Mormugao Port Trust

Preparation of a Business Plan

FINAL REPORT

March 2007

Volume I of II
(Chapter 1 to 5)

Halcrow Group Limited
Halcrow Consulting India Ltd
In Association with
Ernst & Young Private Limited

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1	0	Issued to Client	February 2007	DRB
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E Executive Summary

E.1 General

Mormugao Port Trust (MPT) has commissioned Halcrow in association with Ernst & Young India Limited to prepare a Business Plan for the port in connection with the expansion plans for the port.

The study was awarded on 30th June 2006 with a 15 day mobilization period. The project kick-off meeting took place on 21st July 2006.

An Inception Report, an Interim Report and a Draft Final Report were prepared during the course of the study, culminating in this Report in March 2007.

This Executive Summary provides a brief summary of the constituent parts of the study, principally the conclusions, with particular emphasis on the proposed developments, action plan and financial analysis.

E.2 Study Objectives

The main objectives of the Business Plan preparation are summarized in the terms of reference as:

- Define a long term vision for the port
- Establish goals to be achieved over the next seven years to satisfy this vision
- Identify the strategy to be followed to reach these goals
- Recommend a detailed plan of action to implement the strategy
- Identify sources of financing for all proposed investments

The business plan is to provide the foundation for institutionalizing an annual planning process for reviewing, updating and modifying seven year plans on a rolling basis.

E.3 Vision for the Port

The vision, goals, targets and strategy together comprise a strategic plan. The vision and goals are developed and adopted by the senior management of Mormugao Port Trust (MPT), so that all subsequent decisions are made with the aim of achieving the overall objectives.

In essence the strategic plan is a 'signpost' to help the management to run the business. It contains the vision, which encapsulates the ambition of MPT and expresses how MPT wish to be seen by others. The objectives support the vision and are the key goals that management should seek in every decision they make.

Targets are proposed to help management to assess progress towards meeting the objectives.

A SWOT (strengths, weaknesses, opportunities and threats) analysis was undertaken with senior management to set the framework within which to develop the vision and goals, following which the vision and goals were developed at a meeting held with the senior management of MPT.

The preferred text for the Vision was as follows:

Vision for Mormugao Port Trust

"MPT wishes to be the preferred port for the region, recognised for its environmental policies, efficiency in cargo handling and service to customers, providing quality of life for the workforce and support to the community."

The goals or objectives developed by senior management at MPT are as follows:

- To provide quality, efficient and cost effective services to port customers
- To attract more traffic for the port
- To develop into a multi-commodity port
- To be the preferred port for Goa and the region's importers/exporters
- To be financially self-sustaining
- To promote a trained motivated competent satisfied workforce
- Continual improvement in productivity
- To make the port more environmentally friendly

Targets, Strategies and action plan help management to assess progress towards meeting the objectives. Of necessity, these could be developed once the future developments plans of the port are in place. Again, the future development plans depend on probable traffic the port could attract or realise. Hence in the later part of this section the other elements of business plan like traffic forecasts, future development plans, targets, strategies, action plan, etc, are discussed in a logical sequence

E.4 General Port Information

E.4.1 Location

The port of Mormugao, one of the twelve major ports in India, is situated in Goa state, between the major ports of Mumbai and New Mangalore. It is located at the mouth of the river Zuari at latitude 15° 25' North and longitude 73° 47' East and about 580 km south of Mumbai. Most of the coast line of Goa is fringed by sandy beaches. Goa is dominated by beautiful

landscaping formed by the various rivers and their tributaries, which flow from the western ghat in to the Arabian Sea.

Mormugao port is the largest iron ore exporting port in India and is a major import port for coking coal.

There is a state port Panjim located in Goa mainly exporting iron ore. Last year Panjim handled about 13 MT of iron ore. There are no berths infrastructure at Panjim port and the ore is loaded either from barges brought along side the mother vessel using ships gear or via a transhipper named Goan Pride. Transhippers are larger iron ore carriers capable of transferring ore to the main vessel through conveyors form the trashippers.

The location of Mormugao Port and Panjim is shown in **Figure E.1**

Figure E.1 – Mormugao Port and Panjim

Reference is drawn to the port layout drawing **ES/01 – Port Layout** provided at the end of the Executive Summary to understand the various infrastructure facilities of the port described in the following paragraphs.

E.4.2 Navigational Facilities

a) Approach Channel

The approach channel of the port comprises an outer channel 5200 m long and an inner channel 2300 m long. The channel is 250 m wide. The harbour basin has two Turing circles of 480 m diameter

The outer channel is dredged up to - 14.4 m CD. The inner channel and the turning circles are dredged to -13.1 m CD. The channel is one way navigation channel.

b) Breakwater

The port has a 522 m long breakwater aligned slightly east of north at the western end of the port / berthing facilities. A mole of 270 m long runs from near the tip of the breakwater in an easterly direction. The breakwater and the mole give protection to the berths from W and NW waves during the monsoons.

E.4.3 Berths

The port has about 2.9 km stretch of water front developed into various berths and a shipyard.

A satellite view of the port is shown in **Figure E.2.**

Figure E.2 – Satellite view of Mormugao Port

Table E.1 gives a list of berthing facilities at Mormugao Port:

Table E.1 – Berthing Facilities at MP

Berth no.	Type of berth	Designed/ actual depth (m)	Quay length (m)	Max. size of vessel that can be accommodated	
				Length overall (m)	DWT
5A	Dry Bulk Cargo	13.10	200	100	
6A	Dry Bulk Cargo	14.10	250	225	
7	Barge berth	3.50	100	100	-
8	Liquid bulk	13.10	116 298*	260	125,000
9	Ore (with Mechanical Ore Handling Plant)	14.10	222 358*	335	275,000
10	General cargo	12.00	250	225	55,000
11	General cargo	13.10	270	225	65,000
	West no.1 dolphins	13.10	-	185	-
	West no. 1 & 2 dolphins	13.10	380*	225	70,000
	West no.2 & 3 dolphins	13.10	380	225	70,000

* Length between extreme mooring dolphins

Iron ore for export from port is received from barges brought to the barge berths. The port has five finger berths of length 122 m and width 13 m for receiving the iron ore brought by barges through the inland water ways of Goa. Almost the entire iron ore dispatched by the ore berth no 9 is received through these barges. From the barge berths it is conveyed to the stack yard through barge conveying system and stacked there with the help of 3 stackers. The ore from stack-yard is reclaimed with the help of 2 reclaimers while a ship is ready for loading at Berth no 9 and shipped through shipping conveyor system and two ship loaders. The barge receiving & conveying to stockyard, storing & reclaiming from stack-yard, conveying from stockyard & shipping via berth no 9 all together constitute the Mechanical Ore Handling Plant (MOHP) of the port. Two continuous loaders each of capacity 4000 TPH are used for loading the iron conveyed from stockyard into the vessel berthed at berth no 9.

The mooring dolphins are used for accommodating iron ore vessels and loading them from barges using ship's own gear.

In addition to the MOHP at Berth no 9 and the mooring dolphins, iron ore is loaded in mid stream into larger ore carriers using transhippers. Generally the larger vessels are loaded at Berth No 9 up to the permissible draft and then up topped in mid stream for the remaining part of cargo. However if Berth no 9 is not available, then the ore carriers are taken for primary loading in mid stream by transhippers. These transhippers are provided and

managed by the private exporters and presently, there are four such transhippers in the harbour.

The mooring dolphins are generally more in use during monsoon season while the Berth 9 MOHP and mid stream loading operations through transhippers are shut down.

Port craft are moored at a jetty consisting of two finger piers, situated between berth no 8 and berth no 9.

Apart from the above berthing facilities, the port has a shipyard facility commissioned in 1995 by M/s Western India Shipyard Limited. The port trust has leased out 31,000 m2 land area and 50,000 m2 water area for this purpose. The shipyard facilities include a floating dry dock and a finger jetty for carrying out wet repairs.

E.4.4 Storage Facilities

The storage facilities available at the port are as shown in **Table E.2**:

Table E.2 – Storage facilities at Mormguao Port for Dry Cargo

Description	No of plots/Sheds	Area (sq. m)	Storage capacity
Port Owned			
Covered			
(i) Transit Shed/ Overflow Sheds	1	7700	-
(ii) Ware Houses	3	13810	-
(iii) Container Freight Station	-	-	-
Open	2	167000	600 (TEUs)
Others			
Covered			
(i) Transit Shed/ Overflow Sheds	-	-	-
(ii) Ware Houses	5	16680	-
(iii) Container Freight Station	1	3286	-
Open	-	-	-
Stackyard at MOHP (at Berth No.9)	3 rows of varying length and width	80,000	10,00,000 (T)

Source- MPT Annual Report (2004-05)

For the storage of liquid bulk, two oil terminals are located adjacent to the port area, one for Indian Oil Corporation and the second for Hindustan petroleum Corporation [HPCL]. Other oil companies such as Bharat Petroleum Corporation Ltd [BPCL] use these terminals for product supply that is transported further using road tankers. The management of incoming

oil from berth to tank farms is undertaken by IOC as the port coordinator for POL products. The present tank farm contains 28 separate storage tanks with a total capacity of 170,000 kL.

Zuari Industries Ltd previously known as Zuari Agro has a tank farm adjacent to port area with three phosphoric acid tanks, with a total capacity of 13,670 kL.

For other liquid bulk cargo, there are small tanks with a total capacity of approx, 10,600 kL located behind berths 5A and 6A for molasses, Phenol etc. The storage facilities of liquid cargo are summarised in **Table E.3**.

Table E.3 - Storage facilities for liquid cargo

Commodity	No. of Tanks	Capacity
POL Product	26	150637 kL
Phosphoric Acid	3	13554 kL
Furnace Oil, Caustic Soda, Molasses	8	18025 kL
Other Liquid products	2	10000 tonnes
Ammonia	1	5000 tonnes

Source- MPT Annual Report

E.5 Hinterland Connections

E.5.1 Road Connectivity

An extensive road network exists in the Goa region, providing an important transportation link with the rest of the country. Goa is connected with all major towns of not only Maharashtra and Karnataka, but the rest of India as well via NH4A, NH17 , NH17A and partially built (June 2004) NH 17B. National Highway 17 runs close and parallel to the sea coast.

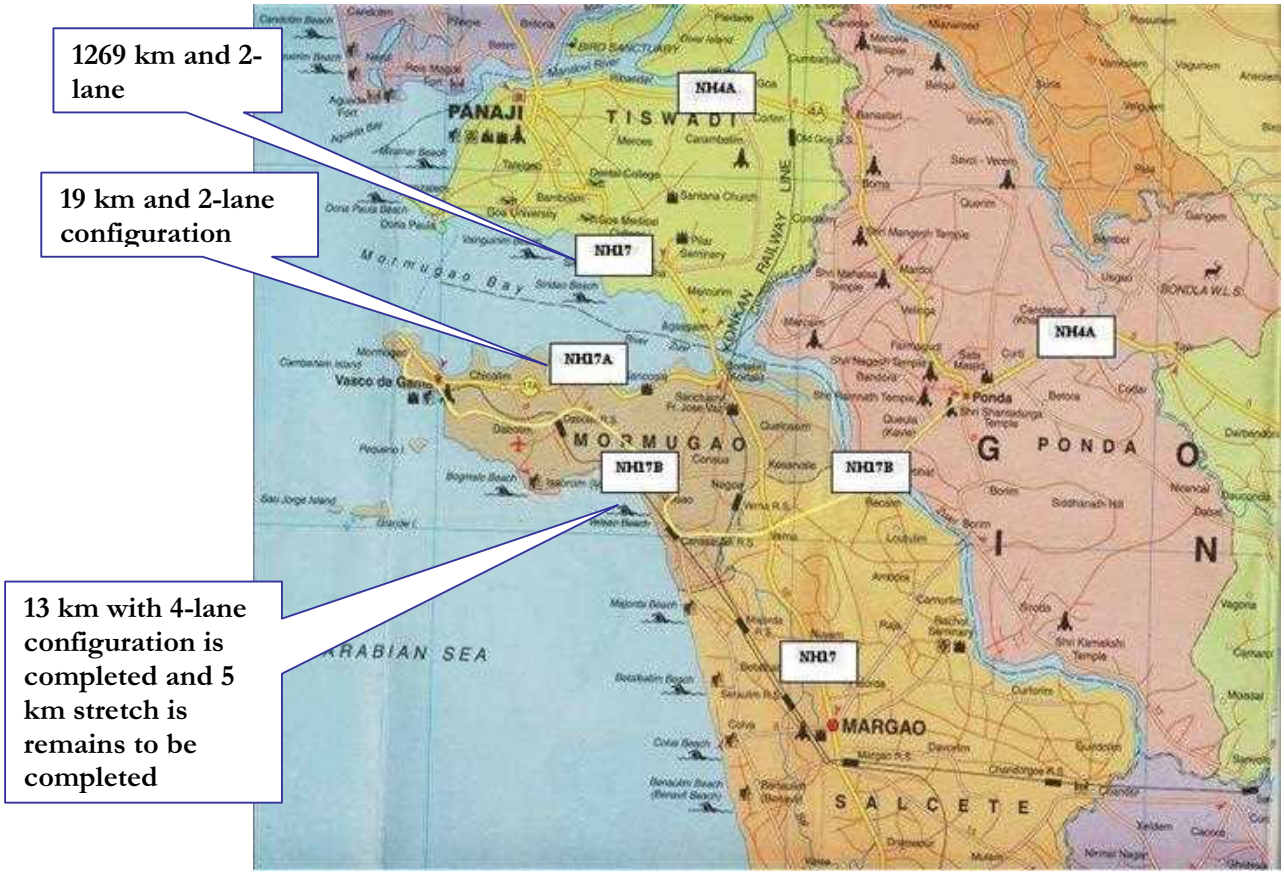


Figure E.3 –Road Connectivity to Mormugao Port

Improvement from 2 lane to 4 lane of much of the NH-17B upto Headland Sada is almost complete with a 5 km stretch between Varanapuri and Headland Sada pending completion due to rehabilitation issues. It is expected that this remaining 5km stretch junction will be completed in another year, as shown in **Figure E.3**.

For cargo movement, access to the port area for both road and rail transport is at the south-eastern side and at Gate no.9 & Gate No 1. The road , called the 'main port road' connecting Gate no 1 to NH-17 A is presently 2 lane road and needs to be improved to 4 lane carriage way to cater to port traffic mostly coming out of Gate No 1.

The port has a poor network of internal roads between the berths. Though these internal roads are not used for cargo traffic movement, the port officers' vehicles, service / maintenance vehicles and vehicles for transporting international passengers arriving by cruise vessels use the internal roads extensively. It is imperative to improve this road network within the port area to international standards.

E.5.2 Rail Connectivity

The existing rail connections are shown in **Figure E.4**.

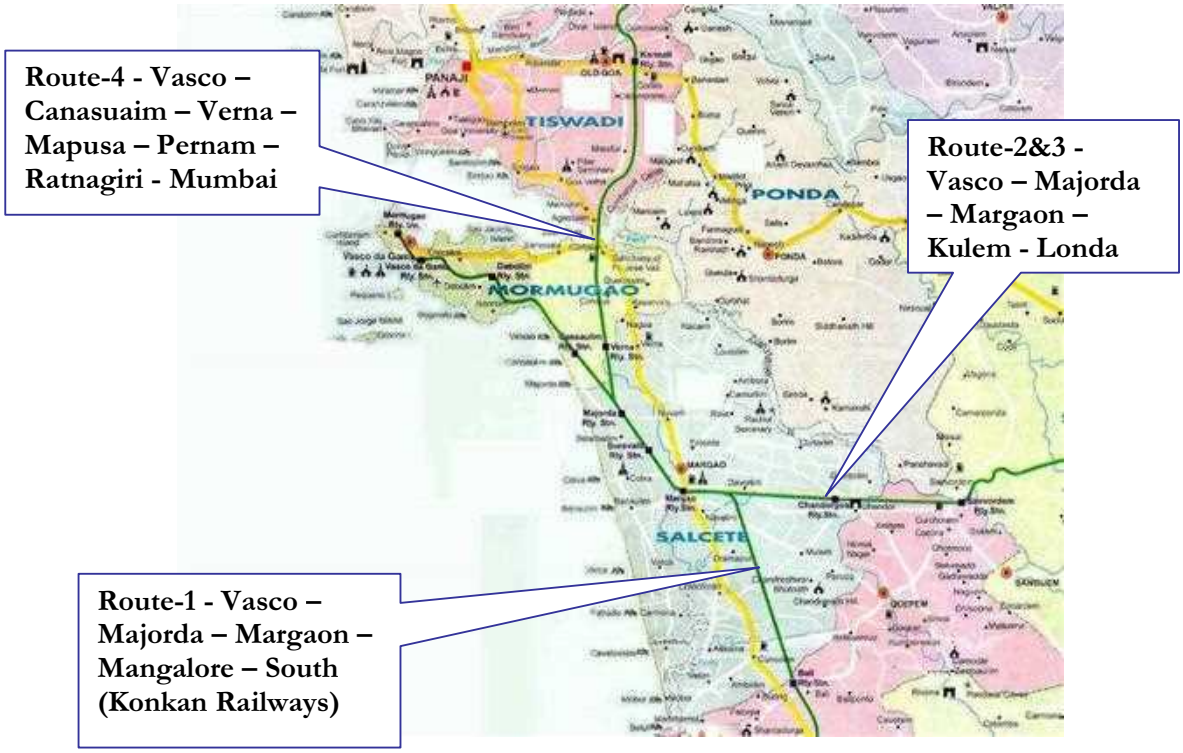


Figure E.4 – Rail Connections to Mormugao Port

At present cargo is received and delivered by rail mainly at berths nos 5A & 6A of South West Port Limited operated by Jindal Steel Works (JSW) and at berth nos 10 & 11 of MPT. Berth no 9 and its MOHP is not connected by rail for receiving the ore. Similarly berth no 8 is not connected by rail. However the tank farms of Indian Oil Corporation at Vasco Bay have a loading bay for its liquid products, although at present it is not being used.

