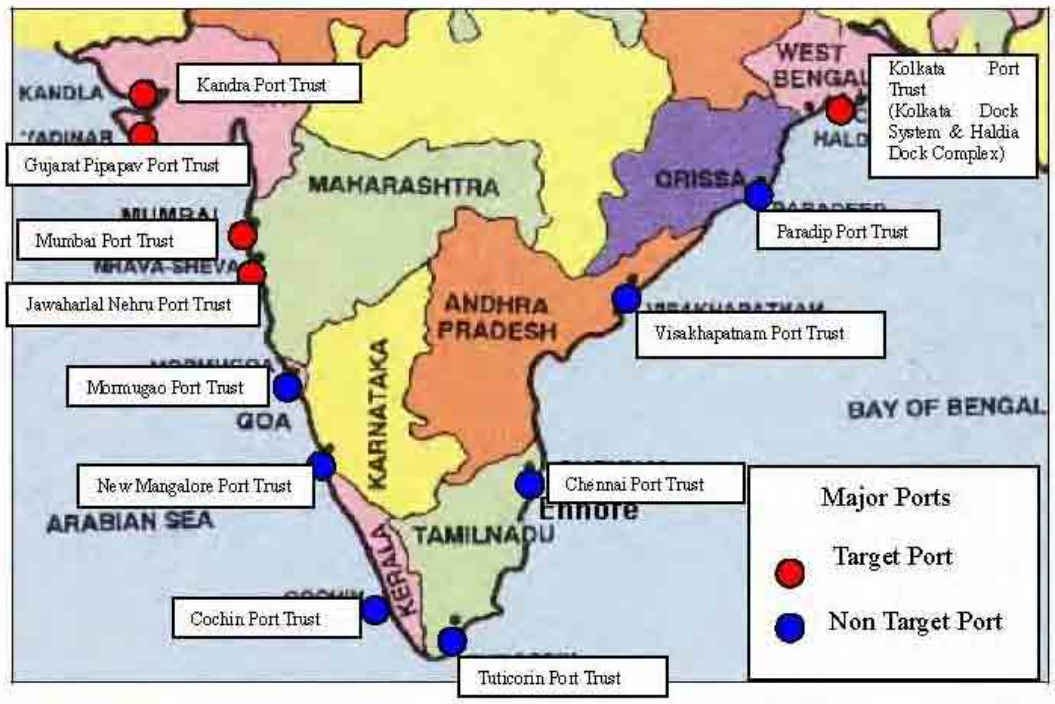
The Indian Port Act (1908) lays down rules regarding safety of shipping and conservation of ports and regulates matters pertaining to the administration of port duties, pilot age and other charges.

The Major Port Trust Act (1963) lays down the institutional framework for the 12 major ports in India. Accordingly, a Broad of Trustees governs each major port that was established in 1992 in tie-up with Port of Singapore of Authority.

Table 7.1 12 Major Ports in India

No	Name of Trust	Location	No	Name of Trust	Location
1	Munbai Port Trust	Mumbai	7	Mormugao Port Trust	Mormugao
2	Kolkata Port Trust (Haldia Dock Complex)	Kolkata (Haldian Midnapore)	8	New Mangalore Port Trust	Mangalore
3	Chennai Port Trust	Chennai	9	Paradip Port Trust	Orissa
4	Cochin Port Trust	Cochin	10	Tuticorin Port Trust	Tuticorin
5	Jawaharlal Nehr Port Trust (JNPT)	Navi Mumbai	11	Visakhapatnam Port Trust	Andhra Pradesh
6	Kandla Port Trust	Kutch, Gujarat	12	Gujarat Pipavav Port Trust	Gujatrat

Source: Ministry of Road Transport, Highways, Shipping



Source: Ministry of Road Transport, Highways, Shipping

Figure 7.1 Location of Major Ports

2) Relevant Major Ports for DFC Study

The largest port, JNPT, is located in Maharashtra state (see Figure 7.1). In addition to the ports in Maharashtra, there are several important ports for DFC, namely, those in Gujarat and West Bengal states that include the Western and Eastern terminals of DFC respectively.

A. Ports in Gujarat State

a) Overview

Gujarat is the most important state amongst 9 coastal states of India. Gujarat has 1600kms long coastline, which is about 1/3rd of total Indian coastline, and have a 43 ports.The state has already framed one of the earliest port policies in the country, which put more focus on development of new port facilities through private investment participation with synchronization of small and large investor in port sector.

The port sector in Gujarat has been identified as one of the prime catalysis to accelerate and enhance the industrialization process of the state. In view if this, in 1995, Gujarat set a precedent by formulation the policy, which explicitly expressed the state's intension to opt for gradual privatization of port &port services. The objection of the policy is to achieve highest standards in port infrastructure & services, attain higher traffic at the ports and thereby enhance industrialization process in the state. The policy holds pivotal position in the state's industrial development attributable to the development of port sector.

The continuous rise in traffic at the ports of Gujarat signifies that GMB has successfully conceived and assimilated the vision of port sector set by the state. During the last financial year, GMB handled a record cargo of 82.54million tones, registering an impressive growth of about 13 per cent over the previous year. It is pertinent to note that the tonnage of the preceding three

consecutive year represented the highest traffic, the total handling capacity in the state including the planned capacities is likely to be around 313 million tones/year (including Kandla & Vadinar) by the year 2015.

b) Current Status and Future development of the ports in Gujarat

There are six ports that are connected to the feeder railway lines of Western Railway in Gujarat as follows;

1) Gujarat Pipavav Port Trust (major port);

2) Kandla Port Trust (major port);

3) Mumdla Port;

4) Navlakhi Port;

5) Rosy/Bedi Port; and

6) Dahej Port

Old ports like Navlahhi, Bhavnagar, Porbandar, Bedi/Rozi, Veraval, Okha etc. are planned to be up graded in new scenario for customization, described as follows:

Navlakhi Port : For the up gradation and modernization, scheme of Rs. 60 crores planned and phased wise works related to infrastructure facilities are under progress.

Bhavnagar Port : The process for revival of Bhavnagar port is under progress. Renovation of existing jetty and lock gate is planned for an estimated amount of Rs. 5 crores.

