Chapter 1

Introduction

Study Objective, Scope & Methodology

1.1 PRELUDE

Growing Relevance of Transport Sector

It is now a common knowledge that transport has evolved out of its traditional garb of a 'derived demand' to be recognised as the 'harbinger of growth'. Barring a few special circumstances of connectivity needs for the movement of mineral resources, it is no longer the growth that ordains 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 thus emerged as one of the select sectors that has the distinction of being able to provide support the economic growth both as a direct contributor as well as an effective catalyst. This has 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 consonance 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 in transport.

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 based on optimum utilisation of the domain competence of each mode, 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 will 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 etc.

1.2 BACKDROP

Overview of the Transport Sector

The mechanized modes of transport constituting the transport sector in the country comprise Railways, Highways, Coastal Shipping, Airways, Inland Waterways, Pipelines and, in a limited measure, the Ropeways. Their operation and management is characterized by a varying mix of institutional framework, there being no central monitoring authority/institution for regulating coordinated operations and integrated growth of different modes of transport. Even among the modes, only Railways is centrally administered under the Ministry of Railways, Government of India, which provides complete wherewithal for running its freight and passenger services. In the case of Highways, however, while infrastructure like the National Highways, State Highways and other roads are provided and maintained by various Central and State Governments agencies, operations of the vehicles i.e. trucks and buses are mostly privately owned, except for buses operated by State Road Transport Undertakings, mainly in the area of passenger transport.

Same is the case with Coastal Shipping and Airways. While the port infrastructure is provided by the Central Government (Ministry of Shipping, Road Transport & Highways) for major ports and by respective State Governments in the case of non-major ports, Coastal vessels are owned and operated by private enterprises. Civil aviation, which was earlier the preserve of the Ministry of Civil Aviation, Government of India, has seen a growing number of private entrepreneurs entering the field of air transport in the wake of increasing pace of economic liberalization in the country. Inland water transport, despite a long history of relevance as a popular mode of transport, had practically fallen to disuse over time. The Inland Waterways Authority of India (instituted by the Government of India vide IWAI ACT 1985 (82 of 1985) is actively involved with development and regulation of Inland Waterways of the country. Pipelines, mainly used for transport of liquid fuels and gas apart from ore slurry, present an important expanding mode, operated & managed both by Government and private agencies.

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. Such a situation would have been in order, except for the implications of individual modal developments not being necessarily in sync with the national economic policy framework for the overall development of the transport sector.

Data Availability Constraints

For modes which are managed and/or operated by Government Departments and agencies, operational and cost data can be had with some effort. However, in other cases, availability of data is a major constraint. For example, in the case of Highways, whereas road network information is available from related government agencies, operational data in relation to movement of goods and passengers are just not available and need to be generated through country wide field surveys. Similarly, in the case of Coastal Shipping, while the ports do maintain data in relation to volumes transported, information in regard to commodity specific origin and destination of traffic flows and cost data are not readily available and field surveys become necessary for the purpose.

Generating Traffic Flow Data: Past Efforts

A number of attempts have been made in the past for assessing traffic flows in select regions. In 1959, the Committee on Transport Policy & Coordination (CTPC) organized field surveys for generation of commodity flow data on six important routes connecting major cities. This was followed by another survey undertaken by the Ministry of Transport in 1963 with enlarged scope covering 16 important routes. These surveys estimated flows across identified routes but did not provide information on commodity wise O-Ds. Subsequently, during 1965-67, the Joint Technical Group (JTG) for Transport Planning, Planning Commission, attempted to assess regional commodity flows. The Group's work, however, remained incomplete. Thereafter, some of the States attempted to carry out such surveys. These exercises, though useful, were confined to limited sample surveys and lacked comprehensiveness in terms of geographic and modal coverage.

Taking cognizance of the need for creating adequate data base for planning integrated development of the transport sector, the Planning Commission had commissioned RITES Ltd. to undertake two major studies on modal costs and traffic flows in respect of mechanized modes of transport viz. Railways, Highways and Coastal Shipping on two occasions in the past - in 1978 and 1986 - results of which provided an important input for formulation of national transport policy for investment allocations for the transport sector.

Changing Traffic Operations Pattern: Need for Fresh Look at Emerging Transport Demand-Supply Scenario

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 and technological developments with associated growth in performance levels of different modes of transport. Rail network has expanded from 61836 route kms in 1986 to 63327 kms in 2006-07. In the wake of project uni-gauge, major part of metre gauge lines have been converted to broad gauge and the process is continuing, leading to availability of parallel routes for improved operations management. With the phasing out of steam locomotives, diesel and electric traction are the main modes of traction. Electric traction has extended from 6919 route kms in 1986 to 17786 in 2006-07. Capacity of wagons and coaches has also improved owing to design improvements. With increasing demand, Railways' originating goods traffic has shown over three-fold increase, from 255.4 million tonnes in 1986-87 to 795.48 million tonnes in 2006-07.

Likewise, the number of originating passengers has gone up from 3594 million in 1986-87 to 6219 million in 2006-07. Length of roads has increased from 1.72 million kms (including 0.1 million kms of National and State Highways) in 1986 to 3.62 million kms (including roads under JRY-Jawahar Rozgar Yojna and 0.2 million kms of National and State Highways) in 2004. Operating performance of Airways and, to a certain measure, Coastal Shipping has also improved.

Increasing containerization of goods has given a further boost to traffic. Sizeable network of Pipelines has come up and IWT is in revival mode. Up-gradation of transport infrastructure, coupled with developments in other related areas of economic activity have led to significant changes in pattern of traffic flows. Consequently, not only the overall demand for transport has grown phenomenally, but new concepts and preferences towards inter/multi-modal mixes have also emerged.