Presently, the iron ore from Karnataka is brought by rail up to Sanvordem (40 km from Vasco). From there the ore is shifted to the nearby barge loading point by road and is brought to Mormugao Port or Panjim port by barges on the inland waterway system. The same rake after unloading at Sanvordem continues to Mormugao Port, where it picks up the imported coal/coke from berths 5A & 6A to transport it to JSW at Toranagulu, Karnataka, about 340 km from Vasco. As per Government Policy, the Karnataka iron ore rich in Fe content needs to blended with Goan ore to bring down the Fe content. It is understood that the blending is not homogenous.

There are capacity problems in the section Vasco – Hubli with various problematic stretches, which will pose a limitation on the growth of rail traffic at Mormugao Port. Railways have already taken up the project of line doubling over a distance of about 340 km between Vasco and Hubli, cutting across the ghat section through Castle rock.

E.5.3 Inland waterways

Goa is bestowed with an excellent system of interconnected and navigable inland waterways which are instrumental in transporting the bulk of the iron ore from the mines to Mormugao Port and nearby Panjim port for export. The two main rivers, the Zuari and Mandovi, are navigable for as much as 60 km inland and are mainly used for barge transport of iron ore, the iron ore being loaded into the barges at riverside terminals. Almost all of the iron ore handled at both Mormugao Port and Panjim Port is shipped to the port via barges on waterways. There are more than 30 loading jetties located along the rivers in mining areas.

Presently there are about 250 barges of total capacity 390,000 T plying in Goan waters for the transport of this iron ore from the mines. These barges carry a total of about 37 MT annually of iron ore to Mormugao Port and Panjim Port.

The quantum of Mormugao port cargo that moved via road, rail & IWT in the recent years is given below;

S No	Export /Import	2003-2004	2004-2005	2005-2006
1	Rail Transport (MT)	2.32	3.14	3.53
2	Road Transport (MT)	1.31	1.19	1.76
3	Inland water Transport (IWT)	22.99	24.67	25.31
4	**Total Cargo (All modes including pipelines) (MT)**	**27.87**	**30.66**	**31.69**

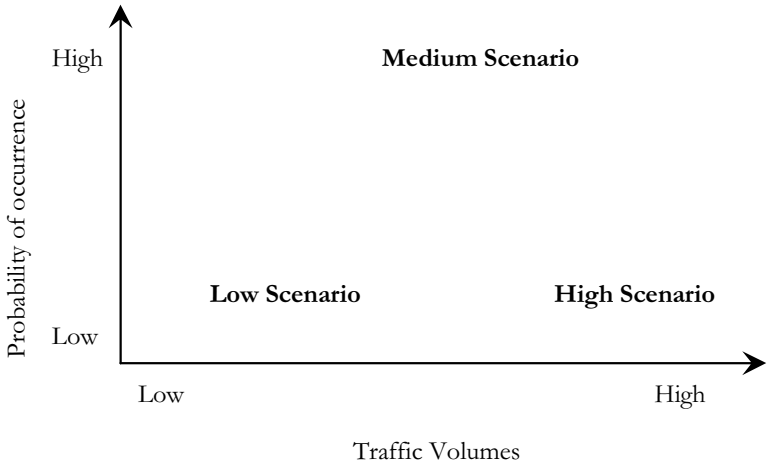
E.6 Traffic Forecast

Presently, Mormugao Port Trust is a premier iron ore handling port and iron ore accounts for about 80% of the port's traffic in the year 2005-06. Coal and liquid bulk were the other prime commodities in the port with the rest accounting for a negligible portion of the traffic and revenues. An analysis of the potential traffic from all commodities was made, including those that are not currently handled at the port. The new areas of opportunities that were examined for the port included traffic from Offshore vessels, navy and coast guard vessels, a transshipment terminal, traffic from the car exporters from the three clusters in India among others. The methodology adopted for forecasting the traffic from each of the commodities and vessels were different considering

a) nature of the commodity,
b) global and Indian demand and supply scenarios of the commodity
c) existing and proposed industries in and around the hinterland
d) natural restrictions of the port,
e) connectivity of the port,
f) efforts of other competing ports in the western coast,
g) Goa as a popular tourist destination and the resultant environment conscious policies of the state

h) economic projections for the state of Goa, Karnataka and Maharashtra

Three scenarios were made for the traffic – Low, Medium and High, considering the vagaries of the economy and other factors mentioned above. The medium scenario has the highest probability of occurrence followed by the other two scenarios. The high scenario is considered for the augmentation of capacity to ensure that the port is equipped to cater to any additional unexpected opportunities. The low scenario is considered for the sensitivity analysis for the funding of the port's projects.



Considering the importance of the iron ore traffic to MPT coupled with the competition posed by the neighbouring state port of Panjim, three additional cases were developed – Case 0, 1 and 2. Case 2 is the recommended case where the port reduces its tariff for its midstream operations, augments its MOHP capacity and also reduces the procedural hassles experienced at the port by the exporters.

Considering the medium scenario and case 2 for the iron ore traffic, the analysis revealed that Mormugao Port Trust would continue to be a premier iron ore handling port, however, the other commodities of coal/coke and liquid bulk would gain prominence in the immediate term. Although the iron ore traffic is estimated to remain more or less at the existing levels, the port can earn additional revenues and also provide efficient and speedy service to the exporters by augmenting its capacity of the Mechanical Ore Handling Plant (MOHP). The coal / coke traffic is projected to grow supported by the increase in the production capacity of the major coal importer of Mormugao Port Trust – JSW Steel Ltd. The liquid bulk traffic is projected to regain all of its traffic lost to other neighbouring ports after the completion of the repair work in the storage yard at the IOC terminal. Goa being a popular tourist destination has a good potential to attract sizeable cruise traffic and the cruise vessels calling at the port is estimated to grow by 10 times in the next 20 years. It is estimated that no considerable potential for the container traffic from the hinterland of MPT is present owing to the strong competing ports of JNPT and Cochin in the western coasts. However, MPT can attract all of the container traffic originating from Goa, especially those of the

pharmaceutical companies by implementing certain measures like making a resident drug controller available at the port. Although there is a potential for the offshore vessels and coast guard / navy vessel traffic, these are estimated not to generate commensurate revenues to the port considering that these earn only vessel related charges.

The summary of the traffic is provided in the following tables:

In Million tonnes / Containers in TEUs / Vessel calls for cruise and non cargo vessels

Particulars	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14
Iron ore – Case 2 (MT)	26.26	37.72	38.05	38.37	38.69	39.02	39.02	39.80
Coal / Coke (MT)	5.70	6.70	6.90	6.90	7.15	7.40	7.65	8.03
Dry Bulk	0.86	0.97	1.00	1.02	1.05	1.08	1.11	1.17
Break Bulk	1.30	1.50	1.50	1.50	1.50	1.50	1.50	1.58
Containers	10,113	15,258	17,538	19,088	20,364	21,576	22,709	24,412
Liquid Bulk	1.82	2.10	2.37	2.69	2.83	2.99	3.15	3.31
Cruise and non cargo vessels	170	191	222	252	265	277	290	305

E.7 Port Operations

E.7.1 Cargoes and Berths

The major dry bulk cargoes handled at Mormugao Port are Iron ore and Coal / Coke. While the major bulk import of coal / coke is handled at the privatised berths 5A and 6A and is operating successfully, a meagre amount is handled at Break Bulk Berths 10 & 11.

Berth no 7, the oldest berth of the port is not being used for cargo handling and is in the process of privatisation as New Berth No 7.

Consequently, this section considers the cargo handing operations and performance of MPT's terminals and berths, nos 8, 9, 10 & 11 only.

- Berth no 8 is the main bulk liquid handling berth in the port.
- Berth no 9 is dedicated for the handling of iron ore with the mechanical ore handling plant (MOHP).
- Berths nos 10 & 11 are used for handling break-bulk cargo, including coal in bulk for minor importers, and berth no. 11 is also used for handling containers.

The significant performance indicators relating to berth occupancy and throughput are presented in **Table E.4.**

Table E.4 – Berths Performance, 2005-06

Berth and Cargo	No. of days		% Occupancy for handling	Quantity handled in tonnes			Avg output per berth day (tonnes)	No. of days occupied for non- cargo handling vessels			% Occupancy for non-cargo handling vessels	Overall Berth Occupancy	
	Available	Occupied for handling		At berth	Offshore	Total		Commercial	Non-commercial	Total		Days	%
8 - Liquid	365	179	49%	1,308,543	5,889	1,314,432	7,343	9	43	52	14.20%	231	63.30%
9 - MOHP	307	204	66.6	11,898,542	0	11,898,542	58,326	5	19	24	7.80%	228	74.30%
10 - GC	365	252	69	801,449	20,640	822,089	3,262	28	29	57	15.60%	309	84.70%
11 - GC	365	292	80%	1,118,224	150,644	1,268,868	4,345	15	29	44	12.10%	336	92.10%

Source: MPA Statistics. Note: Non commercial vessels include Naval ships, survey ships, research ships etc., but exclude port craft

Apart from these berths, the port handled 3.74 MT of iron ore at mooring dolphins and 9.45 MT at midstream via transhippers during 2005-06.

E.7.2 *Berth no 8 – Liquid Bulk*

All bulk liquid products (Palm Oil, Crude Palm Stearin, Palm Fatty Acid Distillate, Other Vegetable Oils, Liquid Ammonia, Phosphoric Acid, Caustic Soda, Motor Spirit, H.S.D., L.D.O., Furnace Oil, Low Sulphur High Flash, Naptha, Kerosene Oil, Acids and Sorts) are handled at berth 8.

Phosphoric acid is handled in bulk mainly at berth 8, but also at berths 10 and 11 and pipelines are available from berth 10 & 11 to transfer it to the storage tanks.

Hoses are used to transfer bulk liquids between onshore pipeline systems and tankers except for Liquid Ammonia which is provided with a mechanical unloading arm.

The berth occupancy for berth 8 is high at 50% for a relatively small throughput of 1.3 million tonnes.

E.7.3 *Berth no 9 - Dry Bulk Cargo / Iron Ore berth*

a) Present Iron ore Handling Practice in Goa

Iron ore in Goa is handled at two ports; the major port Mormugao and the state owned minor port Panjim. While iron ore mines in Goa state are the main supplies to these ports, the iron ore from the mines in Bellay Hospet region of Karnataka state has been increasing with a surge in demand for iron ore. The entire ore from Goan mines use IWT via the rivers Mandavi and Zuari for transporting the ore from the mines to either Mormugao port or Panjim port.

Presently, the iron ore from Karnataka is brought by rail up to Sanvordem (40 km from Vasco). From there the ore is shifted to the nearby barge loading point by road and is brought to Mormugao Port or Panjim port by barges on the inland waterway system. The same rake after unloading at Sanvordem continues to Mormugao Port, where it picks up the imported coal/coke from berths 5A & 6A to transport it to JSW at Toranagulu, Karnataka, about 340 km from Vasco. As per Government Policy, the Karnataka iron ore rich in Fe content needs to blended with Goan ore to bring down the Fe content. It is understood that the blending is not homogenous.

This iron ore handling practice at Goan waters is shown schematically in **Figure 5.**

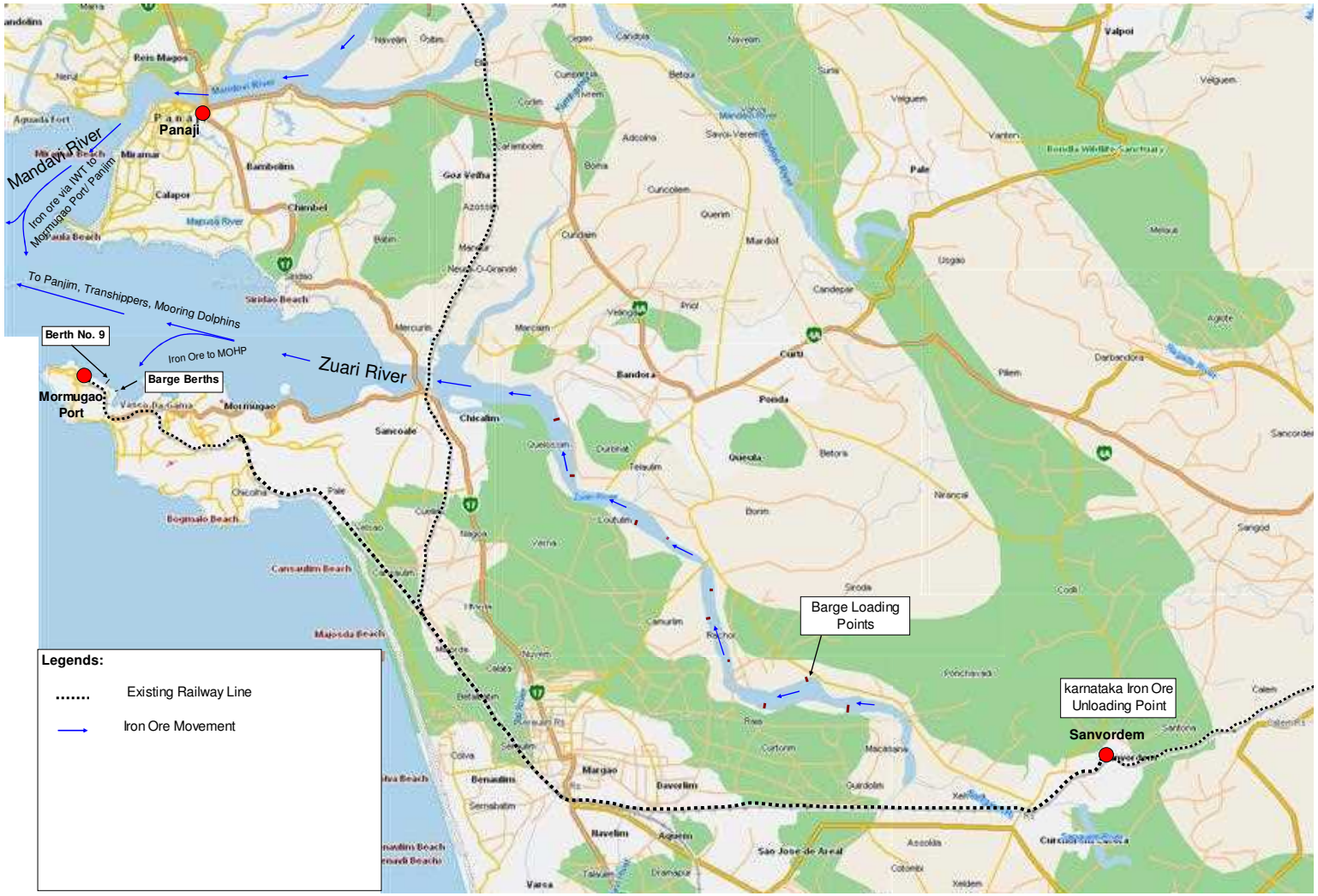


Figure E.5 – Iron Ore Handing Practice at Gaon Waters

b) Berth no 9

There are about 12 different exporters using the mechanical ore handling facilities, with each exporter trading in up to three different grades. Each of these grades has to be stacked and shipped separately.