Probandar Port : 200m long landing placed estimated amounting to Rs. 36 crores planned at south side of existing jetty under co-financing of GMB and Indian Navy.

Bedi/Rozi Port : Development of Bedi port for direct berthing is planned under centrally sponsored scheme for minor port under 'National Maritime development Programme' Central government in ministry of shipping for an estimated amount of Rs. 911.38 crores.

Okha Port : A separate landing facilities for containers.

Road & Rail linkages; Providing infrastructure in terms of road and rail linkage assumes utmost importance in strategic planning of ports. Gujarat Ports viz. Pipavav, Mundra, Navlakhi, Bhavnagar and Okha are connected with B.G. network, which has contributed greatly in increasing throughput at these ports. GMB have already initiated linking of ports like Hazira, Dahej through private participation under SPV model, with an GMB equity share of Rs. 17.30 creres also Porbandar and Bedi B.G. rail project planned with GMB own funds amounting to Rs. 40 crores.

Road connecting to main ports are planned to be upgraded in phased manner. By-pass road leading to Bedi Port joining Khambalia highway planned to be constructed with an estimated amount of Rs. 9.77 crores. Approach road leading to Magdalla Port Planned to be up graded with tender amount of Rs. 2 crores.

Table 7.2 Ports in Gujarat

Major Ports	Minor Ports	Intermediate Port	Proposed Ports
1 Kandla Port	2 Dahej Port	6 Mandvi Port	14 Positra Port
	3 Surat Port	7 Okha Port	15 Salaya Port
	4 Maroli Port	8 Porbander Port	16 Jodiya Port
	5 Veraval Port	9 Sikka Port	17 Simar Port
		10 Naviakhi Port	18 Mithvirdi Port
		11 Bhavnagar Port	19 Vadodra Port
		12 Pipavav Port	20 Hazira Port
		13 Magadalla Port	21 Borsi Port

Figure 7.2 Location of Gujarat Ports

B. Ports of West Bengal State

a) General Overview

West Bengal's export amounted to Rs. 18,719.65 crores during 2003-04. During the same period, Indian export were valued at Rs293, 366.75 crores. Thus, the state's share in all India exports was 6.38 per cent, a marginal improvement over the share of 5.18 per cent during 2002-03.

The most important destination for West Bengal exports is Bangladesh where 30 per cent of the state's export is headed. The USA is the second important export destination with 9 per cent of West Bengal exports. China, Germany and UAE each receive about 4 per cent of West Bengal's exports, while 3 per cent of the state's exports are to the UK. Kolkata Port has been identified for the study in connection with the Eastern Railways

b) Ports facilities in West Bengal

The Port of Kolkata companies two major operational domains, viz., Kolkata Dock System (KDS) and Haldia Dock Complex (HDC).

The depth of the river Hooghly exacerbates the problem. The deteriorating depth for kolkata promoted the selection of Haldia Docks as auxiliary deep-water port. KoPT has to undertake extensive dredging to maintain navigability of its approach channel.

Table 7.3 Brief Overview of Port Facilities in West Bengal

Port Name	Administrated body	Handling Cargo Type	Facilities	Cargo Handling Capacity	Future Plan (privatization)	Remarks (Problem, effect)
Kolkata (KDS)	Kolkata Port Trust	Liquid Cargo Dry Bulk Cargo Container	Draft: 7m 28 berths 8 buoys/mooring 5 dry dock 6 petroleum wharves	8.7 mln tons in 2003-04	-Liquid cargo handling jetties -Commercal berth operation by BOT scheme -Other private initiative	-Congestion -Outdate Equipment -Labor Issue -Cost for dredging and Deep Draft Vessel
Haldia (HDC)	Kolkata Port Trust	Liquid Cargo Dry Bulk Cargo Container	Draft: 8.5m 12 berths 3 oil jetties in the river 3 barge jetties in the river	32.4 mln tons in 2003-04	-Private terminal Operator -Berth construction by BOT scheme -Other private initiative	
Saugor port	Kolkata Port Trust (Planed)	Dry Bulk Cargo Container	Draft: 10m -> 12.5m	Coal: 2 mln tons at 2012 Container: 22.5 mln tons at 2112 (sourced from JICA report)		Multiple effect for KDS and HDC

Source: Confederation of Indian Industry (2005), JICA report (Mar, 2005)
Note: '3' in table is under planning project.

Table 7.4 Improvement project of existing ports in West Bengal

Location	On Going Projects	Proposed Projects
Kolkata Dock System	- Moderation/replacement of Port Craft (Estimated Cost - Rs 90.00 crores) - Replacement/refurbishment/Acquisition of Various Cargo handling equipment (Estimated Cost - Rs 25.00 crore)	
Haldia Dock Complex	- Procurement of Ship Shore Gantry for container Handling (Estimated Cost - Rs 57.00 crores) - Replacement of Ship Shore Gantry for container Handling. - Development of road infrastructure including drainage inside & outside the Dock (Estimated Cost - Rs 30.00 crores) - Improvement of backup area with railway connectivity in and outside dock at HDC.(Estimated Cost - Rs 25.00 crores) - Procurement of 4 RTGs Cranes along with Yard Development (Estimated Cost - Rs 36.24 crores) - River Reguulatory works for bank protection near Sondhia column (Estimated Cost - Rs 13.00 crores)	- Development of 2nd Dock Arm (1st phase) (Estimated Cost - Rs. 95.00 crores). - Construction of Berth No.2 south of Berth No.3 (Estimated Cost - Rs. 25.00 crore).