In the emerging scenario, traditional demand-supply linkages, modal options as well as route specific volumes of traffic have undergone substantial changes and are likely to change further owing to ongoing and anticipated developments in the transport sector. Some of these include:

- Increasing containerization of commodities leading to an annual growth rate of around 14% in containerized movement of goods which has resulted in a more secure and speedier flow of traffic.
- In the Railway sector, the Indian Railways' initiative at throwing open the operation of container trains by private parties, an activity which has so far been the monopoly of CONCOR, is expected to have a major impact on freight traffic movement and tariffs in a competitive market. Indian Railways has mooted an ambitious proposal for augmentation and up-gradation of its assets and expansion of its network at an estimated cost of Rs 5 lakh crore. This includes the proposal for creation of six dedicated high axle load freight corridors along the golden quadrilaterals and its diagonals, viz. Delhi-Mumbai, Mumbai-Chennai, Chennai-Kolkata, Delhi-Kolkata, Delhi-Chennai and Mumbai-Kolkata. Of these, the process for construction of the Delhi-Mumbai and Delhi-Kolkata corridors has already been initiated. These developments will have long term impact on quantitative and qualitative operational performance of the Indian Railways and, consequentially, affect competitive role of road transport as well.
- An SPV, Delhi-Mumbai Industrial Corridor Development Corporation (DMICDC) has been formed for implementation of the project for developing industries in the band of 150 to 200 kilometres around both sides of the proposed 1500 km long rail freight corridor between Delhi and JNPT. The dedicated rail freight corridor passes through the States of Delhi, Haryana, Uttar Pradesh, Rajasthan, Gujarat and Maharashtra. The Government of Haryana has already approved the participation of HSIIDC (Haryana State Industrial and Infrastructure Development Corporation) in the equity of the SPV to the extent of Rs. 40 lakh. This project, on completion, is likely to give further boost to traffic movement by rail.
- Another development which has far reaching implications in demand-supply linkages for iron & steel in future is the proposed installation of around 21 steel plants with a combined capacity of around 32 million tonnes in Palaspanga, Kalinganagar, Angul, Paradip and Sambalpur cluster in Orissa.
- Work on a major road development project linking Delhi-Kolkata-Chennai-Mumbai by six lane Super Highways and North-South corridors linking Srinagar (Jammu & Kashmir) and Kanyakumari (Tamil Nadu) and East-West corridor connecting Silchar (Assam) and Porbander (Gujarat) is in progress, apart from the ongoing process of expansion and strengthening of State Highways, major district roads and addition of rural roads. Completion of these works would lead to smooth and speedier flow of road traffic, resulting in lower transit times as well as savings in fuel consumption.
- There have been accelerated developments in ports and aviation sectors as well as spatial dispersal of new industries and commercial activity. While almost all the major ports are in an expansion mode, new ports at Ennore, Pipavav and Mundhra have developed in a big way. Proposals are also afoot for upgrading the minor ports of Hazira, Rozi Bedi, Simar, Vansi Borsi on the west and Gangavaram, Krishnapatinam, Nizamapatnam and Gopalpur on the east coast through private participation. In the wake of liberalisation of the economy and

with the entry of private operators in the aviation sector, despite the current slow down, Airways are expected to undergo considerable expansion due to consolidation and intra-company integration that would eventually take place.

In the emerging scenario, these factors would have a bearing on general pattern of movement of goods and passengers, modal shares and transport costs, both present and future. The situation, therefore, calls for a fresh look at the emerging supply-demand scenario in the transport sector and for building a vision for future growth of the sector.

1.3 PRESENT 'TOTAL TRANSPORT SYSTEM STUDY'

Need for the Study

Against the above backdrop and the significant changes in the transport sector and consequent re-orientation of traffic patterns as well as modal shares and associated costs in movement of goods and passengers, the Planning Commission has considered the need for creating data and information base for establishing present operational status and associated costs of major modes of transport along with enunciation of the likely future scenario, for the purpose of perspective planning. To this end, the Commission has entrusted RITES Ltd, which had conducted the two earlier studies of like nature, with Total Transport System Study encompassing the four major mechanized modes of transport in the country viz. Railways, Highways, Coastal Shipping and Airways. It would be pertinent to mention here that the term 'Highways' in context of the extant study necessarily refers to the road sector rather than the popular perception of the term denoting National Highways.

Objective and Terms of Reference

Objective

As indicated, the Total Transport System Study is a broad based study, envisaging not only establishing the present operational status and associated costs of transportation by different modes but also visualisation of the likely future scenario in the wake of identifiable developments in the sector. Accordingly, the broad objectives of the study are:

- To generate & analyse inter-modal transport resource costs & traffic flows covering the four major modes of mechanized transport- 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.

Terms of Reference

Terms of reference for the study are as under:

- Generation and analysis of inter-regional and intra-regional origin-destination, mode-wise traffic flows, both freight and passenger traffic. Subsequently, this would mean generation and analysis of:
  - 'Inter-regional' and 'Intra-regional' traffic-flows for Highways;
  - 'Inter-regional' traffic flows for Railways and Airways; and
  - Commodity flows by Coastal Shipping.
- Determination and analysis of modal transport costs in terms of both resource cost and financial cost for each of the above modes of transport, incorporating existing as well as future transport technological advancements.
- Compilation of a 'comparative analysis' of the growth in freight and passenger traffic for each mode of transport during the past thirty years, based on the findings of the proposed study and assessment of the published documents/studies in the past.

- Total transport demand and share of each mode of transport as it exists today and likely to be for the horizon years 2007-08, 2012-13, 2017-18 and 2025-26 in terms of:
  - Major bulk commodities and select non-bulk commodities in freight traffic; and
  - Passenger traffic.

  This would also require an assessment of the growth in multi-modal (container traffic) and its possible impact on the overall traffic scenario in future.
- Indicate the desirable share of each mode of transport on the basis of cost consideration.
- The policy measures required to achieve the desired inter-modal mix.
- Any other work/information/analysis relevant to the broad objectives of the study and above-mentioned terms of reference.

Additionally,

- Any other important work/information/analysis, which may have a bearing on the subject of the study.

Scope and Coverage

Geographic Coverage: The geographic coverage of the study spans across the whole of India, excluding the islands of Andaman & Nicobar and Lakshdweep.

Modal Coverage: The focus of the study is on assessment of traffic flows and modal costs, both present and future, in respect of the four major modes of transport viz. Railways, Highways, Airways and Coastal Shipping. The present brief does not aim at identical studies in respect of Inland Water Transport and Pipelines. Notwithstanding this exclusion, in assessing the total traffic flows, contribution of these modes has been considered. However, no detailed estimation of modal cost or traffic projections has been attempted in their case.

Main Tasks of the Present Study

Flowing from the above terms of reference, the scope of the study envisages:

Modal Traffic Flows - Assessment and Analyses

- Generation and analysis of inter-regional and intra-regional freight traffic and passenger traffic flows by Highways.
- Generation and analysis of inter-regional freight and passenger traffic by Railways.
- Generation and analysis of inter-regional freight and passenger traffic by Airways.
- Generation and analysis of inter-regional commodity flows by Coastal Shipping.

Historical Growth of Traffic: Compilation of a comparative analysis of the growth in freight and passenger traffic, for each of the above modes of transport during the past thirty years, based on findings of the present study and assessment of published documents/studies in the past.

