Chapter 9

Summary Findings, Inferences & Recommendations

PRELUDE

Growing Relevance of Transport Sector

Transport has evolved out of its traditional garb of a 'derived demand' to be recognised as the 'harbinger of growth'. Today, it is no longer the growth that dictates the need and profile of transport facilities. On the other hand, it is the availability of transport facility that determines the locations of future growth centres for the obvious reasons of cost advantage. Transport has therefore, progressively enhanced its relevance to the economy and GDP at the national level. Planning for the transport sector has therefore, become an important concern for governments across the globe. For a vibrantly evolving economy like India, the concern is even more critical.

Moving closely in parallel with the above, there is also a progressive concern for reduction in the transportation cost. For the business sector, logistics cost has become a critical factor in determining the ultimate market competitiveness of a product, thanks to intense competition triggered by the forces of globalization, easy permeability of technical know how and wide range of choice for the users. For the governments however, the concern is extended further to the minimization of resource cost incurred in transportation. Incidentally, while the governmental concern may not always be in sync with that of the business sector, they have a common goal in terms of seeking optimal utilisation of the transport resources. Predictably, there is a growing thrust world over towards the promotion of an optimal modal mix.

It is the goal of an optimal modal mix, which has been the focus of this study. Considering the nation centric profile of the mandate, the desired outcome would obviously have be a solution, which would minimize the resource cost incurred on transportation. The exercise therefore, entails the development of an optimal transport network and system, strategies, policies and institutions, which will facilitate the progress of transportation sector as a whole towards this goal. However, for such solution to be successful, it would necessarily have to be in sync with the basic aspirations of the business sector and end users

Need for an Integrated Approach

Since the basic concerns pertain to the transport sector as a whole across modes, and assign a role to each mode, the main challenge is to have a coordinated and integrated approach to transport planning. This will ensure that competition is not wasteful, and that network effects develop in an environment of complementarity and compatibility. Such an integrated approach inherently entails the following aspects:

A. Integrating the planning for different modes in synergy with each other, and allocating to each mode the traffic in accordance with its niche domain of cost advantage rather than stand alone system for mode specific funding and planning;

B. Assessment of the resource cost of transport for different modes rather than the financial costs, and identifying suitable measures to induce modal shift, in the light of the specific circumstances of the sector.

C. Identifying the gaps between ideal/optimal and actual traffic flows for each commodity and mode and finding out the reasons for the same;

D. Viewing transportation demand in conjunction with and identifying the boundaries with related concerns like land-use planning and environment policy, and also with upstream activities like vehicle production and technology;

E. Identification of goals and setting of performance measures for areas and modes, in relation to economic and social goals, for example, accessibility, mobility, economic development or quality of life.

The above would necessarily involve an understanding of the transportation market, reason for system failures and need and scope for government intervention. Initiatives in this direction may also interalia include, fiscal measures like taxation, user charges etc. and non-fiscal measures like positive inducements of facilities and services, incentives in terms of discounts.

1. BACKDROP

1.1 Past Efforts

Availability of adequate data on modal costs and traffic flows by major modes of transport in the country is a prerequisite for perspective planning and making resource allocations for integrated development of the transport sector with the objective of achieving optimality of modal operations. To this end, a number of attempts have been made in the past, which interalia included the following:

- Field surveys organised by Committee on Transport Policy & Coordination (CTPC) to generate commodity flow data on 6 important routes connecting major cities (1959).
- Follow up survey by the Ministry of Transport, GOI with enlarged scope covering 16 important routes (1963).
- A national exercise to assess regional commodity flows by the Joint Technical Group (JTG) for Transport Planning, Planning Commission (1965-67).
- Sporadic efforts of the State Governments to generate region-specific data on traffic flows.

The above exercises served the need of the hour, but they had their own limitations and lacked comprehensiveness in terms of the geographic and modal coverage. A more comprehensive attempt in this direction came in the late seventies from initiative taken by the Planning Commission to conduct a series of total transport system studies to generate a national level data base on traffic flows and modal costs for the major modes of transport. Two such studies have been conducted so far (in 1978 and 1986), results of which provided important inputs for formulating the national transport policy and investment allocations for the transport sector.

1.2 Genesis of the Present Study

Major quantitative and qualitative changes have taken place in the sector during the past two decades. Driven by the forces of technological innovations and progressive globalization of its business profile, Indian economy has undergone a paradigm shift during the intervening period. Relevant to the transport sector, these changes, broadly, include infrastructure & technological developments with associated growth in performance levels of different modes of transport.

It is against the above backdrop that the Planning Commission considered the need for updating the data and information base for the purpose of perspective planning. To this end, it entrusted the mandate of conducting the third Total Transport System Study to RITES, which had conducted the two earlier studies, with the following objective:

- To generate and analyse inter-modal transport resource costs and traffic flows covering the four major modes of mechanized transport viz. Railways, Highways, Airways & Coastal Shipping.
- To determine an optimal inter-modal mix and allocation of transport investment to assist the planners in designing a transport vision for tomorrow.

1.3 Scope & Coverage

The focus of the study is on assessment of traffic flows and modal costs in respect of the four identified modes of transport viz. Railways, Highways (road transport), Airways and Coastal Shipping, its geographic coverage spanning the whole of India, excluding the islands of Andamans & Nicobar and Lakshdweep. The associated terms of reference of the assignment envisage the focal points of the study as under:

- Generation and analyses of commodity wise freight and passenger traffic flows by major mechanized modes of transport viz. Railways, Highways and Airways and commodity flows by Coastal Shipping;
- Estimation of modal costs in terms of financial and economic/resource costs;
- Formulation of transport demand forecasts in respect of major bulk commodities and select non-bulk commodities in the case of freight traffic and passenger traffic for the horizon years 2007-08, 2012-13, 2017-18, 2022-23 and 2025-26. This would also require an assessment of growth in multi-modal (container traffic) and its possible impact on the overall traffic scenario in future;
- Carrying out transport optimization exercises, determining cost break-even between modes and modal allocations of traffic accordingly.
- Based on comparative costs, assessment of desirable share of each mode and suggestions with regard to policy measures to be adopted for achieving an optimal inter-modal mix.

The present brief does not aim at detailed examination in respect of two developing modes, viz. inland water transport and pipelines. However, the aggregate assessment of inter-modal traffic flows in the study reflects the contribution of these modes.

1.4 Transport Sector Growth

The mechanized modes of transport constituting the transport sector in the country comprise Railways, Highways, Coastal Shipping, Airways, Inland Waterways, Pipelines and, to a minor extent, the Ropeways. Railway and Highway networks have more or less an all-India geographic coverage and provide short, medium and long-lead freight and passenger services. Coastal Shipping represents freight movements along the coastline while Airways represent a growing route-specific network of linkages. A broad review on mode wise historical growth in the period prior to the present study is enlisted below:

RAILWAYS - GROWTH PROFILE

INDEX	PROFILE & PERFORMANCE GROWTH
NETWORK EXPANSION	Growth in route-kilometres from 61836 km in 1986 to 63327 km in 2006-07. Major BG expansion: opening up parallel routes and increased efficiency
TRACTION	Steam phased out. Diesel and electric emerging as main traction with progressive increase in extension of electric traction from 6919 route-km in 1986 to 17786 in 2006-07
ROLLING STOCK	Quantitative and qualitative increase in wagons & coaches
ORIGINATING FREIGHT TRAFFIC	255.4 MT in 1986-87 to 768.72 MT in 2007-08
PASSENGER TRAFFIC	3594 million in 1986-87 to 6219 million in 2006-07

In the global scenario, Indian Railways is one of the top five national railway systems in terms of size and scale of operations with a fleet of 51255 passenger service vehicles, 207719 wagons and

8153 locomotives, carrying around 17 million passengers and 2 million tonnes of freight traffic per day across the length and breadth of the country, meeting requirements of rail users through 6909 railway stations.

HIGHWAYS/ROAD - GROWTH PROFILE

INDEX	PROFILE & PERFORMANCE GROWTH
Network Expansion	From 1.72 million route-kilometres in 1986 to 3.62 in 2004 (including roads under JRY & PMGSY).
Goods Vehicle Population	From 0.863 million in 1986 to 3.748 million in 2004
Pass. Vehicle (Bus) Population	From 0.227 million in 1986 to 0.768 million in 2004
Originating Freight Traffic	From 224.0 MT in 1986 to 1558.87 MT in 2007-08 *

* Inter Regional Traffic Only

At present (as on January, 2008), the Indian road network is the second largest in the world extending over 33 lakh kilometers (NH - 66,590, SH - 1,31,899, District Roads - 4,67,763 and Rural/Other Road - 26,50,000) providing connectivity to every nook and corner of the country. There has been a concerted effort in the recent past to augment the capacity of National Highways, which constitute around 2 % of the total network, but carry about 40 % of the total road traffic. Currently, the NH network comprises Single and Intermediate Lanes (32 %), Double Lanes (56 %); and Four or more Lanes (12 %).

Apart from trucks and buses which carry both long-lead and short-lead freight and passenger traffic, there are a number of varied means of transport like bullock-carts, hand-carts, tongas, tempos, tractor-trolleys or even 'Jugad' (locally contrived mechanical contraptions). For reasons of practical feasibility, this segment of transport has been kept out of the purview of this study notwithstanding the fact that it not only serves the needs of a large part of the population who find it convenient and economical but also provides employment to many.

COASTAL SHIPPING - GROWTH PROFILE

INDEX	PROFILE & PERFORMANCE GROWTH
Major Port Infrastructure	From 10 major ports in 1986 to 13 in 2006
Minor Port Infrastructure	From 139 minor ports in 1986 to 187 in 2006
Ship Population	From 94 in 1986 to 526 in 2006
Originating Freight Traffic	From 5.5 MT in 1986 to 56.3 MT in 2006

India has a long 7517 km of coastline dotted by 13 major and 187 non-major ports. All the 13 major ports in the country viz. Kolkata, Haldia, Paradip, Vishakhapatnam, Ennore, Chennai, Tuticorin, Cochin, New Mangalore, Mormugao, Mumbai, JNPT and Kandla handle coastal traffic. However, amongst the 187 non-major ports, only around 61 are functional. Non-major ports which actually handled coastal traffic during 2006-07 and 2007-08 numbered 32.

AIRWAYS - GROWTH PROFILE

INDEX	PROFILE & PERFORMANCE GROWTH
Airport Infrastructure	Progressive growth to 449 airports in 2006
Aircraft Population	From 23 aircrafts in 1986 to 305 in 2006
Domestic Passenger Traffic	From 9.47 million in 1986 to 36.23 million in 2006 *
Domestic Freight Traffic	From 0.10 MT in 1986 to 0.28 MT in 2006 *

* Includes both Domestic & International Traffic.

There are 449 airports/airstrips in the country. Of these, Airport Authority of India (AAI) owns 127 airports which include 15 international, 79 domestic, 8 customs and 25 civil airport enclaves at airfields belonging to defence authorities. During the period between 1997-98 and 2006-07, there has been around three fold increase in number of aircrafts operated by different airlines.

IWT & PIPELINES

Inland waterways, which had fallen in disuse over time, are in revival mode. Pipelines catering to transport of liquid fuels, gases and, to some extent, iron ore slurry, have a sizeable and growing network owing to its cost effectiveness of operations.

2. FREIGHT TRAFFIC FLOWS

2.1 Historical Overview

Operational performance of different modes of transport in terms of 'inter regional (long & medium lead) traffic' between 1950-51 and 2007-08 is reflected as under:

HISTORICAL OVERVIEW OF OPERATIONAL PERFORMANCE OF DIFFERENT MECHANISED MODES OF TRANSPORT

YEAR	TOTAL ORIGINATING INTER REGIONAL TRAFFIC (Million Tonnes)	MODE WISE TRAFFIC IN MILLION TONNES AND PERCENTAGE SHARE IN TOTAL TRAFFIC					
		RAILWAYS	HIGHWAYS	COASTAL SHIPPING	AIRLINES	PIPELINES	IWT
1950-51	**82.2**	73.2 (89%)	9.0 (11%)	NA	NA	NA	NA
1978-79	**283.40**	184.70 (65%)	95.60 (34%)	3.10 (1%)	NA	NA	NA
1986-87	**484.9**	255.40 (53%)	224.00 (46%)	5.50 (1%)	NA	NA	NA
2007-08	**2555.35 (2386.98 for 4 Modes)**	768.72 (30.08%)	1558.87 (61.01%)	59.10 (2.31%)	0.28 (0.01%)	113.50 (4.44%)	54.88 (2.15%)

Figures in parentheses indicate the Modal Percentage Shares.

During the intervening twenty years since 1986-87, while the growth in the overall freight traffic by the four modes has been over five times, rail traffic has grown by three times and road traffic by about seven times. Freight traffic by Coastal Shipping has grown by over ten times.