Source: Indian Port Association H.P. (http://www.ipa.nic.in/deve.htm)

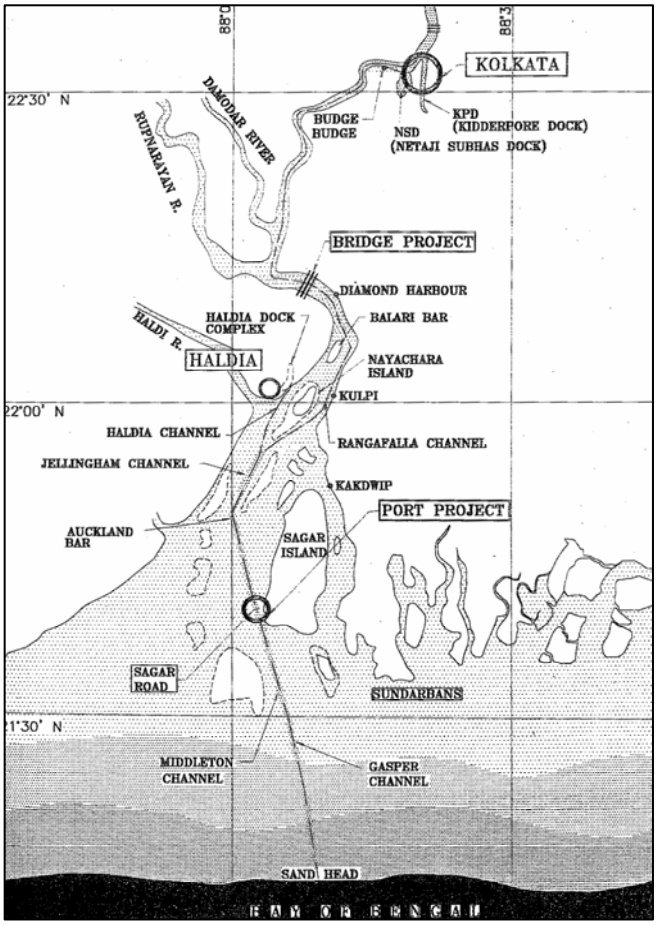


Figure 7.3 Location Map of Target Ports in Western Region

3) Share of cargo handling volume in major ports

The cargo handling volume from 1990 to 2004 at the major ports and container traffic of Indian ports are shown in Table 7.5 and Table 7.6. The top three ports are Visakhapatnam, Kandla and Chennai with a cargo handling volume of 47.74, 41.52 and 36.71 million tons respectively. Their combined cargo shipments in 2003-04 made up 36.4% of total for of all major ports in India. In the meantime, the share of cargo handling volume in 2003-04 through the Study Ports (Kolkata, Haldia, Mumbai, J.N.P.T. and Kandla) was 2.5%, 9.4%, 8.7%, 9.0% and 12.0% respectively, comprising 41.6% of the total shipment in India. These fasts underscore the importance of railway linkage to the Study Ports

The share of container throughput of J.N.P.T accounted for the grater portion of whole container throughput of Indian Ports and has reached 58.2% in 2003/04. The share of the other target ports has reached less than 5.1% respectively.

Table 7.5 Cargo handling Volume at Major Ports in India (Unit: million tons)

	Name of Port	1990-91	1995-96	2000-01	2001-02	2002-03	2003-04	%
1	Koikata	4,126	6,124	7,158	5,374	7,201	8,693	2.5%
	Haldia	11,114	15,391	22,842	25,029	28,603	32,567	9.4%
2	Paradip	6,844	11,259	19,901	21,131	23,901	25,311	7.3%
3	Visakhapatnam	19,421	32,817	44,685	44,344	46,006	47,736	13.8%
4	Ennore	-	-	-	3,401	8,485	9,277	2.7%
5	Chennai	24,518	31,720	41,220	36,115	33,687	36,710	10.6%
6	Tuticorin	5,075	9,286	12,284	13,017	13,294	13,678	4.0%
7	Cochin	7,275	11,503	13,117	12,057	13,024	13,572	3.9%
8	New Mangalore	8,033	8,884	17,891	17,501	21,430	26,273	7.6%
9	Mormugao	14,911	18,095	19,628	22,928	23,649	27,874	8.1%
10	Mumbai	29,786	34,048	27,063	26,433	26,796	29,995	8.7%
11	J.N.Port	2,027	6,873	18,575	22,521	26,844	31,190	9.0%
12	Kandla	19,685	30,338	36,741	37,728	40,633	41,523	12.0%
Total		152,855	215,338	281,105	287,579	313,553	344,799	100%
Growth (%)		-	-	-	2.30	9.03	9.96	-

Source: Indian Ports Association

Table 7.6 Container Throughput of India Ports (Unit: thousand TEU)

	1990-91	1995-96	2000-01	2001-02	2002-03	2003-04	%
Koikata	49	121	138	98	106	123	3.2%
Haldia	22	4	51	93	117	137	3.5%
Visakhapatnam	8	8	20	22	22	20	0.5%
Chennai	109	227	362	344	425	539	13.8%
Tuticorin	20	69	157	214	213	254	6.5%
Cochin	49	96	143	152	166	170	4.4%
Mumbai	324	518	321	254	213	197	5.1%
J.N.Port	55	339	1,189	1,573	1,930	2,269	58.2%
Kandla	43	65	91	126	157	170	4.4%
Others	2	2	6	10	17	21	0.5%
Total	681	1,449	2,468	2,886	3,366	3,900	100.0%

Source: Indian Ports Association

The above tables indicate the remarkable of cargo volume and container throughput since 2002. The annual growth rate was about 10% in 2003/04. More than 50% of container throughput of India is handled by J.N.P.T since 2001. The container throughput through the major ports has been showing an upward trend to date, while the container throughput at

Mumbai port has declined since 1995 due in part to container throughput being shifted from Mumbai to J.N.P.T. The share of container throughput of minor ports is limited to 0.5% of whole throughput in India.

7.1.2 Cargo Handling Capacity

a. Mumbai Port

Two berths with total length of 476m (with berth depth of 9.9m) are available for container handling at Ballard Pier (BPS). There are 2 gantry cranes with 15m spans that ware installed between 1989 and 1990. They have a cargo handling capacity of 16 units per hour. One of these berths is equipped with two container quay cranes and has a container yard. The other berth is a passenger berth. The capacity of BPS is estimated at 200,000TEU per year.

b. Jawaharalal Nehru Port

J.N.P.T consists of 3 container terminals: NSICT, JNPCT and Gateway Terminal. NSCIT and JNPCT have 6 gantry cranes each with capacity of 24-25 unit/hour respectively. Gateway Terminal has 8 gantry cranes with a capacity of 32 unit/hour when all three of them are operational. The annual cargo handling capacity at each container terminal is 3.6 million TEU, which consists of 1.1million TEU for NSICT, 1.2million TEU for JNPCT, and 1.3million TEU for Gateway Terminal.