Traffic Projections: Assessment of total transport demand and modal shares emerging from the present study and future traffic projections for major bulk commodities and select non-bulk commodities for the horizon years 2007-08, 2012-13, 2017-18 & 2025-26.

Modal Transport Costs: Estimates of transport cost for each of the four identified modes of transport, both in terms of resource cost and financial cost, taking into account the present as well as future technological advancements in transport sector.

Modal Shares in Traffic & Policy Measures: 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.

Additionality in Coverage of the Present Study vis-à-vis Earlier Studies

The present study has a wider and more comprehensive scope compared with the earlier studies. Broadly, the elements of additionality include:

- Coverage of an additional mode i.e. Airways.
- Inclusion of intra-regional goods road traffic survey in the scope necessitating increase in number of survey check-posts to 1073 (including 709 inter-regional and 364 intra-regional) as against 551 check-posts in the earlier study.
- Increase in number of seven-day round-the-clock road traffic survey check-posts from 56 in the earlier study to 217 (including 91 intra-regional) in the present study.
- Special focus on multi-modal (container) traffic in view of increasing trend in the containerization of goods.

1.4 STUDY TEAM - ORGANISATIONAL STRUCTURE

Study Team

For a study of this magnitude, specific tasks have necessarily to be assigned to separate study groups with a view to ensuring focused attention and successful completion of the study. In this context, the study team comprising RITES professionals was split into the following task-specific groups, whose activities were guided by the National Coordinator for the study:

- Study group for generation/analyses of freight and passenger traffic flows by Railways.
- Study group for generation/analyses of freight and passenger traffic flows by Highways.
- Study group for generation of operator cost data, both freight & passenger, and estimation of operator cost in respect of Railways.
- Study group for generation of operator cost data, both freight & passenger, and estimation of operator cost in respect of Highways.
- Study group for generation of data and estimation of freight and passenger user costs for Railways and Highways.
- Study group for generation/analyses of freight traffic flows by Coastal Shipping and generation of operator & user cost data and estimation of operator and user costs.
- Study group for generation and analyses of freight & passenger traffic flows by Airways and generation of requisite operator & user cost data for estimation of operator & user costs.
- Study group for commodity specific forecasts for identified horizon years.
- Multi-disciplinary expert group for formulating findings and recommendations.

Support and Assistance

For drawing benefit from the knowledge and experience of acknowledged experts in the transport sector and improving quality content of the study, a 'Project Advisory Board' comprising the following field experts, retired apex level government officials and academicians from premier educational institutions was instituted:

1. Shri M. Ravindra, former Chairman, Railway Board and Member, TRAI
2. Shri R.K. Thoopal, former Member Traffic, Railway Board
3. Dr. Prem Vrat, VC, UP Tech. University, and former Director, IIT, Roorkee
4. Dr. G. Raghuram, Professor, Indian Institute of Management, Ahmedabad
5. Dr. S. Sriraman, Professor, Transport Economics, Mumbai University
6. Shri S. Nautyal, former Chairman, National Highways Authority of India (NHAI), GOI
7. Shri D.T. Joseph, former Secretary, Ministry of Shipping & Ex DG, Shipping, GOI
8. Shri Brijesh Kumar, former Secretary, IT and CMD, Air India/Indian Airlines
9. Shri Anil Baijal, former Secretary, Urban Development, GOI

In addition, Shri B.N. Puri, Principal Adviser (Transport) from the Planning Commission was a permanent invitee to the deliberations of the Advisory Board. During the execution of the study, the in-house team of experts had five formal sessions with the Advisory Board apart from numerous informal interactions with the members at various occasions on need-specific basis. Guidance and suggestions arising out of the discussions in these sessions have subsequently contributed to the profile and value enhancement for this landmark project and in consolidating the results and recommendations of the Study.

Another value addition to the study came from the five periodic interactive sessions with the High Powered Steering Committee constituted by the Planning Commission, which helped the study team to firm up the directions on some complex issues and affect mid-course corrections, where ever necessary.

It would be pertinent to mention that in conducting the two rounds of nation-wide road traffic surveys the study team had to draw heavily on the proactive support and assistance extended by all concerned State Governments. Similarly, collection of vast secondary data/inputs required for the study was facilitated by the unflinching cooperation received from many Central Government Departments and a number of governmental and non-governmental agencies. In obtaining the above support, the Transport Wing of Planning Commission extended the pivotal support, as and when required.

1.5 APPROACH & METHODOLOGY: GENERATION OF TRAFFIC FLOWS

Conceptual Framework: Regions and Commodity Groups

The defining parameters for identification of regional framework for establishing traffic flow linkages for different commodity groups as well as grouping of commodities for the purpose of cost estimation have been conceived as under:

Delineation of a Region: A region is conceived as coterminous with a Revenue District. However, taking into account other industrially and commercially active locations, additional regions have been identified in respect of major cities, ports, industries, etc. Thus, as against 586 Districts in the country, the number of Regions identified is 623. A demand/supply centroid, representing each region, has been identified. A detailed listing of the identified regions is presented in **Annexure 1.1** (contained in Annexure Volume - 1).

Inter-regional Traffic: Conceived as traffic flowing between different regions. Intra-regional Traffic on the other hand is conceived as the traffic originating and terminating within a region.

Commodity Grouping: The traffic flow data maintained by the Railways, Airlines and Coastal Shipping authorities permit a highly disaggregated identification of the commodities carried by these modes. In the case of road transport, however, there is no such comprehensive commodity flow data bank. Data in this case are required to be collected through road side sample surveys at identified check-posts spread across the country. For ensuring as accurate commodity identification as possible as well as keeping the O-D matrices within manageable limits, all the commodities have been grouped into 52 commodity groups for the purpose of comparative studies (Annexure 3.2).

It is necessary to point out that while the 52 identified commodity groups would be relevant for comparative analysis of traffic flows by rail and road, only limited number of commodities that move by Airways and Coastal Shipping would figure in flow estimates. For estimation of costs, commodities have been aggregated into 11 commodity groups based on their handling characteristics. Details of the identified commodity groups are given at **Annexure 1.2** (contained in Annexure Volume - 1).

Base Year: For generation of traffic flows and estimation of costs, the base year is 2007-08.

1.6 DATA COLLECTION FOR INTER-REGIONAL FREIGHT TRAFFIC - HIGHWAYS

Road Traffic Surveys

For generating commodity wise inter-regional O-D flow data and to capture the seasonality element (Kharif and Rabi) in the pattern of flows, two rounds of traffic survey were undertaken at identified check-posts in different regions across the country.