The MOHP system commissioned during 1979 broadly consists of a) barge unloading and stock piling system and b) Reclaiming & shipping system.

The MOHP conveying system as part of ore handling facilities at the port is provided in **Drawing no ES/02** and described below**.**

c) Barge Unloading

The barge receiving system has 8 grab type unloaders of 500 TPH capacity and 1 Continuous Barge Unloader (CBU) of 1250 TPH capacity. The grab unloaders are being replaced in a phased manner during the last four years with unloaders of similar type but of 750 TPH rated capacity. Six units have been replaced with the final two units in progress. The CBU was installed during 1992, so it will be due for replacement in some 5 to 6 years time.

From the receiving system, conveyors run to the stockyard.

d) Stock Piling System

The system of conveyors enables ore from any of the barge unloading berths to be conveyed to any of the three stackers.

The stacker I unloads in the full land side row of the stock pile and the land side half of middle row stock pile. The stacker II unloads in the land side half middle row stock pile and sea side half of sea side row stock pile. The stacker III unloads only in the sea side row stock pile. In other words stacker III is comparatively less utilised as it has to stack only in one stockpile, namely the sea side row whereas stackers I and II are each required to serve two rows.

E.7.4 *Berths 10 & 11 – Break Bulk Cargo*

The main commodities handled at the general cargo berths comprise alumina and sugar in bags for export, while imports include fertilisers, fertiliser raw materials, coal, coke, bauxite, foodgrains, finished steel, HR coils, containers and phosphoric acid. The import cargoes are mostly in bulk, with some bagged.

There port has no equipment for loading / unloading cargo so the shipside operations are carried out using ship's gear.

Containerised cargo is received / dispatched by road only. As a result most packing or stripping of containers takes place in an open stack yard area provided behind Berth 10. The port has provided plug-in reefer points at this location with a back-up generator. Monitoring is carried out by the agent of the shipping line.

The average handling rate (1,300 T/ship day) for break bulk cargo represents an improvement in performance which has been achieved due to the deepening of berths 10 & 11, elimination of earlier practice of multiple

handling between earlier berths 5, 6 and berths 10 , 11 and enforcement of productivity norms.

E.8 Proposed Developments – Common Port Works

E.8.1 *Breakwater*

Frequent repairs are required to maintain the breakwater, principally the addition of armour stones to replace that lost during storms.

Stability analyses undertaken by IIT Madras revealed that the seaward side armour slope should be built up with additional armour to create a flatter slope of 1:2 compared with the present 1:1 profile, together with a flat berm area and toe construction. This will reduce the impact of wave forces on the breakwater.

These works comprise essential maintenance of the breakwater; hence it is recommended that the port should undertake these works as a priority project.

E.8.2 *Deepening of the Approach Channel and Berth no 9*

A proposal was developed to deepen the approach channel and Berth no 9 by one metre. This in turn would permit ships to load iron ore to a draft one metre greater than at present, thus encouraging a more competitive basis for the iron ore shipments.

If the capacity of the receiving and loading systems were increased, then the ability to load more cargo as result of the deepening could generate a benefit to both MPT and the shippers.

The effect of deepening the channel would principally be an increase in the average size of ship handled at Berth 9, a reduction in berth occupancy at Berth 9 and a reduction in the average size of ship handled by the transhippers.

It appears that under the current circumstances the direct benefit to MPT / the additional cargo that could be handled by deepening appears less. However, there are economic benefits to shippers making the iron ore shipping through Mormugao port competitive. But it is likely that it would be most effective for MPT in conjunction with increased loading capacity. There would also be an increased annual maintenance dredging cost to MPT due to the increased depth.

The recommendation for whether MPT should carry out the deepening or not, is covered in the later part of this section while summarising the financial capability of the port, prioritization of projects and the funding options.

E.9 Proposed Developments – Improved Facilities

E.9.1 *Iron Ore*

a) Capacity

Berth 9 is operating at the capacity of the receiving system. The receiving and shipping systems are in the process of upgrading which will result in an estimated capacity of 14 million tonnes per year. At that stage it is expected

that the capacity will be limited by the difficulties in managing the stockyard, manifested by long waiting times for ships awaiting cargo.

Four transhippers operate except during the monsoon period, carrying out both primary loading and uptopping. The capacity of these transhippers is estimated at 11.5 million tonnes per year.

Ship loading also takes place in the river at the mooring dolphins, particularly during the monsoon when Berth 9, the transhippers and the nearby competitor port, Panjim, are all closed. The present handling rates are low (5800 – 9000 TPD) due to provision of inadequate labour (gangs). If the existing mooring dolphins (3 vessels at one time) are operated with 70% occupancy for the whole year including monsoon and a net handling rate of 9000 TPD is achieved, the capacity of the mooring dolphins will be 6.8 MT. If an improvement in handling rate could be achieved by removing the present constraints on 'gangs', the capacity of these mooring dolphins will be as high as 7.5 MT and 8.5 MT for an average handling rate of 10,000 TPD and 11,500 TPD respectively.

Overall, the port's total capacity for loading iron ore is assessed to be about 32 million tonnes once the upgrading of MOHP equipments is complete & with an average output of 9000 TPD at mooring dolphins.

The traffic forecast explains that if the capacity of the MOHP at Berth 9 is increased, then MPT may retain its share of iron ore exports, but otherwise its share will reduce, the traffic being lost to Panjim.

b) Additional Facilities

Integration of Berth 8 with Berth 9 to Handle Iron Ore

Since MOHP is the most preferred option for the shippers and an increase in MOHP shipping capacity would retain or improve the share of iron ore shipped from MPT, it is recommended that the MOHP shipping capacity be increased by integrating berth no 8 with berth no 9 as a single continuous berthing facility capable of accommodating two ships at one time. The capacity increase in MOHP shipping system will then need to be matched with the MOHP receiving system and storage / reclaiming system.

The location of berth no 8 makes it eminently practical and appropriate to convert it for iron ore handling. Berths 8 and 9 are aligned and it would be a relatively simple matter to make the conversion and extend the mechanical shipping system to a second berth. The rebuilt Berth 8 could also be designed to accept Capesize ships which cannot be handled at present.

In the first instance it is suggested that no further mechanical handling equipment is required: if the conveyors and rails are extended along to Berth 8, then the existing shiploaders could operate at Berth 8 as well as at Berth 9.

The average productivity per shiploader is in the region of 2,854 tonnes per hour (tph) based on the statistics for the period from October '05 to May '06. When the delays during loading are taken into account, the average productivity falls to 1,719 tph. Much of this delay is a delay to one of the

shiploaders, due to waiting for the other to complete loading a hold before they both move to new holds. Presently, the net working time of each ship loader is 51%. The net working time of the ship loaders could be improved by immediately moving the ship loaders to the second vessel by then ready for loading while the ship just finished loading is waiting for tide and other formalities to sail out. If the two shiploaders worked on different ships, one at each berth, or both on one ship during prime loading, then a higher productivity could be achieved, approaching the 2,854 tph figure. This would mean that the real capacity of the shiploaders would increase.

Also, with two berths, the berth occupancy would be much lower, virtually eliminating pre-berthing delays due to non-availability of a berth.

With the two shiploaders on two berths, the loading capacity is estimated to be in the region of 20 million tonnes per year, so the overall capacity is likely to be limited by the MOHP and storage limitations. This capacity, in conjunction with up-topping by the transhippers and operations at the mooring dolphins, could respond to the traffic forecast until at least 2014 in all but the Case 2, medium scenario, alternative.

Wagon Tippler

The iron ore is brought by part of the way to the port by rail, then unloaded, the ore is trucked to a barge loading point and the ore is then brought to the port by barge where it is unloaded at the barge unloaders. Meanwhile the rail wagons proceed to the port to load with coal for the return journey.

To avoid this intermediate transhipment it is proposed to install a wagon handling system at the port. An initial throughput of 3 million tonnes per year is envisaged, which could subsequently increase to match the coal throughput in the opposite direction, i.e. up to 6 million tonnes.

A wagon tippler, integrated with the MOHP, will also facilitate the blending of Goan ore with ore from Karnataka.

The wagon tippler should be allocated an area behind Berth 9 close to the present stackyard area, even if this means relocating other buildings or facilities. A tandem tippler is recommended which can handle two wagons simultaneously.

Increased Iron Ore Storage

The throughput capacity of the iron ore export facilities is constrained by the limited storage capacity of the iron ore storage yard behind Berth 9.

An additional capacity of about 250,000 tonnes may be achieved by adding an extra row on the landward side to complement the additional unloading capacity provided by the wagon tippler.

The concept of integration of berth 8 with berth 9 for iron ore loading along with the proposed wagon tippling system is shown in **Figure E.6** and **Figure E.7**.

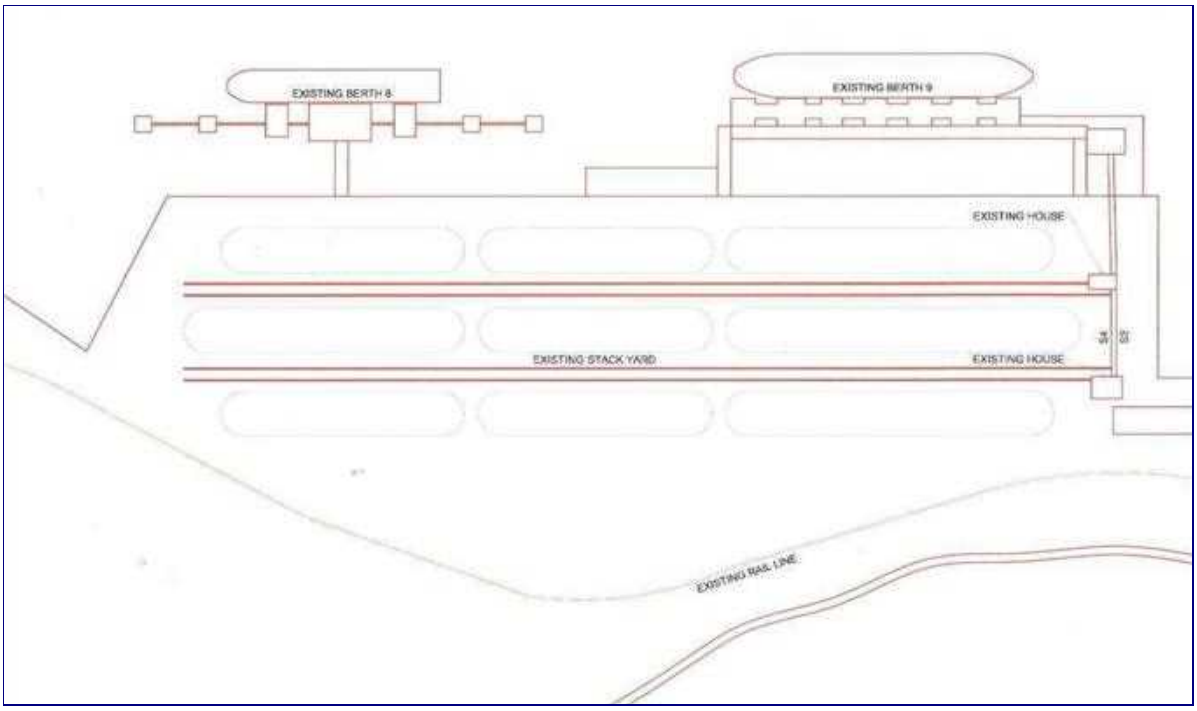


Figure E.6 – Present Berth 8 and Berth 9

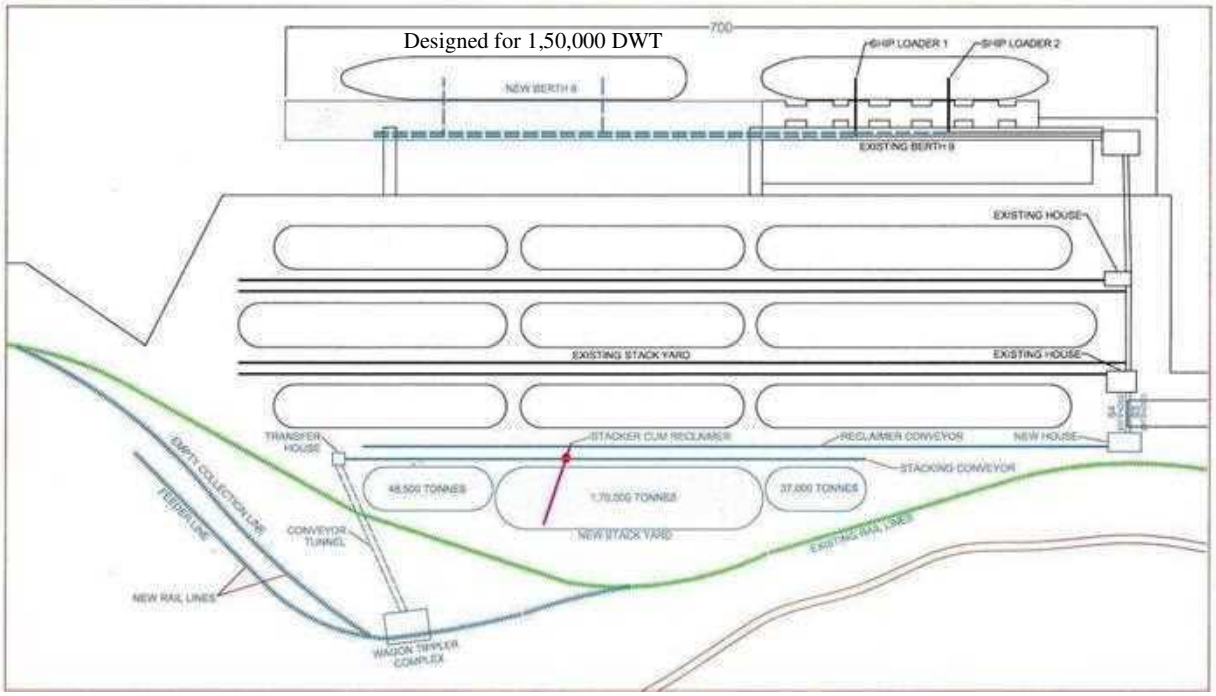


Figure E.7 – Integration of Berth 8 with Berth 9 for iron ore handling

The integration of berth 8 and berth 9 coupled with a wagon handling system to receive Karnataka iron ore could assure this traffic to Mormuugao Port /

MOHP and help Mormugao port retain its share of iron ore in Goan ports. This could also add revenues to the Port.

Additional Mooring Dolphins

To increase the loading capacity, particularly during the monsoon, additional mooring dolphins are proposed for mid stream iron ore loading.

The port has at present three mooring dolphins and has a proposal underway to add another three, one in line with the existing ones and two parallel to the existing dolphins at a cost of Rs 20 Crores including the dredging involved.

The capital investment required for the construction of mooring dolphins is less for the throughput that could be handled. Hence MPT may consider construction of these additional dolphins. However, to make them effective it is required to remove the existing constraints in supplying Gangs.

Business strategy like giving preference in monsoon to the exporters who use this facility during fair-weather season could attract full potential of traffic through mooring dolphins.

It is recommended that MPT go ahead with the construction of more mooring dolphins but at the same time efforts taken to remove the present constrains of supplying gangs.

The above schemes is expected to increase the iron ore handling capacity of the port to

MOHP by rebuilding berth 8 and integrating with 9	20
Existing transhippers	12
Present Mooring Dolphins	7
Additional Mooring Dolphins	7
Total Iron ore handling capacity	**46 MTPA**

It is important in this context to note that the area proposed for providing wagon tippler to unload iron ore at port has been earmarked for New Berth 7 for wagon tippling which is under privatisation process.

It is prudential for MPT to designate New Berth 7 for importing coal in conjunction with Berths 5A and 6A without the need for this additional area. The estimated cost for development of new berth 7 is Rs.1400 million in which case it less likely to be a 'iron ore berth' as there are other modes of handling iron ore via Goa without investing such a big sum on capital costs that too for a non mechanised system similar to current MOHP. Coal being an import cargo does not require a Wagon Tippling system.

Hence it is recommended that the area where wagon tippling is shown for integrating berth 8 and berth 9 is allocated to iron ore, not to Berth 7.

Berth 7 can be used for coal imports in conjunction with Berths 5A and 6A without the need for this additional area. Only in this way can the capacity of the port be optimised.

E.9.2 Break Bulk Cargo

a) Capacity

At present Berths 10 and 11 are operating at full capacity. Berth occupancy in the past three years has consistently been over 80%, reaching as high as 92% on Berth 11 in 2005 – 06. Pre-berthing detention times have risen rapidly with increasing berth occupancy.

