Chapter 7

Freight Transport Demand Forecasts: Short-Term & Long-Term Projections

7.1 INTRODUCTION

Transport demand forecasts provide the basis for modal allocations of traffic likely to materialise in future years, evaluation of transport system capacity to meet the estimated transport demand, identification of possible bottlenecks in smooth flow of traffic and planning for required capacity augmentation.

The need for transport of goods of various types arises out of regional supply and demand imbalances. Demand for freight transport is, thus, derived from the gap between regional production and consumption of a commodity or product. Spatial dispersal of sources of raw materials, industries and other commodities/products together determine the extent of transport demand. Further, the nature, value and volumes of commodities/products and comparative modal costs of transport inter-alia influence choice of a mode of transport by users.

This chapter presents short, medium and long-term 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 in respect of 11 major commodities viz., cement, coal, fertilisers, iron & steel, iron ore, limestone & dolomite, POL, pulses, rice, salt and wheat. Short, medium and long-term transport demand projections for the 20 year horizon of the study are conceived as under:

- Short-term: A five year span from 2007-08 to 2012-13 (over the 11th Five Year Plan);
- Medium-term: A five year span staring from 2012-13 to 2017-18; and
- Long-term: An eight year time span starting from 2017-18 to 2022-23 and 2025-26.

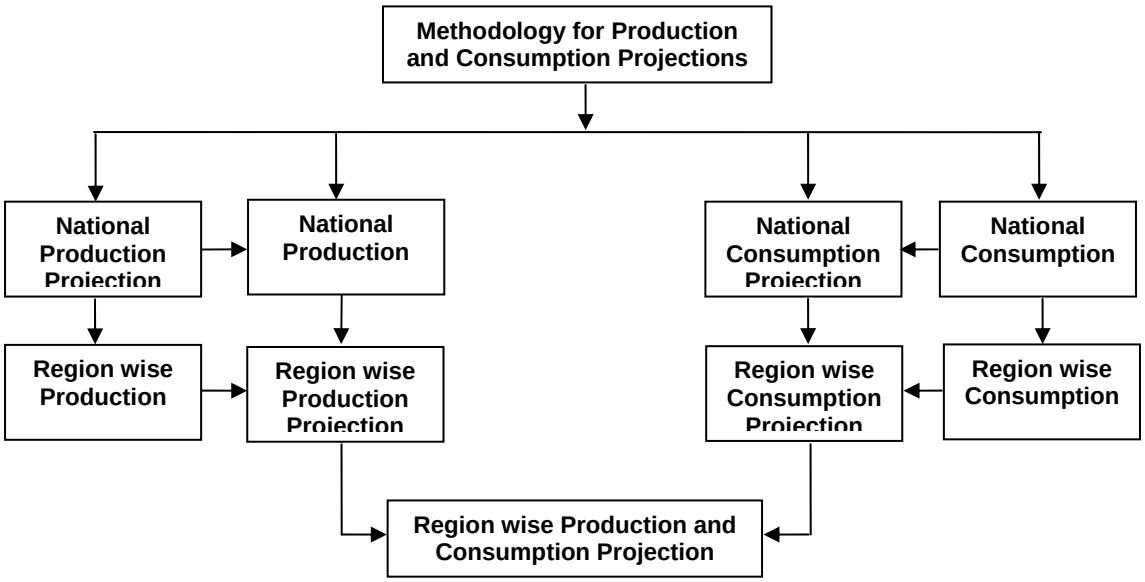
7.2 METHODOLOGY

In the context of geographic spread of commodity specific demand and supply, following factors assume significance in terms of inputs for assessing the future transport demand:

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

Transport demand projections are made in two stages. In the first stage, the commodity production and consumption estimates are firmed up for different horizon years at the district (regional) level. In the second stage, the gap between commodity specific estimates of regional production and consumption is worked out to reflect demand for transport of the commodity.

The flow chart below indicates the steps followed in projecting the commodity production (or supply) and consumption (or demand) figures for various horizon years.



As would be observed from the flow chart, projections in respect of different commodities are made in two-steps. First, the national projections are made for various years. The national projection data are regionalised by estimating the district level figures. A distribution model incorporating the regional demand and supply vectors has been used for distribution of traffic for arriving at transport demand estimates and modal split for the horizon years.

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 projecting demand. The detailed process adopted for projecting short, medium and long-term projections of commodity wise traffic is given in the following paragraphs.

Base Year (2007-08) Freight Traffic Estimates

Base year i.e. 2007-08 data on commodity wise regional production, consumption and freight traffic flows by Railways, Highways, Coastal Shipping and Airways collected by the Study Team in respect of identified 623 regions, including major ports and steel plants have been collated and assimilated for the purpose of estimating regional demand, supply and mode wise inter-regional linkages. The data are organized in the following manner:

- Region wise details of production.
- Region wise details of consumption.
- Mode wise traffic flows between different regions represented by centroids or nodes.

The exercise on preparation of base year estimates of commodity wise demand and supply based on firm data also helped in identifying important factors like population, urbanization, industrial production, etc. affecting the attraction of traffic to different regions.

Short-Term Forecasts (2007-08 to 2012-13)

The approach adopted for forecasts is as under:

- The study team has made use of the estimates of aggregate demand and consumption of commodities made by the 11th Plan Working Groups, estimates made by Expert Committees and, where the data are not available, we have made our own estimates.
- The production and consumption data were assigned to regions on the following basis:
  - Using the regional projections developed by the Ministries, if available;
  - Supplementing the above with data obtained from industry association projections, company's perspective plans, expert views reported in the press and academic journals;
  - In-depth discussions with industry experts; and
  - Using econometric forecast tools.

Medium-Term and Long-Term Forecasts

As the time span increases, demand forecasts become difficult as availability of firm data reduces. Therefore, feasible approach would be to juxtapose available data with inputs from experts and adopting standard methods of formulating projections. Accordingly, the following process for estimating medium and long-term transport demand has been adopted.

- Obtained data where available from the related Ministries/Planning Commission in the cases where production and consumption are estimated beyond the 11th Plan periods;
- In case of non-availability of data from above sources, we have developed projections of demand for the commodity based on time series and cross-section data;
- Discussed with the Ministries, Planning Commission and other experts to moderate the information; and
- The production and consumption data have been assigned to regions on the pattern emerging from the data used for the short-term projections.

As seen from above, the study required a voluminous data. Extensive use of official data sources, internet-based data sources and privately available databases were used. Important reference material used in projections is listed in **Annexure 7.1** given in Annexure Volume 2.

The process adopted for estimating demand and supply of different commodities and the results of the exercises presenting estimates for the horizon years are detailed in the following paragraphs.

7.3 COMMODITY WISE DEMAND PROJECTIONS

7.3.1 Coal

India is the third largest coal producer in the world after China and US. Coal is one of the major energy sources in India and it has the largest share of India's energy production. It is expected that coal will remain as the main source of energy supply in the years to come.

7.3.1.1 Demand Projections

The most important determinants of demand for coal are the electricity generation based on coal, domestic production of steel and cement to meet domestic and export demand, demand from the unorganized small scale sector comprising primarily foundries brick kilns and ceramic industry.

We have reviewed the projections given in various reports, i.e. Reports of the Working Group on Coal for 11th Five Year Plan; Coal Vision 2025; Expert Committee on Road Map for Coal Sector Reforms by Ministry of Coal; Expert Committee on Integrated Energy Policy, Planning

Commission. The short-term and the long-term projections appearing in these reports are given in Table: 7.1.

TABLE 7.1: DEMAND PROJECTIONS OF COAL BY VARIOUS AGENCIES (IN MT)

Source	2006-07	2011-12	2016-17	2021-22	2024-25	2026-27	2031-32
11th Plan Working Group	473	731	1125				
CV: 7% GDP	473	611	782	992	1148		
CV: 8% GDP	473	630	828	1080	1277		
ECCSR	473	710					
ECIEP Scenario-I	439	579	734	1008		1434	2018
ECIEP Scenario-II	448	652	922	1331		1912	2704
ECIEP Scenario-III	393	489	582	740		970	1398

CV: Coal Vision 2025
ECCSR: Expert Committee on Coal Sector Reforms
ECIEP: Expert Committee on Integrated Energy Policy

For the short-term (terminal year 2011-12) the projections range from the minimum demand of 489 million tonnes to the maximum of 731 million tonnes. For the medium-term (terminal year 2016-17), the projections vary from 582 million tonnes to 1125 million tonnes with a huge difference of 543 million tonnes. For the long-term (terminal year 2026-27), the projections vary from 970 million tonnes to 1912 million tonnes, with a variation of 942 million tonnes. These high-levels of variations in estimates are due to uncertainties about the energy requirements and the source which will fill the requirement. If the coal-based energy requirements are very high (due to higher economic growth), the demand for coal is going to be very high.