Table 7.7 Container Throughput per Terminal Operator in Jawaharalal Nehru Port

Name of Berth	NSICT	JNPCT	Gateway Terminal	Total
Container	13.2mil. Tons (1.1mil. TEU)	14.4mil. Tons (1.2mil. TEU)	15.6mil. Tons (1.3mil. TEU)	43.2mil. Tones (3.6mil. TEU)
Liquid Cargo	5.5mil. Tons	-	-	5.5mil. Tons
Dry Bulk Cargo	0.25mil. Tons	-	-	0.25mil. Tons
Total	18.95mil. Tons (1.1mil. TEU)	14.4mil. Tons (1.2mil. TEU)	15.6mil. Tons (1.3mil. TEU)	48.95mil. Tons (3.6mil. TEU)

Source: JN Port Trust

c. Kolkata Dock System

Kolkata Dock System has container terminals at berths No.7 and 8 and has an extended 50,000m2 container stacking yard and a 9,000m2 container freight station. The container-stacking yard has 1,284 ground slots with a permissible stack height of 4 containers. A new stacking yard using reach stacker equipment providing about 350 *20m additional ground slots has been put into operation. The capacity of KDS is estimated 150,000TEU annually.

d. Haldia Dock System

At Haldia Dock System there are 12 berths: 9berths for dry bulk, break bulk and liquid bulk, and 3 berths for container. Annual cargo handling capacity is estimated at 37.5million tons, which includes 3 oil jetties. The container terminal has 2 gantry cranes with a capacity of 30TEU/hour and 5 transfer cranes with 16m of span capable of providing a permissible stack height of 5 containers. The container-stacking yard has 4,500 ground slots. There are 6 reach stackers and top lifter operated at stacking yard.

Table 7.8 Handling Capacity in Haldia Dock System

Name of Berth	Annual Cargo handling capacity (mil. Ton)	Name of Berth	Annual Cargo handling capacity (mil. Ton)
Haldia Oil Jetty No.1	2.20	Berth No.6	1.15
Haldia Oil Jetty No.2	6.00	Berth No.7	1.15
Haldia Oil Jetty No.3	9.50	Berth No.8	1.80
Berth No.3	2.25	Berth No.9	1.00
Berth No.4	3.25	Berth No.10	1.00
Berth No.4A	3.00	Berth No.11	1.00
Berth No.4B	2.00	Berth No.12	1.00
Berth No.3	1.20	Total	37.5

Source: Haldia Dock (Redefining Opportunities)

e. Gujarat Pipavav Port

Gujarat Pipavav Port has handed more than 10.5million tons of cargo until 2005. The port has started a plan to create a world-class container terminal and further enhanced the bulk cargo handling facilities at the port. The plan provides the basis for creating a container terminal with capacity to handle 1million TEU and handle 5million tons of bulk cargo annually.

f. Kandla Port

Kandla port has plans for the development of the port facilities for a period spanning from 2004 to 2014 under the National Waterland Development Program (NWDP), which is expected to increase the capacity of cargo handling volume up to 90million tons by 2014, compared to the 41.54million during 2004-05.

g. Mundla Port

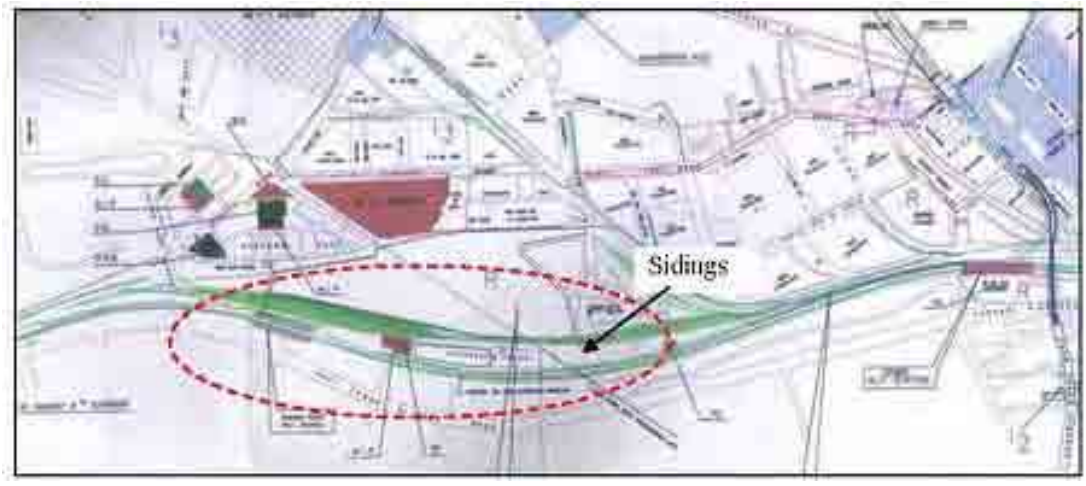
The container terminal here consists of 2container berths capable of handling 1.2million TEU per year. It is strategically located near India's largest cargo generating regions and is able to handle the deepest container vessels of the world.

7.1.3 INTERMODAL OPERATION

(1) Mumbai Port

1) Port Railway

Many sidings of port railway run inshore of the main berth facilities of Mumbai port, including India Dock, Prince's Dock, Victria Dock and Ballard Pier. The trains running at the rail-sidings are marshaled at the Wadala sidings. The alignments of the railway siding are shown in Figure 7.4.



Source: Feasibility Report for Offshore Container Terminal, Road Development Plan (April 2005)

Figure 7.4 Location Map of sidings of Port Railways

2) Cargo Train Operation

The average number of train from the port has been decreased to 4 trains per day at the present time, compared to 6train per day in 1998. The number of trains from the port to Delhi is about one every 2 months. The train is composed of 45 wagons for container cargo, 40 wagons for open wagon for general cargo and 58 wagons for coal.

3) Coal Transport

There are some thermal power stations about 200km from the port. These are located at Nsik Rd, Parabhani Akola Jn, and Chandapor. Train mostly transports coal with the expectation of Chandrapor where some coalmines are located near the power station of Chandapor. The share of transportation from the coalmines to Chandapor is 60% by train and 40% by road.