2.2 Base Year Inter-Regional Traffic Flows

Modal Performances:

A more detailed position of modal shares in total inter-regional freight traffic in the base year i.e. 2007-08 on various related indices is enclosed at **Appendix 1 to 9** at the end of the report. A summary position of the modal performances in terms of originating traffic and throughput is reflected in the table below:

MODAL SHARES IN FREIGHT TRAFFIC (2007-08

MODE	MODAL SHARES IN TOTAL ORIGINATING TRAFFIC		PERCENTAGE SHARES IN TOTAL TRANSPORT OUTPUT	
	TONNES (MILLION)	NTKMS (BILLION)	TONNES	NTKMS
Rail *@	768.72	508.10	30.08	36.06
Highways (Road) @	1558.87	706.16	61.01	50.12
Coastal Shipping	59.10	85.70	2.31	6.08
Airways	0.28	0.29	0.01	0.02
IWT	54.88	3.38	2.15	0.24
Pipelines	113.50	105.45	4.44	7.48
TOTAL	**2555.35**	**1409.08**	**100**	**100**
TOTAL FOR 4 MODES IDENTIFIED IN THE STUDY	**2386.97**	**1300.25**		

* Includes IR & KRC 'non-revenue' inter-regional traffic as well as NTPC MGR traffic aggregating to 1.86 million tonnes and 26.1 million tones, respectively

@ Excluding Intra-Regional Traffic of 96.66 MT by rail and 4640. 17 MT assessed separately.

A. In the total originating freight traffic of 2555.35 million tonnes handled by all the six modes during 2007-08, the share of railways and road transport was around 30 % and 61 %, respectively. Both the modes together accounted for 91 % of the total traffic. The balance 9 % was handled by the remaining four modes.

B. In terms of NTKMs, the corresponding shares of rail and road were around 36 % and 50 %, respectively, together amounting to 86 %. The share remaining four modes taken together was 14 %. As is evident, major chunk of traffic is carried by Railways and Road Transport.

C. On a pragmatic approach to compare shares of rail and road in their respective areas of domain competence i.e. assigning low volume short-lead traffic to road transport in a complementary role and medium and long-lead (above 300 km) high volume bulk traffic to rail indicates rail and road shares to be 51.5 % and 48.5 %, respectively.

Commodity Flows:

A summarized position of the base year (2007-08) traffic flows by the four major modes in respect of the identified 52 commodity groups has been enclosed in the Appendix. Share of nine major commodities in the total traffic carried by all the four modes is presented in the table below:

COMMODITY WISE MODAL PERFORMANCE DURING BASE YEAR (2007-08)

COMMODITY	RAIL	ROAD	COASTAL SHIPPING	AIRWAYS	**TOTAL**	%AGE SHARE OF MAJOR COMMODITIES IN TOTAL TRAFFIC
	TONNES ('000)	TONNES ('000)	TONNES ('000)	TONNES ('000)	TONNES ('000)	
Coal	331768	68352	15247	0.00	415367	17.40
Foodgrains *	37651	122685	0.00	0.00	160336	6.72
Iron & Steel	27314	107177	0.00	0.00	134491	5.63
Iron Ore	121799	23296	9590	0.00	154685	6.48
POL Products (Liquid)	35129	128138	26296	0.00	189563	7.94
Limestone & Dolomite	13694	6152	0.00	0.00	19846	0.83
Cement	78830	75981	3046	0.00	157857	6.61
Fertilizers	36382	18189	0.00	0.00	54571	2.29
Miscellaneous / Others	22293	201499	3181	283	227256	9.52
TOTAL OF 9 COMMODITIES	**704860**	**751469**	**57360**	**283**	**1513972**	
TOTAL OF 52 COMMODITIES	**768716**	**1558875**	**59101**	**283**	**2386976**	
% AGE SHARE OF ABVE 9 COMMODITIES IN TOTAL 52 COMMODITY TRAFFIC					**63.43**	
RAIL & ROAD SHARE IN TOTAL MOVEMENT OF ABOVE 9 COMMODITIES		**RAIL**	**46.56%**	**ROAD**	**49.64%**	

* Combined volume of rice (all types), wheat+ wheat flour, other foodgrains and grams + pulses.

A. Total volume of the above 9 commodities (1513.97 million tonnes) constituted 63.43 % of the total volume of 52 commodities (2386.98 million tones) carried by all the four modes.

B. Share of rail and road in the movement of nine major commodities was 46.56 % and 49.64 %, respectively. Coastal Shipping accounted for 3.79 %. Airways catered to 0.02 % of the total traffic constituting only high value small volume commodities in the category of miscellaneous commodities.

C. Share of Road Transport in movement of the nine major commodities was higher than that of Railways due not only to higher volumes of miscellaneous/smalls/parcel traffic (88.67 %) but also the higher share in transport of bulk commodities like POL (67.60 %) and iron & steel (79.69 %), which have traditionally been carried by rail. In the case of cement too, share of Road Transport was around 48 %.

D. The highest share in commodity movement by rail was that of coal which constituted 79.87 % of the total movement of the commodity by all modes. The balance was accounted for by road transport (16.46 %) and Coastal Shipping (3.67 %). Other commodities which reflected predominant rail share in their total movement include iron ore (78.74 %), limestone & dolomite (69.00 %) and fertilizers (66.67 %).

E. The total volume of the nine commodities carried by road (751.47 million tonnes) amounted to 48.21 % of the total traffic (1558.87 million tonnes) carried by the mode. The balance traffic consisted of the remaining 43 commodities in which the road share was consistently higher than rail.

F. In the case of railways, the total volume of these commodities (704.86 million tonnes) accounts for 91.7 % % of the total traffic (768.72 million tones) carried by rail.

G. The shares of Coastal Shipping and Airways in the total freight traffic were around 2.48 % and 0.01 %, respectively. Further, while the freight movement by Coastal Shipping was confined to six commodities viz. POL products, coal, iron ore, cement, containers and miscellaneous goods, in Airways, it was limited to only high value parcels & miscellaneous commodities. In terms of NTKMs, share of Coastal Shipping was 6.6% and that of airways 0.02 %.

Rail-Road Commodity Share

A comparative statement of top nine commodities transported by Road Transport along with road and rail shares in their movement is given below:

TOP NINE COMMODITIES TRANSPORTED BY ROAD TRANSPORT

SN	COMMODITY	TOTAL	MODAL SHARE			
			ROAD		RAIL	
		MILLION TONNES	MILLION TONNES	% OF TOTAL	MILLION TONNES	% OF TOTAL
1	Parcels, Misc, Others	227.17	201.50	88.70	22.29	9.81
2	POL Products (Liquid)	189.56	128.14	67.60	35.13	18.53
3	Building Materials (Bricks/ Earth/Sand/Stone/Chips, etc.)	121.13	116.08	95.83	5.05	4.17
4	Iron & Steel (All types)	134.49	107.18	79.69	27.31	20.31
5	Provisions & Household Goods	80.93	80.75	99.78	0.19	0.23
6	Cement/Cement Structures	157.86	75.98	48.13	78.83	49.94
7	Fruits & Vegetables	71.81	69.93	97.38	1.89	2.63
8	Coal	415.37	68.35	16.46	331.77	79.87
9	Containers (Loaded & Empty)	85.44	56.60	66.25	27.09	31.71
	SUB-TOTAL	**1483.76**	**904.51**	**60.96**	**529.55**	**35.69**
	TOTAL: All Commodities, All Modes	**2386.97**		**37.89**		**22.19**

The above nine commodities predominantly moving by road constitute 58 % of total traffic carried by road (1558.87 million tonnes) and 37.89 % of the total traffic carried by all the four modes (2386.98 million tonnes).

Share of rail transport in movement of these commodities amounts to 68.89 % of total traffic carried by rail (768.72 million tonnes) and 22.19 % of the total traffic carried by all the four modes. Some broad observations on the rail-road shares are as under:

A. Three commodities - building material, provisions & household goods, fruits and vegetables; account for over 95 % of the total individual commodity flows. There are another eight commodities which, though comparatively low in volume, fall in this category. These include chemicals, grams & pulses, wood/timber, heavy machinery, milk & products, edible oils, electrical goods & paper/paper products. The level of movement in miscellaneous goods, including assorted goods (commonly termed as 'parchun') was also very high in terms of volume.

B. Except for four commodities viz. coal, iron ore, limestone and dolomite and fertilizers, which are predominantly carried by rail, the share of road transport was consistently higher in movement of the remaining 48 commodities.

C. Road transport reflects a comparatively high share in movement of commodities like POL, iron and steel and containers, which have traditionally been carried by rail. In the case of cement, both the modes show nearly equal shares.

D. In case of loaded/empty containers, the high share of road transport (66.25 %) has been occasioned by heavy short-lead movement of containers detected during road traffic surveys. Over 60 % of movement of containers by road is confined to leads up to 150 kilometers. Another 11 % move over leads between 151 and 300 kilometers, while the share of container movement beyond 300 kilometres is around 28 % only.

Geographic Concentration

Geographic concentration of freight traffic in different States revealed the following:

A. The State of Maharashtra tops with originating traffic of 263.28 million tonnes, constituting around 11 % of the total traffic (2386.98 million tonnes). Sikkim ranks the lowest with annual originating traffic of 0.11 million tonnes or 0.005 % of total traffic. Ten states viz. Maharashtra, Gujarat, Andhra Pradesh, Orissa, Madhya Pradesh, Karnataka, Jharkhand, Uttar Pradesh, Punjab and Rajasthan account for over 82 % of the total originating traffic.

B. As in the case of originating traffic, the State of Maharashtra tops in terminating traffic too, with 286.01 million tones of traffic, constituting around 12 % of total traffic. Likewise, Sikkim ranks the lowest with annual terminating traffic of 1.24 million tonnes or 0.05 % of total traffic. Ten states viz. Maharashtra, Gujarat, Andhra Pradesh, Uttar Pradesh, Orissa, Tamil Nadu, Madhya Pradesh, West Bengal, Karnataka and Punjab account for about 70 % of the total terminating traffic.

C. In respect of total originating and terminating traffic, the maximum concentration of traffic is in the State of Maharashtra, followed by Gujarat and Andhra Pradesh with their shares in total traffic ranging between 9.24 % and 11.51 %. Thirteen states, viz. Maharashtra, Gujarat, Andhra Pradesh, Orissa, Uttar Pradesh, Madhya Pradesh, Karnataka, Tamil Nadu, Punjab, Rajasthan, Jharkhand, West Bengal and Haryana together account for over 83 % of the total originating and terminating traffic in the country. The remaining twenty states together have 17 % share in total traffic.

D. Delhi is a major traffic hub in north India. However, since traffic handled in Delhi gets distributed and credited to different locations in adjacent States/NCR, its hierarchical status in traffic concentration is low – 16th in the case of originating traffic, 11th in terminating traffic and 14th in total originating & terminating traffic.

O-D Flows

Traffic flows by rail relate to 15576 pairs of regions out of which 1393 pairs of regions account for about 80 % of the total traffic moving by rail. In the case of road transport, the pairs of regions are 39994 with 6539 accounting for 80 % of the traffic.

In the case of Coastal Shipping, the inter-regional flows extend over 188 pairs of regions of which 34 pairs account for 80 % of the total cargo movement. The volumes of commodity wise flows between 25 pairs of regions accounts for 74.06 % of the total tonnage of cargo. Similarly, air cargo flows span 359 pairs of regions of which 54 pairs account for 80 % of cargo by volume. This excludes movement of around 80,000 tonnes of cargo carried by cargo planes for which O-D data are not available. Cargo flows between the 25 pairs of regions constitute 60.52 % of the total traffic.

The total volume of traffic flow by all modes between top 100 pairs of regions constitute around 18 % of the total volume of traffic by all the four modes. Illustratively, traffic flows between aggregate top 10 pairs of regions are given below:

TOTAL VOLUME OF ALL COMMODITY MOVEMENT BY ALL MODES (TOP 10 PAIRS OF REGIONS)

SN	FROM REGION	T0 REGION	MODAL SHARE (TONNES)				
			RAIL	ROAD	COASTAL SHIPPING	AIR	TOTAL
1	SONEBHADRA	SIDHI	17583000	0	0	0	17583000
2	ANGUL	PARADEEP PORT	10998510	161221	0	0	11159731
3	JNPT	MUMBAI PORT	1274	10355499	594147	0	10950920
4	KRISHNA	HYDERABAD	91027	10608056	0	10	10699093
5	BELLARY	MADRAS PORT	9588149	22111	0	0	9610260
6	MUMBAI (SUBURBS)	JNPT	0	9553003	0	0	9553003
7	KACHCHH	KANDLA PORT	20871	9095318	0	0	9116189
8	KENDUJHARGARH	JAGATSINGHPUR	0	8673091	0	0	8673091
9	DANTEWARA	VISHAKHAPATNAM PORT	6940263	0	0	0	6940263
10	KANDLA PORT	KACHCHH	4650	6754345	0	0	6758995
		TOTAL	**45227744**	**55222644**	**594147**	**10**	**101044545**

The traffic flows include inter-regional coal flows emanating from MGR systems of NTPC. The top pair (Sonebhadra-Sidhi) amongst the 10 pairs given above reflects coal movement at Shaktinagar and Rihand thermal power plants of NTPC. Of the eight MGR systems of NTPC, four generate inter-regional flows because the pitheads and the plants fall in different districts.