Berth requirements for non-cargo vessels are also increasing. They are using the general cargo berths, thus reducing their cargo handling capacity. Priority is given to passenger and defence vessels.

b) Additional Facilities

Adjusting the number of gangs and gang sizes can assist with improving productivity. However, to achieve a significant step up in capacity requires the introduction of new cargo handling equipment: at present the ships all use their own gear.

A mobile harbour crane is recommended for Berth 11.

The structural design of Berth 10 does not permit deployment of a mobile harbour crane. However, preliminary analysis of the design of Berth 11 indicates that a mobile harbour crane, such as a Gottwald HMK 170 EG, could be acceptable. This crane has a lift capacity of up to 67 tonnes and its operating radius makes it suitable for ships up to 40,000 DWT.

E.10 Proposed Developments – New Port Facilities

E.10.1 Berths Required

Based on the forecast and the expected handling rates, the number of berths required has been assessed. The ship size appropriate to each of the cargo types has been forecast, leading to both a berth length requirement and a water depth requirement. The cargo storage area requirement generates the terminal depth and hence the overall area required. The resultant development requirements are shown in **Table E.5.**

Table E.5 – Port Development Requirements

	Design ship	Design ship length	Required Berth length	No berths required		Total length	Back-up Land	Required Land area	Ship Draft	Required Berth depth
				Phase 1	Phase 2					
	DWT or TEU	(m)	(m)			(m)	(m)	(sq.m)	(m)	(m)
Iron ore	150,000	290	320	0	0	0				
Coal	70,000	225	250	0	1	250	500	125,000	14.0	15.4
General	30,000	193	215	1	1	430	500	215,000	11.2	12.3
Container	1,200	160	180	0	1	180	500	90,000	10.0	11.0
Liquids	50,000	200	220	1	1	440	30	13,200	13.0	14.3
Cruise		216	240	1	0	240	100	24,000	7.0	7.7
Navy		227	250	1	0	250	100	25,000	8.8	9.7
Port craft		40	45	5	2	315	50	15,750	6.0	6.6
OSV		110	130	1	1	260	50	13,000	6.0	6.6
Total						**2,365**		**520,950**		

The additional berths requirement for phase – I (2013-14) development is summarised in **Table E.6** .

Table E.6 – Phase-I Development Plan for Mormugao Port (by 2013 – 14)

Commodity	Number of berths	Berth length (m)	Remark
Iron ore	Berth no 8 dismantled and rebuilt to integrate with berth no 9	350	Area adjacent to the present stack yard area modified for iron ore handling to provide wagon handling facilities and additional stackyard area
	Additional 3 mooring dolphins which is already under consideration by MPT		
Coal	1	250	If new berth 7 is not designated for coal, an additional berth need to be created elsewhere
Liquid bulk berth	2	440	With the conversion of present berth 8 for iron ore, 2 new berths for liquid bulk to be created
Cruise	1	240	Required to create a dedicated berth for cruise vessels
OSV + Non cargo vessels berth	1	200	
Port craft jetty	1	225	With the conversion of Berth 8 for iron ore, need to build a new port craft jetty to accommodate 5 crafts

E.10.2 *Site Selection*

There are three possible sites for future port development in the area of Mormugao Port, at Vasco Bay, Baina Bay and to the west of the breakwater.

The site to the west of the breakwater is the least promising and is not considered further. Development of Vasco Bay would be an appropriate option since it would involve the minimum capital cost making it attractive to private investment. However, Baina Bay must be considered seriously by MPT if they fail to progress with the Vasco Bay option.

E.10.3 *Preferred Site – Vasco Bay*

In the short term, the facilities required are as follows:

- Liquid bulk berths – one berth is required to replace the existing liquid bulk berth (Berth 8). A second berth will be required before 2012 as the traffic rises.
- Non-cargo berths – a berth is required to handle cruise vessels and another berth is required for visiting naval vessels, both Indian Navy and visiting navies.

The total requirement in the short term is therefore for 4 additional berths. In the particular case of liquid bulk and non-cargo vessels, no storage facilities are needed at the berths. The liquid bulk would be transferred by pipeline to the existing storage tanks. The required port craft jetty could be created near the breakwater.

The Phase 1 layout for Vasco Bay can therefore comprise a narrow finger pier, with berths on both sides, thus optimising the use of the available water area as shown on **Figure E.8** below.

Figure E.8 – Vasco Bay: Phase-I Layout

The finger pier may be located close to the east of Berths 10 and 11, extending out from the shore at Vasco da Gama. This location will be ideal for the cruise passengers and naval personnel, for whom access is required to Vasco da Gama's facilities rather than port facilities.

The fishermen need not be inconvenienced significantly by the finger pier development as this does not extend far along the Vasco Bay coastline. It is therefore anticipated that this development may be commenced at an early date, before the relocation of the fishermen has been completed.

Subsequent phases of development may be planned to provide further berths in phases to respond to the increased traffic as forecast above. These further berths would be to the east of the finger pier, with reclaimed land behind the berths to provide the required storage areas. The final phase 4 of the development is shown in **Figure E.9**.

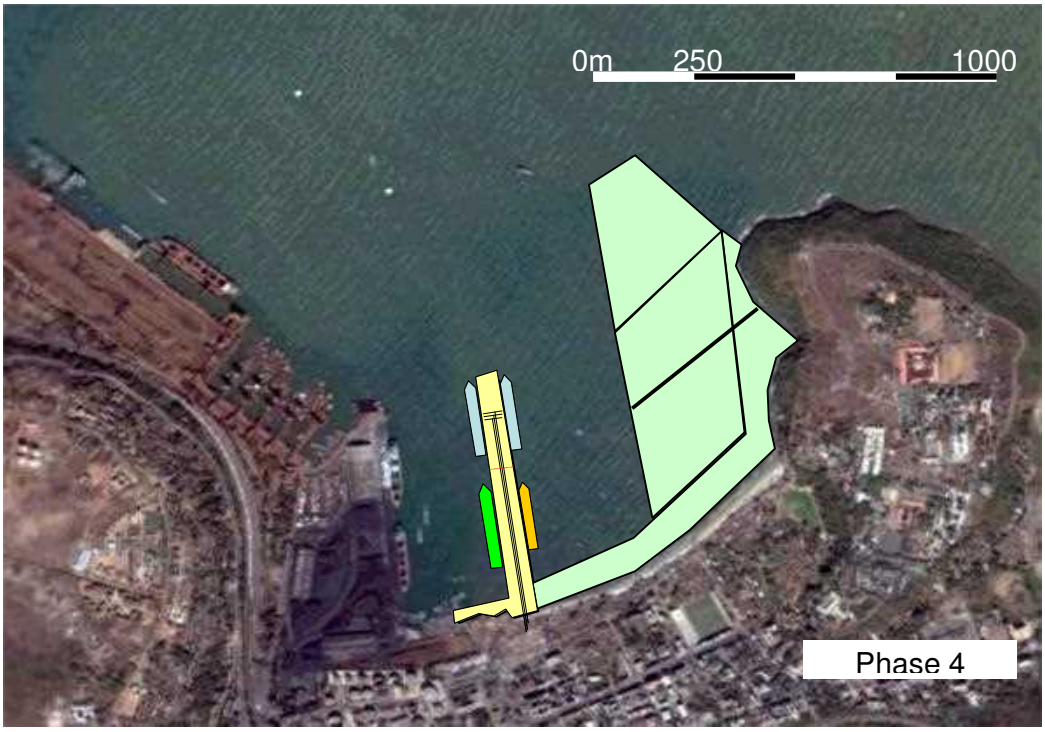


Figure E.9 – Vasco Bay: Phase 4 Layout

E.11 Human Resources

E.11.1 Organisational Structure

The Organization structure of MPT is well defined and formulated along separate operations, some departments provide centralized administrative and functional support. However, a detailed analysis of the staff strength by level indicates a bottom heavy pyramidal structure of the organization.

E.11.2 Productivity

Productivity targets are set by the Ministry of Shipping, on the basis of previous year target, usually a percentage increase, also performance of other ports is taken into account. MPT has been able to meet these set productivity targets so far. However the freeze on recruitment is causing a shortage of required labor in CHLD and MOHP.

A detailed work study and document flow study pinpointing responsibility and decision making powers at each level will help to reduce time taken to resolve issues and paperwork. This coupled with redeployment and job rotation will lead to better productivity.

E.11.3 Union & Managment

Union –Management relations are largely cordial and mature. However slow working, excessive overtime, loss of productive time during change of shifts are resulting in less than optimum productivity. This can be remedied by automated sign in/sign out system and improved scheduling matching shift change with available manpower.

Also Unions have been opposing the introduction of private labours though there seems to be some improvements in the dialogues between MPT and Unions. MPT by making use of the present harmonious & mature relation with the Unions, should try to introduce Private Labours in the port for solving the present 'Gangs' problems.

E.11.4 *Computerisation*

The port has an Information Technology cell that comes under finance department. The information technology section has 1 No Pentium server and 1 Celeron – 400 Server.There are about 20 terminals connected to these servers. There are about 150 Personal Computers linked to the LAN and about 125 stand alone computers for the total work force of the port.

The port has various stand alone software applications in various departments for improving the operational efficiency like for financial management, material management and payroll. Communication between ports and customs is partly computerized.

Thus the port is only partially computerized.

The port has a lease line from VSNL to provide email facility. Out of the total work force, about 50 officers have email facility though E-mail is used for communication with the Clients and users of the port. All inter departmental communication is through paper and the concept of Email communication for internal / inter staff communication is not yet established.

The port's immediate plans include computerization of labour booking.

The following recommendations of made with regard to computerisation of port;

- The Port should aim for an integrated Computerisation approach where in all the Employees of the port are connected to each other rather than stand alone packages for various needs.
- The Emailing facilities and concept of emailing for internal communication need to be well established and followed as a routine procedure to improve the operational efficiency.
- Purchase of new 150 computers along with required licensed softwares for the employees in another two years is recommended which will increase the computer: employee ratio to 1:4.

E.11.5 *Bureaucracy and excessive Paperwork*

Bureaucracy and excessive paperwork can be significantly reduced by

- Extending e-mail facility to all levels for better and speedier communication
- Development centre for senior management to encourage decentralization of operating decisions and empowerment of subordinates.
- Retraining and redeployment such that employees can add value.

- Creation of temporary interdepartmental task forces for specific projects for result oriented performance.
- Department wise performance reward system

E.11.6 Training

About 2350 in house and 275 outside training programmes covering various classes of employees are conducted by MPT.

It is suggested that training in MPT should have the following thrust for training in corporatisation, commercialization, privatization schemes such as BOT, BOOT, etc. apart form the current topics covered.

MPT being a strategic location to attract cruise traffic, specific training initiatives should be taken for development of the knowledge, skills and attitudes towards the cruise tourism industry.

Also, increased commercial and customer orientation is necessary for competing with other domestic and international ports.

E.12 Environmental Aspects

MPT is taking efforts to minimise pollution in side the city caused by handling mainly the dry bulk commodities like coal and iron ore. Reportedly however the port does get complaints about dust during the dry season when the wind direction is towards the East and hence towards Vasco City. MPT have confirmed that they will mitigate the dust nuisance, which they intend to do by improving the dust suppression at the stacks. It was however noticed that the conveyors at the port are all open and may be partially to blame for the dust and thus may also require to be enclosed.

It is understood that road, rail and barge transport of the iron ore and coal is not thought to be a problem as:

- All road trucks are checked before loading to ensure that there are no holes which would leak cargo.
- Where such holes are found they are required to be fixed before loading. All trucks are properly covered and are also checked to ensure that they are not overloaded.
- All rail wagons are similarly checked and properly covered.
- The iron ore in the barges is generally damp and so not so prone to becoming air borne; it is also loaded in the barges' holds below deck level.

Iron ore is not normally sprayed as it arrives in the port in damp condition and remains damp while stored. However, during the hot pre monsoon months it is reported that it does occasionally dry out and dust becomes a problem which would indicate that spraying may need to be introduced as this time of the year.

Other mitigation measures that are taken to avoid dust pollution include:

- Lorry drivers are advised to move slowly from the port to the airport junction so that the flying of dust on the road is completely eliminated
- Installation of two 7.5m high masts at GCB backup area of berth No.11 for water sprinkling at regular intervals
- Restricting the height of coal stacks and quantity of coal on plots
- A 'coal pollution monitoring committee' has been notified by the Goa Government to oversee port operations so that there is no major impact on environment.

The port's present environmental management plan is in line with meeting their objective of becoming 'Environmentally more friendly and clean'.

However, the municipal waste dumping site (with out any design)) catering to the disposal of municipal waste for the town is located with in populated area as well as close to sensitive location, hospital of the port. It is actually only a road corridor about 7 m wide that separates the hospital and the dumping ground.

As per MSW notification in year 2002, Municipal corporations/councils should establish a separate engineered landfill site as per norms prescribed. Under this notification, the disposal site should not be located close to any residential colony/school/ hospitals. Therefore, the existing site is violating the rules & regulations provided by MoEF and must be abandoned. The hon'ble supreme court has also been intervening in this matter from time to time and has notified the time limits for establishing new engineered land fill sites. The time limit in the case under investigation is already over and calls for urgent action by the concerned urban authorities.

- If this present dumping site is abandoned, the feasibility of earning Carbon Credits / Certified Emission Reductions (CERs) could be explored for this site. The proposal is already under consideration by MPT, but it is required to initiate a Feasibility Study to ascertain the site potential of carbon credits. It depends on the size, life and quantity of executable methane gas.

Hence it is recommended that MPT take necessary action to abandon existing dumping site and initiate a study on feasibility of potentials for earning CERs through capture of methane gas from the site. The amount, if any, earned through CERs can, of course, be pumped in to construction of new engineered land fill site.

MPT has another proposal to set up wind form energy at this site. Establishment of Wind farm is a good proposal and can qualify for CERs immediately. This project will generate electricity using wind energy source. As such projects are green project and do not require any energy consumption as well as do not create any pollution in form of air/noise or

water. Therefore such projects are eligible to earn CERs through CDM mechanism under Kyoto protocol. Therefore the abandoned site can be used for energy recovery from solid waste which is dumped in side the earth and wind energy source.

Based upon the above discussion, it is recommended that MPT should arrange to undertake following:

- A feasibility study for recovery potential of methane gas from the existing disposal site
- Initiate steps to arrange for establishment of wind farm energy
- Initiate steps to locate/select another disposal site as per MSW regulations 2002 and initiate construction of a engineered landfill disposal site

The environmental management plan required during the construction of additional port facilities is covered separately in the report under the environmental aspects Chapter.

E.13 Projects and Investments

The projects recommended for development to cater to traffic forecast up to 2013-14 are therefore those in **Table E.7** .