4) Overhead Electric (OHE) System

The port has its own rail system from the dock to Wadala, the interchange point for Central Railway. The port rail system runs close to the three docks: Prince, Victoria and Indira. At Wadala, the port has developed a marshaling yard where the port's rail-bone cargo is interchanged with trunk railways. Central Railways allows 6 movements of rakes at Wadala towards Mumbai in the north. These freight trains are operated during off-peak hours so as not to affect the city traffic.

Source: Techno Economic Viability of the JICA Master Plan for Munbai (April 2001)

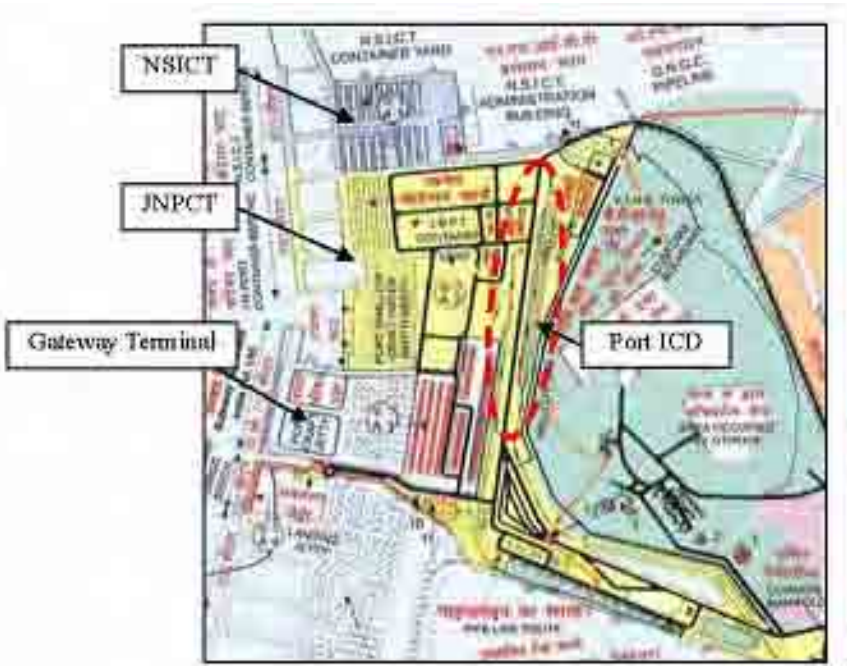
Figure 7.5 Location of Wadala Area

(2) Jawaharlar Nehru Port

1) Railway Yard (Port ICD)

Two container terminals are in operation in J.N.P.T. , namely JNPCT and NSICT, and one more terminal named "Gateway Terminal" is now ready for operation. For the railway transfer of container cargo, a port railway yard called the port ICD is operating about 2km away from the container terminals. The port ICD has five tracks. Line No.1 and 2 are used by JNPCT, while line No.4 and No.5 are assigned to NSICT. Line No.3 located in between the JNPCT and NSICT Terminals served as a common engine run-round line. The location of each terminal and ICD are shown in Figure 7.6

The JNPCT provides service to JNPCT, NSICT by P&O and Gateway Terminal and is operated by the A.P. Moller-Meask Group and CONCOR. The ICD at JNPCT and NSICT is operated by CONCOR and NSICT respectively.



Source: Harboring Dreams Navigating Prosperity (Jawaharlal Nehru Port Trust)

Figure 7.6 Location of Container Terminals and Port ICD

2) JNPTC's Port ICD

Here two of lines (No.1 & No.2) in the rail yard are straddled over by 3 rail-mounted gantry cranes (RMGCs) with a span of 25.5m and a lifting capacity 35.5tons. A service road and space for stacking of about 500TEU is also provided under the gantry. During 2003-04, JNPCT handled 1.32million TEU overall and 276,926TEU in terms of ICD traffic (equal to 21% of all container shipments). The number of train handled was 1,943, an average of 5.32trains per day.43% of these trains comprised mixed trains containing container boxes for both JNPCT and NSCIT. The average dwell time of trains at the port ICD was 12.1hours.

3) NSICT's Port ICD

Here two of the lines (No.4& No.5) in the rail yard are straddled over by 3 RGM's, with a span of 25.5m and a lifting capacity of 40tons. The service roads are provided at both ends outside the gantry portals, and there is stacking space for about 1,000TEU is also provided under the gantry. The cranes have cantilevers on either side, thereby enabling them to perform lift-on and lift-off operation outside their portals. During 2003-04, NSICT handled 1.2million TEU overall and 336,989TEU in terms of ICD traffic (equal to 27% of all container shipments). The number of train handled on its two ICD lines (No.4 and No.5) was 1,772, an average of 4.85trains per day. Of the total trains handled, 27% ware mixed and 73% dedicated. The average dwell per train at the port ICD was approximately 9hours.

4) Gateway Terminal's Port ICD

The construction of 3 tracks has already been completed at the GT container terminal and the freight trains are already being operated. The operator is scheduled to install 3 transfer cranes on September 2006. At the present time, the container cargo are temporarily being loaded and unloaded to and from trains by reach stackers.

5) Railway Yard Operation by CONCOR

The container is transferred from the container terminal to the port ICD by tractor-trailer. There are two method of handling the container cargo after sorting at container terminals, one is transportation and stacking at the port ICD and the other is transportation to railway directly.

Each train is composed of 45 wagons (5 wagon unit × 9); the length if each a unit is 69m. The capacity of the train is 90TEU. The monthly cargo transportation by train is approximately 70,000TEU. The following shows transportation by import and export and the number of trains in June 2006 is shown. This is based on information from CONCOR.

Table 7.9 Container Throughput per EX/IM

Import (TEU)			Export (TEU)			Train	
Load	Empty	Total	Load	Empty	Total	Arrive	Depart
33,380	536	33,916	29,502	503	33,005	392	392

Source: Rail Transport Logistics Study for the Planned development of J.N. Port

Average time for loading the container cargo to a train is about 4hours. (The maximum is 8 hours.)

(A 20-feet container unloaded in Line No.2 is being placed by RMGC onto a trailer-truck parking alongside the railway.)

Figure 7.7 Port ICD

6) Connected with IR trunk line

Tracks for loading/unloading containers link between port ICD and the yard connects with Jasai yard of IR, which is located out of the port area on Panvel-Uran line. The construction of double tracking between port ICD and Panvel Jn. has completed. IR lines beyond Jasai Yard have already electrified.