Commodity Wise O-D Flows

Owing to wide spread of varying regional demand and supply of commodities, huge number of O-D pairs of regions figure in the movement of nine bulk commodities. In the case of coal, the flows span a total of 3717 pairs of regions of which 247 pairs account for around 80 % of total flow of the commodity. In foodgrains, the flows span 20592 pairs of regions of which 15274 pairs account for about 80 % of the total movement of the commodity. Similar is the pattern in respect of iron & steel, fertilizers, cement, POL, iron ore, limestone & dolomite and miscellaneous commodities.

Average Leads

The average lead of traffic in all modes was 545 kilometers. Commodity wise average leads in different modes indicate that in the case of POL, iron and cement, the average lead of movement by road is 272 km, 525 km and 358 km, respectively while the leads by rail are much higher at 658 km, 936 km and 557 km, respectively. Mode wise average leads in various commodities are described as under:

Railways: 23 commodities out of 52, display leads of more than 1100 kilometres. The lowest lead is that of sugar cane (88 km) and the highest lead (2489 km) relates to Tyre & Tubes. The overall lead for 52 commodities is 661 km.

Highways: The lowest lead is of sugar cane (136 km) and the highest (810 km) in case of cars/vans. Overall average lead for 52 commodities is 453 kilometres. This lead of 453 km however, includes detours and movements across by-passes; and if calculated based on the shortest path, the lead comes down to 432 km.

Coastal Shipping: The average lead of six commodities, carried by Coastal Shipping ranges between 552 (cements & cement structures) and 2965 km (iron ore), aggregating to an overall average lead of 1450 km for all commodities.

Airways: Miscellaneous commodities forming part of air cargo have an average lead of 1027 kilometres.

MG Rail Traffic

Metre Gauge (MG) system constitutes around 17 % of the total route-kilometers on IR, its share in total inter-regional traffic was only 2.77 million tonnes, representing 0.36 % of the total originating traffic of 768.72 million tonnes during 2007-08. In terms of NTKMs too, the share of MG was 0.31 %, 1597.66 million out of total 508104 million NTKMs.

Of the 27 commodities figuring in originating traffic, ten commodities viz. Miscellaneous goods, sugar & khandsari, limestone & dolomite, containers, building material, chemical manures, rice, wheat & wheat flour, sugar cane and salt constituted 84.48 % of the total traffic. Remaining 17 commodities accounted for the balance 15.52 % of the traffic.

2.3 Multimodal (Container) Traffic

Rail-Borne Container Traffic

The following table summarizes the rail-borne container traffic in ISO/DSO containers:

TOTAL ANNUAL MOVEMENT IN ISO AND DSO CONTAINERS BY RAIL (2007-08)

CONTAINER TYPE	TOTAL TONNES (MILLION)	TOTAL NTKMS (MILLION)
ISO/EXIM	21	25084
DSO/Domestic	6	8824
TOTAL	**27**	**33908**

ISO Containers: Movement of containers relates to 722 pairs of O-Ds in the case of EXIM containers and 1326 pairs of O-Ds in the case of domestic containers.

The table below presents the traffic carried in ISO containers for top 10 pairs of O-Ds:

TOP TEN O-D PAIRS IN MOVEMENT OF ISO CONTAINERS (2007-08)

FROM	TO	NO. OF WAGONS	TONNES ('000)	NTKMs (Million)
NHAVA SHEVA PORT	TUGLAKABAD CONTAINER SDG.	213319	3650	5266
TUGLAKABAD	NHAVA SHEVA PORT	126308	1637	2362
NHAVA SHEVA PORT	DHANDARI KALAN	53135	1069	1897
NHAVA SHEVA PORT	DADRI	67624	1031	1539
DADRI	NHAVA SHEVA PORT	51371	786	1166
DHANDARI KALAN	NHAVA SHEVA PORT	49426	730	1293
CHENNAI HARBOUR ICD	WHITEFIELD	29300	607	198
NHAVA SHEVA PORT	MULUND NEW GOODS DEPOT	27741	506	35
NHAVA SHEVA PORT	NAGPUR JN. C.R.(B.G.)	23715	448	381
ICD SABARMATI	NHAVA SHEVA PORT	27276	433	252
	TOTAL	**669215**	**10897**	**14389**

The above 10 pairs account for 52 % of total tonnage carried in ISO containers. Corresponding share of NTKMs is 43 %.

DSO Containers: Volume of traffic carried by DSO containers between top 10 O-Ds is as under:

TOP TEN O-D PAIRS IN MOVEMENT OF DSO CONTAINERS (2007-08)

FROM	TO	NO. OF WAGONS	TONNES ('000)	NTKMS (MILLION)
Tuglakabad Container Sdg.	Tondiarpet	13232	337	731
Tondiarpet ICD	Tuglakabad Container Sdg.	9436	251	545
Tuglakabad Container Sdg.	Whitefield	9568	249	586
Sanat Nagar Concor	Tuglakabad Container Sdg.	7488	209	348
Tuglakabad	Nhava Shiva	6255	139	200
Panipat Jn.	Nagpur Jn. C.R.(B.G.)	5446	127	149
Turbhe Apm Complex	Tuglakabad Container Sdg.	4803	121	172
Tuglakabad Container Sdg.	Sanat Nagar Concor	5176	103	172
Noli	Nhava Sheva	7760	95	143
Dhandari Kalan	Nhava Sheva	4452	94783	167
	TOTAL	**73616**	**1726**	**3213**

Traffic between the above 10 pairs of points represents 27.03 % of the total traffic carried in DSO containers.

Containers Commodities Profile: Commodities carried in DSO containers include sugar, iron & steel, foodgrains, cement, stones (including gypsum), iron & other ores, salt, limestone & dolomite, coal, fertilizers POL products and others. Their total tonnage was 6.4 million with 8824.5 million associated NTKMs. Commodities moved by EXIM containers include automotive parts, handicrafts, etc.

Road-Borne Container Traffic

Road traffic survey data provided information regarding number of loaded and empty containers between different pairs of regions. The flows span 954 pairs of regions. The total volume of traffic reflected in the flows is 56.60 million tonnes during 2007-08. Movement of containers between top 20 pairs of regions is shown in Table below:

SN	ORIGINATING REGION	TERMINATING REGION	TONNES ('000)	TKM (MILLION)	AVERAGE LEAD (KM)
1	JNPT	Mumbai Port	9,764	586	60
2	Mumbai	JNPT	9,553	477	50
3	Ernakulam	Cochin Port	3,376	101	30
4	JNPT	Mumbai	2,891	173	60
5	Cochin Port	Ernakulam	1,986	59	30
6	Kandla Port	Kachchh	1,276	100	78
7	Coimbatore	Ernakulam	1,230	234	190
8	Ahmedabad	JNPT	962	598	621
9	Kachchh	Kandla Port	809	63	78
10	JNPT	Ahmedabad	738	459	622
11	JNPT	Delhi	655	951	1452
12	Delhi	JNPT	617	896	1453
13	Pune	JNPT	572	106	185
14	JNPT	Pune	526	97	185
15	East-Medinapur	Haldia Port	436	20	46
16	Thane	JNPT	410	25	62
17	JNPT	Thane	333	21	62
18	Calcutta Port	Haldia Port	316	58	185
19	JNPT	Raigad	281	38	137
20	Gautam Budh Nagar	Delhi	276	9	34
		TOTAL	**37007**	**5074**	**137**
		% SHARE IN TOTAL TRAFFIC	**65.38**	**29.25**	

The above container flows between top 20 pairs account for around 65 % of the volume and 29 % of the total NTKMs. The average lead is 137 km. Over 60 % of movement of containers by road is confined to leads up to 150 kilometres. Another 11 % move over leads between 151 and 300 km. The share of container movement beyond 300 km is around 28 %.

2.4 Intra-Regional Freight Traffic

Railways

The Intra-regional traffic by rail during the base year amounted to 96.66 million tonnes, including 43.90 million tonnes of coal movement over the MGR systems of NTPC at Vindhyachal, Korba, Angul and Karimnagar.

Highways

The methodology adopted for assessment of intra-regional traffic by road entailed a sampling approach envisaging conduct of surveys at select representative regions, which would be replicable in the case of other districts/regions with similar demographic, agricultural, mineral, commercial and industrial texture.

All-India intra-regional traffic arrived at on the basis of allocation of sample results to other districts/regions has been estimated at 4640.68 million tonnes.

3. PASSENGER TRAFFIC FLOWS

3.1 Passenger Traffic: RAILWAYS

Historical Perspective

Based on Indian Railways (IR) published data, trend of passenger traffic growth on IR for select years between 1950-51 and 2007-08 is presented in table below. Although the study aims at assessing non-suburban passenger flows, it also gives status of suburban traffic for presenting a total picture of passenger traffic on IR.

HISTORICAL GROWTH IN ORIGINATING PASSENGER TRAFFIC ON IR

(Figures in Millions)

YEAR	SUBURBAN		NON-SUBURBAN					SUBURBAN + NON -UBURBAN	
	TOTAL ALL CLASSES	% GROWTH	UPPER CLASS	MAIL/ EXPRESS	SECOND CLASS ORDINARY	TOTAL	% GROWTH	TOTAL	% GROWTH
1950-51	412		25	52	795	872		1,284	
1960-61	680	65.05	15	96	803	914	4.82	1,594	24.14
1970-71	1,219	79.26	16	155	1041	1212	32.60	2,431	52.51
1980-81	2,000	64.07	11	260	1342	1613	33.09	3,613	48.62
1990-91	2,259	12.95	19	357	1223	1599	-0.87	3,858	6.78
2000-01	2,861	26.65	40	472	1460	1972	23.33	4,833	25.27
2002-03	2,934	2.55	42	513	1482	2037	3.30	4,971	2.86
2003-04	2,986	1.77	42	571	1513	2126	4.37	5,112	2.84
2004-05	3,178	6.43	44	609	1547	2200	3.48	5,378	5.20
2005-06	3,329	4.75	50	668	1678	2396	8.91	5,725	6.45
2006-07	3,514	5.56	58	713	1934	2705	12.90	6,219	8.63
2007-08	3,689	4.98	66	776	1993	2835	4.81	6,524	4.90

Total suburban and non-suburban passenger traffic has increased five times over a period of fifty eight years – from 1284 million originating passengers in 1950-51 to 6524 million in 2007-08. Till the nineteen sixties, share of non-suburban passengers in total originating passengers was much higher than suburban passengers. However, from 1970-71 onwards, share of suburban component of passenger traffic has displayed continued trend of predominance vis-à-vis non-suburban traffic. Share of annual suburban passenger traffic in total traffic during the period between 2002-03 and 2007-08 has ranged between 56.55 % (2007-08) and 59.09 % (2004-05) of the total passenger traffic. There has, however, been no consistency in year on year growth in suburban traffic during the period which has ranged between 1.77 % (2003-04) and 6.43 % (2004-05).

The number of non-suburban originating passengers, on the other hand, has risen by about 39 % during past five years – from 2037 million in 2002-03 to 2.835 million in 2007-08. There has been a marked spurt in number of non-suburban passengers during 2006-07 and 2007-08 even though the annual rates of growth of 12.90 % achieved in 2006-07 came down to 4.81 in 2007-08. This substantial increase in non-suburban passenger traffic can be attributed to increase in number of passenger trains, particularly medium and long distance, increase in frequency of a number of trains and strengthening of number of trains to 24 coach rakes, leading to an overall increase in availability of seats and berths. The extent of increase in availability of seats/berths and resultant annual class wise capacity on the BG during the period between 2004-05 and 2007-08 is presented in Table below

CLASS WISE AVAILABILITY OF SEATS/BERTHS –BG PASSENGER TRAINS

CLASS/ YEAR	NUMBER OF AVAILABLE SEATS/ BERTHS				ANNUAL CAPACITY OF SEATS/BERTHS			
	2004-05	2005-06	2006-07	2007-08	2004-05	2005-06	2006-07	2007-08
1A	3,010	3,244	3,200	3,394	1,098,650	1,184,060	1,168,000	1,238,810
2AC	67,682	70,438	71,438	80,672	24,703,930	25,709,870	26,074,870	29,445,280
3AC	115,564	135,200	152,904	183,177	42,180,860	49,348,000	55,809,960	66,859,605
AC Chair	37,801	36,054	42,581	49,801	13,797,365	13,159,710	155,42,065	18,177,365
First	8,851	7,721	7,095	7,346	3,230,615	2818,165	2,589,675	2,681,290
2nd Sleeper	795,671	836,193	875,705	902,843	290,419,915	305,210,445	319,632,325	329,537,695
Second	1,211,810	1,219,694	1,279,619	1,323,909	442,310,650	445,166,310	467,060,935	483,226,785
TOTAL	2,240,389	2,308,544	2,432,542	2,551,142	817,741,985	842,618,560	887,877,830	931,166,830
Increase (%)	**-**	**3.0%**	**5.4%**	**4.9%**				

Increase in number of seats/berths amounted to 3 % in 2005-06, 5.4 % in 2006-07 and 4.9 % in 2007-08. Increase in annual capacity reflects similar pattern.