Table E.7 – Recommended Port Development Projects

Common Port Development Works
(a) Breakwater Repairs & Strengthening
(b) Capital Dredging for deepening of approach channel and Berth 9 by 1m
Capital Investments Related to Cargo Handling
(a) Providing Harbour Mobile Crane at Berth - 11
(b) Integration of berth no 8 with with berth 9 for iron ore handling along with increased stackyard area, wagon handling system
(c) Replacement of MOHP present equipments
(d) Construction of additional mooring dolphins
(e) Construction of Berth no 7 as new berth 7
(f) Construction of a new Port crafts jetty
(g) Development of Vasco Bay (Phase – I) with one finger jetty capable of accommodating 2 liquid cargo berths, 1 berth for
Connectivity Aspects
Roads
(a) Construction of the remaining 5 km strech NH-17B between Vernapuri and Sada
(b) Construction of flyover from Tariwada on NH-17B to Gate no 9
(c) Construction of 2 lane road between Gate no 9 and Gate no 1 within the existing port area
Rail
(a) Doubling of Bellary - Vasco Section in two phases
(b) Yard improvements to Vasco Railway yard including remodelling of present R&D yard
Human Resources Aspects
(a) Computerisation - including server and software for integrated computerisation
(b) Adding additional 150 computers for Class III & Class IV staff
Environmental issues
(a) Environmental management
(b) A feasibility study to ascertain the recovery potential of methane gas from the existing disposal site near the new Hospital
(c) Initiate steps to arrange for establishment of wind farm energy
(d) Initiate steps to locate/select another disposal site as per MSW regulations 2002 and initiate construction of a engineered landfill disposal site

The associated development costs are estimated as follows in **Table E.8:**

Table E.8 – Summary of Capital Investment

S.NO	Project Description	Cost - INR Million
A	**Common port development works**	
1	Breakwater Repairs & Strengthening	270
2	Capital Dredging for deepening of approach channel and Berth 9 by 1 m	650
	Subtotal (A)	**920**
B	**Improvements to existing facilities and Vasco Bay Phase -I development**	
3	Providing Harbour Mobile Crane at Berth - 11	151
4	Integration of berth no 8 with with berth 9 for iron ore handling along with increased stackyard area, wagon handling system	1071
5	Replacement of MOHP present equipments	1842
6	Construction of additional mooring dolphins	220
7	Construction of a new Port crafts jetty	25
8	Development of Vasco Bay - Phase - I with 1 finger jetty -	901
	Subtotal (B)	**4210**
C	**Construction of New Berth 7 on BOT basis**	**1400**
	Subtotal – (C)	**1400**
D	**Connectivity Aspects**	
	Roads	
9	Construction of the remaining 5 km stretch NH-17B between Vernapuri and Sada	230
10	Construction of flyover from Tariwada on NH-17B to Gate no 9	260
11	Construction of 2 lane road between Gate no 9 and Gate no 1 within the existing port area	105

	Rail	
12	Doubling of Bellary - Vasco Section in two phases and yard improvements to Vasco Railway yard including remodeling of present R&D yard	20000
	Subtotal (D)	**20595**
E	**Human Resources Aspects**	
13	Computerization - including server and licensed software for integrated computerization	33
14	Adding additional 150 computers for staff	8
	Subtotal (E)	**41**
F	**Environmental issues**	
15	Study on alternative municipal disposal site, wind farm and CDM credits	5.5
16	Environmental Management	14
	Subtotal (F)	**19.3**
	Total (A+B+C+D+E+F)	**27185.3**

E.14 Financial

Based on the most likely medium scenario (and case 2 for iron ore traffic) of the traffic forecasts, certain projects have been identified which could be broadly classified into

a) Cargo Related Projects

b) Connectivity Projects

c) HR Related projects

In a preliminary analysis, it was ascertained that the free cash resources that would be available for funding the projects is Rs. 3,256 million upto Rs. 2010-11 and the debt capacity of the port as at 31st Mar 2007 was Rs. 5,645 million (assuming a 60:40 debt equity ratio). The free cash resources were computed after considering the following major expenses of the port

(a) pension liability that is estimated not be offset by the additional levy as provided by TAMP over the next two years

(b) Estimated increase of 20% in salary due to the impending revision through pay commission.

The total cost of the projects is projected to be Rs. 27,166 million out of which the common projects which would be funded by National Highways Authority of India and/or Centre / State government is estimated at Rs. 20,940 million. The specific port related projects is estimated to cost about Rs. 6,226 million out of which the port will fund Rs. 1,930 million from its own sources and Rs. 2,896 million from external debt sources. The port will not be in a position to fund its deepening of the approach channel and Berth No 9 project until 2010-11 due to the cash unavailability and hence it is recommended that the port apply to the centre to fund this project through the viability gap funding route. However, should the funding from the centre not be granted, the port may undertake this project from its internal accruals beyond 2010-11 based on actual cash availability then. It is recommended that the development of berth No. 7 be done on a private public partnership basis on the BOT route.

The cost of the projects and the funding options are summarized in the following **Table E.9**;

Table E.9 – Cost & Funding Options

Rs in million

Project	Total Cost	Funding			
		Centre / NHAI	BOT	MPT's Sources	
				Own	Debt
A. Cargo Related Projects					
Repair and strengthening of breakwater	270			108	162
Deepening the approach channel and Berth No 9	650	650			
Increasing the iron ore handling capacity	3,158			1,263	1,895
Developing Vasco bay to handle the liquid bulk and other non cargo vessels	901			360	541
Construction of New Berth No 7	1,400		1,400		
Increasing the capacity of handling miscellaneous commodities	151			60	91
B. Connectivity Projects					
Improving the rail and road connectivity between hinterland in Karnataka and Goa	20,290	20,290			
Improving the road and rail connectivity within the port premises	305			122	183
C. HR Related projects					
Computerization of the port	41			16	25
Total	**27,166**	**20,940**	**1,400**	**1,930**	**2,896**

The above funding pattern has been identified after considering the following:

(a) the profitability potential of the projects and its importance to MPT

(b) projects, the revenues of which could be specifically identified and hence the port has an option to develop it through public private partnership basis.

(c) Availability of funds

(d) free cash and investment resources available with the port

(e) the networth of the port and its debt capacity

The project of deepening of approach channel and berth No.9 is integral to the project of increasing the iron ore handling capacity at the port. Although this project is imperative to the development of the port, it is estimated that funding this project (after funding the other development activities identified for the port) with port's own resources would burden the financials of the port. It is suggested that the Port apply for funding the Centre to carry out this project. The cost of deepening the approach channel and berth no. 9 is Rs. 650 million which is lesser than 40% of the total cost of the project and the Port can apply for a viability gap funding from the government. However, should the funding from the centre not be granted, the port may deepen the approach channel and berth No. 9 from its internal accruals beyond 2010-11 based on actual cash availability then.

Upon completion of the identified projects, the port is estimated to earn revenues of Rs. 3,540 in the year 2013-14 (from Rs. 2,210 million in 2005-06) from when on it estimated to consistently grow to Rs. 4,401 million in 2025-26). Due to the higher than fixed norm of return on capital employed for the proposed liquid bulk operations at Vasco bay and the iron ore handling operations at MOHP, it is expected that the tariffs may be subjected to downward revision of 20% by the TAMP. The port is estimated to earn a negative net margin in the year 2008-09 due to the contribution to the pension liability. However, in all the other years the port is projected to earn positive earnings, although in the initial years, the earnings are expected to be lesser than 2005-06 due to the increase in salary cost and reduction in tariff of iron ore MOHP and liquid bulk operations.

The revenues and the earnings are summarized in the following table:

Table E.10 – Revenues and Earnings

Rs in million

Particulars	2006-07	2010-11	2015-16	2020-21	2025-26
Operating revenues	2,519	3,069	3,726	4,036	4,401
Operating costs	1,949	2,299	2,537	3,388	4,227
Operational net earnings before depreciation, interest and tax	569	770	1,190	648	174
Net earnings	527	354	1,069	899	756

The free cash available with port of Rs. 1,230 million as at Mar 2006 is estimated to dip to just about Rs. 39 million in the year 2009-10 due to the

capital expansion plans. This free cash port along with the other current assets is estimated to be sufficient to carry on the operations of the port. Beyond fiscal 2010, when the port's new investments start generating earnings, the free cash of the port is estimated to grow consistently to Rs. 11,577 million as at 2025-26. The increase in the cash and investment resources available with the port is due to the fact that no capital expansion plans have been identified for the port beyond the projection period of 2012-13.

However, the actual scenario on the cash available with the port will be considerably different should the port identify certain viable opportunities to invest its resources in.

E.15 Strategies

Strategies are suggested which are specific policies and actions which management can implement with the intent of meeting the Goals & Objectivies.

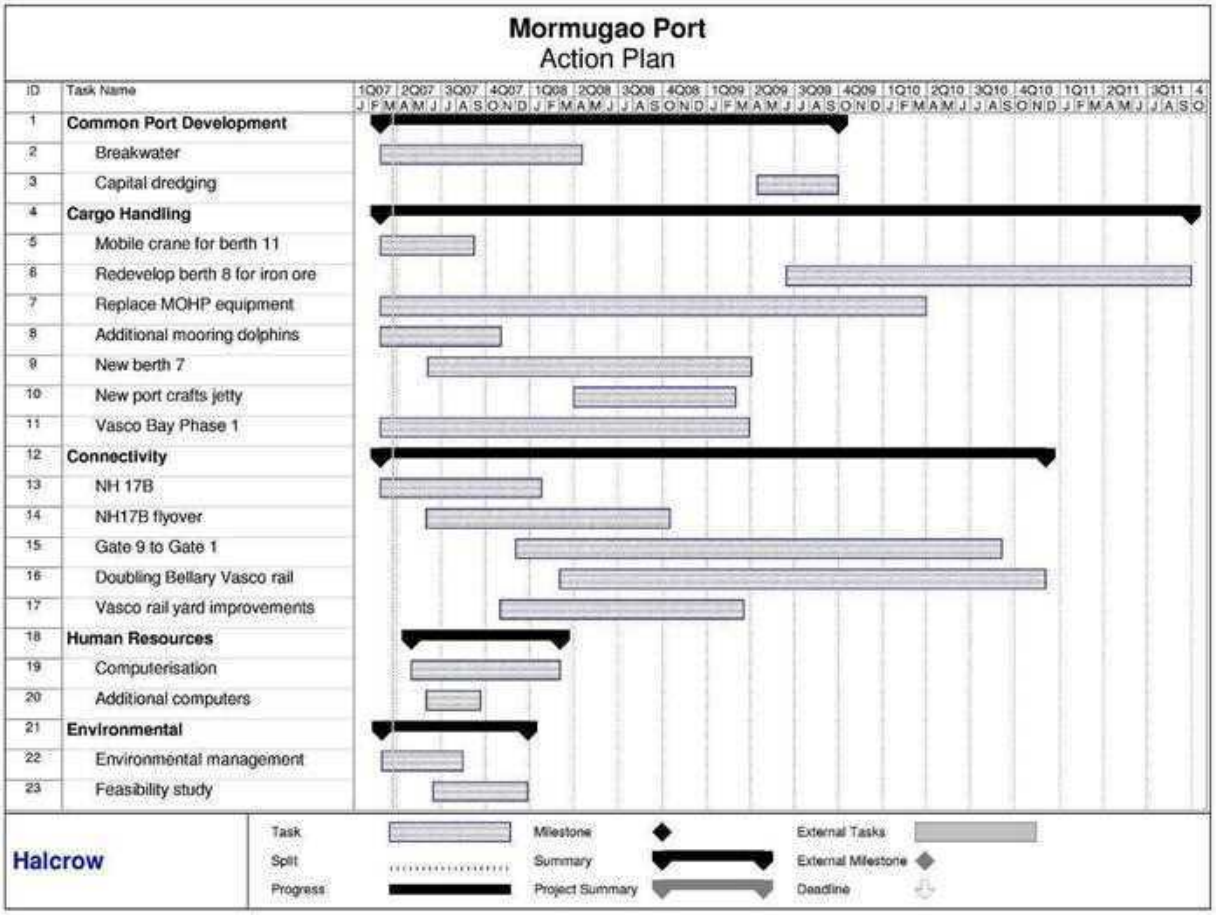
The following strategies are suggested for MPT;

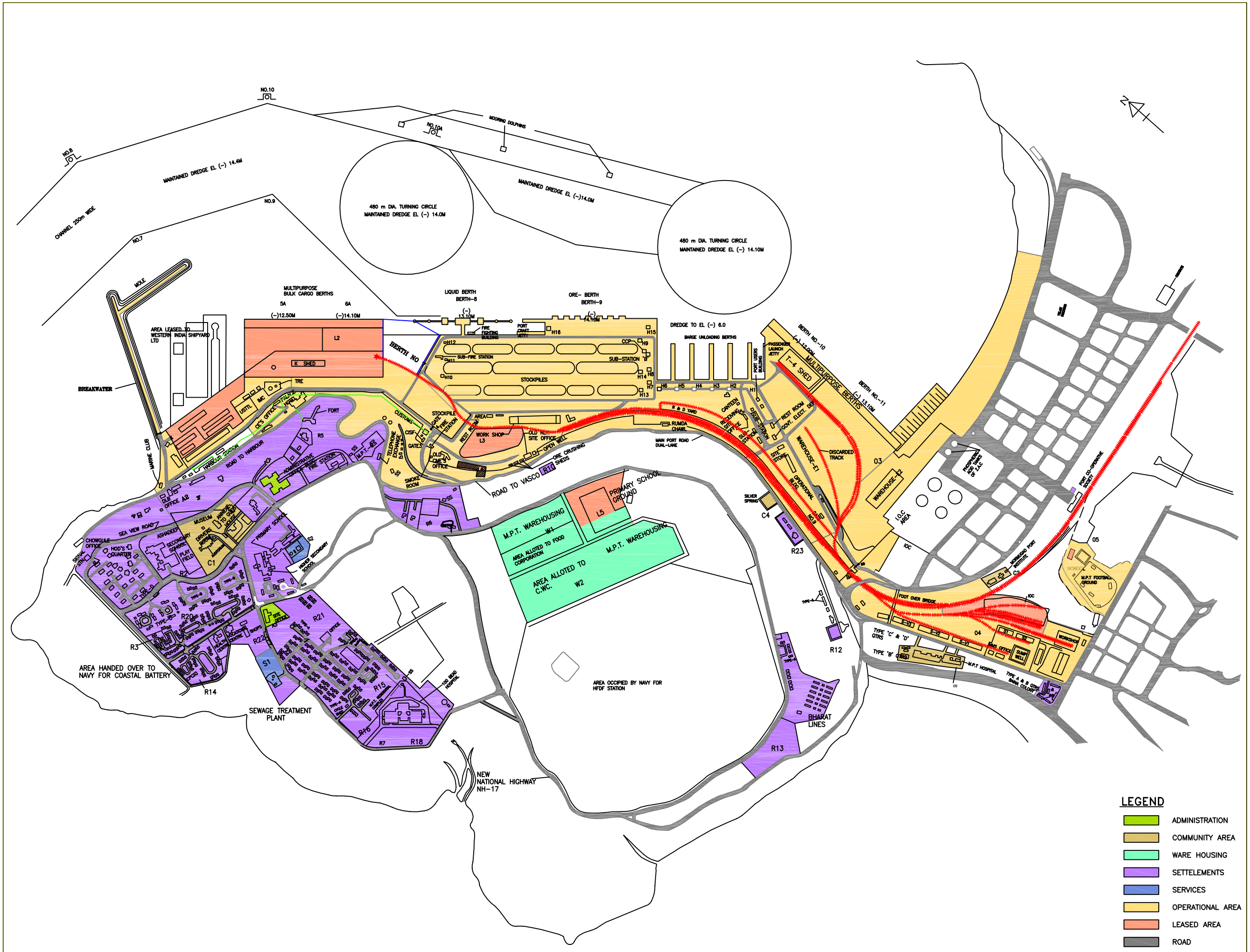
- Advance towards 'Corporatisation' or 'landlord' port concept
- Set up privatisation steering group to define activities for privatisation and decide the order of implementation
- Redeployment of manpower / staff based on work study
- A Development Centre for senior management.
- Specific training for handling cruise ship traffic
- Performance based rewards for departments
- Create new terms and conditions of employment which give incentives to improve productivity.
- Reorganize and create accountable business units
- An Integrated Computer system
- Lateral job rotation and deployment on projects to enhance overall capability
- Changes in Organizational Structure e.g introduction of strategic planning cell and combining related functions like training with welfare, administration and IR.
- Seek and respond to Customers / Users feed back
- Monitor performance

E.16 Action Plan

The overall Action Plan for Mormugao Port is summarised on the following programme in **Figure E.10**.