(3) Kolkata Port System

1) Port railway

There are 10 siding at marshaling yard of Kolkata Dock System. The capacity of yard is sufficient at the present time. In addition, there are 3 sidings at container terminal behind Berth No.8.

2) Railway Dock System

The flow of container cargo from berth to freight train is station 1)unloading from vessel by mobile harbor crane, 2) movement from apron to container yard by tractor/chassis, 3) unloading tractor /chassis by reach stacker, 4) loading to tractor/chassis by reach stacker and 5) loading from tractor/chassis to wagon by reach stacker. Average loading time of the container cargo to a train takes for about 2 hours.

3) Railway Operating to Nepal

The train composed of 34 wagons (68TEU) for export to Birganj in Nepal. The number of freight train for Birgani is about 15 trains per month. The cargo transportation volume for Birgani is 800-900 TEU per month by train and 1,300-1,400TEU per month by road.

There are 2 ICD's between the Kolkata Dock System and Nepal that are connected by railway. They are shown below.

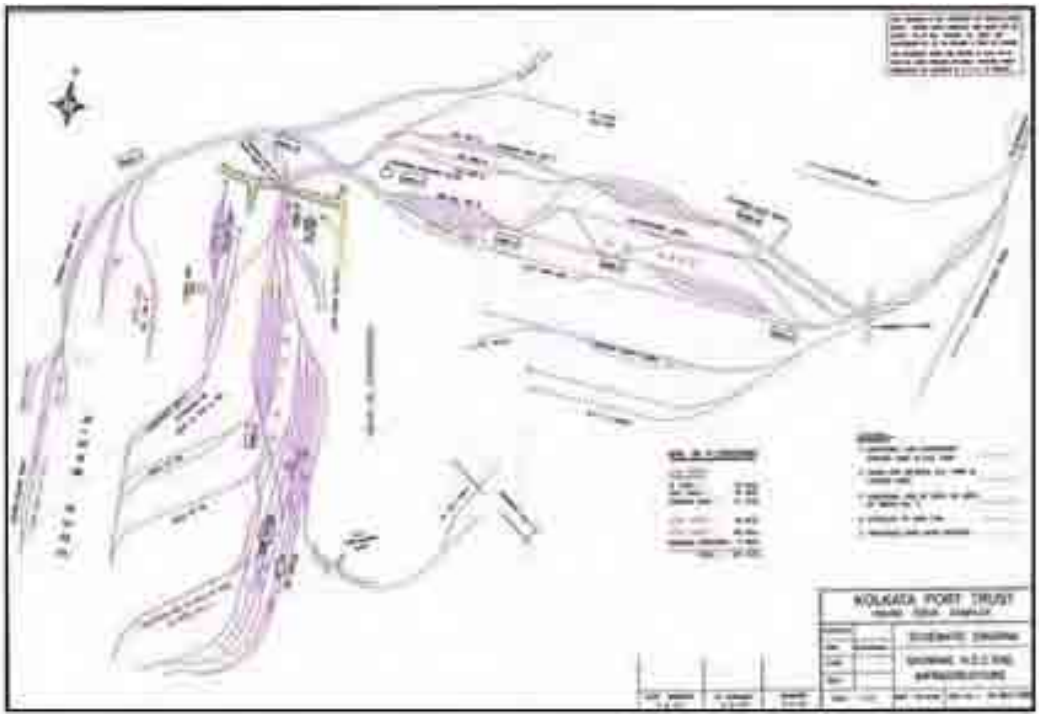
- Birgani (704km from Kolkata Dock Sysem)

- Amingaon (979km for Kolkata Dock System)

(4) Haldia Dock Complex

1) Sidings of Port Railways

Many sidings are located near the Haldia Dock Complex. Most are concentrated on the western part of the dock for handling bulk cargo, including coal, iron ore, limestone, coking coal, and others. The railway yard consists of a general marshaling yard and bulk handling yard, where departure and arrival operation for massive amount of bulk cargo trains are executed. The ports railways are connected to Durgahack belong to Southeastern Railway. The schematic diagram of HDC Rail Infrastructure is shown in Figure 7.8.



Source: Schematic Diagram, Kolkata Port Trust (December 2004)

Figure 7.8 Schematic Diagram of HDC Railway Infrastructure

2) Container/Bulk Cargo and Railway Operation

Berths No.6 through 9 handle bulk cargo such as coal, iron ore, but there is no cargo handling equipment on the apron. When exporting iron ore, the following general flow is used: 1) loading by pay loader to a dump truck at the stock yard behind berth, 2) transportation by dump truck to the apron, 3) unloading by dump truck on the apron directly and 4) loading using the crane on the vessel.

Berth No.4A is operated by a private company that was selected on a build, operate and transfer basis (BOT). This company handled coal as their main cargo. Briefly, the flow of cargo handling is : 1) cargo is unloaded on the berth, 2) transfer by conveyor, 3) placed in the stack yard, 4) processed by re-claimer, 5) transfer by conveyor and 6) placed on wagons. The average and maximum cargo handling volume per a freight train is 3,480 metric ton

(MT) and 3,600MT respectively. The average loading time from bulk to wagon takes about 4 to 5 hours. The average cargo handling volume is 16,500MT per day.

There are 3 lock gates, but only two of them are operated. The in Haldia Dock Complex (HDC) is kept at –11m by those 2 lock gate. Three vessels can enter and leave the point during high tide only. Ships wishing to enter this port must wait off the coast of Sagar. The width of lock gate is 36.5m, suitable for Panama Canal class ships.

The container cargo has handled at Berth No.10 and 11. These berths have 2 gantry cranes, 5 transfer cranes, 1 top lifter and 6 reach stackers. The container cargo transported from here by railway is bound for the western industrial area only.

HDC pays South Eastern Railway for the cost of the locomotive for pulling the train and, conversely. South Eastern Railway pays HDC a rental fee for the use of railroad to the port area.

3) Mineral Bulk Transportation

A thermal power station at the back of Haldia is using local coal and imported coal from Indonesia. The imported coal is transferred by railway to several thermal power stations at Bhagalpur and Farakta to the north of Kolkata and around Delhi. Mines of iron ore around Haldia are located in Raulkena, Jhinkepani and Jamshedpur. Iron mined in the area is exported mainly to China. Train from mines to the port transports iron ore.