The impact of increased availability of seats and berths on number of passengers carried and the occupancy ratio of class wise seats/berths in respect of performance on BG during past four years has been as under:

CLASS WISE PASSENGERS CARRIED & OCCUPANCY RATIO–BG PASSENGER TRAINS

YEAR/CLASS	CLASS WISE NUMBER OF PASSENGERS CARRIED				OCCUPATION RATIO			
	2004-05	2005-06	2006-07	2007-08	2004-05	2005-06	2006-07	2007-08
1A	1,093,700	1,162,500	1,353,600	1,589,500	99.55	98.18	115.89	128.31
2AC	11,439,200	12,051,700	13,375,000	14,077,400	46.31	46.88	51.29	47.81
3AC	17,566,200	20,680,100	26,575,000	31,410,900	41.64	41,91	47.62	46.98
AC Chair	8,981,700	9,345,400	1,141,600	12,961,400	65.10	71.02	71.69	71.31
First	4,852,500	6,258,800	5,596,600	5,688,400	150.20	222.09	216.11	212.15
2nd Sleeper	164,570,100	181,424,600	212,530,400	221,705,600	56.70	59.44	66.49	67.28
Second	1,811,938,900	2,004,375,300	2,288,534,200	2,413,341,000	409.65	450.23	489.99	499.42
TOTAL	2,020,442,300	2,235,298,400	2,559,106,400	2,700,774,200	247.08	265.28	288.23	290.04
Increase (%)	-	10.6 %	12.7 %	5.5	-	7.4 %	8.7 %	1.3 %

Overall occupancy ratio of seats is quite high, ranging between 247 and 290. Expectedly, the occupation ratio of second class seats is exceptionally high, ranging between 410 and 500, indicating persisting overcrowding of second class coaches. Next comes first class with an occupancy ratio ranging between 150 and 222 during the same period. Barring 1AC class, which reflects an occupancy ratio of around 100 and 128, the occupancy ratio of other classes of travel, including 2AC, 3AC, AC Chair and Second Sleeper shows ratios far below 100.

Average Lead: The average lead of non-suburban passengers has increased from 68.8 km in 1950-51 to 229.3 in 2007-08. During last five years, between 2003-04 and 2007-08, the average lead has ranged between 209.4 km in 2003-034 and 229.3 km in 2007-08 as indicated in the table below:

AVERAGE LEAD OF PASSENGERS

(Kilometres)

YEAR	SUBURBAN	NON-SUBURBAN				SUBURBAN + NON-SUBURBAN
	TOTAL ALL CLASSES	UPPER CLASS	MAIL/ EXPRESS	SECOND CLASS ORDINARY	TOTAL	TOTAL
1950-51	15.9	151.6	241.1	54.9	68.8	51.8
1960-61	17.3	203.3	232.4	50.0	72.1	48.7
1970-71	18.9	274.6	244.2	50.8	78.5	48.6
1980-81	20.5	484.0	333.3	56.4	103.9	57.7
1990-91	26.4	462.8	386.5	73.0	147.6	76.6
2000-01	31.1	659.3	471.3	81.7	186.7	94.6
2002-03	30.8	689.7	495.3	95.6	208.6	103.6
2003-04	32.1	676.2	456.4	103.2	209.4	105.9
2004-05	32.7	570.3	449.2	112.1	214.5	107.0
2005-06	32.0	558.9	437.9	112.7	212.6	107.5
2006-07	31.8	585.5	467.3	111.5	215.5	111.7
2007-08	32.5	624.7	495.5	112.6	229.3	118.0

Base Year (2007-08) Non-Suburban Passenger Traffic

Share of PRS (Passenger Reservation System) and Non-PRS Passengers

Passenger reservation on about 3000 trains is provided to around one million passengers daily, at 1372 locations across the country though 5473 terminals. However, out of 2835 million originating non-suburban passengers on IR during 2007-08, the number of passengers booked under PRS (passenger reservation system) amounted to about 276 million i.e. around 9.7 %. The balance i.e 2559 million passengers constituting 90.3 % of total originating passengers belonged to non-PRS category.

Share of Different Zonal Railways

Share of different zonal railways in non-suburban originating passengers is given below:

ZONAL RAILWAY SHARES IN TOTAL NON-SUBURBAN ORIGINATING PASSENGERS ON IR (2007-08)

SN	ZONAL RAILWAY	SHARE IN TOTAL NO. OF ORIGINATING PASSENGERS	PERCENTAGE SHARE (%)
1	Central Railway	184920501	6.52
2	Eastern Railway	124140402	4.38
3	East Central Railway	207187010	7.31
4	East Coast Railway	58073012	2.05
5	Northern Railway	542651303	19.14
6	North Central Railway	140121013	4.94
7	Northeastern Railway	182795404	6.45
8	Northeast Frontier Railway	35887305	1.27
9	North Western Railway	114510411	4.04
10	Southern Railway	296006206	10.44
11	South Eastern Railway	99239907	3.50
12	South Central Railway	260395809	9.19
13	South East Central Railway	92697714	3.27
14	South Western Railway	115070415	4.06
15	Western Railway	282975308	9.98
16	West Central Railway	98283016	3.47
	TOTAL	**2834954736**	**100**

Around 56 % of the total non-suburban passengers originate on five railways viz., Northern, Western, Southern, South Central and East Central Railways, with the Northern Railway topping the list with 19.14 % share. The share of remaining 11 zonal railways in total originating passengers ranges between 2.05 % (East Coast Railway) and 6.52 % (Central Railway). With the Metre Gauge (MG) and Narrow Gauge (NG) systems shrinking in the wake of project uni-gauge, around 93.7% of the passengers originate on the BG. The share of MG and NG amounted to 5.7 % and 0.6 %, respectively.

Class-wise Composition of Non-suburban Originating Passengers

Of the total 2835 million non-suburban originating passengers during 2007-08, the number of passengers booked by Second Class (ordinary) amounted to 1993 million constituting 70.31 % of the total passengers booked by all classes. Share of Second Class Sleeper (Mail & Express) Passengers amounted to 19.55 %, followed by First Class Ordinary (7.57%) and 3 AC class (1.1 %). Rest of the classes of travel accounted for less than one per cent each of the total passengers.

Class wise distribution of passengers is presented in the table below.

CLASS COMPOSITION OF NON –SUBURBAN PASSENGERS (2007-08)

CLASS	NUMBER OF PASSENGERS	PERCENTAGE SHARE (%)
1 AC	1,584,384	0.06
2 AC	14,016,680	0.49
3 AC	31320,808	1.10
First Class (Mail/Express)	1,105,322	0.04
First Class (Ordinary):	214,635,668	7.57
Chair Car	12,960,610	0.46
Second Sleeper (Mail & Expres)	554,069,287	19.55
Second Sleeper (Ordinary)	7,785,836	0.27
Second-Sitting (Mail & Express)	4,594,069	0.16
Second Class - Ordinary	1,993,010,026	70.31
TOTAL	**2,834,664,940**	**100**

Class-Wise Average Lead of Passengers

Class-wise average lead of passengers is given below.

CLASS-WISE AVERAGE LEAD OF PASSENGERS -2007-08

CLASS	AVERAGE LEAD (KMs)
1 AC	611
2 AC	740
3 AC	714
First Class (Mail/Express)	924
First Class (Ordinary):	36
Chair Car	426
Second Sleeper (Mail & Express)	720
Second Sleeper (Ordinary)	345
Second-Sitting (Mail & Express)	404
Second Class - Ordinary	60
All Classes	118

First class (mail & express) passengers have the highest average lead of 924 kilometres, followed by 2 AC passengers (740 kms), second class (mail & express) passengers (720 kms), 3 AC passengers (714 kms) and first class AC passengers (611 kms), in that order. The remaining passengers traveling by other classes reflect average leads ranging between 36 km (first class ordinary) and 426 km (chair car). The overall lead of passengers of all classes is 118 kilometres.

Origin – Destination (O-D) Wise Passenger Flows

PRS passenger flows relate to over 4,64,610 pairs of origins and destinations. Non-PRS passenger flows encompass 6,54,733 pairs of stations. Illustratively, O-D wise passenger flows in respect of both PRS and non-PRS passengers taken together between top-25 pairs of stations are presented below.

PASSENGER FLOWS BETWEEN TOP 25 PAIRS OF STATIONS- PRS & Non-PRS

ORIGIN	DESTINATION	NO. OF PASSENGERS
GORAKHPUR	DELHI/NEW DELHI	2,995,857
DELHI/NEW DELHI	KANPUR CENTRAL	2,616,491
KANPUR CENTRAL	DELHI/NEW DELHI	2,575,539
CHENNAI CENTRAL	BANGALORE	2,554,496
BANGALORE	CHENNAI CENTRAL	2,452,573
DELHI/NEW DELHI	ALLAHABAD	1,893,316
CHENNAI CENTRAL	MADURAI JN	1,789,143
COIMBATORE JN.	CHENNAI CENTRAL	1,733,772
CHENNAI CENTRAL	COIMBATORE JN.	1,670,382
MADURAI JN	CHENNAI CENTRAL	1,666,970
ALLAHABAD	KANPUR CENTRAL	1,618,356
ALLAHABAD	DELHI/NEW DELHI	1,539,652
KANPUR CENTRAL	ALLAHABAD	1,450,609
DELHI/NEW DELHI	GORAKHPUR	1,375,712
LUCKNOW JN.	DELHI/NEW DELHI	1,152,189
DELHI/NEW DELHI	HOWRAH	1,144,530
JAMMU TAWI	DELHI/NEW DELHI	1,037,117
TIRUCHIRAPALLI JN.	CHENNAI CENTRAL	769,497
DELHI/NEW DELHI	MUMBAI CENTRAL	747,414
AHMADABAD JN	MUMBAI CENTRAL	744,732
HOWRAH	DELHI/NEW DELHI	700,073
PUNE JN.	MUMBAI CST	653,581
AMRITSAR JN.	DELHI/NEW DELHI	647,585
CHENNAI CENTRAL	HOWRAH	631,213
MUMBAI CST	HOWRAH	602,610
	TOTAL	**36,763,409**

Future Rail Travel Demand

Assessing passenger travel demand is a difficult task. There is an element of transferability of passenger transport demand between modes. Rail travel demand has, therefore, to be seen as part of overall demand encompassing all the modes viz., railways highways and airways. Comprehensive data for this purpose, particularly for highways, are just not available and creation of requisite data on passenger traffic flows including user preferences is a daunting task requiring extended period of studies entailing huge resources. However, based on past trend for the period 2000-01 to 2007-08, an attempt has been made to project likely growth in number of suburban and non-suburban passengers in future years, up to the horizon year 2025-26.

PROJECTED NUMBER OF PASSENGERS

YEAR	SUBURBAN	NON-SUBURBAN	TOTAL
2012-13	4414	3671	8085
2017-18	5281	4754	10035
2022-23	6318	6156	12474
2025-26	7036	7189	14225

Line capacity and financial constraints have been the impeding factors in augmentation of passenger train services on IR. Notwithstanding the constraints, IR has managed to introduce, during the past couple of years, a number of new trains and extended the run of some trains on heavy demand routes. However, medium and long lead passenger travel demand on the trunk routes continues to be the critical area. This segment of passenger traffic has been showing continuing substantial increase in demand.

The worst affected segment of passengers comprises medium and long lead Second Mail & Express passengers traveling without reservation in limited number of heavily crowded general second class coaches (around 3) provided on each of the long distance mail and express trains run on the trunk routes. The number of passengers in this category is sizeable. During 2007-08, 4.59 million passengers in this category, with an average lead of 404 km, were carried by the railways. The scenario provides a justification for running of long distance mail and express trains on selected corridors comprising only second class unreserved coaches, based on route wise review of the travel demand of passengers in this category,

3.2 PASSENGER TRAFFIC: HIGHWAYS

In the case of road transport, unlike Railways, all-India level databank on passenger traffic flows does not exist. Generation of passenger flow data through physical surveys poses several handicaps. On pragmatic considerations, therefore, only sample passenger flow surveys on selected routes were found feasible.