While the surveys started off at an encouraging note, the tempo suffered a major setback in Bihar, Uttar Pradesh, Assam, Orissa, Jharkhand and Andhra Pradesh due to unprecedented floods resulting in large scale disruption of the roads in these States. In addition, heat waves, uncertain law and order situations occasioned by frequent local bandhs as well as Maoist activities also posed a constraint in execution of the survey in some states. The painstaking rescheduling exercises that followed resulted in overall backlog of almost a year in the original schedule of the first round of surveys. As a damage control strategy, the second round of survey was carried out in states where first round had been completed, pending first round of surveys in the affected states. Notwithstanding all the positive efforts, it was possible to organise only one round of survey in the states of Uttar Pradesh, West Bengal and Jharkhand owing to floods and local inhibitive conditions.

Check-Post Locations

As a first step, a State wise list of candidate check-posts around major cities, industries, ports, etc. were identified using cordoning approach aimed at capturing an optimal sample of inter-regional traffic. Their physical sites were firmed up in consultation with officers of the PWD and Departments of Economics and Statistics of the related State Governments, taking into consideration the operational convenience e.g. adequacy of space for parking of goods vehicles on either side of the road so as to cause minimum disruption to through traffic.

In meeting the above requirements, efforts have been made to use suitable alternative sites like Octroi, Excise, Sales Tax and Toll-Gate check-posts where trucks/other goods vehicles necessarily stop for the purpose of paying taxes. Required commodity O-D data were collected at such locations with the help and cooperation of the concerned authorities.

State/Region wise list of check-post locations is enclosed at **Annexure 1.3** (contained in Annexure Volume - 1).

Survey Design

The survey design envisaged collection of requisite data as under:

Goods Origin-Destination Survey: Canvassing a specially designed Survey Instrument/ Schedule prepared by RITES Ltd. for obtaining commodity and O-D wise traffic data. This survey covers enumeration of all mechanized goods vehicles during the 2/7-day survey.

Vehicle Count Survey: Half-hourly traffic count of all types of vehicles was carried out round-the-clock on the first day of O-D survey.

Vehicle Operating Cost and Performance Behaviour Survey: During this survey, information with regard to vehicle particulars, commodity flow and operating expenses, including en-route octroi and other expenses was collected from a sample of goods vehicles intercepted at the check-post. This survey was conducted on the 2nd day of the O-D surveys.

Dates of road traffic surveys in various states are given in **Annexure 1.4** (contained in Annexure Volume: 1).

Weighbridge Survey: Weighbridge survey aims at ascertaining the understatement of loadings in a goods vehicle. This survey was carried out at weighbridges located near important cities/towns, taking into account the terrain and load restrictions. During this survey, data were collected for commodity-specific sample of goods vehicles coming on to the weighbridges for weighment.

Detailed 'Schedules/Questionnaires' used for each of the above mentioned surveys are placed at **Annexure 1.5, 1.6, 1.7** and **1.8** (contained in Annexure Volume: 1).

Management and Coordination

Conduct of the countrywide surveys has been a gigantic exercise, involving multi-layer coordination and proactive support from several administrative departments including police authorities of the concerned State Governments. Sequel to the request from Hon'ble Deputy Chairman of the Planning Commission to the State Governments, a Liaison Officer was nominated by each of the State Governments for facilitating RITES coordination with the related departments, viz. Public Works Department (PWD), Bureau of Economics & Statistics, Traffic Police, Transport Department, etc. for smooth conduct of the surveys.

Field Organisation and Operations

Depending on the local conditions, conduct of the road traffic surveys was, generally, under the charge of the concerned Executive Engineer, PWD in each district or the District Statistical Officer or the State Transport Authority. Supporting staff, including enumerators and survey supervisors were arranged by District Statistical Officers/XENS. Similarly, the local Traffic Police and Transport Department were associated in providing the required assistance in controlling movement of goods vehicles for collection of the data. Further, to ensure completeness of entries at the source level, the filled up O-D survey schedules were scrutinised at the level of the District Statistical Officer or the Statistical Officer of the PWD, in the field itself.

Coordination Committee Meeting

For ensuring successful conduct of the field surveys, the Liaison Officer organized a coordination meeting of concerned departmental heads viz. PWD, Bureau of Economics and Statistics, Traffic Police and the Transport Departments prior to start of the surveys.

Training of Enumerators and Supervisors

To ensure quality of information to be collected during the surveys, it was necessary to suitably orient the enumerators and supervisors entrusted with the job of data collection especially in terms of rapport with the respondents i.e. the vehicle drivers by assuring them about the confidentiality of the data. For this purpose, RITES representatives interacted with the concerned departmental officers and held field demonstrations at suitable places in the States. Field officers of the nodal epartment/s in-turn imparted similar training to the survey supervisors and enumerators functioning under them.

Publicity

With a view to obtaining willing cooperation of road transporters and spreading general awareness about the surveys, wide publicity was given in the local print media well before the start of the surveys.

Data Processing

The traffic flow data collected during the surveys were thoroughly scrutinized for ensuring completeness of the entries. The data were then punched for computer aided processing. Using the traffic count data, raising factors/multipliers were worked out and used to provide for number of trips that may have been missed during enumeration owing to unavoidable circumstances. Further, 2 days/7 days data have been annualized to reflect yearly flow pattern.

Integrated originating and terminating traffic for various regions have been tabulated using specially devised computer programmes.

A virtual road network, incorporating all the regional nodes has been designed for the purpose of road section/route loading by application of specially designed computer programme. The network also provides the basis for working out cost matrices for different O-D linkages.

1.6.1 ESTIMATION OF INTRA-REGIONAL TRAFFIC FLOWS - HIGHWAYS

Conceptual Framework

Road transport sector enjoys an advantage over other modes of transport in handling short-lead (distance) traffic. Most of the intra-regional traffic, therefore, moves by road transport even though some part of such traffic does move by rail transport too including coal moved from pit-heads to thermal power plants by MGR systems. However, while data on intra-regional commodity flows by rail are available such flows by road transport have to be generated through region specific surveys.

Conduct of an all-India intra-regional road traffic survey is far more expansive and complex compared with inter-regional survey as it calls for setting up of a huge number of check-posts and involves much more time and resources. The issue was brought forth during preliminary discussions in the Steering Committee meeting. During these discussions, it was agreed that, for ensuring optimal use of time and resources, sample intra-regional traffic surveys coupled with market surveys, as suggested by RITES in its methodology paper presented at the meeting, may be carried out at select regions representative enough to throw up results which would be replicable in the case of other districts/regions with similar demographic, agricultural, mineral, commercial and industrial texture.