(5) Gujarat Pipavav Port

Of the wagon loading system at the port, the use of 9 wagons loaders for back loading consignments will be commenced in September 2006.

Pay loaders are currently doing cargo handling, crane and mobile harbor cranes, electric leveling luffing (ELL) cranes, reach stacker and conveyor belts for coal handling.

The double-stack transportation of container has been operated between Pipavav port and Kanakpura since March 24, 2006. The record for double stack-operation is shown below.

March: 1 train

April: 2 trains

May: 5 trains

June: 1 trains

July: 5 trains (as of 17 July)

(6) Kandla Port

Ship are unloaded and loaded by the crane mounted on the ship and newly installed crane at the port. Loading for rail transport is completely manual.

(7) Mundla Port

The container terminal is capable of accommodating Super Post Panamax 8,000TEU vessels. The terminal operates 24hour a day, 365 day a year and has no tidal restriction.

Crane and conveyor belts handle cargo such as coal, food grain and fertilizer while liquid cargo is handled through pipeline. Containers cargos are handled by reach stackers, tire mounted gantry crane (TMG) and railed mounted gantry crane (RGM).

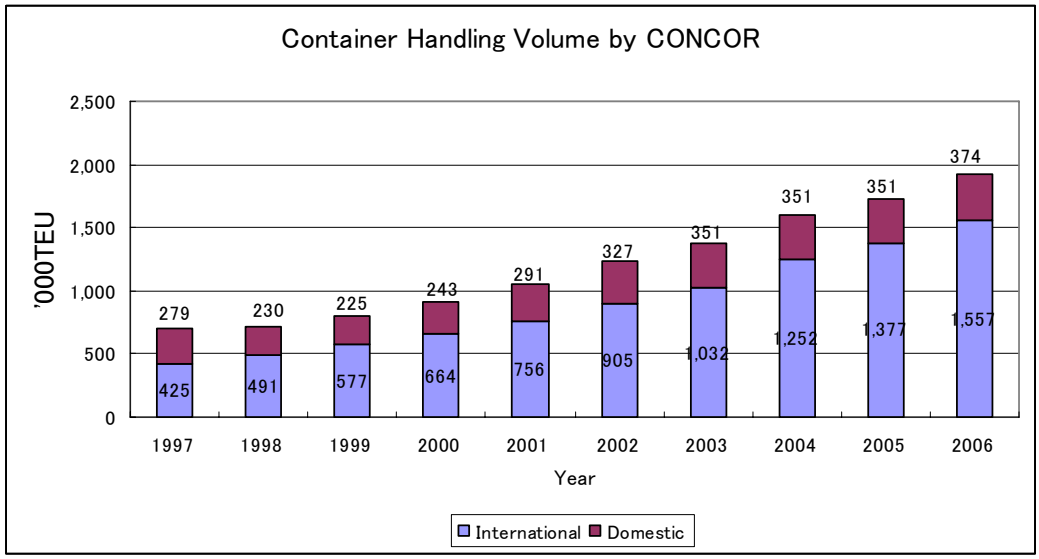
Double stack transportation has operated between Mundla port and Jaipure since July 2, 2006.

7.2 INLAND CONTAINER DEPOT (ICD)

7.2.1 INTRODUCTION

CONCOR was the only company that handles rail international container transport in India. CONCOR was former Indian Railway subsidiary but currently it is a half public, which aims to provide prompt, punctual service by (1) establishing Inland Container Depots (ICD) capable of providing international intermodal transport services including customs clearance and other related service, and (2) operating dedicated container transportation between the ICDs and ports as well as among ICDs.

Currently, railway intermodal transportation is such a widespread transportation method that it is said that railways are used to carry 30% of the containers bound inland from Nhava-Sheva port, which handles the major container port in India. The volume of containers handled by CONCOR has increased steadily since 1992. In addition to international containers, CONCOR is also actively offering domestic transportation, but its main business activity is still based on international container shipments. In 2005, it handled approximately 1.40 million TEUs, and international shipments accounted for 80% of that.



Source: CONCOR website

Figure 7.9 Trends in Cargo Volume Handled by CONCOR (unit: 1,000 TEU)

Facilities operated by CONCOR in addition to ICDs include the following types.

- CFS（Container Freight Station: for Consolidated cargo）
- PSCT（Port Side Container Terminal: container handling facility located at port area）
- DCT（Domestic Container Terminal: domestic container handling facility）

These terminals form a nationwide network that provides rail freight transportation between major ports and ICDs as well as between ICDs.

In 2004, the northern and western region accounted for nearly 80% of all CONCOR's freight volume. The southern region, centered on Bangalore, accounted for 16%. The main and most important ICD, located in the northern region, is TKD in Delhi handles 48 thousands TEU, one-third, of the total freight volume.

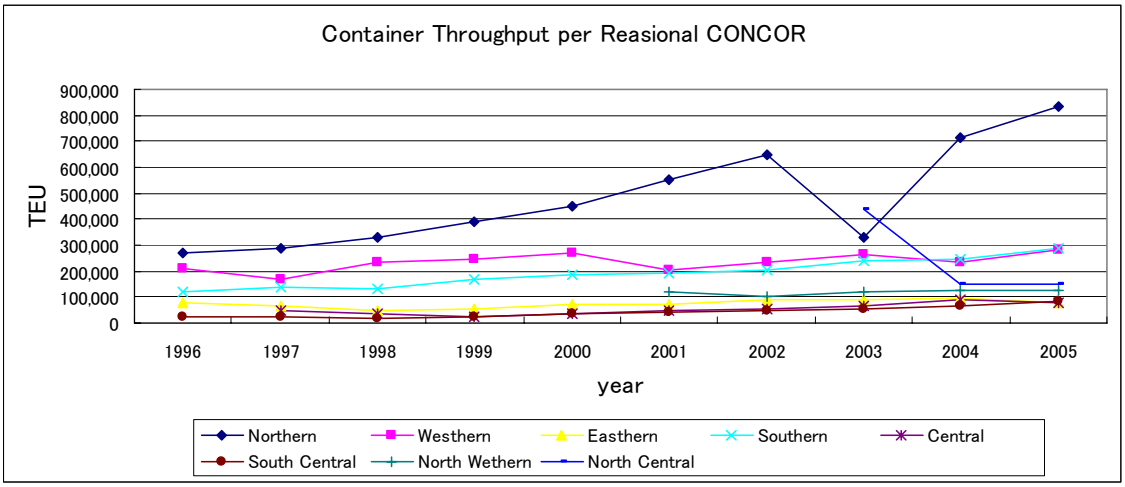


Figure 7.10　Container Volume per Regional Office in CONCOR

Source: CONCOR H.P.