For assessing sectoral demand for coal, we have considered the following two scenarios:

Scenario 1:

In this scenario, for the horizon years 2012-13 and 2017-18, 2022-23 and 2025-26 the Study Team adopted the same CAGR assumed by the 11th Plan Working Group on Coal for the horizon year 2016-17. Therefore, the projections of coal requirement for power, cement, sponge iron, others and steel are assumed to grow at the rate of 9.1%, 9.4%, 8.29% and 8.9%, respectively. These estimates are on higher side due to the fact that the Working Group based their estimates on the inputs from the user industries, which tend to project more optimistic input requirement to ensure plenty of raw material availability (Table 7.2).

TABLE 7.2: DEMAND PROJECTIONS OF COAL
ASSUMING OPTIMISTIC GROWTH RATE OF THE WORKING GROUP

(Million Tonnes)

Sector/Year	2007-08	2012-13	2017-18	2022-23	2025-26	CAGR (2011-12 to 2016-17)
Power	360	510	789	1221	1586	9.11
Cement	19	28	43	68	89	9.40
Sponge and other	83	115	171	255	323	8.29
Total Non-coking	462	653	1003	1544	1998	9.01
Steel (Coking Coal)	39	54	83	127	165	8.92
Total Coking & Non-coking Coal	**502**	**708**	**1089**	**1676**	**2172**	**9.00**

The totals may not tally due to rounding off and different growth rates adopted for different sectors.

Scenario 2:

In this scenario, for the horizon year 2012-13, we have adopted the estimates made by the 11th Plan Working Group on Coal for the power sector, cement, steel and others, assuming to grow

at the rate of 5.2% per annum based on past performances and future expectations. In the case of projections for 2017-18, 2022-23 and 2025-26, we have derived the coal demand from various sectors assuming 8% GDP growth for 2017-18, 7% for 2022-23 and 6.5% for 2025-26. Sector wise details are given in Table 7.3.

TABLE 7.3: SECTORAL COAL DEMAND PROJECTIONS

(Million Tonnes)

Sector/Year	2007-08	2012-13	2017-18	2022-23	2025-26
Power	360.15	590.25	775.10	984.55	1125.15
Cement	19.31	33.51	53.87	80.62	101.00
Steel & Sponge Iron	59.65	75.19	96.56	131.06	155.43
Others	62.41	80.41	103.61	133.50	155.43
Grand	**501.52**	**779.36**	**1031.14**	**1329.73**	**1537.01**

Power (Utilities and Captive)

For the purpose of coal requirement by the power sector, the Study Team derived the elasticity of coal required for power generation with respect to GDP. This was derived from the coal requirement for the thermal power at 7% and 8% GDP growth rate given by the report on Coal Vision 2025 according to which the coal requirement is assumed to increase at a CAGR of 5.42% when GDP grows at 7%. This implicitly means that the elasticity is 0.77 (5.42% / 7%), and when GDP increases at 8% the CAGR is assumed to increase at 6.12%. Thus this also assumes that the elasticity is 0.77. By applying the same principle, the elasticity derived for the horizon year 2017-18 stands at 0.69. Therefore, the coal demand elasticity of 0.70 for thermal power with respect to GDP, for the horizon years 2017-18, 2022-23 and 2025-26 has been assumed.

Cement

At the end of 11th Plan, cement industry was consuming 0.154 tonne of coal for producing one tonne of cement. This ratio has come down to 0.127 tonne due to more efficient methods of production. The reason behind this is efficiency in fuel consumption. The Team decided to use this conversion factor for deriving coal demand for different horizon years. The cement production requirement is estimated by the Study Team; the details are given in the section on the cement demand projections.

Steel (Metallurgical Coking Coal)

Steel industry is consuming approximately 1 tonne of washed coal for producing one tonne of steel. Given that the domestic coking coal is approximately 50% of the metallurgical coal requirement and washed to non-washed coal is approximately 1:2, it means a conversion factor of crude steel to metallurgical coking coal is 1.5 in terms of non-washed coal. It was, therefore, decided to use this conversion factor for deriving coal demand for different horizon years. The steel production requirement is estimated by the Study Team. In this regard, details are given in the section on the steel demand projections.

Other Industries

Coal is consumed by sponge iron industry and other industries like fertilizer, paper industry, textile industry, ceramic tiles, brick kilns, etc. The coal requirement is assumed to increase at a CAGR of 5.2% for the rest of the sectors.

7.3.1.2 Coal Production Projections

Coal is largely available in the areas situated in the valleys of rivers i.e. Sone, Damodar, Godavari and Wardha. Most of the coal production in India comes from open pit mines contributing over 81% of the total production and the remaining from underground mining. Coal production

profiles as reflected in various documents prepared by Coal India Limited and Singareni Collieries Company Limited give emphasis to raise production of coal through a sustained programme of investment and greater thrust on application of modern technologies. The current demand situation of coal is given in Table 7.4:

TABLE 7.4: CURRENT (2006-07) DEMAND OF COAL (Million Tonnes)

Sector	Production	Change in Stocks	Net Imports	Demand
Coking Coal	32.10	0.43	17.87	49.54
Non-coking Coal	398.73	9.58	23.65	412.81
Total	**430.83**	**10.01**	**41.52**	**462.35**

In 2006-07, total demand of coal was 462.35 million tonnes. The table also shows that India imported 41.5 million tonnes of coal which included 17.9 million tonnes of coking coal and 23.6 million tonnes of non-coking coal.

Coking Coal

In the total demand of 49.54 million tonnes of coking coal during 2006-07, the share of domestically produced coal was 32.1 million tonnes. In percentage terms, domestic production constituted 65% of country's coking coal requirement. But, due to poor quality, entire coking coal can not be used for the metallurgical purposes; 17.9 million tonnes out of the 32.1 million tonnes (ratio of 55%) is of metallurgical quality. Therefore, in metallurgical terms, domestic coking coal is fulfilling around 50% of the domestic requirement.

Non-Coking Coal

The country's requirement of non-coking coal is mainly met by domestic production and imports are limited to 5.7% of total requirement. Keeping in mind the importance of coal in the energy mix in the years to come, government has started allocating coal mining blocks to private players and increased the production plans of the public sector companies. We have adopted the projections made by Working Groups for the 11th and 12th Plans. According to these projections, coal production is anticipated to grow by 9.18% for the period 2011-12 and 2016-17. However, the Plan Document has given break-up of metallurgical, non- metallurgical and coking-coal for only 2011-12. We have, therefore, assumed 5% growth in the metallurgical coking-coal (keeping in mind the domestic reserves situation) and rest is allocated to non-coking plus non-metallurgical coking-coal, which works out to 9.34%.

In the case of projections for 2017-18, 2022-23 and 2025-26, the Study Team has considered 5% growth for the metallurgical coal and 9% for the non-coking plus non-metallurgical coking-coal. As assumed in the Plan Document, the Team has also assumed that in the event of low demand scenario, captive blocks would be adjusting their production facilities in accordance with the coal demand scenario. The production projections of coal are given in Table 7.5.

TABLE 7.5: NATIONAL PRODUCTION PROJECTIONS OF COAL (Million Tonnes)

Year	Metallurgical Coking Coal	Non-Coking + Non-Met Coking Coal	Total
2007-08	18.10	438.29	456.39
2012-13	23.10	684.95	708.05
2017-18	29.49	1053.88	1083.37
2022-23	37.63	1621.53	1659.16
025-26	43.57	2099.92	2143.49

7.3.1.3 Regional Allocation of Demand & Supply

As a first step for the allocation of demand and supply of coal to regions/districts, the Team has collected the traffic flow data from primary (road survey) and secondary sources (Railway, Port, and MGR).

Coal-field wise production data has been obtained from the Ministry of Coal and Plan Documents. District-wise coal production data for the year 2004-05 was sourced from Ministry of Labour report.