Considering the above, passenger traffic surveys have been undertaken with the help of State Transport Authorities in respect of major road routes linking 16 identified major cities/state capitals which include Ahmedabad, Mumbai, Nagpur, Raipur, Shimla, Surat, Kolkata, Ranchi, Chandigarh, Delhi, Patna, Vadodara, Pune, Thiruvanthapuram, Chennai, Vishakhapatnam and Panaji (Goa). Passenger survey results emerging from the 16 selected cities in relating to their population are presented in the following table:

PASSENGERS ORIGINATING FROM SAMPLE CITIES - HIGHWAYS

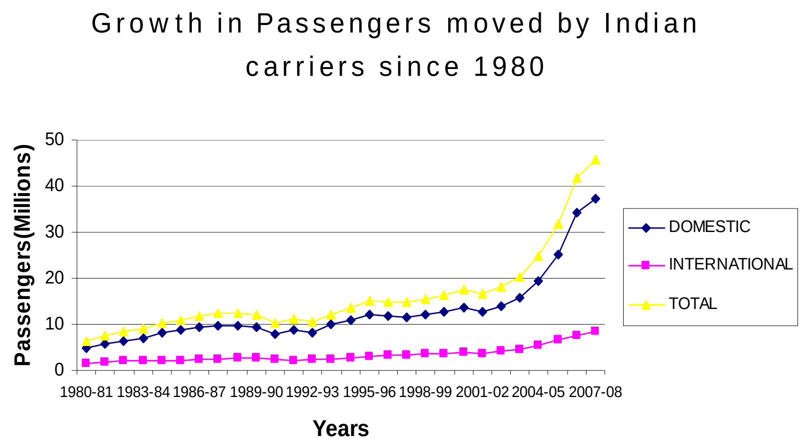
(Figures in '000)

SN	STATE	CITY	POPULATION (2001 Census)	ANNUAL PASSENGERS ORIGINATING FROM THE CITY	ANNUAL EN-ROUTE PASSENGERS	TOTAL ANNUAL PASSENGERS	OVERALL PASSENGER DEMAND
1	Jharkhand	Ranchi	2,784	7,026	2,354	9,380	2.52
2	Bihar	Patna	4,710	8,999	8,186	17,185	1.91
3	Gujrat	Ahmedabad	5,808	5,598	2,647	8,245	0.96
4	Gujrat	Vadodara	3,640	5,909	2,644	8,553	1.62
5	Gujrat	Surat	4,996	3,458	3,643	7,101	0.69
6	West Bengal	Kolkata	15,764	7,041	7,524	14,566	0.45
7	Chatisgarh	Raipur	3,009	4,230	4,221	8,451	1.41
8	Maharashtra	Nagpur	4,051	4,654	2,519	7,173	1.15
9	Himachal Pradesh	Shimla	722	4,149	3,585	7,734	5.75
10	Goa	Panji	1,344	2,671	2,259	4,929	1.99
11	Tamil Nadu	Chennai	4,343,645	35,796	36,518	72,314	0.01
12	Maharashtra	Mumbai	11,978,450	16017	25381	41,398	0.00
13	Maharashtra	Pune	7,232,555	20801	6795	27,596	0.00
14	Andhra Pradesh	Vishakhapatnam	3,789,823	24212	14896	39,108	0.01
15	Delhi	Delhi	13,850,507	119451	50867	170,318	0.01
16	Chandigarh	Chandigarh	900,914	58983	15057	74,040	0.07

3.3 Passenger Traffic: AIRWAYS

Historical Perspective

In a span of 28 years from 1980-81 to 2007-08, number of air passengers has increased by almost seven times from 4.85 million in 1980 to 34.37 million in 2006-07 and 37.21 million in 2007-08. The following graph indicates the trend in total, domestic and international passengers moved by Indian carriers since 1980:



The years from 2002-03 onwards witnessed a spurt in domestic air traffic in passengers coupled with a quantum increase in the number of private carriers.

Base Year Originating Passenger Traffic

During 2007-08, the numbers of originating domestic passengers were 37.21 million (with specific O-D flows) with an associated PKM (Passenger kilometres) of 34.17 billion PKMs and average lead of 918.13 kms. The total number of passengers handled by all the airports was 116.87 million, including 87.05 million of domestic (including traffic on which specific O-D flows are not available) and 29.81 million international passengers. Shares of domestic and international passengers to the total traffic were 74% and 26% respectively. Table below presents the top 10 O-D pairs in the domestic sector:

TOP TEN O-D PAIRS OF AIR PASSENGER TRAFFIC (2007-08)

ORIGIN	DESTINATION	PASSENGERS (MILLIONS)
MUMBAI	DELHI	1.80
DELHI	MUMBAI	1.80
MUMBAI	BANGALORE	0.92
BANGALORE	MUMBAI	0.90
DELHI	BANGALORE	0.85
BANGALORE	DELHI	0.81
MUMBAI	CHENNAI	0.64
DELHI	HYDERABAD	0.58
HYDERABAD	DELHI	0.55
DELHI	KOLKATA	0.55
	Total	**9.40**

In terms of origin-destination, 46 per cent of the domestic passengers travelled between the six metro cities (Mumbai, Kolkata, Chennai, Hyderabad, Delhi and Bangalore). Another 49.32 per cent travelled from the six metro cities to other places. Only 4.3 per cent of passengers travelled between places other than the six metro cities.

Scenarios showing the Inter City Passenger Traffic Flows and Distance Slab Wise Passenger Traffic Distribution are depicted in the tables below:

PASSENGER SLAB AND O-D PAIR-WISE PERCENTAGE OF TRAFFIC

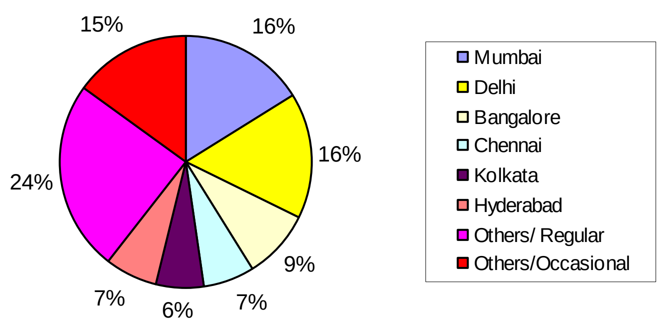
PASS. SLABS	O-D PAIRS	%AGE OF TRAFFIC
Above 5 Lakh	16	34%
1-5 Lakh	77	43%
Below 1 Lakh	444	23%

DISTANCE SLAB WISE DISTRIBUTION OF PASSENGERS

DISTANCE (KMS)	PASSENGERS (MILLION)	% AGE SHARE
0-400	4.6	13.5
401-800	11.0	32.1
801-1200	10.9	31.8
1201-1600	4.4	12.8
Above 1600	3.3	9.6

Airport-wise Passenger Traffic Profile: The total traffic handled by the six cities (Mumbai, Delhi, Bangalore, Chennai, Kolkata, and Hyderabad) is shown in the table below and graphically represented as a pie chart.

Traffic Handled by Major Airports



Mumbai and Delhi featured as airports having highest number of passenger originating and terminating traffic accounting for 1.80 million passengers in each direction.

4. MODAL TRANSPORTATION COSTS

Transport costs include the expenses incurred for moving cargo by different modes of transport and the costs incurred for moving cargo to/from a destination/origin point to the terminal. The former costs, referred to as the modal costs, include all the costs incurred for provisioning the infrastructure, and operation and maintenance of assets. Costs incurred to move cargo to/from terminals including handling, storage and other related costs are incurred either by a consignor or consignee are called user costs.

Main cost, and the most visible element, referred to as financial cost, is the cost borne in cash form: either in long-term for asset acquisition or building or on operating the assets. The financial cost when adjusted for taxes and subsidies gives an indication of economic cost. The economic cost is estimated for each element of financial cost by working out the corresponding shadow price factor. In addition to the economic cost, transportation involves costs not borne by the user or service provider – referred to as social costs. In the study the environmental and accident costs for all modes are included in social costs. The total cost of transportation is sum of economic and social costs, referred to as resource costs. The basic equation for estimating the resource costs is as follows:

Resource Cost = (Economic Cost + Social Cost) = (Financial Cost * Shadow Price Factor + Social Cost)

Keeping the long-term nature of the project, the costs estimated are long-term marginal costs i.e. all the expenses are considered as variable. The costs estimated are comprehensive; including operational and maintenance costs, and asset construction and acquisition costs for moving and fixed assets. Using the above frame work the modal costs were estimated for rail, road, coastal shipping and airways. Similarly, user costs were estimated for accessing the services provided by different modes of transport.

4.1 Modal Costs: RAILWAYS

Freight Transportation Cost

Unit costs for broad gauge railway operations and maintenance were estimated by linking output units to the costs incurred for providing services under 16 heads – repair and maintenance, and overhaul of locomotives, coaches, and wagons; operating costs under 4 different categories; maintenance of track, signal and communication equipment and overhead electric equipment; terminal and other transportation expenditure. Out of these unit costs were estimated for 7 heads at the divisional level, 5 at the zonal level and 4 at the workshop level. The capital cost was estimated for each of these services by considering the 2006-07 costs for acquiring/constructing a new asset.

The costs were converted to 8 types of sectional costs based on three parameters: traction - electric and diesel; gradient - plain and ghat; and track type - single or double and more. The costs estimated for these sectional types are converted into commodity costs by accounting for load-ability and empty return ratio. The unit economic costs for moving different commodities by rail are given in the table below:

UNIT ECONOMIC COSTS FOR THE 10 COMMODITIES

Unit: RUPEES/TKM

SN	ELEMENTS	PLAIN SECTION				GHAT SECTION			
		DIESEL		ELECTRIC		DIESEL		ELECTRIC	
		SL	DL	SL	DL	SL	DL	SL	DL
1	FOODGRAIN	0.63	0.59	0.53	0.52	0.98	0.91	0.80	0.74
2	FRUITS & VEGETABLE	0.65	0.61	0.55	0.53	1.00	0.93	0.83	0.76
3	COAL	0.68	0.64	0.57	0.55	1.04	0.96	0.85	0.78
4	FERTILISERS	0.65	0.62	0.55	0.54	1.00	0.93	0.82	0.76
5	SUGAR	0.63	0.59	0.52	0.51	0.97	0.90	0.80	0.74
6	POL	0.74	0.70	0.62	0.60	1.15	1.06	0.94	0.86
7	CEMENT	0.67	0.64	0.57	0.56	1.02	0.95	0.84	0.78
8	LIVESTOCKS	1.56	1.47	1.30	1.27	2.44	2.26	2.00	1.84
9	IRON & STEEL PROD.	0.69	0.65	0.57	0.55	1.08	1.00	0.88	0.80
10	CONTAINER	0.80	0.76	0.67	0.66	1.23	1.15	1.02	0.94

Passenger Transportation Cost

The unit economic costs for moving passengers were also estimated for different occupancy levels and for different types of services.

SECTIONAL ECONOMIC COSTS FOR MOVEMENT OF PASSENGERS

DESCRIPTION	OCCU-PANCY	PLAIN SECTION								GRADIENT SECTION			
		MAIL/EXPRESS				ORDINARY SERVICES				MAIL/EXPRESS		ORDINARY SERVICES	
		DSL-SL	DSL-DL	ELC-SL	ELC-DL	DSL-SL	DSL-DL	ELC-SL	ELC-DL	DSL-SL	ELC-DL	DSL-SL	ELC-DL
UNITS: Rs. Per Passenger Kilometer													
METRO CITY TO METRO CITY	100%	0.32	0.31	0.28	0.28	0.26	0.25	0.23	0.23	0.36	0.32	0.30	0.27
	76%	0.41	0.39	0.36	0.35	0.34	0.32	0.30	0.29	0.46	0.41	0.38	0.34
	Actual	0.39	0.37	0.34	0.34	0.30	0.29	0.37	0.26	0.44	0.39	0.33	0.31
METRO CITY TO MOFUSSIL CITY	100%	0.31	0.29	0.27	0.27	0.25	0.24	0.22	0.22	0.34	0.31	0.28	0.26
	76%	0.39	0.37	0.34	0.33	0.32	0.31	0.28	0.28	0.43	0.39	0.36	0.33
	Actual	0.37	0.35	0.33	0.32	0.29	0.27	0.25	0.25	0.41	0.37	0.32	0.29
MOFUSSIL CITY TO MOFUSSIL CITY	100%	0.27	0.26	0.24	0.23	0.28	0.26	0.24	0.24	0.30	0.27	0.31	0.28
	76%	0.34	0.32	0.29	0.29	0.35	0.34	0.30	0.30	0.38	0.34	0.40	0.35
	Actual	0.32	0.31	0.28	0.28	0.31	0.30	0.28	0.27	0.36	0.32	0.35	0.32

Note:
Actual Occupancy Ratio Formulae = (Passenger KMs/Vehicle KMs)X (2/Coach Capacity)
Actual Occupancy Ratio For M/E trains = 79%
Actual Occupancy Ratio For Ordinary Services = 86%
DSL: Diesel, ELC: Electric, SL: Single Line, DL: Double Line

4.2 Modal Costs: HIGHWAYS

Freight Transportation Cost

Highway costs have two distinct components: the vehicle operating costs and road infrastructure costs. In financial costing total vehicle operating costs and the taxes paid (such as road tax, goods or passenger tax, etc) and tolls are considered for the study.