Choice of Sample Regions

In line with the suggested strategy, out of 623 regions identified for inter-regional traffic surveys, 20 representative regions have been identified for conduct of intra-regional traffic surveys based on the following criteria.

Criteria

The nature and extent of intra-regional transport demand varies from region to region depending upon its population, agricultural, industrial, mining and commercial level of activity. Further, certain activity areas like major ports and major industrial locations by themselves constitute intra-regional traffic hubs. Similarly, metro cities reflect comparatively high local transport demand. Therefore, the underlying consideration in choosing sample regions is that the spatial coverage should ultimately reflect, in the backdrop of their transport demand, representative socio-economic factors like population, industrial, agricultural and commercial activity as well as impact of urbanization. Accordingly, while population (2001 Census) is considered as an important factor in choosing sample regions/districts, based on an analytical study of socio-economic factors and ensuing intra-regional transport demand, the choice of regions for the study has been delimited to the following three categories:

- Major Ports
- Major Industries
- Civil Districts: (Metro Cities, Other Civil Districts)

The process of choosing specific regions/districts within the framework of the above three categories is elaborated in the following paragraphs.

Movement of natural resources within a limited/mining area that involves movement by road transport has been considered independently.

Major Ports:

From amongst the 13 Major Ports in the country which are by themselves major economic hubs, each generating huge transport demand, Haldia Port, situated around 104 km from Kolkata with both rail and road connectivity, has been selected for detailed intra-regional traffic study. The port has a capacity of 38.0 million tonnes of which 17.7 million tonnes have been assigned to POL products, using pipelines. The port also handles containers.

Major Industries:

After a review of 14 sample industrial units, including 10 major steel plants, one oil refinery, two ship-breaking yards and one industrial city, Bhilai Steel Plant has been selected as the representative region. Bhillai Steel Plant is located in the Chattisgarh State and is well connected by rail and road. The Plant has an installed annual capacity of 8.005 million tonnes, with captive coal and iron ore mines, the main source of raw materials.

Civil Districts:

Metro Cities: As described earlier, traffic regions considered for the purpose of this study are more or less coterminous with civil districts. Apart from level of District's population which has direct relationship with economic activity and local transport demand, urbanization has higher impact on intra-regional transport demand. Keeping the level of urbanization in view, all the regions/civil districts have been divided into two categories i.e. civil districts covering Metro Cities and others.

Further, even though all cities with population above one million are regarded as metro cities, there are metro cities with much higher population. In view of the vast variation of population amongst the metro cities they have been further categorized into two groups i.e. metro cities having population above four million and those below this level.

Other Districts/Regions: Apart from regions identified above, remaining regions are covered under the category of other regions/districts, divided into six categories based on the level of population. Total number of regions in each category and the number of sample regions selected for intra-regional traffic surveys are given in Table 1.1.

TABLE 1.1: DISTRIBUTION OF REGIONS (DISTRICTS) BASED ON POPULATION

CIVIL DISTRICTS :				
POPULATION RANGE (2001 CENSUS)		**NO. OF REGIONS**	**SAMPLE REGIONS COVERED**	
			NO. OF SAMPLE REGIONS	**NAMES OF SAMPLE REGIONS (Indicating States)**
1	Up-to 1.0 Lakh	21	2	East Siang, Tawang (Arunachal Pradesh)
2	1.0 to 5.0 Lakh	63	2	Uttarkashi (Uttarakhand), Solan (Himachal Pradesh)
3	5.0 to 10.0 Lakh	95	2	Morigaon (Assam), Kathua (J&K)
4	10.0 to 20.0 Lakh	207	5	Yamunanagar (Haryana), Betul (MP), Patiala (Punjab), Dhule (Mah), Bidar (K'Taka)
5	20.0 to 30.0 Lakh	108	4	Buldana, Nanded (Maharashtra), Mysore (Karnataka), Mathura (UP)
6	Above 30 Lakh	66	2	Allahabad (UP), Rajkot (Gujarat)
	TOTAL	**560**	**17**	
OTHER SAMPLE REGIONS :				
1	Metro City		1	Delhi (Delhi)
2	Major Port		1	Haldia (West Bengal)
3	Industry		1	Bhillai Steel Plant (Chattisgarh)
	TOTAL		**3**	**Note:** Districts carved out of other districts not considered separately

As per 2001 Census, 25 cities were designated as metro cities, of which fifteen had population above four million. Delhi, with seven administrative districts, tops the list followed by Mumbai. Delhi has been identified as the sample metro from amongst these 15 metros. From the remaining ten metro cities, Jaipur was chosen as a representative metro for the purpose of generating intra-regional flows. However, due to lakh of adequate data support, it was finally decided to be excluded.

Mining of ores require special type of movement between the place of excavation and the place of final dispatch, because a number of activities are performed within the mining area before it is dispatched to the concerned industry as an input. Based on the representative data collected from the sample mining units (covering coal, iron ore, limestone & dolomite and zinc), overall transport demand has been worked out using 2007-08 throughput of various ores. In this context, it may be stated that for consideration of total transport demand, ores, which are exported have been considered whereas ores, which are imported during the reference year have not been considered.

Check-Post Locations and Period of Survey

The intra-regional traffic surveys were carried out at 364 check-posts with the help and cooperation of local civil authorities, interalia included commodity wise O-D surveys as well as comprehensive market surveys aimed at assessing contribution of agricultural, industrial, mining and commercial sectors in intra-regional traffic, with the help of the related district officers. In view of the complexity of the surveys and to maintain an overall parity of approach, a select team of highly skilled personnel was deployed for the purpose. Although this implied extended time for surveys, it was considered worth the while because results of these representative surveys ultimately formed the basis for estimation of the total intra-regional traffic at the national level. Number of intra-regional survey check-posts and dates of survey are given in **Annexure 1.9** (contained in Annexure Volume - 1).

Exclusions

Although efforts have been made to capture all the streams of intra-regional traffic, inhibited by ground realities, following components of traffic remained uncovered:

- Goods movement by non-mechanized modes.
- Military traffic.
- Goods movement by personalized vehicles.
- Un-authorised goods movement by personalized mode.
- Goods movement within the Industrial Units, Ports (excluding those selected as independent traffic regions), Airports, etc.
- Of the traffic handled by Public or Private transport plying under contract arrangement, only the part intercepted at check-posts has been covered.