For deriving the district-wise production for the base year 2006-07, we mapped districts to coal fields and district-wise production ratio for each coal field for the year 2004-05 as the basis for 2006-07, allocating coal production to the regions. Consumption data of coal have been obtained from secondary sources (Plan Documents, company reports, reports of various ministries, Indian Minerals Year Book and internet, etc). The Team has spent considerable time to make sure that the errors are minimized by reconciling the flow data with the production and consumption data of 623 regions identified for the purpose of the study.

7.3.1.4 Regional Allocation of Demand

Regional demand allocation is more difficult exercise as it is very difficult to pinpoint district wise location of the future plants of power, steel, cement, etc. For the 11th Plan period, the Team has considered the demand pattern indicated in the Plan Document. For the rest of the terminal years we considered 2 different scenarios.

Scenario 1

Business as usual: where the expansion of consumption industries will follow the existing flow pattern.

Scenario 2

Where 75% additional power requirement (over and above the 11th Plan requirement) will be met mainly from the thermal power plants located near the coal producing regions/ports. The Team has identified the locations of thermal power plants, steel plants (including integrated, major and minor plants) and cement plants, and converted these locations to regions identified for the purpose of the study.

7.3.1.5 Regional Allocation of Production

Depending on the locations of all coal fields (42 coal fields) along with their production, the Team has calculated the district-wise coal production. Considering production planning of Coal India Ltd (CIL) and Singareni Collieries Company Limited (SCCL) and government's plans to consider the private participation, the Team has projected the region-wise coal production for the horizon years. Depending on the locations of coal mines, their production projection has been allocated to their respective regions/districts.

The region/district-wise demand and supply projections of coal for the horizon years are given in **Annexure 7.2 contained in Annexure Volume 2.**

7.3.2 Food Grains

Owing to climatic, geographical socio-economic diversities and varying food grain preferences across the country, the supply and demand for specific food grains reflect varying regional patterns. Food grain consumption and production patterns are, thus, highly diversified. District level estimates of food grain production and consumption have accordingly to be made. District

level projections of all food items separately are thus extremely daunting and beyond the scope of the study. Keeping this in view, projections are focussed on three important food grains; namely; rice, wheat and pulses.

7.3.2.1 Food Grains Demand Projections

The factors which influence the demand for food grains are:-

- Growth of population and urbanisation
- Changes in per capita real income
- Consumption behaviour

Future food grains demand estimates made by some experts are given in the Table 7.6.

TABLE 7.6: DEMAND PROJECTIONS MADE BY VARIOUS EXPERTS

(Million Tonnes)

Commodity	Year	By Working Group	By Mittal, 2008	By Kumar, 1998	By Hanchate & Dyson, 2004
Rice	2011		94	104	
	2021		97	122	
	2026		102		
Wheat	2011		59	86	
	2021		64	102	
	2026		66		
Pulses	2011	20	24	23	
	2021		42	31	
	2026		58		16

Note: Blank cells indicate no estimates were made.

The estimates vary owing to difference in methodology and the variables adopted. Kumar (1998)[1] used food characteristic demand system. Hanchate & Dyson (2004)[2] projected the total demand for pulses at 16 million tonnes in 2026 based on NSS consumer expenditure and expenditure elasticity. Mittal (2008)[3] used population, expenditure elasticity and economic growth for estimating the demand.

As Indian food habits are changing owing to increasing per capita income impacting life style of the people, the behavioural approach used by Mittal (2008) was used for estimating the demand. The projections made by Mittal were interpolated for obtaining the final demand for different horizon years. The national demand for different horizon years is given in the Table 7.7.

Table 7.7: DEMAND PROJECTIONS OF RICE, WHEAT AND PULSES

(Million Tonnes)

Commodity/Year	2007-08	2012-13	2017-18	2022-23	2025-26
Rice	90.38	102.42	108.94	111.34	114.49
Wheat	51.2	56.79	59.69	60.07	66.68
Pulses	12.12	25.82	33.79	43.95	52.2

7.3.2.2 Food Grains Production Projections

Food grains demand is met through either domestic production or through imports. Supply projections made by various agencies/research scholars are given in the Table 7.8.

[1] Pradum Kumar (1998). Food Demand and Supply Projections for India.
[2] Amresh Hanchant & Tim Dyson (2004) Prospects for Food Demand and Supply in the Book Twenty First Century
[3] Mittal, Surabhi (working paper No. 209, ICRIER, 2008)

TABLE 7.8: SUPPLY PROJECTIONS MADE BY VARIOUS AGENCIES

(Million Tonnes)

Commodity	Year	11th Plan Working Group	Mittal (2008)	Kumar (1998)	Kumar & Mittal
Rice	2011		95	109	108
	2021		106	134	127
	2026		111		
Wheat	2011		80	96	95
	2021		92	127	111
	2026		98		
Pulses	2011	16	16		14
	2021		18		15
	2026		18		

Note: Blank cells indicate no estimates were made.

The Team has broadly reviewed projected supply of rice, wheat and pulses given by Mittal (2008). On the basis of trend, it is estimated that supply increased by 1.0%, 1.34% and 0.89% per annum for rice, wheat and pulses, respectively. On the basis of above growth trend supply projections for rice, wheat and pulses for different horizon years are given in Table 7.9:

TABLE 7.9: SUPPLY PROJECTIONS OF RICE, WHEAT AND PULSES

(Million Tonnes)

Commodity/Year	2007-08	2012-13	2017-18	2022-23	2025-26
Rice	96	99	102	107	110
Wheat	78	81	87	93	97
Pulses	15	16	17	18	18

From the expected production a certain proportion does not enter the market as it is consumed towards seeds, animal feed, wastages and industrial use. The quantity not entering the market is estimated by the Working Group for 11th Plan to be 12.5% for wheat and pulses and 7.6% for rice. By reducing the production by this proportion the total quantity of supply is given in Table 7.10.

TABLE 7.10: SUPPLY PROJECTIONS OF RICE, WHEAT AND PULSES (AFTER ADJUSTING FOR SEED, FEED & WASTE)

(Million Tonnes)

Commodity/Year	2007-08	2012-13	2017-18	2022-23	2025-26
Rice	83	89	94	99	102
Wheat	70	71	76	81	84
Pulses	16	17	17	18	18

In case supply is less than demand, imports cover the difference. If estimated supply of food grains exceeds the demand, exports on the existing pattern are considered.

7.3.2.3 Regional Allocation

7.3.2.3.1 Regional Allocation of Food Grains Demand

Total national level demand projections worked out by the above approach were converted to district level demand in the following manner:

- The state level rural and urban per capita consumption was obtained from National Sample Survey Organisation estimates for the year 2006-07 for wheat and rice and for the year 1999-2000 for pulses.
- District level rural and urban population was projected using population trends made by Registrar General of India and urban growth trends by the 11thI Plan Working Group.

- The per capita consumption projected over different years by Mittal (2008) was used to obtain national per capita consumption for the horizon years by interpolation.
- The figure obtained as above was weighted by NSSO data to obtain state level per capita rural and urban consumption.
- The state level rural and urban per capita consumption was multiplied with district rural and urban population to obtain district level rural, urban consumption.

7.3.2.3.2 Regional Allocation of Production

As a prelude to preparation of district level production allocation, the 2007-08 production figures were compiled based on data obtained from different sources. The district level production figures were increased assuming that they would maintain the national growth trend of the commodity. The district level production figures were converted to effective production by accounting for seed, feed, wastage, and industrial use. In the end the production figures were adjusted to match the supply figures.

The region/district-wise demand and supply projections of rice, wheat and pulses for horizon years are given in **Annexure 7.3, 7.4 and 7.5,** respectively, contained in Annexure Volume 2.

7.3.3 Fertilizers

Fertilizers have been considered as an essential input for Indian agriculture for meeting the food requirements of the growing population of the country. Studies have shown around 50 to 60 percent of the enhanced food production during seventies and eighties could be attributed to use of fertilizers. The fertilizer need is met by a variety of nutrients. Out of these, three important ones – Nitrogen (N), Phosphates (P_2O_5) and Potassium (K_2O) are extensively used. For specific crops like cotton, complex fertilizers (NPK) are also required. In addition a number of other nutrients – called micro nutrients - are also consumed.