In the economic costs the taxes are removed and the road capital and maintenance costs are added. Financial and economic costs were estimated for 108 categories to reflect;

i. Highway Type (3 types) : National, State, and Major District Road;

ii. Highway Terrain (3 types) : Plain, Rolling and Hilly;

iii. Road Width (4 types) : 2 lane, 4 lane, 4 Lane Express and Intermediate; and

iv. Vehicles (4 types) : Tempo, 2 Axle, 3 Axle and Multi Axle Trucks.

Similarly the road construction and maintenance costs were estimated from sample sections based on 2007-08 base year data. Thus costs were estimated for different vehicle types and for different types of sections. The costs were then varied based on the route distances using the vehicle composition data as per distance.

Illustratively, sample vehicle operating cost (economic) for one of the commodity groups, estimated for various distance slabs in PLAIN SECTION covering NH, SH and MDR/ODR are given in the table overleaf:

DISTANCE SLAB WISE VEHICLE OPERATING COST (ECONOMIC)
COMMODITY GROUP - Normal (Sugar, Wheat, Fertiliser Etc.)

(Paise Per Tonne-Km)

SN	HIGHWAY CODE*	UP TO 200 KM	201-400 KM	401-600 KM	601-800 KM	801-1000 KM	1001-1500 KM
1	111	140.0	124.6	119.6	114.7	113.6	111.1
2	112	126.8	113.7	109.4	105.2	104.2	102.2
3	114	117.9	105.7	101.8	97.8	96.9	95.0
4	115	114.9	103.0	99.2	95.3	94.5	92.6
5	116	133.4	119.2	114.5	109.9	108.9	106.7
6	121	148.4	132.8	127.7	122.7	121.5	119.1
7	122	134.4	121.2	116.8	112.5	111.5	109.5
8	124	124.8	112.7	108.7	104.7	103.8	102.0
9	125	121.6	109.8	105.9	102.0	101.1	99.4
10	126	141.4	127.0	122.3	117.6	116.5	114.3
11	131	196.4	175.6	168.8	162.0	160.5	157.3
12	132	166.4	149.5	144.1	138.7	137.3	135.0
13	136	177.9	160.1	154.3	148.6	147.3	144.5
14	134	124.8	112.7	108.7	104.7	103.8	102.0
15	135	121.6	109.8	105.9	102.0	101.1	99.4
* **TERRAIN TYPE:** Plain=1, Rolling=2, Hilly=3 **ROAD TYPE:** NH=1, State Highway=2, MDR=3							
NO. OF LANES: SL=1, DL=2, 4L=4, IL=5, 4L Express Way=6							

Passenger Transportation Cost

Similar to the railway system, road passenger costs were estimated for different types of movement; Metro city to metro city, metro city to moffusil town, and moffusil town to moffusil town. The total costs for passenger movement are tabulated below.

ECONOMIC COST OF HIGHWAYS PASSENGER MOVEMENT

MOVEMENT TYPE	TRIP LENGTH (KM) (RS./PASSENGER)											
	100	150	200	250	300	350	400	450	500	550	600	650
Metro City to Metro City	55.46	71.89	88.31	104.74	121.17	137.60	154.03	170.46	186.88	203.31	219.74	236.17
Metro City to Moffusil Town	50.24	67.15	84.06	100.97	117.87	134.78	151.69	168.59	185.50	202.41	219.32	236.22
Moffusil Town to Moffusil Town	51.79	72.55	93.32	114.08	134.85	155.62	176.38	197.15	217.91	238.68	259.44	280.21

4.3 Modal Costs: AIRWAYS

Passenger & Freight Transportation Cost

Airline costs were estimated using the base data provided by Directorate General Civil Aviation for airline operations and the airport infrastructure construction and maintenance costs were based on data available with RITES and those published by Airport Authority of India. The airline operations and maintenance costs were estimated for various types of expenses categorized into variable and fixed costs. The capital costs were estimated based on new air crafts and also costs of different types of aircrafts. The airport infrastructure costs were based on different types of airport constructions; larger airports for metro cities and smaller airports for smaller cities. The economic costs of the services are tabulated below.

ECONOMIC COSTS OF AIRLINE OPERATIONS

UNIT	ACTIVITY/CENTRE	ECONOMIC COST
Rs Per PKM	Operation	2.65
	Terminal	0.45
	Total	**3.10**
Rs Per TKM	Operation	32.79
	Terminal	6.63
	Total	**39.42**

4.4 Modal Costs: COASTAL SHIPPING

Freight Transportation Cost

Costs for Coastal Shipping, like Airways, can be easily segregated into costs of acquiring and operating ships and the costs of building and operating the ports. The costs for shipping operations were collected from shipping companies using a specially designed schedule. The port costs were estimated from the data provided by Tariff Authority for Major Ports (TAMP). The costs of Coastal Shipping are tabulated below.

ECONOMIC COSTS OF TRANSPORT BY COASTAL SHIPPING

COMMODITIES	RS./TKM
IRON ORE	0.096
POL PRODUCTS	0.509
POL CRUDE	0.277
COAL	0.294
CEMENT	0.372
CONTAINER	0.346

As explained earlier the user costs include all the costs incurred at the terminals for moving cargo. The costs include packing, handling, local carting, and loss and damage in transit. These costs are estimated by analyzing sample situations. The costs estimated for different modes of transport are tabulated below.

ECONOMIC GOODS USER COSTS FOR DIFFERENT COMMODITIES

Unit: Rupees/Tonne

COMMODITY	RAILWAYS	HIGHWAYS	COASTAL SHIPPING
FOODGRAINS	243.70	57.98	-
FRUITS & VEGETABLES	204.42	90.67	-
COAL/OTHER LOOSE MINERAL	199.53	102.24	337.82
FERTILIZERS (UREA)	274.23	189.77	-
SUGAR	250.45	96.41	-
PETROLEUM PRODUCTS	177.15	72.02	176.59
CEMENT	256.32	119.46	205.46
LIVESTOCK	58.64	31.53	-
IRON & STEEL	292.79	135.79	-
CONTAINERS	602.04	469.98	648.90
OTHERS	602.04	469.98	648.90

4.5 Social Cost of Transportation

The social costs consist of environmental and accident costs. The environment cost is based on cost of abatement of green house gas emissions. These were based on studies conducted by Institute of Economic Growth and pollution estimates from Central Pollution Control Board. The costs in turn have two components; one for improvement of fuel emission norms and the other for improvement of fuel quality. The environmental costs of different modes of transport are tabulated below.

ENVIRONMENT COST (PER TONNE-KM)

MODE	COST (in Rs)
ROAD (Freight)	0.202
RAIL (Diesel Traction)	0.051
RAIL (Electric Traction)	0.015
AIRWAYS	0.690
COASTAL SHIPPING	0.030

The accidental cost estimate is based on study conducted by the Asian Institute for Transport Development in 2002, suitably updated for 2007-08. The costs are estimated to be Rs. 0.062/ tkm for road and Rs. 0.001 / tkm for rail.

5. OPTIMAL ANALYSIS

Break-Even Distances

Break-even distance refers to a point of indifference between two choices, i.e. at certain distance user perceives that usage of any options (say rail or road modes) does not matter. The break-even distance is a ratio of difference of fixed costs of two modes to difference of variable costs of the two modes. The fixed costs comprise of user costs incurred per tonne for each mode of transport while the variable costs consist of resource costs incurred per tonne-kilometre. The break-even distances between rail and road for different commodities assessed in the study are indicated in the table below.

BREAK-EVEN DISTANCES (RAIL & ROAD)

SN	COMMODITY	BREAK-EVEN DISTANCE (KM)
1	FOODGRAINS	222
2	FRUITS & VEGETABLES	313
3	COAL & OTHER MINERALS	188
4	FERTILIZERS	167
5	SUGAR	372
6	PETROLEUM PRODUCTS (POL)	126
7	CEMENT	160
8	LIVESTOCK	162
9	IRON & STEEL	173
10	CONTAINERS	307
11	OTHERS	307

It may be pertinent to mention that Break-even distances assessed above are based on Resource Costs and would vary from the lead distances observed in the market as the market phenomena are based on actual freight rates charged.

Optimal Flows

The optimization module integrates the cost and flow data on the transport network of the country. The model was built with two objectives, first one is to model the current flows as they are flowing in the base year and the next one is how the modes respond after the traffic is assigned to rail and road by applying break-evens.

To develop optimal models two methods were followed. In the first case the problem was addressed as a simultaneous allocation and route-mode mix problem. In this scenario the total demand (or supply) from a region is the difference of supply and demand of the region. Thus, if a region has more demand than supply it becomes a net supplier, and if a region has more demand than supply it becomes a net consumer. The model is named Transport Allocation and Route-mode mix Optimisation (TAROP) model. TAROP model underestimates the total transport demand.

To remedy the situation another approach is to model the flows as noticed in the base years. In this approach every flow is modelled as it is without netting at the regional level. This model captures the empirically observed flows. Thus, given the flows of commodities for O-D pairs, this

Model calculates least cost route mix for transporting those commodities for each O-D pair. The model is named Transport Route-mode mix Optimisation (TROP) model.

Gap between Actual & Optimal Modal Mix

A comparative assessment of the impact arising out of the two different scenarios of modal mix i.e. Actual and Optimal (applying Break-Even Distances based on resource cost) on the transport system during the base year (2007-08) in terms of Flows, Cost and Throughput is presented in the table below:

COMPARATIVE IMPACT ASSESSMENT OF THE ACTUAL Vs. OPTIMAL MODAL MIX ON THE TRANSPORT SYSTEM

MODE	IMPACT OF ACTUAL MODAL MIX			IMPACT OF OPTIMAL MODAL MIX		
	FLOWS	COST	THROUGHPUT	FLOWS	COST	THROUGHPUT
	Unit: Million Tons	Unit: Billion Rs.	Unit: Billion TKMs	Unit: Million Tons	Unit: Billion Rs.	Unit: Billion TKMs
Rail	736.2	497.3	498.6	1,704.18	1,423.4	1,168.7
Road	1,558.9	1,555.6	692.3	590.86	244.8	66.5
Coastal	59.7	34.0	90.0	59.72	34.0	90.0
Total	**2,354.8**	**2,086.9**	**1,280.9**	**2,354.8**	**1,702.2**	**1,325.2**
Note: Coastal Flows NOT subjected to the optimal analysis.						

The above assessment indicates that total throughput increased by 44.3 (around 3%) million tonne kilometres while cost decreased by Rs. 38.47 billion (Rs. 38,470 crores), which constitutes about 16% of the total cost incurred on transportation during the year.

Modal Switch

An exercise carried out on the envisaged inter modal switch between rail and road in different commodities of the base year (2007-08) traffic in the two scenarios of actual modal and optimal modal mix revealed the following:

SWITCH OF TRAFFIC BETWEEN RAIL & ROAD IN A COMPARATIVE SCENARIOS OF ACTUAL & OPTIMAL MODAL MIX

SN	COMMODITY NAME	TOTAL FLOWS (In Million Tonnes)	SHIFT FROM ROAD TO RAIL			SHIFT FROM RAIL TO ROAD		
			FLOW (In Million Tonnes)	O-D PAIRS (In Nos.)	TONNES (In %)	FLOW (In Million Tonnes)	O-D PAIRS (In Nos.)	TONNES (In %)
1	COAL	674.6	105.3	4,676	15.6	75.9	167	11.3
2	OTHER & MISC.	667.1	520.1	28,377	78.0	3.0	331	0.5
3	POL	189.6	115.8	5,692	61.1	15.5	255	8.2
4	FOODGRAIN	187.7	86.4	10,182	46.1	2.4	243	1.3
5	IRON & STEEL	169.1	103.3	10,091	61.1	4.0	141	2.4
6	CEMENT	154.8	55.1	5,029	35.6	5.2	159	3.4
7	CONTAINERS	77.5	15.8	689	20.4	1.0	84	1.3
8	FRUITS & VEGETABLES	71.8	37.7	6,460	52.5	0.0	4	0.0
9	FERTILIZERS	54.6	10.4	1,668	19.0	1.9	169	3.4
10	SUGAR	24.8	8.6	1,794	34.5	1.3	70	5.4
11	LIVESTOCK	8.2	4.8	810	58.8	0.003	2	0.0
	TOTAL	**2279.8**	**1063.3**	**75,468**	**46.6**	**110.203**	**1625**	**4.8**

From the table above, it would be seen that while the traffic shift from road to rail is around 1063 million tonnes, about 110 million tonnes shifts from rail to road. Interestingly, the major shift from road to rail is noticed in other commodities, indicating potential for containerisation.