Estimation of All-India Intra-Regional Traffic

All the regions/districts in the country have been categorized essentially on the basis of population compatible with the levels adopted for the sample regions/districts. Category wise traffic flow levels have then been attributed to the regions not covered by the surveys. The emerging category wise total flows when aggregated reflect the total intra-regional freight traffic flow in the country. It is necessary to point out that while the surveys at the selected regions bring out commodity wise flows, the resultant figures from the above aggregation process show region wise total volume of intra-regional traffic flow. Further, for estimating overall through-put in terms of tonne-km, leads of only loaded trips have been considered.

1.6.2 GENERATION OF PASSENGER TRAFFIC FLOW DATA - HIGHWAYS

Generation of passenger flow data poses several handicaps. Unlike trucks, it is neither advisable nor feasible to stop buses at check-posts for eliciting O-D data. Looking to the massive spread of bus services, operated both by State Undertakings and private agencies, it is also not feasible to collect data through in-bus travel.

The only apparent alternative would be to obtain information from the management of State Transport Undertakings on a specific format and, through the active involvement of State Transport Departments and regional transport authorities, from private operators. However, not only would this approach be time consuming but also inhibitive owing to the need for supplementing the data through field visits for incorporating en-route passenger boarding/de-boarding pattern for various routes. Looking to the expanse of passenger bus operations in the country, an exercise of this nature for estimating O-D wise passenger movement at all-India level would involve prohibitive time and resources.

On pragmatic considerations, therefore, only sample passenger flow surveys on selected routes were found feasible. In this context, passenger traffic surveys have been undertaken with the help of State Transport Authorities in respect of major road routes linking 16 identified metropolitan cities/state capitals which include:

CITIES		CITIES		CITIES		CITIES	
1	Ahmedabad	5	Surat	9	Vadodara	13	Mumbai
2	Nagpur	6	Kolkata	10	Goa/Panaji	14	Delhi
3	Raipur	7	Patna	11	Chennai	15	Chandigarh
4	Shimla	8	Ranchi	12	Pune	16	Vishakhapatnam

During these surveys, RITES study teams physically ascertained boarding/deboarding pattern on different routes for arriving at passenger O-Ds. It will be observed that despite the constraints, it has been possible to capture sizeable information on passenger travel by major road routes.

It is necessary to point out that passenger traffic flow data generation has been related to route specific movement of buses only, excluding passenger movement by cars, taxis, tempos, etc. It also excludes intra-city movement of passengers as well as inter-city movement by chartered and contract buses.

1.7 FREIGHT & PASSENGER TRAFFIC FLOW GENERATION - RAILWAYS

Data Base

Data on freight and passenger traffic flows have been sourced from the Indian Railways, Konkan Railway Corporation and, in the case of Merry Go Round systems (MGR), from the National Thermal Power Corporation (NTPC).

Coverage

The available data used for the study includes traffic flows across the whole of the all-gauge rail network in the country. In addition, movement of coal by captive systems like MGR for transporting coal from pit-head to the adjacent thermal power stations, though not owned by IR, have also been covered in the study. NTPC owns and operates MGR systems at eight places viz. at Shaktinagar, Rihand, Vindhyachal, Korba, Kahalgaon, Farraka, Talcher Kaniha and Ramagundam. In addition, Uttar Pradesh State Electricity Board has MGR system at Annapara Thermal Power Station. Data on coal movement by 8 MGR systems for the year 2007-08 has been obtained from NTPC. Since the pit-heads and linked power plants, in some cases, are

situated in different districts, traffic flows have been assessed both in terms of inter-regional and intra-regional movements.

Data Base

Each of the 16 Zonal Railways forming part of the Indian Railways as well as Konkan Railway Corporation (KRCL) maintain comprehensive computerized data on freight and passenger traffic flows in the following formats:

INDIAN RAILWAYS - FREIGHT & PASSENGER DATA FORMAT

FREIGHT TRAFFIC FLOW (DATA FORMAT)	PASSENGER TRAFFIC FLOW (DATA FORMAT)
Month, Year, Station From, Station To, Commodity Code, Charged Distance, Zone Code, Originating Gauge, No. of Wagons (Full Wagon Load), Number of Wagons (Train Load), Actual Weight, Charged Weight (For Train Load), Charged Weight for Full Wagons, Charged Weight for Small Wagon Traffic, Calculated Freight for Train Loads, Calculated Freight for Full Wagon Load, Tonne KMs for Train Load, Tonne KMs for Full Wagon Load, Tonne KMs for Small Wagon Traffic	Station from, Station to, Gauge, Via Stations, Class, Rate, Free Pass, Concessional Tickets (Concession/Total Fare/Concessional Fare), Year, Month, Distance, Local/Foreign, Other Charge (Safety, Super Fast), Type (Group/Single), Platform Ticket

It may be clarified that only non-suburban passengers are considered in the present study. The above information is common to both unreserved and reserved passengers. However, separate records are maintained for un-reserved passengers and passengers booked under PRS (Passenger Reservation System) The additional information in respect of reserved passengers is the indication of train number by which the passenger is reserved. Data in the case of un-reserved passengers are maintained separately by way of different type of ticketing systems which include: ARTS (Advanced Railway Ticketing System developed by CMS), BPT (Blank Paper Tickets), PCT (Printed Card Tickets) and UTS (Computerised Unreserved Ticketing System). Railways also issue monthly season tickets, quarterly season tickets and single return journey tickets. Information pertaining to these tickets is included in the PCT and UTS data statements.

Data Limitations

Freight traffic flow data is complete except for the coal movement at Annapara MGR system of UPSEB. In the case of passenger traffic flows, whereas PRS and UTS data are complete, there are some deficiencies in data received in respect of other type of ticketing systems. For instance ARTS data are available only for KRCL. It is understood that Railways have since discontinued this system of ticketing. In the case of PCT data, information with respect to the following months could not be had from the concerned Railways:

RAILWAY	PCT DATA NOT AVAILABLE	RAILWAY	PCT DATA NOT AVAILABLE
Southern Railway	March, 2008	South Eastern Railway	March, 2008
West Central Railway	Feb, March, 2008	South Western Railway	February, 2008
Northern Railway	Feb, March, 2008	South East Central Rly.	July, August, 2007
North Eastern Railway	March, 2008	N.F. Railway	Data Only for July 2007
North Western Railway	March, 2008		

Similarly, in the case of BPT, Eastern Railway data are available only for September 2007 to January 2008. For Northern Railway, data are available only for the months of April and October 2007. Central Railway data are available for three months i.e. May, June and September 2007. For rest of the Railways, no data for BPT are available.