Figure E.10 – Schedule of Action Plan





NOTES

L1– AREA LEASED TO WISL

L2– AREA LEASED TO ABG

L3– AREA LEASED TO CWC

L4– AREA LEASED TO ZIL

L5– AREA LEASED TO GANESH BENZOPLAST

SS	– SULABH SOUCHALAYA
A1 TO A3	– ADMINISTRATION
C1 TO C4	– COMMUNITY AREA
W1 TO W2	– WAREHOUSING
R1 TO R23	– SETTLEMENTS
S1 TO S2	– SERVICES
O1 TO O5	– OPERATIONAL AREA
T	– PARKING SPACE

STATEMENT OF AREA

ADMINISTRATION	–	6.41 ACRES
COMMUNITY AREA	–	9.11 ACRES
WAREHOUSING	–	33.80 ACRES
SETTLEMENTS	–	135.58 ACRES
SERVICES	–	3.47 ACRES
OPERATIONAL AREA	–	202.87 ACRES
LEASED AREA	–	47.63 ACRES
TOTAL AREA	–	438.87 ACRES

LEGEND

- ADMINISTRATION
- COMMUNITY AREA
- WARE HOUSING
- SETTELEMENTS
- SERVICES
- OPERATIONAL AREA
- LEASED AREA
- ROAD
- RAIL LINE

PRELIMINARY

Revision	By	Checked	Approved	Date	Description
0	AKS	VS	SI	AUG.'06	PRELIMINARY LAYOUT

CLIENT
MORMUGAO PORT TRUST
HEADLAND SADA, MORMUGAO–GOA
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Halcrow

PROJECT
PREPARATION OF BUSINESS PLAN

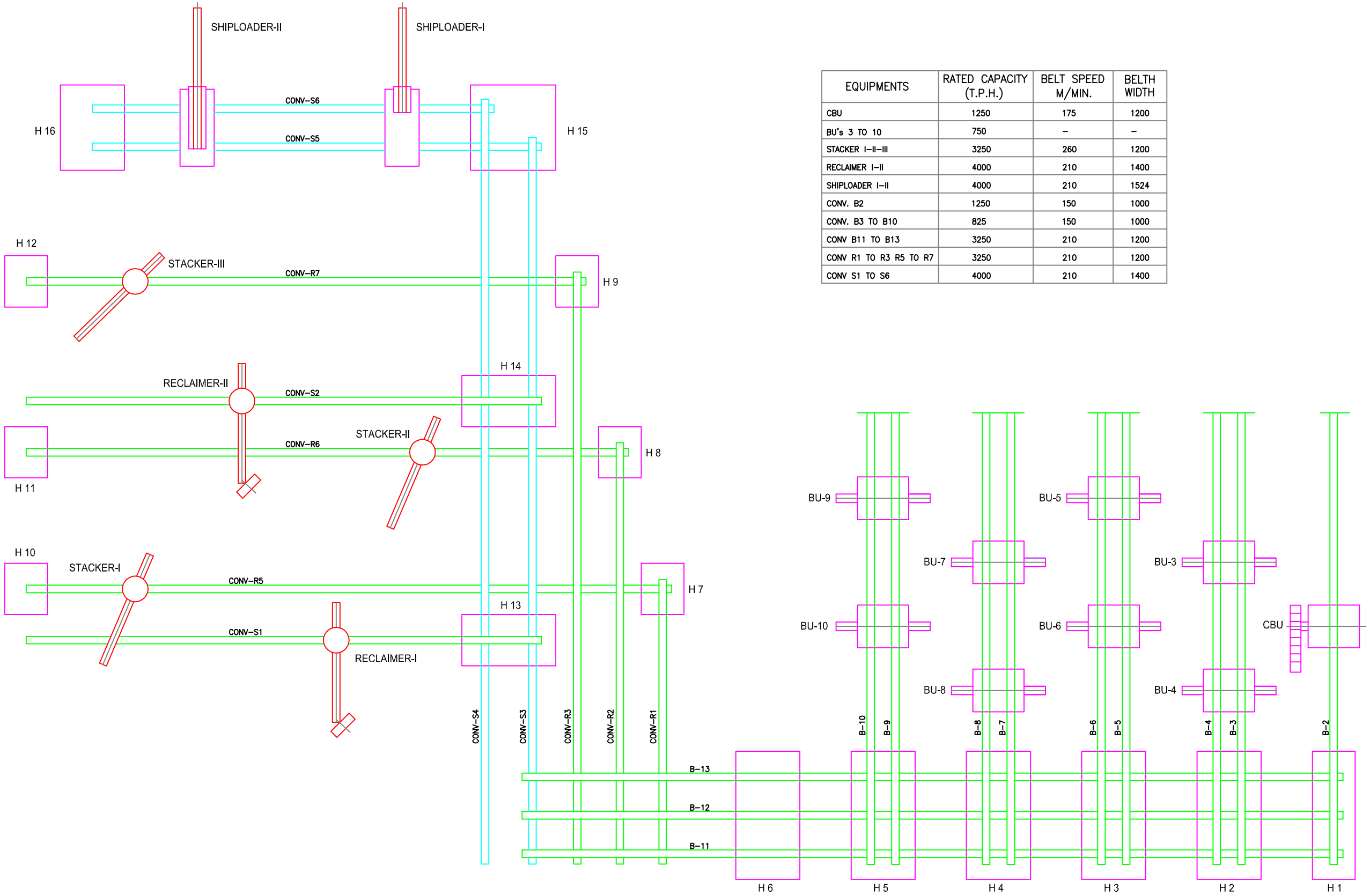
DRAWING
PORT LAYOUT

Drawn by	AKS	Date:	AUG 2006
Checked by	VS	Date:	AUG 2006
Authorised by	SI	Date:	AUG 2006

DRAWING No. ES/01 | Revision 0

Drawing Scale: N.T.S

CAD filename: ES/01 | Plot scale: N.T.S



EQUIPMENTS	RATED CAPACITY (T.P.H.)	BELT SPEED M/MIN.	BELTH WIDTH
CBU	1250	175	1200
BU's 3 TO 10	750	–	–
STACKER I–II–III	3250	260	1200
RECLAIMER I–II	4000	210	1400
SHIPLOADER I–II	4000	210	1524
CONV. B2	1250	150	1000
CONV. B3 TO B10	825	150	1000
CONV B11 TO B13	3250	210	1200
CONV R1 TO R3 R5 TO R7	3250	210	1200
CONV S1 TO S6	4000	210	1400

ORE HANDLING FACILITIES AT MORMUGAO PORT

PRELIMINARY

NOTES

CBU – CONTINUOUS BARGE UNLOADER
BU – BARGE UNLOADER
CONV– CONVEYOR
SHIPPING
RECEIVING

Revision	By	Checked	Approved	Date	Description
0	KAM	VS	SI	AUG.'06	PRELIMINARY LAYOUT

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PROJECT
PREPARATION OF BUSINESS PLAN

DRAWING
ORE HANDLING FACILITIES AT MORMUGAO PORT – MOHP CONVEYOR SYSTEM

Drawn by	KAM	Date:	AUG 2006
Checked by	VS	Date:	AUG 2006
Authorised by	SI	Date:	AUG 2006

DRAWING No. ES/02 | Revision 0

Drawing Scale: N.T.S
CAD filename: ES/02 | Plot scale: N.T.S

1 Introduction

1.1 General

Mormugao Port Trust (MPT) has commissioned Halcrow in association with Ernst & Young India Limited to prepare a Business Plan for the port in connection with the expansion plans for the port.

The study was awarded on 30th June 2006 with a 15 day mobilization period.

As per the Terms of Reference (TOR), the deliverables under this study comprise Inception Report, Interim Report, Draft Final Report and a Final Report to MPT. The first three deliverables Inception Report, Interim Report and Draft Final Report were finalised in October 2006, January 2007 and February 2007 respectively.

This report is the next & final stage of deliverable 'Final Report' and it is being submitted as a stand alone report incorporating the major findings of the earlier deliverables. Suggestions for improvements in existing port operations and future development opportunities are presented in this report along with detailed financial aspects and an action plan for MPT.

1.2 Objectives & Scope of Study

The main objectives of the Business Plan preparation are summarized in the terms of reference as;

- Define a long term vision for the port
- Establish goals to be achieved over the next seven years to satisfy this vision
- Identify the strategy to be followed to reach these goals
- Recommend a detailed plan of action to implement the strategy
- Identify sources of financing for all proposed investments

The business plan is to provide the foundation for institutionalizing an annual planning process for reviewing, updating and modifying seven year plans on a rolling basis.

1.3 Plan of Report

Following this introduction, the structure of this Final Report is as follows;

2 Mromugao Port - Current Situation

3 Vision, Goals & Objectives

4 Traffic Forecast & Competitive Position

5 Vessesl Size Developments

6 Proposed Facilities

7 Hinterland Connectivity

8 Human Resources

9 Environmental Management

10 Investments

11 Targets, Strategies & Action Plan

12 Financial Aspects

13 Conclusions and Recommendations

2 Mormugao Port – Current Situation

2.1 Location

The port of Mormugao, one of the oldest ports of India commissioned in 1888 and one among the twelve major ports in India, is situated in Goa state, between the major ports of Mumbai and New Mangalore. It is located at the mouth of the river Zuari at latitude 15° 25' North and longitude 73° 47' East & Goa is located at a distance of about 580 km south of Mumbai. Most of the coast line of Goa is fringed by sandy beaches. Goa is dominated by beautiful landscaping formed by the various rivers and their tributaries, which flow from the western ghat in to the Arabian Sea. Location of the Mormugao Port in India is shown in **Figure 2.1**.

Figure 2.1 – Location of Mormugao Port

2.2 Environmental Conditions

2.2.1 Wave conditions

A number of wave observations have been made at and around Mormugao harbour at different times, including both ship observations & those made from the shore and the measured wave heights by installing a wave rider buoy.

Mormugao harbour on the Southern side where berths are located is protected by a breakwater and mole and generally it is the waves from directions between SW and NW that could affect the tranquillity in the harbour. The deep water waves from NW generally have a small % probability exceedence and do not affect harbour tranquillity significantly since their heights get reduced by the time they reach the harbour.

HOWE during their master plan study constructed the wave rose diagram from the visually observed wave heights during the period 1949 to 1962, from the area bounded by Latitude 10°N to 20°N and Longitude 70°E to 80°E. These wave analyses indicated that the yearly average probability of exceedence of the wave height of 2 m for the Westerly direction would be

Direction	Exc. Hs = 2 m
SW	4.7 %
W	4.5%
NW	0.4 %

Frederic R Harris (FRH) during their master plan study in 1997 carried out further additional wave climate analyses based on wave observations made during the period 1961-1980 bound by Latitude 13° N to 16°N and Longitude 70°E to 74°E and arrived at the following results for deep water wave climate and wave heights at harbour entrance;

Table 2.1 - Deep Water Wave Climate

(Probability of exceedence in % of time)

HS =	1.0 m	2.0 m	3.0 m	4.0 m	5.0 m	6.0 m
SW	12.2	8.7	4.7	2.2	0.8	0.3
W	22.0	14.4	8.1	3.6	0.7	-
NW	9.6	2.5	0.7	0.3	-	-

Due to refraction, shoaling and breaking, the wave direction and wave height will change while travelling from deep water to the harbour entrance. Generally by refraction the waves from NW turn to WNW. Waves from W and NW reduce in height. All wave conditions higher than Hs = 4 m are

reduced by wave breaking. The operational wave climate at the harbour entrance is presented here below;

Table 2.2 - Operational Wave Climate at Harbour

(Probability of exceedence in % of time)

HS =	1.0 m	2.0 m	3.0 m	4.0 m
SW	12.2	8.7	4.7	2.2
W	21.6	13.6	7.4	3.0
NW	8.4	2.0	0.6	0.2

The extreme wave climate at the harbour entrance is as follows:

Frequency of occurrence	Hs
10/year	4.7 m
1/year	5.0 m
1/10 years	5.4 m
1/100 years	5.8 m

Extreme wave conditions at harbour entrance will occur mainly during the monsoon period. The period of the extreme waves varies between T = 7 S and 13 S.

During the last 4-5 years since the installation of VTMS, MPT is measuring the wave heights near the approach channel at a water depth of 10 m by installing a wave rider buoy. The VTMS captures these measured wave heights at the signal station. Twice a day, the recorded values are sent to MPT for their records.

It is also understood that National Institute of Ocean Technology (NIOT), Chennai has installed a wave rider buoy in Mormugao port waters and the observations are maintained by NIOT.

2.2.2 Wind conditions

The mean wind speed varies from 2 on the Beaufort scale in November to 4 in July, the annual mean wind speed being 13.6 KMPH. In an average year, there are 316 days with winds varying from 0 to 3 on the Beaufort scale and 48 days with winds scaling 4 to 7 on the Beaufort scale, and 1 calm day.

The predominant wind direction changes with the time of the year. During the period June - September wind blows from the W and SW. During the remaining period, the wind direction is from NE, ESE.

2.2.3 *Currents*

The currents in the region outside the sheltered harbour have been found to be generally less than one knot, during fair season and are mainly caused by tidal ebb and flow. Within the sheltered harbour, indicated current strengths are of the order of 30 to 40 cm/sec. During heavy monsoon rains the current pattern is altered from that during the fair season but the current strengths do not get appreciably altered.

As part of the field investigations in Vasco Bay, current observations were taken at two locations (CM1 – 15° 26' 00"N, 73° 48' 18" E , CM2 – 15°o24' 21"N, 73° 48' 42" E). A summary of the current measurements is given in **Table 2.3**.

Table 2.3 - Current Measurements

	CM1 (Water depth, 7 m)			CM2 (Water depth, 3.5 m)
	Near surface	**Mid depth**	**Near bottom**	**Near bottom**
Maximum Speed (cm/sec)	68	31	29	57
Minimum Speed (cm/sec)	0	0	0	0
Predominant Direction	ESE _ WNW	ESE _ WNW	ESE _ WNW	ESE

Measurements at open location (CM1) indicate that the predominant flow is in the ESE - WNW direction, while at the location (CM2) close to the shore, the predominant direction is ESE. The flow of currents is predominantly due to the tidal currents. During flood water, flow is towards Zuvari River while during the ebbing, the reversal of flow takes place.

The maximum current velocity was observed as 68 cm /sec.

Presently current measurements near berth no 8 are captured by VTMS at the signal station. The current values are printed and sent to MPT twice a day.

2.2.4 *Tides*

The nature of tide prevailing at Mormugao is mainly semi - diurnal exhibiting two high and two low waters in a tidal day. The mean tidal variation is of the order of 1.6 m at spring tides and around 0.7 m at neap tides.

Based on Indian Naval Hydrographic Chart No.2020, the tide levels with respect to Chart Datum at Mormugao harbour are as follows:

Higher High Water at Spring Solstices	-	+ 2.3	m
Mean Higher High Water (MHHW)	-	+ 1.9	m
Mean Lower High Water (MLHW)	-	+ 1.8	m
Mean Higher Low Water (MHLW)	-	+ 1.0	m
Mean Lower Low Water (MLLW)	-	+ 0.5	m
Mean Sea Level (MSL)	-	+ 1.3	m

Tides were measured at 15 minute interval for a month during Apr – May 1998 by installing a tide guage at Oil Berth No. 8. The maximum tidal range observed during the spring tide was 2.7 m and the minimum range during neap tides was 0.51 m.

At present, an electronic tide gauge has been installed at Berth no 8 and tide levels are captured by VTMS at the signal station.

2.2.5 *Dredging Requirements*

Annual maintenance dredging of about 3.5 million cubic metres is carried out every year within 56 days during September & October.

Mormugao Port Trust does not have its own dredgers and the maintenance dredging is tendered and the contract is awarded every year.

All dredged material is deposited in the spoil ground identified by the port & located north of outer approach channel.

2.2.6 *Soil conservation*

Being on a steeply slopping site and having intense and heavy rainfall during the monsoon months the port area suffers from soil erosion. To green the area and prevent soil erosion the port is planning the plantation of 3000 trees of various species in port operational areas. The Port has planted nearly 1,00,000 saplings for the past 20 years with survival rate of about 75%.

2.3 *Existing Port Facilities*

Reference is drawn to the port layout drawing **DCMPBP/01 – Port Layout** provided at the end of the report and a satellite view of major existing facilities of the port is shown below in **Figure 2.2** for ready reference.

Figure 2.2 - Satellite view of Mormugao Port

2.3.1 Navigational Facilities

a) Approach Channel

The approach channel of the port comprises an outer channel 5200 m long and an inner channel 2300 m long. The channel is 250 m wide. The harbour basin has two Turing circles of 480 m diameter

The outer channel is dredged up to - 14.4 m CD. The inner channel and the turning circles are dredged to -13.1 m CD. The channel is one way navigation channel.

b) Breakwater

The port has a 522 m long breakwater aligned slightly east of north at the western end of the port / berthing facilities. A mole of 270 m long runs from near the tip of the breakwater in an easterly direction. The breakwater and the

mole give protection to the berths from W and NW waves during the monsoons.

2.3.2 *Berthing Facilities*

a) Quay walls and jetties

The **Table 2.4** gives the list of available berthing facilities at MP;

Table 2.4 - Berthing Facilities at MP

Berth no.	Type of berth	Designed/ actual depth (m)	Quay length (m)	Max. size of vessel that can be accommodated	
				Length overall (m)	DWT
5A	Dry Bulk Cargo	13.10	200	100	
6A	Dry Bulk Cargo	14.10	250	225	
7	Barge berth	3.50	100	100	-
8	Liquid bulk	13.10	116 298*	260	125,000
9	Ore	14.10	222 358*	335	275,000
10	General cargo	12.00	250	225	55,000
11	General cargo	13.10	270	225	65,000
	West no.1 dolphins	13.10	-	185	-
	West no. 1 & 2 dolphins	13.10	380*	225	70,000
	West no.2 & 3 dolphins	13.10	380	225	70,000

* Length between extreme mooring dolphins

A brief description of the above berthing facilities available in the port is given below;

Berths 5A & 6A (Dry bulk cargo & Lime stone)

The berth 5A and 6A were commissioned in June 2004 on BOT basis to handle dry bulk cargo. The

mechanisation of the berth was completed in Sep 2005.