6. TRANSPORT DEMAND FORECASTS

The study aims to unravel the transport demand forecasts not only at the national level but at the link level. However, transport demand forecasts in turn are dependent on the commodity production, consumption, the regional imbalance between the two and the nature of the product. More homogenous and bulk commodities tend to be consumed closer to the centres of production while value added and branded products usually have higher average leads. The transport demand is forecasted for 9 bulk commodities; coal, Foodgrains, Fertilizers, Iron and Steel, Iron Ore, Cement, Petroleum products (POL), Limestone & Dolomite and Salt. In foodgrains separate projections were made for rice, wheat and pulses; making the total commodities into 11. With 2007-08 as the base year, forecasts were made for four horizon years; 2012-13, 2017-18 and 2022-23 and 2025-26. For transport demand forecasting the following factors were considered:

A. Demand of goods (consumption and exports) at national level and at regional level;
B. Supply of goods (production and imports) at national level and regional level;
C. Spatial travel (move from production centres to consumption centres directly or through marketing centres/storage depots), modal split and link assignment; and
D. Estimation of transport demand in terms of tonne kilometre (tkm).

The transport demand projection is done in two stages. In the First Stage the commodity production and consumption projections are worked for different horizon years at the district (regional) level. In the Second Stage, the production and consumption data is used to estimate the transport demand through Optimisation modules. To estimate the production and demand the time is split into three time frames:

A. Short-term (For horizon year 2012-13): period for which more firm estimates of national demand and production are available
B. Medium-term (For horizon year 2017-18): where some official forecasts are available
C. Long-term (For horizon years 2022-23& 2025-26): where forecasting tools are used prominently

The methodology and the process adopted for forecast of commodity production and consumption for specific commodities are different for each term. For the short-term, estimate for the 11th Plan, Documents were used. For the medium-term and long-term where projections made by the Ministries and the Planning Commission were available they were used. In cases where the projections were not available projections made by experts were considered. In the cases where both were not available study team made separate projections. The national level production and consumption estimates are given in the table below and the estimated growth rates in the next table.

COMMODITY-WISE SUPPLY & DEMAND PROJECTIONS (Million Tonnes)

SN	COMMODITY	2007-08	2012-13	2017-18	2022-23	2025-26
1	COAL	489.70	768.97	1,182.42	1,822.86	2,364.77
2	RICE (FOODGRAIN)	82.61	89.32	93.90	98.72	101.73
3	WHEAT (FOODGRAIN)	70.39	72.91	76.00	81.23	84.53
4	PULSES (FOODGRAIN)	15.86	16.84	17.49	18.16	18.58
5	FERTILIZERS	47.79	57.35	67.60	77.84	83.99
6	IRON & STEEL	53.90	79.99	117.46	159.39	189.02
7	IRON ORE	171.00	216.98	276.19	344.09	393.53
8	CEMENT	167.67	257.98	407.98	610.64	764.97
9	POL PRODUCTS	118.83	139.76	170.44	210.31	239.82
10	LIMESTONE/ DOLOMITE	193.33	298.07	469.62	699.68	874.42
11	SALT	14.42	17.08	19.49	21.92	23.18
	TOTAL	**1,425.49**	**2,015.25**	**2,898.59**	**4,144.84**	**5,138.54**

ANNUAL GROWTH RATE PROJECTIONS (In %)

SN	COMMODITY	2007-08 to 2012-13	2012-13 to 2017-18	2017-18 to 2022-23	2022-23 to 2025-26	2007-08 to 2025-26
1	COAL	9.45	8.99	9.04	9.06	9.14
2	RICE (FOODGRAIN)	1.57	1.01	1.01	1.01	1.16
3	WHEAT (FOODGRAIN)	0.71	0.83	1.34	1.34	1.02
4	PULSES (FOODGRAIN)	1.21	0.76	0.75	0.77	0.88
5	FERTILIZERS	3.72	3.34	2.86	2.57	3.18
6	IRON & STEEL	8.21	7.99	6.30	5.85	7.22
7	IRON ORE	4.88	4.94	4.49	4.58	4.74
8	CEMENT	9.00	9.60	8.40	7.80	8.80
9	POL PRODUCTS	3.30	4.05	4.29	4.47	3.98
10	LIMESTONE/ DOLOMITE	9.04	9.52	8.30	7.71	8.75
11	SALT	3.45	2.67	2.38	1.88	2.67
	TOTAL	**7.17**	**7.54**	**7.41**	**7.43**	**7.38**

To estimate the production and consumption at the district level different approaches were used. The base year district level production and consumption was estimated form different sources from either the ministries or industry sources. In the cases where the data are not available input-output tables ere used to estimate the commodity consumed and produced. In commodities like foodgrains state level estimates of National Sample Survey Organisation were used to estimate the district level consumption.

The transport demand forecast depends on the demand, supply and patterns of movement. It is very specific to an economy and is driven by the location decisions of various sectors. As no ready tools are available to predict the location decisions with any accuracy the optimization model output is used to estimate the transport demand. Incremental production and consumption of a commodity was used to run the TAROP model to convert demand supplies to optimal O-D flows. The O-D flow outputs are combined to the previous years O-D flow data to run the TROP model to estimate total transport demand. The total transport demand so estimated is lower as TAROP (Demand-Supply) outputs are lower than the TROP (Origin-Destination) models. Thus the TAROP models are multiplied with the base year market deviation factors to arrive at the total transport demand. The 11 bulk commodities constitute 53 per cent in the base year and assuming the ratio remains same the total transport demand projections are estimated. The total transport demand for the 11 bulk commodities and all the 52 commodities is given below.

COMMODITY-WISE TRANSPORT DEMAND PROJECTION (TKM IN MILLIONS)

SN	COMMODITY	2007-08	2012-13	2017-18	2022-23	2025-26
1	COAL	224254.22	419515.57	724568.56	1147601.62	1502868.27
2	RICE	44438.00	46084.56	48016.63	50154.73	51666.12
3	WHEAT	29753.00	31360.85	34371.60	37445.24	39798.43
4	PULSES	20944.55	22751.98	23968.61	25361.06	26355.49
5	FERTILISERS	37119.82	44404.23	51532.60	58660.96	62932.39
6	IRON & STEEL	81889.00	125594.69	188419.42	258772.81	308607.89
7	IRON ORE	60323.87	87083.75	125362.35	169104.11	172118.95
8	CEMENT	71119.00	114974.39	187992.98	286547.51	361707.25
9	POL	57909.00	96694.57	126271.70	169330.71	200097.39
10	LIMESTONE & DOLOMITE	11948.40	28661.63	55491.68	91099.81	118001.84
11	SALT	9802.24	11814.39	13142.39	14505.47	15054.34
	TOTAL (11 COMMODITIES)	**649501.10**	**1028940.61**	**1579138.51**	**2308584.05**	**2859208.37**
	TOTAL (52 COMMODITIES)	**1214261.29**	**1923634.57**	**2952245.63**	**4315965.39**	**5345373.66**
	CAGR%		**9.64**	**8.94**	**7.89**	**7.39**

CAGR OF COMMODITY-WISE TRANSPORT DEMAND PROJECTION (in %)

SN	COMMODITY	2007-08 to 2012-13	2012-13 to 2017-18	2017-18 to 2022-23	2022-23 to 2025-26	2007-08 to 2025-26
1	COAL	13.34	11.55	9.63	9.41	11.15
2	RICE	0.73	0.82	0.88	0.99	0.84
3	WHEAT	1.06	1.85	1.73	2.05	1.63
4	PULSES	1.67	1.05	1.14	1.29	1.28
5	FERTILISERS	3.65	3.02	2.63	2.37	2.98
6	IRON & STEEL	8.93	8.45	6.55	6.05	7.65
7	IRON ORE	7.62	7.56	6.17	0.59	6.00
8	CEMENT	10.08	10.33	8.80	8.07	9.46
9	POL	10.80	5.48	6.04	5.72	7.13
10	LIMESTONE & DOLOMITE	19.12	14.13	10.42	9.01	13.57
11	SALT	3.80	2.15	1.99	1.25	2.41
	OVERALL	**9.64**	**8.94**	**7.89**	**7.39**	**8.58**

The transport demand for the nine bulk commodities accounts for 53 per cent of the total transport demand in 2007-08. Assuming the ratio remains the same, the demand for transport for the four horizon years is 1.21, 1.92, 2.95, 4.31 and 5.34 trillion TKMs in the years 2007-08, 2012-13, 2017-18, 2022-23 and 2025-26, respectively. The total transport demand is increasing @ 9.64, 8.94, 7.89 and 7.39 per cent in first, second, third and fourth projection periods respectively.

7. CAPACITY UTILISATION & CONSTRAINTS

7.1 RAILWAYS

In the latest available annual line capacity statement (2006-07), Railways have classified the total BG rail network into 1036 sectional links based on available capacity and their utilization. Of these 1036 sections, over 40 % i.e. 415 sections reflect capacity utilization of over 100 %. Another 226 sections or 22 % have utilization levels between 80 % and 100 %. Thus, around 62 % of the total sections have reached saturation levels. 167 sections display capacity utilization level of 60 % to 80 %. Another 228 sections show spare capacities as their utilization lies below 60 %. Capacity on most of the sections on major routes between Delhi–Mumbai Central/ Chhatarpati Shivaji Terminal, Delhi-Chennai and Delhi-Kolkata is severely constrained.

Share of the zonal railways in terms of number of sections in each category of capacity utilization is presented in the table below:

ZONAL RAILWAY WISE SECTIONAL CAPACITY UTILIZATION ON IR

RAILWAY	TOTAL NUMBER OF SECTIONS	LINE CAPACITY UTILISATION (In Total No. of Sections)			
		100% AND ABOVE	BETWEEN 80-100%	BETWEEN 60-80%	BELOW 60 %
CENTRAL	74	31	12	10	21
EASTERN	84	3	33	27	21
NORTHERN	192	77	30	34	51
NORTH EASTERN	27	12	7	3	5
NORTHEAST FRONTIER	25	9	7	7	2
SOUTHERN	97	39	19	13	26
SOUTH CENTRAL	80	59	8	7	6
SOUTH EASTERN	70	18	25	10	17
WESTERN	80	31	19	9	21
EAST COAST	41	7	13	10	11
EAST CENTRAL	79	34	20	10	15
NORTH CENTRAL	52	31	5	9	7
NORTH WESTERN	39	9	10	8	12
SOUTH EAST CENTRAL	28	15	4	4	5
SOUTH WESTERN	47	26	9	5	7
WEST CENTRAL	21	14	5	1	1
TOTAL	**1036**	**415**	**226**	**167**	**228**

In the case of most of the zonal railways, the major routes suffer from capacity constraints and require augmentation of capacity to meet the increasing transport demand in coming years. At present, major concentration of traffic is on the golden quadrilaterals and diagonals of the rail network. Section loading of likely volumes of future traffic shows substantial increase in traffic on the already constrained routes.

A welcome development is the initiation of the process for construction of eastern and western Dedicated Freight Corridors with higher axle load, double line operations, automatic signalling and limited number of stations, which would carry heavier loads at higher speeds leading to lower cost of operation. Feasibility studies undertaken so far have allocated incremental traffic to these corridors. At present there is no clarity about the nature and volume of traffic that may ultimately be shifted from the existing parallel routes to these corridors.

7.2 HIGHWAYS

In the current study, road network has been developed to inter connect all the 623 regional centroids. The road network comprises numerous links and nodes. Each section describes the road characteristics, such as; names of the two nodes, distance (km), terrain (Plain, Rolling or Hilly), type of highways (National Highways, State Highways, Major/Other District Roads) and width in terms of number of lanes.

Since, the above network is developed with a specific objective to provide linkage to all the regions, road sections are not strictly adhering to the road section capacity definition, wherein a section always possesses common road characteristics. Composition of road network under the extant study is summarized below:

SUMMARY OF ROAD NETWORKS UNDER THE PRESENT STUDY (IN KMs.)

ROAD TYPE	ROAD NETWORK 1ST JAN. 2008	COVERED			TOTAL COVERED	% COVERED TO TOTAL
		PLAIN	ROLLING	HILLY		
NH	66,790	49,440	1,021	5,727	56,188	84.1
SH	131,899	79,026	1,130	10,706	90,862	68.9
MDR / ODR	467,763	6,135	86	1,431	7,652	1.6
Rural and Other Roads	2,650,000	0	0	0	0	0.0
TOTAL	**3,316,452**	**134,601**	**2,237**	**17,864**	**154,702**	**4.7**

National Highways which cater to about 80 % of the long distance traffic, out of 66,790 kms of National Highways, about 56,188 kms (84.1 %) have been considered in the network.