7.3.3.1 Fertilizers Demand Projection

Accurate forecasting of fertilizer demand is essential, both for companies producing, importing and marketing fertilizers and for governments in their efforts to monitor the development of agriculture. The study team reviewed the demand projections for major fertilizer nutrients made by different agencies. A summary of their forecasts is given in Table 7.11.

TABLE 7.11: PROJECTIONS BY DIFFERENT STUDIES OF 11th PLAN & THEIR AVERAGE

(Million Tonnes)

Year	NCAEPR Study*	DAC	FAI **	FAI ***	11th PLAN WG ****	Average
2006	21	21	23	22	22	22
2007	22	22	24	23	23	23
2008	23	23	25	25	24	24
2009	23	24	26	26	25	25
2010	24	24	26	28	26	26
2011	25	25	27	29	27	27

NCAEPR: National Centre for Agricultural Economics and Policy Research
DAC: Department of Agriculture and Cooperation
FAI: Fertilizer Association of India
WG: Working Group
***** Agricultural Output Growth 4.08%. ****** Population Nutrition Approach.
******* Food grains Target Approach. ******** Multiple Regression Method.

Growth trend was worked out by using the average of projected estimates as above. The resulting growth rates were used for forecasting demand for major nutrients as presented in Table 7.12.

TABLE 7.12: ESTIMATES OF FERTILIZERS DEMAND IN TERMS MAJOR NUTRIENTS (LAKH TONNES)

Year	N	P_2O_5	K_2O	Total
2007-08	144	61	27	231
2012-13	173	73	32	278
2017-18	203	86	38	327
2022-23	234	99	44	377
2025-26	253	107	47	406

The major nutrients were converted to materials by assessing the conversion factors from materials and nutrient information provided in the 11th Plan Working Group estimates. The final demand for different horizon years is given in Table 7.13.

TABLE 7.13: FERTILIZERS MATERIAL DEMAND ESTIMATES

YEAR	LAKH TONNES
2007-08	477.9
2012-13	573.5
2017-18	676.0
2022-23	778.4
2025-26	839.9

7.3.3.2 Fertilizers Availability Projections

Fertilizers availability is the sum of domestic production and imports. Supply trend has been worked out based on indigenous production and imports data for the last 30 years. The trend of the fertilizer import was worked out to estimate the likely imports in the horizon years. The difference between demand and imports was worked out as the production. On the basis of demand and import projections estimated supply of fertilizer nutrients is given in Table 7.14.

TABLE 7.14: SUPPLY OF FERTILIZER NUTRIENTS (LAKH TONNES)

Year	N	P_2O_5	K_2O	Total
2007-08	112	44	0	155
2012-13	165	64	0	229
2017-18	197	77	0	274
2022-23	229	89	0	318
2025-26	248	97	0	345

The fertilizer materials were estimated by using the nutrient estimates and a conversion factor of 2.07. The fertilizer materials production and imports are given the Table 7.15.

TABLE 7.15: SUPPLY OF FERTILIZER MATERIALS (LAKH TONNES)

Year	Production	Import
2007-08	321	157
2012-13	474	99
2017-18	566	110
2022-23	658	121
2025-26	713	127

7.3.3.3 Regional Allocation

7.3.3.3.1 Regional Allocation of Demand

To estimate the district level demand, for the base year 2007-08 district level consumption estimates were prepared first. The national growth rates were then applied to the base year district figures to arrive at district level projections of fertilizer materials.

7.3.3.3.2 Regional Allocation of Production

To arrive at the district level production trend, district level production data base was generated for 2007-08. The estimated indigenous production for different years was then allocated to various regions/districts in the same proportion as existing in 2007-08.

To regionalise the imports, a data base of imports at different ports in 2007-08 was built up. The estimated volumes of import fertilizers in different years were then assigned to the ports/regions on the basis of existing pattern of imports. The region/district-wise demand and supply projections of fertilizer for the horizon years is given in **Annexure 7.6 contained in Annexure Volume 2.**

7.3.4 Iron & Steel

The Indian steel industry has entered into a new development stage from 2005-06, riding high on the resurgent economy and rising demand for steel. Rapid rise in production has resulted in India becoming the 5th largest producer of steel in the world. In the present study, for the purpose of transport demand forecast, the following iron and steel products have been considered:

- Bars and rods
- Structurals
- Railway materials
- Plates
- HR coils/sheets/skelp
- CR coils/sheets
- GP/GC sheets
- Electric sheets
- Tin plates
- Pipes
- Pig iron

7.3.4.1 Iron and Steel Demand Projections

Iron and steel is mainly used in manufacture of capital goods (machinery, equipment, etc.), consumer durables, intermediate products (e.g. bolts, nuts, nails, etc.). It is also used as just finished steel as reinforcement material in the construction sector. Other than plain carbon steel, products such as bars and rods, plates, sheets, tin plates, wires, etc. have a significant share in this sector's output and generally have different growth rates depending on their end-use pattern.

The National Steel Policy, 2005, indicates that the present annual per capita steel consumption is about 30 kg for urban areas and 2 kg for rural areas. The Policy Document also visualises future per capita steel consumption for urban areas at approximately 165 kg in 2019-20, implying a CAGR of 5% and 4 kg per annum for rural areas by 2019-20, implying CAGR of 4.4 percent. The Steel Policy Document also projects 90 million tonnes demand for steel by 2019, implying CAGR of 6.9%. In order to have a long-term perspective, the Team has reviewed the projections given by the Planning Commission Working Group on Steel Industries for the 11th Plan (2007-12) The Working Group has considered different GDP scenarios for forecasting steel demand during the 11th Plan, 2007-08 to 2011-12. The Working Group's projections are given in Table 7.16

TABLE 7.16: FORECAST OF DEMAND FOR FINISHED STEEL

(MILLION TONNES)

Year	Scenario 1: 7% Growth in GDP	Scenario 2: 8% Growth in GDP	Scenario 3: 8.5% Growth in GDP	Scenario 4: 9% Growth in GDP
2007-08	49174	49605	49865	50290
2011-12	66487	67533	68908	70347

For the projections of steel demand, the Team has considered different growth scenarios i.e. 7.5% GDP growth for 2012-13, 8% for 2017-18, 7% for 2022-23 and 6.5% for 2025-26. For demand estimation, we have adopted these growth rates. At present, the steel elasticity with respect to GDP is 1.3. The Team has assumed the declining rate of steel elasticity for future year's i.e. 1.1 for 2012-13 and 1.0 for 2017-18 and 0.9 for 2022-23 and 2025-26.

7.3.4.2 Iron and Steel Production Projections

For production projections of iron and steel, the Team has used two components i.e. demand and net exports. Regarding projections of net exports, the Team has reviewed the past net export growth and assumed the net export growth of 1% for 2012-13, 5% for 2017-18, 2022-23 and 2025-26. Production has been worked out by the sum of demand and net exports. The projections are given in Table 7.17.

TABLE 7.17: PRODUCTION PROJECTIONS OF CRUDE STEEL

(Million Tonnes)

Year	Demand	Net Export	Production
2007-08	54	0.32*	54
2012-13	80	0.33	80
2017-18	117	0.42	117
2022-23	159	0.54	159
2025-26	188	0.62	189

* 2006-07

7.3.4.3 Regional Allocation

7.3.4.3.1 Regional Allocation of Demand

Based on the behavioural pattern of user sectors, urbanization, growth of steel consumption sectors i.e. construction, manufacturing & automobile and transport, the Team has estimated the regional demand of steel.

Construction

Construction sector is major user of steel, consuming nearly 60% of the total steel consumption. In future this sector will increase its consumption further.

Manufacturing

Manufacturing sector is the second largest consumer, using almost 31% of total steel consumption for the past three years. Its share is expected to increase further in future.

Automobile and Transport

The automobile and transport sector accounts for nearly 8% of total steel consumption. It is expected to increase in future given the growth in automobile sector.

Regional Allocation of Production

Considering the plant-wise capacity expansion mainly for integrated steel plants, the Team has allocated the region-wise steel production separately for crude steel and sponge iron. The region/district-wise demand and supply projections of iron and steel for the horizon years are given in **Annexure 7.7** contained in Annexure Volume 2.

7.3.5 Iron Ore

India is one of the leading producers as well as exporters of iron ore in the world. Iron ore has two principal roles in our economy: (1) main raw materials for steel production, (2) an important item in the country's exports.