Though it is a multi user facility, at present it is mostly handling the captive coal cargo of Jindal for their steel plant at Tornagulu. These berths are RCC piles and superstructure construction.

Berth no 7

This berth is about 100 m long with an available draft of 3.5 m and generally used for barges. This berth is of block work type constructed in 1959.

Presently, this berth is one of the oldest berths of the port and it is highly deteriorated and in a non operable condition.

At present there is a proposal to convert this berth 7 to a New Berth 7 on BOT basis. The new berth 7 will be of 225 m long, the berthing line in line with berth no 6A & Berth 8 and reclaiming the area in between the new berthing line and the present on shore land. A small portion of (50 m) Berth no 8 would become part of New Berth 7 under this scheme. The selection of BOT developer is under process by MPT. In the selection process, the choice for cargo that would be handled at this berth is left to the BOT developer. The BOT developer could handle any type of cargo except containers. It is expected that this berth is likely to handle bulk cargo like coal or iron ore.

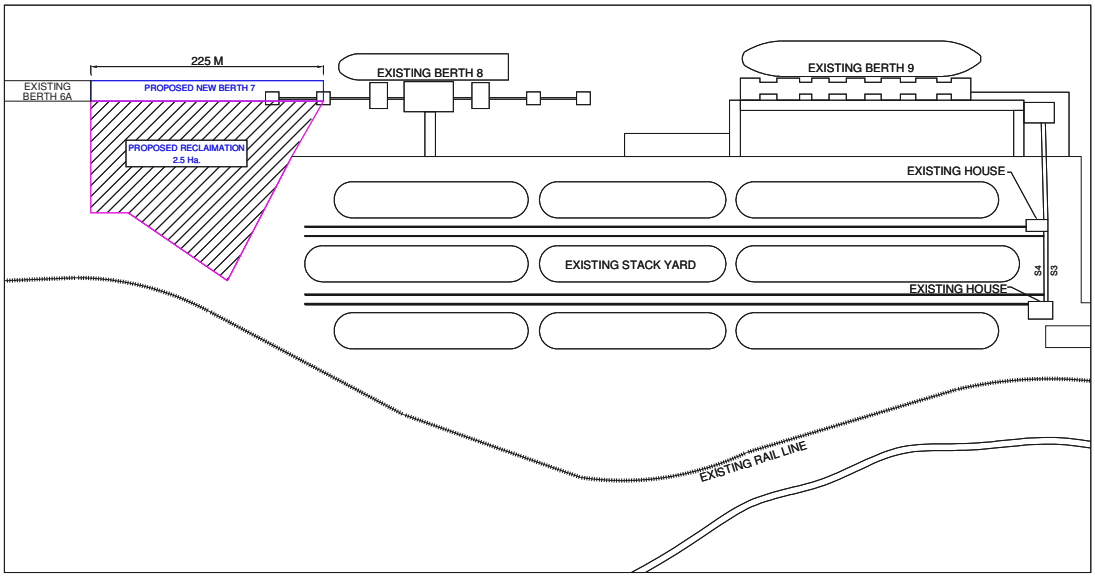


Figure 2.3 – Proposed new Berth No. 7

Berth no 8 (Liquid Bulk)

The berth is 298 m long with a depth availability of -13.1 m CD. It has two breasting dolphins, four mooring dolphins connected by a walk way and one service platform. This berth was constructed and commissioned in 1978.

The structure is of concrete caissons for service platforms, berthing and mooring dolphins. The berth is connected to the shore by a 40 m long approach trestle.

This berth apart from liquid bulk cargo accommodates cruise vessels and some times iron ore vessels are berthed for loading iron ore from barges especially during monsoon while the MOHP and mid stream loading is closed.

Berth no 9 (Iron Ore)

The berth no. 9 is dedicated for the handling of iron ore with Mechanical Ore Handling Plant (MOHP). This berth is 357 m long and dredged to -14.1 m CD. The structure is of concrete cribs with R.C.C. decking. There are 7 cribs connected by RCC beams and decking. This berth was constructed in 1978.

It can handle vessels up to LOA 335 m; Beam 50 m. The vessels are given a swell allowance of 0.5 m and under keel clearance of 1.2 m.

Berth No 10 (General Cargo)

This berth was commissioned in 1985 using diaphragm wall type of construction. This berth is 250 m long with depth availability of -12 m CD. Mostly general cargo is handled at this berth though occasionally iron ore is loaded from the barges using ship's own gears especially during monsoon while the MOHP is shut down for maintenance.

This berth is also used for receiving cruise vessels.

Berth No 11 (General Cargo & Containers)

This berth was commissioned in 1994 using diaphragm wall type of construction. This berth is 270 m long with depth availability of -13.1 m CD. Mostly general cargo is handled at this berth though occasionally iron ore is loaded from the barges using ship's own gears especially during monsoon while the MOHP is shut down for maintenance.

All these berths Berth no 8, 9, 10 and 11 are used to berth non commercial vessels also. Non commercial vessels include naval ships, survey ships, Research ships etc., but exclude port crafts.

Barge Berths

The port has five finger berths of length 122 m and width 13 m for receiving the iron ore brought by barges through the inland water ways of Goa. Almost the entire iron ore dispatched by the ore berth 9 is received through these barges.

b) Shipyard

Apart from the above berthing facilities, the port has a shipyard facility developed by M/s Western India Shipyard Limited which was commissioned in 1995 The port trust has leased out 31,000 m^2 land area and 50,000 m^2 water area for this purpose. The shipyard facilities include a floating dry dock and a finger jetty for carrying out wet repairs.

c) Port Crafts Jetty

The port has a port craft jetty consisting two finger piers, recently constructed (June 2006). This jetty is situated between berth no 8 and berth no 9.

The port craft jetty is of RCC piles and deck construction.

d) Mooring Dolphins

Apart from these berthing facilities there are three mooring dolphins in the port with a draft availability of 13.1 m CD. These mooring dolphins are used for accommodating iron ore vessels and loading them from the barges using ship's own gear.

The distance between two of the mooring dolphins is 380 m. Vessels of LOA upto 225 m and DWT 70,000 can be accommodated here.

The mooring dolphins are generally more in use during monsoon season while the MOHP and mid stream loading operations through transshipers are closed.

e) Mid Stream Loading / Transhippers

Apart from MOHP / Berth no 9 and mooring dolphins, iron ore is loaded in mid stream into larger ore carriers using Transhippers. Generally the larger vessels are loaded at Berth No 9 up to the permissible draft and then up topped in mid stream for the remaining part of cargo. However if Berth no 9 is not available, then the ore carriers are taken for primary loading in mid stream by transhippers.

These transhippers are provided and managed by the private exporters and presently, there are four such Transhippers in the harbour as given below in **Table 2.5**;

Table 2.5 - Transhippers

Name of the transhipper	Year of acquisition	Owner
MarathaDeep	1986	Chowgle & Co. Ltd.
Swathi Rani	1981	V.M.Salagaovar & Bros Ltd
Priyam Vada	1981	V.S.Dempo & Co. Ltd
Orissa	1991	SESA Goa

The Transhippers are loaded by barges brought along side which in turn get loaded into the main ore carriers through the conveyor system available in the Transhippers and generally achieve loading rates ranging from 12,000-22,000 TPD. The quantity loaded in mid stream during 2002-03, 2003-04 and 2005-06 is 8.2, 8.8 and 9.4 MillonT respectively.

The midstream operations are closed during monsoon that normally occurs during June - September.

2.3.3 Storage Facilities

Storage facilities comprise of covered storage areas in the form of transit sheds, warehouses and open storage areas and tanks for liquid cargo. However, there are no Container Freight Stations or Port based SEZ in the port area.

Details of storage facilities for general cargo are shown in the **Table 2.6** below;

Table 2.6 - Details of Storage Facility in MPT

Description	No of plots/Sheds	Area (sq. m)	Storage capacity
Port Owned			
Covered			
(i) Transit Shed/ Overflow Sheds	1	7700	-
(ii) Ware Houses	3	13810	-
(iii) Container Freight Station	-	-	-
Open	2	167000	600 (TEUs)
Others			
Covered			
(i) Transit Shed/ Overflow Sheds	-	-	-
(ii) Ware Houses	5	16680	-
(iii) Container Freight Station	1	3286	-
Open	-	-	-
Stackyard at MOHP (at Berth No.9)	3 rows of varying length and width	80,000	10,00,000 (T)

Source- MPT Annual Report (2004-05)

For the storage of Iron Ore, the stock pile yard is arranged in three rows of varying length and width.

For the storage of liquid bulk, two oil terminals are located adjacent to the port area, one for Indian Oil Corporation and the second for Hindustan petroleum Corporation [HPCL]. Other oil companies such as Bharat Petroleum Corporation Ltd [BPCL] use these terminals for product supply that is transported further using road tankers. The management of incoming oil from berth to tank farms is undertaken by IOC as the port coordinator for POL products. The present tank farm contains 28 separate storage tanks with a total capacity of 170,000 kL.

Zuari Industries Ltd previously known as Zuari Agro has a tank farm adjacent to port area with three phosphoric acid tanks, with a total capacity of 13,670 kL.

For other liquid bulk cargo, there are small tanks with a total capacity of approx, 10,600 kL located behind berths 5A and 6A for molasses, Phenol etc.

Table 2.7 - Storage facilities for liquid cargo

Commodity	No. of Tanks	Capacity
POL Product	26	150637 kL
Phosphoric Acid	3	13554 kL
Furnace Oil, Caustic Soda, Molasses	8	18025 kL
Other Liquid products	2	10000 tonnes
Ammonia	1	5000 tonnes

Source- MPT Annual Report

2.3.4 Cargo Handling Equipment

a) Berth no. 8 – Liquid Bulk Berth

Generally hoses are used to transfer bulk liquids between the tankers and onshore pipeline system. A mobile mechanical unloading arm is provided to handle Ammonia by the user Zuari Industries.

This unloading arm is in a reliable condition.

b) Berth no 9, MOHP and Barge unloading berths

The berth no 9 is provided with a Mechanical Ore Handling Plant (MOHP) to unload the iron ore from the barges, stacking, reclaiming and then for loading through ship loaders to the ore carriers.

The Mechanical Ore Handling System consists of the following equipment

- Grab type barge unloaders (6 o of 750 TPH; 2 of 500 TPH)
- One Continuous Barge Unloader (CBU) of 1250 TPH capacity installed in 1991.
- 37 nos. conveyors in both shipping and receiving sections;
- Three stackers with tipper cars of capacity 3250 TPH each ;
- 2 bucket wheel reclaimers each of capacity 4000 TPH and
- 2 ship loaders of the same capacity – 40000 TPH.

The MOHP was commissioned in 1978 and all the equipment installed that time have served their life. MPT is on the way to replace all the equipment related to MOHP. So far 6 grab type barge unloaders have been replaced.

The key maintenance activities that have been carried out by MPT are;

- Replacement of bearings of the reclaimers every 5-7 years
- Introduction of hydraulic system for lifting and luffing of the reclaimers by replacement of Bucket wheel Drive's Electro Magnetic Coupling with toothed hub gear by VIOTH Hydraulic Couplings in 1997-98.
- Maintenance of long travel equivaliser since the alignment of long travel drive helps in prolonged life.
- The conveyors were maintained by replacing the earlier gear boxes with Standard gear box series of Hellicon / FMG make.
- Replacement of all the conveyor drives during 1988 – 94 in phased manner
- Removal of all 'T' conveyors in 1997, surge beams, Apron Feeders and replaced with movable head pulley for all the receiving conveyors ('B' Conveyors).

MOHP has been performing well because of the above careful maintenance works carried out by MPT for all its components.

The remaining equipment of the plant like stackers, reclaimers and 2 ship loaders will be replaced by 2010 with a higher capacity system**.**

This replacement is essential for the continued good performance of MOHP.

c) Berth No 10 & 11

Fork Lift Trucks (FLTs)

There are 8 No 3 T capacity and 1 no. 5 T capacity at these berths for movement of cargo, used for transporting cargo from berths to sheds and vice versa. Out of 8 no. 3T FLTs 3 are of low mast type meant for container stuffing and destuffing and 5Nos conventional mast for handling general/palletised cargo

These FLT were installed in 1996 by MPT and hence all the forklift trucks have crossed their stipulated life of 8 years.

Though the life of equipment recommended as 8 years these FLTs are in good condition because of their less utility. Their current utilization is as low as 7%.

There is 1 no. 35 T capacity reach stacker for movement of containers. However this does not belong to MPT and this has been provided on contract / lease basis.

2.3.5 Port Crafts

a) Tugs

Mormugao port has 4 tugs of overall capacity 165T bollard pull comprising of;

- Three tugs - each of 45T capacity
- One tug of 30T Capacity

Three of the above tugs are owned by MPT and one tug is on hire basis owned and managed by a private agency.

Tug assistance is provided to manoeuvre the vessels for berthing / deberthing once the vessels enter the basin area from the channel.

Normally, vessels up to 65,000 DWT require 2 tugs and above 65,000 DWT require 3 tugs for assistance.

The number of tugs (4) available at the port is adequate. There has not been an incidence where the vessels are waiting for tug assistance. The need for additional requirement of tugs needs to be reviewed depending on the additional facilities that will be developed in future.

However, it is understood that the number of staff available are adequate to operate only 3 tugs at any time. Each tug is operated by a crew of 14 people as per old norms and this may be more than adequate. This will have to be reviewed and steps need to be taken to put the right staff strength for operating each tug.

As per the current practices prevailing in the port, this may require concurrence from the labour union of the MPT.

b) Flotilla

- 3 no of Pilot boats
- 1 no of survey launch
- 1 No self propelled water barge of 200 tons capacity
- One dumb barge capable of handling mooring and channel buoys, supplying 100 tons fresh water and receiving 50 cu.m of slop.

2.3.6 Vessel Traffic Management System (VTMS)

Vessel Traffic Management System (VTMS) is highly sophisticated computerised radar based system for the purpose of safe navigation on the approach channel and harbour are. The Mormugao port's VTMS is installed at the central signal station of the port. Vessels entering and leaving the port are guided for navigation in the channel and up to the berths / anchorage points by this system.

It is round the clock, all weather system by which the vessel entering in the port is automatically acquired on radar screen and tracked by VTMS. VTMS are continuously monitoring the vessels anchored at berths or in port limit. Vessels within about 12 nautical miles rage from the port breakwater are tracked by this system.

An automatic identification system (AIS) SAAB R 30 has been installed at signal station. This system gives information on details of vessels, i.e. arrival

time, anticipated departure time, previous port call, LOA, beam, draft, vessel position, vessel speed, etc.

The signal station of the port also has the capability to record & print the wave heights, wind speed, gust speed, tide measurements, current values, etc of these recording instruments located in the port through this electronic system.

The signal station prints twice a day these recorded information to pass it to the port administrative office for their records. These measured environmental data is available with the port for the last 4-5 years.

2.4 Utilities

2.4.1 *Power Supply*

Earlier, necessary power for working the port facilities was purchased from neighboring State electricity boards, namely Maharashtra and Karnataka State Electricity Boards. (MSEB & KSEB).

From 1999, Reliance Energy Limited (REL), a private organisation and Goa State Government are supplying the required electric power to the port.

The power supply for main port operations like MOHP, berths, port hospital, administrative building, 13 Bungalows of various Head of Department, Baina work shop, all internal lighting of the port is catered by supply from RIL.

The port colony is served by the state government supply.

The power is received from REL at the main receiving substation near the MOHP yard through 33 kV supply line and is transformed to 3.3 kV for distribution to the ore handling equipment with their large capacity motors and to supply two other substations in the port area. Power transformed to 415 volts to supply small power and lighting systems in the port areas, workshop, hospital etc.

Main incoming power system has a capacity to handle 15 MVA (three substations each of 5 MVA) though the contracted power supply is around 5.5 MVA.

Discussion with the port authorities reveal that there is no power cuts and voltage drops in the supply from Reliance. Hence 'Breakdowns' impacting the bulk handling operations that occurred earlier, are not happening since the last 6 years.

The port does not supply power to any of the associated areas such as I.O.C

terminal, WISL (shipyard), SWPL (Berths 5A & 6A), etc., which are arranged by the concerned users.

The only generated power in the port area is for the standby supply to the reefer container units, comprising of 2 - 300 kVA diesel generators.