It may hoever, be mentioned that unlike in case of the railways where the capacity of the section is defined in terms number of trains that can be run in 24 hours, road capacities are estimated in equivalent passenger car units (PCUs). Design service volumes in PCUs for two-lane roads for plain, rolling and hilly sections are given in table below:

SN	TERRAIN	CAPACITY PCU/DAY
1	PLAIN	15000
2	ROLLING	11000
3	HILLY	7000

Similarly, to estimate average daily traffic in terms of PCUs, IRC recommended factors for various types of vehicles on rural roads have been used as given in the table below:

SN	VEHICLE TYPE	EQUIVALENT PCU FACTOR
FAST VEHICLES		
1	MOTOR CYCLE OR SCOOTER	0.50
2	PASSENGER CAR, PICK-UP VAN OR AUTO-RICKSHAW	1.0
3	AGRICULTURE TRACTOR, LIGHT COMMERCIAL VEHICLE	1.5
4	TRUCK OR BUS	3.0
5	TRUCK-TRAILER, AGRICULTURAL TRACTOR-TRAILER	4.5
SLOW VEHICLES		
6	CYCLE	0.50
7	CYCLE-RICKSHAW	2.0
8	HAND-CART	3.0
9	HORSE-DRAWN VEHICLE	4.0
10	BULLOCK-CART	8.0

Sections Loading- Highways

In accordance with the above, Sections Loading of the base year inter-regional traffic on different road sections has been done for the entire road network, allocating proportionate share for the Inter-Regional Goods Traffic. Section loadings on a sample 4-lane highway sections and expressway sections are tabled overleaf:

SECTION LOADINGS: BASED ON 2007-08 INTER-REGIONAL GOODS TRAFFIC FLOWS

SN	HIGHWAY SECTION	DIST. (KM)	INTER- REGIONAL FLOWS (TONNES)		DESIGNED CAPACITY PCUS/DAY	CAPACITY ASSIGNED TO INTER REGIONAL GOODS TRAFFIC PCUS/DAY	ESTIMATED INTER-REGIONAL PCUS /DAY	AVAILBALE CAPACITY PCU/DAY
			ANNUAL	DAILY				
1	AMBALA-RAJPURA	21	36635933	100372	60000	25200	25789	-589
2	FARIDABAD-BADARPUR BORDER	10	67208582	184133	60000	25200	47310	-22110
3	GURGAON-DUNDA HERA	8	42967888	117720	60000	25200	30246	-5046
4	KARNAL-PANIPAT	34	38421663	105265	60000	25200	27046	-1846
5	PANIPAT-SAMALKHA	24	38919841	106630	60000	25200	27397	-2197
6	PANCHKULA-CHANDIGARH	8	8108555	22215	60000	25200	5708	19492
7	NEW DELHI-KUNDLI X	40	44966876	123197	60000	25200	31654	-6454
8	NEW DELHI-BAHADURGARH	29	35952325	98500	60000	25200	25308	-108
9	NEW DELHI-DUNDA HERA	23	42967888	117720	60000	25200	30246	-5046
10	NEW DELHI-BADARPUR BORDER	29	67208582	184133	60000	25200	47310	-22110
11	SAMALKHA-MURTHAL (SNP X-ING)	30	38919841	106630	60000	25200	27397	-2197
12	DHURUHERA-GURGAON	38	42972253	117732	60000	25200	30249	-5049
13	BAWAL-DHURUHERA	26	35163337	96338	60000	25200	24753	447
14	BALLABGARH-PALWAL	23	55187423	151198	60000	25200	38848	-13648
15	MURTHAL(SNPX-ING)-RAI X	9	37741602	103402	60000	25200	26567	-1367
16	LONI BORDER-GHAZIABAD	12	41791405	114497	60000	25200	29418	-4218
17	JALANDHAR-PHAGWARA	22	30733683	84202	60000	25200	21634	3566
18	LUDHIANA-PHILLAUR	13	40457516	110843	60000	25200	28479	-3279
19	MANDI GOBINDGARH-KHANNA	8	30702884	84117	60000	25200	21613	3587
20	AGRA-FATEHPUR SIKARI	37	10172251	27869	60000	25200	7161	18039
21	ALIGARH-HATHRAS	34	4664773	12780	60000	25200	3284	21916
22	ALLAHABAD-ALLAHABAD X 1	12	26029723	71314	60000	25200	18323	6877
23	ALLAHABAD-ALLAHABAD X 2	8	5433328	14886	60000	25200	3825	21375
24	ALLAHABAD-ALLAHABAD X 3	10	21136478	57908	60000	25200	14879	10321
25	ALLAHABAD-MIRZAPUR	79	194560	533	60000	25200	137	25063

A daily capacity of 60,000 PCUs for 4-lane carriageway has been considered.

Sections with negative sign denote sections with exhausted capacities.

It may however, be noted that many of the 4-lane road sections are already under various stages of up-gradation to 6-lanes and above. Further, as the traffic flows are generated by using short distance paths, some of the sections may show unexpected results because of the distance advantage on a particular corridor.

8. INFERENCES & BROAD RECOMMENDATIONS

Based on the findings enunciated in the preceding columns of this chapter, some important inferences of the study and considered recommendations, which are relevant to the focal concern of the study and; which to a fair degree of finality establish the present status of the transport sector are enumerated below:

8.1 There has been a quantum increase in the inter-regional freight traffic during the intervening two decades since the last study conducted in 1986-87. The total freight traffic has grown by over five times with Railways recording growth of three times, Highways traffic by about seven times and Coastal Shipping by over ten times. Coupled with a general hike in the average leads, the overall throughput has resultantly gone up by over four times. There are clear signs of more aggressive growth in the future years.

The resultant stress of the above growth in traffic on the system capacities of various modes is clearly visible, indicating severe capacity constraints, particularly in the dense corridors. Even at the present level of traffic, 62% of the total sections on IR have reached saturation levels with the major diagonals exceeding the point of saturation. Similar situation is in the case of Highways in which almost all major corridors are either saturated or close to saturation. Considering the snowballing of demands for transport in the horizon years, capacity constraints would be a real issue, which will require urgent attention. The recent government initiatives in developing national highways through Public Private Partnership route have yielded appreciable results in terms of capacity enhancement in the road sector. For the railways, considering the massive capacity enhancement required, huge investments involved and physical challenges of implementation, a concerted shift towards the PPP route for infrastructure development would be highly desirable.

8.2 The share of freight traffic by coastal shipping is low in spite of a long length of coastline. Poor connectivity in terms of both rail and road, particularly for minor ports has been a major constraint. Considering the fact that coastal shipping is one of the cheapest modes of bulk transportation, having the potential of contributing effectively towards realisation of optimal modal mix it needs to be encouraged as a viable alternative. Incidentally, this would also provide the much relief to other surface modes already under pressure. To this end, the current port connectivity projects need to be extended to include minor ports and accorded top priority. Further, for rail connectivity to ports, development through PPP route as already indicated is expected to yield appreciable results.

Similarly, in case of the airways, there are clear signs of promising prospects for the sector in terms of both passenger and freight. Severe capacity constraints are consequently foreseen in the airport infrastructure particularly in the metro cities, which would need urgent attention.

8.3 The study has additionally brought out a huge volume of intra-regional traffic estimated for the first time. Incidentally, the estimated 4640.68 MT of intra-regional traffic amounts to two times the volume of total inter-regional traffic by all modes. Keeping in view the huge volume of intra-regional traffic and resultant need to develop the feeder roads for the arteries, the current road development programmes under the JRY and PMGSY schemes are initiatives in the right direction and need to be carried further.

8.4 There is a discernible gap between the way in which the traffic is actually moving today and the way in which it should move. A comparative assessment of the impact arising out of the two different scenarios of modal mix i.e. Actual and Optimal (applying Break-Even Distances based on resource cost) on the transport system during the base year (2007-08) in terms of Flows, Cost and Throughput reveals the following scenario:

COMPARATIVE IMPACT ASSESSMENT OF THE
ACTUAL Vs. OPTIMAL MODAL MIX ON THE TRANSPORT SYSTEM

MODE	IMPACT OF ACTUAL MODAL MIX			IMPACT OF OPTIMAL MODAL MIX		
	FLOWS	COST	THROUGHPUT	FLOWS	COST	THROUGHPUT
	Unit: Million Tons	Unit: Billion Rs.	Unit: Billion TKMs	Unit: Million Tons	Unit: Billion Rs.	Unit: Billion TKMs
Rail	736.2	497.3	498.6	1,704.18	1,423.4	1,168.7
Road	1,558.9	1,555.6	692.3	590.86	244.8	66.5
Coastal	59.7	34.0	90.0	59.72	34.0	90.0
Total	2,354.8	2,086.9	1,280.9	2,354.8	1,702.2	1,325.2

Note: Coastal Flows NOT subjected to the optimal analysis.

The above table, reproduced for its referral value in the context, indicates that total throughput increased by 44.3 (around 3%) million tonne kilometres while cost decreased by Rs. 38.47 billion (Rs. 38,470 crores), which constitutes about 16% of the total cost incurred on transportation during the year.

The above exercise has indicated a significant scope for modal switch from road to rail in the case of Miscellaneous/Other Commodities up to the extent of 78%. Incidentally, the total quantity of potential traffic for switch (520 MT) in this commodity group constitutes almost 50% of the total palpable quantity of modal shift from road to rail (1063 MT), reinforcing the case in favour of a concerted on developing domestic container movement in a big way. Incidentally, there has been a significant growth in the multimodal container traffic particularly in the recent years, which reinforces the success quotient of future initiatives in this direction.

8.5 Other commodities in which there is strong potential for modal switch are Iron & Steel (61%), POL (61%), Fruits & Vegetables (52.5%) and Cement (35.6%). These commodities constitute a significant percentage of such traffic on which optimal modal mix can effectively be induced. The situation calls for a serious attention towards developing of a country wide network of Multi Modal Logistics Parks (MMLPs). The global experiences with MMLPs elsewhere have proved the effectiveness of the concept as an instrument to achieve the goal of ideal modal mix ensuring synergic operation of different modes functioning within their individual strengths of domain competence.

8.6 Road transport operations involve high fuel costs and are subject to handicaps of congestion, accidents, en-route impediments besides the high quotient of environmental pollution. RO-RO Operations which has been successfully tried in the Konkan Railway Corporation (KRC) could provide an effective solution. Such a system can be effectively designed to suit the mutual interests of the two modes and could eventually make a marked difference in the overall resource cost incurred on transportation. However, considering the related issues of technological modifications, rail tariff, etc. and the perceived operational constraints, it would be advisable to try it on a pilot basis to begin with.

8.7 Analysis of break-even distances and optimal flows in the study has brought out a visible criticality of 'User Cost' (particularly the handling cost) in establishing the cost effectiveness of a mode to the user. Further, amidst the fast growing concern for environment, Social Cost has also emerged as a vital factor in ascertaining the resource cost of transportation by a mode.

Concurrently, there are visible signs of technological innovations in all the modes in terms of higher powered locomotives, high speed wagons & coaches, multi-axle vehicle road vehicles, energy efficient aircrafts and ships etc. Considering the positive impact of such initiatives on improving the efficiency and safety in provision of services, minimizing the harmful impact on the environment and above all the cost to the users, it is necessary to emphasize technological modernization and up-gradation of technology in the transport sector through suitable policies and effective enforcement mechanisms.

8.8 Environment and climate change are one of the most serious challenges facing mankind today. Since the transport sector would continue to be a major contributor to environmental pollution in the future too, it has a very compelling mitigatory role. The total economic potential for efficiency in the transport sector from the environment angle is estimated to be about 2550 million tonnes CO2 for a carbon price up to $100 /tCO2-eq.

Volume of road traffic would multiply by about four-folds in the next 20 years. Air-growth rate would be about 15 %. Air passenger traffic would increase four-folds over the next twenty years. 30 % of world trade (by value) moves by air. On the basis of mode-wise share of originating loadings in 2007-08, the indicative CO2 emissions from the major modes are:

Freight Transport (gm/tkm)		Passenger Transport (gm/pkm)	
Road	160	Passenger Cars	175
Rail	29	Rail	75
Shipping	31	Airways	229

There should be a policy framework to facilitate technology development and dissemination in sync with the extant carbon credit system, which would eventually trigger the movement towards a low-carbon economy. To this end, possibility of incentives/investment in carbon trading for environment friendly transport modes could also be explored.

8.9 Operation and management of different modes of transport is characterized by a varying mix of institutional framework, acting independent of each other. In the given situation, while the Planning Commission does weigh modal roles and needs for making investment allocations in the transport sector, different modes do seek to develop as isolated entities within the framework of their individual modal interests.

This above scenario would have been in order except for the implications of individual modal developments not being necessarily in sync with the national concern for an optimal modal mix and formulating an integrated policy for development in the sector. There is thus need for instituting a Central Transport Coordinating Agency for planning, monitoring and selective regulation on policies/projects related to development of an integrated transport system.

8.10 The difficulties faced in sourcing data in execution of the present study have reinforced the crying need for setting up a system of regular collection of data on the sector, required as an important input for planning. Absence of accurate data of the present directions, distances and volumes of passenger and freight traffic makes predictions on the quantum and profile of future demand for transport. The need is even more critical because changes and rates of growth are not easy to predict as they are dependent on such a multiplicity of factors. The scenario therefore, calls for setting up of a mechanism for monitoring growth and developments in the transport sector on a regular basis for ensuring a systematic and continuous process of data availability, required to support decision making at various levels.