7.3.5.1 Iron Ore Demand Projections

Iron ore mines broadly yield two types of products viz. lumps and fines. While these two products are used in varying proportions by the integrated steel plants, the lumps alone are required for manufacture of sponge iron and fines for pellets making.

As indicated above, apart from steel production, iron ore is also required for manufacture of sponge iron and pellets. Sponge iron is used for supplementing steel scrap as a raw material in electric furnace based steel production, and pellets as a higher value added item for exports.

The estimation of iron ore domestic demand for the horizon years is based on:

(1) Levels of capacity available at the existing steel plants,
(2) Levels of capacity assumed to be available during the target years,
(3) Levels of capacity utilization of the existing plants in the past,
(4) Levels of capacity utilization assumed for the plants during the target years, and
(5) Input-output coefficient being 1.5 for finished steel.

Thus, Domestic Demand = Steel Production x 1.5

Iron ore demand projections for the horizon years are presented in Table 7.19.

TABLE 7.19: DEMAND PROJECTIONS OF IRON ORE (MT)

Year	Domestic Demand of Iron Ore
2007-08	81
201213	120
2017-16	176
2022-23	239
2025-26	284

7.3.5.2 Iron Ore Production Projections

For the projections of iron ore production, the Team has considered two factors, i.e. domestic demand and exports. The following formula is used for estimation of iron ore production for horizon years:-

Production = Domestic Demand + Exports

Iron ore production projections for the horizon years are given in Table 7.20.

TABLE 7.20: PRODUCTION PROJECTIONS OF IRON ORE (MT)

Year	Domestic Demand	Exports	Production*
2007-08	81	90	171
201213	120	97	217
2017-16	176	100	276
2022-23	239	105	344
2025-26	284	110	394

*Excluding surplus

Export of iron ore has increased rapidly over the last few years. But adopting the past export growth rate would not be realistic owing to increase in requirement of iron ore by domestic industry and the fall in the global demand for steel due to current slowdown in the global economy. The National Steel Policy predicts that by 2019-20, the exports will be limited to 100

million tonnes. Even if it grows beyond this estimate, the increase will be very limited and our projections reflect this fact.

From the above it is seen that there is rapid increase in iron ore production due to domestic and international requirement (Export). In 2007-08, iron ore production was 171 million tonnes and the Team has projected 217 million tonnes by 2012-13, 276 million tonnes by 2017-18, 344 million tonnes by 2022-23 and 394 million tonnes by 2025-26. The domestic demand of iron ore depends on growth of steel industry. In 2007-08, the domestic demand of iron ore was 81 million tonnes and the Team has projected domestic demand at 120 million tonnes by 2012-13, 176 million tonnes by 2017-18, 239 million tonnes by 2022-23 and 284 million tonnes by 2025-26.

7.3.5.3 Regional Allocation

7.3.5.3.1 Regional Allocation of Demand

The total estimated demand for iron ore in different years has been allocated to various regions adopting the pattern existing in the base year 2007-08.

7.3.5.3.2 Regional Allocation of Production

The region-wise iron ore production has been allocated to the regions according to iron ore producing locations and anticipated increase in production in future years.

The region/district-wise demand and supply projections of iron ore for the horizon years are given in **Annexure 7.8 contained in Annexure Volume 2.**

7.3.6 Cement

The Indian cement industry has grown tremendously in the last decade and has emerged as the second largest producer after China. Cement plays a key role for the development of housing and infrastructure sectors.

7.3.6.1 Cement Demand Projections

Fast rising Government Expenditure on infrastructure sector in India has resulted in higher demand for cement in the country. The recent boom in infrastructure and the housing market has only boosted the cement industry. Flurry of activity in infrastructure projects – highways roads, bridges, ports and houses has led to increase in cement demand. Infrastructure and construction sectors are the major demand drivers. Some demand determinants are:

- Economic growth
- Industrial activity
- Real estate business
- Construction activity
- Investments in the core infrastructure sector.

The Team has reviewed the projections given by Planning Commission Working Group on Cement Industry for 11th Five Year Plan. According to the Approach Paper for 11th Five Year Plan, the Indian economy is expected to grow between 8 to 9% per annum. The Working Group Report has estimated the cement demand for the 11th Plan period considering three scenarios. Firstly, in the low growth scenario if GDP grows at 8% the cement industry will grow at 10%. Secondly, in the average growth scenario if GDP grows at 8.5% the cement industry will grow at 11%. Thirdly, in the high growth scenario if GDP grows at 9% the cement industry will grow at 11.5%. The projections by Working Group are given in Table 7.21.

TABLE 7.21: CEMENT FORECASTS BY THE WORKING GROUP (MT)

Scenarios	Year	Domestic Demand	Cement and Clinker Exports	Production Required
Scenario-I	2006-07	152	10	162
	2011-12	241	11	252
Scenario-II	2006-07	152	10	162
	2011-12	252	11	263
Scenario-III	2006-07	152	10	162
	2011-12	258	11	269

The Team has considered the Working Group Report and also present economic conditions for the projections of cement demand for next 20 years. Due to present economic crisis in the world, the Indian economy will grow slowly compared to last three years and it also affects the manufacturing sector growth. For cement demand projections, the Team has assumed the GDP growth by 7.5%, 8%, 7% and 6.5% for 2012-13, 2017-18, 2022-23 and 2025-26, respectively. The Team has also estimated GDP elasticity of cement demand using the regression approach. The GDP elasticity of cement is derived as 1.2. The projected demand of cement for horizon years is given in Table 7.22.

TABLE 7.22: PROJECTED CEMENT DEMAND

Year	MILLION TONNES
2007-08	167.67
2012-13	257.98
2017-18	407.98
2022-23	610.64
2025-26	764.97

7.3.6.2 Cement Production Projections

Production of cement is the sum of domestic demand and exports demand. Exports are assumed to grow at the rate of past 5 years CAGR, which is 2%. The projected production of cement for the horizon years is given in Table 7.23.

TABLE 7.23: PROJECTED CEMENT PRODUCTION (MT.)

Year	Domestic Demand	Cement and Clinker Exports	Production Required
2007-08	167.67	6.64	174.31
2012-13	257.98	7.33	265.31
2017-18	407.98	8.09	416.08
2022-23	610.64	8.94	619.58
2025-26	764.97	9.48	774.45

7.3.6.3 Regional Allocation

7.3.6.3.1 Regional Allocation of Demand

Review of cement consumption pattern over the past decades, brings out that almost 77% of the cement demand is accounted for by urban areas and the balance 23% by rural areas. Keeping this in view, the Team has allocated the region-wise cement demand based on perspective urban and rural population, infrastructure development plans, housing construction activities, sanitation, etc.

7.3.6.3.2 Regional Allocation of Production

Regional location of cement plants, both public and private sector, and their estimated production in different years forms the basis for allocation of production to different districts/regions. Compatible with national demand forecasts, location-specific region-wise production profiles for the horizon years have been prepared taking into account the existing capacity, its utilization and expansion plans of cement plants.

The region/district-wise demand and supply projections of cement for the horizon years are given in **Annexure 7.9 contained in Annexure Volume 2.**

7.3.7 Petroleum, Oil and Lubricants (POL)

Petroleum products are useful materials derived from crude oil after it is processed in oil refineries. In the post-independence era, India grew tremendously in terms of infrastructure in the petroleum industry, which in turn helped us to increase the production of petroleum and petroleum-related products. For the purpose of the present study, product coverage under POL products is:

- Superior Kerosene Oil (SKO)
- Aviation Turbine Fuel (ATF)
- Motor Spirit (MS)
- High Speed Diesel (HSD)
- Light Diesel Oil (LDO)
- Fuel Oil/Low Sulphur Heavy Stock (FO/LSHS)
- Bitumen
- LPG
- Naphtha
- Lubes
- Others

7.3.7.1 POL Demand Projections

In the last decade, a steady growth in demand for petroleum products has been observed. The main consuming sectors are Transport and Agriculture; Power Generation, Chemical & Allied industries and Household sector. Various groups have estimated long-term demand projections for petroleum products for the country from time to time. Some of these projections are contained in:

- Report of the Working Group on Petroleum & Natural Gas Sector for the 11th Plan.
- Energy Information Administration (EIA)
- International Energy Agency (IEA)
- India Hydrocarbon Vision 2025
- India Vision – 2020