However, taking advantage of the Railway wise data on total passengers and their class wise composition which became available after submission of the Draft Report, data gaps were filled up and analysis of total passengers carried out. The process of up-dation of data has been detailed in Chapter 4.

Building Data Framework Compatible with Other Modes

Prior to processing of the traffic flow data for generating commodity wise O-D flows, following exercises were undertaken to obtain commodity grouping and regional structure of O-Ds which would be comparable with that of other modes, particularly road transport.

Commodity Aggregation

While IR has a highly disaggregated listing of commodities carried by it, road traffic estimates based on data collected through country-wide traffic surveys relate to large number of commodities which have been grouped into 52 commodity groups (Annexure 1.2). For building a comparable commodity structure, various commodities appearing in Railways' classified commodity list have been suitably aggregated to match the commodity groups adopted in the case of flows by road transport. Results of this exercise are placed at **Annexure 3.2** (contained in Annexure Volume - 1).

Regionalisation of O-Ds – Formulation of Concordance Table

As already explained, traffic flow generation in the case of road transport relates to movement between regions, a region being, in general, coterminous with a Civil District. For obtaining a compatible framework in the case of Railways, all railway stations and sidings figuring in the Railways' traffic flow statements have been assigned codes according to the districts/regions in which these are situated. In addition, each station/siding has been assigned the code of the State in which it lies. The concordance table so formulated enables aggregation of originating and terminating traffic in a particular district/region as well as at the state level.

Data Processing - Freight and Passenger Traffic Flows

Freight Traffic: Data processing has been carried out using objective specific programme for drawing out statements in respect of commodity, origin, destination, quantum, lead (kms) and tonne-kilometres. From these basic commodity wise tabulations, analytical statements have been drawn to identify modal shares in total commodity movement and concentration of commodity demand and supply at the regional and state level.

The results of the above exercise provided the inputs for comparative modal (Railways, Highways, Coastal Shipping and Airways) performance analysis of commodity demand-supply concentration at regional and state levels. However, it is equally important to analyse O-D specific traffic flows at zonal and station levels in the context of sectional and terminal capacities. Therefore, apart from regional level traffic flow statements, flows between specific O-Ds have also been tabulated to bring out, in hierarchical manner, the commodity traffic handled at railway zonal and terminal levels.

Passenger Traffic: Subject to data limitations, data have been processed for preparing statements in respect of inter-regional passenger flows pertaining to both reserved and un-reserved passengers.

Rail Network Construction and Section Loadings

Rail Network: A virtual rail network of IR and KRCL has been constructed, incorporating sectional nodes, gauge, track, traction and inter-node distance for the purpose of developing computer aided projected traffic assignations on various rail sections as well as for building cost matrices for all the O-D combinations across the all-India railway system.

Section Loadings of Network

Section loadings of the network have been undertaken for the base year in terms of the number of section wise goods trains run in 2006-07 as per Railways' capacity statements, number of trains emerging from conversion of freight traffic flows pertaining to 2007-08 based on shortest path and number of trains resulting from optimisation of traffic flows. Comparative results in this regard have been presented in Chapter 8.

1.8 GENERATION OF PASSENGER AND CARGO FLOWS BY AIRWAYS

Data Collection

Airport Authority of India (AAI) owns 127 airports in the country including 15 international, 79 domestic, 8 customs and 25 civil airport enclaves at Defence Airfields. At present, apart from Indian Airlines, Alliance Air, Air India, Air India Express in the public sector, there are 8 private airlines operating domestically. These include Jet Airways, Kingfisher, Indigo, Sahara, SpiceJet, Go Air, Air Deccan and Paramount.

Apart from passengers, major commodities forming part of air cargo include consumer durables, machinery and parts, perishable commodities (flowers and fruits), medicines, automobiles and high-valued goods.

Data on passenger and cargo flows between different airports have been collected with the help and support of AAI and DGCA (Directorate General of Civil Aviation). In the case of cargo, efforts were made to ascertain commodity wise volumes of traffic but data could be had in terms of total tonnage only.

Data Processing

The expanse of operations of airlines is characteristically different from Railways and Highways in the context that airlines have limited and specific linkages at present. Accordingly, to the extent that operations relate to compatible routes, a comparative picture of aggregated O-D wise traffic flows vis-a-vis Railways and Highways has been developed for the year 2007-08.

1.9 GENERATION OF CARGO FLOWS BY COASTAL SHIPPING

Major commodities figuring in Coastal movement include, crude, POL, iron ore, thermal coal, cement, containers and miscellaneous commodities. Data in respect of these commodities on port and commodity wise cargo flows by Coastal Shipping have been collected though the help of Ministry of Shipping, Road Transport & Highways, Director General of Shipping (DGS), Government of India, State Maritime Boards and the Indian Ports Association. Inter-port traffic flows in respect of above commodities have been analysed and presented in Chapter 3.

1.10 ESTIMATION OF MODAL TRANSPORT COSTS

Conceptual Framework

Modal transport costs are estimated for the operator as well as the user, both in terms of financial and economic (resource) costs. Financial costs include total expenditure actually incurred by an operator or user, inclusive of taxes, duties and other elements reflecting market imperfections. Financial cost estimates do not provide for cost to the society in terms of congestion, pollution, social inconveniences, accidents, etc. In estimating resource costs on the other hand, transfer payments in terms of taxes and duties are excluded, barring taxes reflecting scarcity value of factor inputs which are in the nature of shadow prices. Factor inputs like exchange rates and interest on capital are adjusted to remove element of artificiality in rates.

Operator Cost

Cost to the operator (Highways, Railways, Coastal Shipping and Airways) comprises costs incurred by the operator of the transport including cost of operation of the service, repair and maintenance of infrastructure and moving units, overheads, replacement costs and investments in up-gradation of the system. Financial data in respect of these items of cost is converted into resource or economic costs. In this context, there are modal variations in cost inputs like the cost of way. While Railways provide for the installation and maintenance of rail tracks, in the case of Highways, Coastal Shipping and Airways the construction and maintenance of roads, ports and airports are by and large funded and maintained by the Government agencies.

User Cost

User cost includes cost borne by user of the transport system i.e. a consigner/consignee of goods or passenger. In the case of goods transport, this cost relates to packing, cartage (local transit) from/to godown and from/to the terminal, handling of goods at either end, transit losses, rail siding and transit inventory costs. For passengers, user cost includes cost of ingress and egress at the terminal in the nature of local travel and porterage at the terminal at either end. Added elements are value of travel time and degree of comfort or discomfort in travel by a particular mode. Formats of goods & passenger user cost survey instrument are given at **Annexure 1.10 and 1.11**, respectively (contained in Annexure Volume-1).