Figure 7.11 CONCOR's Terminals

Note:
Northern: Tughlakabad(Delhi), Panipat, Moradabad, ICD DDL (Ludhiana), Ballabgarh, Jaipur, Jodhpur, Rewari, DCT/TKD, Kharia Khangar, Gotan, DCT Phillaur, Moga, Gurgaon, Dhappar (Under Construction), Surnasi (Planned), Khemli (Planned) Dadri, Agra, Juhi Kanpur, Malanpur (Gwalior), Rawtha Road, Madhosingh (Planned)
Western: New Mulund(Mumbai), Mulund (Mumbai), Pithampur (Indore), Miraj, Chinchwad (Pune), Dronagiri Node, Turbhe / DOM (Mumbai), Ratlam
Eastern: Amingaon (Guwahati), Shalimar (Kolkata), CONCOR Terminal KOPT Coal Dock Road (Kolkata), Kolkata Port (Kolkata), Jamshedpur, Haldia, Fatuha (Patna), Balasore, Raxaul
Southern: Whitefield (Bangalore), Irugur , Tondiarpet(Chennai), Madurai, Harbour of Chennai (HOM), Pondicherry, Cochin (CHTS), Milavittan(Tuticorin), Salem Market/DOM, Tiruppur
Central: Nagpur / Daulatabad (Aurangabad) / Bhusawal/ Raipur / Mandideep,
Sanatnagar(Hyderabad), Guntur, Visakhapatnam, Desur
North Western: ICD Sabarmati (Ahmedabad), Vadodara, Gandhidham, Kandla , DCT Khodiyar, Ankleshwar, Mundra, Pipavav

In other words, it may be concluded that transportation in the western corridor from and to Delhi is critical. However, in the case of the Kolkata-Delhi route, the cargo volume has not been developed to the level in the western corridor. The situation is summarized as follow.

- There is no dedicated trains service for ocean containers, however, passenger trains are acceptable for cargo, the lead-time of which is estimated around two days.

- Meanwhile, the road infrastructure is underdeveloped between Kolkata and Bihar. In addition, there are high risks for truck attacks, and safety cannot be guaranteed. For this reason, trucks form comboys and move only during the daytime, which required around five days.

7.2.2 ICD FACILITY

1) Condition of TKD

The most important ICD in the east-west corridor is the Tugklakabad (TKD) terminal in Delhi. With Delhi growing as one part of the "golden quadrilateral", TDK is greatly expanding the volume of freight it handles. In order to catch up the increasing cargo demand, TDK has been developing its facilitation.

Table 7.10 Outline of TKD Facilities

Square Area	60 hectares
Railroad Sidings	4 Tracks
Container Holding Capacity	14,000TEU (Of which 10,000 TEU is for export, and 4,000 TEU is for storage of full containers)
Warehouse Capacity	16,000 square feet, of which 10,000 square feet is warehouse space for exports and 6,000 square feet is warehouse space of imports
Equipment	3 Gantry Cranes 1 Goliath Tire Crane 8 Reach Stackers for Full Containers 6 Reach Stackers for Empty Containers 30 Trailers Other equipment including forklifts, etc.

Source: CONCOR website

Because this ICD plays a role in Delhi as a focal point for international transportation, agencies involved in international trade business concentrated here. Specifically, these include offices of customhouses, banks, ship companies, inspection agencies, which results in creating a setup that offers one-stop service.

In addition to ICDs basic function, they are eager on providing value added service as follows:

- Loading and unloading ocean freight containers

- Handling refrigeration containers

- Offering trucking service (trucking between Nhava-Sheva and Delhi is also available from CONCOR)

- Offering warehouse storage for exports and imports (Because customs taxes on imports are high in India, single-installment payments are likely to be a large burden on importers.)

However, there is concern that the increase in the number of containers due to local economic growth will exceed the capacity of TKD. (Even now, trucks form a long line waiting to drop off and pick up containers at the ICD, and access roads are congested.)

2) New ICD (Dadri)

In the expectation that

- Western ports will be expanded and the amount of containers will increase in the future, and

- In the Delhi area, multiple ICDs will become necessary that do not entail crossing through Delhi,

It was decided in 1996 to open a new ICD in the Dandori region, and it has begun operation. In FY2005, the volume of freight handled was still approximately 100,000 TEU, but there is space to expand it so that it can handle 1,000,000 TEU. This would make it one of the top inland container-handling sites in Asia, and in combination with TKD, the two ICDs will be able to handle three times the amount currently handled by TKD. Furthermore, there are two industrial areas in Delhi, Gurgaon and Noida, and it is possible for TKD to handle Gurgaon cargo and Dadori to handle Noida cargo. It is quiet reasonable to improve container-handling capacity in the Delhi area. The basic concept of the Dadori ICD is no different from that of TKD, but at Dadori there are advanced efforts not seen at TKD to strengthen services for consolidated cargo and small shipments.

Although it is common that ICDs have only one CFS warehouse operated by CONCOR. Dadori ICD has five CFS warehouses, with one of them operated by CONCOR and the other four operated as a joint venture by a ship companies (51% foreign-owned). ICDs have advanced beyond their original objective of handling containers in inland regions and are working toward becoming logistic parks that offer higher added value. To proceed in the direction of strengthening logistics services by adding services not previously provided, it is necessary to make efforts to distinguish their services from trucking services.

The level of service for handling ocean containers, which is the most basic service of the Dadori ICD, is highly appreciated. One day is required to unload freight that arrives by train and to place it in the storage yard. After that, one day is required for customs clearance at least. So, it is possible to pick up containers, at the fastest, the day after it arrives (2-3days is common).