TABLE 7.24: DEMAND PROJECTIONS BY VARIOUS AGENCIES FOR PETROLEUM PRODUCTS

Year	11th Plan Working Group (2006)		EIA (2004)			IEA (2004)	IHV - 2025 (2000)	India Vision - 2020 (2002)	
	Base Case	Upper Case	Reference Case	High Case	Low Case			BAU	BCS
Base Year	2006-07 (114.034 Mt)		2001 (105 Mt)			2000 (102 Mt)	1998-99 (91 Mt)	1997 (83 Mt)	
2004-05			119	122	115	122	132	121	112
2009-10			139	149	129	145	175	153	135
2011-12	131.8	141.8							
2014-15			157	194	154	171	226	193	162
2016-17	160.2	179.3							
2019-20			219	254	189	201	288	245	195
2021-22	190.3	212.9							
2024-25			264	324	204	230	368	309	235
2029-30						271			

EIA - Energy Information Administration, USA
IEA - International Energy Agency
IHV - India Hydrocarbon Vision 2025
BAU - Business as Usual
BCS - Best Case Scenario
Source: Report of the Working Group on Petroleum & Natural Gas for the 11th Plan (2007-2012)

The demand of petroleum products depends on various factors i.e. future technologies, state of the economy, development of alternatives and new products, geopolitical developments, etc. which cannot be accurately determined. However, general economic growth can determine the POL consumption. According to the Report of the Working Group on Petroleum and Natural Gas Sector for the 11th Plan (2007-2012), the demand elasticity is declining. The elasticity was 1.15 in 7th Plan, 1.0 in 8th Plan, 0.89 in 9th Plan and 0.35 in 10th Plan.

The main reasons for declining elasticity are higher contribution of services sector to the economy compared to the past and the growth of manufacturing sector has almost remained the same. The Team has estimated the demand elasticity of petroleum products for different time periods taking in to account the consumption of petroleum products and GDP. During the period 1970-2006, the demand elasticity of petroleum products was 1.07, 0.91 for the period of 1986-2006 and 0.46 for the period of 2002-2006. These are almost matching the Working Group estimates. Therefore, it is decided to adopt the base case and upper case estimates of the Planning Commission Working Group.

Scenario: 1 – Upper Case

In this scenario, the Team has adopted the growth rates given by the Working Group Reports for 11th and 12th Plans. For the projections for 2012-13, 11th plan growth rate (4.45%) and for 2017-18, 2022-23 and 2025-26, 12th plan growth rate (4.8%) was adopted. National demand projections are given in Table 7.25.

TABLE 7.25: DEMAND PROJECTIONS OF PETROLEUM PRODUCTS – UPPER CASE

YEAR	DEMAND (MT)
2007-08	118.83
2012-13	147.73
2017-18	186.76
2022-23	236.09
2025-26	271.75

Scenario: 2 – Base Case

In this scenario, the Team has adopted the product-wise growth rates given by Working Group Report for 11th and 12th Plans. The 11th plan growth rate for the projections for 2012-13, and the 12th plan growth rates for 2017-18, 2022-23 and 2025-26 have been adopted. Product-wise projections are given in Table 7.26.

TABLE 7.26: DEMAND OF PETROLEUM PRODUCTS (MT)

Products	2007-08	2012-13	2017-18	2022-23	2025-26
LPG	11.32	13.78	18.24	24.15	28.58
MS	10.33	12.76	15.52	18.88	21.24
NAPHTHA/NGL	8.89	9.09	13.62	20.41	26.02
ATF	4.56	7.41	9.02	10.98	12.35
SKO	9.35	7.68	6.74	5.92	5.48
HSD	42.85	51.12	62.20	75.67	85.12
LDO	0.72	0.45	0.45	0.45	0.45
LUBES	1.13	1.21	1.31	1.41	1.47
FO/LSHS	11.75	12.12	12.42	12.74	12.93
BITUMEN	4.47	5.71	6.62	7.67	8.38
OTHERS	13.46	18.44	24.30	32.04	37.81
TOTAL	**118.83**	**139.77**	**170.44**	**210.32**	**239.83**

From the analysis of 2006-07 figures, the following pattern (Table 7.27) of sectoral consumption emerges in respect of major products:

TABLE 7.27: SECTOR-WISE (END-USE) CONSUMPTION OF SELECTED PETROLEUM PRODUCTS (2006-2007 (P)
('000 TONNES)

Petroleum Products	Transport	Plantation	Power Generation	Industry	Miscellaneous Services	Private Sales	Total
High Speed Diesel Oil	21611	7914	2894	5108	3091	2248	42866
Light Diesel Oil	53	130	67	133	337	0	720
Furnace Oil	276	**	254	973	5600	1083	8186
Low Sulphur Heavy Stock	0	0	298	1358	1705	@	3361

Abbreviation: (P)- Provisional.
Note: @: LSHS sales through private parties included in Furnace Oil sales
**: Included in Miscellaneous services. Break up not available
Source: Ministry of Petroleum & Natural Gas, Govt. of India.

7.3.7.2 POL Production Projections

The production of petroleum products in India is dependent on imports of crude oil. In 2007-08, India produced only 34.117 million tonnes of crude oil as against the consumption of 156.1 million tonnes. In terms of petroleum products, India produced 144.93 million tonnes as against the consumption of 118.83 million tonnes. In 2007-08, India imported 121.67 million tonnes of crude oil and 22.72 million tonnes of petroleum products and exported 39.33 million tonnes of petroleum products and net export of petroleum product was 16.61 million tonnes. From the above it is clear that the production (in terms of export) of petroleum products mainly depends on import of crude oil. So the export of petroleum products does not have any comparative advantage to the country.

Thus, the production of petroleum is heavily dependent on two factors: - (1) Import of crude oil, (2) Rise in price of petroleum product in global market. For the production projections of petroleum products, the Team considered the two factors – domestic demand and net export

growth. The projections of demand have been made as above. For the projections of net export, the Team has decided the GDP growth of economy as major determinant. From the comparison of past data on net export and GDP, it is seen that the growth of GDP is higher than net export growth. In this, the Team assumed the Net export growth of 3.39% for 2012-13, 3.62% for 2017-18, 3.17% for 2022-23 and 2.94% for 2025-26 as against the GDP growth of 7.5%, 8%, 7% and 6.5% for the respective years. Production projections of petroleum products for the horizon years are given in Table 7.28.

TABLE 7.28: PRODUCTION PROJECTIONS OF PETROLEUM PRODUCTS* (MT)

Year	Domestic Demand	Net Exports	Production	Net Exports Growth
2007-08	118.83	16.61	135.44	4.07
2012-13	139.76	19.63	159.39	3.39
2017-18	170.44	23.45	193.89	3.62
2022-23	210.31	27.40	237.71	3.17
2025-26	239.82	29.89	269.71	2.94

*Excluding RBF

7.3.7.3 Regional Allocation

7.3.7.3.1 Regional Allocation of Demand

Regional allocation of demand is based on the base year estimates and then allocated, first at the level of the state, based on projected state level GDP and then to the districts based on the rural-urban population and total population projections.

7.3.7.3.2 Regional Allocation of Productions

The supply is allocated to regions based on the location of refineries and the tap points of the pipelines. Availability of refinery is reduced by the POL supplies through the pipelines. Refinery/port-wise POL production/import projections for meeting the total transport demand have been aggregated at the regional level on the basis of refinery/port locations.

The region/district-wise demand and supply projections of POL for the horizon years are given in **Annexure 7.10** contained in Annexure Volume 2.

7.3.7.4 Petroleum Product Pipelines

Pipeline network is the preferred mode of transportation for petroleum products because it is environment friendly, cost effective and safe. In India, the share of petroleum product movement through pipelines was only 35.6% of the total consumption as compared to more than 62% in the developed countries. In 2007-08, the number of existing pipelines was 20 and the total capacity was 57.97 million MTPA. During this period the throughput and tkm were 42.31 million tonnes and 2452.71 million, respectively.

For the purpose of projections of petroleum products, the Team has distributed the segment-wise throughput of petroleum products. Generally the pipelines originate from refinery locations and terminate at major consuming centres. Hence the originating tonnages of petroleum products from refinery locations were deducted and added the terminating tonnage to the terminating centres.

7.3.8 Limestone

Limestone is a sedimentary rock composed largely of the mineral calcite. Limestone may be classified into three grades: cement, metallurgical and others.