Social Costs

Social costs include costs borne by the society in terms of costs of pollution, congestion and accidents.

Process of Estimation

Within the conceptual framework enunciated above, modal operator and user costs have been worked out both in terms of financial and economic costs. Detailed process of estimation of costs for each mode is presented in Chapter 5 on Modal Costs.

1.11 IMPACT OF TECHNOLOGICAL UP-GRADATIONS

Technological up-gradations relate to moving units, expansion of paths, traction, etc. which may lead to increase in loadability per unit of movement and higher speeds impacting transit times. All these collectively leading to resultant higher throughputs to be achieved by each mode; and its consequent impact on transport costs has been studied in light of the likely future scenario. The results of the study are reflected in formulation of the costs and are covered in the modelling exercises discussed in the chapter on impact of projected traffic on the system capacity.

1.12 TRANSPORT DEMAND FORECASTS

Freight Traffic

Freight traffic projections for the base year 2007-08 and horizon years of the study i.e. 2012-13, 2017-18, 2022-23 and 2025-26 have been attempted for 11 major commodities viz., cement, coal, fertilisers, iron & steel, iron ore, limestone & dolomite, POL, pulses, rice, salt and wheat.

Estimates of commodity demand and modal shares in the base year (2007-08) are based on actual data compiled during the study. End-use approach coupled with review of assessments made by various Government and expert bodies, in general, forms the basis for formulation of commodity demand estimates for the future years. However, as the horizon elongates, availability of firm data gets hazier, necessitating juxtaposition of available data with inputs from experts and use of standard econometric methods of projection.

Accordingly, short-term forecasts for the year 2012-13 are based on estimates of aggregate demand and consumption of commodities made by the 11th Plan Working Group and estimates made by expert committees, supplemented by data firm up exercises undertaken by the study team. Medium and long-term commodity demand projections for the years 2017-18 and 2025-26, on the other hand, relate to available data from the ministries supplemented by our estimates of demand and consumption based on time series data in conjunction with moderation of results in consultation with the government agencies, the Planning Commission and other knowledgeable persons in the field.

Within the above framework, detailed process adopted for estimation of future commodity wise demand and supply for different horizon years is detailed in Chapter 7 of this report. A distribution model incorporating the regional demand and supply vectors has been used for distribution of traffic based on the pattern obtaining in the base year for arriving at transport demand estimates and modal split for the horizon years.

1.13 MODAL SHARES IN PROJECTED TRAFFIC

Based on commodity wise break-even points emerging from modal cost comparisons given in Chapter 5, modal shares in projected traffic have been worked out and presented in Chapter 6.

1.14 IMPACT OF PROJECTED TRAFFIC ON SYSTEM CAPACITY

As a prelude to sectional assignments of traffic on the rail and road networks, a specially designed transport optimization model has been developed for the purpose of defining optimal modal traffic flows for ultimate traffic loading of rail and road sections. As mentioned earlier, section loadings of the network have been undertaken for the base year in terms of the number of section wise goods trains run in 2006-07 as per Railways' capacity statements, number of trains emerging from conversion of freight traffic flows pertaining to 2007-08 based on shortest path and number of trains resulting from optimisation of traffic flows. Comparative results in this regard have been presented in Chapter 8.

1.15 GROWTH & PROSPECTS OF MULTI-MODAL TRAFFIC

Based on a study of past growth in containerization of goods and the indicators of future growth, a perspective on containerized flow of commodities is presented in Special Report-1 placed at the end of this Report.

1.16 POLICY MEASURES

The visualized objective of policy initiatives for the transport sector is two-fold, firstly, the smooth flow of men and material and secondly the cost effectiveness of such movement by different modes of transport. However, in a liberalized market led economy, cost-based modal split cannot brook the regulatory tenets of a command economy. Policy framework has, therefore, to be conceived in terms of institutional initiatives coupled with selective regulatory measures that induce the desired scope of operation of different modes within their areas of cost advantage. Based on an in-depth perceptive analysis of market behaviour, an attempt has been made to suggest desired policy initiatives towards achieving the desired goal of an optimal modal mix.

1.17 DRAFT FINAL REPORT

The Draft Final Report on the study was submitted to the Planning Commission in July 2009 and subsequently presented before the Steering Committee in its meeting held on 23 July 2009. In the said meeting it was decided that the report should be finalised incorporating necessary

modifications taking due cognisance of the comments received from concerned ministries on the Draft Final Report.

Accordingly, during the intervening period the study team first carried out a thorough revision of the Draft Final Report to effect necessary modifications arising out of the suggestions, which emanated during the said meeting of the Steering Committee and in-house queries. Furthermore, pre-empting the practical time constraints of formulating comprehensive formal comments on a study of such magnitude, involving complex exercises, a concerted effort was made additionally to obtain feed back and reactions to the report through formal and informal interactions with the officials of concerned ministries as well as a spectrum of field experts. Value added inputs received from the above exercises have been suitably incorporated in finalising the report.

1.18 FINAL REPORT

The Final Report consists of the following volumes:

- Final Report - Main analytical narrative report on findings of the study.
- Annexures to the Final Report
  - Annexure Volume-1 (Chapters 1 to 4)
  - Annexure Volume-2 (Chapters 5, 7 and 8)
- Summary Findings and Recommendations

This Final Report comprises eight more chapters apart from this Introductory Chapter. Chapter 2 describes the transport sector in India, its system attributes and past performance. Comparative base year (2007-08) modal freight traffic flows are analysed in Chapter 3. Similar analysis in respect of passenger traffic flows is presented in Chapter 4. Chapter 5 contains a treatise on modal costs in a comparative structure. Chapter 6 brings out cost break-even points for freight traffic between different modes and results of transport optimization exercises in the context of optimal modal roles and associated cost implications, both in respect of base year and future freight traffic flows. Transport Demand Forecasts up to the horizon year 2025-26 have been presented in Chapter 7. Chapter 8 presents the impact of projected traffic on system capacity in respect of Railways and the Highways. Finally, in Chapter 9, findings and inferences of the study as well as the broad recommendations have been summarised and.

Special Report-1 on Growth & Prospects of Multi-modal Traffic and Special Report-2 on Intra-Regional Traffic in Road Sector are also appended to this report. Annexures referred to in various chapters of the report have been compiled separately in two volumes.

Additionally, a detailed discussion on the recommendations arising out of inferences drawn from the study, enunciating the desired policy initiatives has been presented in a separate volume titled 'Summary Findings and Recommendations'. It also contains an abridged executive version of the findings for ready reference.