7.3.8.1 Limestone Demand Projections

Limestone consuming industries are: cement, steel (including refractories), chemicals, sugar, paper, fertilizers, ferro-alloys, alloy steel and others i.e. aluminium glass, foundry, etc. For each of the industries mentioned above except others, the demand levels for limestone have been estimated on the basis of the respective input-output coefficients and their likely production levels for each of the horizon years 2012-13, 2017-18, 2022-23 and 2025-26. In the case of cement, growth of cement industry will spur a proportionate demand on limestone. Limestone security is, therefore, vital for sustainable growth of the cement industry. This postulate is borne out from a review of growth pattern of the industry and cement consumption in the previous plan period. This will define the future limestone demand to meet the growth of cement industry.

Based on the demand of user sectors i.e. cement, steel and others, the Team has derived the demand of limestone. In this case, the Team has already made the projections for cement and steel production. It is seen from past data that cement and steel consume almost 98.2% of total limestone consumption and the remaining 1.8% is used by others including chemicals, assuming the conversion factor i.e. 1.03 tonne of limestone for 1 tonne of cement production and 0.089 tonne of limestone for 1 tonne of steel production. For other consumers RITES Team has also taken the share of 1.8% of total consumption. Projected limestone demand for the horizon years is given in Table 7.29.

TABLE 7.29: DEMAND PROJECTIONS OF LIMESTONE

(Million Tonnes)

Year	Sectors			Total
	Cement	Steel	Other	
2007-08	180	5	3	188
2012-13	277	7	5	289
2017-18	439	10	8	457
2022-23	657	14	12	683
2025-26	822	17	15	854

7.3.8.2 Limestone Production Projections

The production plan for limestone depends on the requirement for the user industries. India has huge resources of limestone distributed over different parts of the country. India is comfortably placed in the world in annual capacity and production of cement. Although cement-grade limestone occurs in all the limestone-bearing areas, SMS, BF and chemical-grade-limestone occur in selective areas. Due to increase in steel production in the country, the demand for SMS and BF grade limestone is increasing. Emphasis has to be thus given for locating SMS and BF-grade limestone along with cement-grade limestone from the states of Meghalaya, Rajasthan, Madhya Pradesh, Gujarat, Orissa and Assam. The availability of potential limestone deposits of hill states and north-eastern states is restricted due to Forest Conservation Act.

In order to ensure rational utilization of limestone reserves of various grades available in the mining lease area and to assess the shortfall, if any, for expansion of existing cement plants periodic re-assessment of captive limestone reserves has to be made. In the case of limestone production projections, the Team has assumed the demand as the required production of limestone. Projections for the horizon years are given in Table 7.30.

TABLE 7.30: PRODUCTION PROJECTIONS OF LIMESTONE

Year	Production (MT)
2007-08	188.46
2012-13	289.70
2017-18	457.32
2022-23	683.00
2025-26	854.64

7.3.8.3 Regional Allocation

7.3.8.3.1 Regional Allocation of Demand

For limestone, for all industries except 'others' the grade-specific plant-wise requirement has been aggregated at the transport region level on the basis of plant locations. For others, the aggregated demand is distributed to various transport regions on the basis of base year pattern.

7.3.8.3.2 Regional Allocation of Production

The regional production profiles have been worked out on the basis of locations of limestone production and reserves. The region/district-wise demand and supply projections of limestone for horizon years is given in **Annexure 7.11 contained in Annexure Volume 2.**

7.3.9 Dolomite

Dolomite may be classified into two grades: metallurgical and others. Dolomite consuming metallurgical industries are steel (including refractories), alloy steel, ferro-alloys, fertilizers, glass and other industries (foundry, paint, charge chrome, etc.).

7.3.9.1 Dolomite Demand Projections

The total consumption of dolomite in 2004-05 was 4.35 million tonnes. Iron and Steel was the major consumer of dolomite in 2004-05 accounting for 84%, followed by refractory (8%,) sponge Iron (2.43%), glass (1.93%), and Ferro-alloys (1 percent). The consumption of dolomite rose from 3418.90 thousand tonnes in 1997-98 to 3828.70 thousand tonnes in 2003-04. The maximum consumption of dolomite has been in iron and steel industry which also uses dolomite for captive refractory. For estimation of dolomite demand, used conversion factor i.e. 0.09 tonne of dolomite for 1 tonne of steel production has been used. Projections of dolomite demand are given in Table 7.31.

TABLE 7.31: DOLOMITE DEMAND PROJECTIONS (MT)

Year	Demand
2007-08	4.87
2012-13	7.20
2017-18	10.57
2022-23	14.35
2025-26	17.01

7.3.9.2 Dolomite Production Projections

Production of dolomite was 4.43 million tonnes in 2005-06, up 2 per cent over the preceding year. The share of Public Sector in production during 2005-06 was 62% as against 52% in previous year. Orissa was the leading producer state of dolomite and accounted for 32% of total production in 2005-06, followed by Chhattisgarh (24%), Andhra Pradesh (21%), Karnataka and Jharkhand (7% each). The remaining 9% was shared by Gujarat, Madhya Pradesh, Maharashtra and Rajasthan. For projections of dolomite demand, the Team has used the conversion factor of 0.09 tonne of dolomite per tonne of steel production. Assuming production of dolomite equivalent to its demand, projections of production of the commodity in different horizon years has been worked out as in Table 7.32.

TABLE 7.32 : DOLOMITE PRODUCTION PROJECTIONS (MT)

Year	PRODUCTION
2007-08	4.87
2012-13	7.20
2017-18	10.57
2022-23	14.35
2025-26	17.01

7.3.9.3 Regional Allocation

7.3.9.3.1 Regional Allocation of Demand

In the case of all industries except 'others' grade-specific plant-wise requirement of dolomite has been aggregated at the regional level on the basis of plant locations. For others, the aggregated demand is distributed to various regions/districts on the basis of base year pattern.

7.3.9.3.2 Regional Allocation of Production

The regional production profiles are worked out on the basis of locations of dolomite production and reserves.

The region/district-wise demand and supply projections of dolomite for the horizon years are given in **Annexure 7.12** contained in Annexure Volume 2.

7.3.10 Salt

India is the third largest salt producing country in the world after China and the USA. The growth and achievement of salt industry over the last 60 years has been remarkable. The major sources of salt in India are sea brine, lake brine, sub-soil brine and rock salt deposits.

7.3.10.1 Salt Demand Projections

Salt is used for edible and industrial purposes. The edible salt is required for human and livestock consumption. The industrial salt is mainly used by caustic soda/ soda ash industries.

Human Consumption

In 2007-08, human consumption of salt was 5.07 million tonnes as against 5.78 million tonnes in 2006-07. The only determining factor of salt for human consumption is population. The Team has estimated per capita annual consumption of salt at 0.005 tonnes. Based on this per capita consumption and the population projections for respective years, the Team has projected requirement of salt for human consumption for the horizon years 2012-13, 2017-18, 2022-23 and 2025-26.

Industrial Consumption

Industries like caustic soda, soda ash, soaps & detergents, chemicals, water softening plants, dyes, etc. use salt. In 2007-08, various industries in the country consumed 9.35 million tonnes as against 8.62 million tonnes of salt in 2006-07. RITES Team has used the Trend Analysis Method for projections of salt consumption by various industries for the horizon years 2012-13, 2017-18, 2022-23 and 2025-26. Salt projections are presented in Table 7.33.

Table 7.33: SALT DOMESTIC CONSUMPTION PROJECTIONS (MT)

Year	Human Consumption	Industrial Consumption	Domestic Consumption
2007-08	5.07	09.35	14.42
2012-13	6.04	11.04	17.08
2017-18	6.43	13.06	19.49
2022-23	6.84	15.08	21.92
2025-26	7.15	16.29	23.44

7.3.10.2 Salt Production Projections

India is the third largest salt producing country after US and China in the world. In 2007-08, In 2007-08, India produced 17.85 million tonnes of salt as against 17.9 million tonnes in 2006-07.

The Central Government is responsible for controlling all aspects of salt industry. More specifically the Central Government is responsible for:

- Manufacture, supply and distribution of salt by union agencies, and
- Regulation and control of manufacture, supply and distribution of salt by other agencies.

The Team has projected the salt production on the basis of Three-Yearly Moving Average Method (because of inconsistency/volatility in production of past years) for the horizon years 2012-13, 2017-18, 2022-23 and 2025-26 which are given in Table 7.34.

TABLE 7.34: SALT PRODUCTION PROJECTIONS (MT)

Year	Production
2007-08	17.85
2012-13	19.83
2017-18	22.05
2022-23	24.26
2025-26	25.59

Export and Change in Stocks

The exports of salt were 1.893 million tonnes in 2007-08 as against 1.898 million tonnes in 2006-07. The total sum of exports and change in stock was 3.43 million tonnes in 2007-08 as against 3.51 million tonnes in 2006-07. The Team has derived the exports and change in stocks for the horizon years 2012-13, 2017-18, 2022-23 and 2025-26 on the basis of the following formula:-

Export+Change in Stocks = Production – Domestic Consumption (Human + Industrial)

Projections of production, consumption and exports of salt are given in Table 7.35.

TABLE 7.35: SALT EXPORTS AND STOCKS FOR HORIZON YEARS (MT)

Year	Production	Domestic Consumption	Exports
2007-08	17.85	14.42	3.43*
2012-13	19.83	17.08	2.75
2017-18	22.05	19.49	2.56
2022-23	24.26	21.92	2.34
2025-26	25.59	23.44	2.15

* includes Change in Stocks

Nepal, Bhutan, Bangladesh, Japan, UAE, Vietnam, China are the major importers of Indian salt. Other importers are Hong Kong, Singapore, Korea, Malaysia, etc. Salt is exported to Nepal as well as Bhutan and Bangladesh by rail through Nautanwa/Raxaul and New Jalpaiguri/Hasimara transit stations, respectively and to other countries by sea through ports.

7.3.10.3 Regional Allocation

7.3.10.3.1 Regional Allocation of Demand

The regional allocation of the domestic demand for salt has been done separately for human consumption and industrial consumption. For the region-wise allocation of human consumption, it is based on population and multiplied by per capita consumption (0.005 tonnes). In the case of industrial consumption, RITES Team has found out the production of salt consuming industries. Considering the input-output ratio i.e. the requirement of salt for making 1 tonne caustic soda =1.75 tonne salt, 1 tonne soda ash = 1.7 tonne salt and 1 tonne chlorine = 1.35 tonne salt, the region-wise salt consumption by industries has been allocated. As regards exports, depending on its location, the concerned port/rail transit station together with its related demand has been allocated to the relevant region where it is located.

7.3.10.3.2 Regional Allocation of Production

Relating the salt producing locations to districts, RITES Team has worked out the region-wise production percentage share of total production for the base year. Considering the same percentage share, the region-wise production has been allocated for the horizon years 2012-13, 2017-18, 2022-23 and 2025-26.

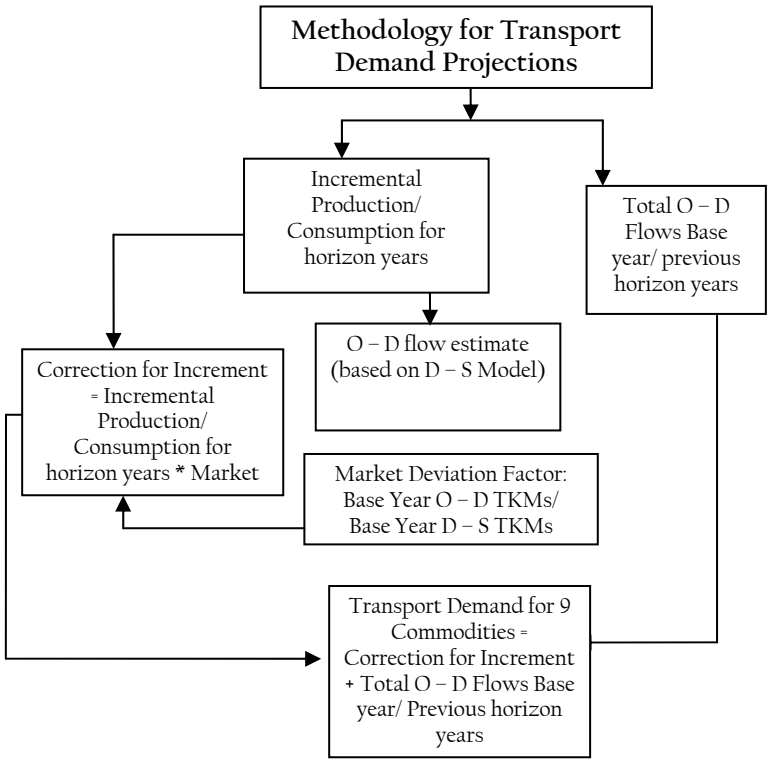
The region/district-wise demand and supply projections of salt for horizon years are given in **Annexure 7.13** contained in Annexure Volume 2.

7.4 TRANSPORT DEMAND FORECASTS

Forecasting of transport demand is an important element in the exercise on determination of optimal inter-modal mix and investment plan for the transport sector. The transport demand forecasts depend on the demand, supply and patterns of movement. It is very specific to the economy and is driven by the locational 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.

7.5 THE FLOW CHART

The flow chart given below presents the basic steps involved in estimation of 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. For running the model to generate total transport demand estimate, O-D flow outputs are combined to the previous years O-D flow data.



The total transport demand so estimated is lower than the likely 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.

Transport Demand for Year i = (Incremental Flows*Escalation Factor) + Transport Demand for Year i - 1

7.6 CHANGES IN THE NETWORK AND COSTS

As projections are to be made for next 20 years the rail and road network and the modal costs would vary over this period. The rail and road network is changed by assessing the works in future. In the case of IR, planned works were compiled from the pink book – name of the official document that compiles the sanctioned line capacity works in different years. The Eastern and Western dedicated freight corridors were assumed to be ready by 2017-18. Similarly the road network was upgraded by considering the works sanctioned under National Highway Development Program and also considering other works.

The costs were also reduced during the horizon years. The rail costs were reduced by one per cent per annum. The reduction is based on analysis of IR unit costs and analysis of sample costing studies done over South Central Railway. As a pure freight system the dedicated freight corridors are expected to cost less, and the costs were assumed to be around 25 per cent less than costs estimated on double line electric system. The road costs were changed by changing the vehicle composition in different distance slabs. The road costs were reduced by 3-5 per cent in different distance slabs. The changed costs of road and rail for coal are given in **Annexure 7.14 and 7.15,** respectively (in Annexure Volume 2).

7.7 RESULTS

Table 7.36 shows the total transport demand for all the horizon years for the 9 bulk commodities (11 commodities if rice, wheat and pulses are counted separately). 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 works out to 1.21, 1.92, 2.95, 4.31 and 5.34 trillion tkm in the years 2007-08, 2012-13, 2017-18, 2022-23 and 2025-26, respectively.

As seen in Table 7.36 the total transport demand is increasing at the rate of 9.64, 8.94, 7.89 and 7.39 per cent in first, second, third and fourth projection period, respectively. The detailed mechanism for calculation is shown in **Annexure 7.16.** The total system cost, tkm and tonnes for various years are given in **Annexure 7.17** (in Annexure Volume 2).

TABLE 7.36: COMMODITY-WISE TRANSPORT DEMAND PROJECTIONS (TKM IN MILLIONS)

SN	COMMODITY	2007-08	2012-13	2017-18	2022-23	2025-26
1	COAL	224254	419516	724569	1147602	1502868
2	RICE	44438	46085	48017	50155	51666
3	WHEAT	29753	31361	34372	37445	39798
4	PULSES	20944	22752	23968.61	25361	26355
5	FERTILISERS	37120	44404	51533	58661	62932
6	IRON & STEEL	81889	125595	188419	258773	308608
7	IRON ORE	60324	87084	125362	169104	172119
8	CEMENT	71119	114974	187993	286547	361707
9	POL	57909	96695	126272	169331	200097
10	LIMESTONE & DOLOMITE	11948	28662	55492	91100	118009
11	SALT	9802	11814	13142	14505	15054
	TOTAL 11 Commodities	**649500**	**1028942**	**1579139**	**2308584**	**2859213**
	TOTAL 52 Commodities	**1214261**	**1923635**	**2952246**	**4315965**	**5345374**
	% of CAGR		**9.64**	**8.94**	**7.89**	**7.39**

7.8 CONCLUSION

The projection of transport demand has an important role for planning transportation facilities, for corridor planning and strategic planning for the entire transportation system. The purpose of projection of transport demand for this study also aimed at the same.