Only electrically classified area is the oil berth no. 8. Area lighting level of 25 lux as a minimum has been provided at the working area of the berths and with an intensity level along the roads and sheds at 10 lux.

2.4.2 *Water Supply*

The current fresh water demand of the port is met by Publics Work Department (PWD), Goa supply and port's own resources like borewells and wells. The present demand of is about 3000 cum / day.

PWD is supplying about 1500 -1800 cum/day. PWD supply originates from Selaulim Dam in Goa situated at about 60 km from Vasco. The supply line from PWD is 3000 mm dia.

The current PWD supply line is received at 2 water tanks viz; Steamer tank – 550 cum capacity located at Midland Sada and one more tank 800 cum capacity near MPT's new hospital complex.

Water is pumped from these two main receiving tanks to four main distribution tanks of the port. Out of the four, three are (1 over head tank of 325 cum, 1 Under Ground of 440 Cum and one surface tank of 560 cum) located behind the Primary School Building of the port and one over head tank of 500 cum capacity is located at CISF colony.

The port's own resources for fresh water requirements include 2 sump wells, 21 bore wells and a few wells.

One sump (open) well of size 100 x 100 m is located near Material Management complex at Baina and another near foot ball ground. The water from these open wells are also are pumped to the man distribution tanks. These two Open wells have the capacity to yield about 700-800 cum /day. Supply is more in rainy season and average is around 600 cum / day.

Out of the 21 bore wells, 7 are of submersible pumps & the rest all are hand pumps. The capacity of each these bore wells is about 10 cum / hour. Average On an average these bore wells are supplying around 200 cum / day to the main distribution tanks through pipelines.

One more well of size 6 x 4 x 8 m called 'Jetty well' is located behind old CME office. This water is pumped to old CME office. The capacity of this

supply is around 150 cum / day. From this well, pumping is carried out to connect steamer tank during emergency purposes. Road tankers are also supplied by this 'jetty well' on emergency purposes.

The port has added two more wells of size 4 m dia 8 m height in 2001 to add to its water supply capacity. One is located near old harbour railway station and the other is near Gate no 2.

The pumping arrangements for these wells are yet to be made and hence these two wells are not currently used as water source.

There are a few more wells supplying to the individual buildings like Cargo handling department office, port users building (Harbour) near Gate no 1, etc.

Apart from this, the port has the 18 month contract with Popular Construction for 5000 cum / year of water supply on commercial terms. These tankers are used occasionally in summer.

Currently, the port colony is supplied of fresh water only for 2 hours a day.

If the port colony is to have water supply around the clock, more freshwater supply is required to be provided to the port colony. This would increase the current fresh water demand of the port from 3000 cum to about 5000 cum per day.

To achieve this, improvements are required in supply and storage. Discussion with the port authorities reveal that the port has requested PWD to increase the supply and this is likely to happen since a new supply line of 600 mm dia has been recently added from PWD supply source at Tari point. However, this is line is presently not supplying water regularly.

Another point of concern with the fresh water supply to the port is, currently even if there is a minor / short breakdown, the port falls short of water. A partial reason to this is lack of adequate storage capacity catering to breakdown. This situation needs to be improved by increasing the present storage capacity at the port and supply to this.

An additional storage of about 2000 cum at the Port's main distribution system in receiving water from the city's mainland the associated supply would be able to meet the demand for supplying water around the clock to port colony and in case of a breakdown.

2.5 Hinterland Connectivity

2.5.1 Road Connectivity

Mormugao Port is well connected to the hinterland by road, rail and inland waterways. Information regarding the hinterland connections in the region, both existing and proposed has been collected by the Consultant from various sources. The hinterland connections related to road transport are briefly discussed in the following paragraphs for both external roads outside port and internal roads within port area.

a) External Roads

An extensive road network exists in the Goa region, providing an important transportation link with the rest of the country. Goa is connected with all major towns of not only in Maharashtra and Karnataka, but the rest of India as well via NH4A, NH17, NH17A and partially built NH 17B. The existing road network of Goa is shown in **Figure 2.4**. The details of these roads are presented below.

Figure 2.4 - Important Road Network of Goa

(i) NH-17 (Panvel – Panaji – Mangalore – NH 47 junction in Kerala)

National Highway 17 runs close and parallel to the sea coast. It starts at Panvel in Maharashtra and meets NH 47 near Edapally in Kerala, passing though the states of Goa and Karnataka. The total length is 1269 Km and serves not only Mormugao port but also Mumbai, Karwar and Mangalore ports. There are three bridges along this route in Goa state which include Zuari bridge on river Zuari, Mandovi bridge on river Mandovi and Colvale bridge on river Chapora. The road presently has 2 lane configuration and provides the access for movement of cargo towards Mumbai in north direction and towards Kerala in south direction.

NH-17 between Cortalim and Verna

(ii) NH-17A (Cortalim – Mormugao)

A bifurcation of NH17, designated as NH17A approximately 19 kms long connects Mormugao Port (Sada Junction) to NH17 at Cortalim. The main port road connecting Mormugao port with NH-17A meets NH-17A just after Vasco da Gama town. NH-17A is presently 2 lane road, passes through mostly in rolling terrain with blind curves at certain locations. Important settlements along this road apart from Vasco are Chicalim and Sancoale.

NH-17A between Chicalim and Sancole

Within Vasco town, the trucks bound for port use FL Gomes road to Gate No 9 of Mormugao port. This stretch has 4 lane configuration with on-street parking on either side with commercial landuse all along. Before construction of NH-17B, NH-17A is the only connection for the port with rest of inland areas. The truck movement within Vasco town is banned during 7.00 – 9.00 hours in the morning and 12.30 – 14.00 hours in the afternoon to prevent delays to town traffic and accidents in the town.

Truck movement on F L Gomes road within Vasco town

As the traffic volume on Vasco town roads is low at present, truck movement is not causing any major problems in the town. However in the long run, the port bound truck movement is to be banned to provide safe and smooth movement of urban traffic.

(iii) NH-17B (Ponda -Verna-Vasco)

NH-17B between Verna and Dabolim

NH-17B between Ponda and Vasco connects NH-17 and NH-4A with Mormugao port. It provides the missing east-west connection between the port and Karnataka state. Implementation of 4 lane NH-17B of 18 km long connecting Verna Junction on NH-17 to headland Sada junction via Saneole, Pale, MES College junction, Bogmelo, Airport and Varunapuri was taken up in 2001 and this stretch has been completed for 13 km from Verna to Varunapuri junction in 2004. The remaining 5 km stretch between Varunapuri junction and headland Sada junction remains to be completed. This is held up because of rehabilitation problems faced in the stretch of about 500 m before Sada.

About 5 Km from Verna towards Ponda is also 4 laned and the rest of the stretch has 2 lane carriage way. However about 3 Km stretch is not constructed due to land acquisition problems. Now the trucks towards NH-4A (Belgaum side) pass through either Panaji town or Madgoan.

Presently, port bound traffic reaches along NH-17B upto Dabolim airport along NH-17B and then use the connecting between Dabolim (NH-17B) and Chicalim (NH-17A), pass through Vasco town and reach Gate No 9 of the port 9 (due to missing link from Varunapuri to Sada/port).

The entire port bound traffic has to pass through Vasco town to Mormugao from both NH-17A and NH-17B. Construction of missing links of NH-17B between Varunapuri & Sada and Verna & Ponda are of immediate necessity. It is being learnt that a flyover being planned from Tariwada on NH-17B to Gate No 9 to provide direct access to Mormugao port.

(iv) NH-4A (Panaji – Belgaum)

NH4A connects Panaji with Belgaum via Ponda and Londa. It joins NH4 (Mumbai-Chennai) at Belgaum, which is south-western stretch of the Golden Quadrilateral. NH-4A along with NH-4 and NH-17B provide the east – west accessibility of freight traffic movement to/from the port. It has 2 lane configuration at present.

(v) Other Important Corridors

NH-17A and NH-17B are located within the state of Goa. NH-17 connects Goa with Maharashtra, Karnataka, and Kerala states. NH-4A connects Goa with Karnataka. Apart from these, other important corridors serving the port traffic in the major influence area states Goa, Karnataka and Maharashtra include the following (Refer **Figure 2.4**).

- NH-4 (Mumbai –Chennai)
- NH-63 (Ankola – Gadag – Bellary – NH7)
- NH-206 (Honavar – Shimoga – Tumkur)

NH-4 is being developed 4 lane dual carriage way and 62.4% of the stretch between Mumbai and Chennai is already upgraded to 4 lanes (as of September 2006). NH-13 and NH-218 connect NH-4 in Karnataka state with NH-9 in Maharashtra in north-south direction. NH-63 connects NH-17 with NH-7 through Karnataka state while NH-206 connects NH-17 with NH-4 in Karnataka state. Except NH-4, rest of the corridors primarily have 2 lane configurations.

b) Internal Roads

The freight traffic from inland areas enters the port premises through Gate No 9, Gate No 1 and Gate No 2. Gate No 9 essentially provide access to almost 95% of truck traffic movement and the rest of the traffic enter through Gate No 1. All the important loading/unloading points related to road transport i.e container terminal, cruise terminal, and other general cargo are located close to Gate No 9 while Gate No 1 is used for ammonia tanker movement and the trucks bound for AVG and South West companies. Gate No 2 is used for only mini truck movement bound for air cargo terminal located within port area. This terminal is being shifted away from port shortly.

Gate No 9 intersection at Port

Gate No 1 intersection at Port

Gate No 9 and Gate No 1 are connected by 2 lane road in rolling terrain with blind curves outside port premises along port boundary. Inside the port area, there are no major roads providing access to all the facilities inside the port. A short stretch of 2 lane concrete road is present at Gate No 9 for truck movement. Rest of the roads have either 2 lane narrow or single lane carriageways which are not suitable for heavy truck movement. Movement of traffic takes place through barge unloading area, MOHP, and other port facilities. No traffic signs indicating speed limits, road geometry and information about the port facilities are present inside the port.

Though all the internal roads are not used for cargo traffic movement, they need to be improved to bring the port to international standards. It is important develop a road with atleast 2 lane configuration from Gate No 9 and Gate No 1 and connect rest of the facilities with this road.

2.5.2 Rail Connectivity

a) External Rail Connectivity

Present scenario of railway connectivity to MPT is been linked to hinterland districts of Belgaum, Dharwad, Bellary and Uttarkannad in Karnataka State from where major share of iron ore reach to the port and equal quantities of coal /coke are propose to dispatched from port by rail route from Vasco-da-gama.

The existing rail connection to Goa is shown in the following **Figure 2.5**.

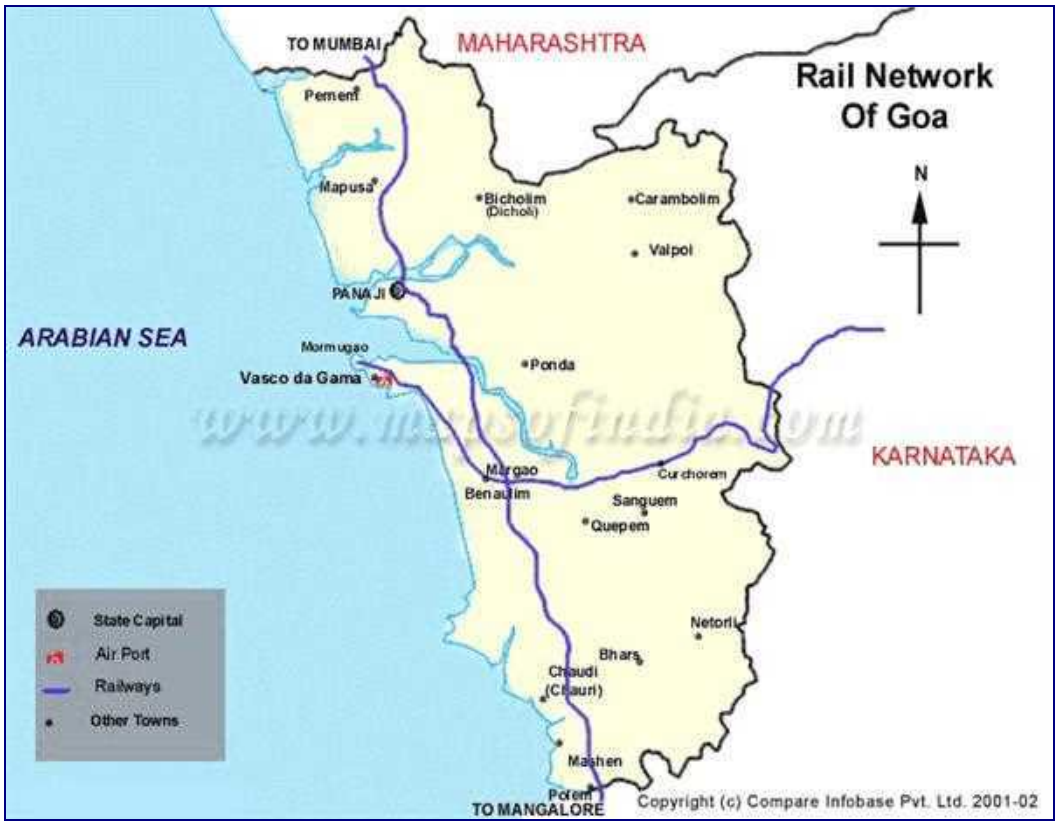


Figure 2.5 - Rail Network of Goa

There are four routes are the main sections that would influence the rail connectivity capacity analyses.

They may be summarised as follows;

Route No	Rail routes	Traffic Directions
1	Vasco-Majorda- Madgaon—Loliem -Mangalore	South (Along the coast)
2	Vasco-Majorda-Madgaon-Kulem-Castlle Rock-Londa –Belgaum- Miraj	East & North bound traffic
3	Vasco-Majorda-Madgaon-Kulem-Castlle Rock-Londa—Dharwad -Hubli- Hospet –Bellary	East & south East bound
4	Vasco-Canasuaim-Verna- Mapusa-Pernam-Ratnagiri -Mumbai	West (along the Coast)

The above routes are shown in **Figure 2.6** and explained in the subsequent paragraphs.

Figure 2.6 - Rail Network of South Western Railway

Route -1- Vasco-Majorda- Madgaon—Loliem –Mangalore- South (Along the coast)

A single-line broad gauge runs close and parallel to the sea coast. It starts at Vasco in Goa through Majorda & Madgaon section of Konkan railway further through Loilem passing through Karnataka states towards Mangalore on Konkan railway section. It serves not only Mormugao port but also connects Mumbai, Karwar and Mangalore ports.

Route -2- Vasco-Majorda-Madgaon-Kulem-Castlle Rock-Londa –Belgaum- Miraj

A single-line broad gauge, which reaches to east and North part of India through bifurcation at Kuluem – Londa Junction, then connect Belgaum & via Miraj connects the Central railway section. It serves & connects Mumbai, Belgaum & north sates of India

Route 3- Vasco-Majorda-Madgaon-Kulem-Castlle Rock-Londa—Dharwad -Hubli-Hospet –Bellary

This is the one of the prime section that has potential market to MPT through rail and expected to grow in traffic in future.

Hence this Section of railway is elaborately described than the other routes.

Route -4- Vasco-Canasuaim-Verna- Mapusa-Pernam- Ratnagiri -Mumbai

This route lies basically on the Konkan railway stretch & can be look out for reaching out demand of near future to western coast of Maharashtra, especially Ratnagiri, Sawantwadi & Kudal, for the power generation projects potential.

But due to topographical constraints this particular route has limitations.

b) Internal Rail Connectivity

The existing rail lines within the port area are shown in the port layout drawing **DCBPMP/01.** It can be noticed from the referred drawing that after the Main entry point, the railway lines are bifurcated into 4 lines.

2.5.3 *Inland waterways*

Goa is bestowed with an excellent system of interconnected and navigable inland waterways which are instrumental in transporting the bulk of iron ore from the mines to Mormugao Port and near by Panjim port for export. The river system in Goa consist of the rivers Mandovi, Zuari, Tiracol, Chapora, Talpona, Sal and Galgibaga rivers. The two main rivers, the Zuari and Mandovi are navigable for as much as 60 km in land from their mouths and are mainly utilized for barge transport of iron ore, the iron ore being loaded in to the barges at riverside terminals. Almost all of the iron ore handled at the Mormugao port and nearby Panjim Port is shipped to the port through barges on waterways. There are more than 30 barge loading jetties located along the rivers in mining areas.

The economy afforded by this mode of transport has made the Goan iron ore competitive in the international market, as it more than compensates for the higher shipping costs incurred due to slower turnarounds.

Earlier river Mandovi carried the bulk of the barges, with over 70% of the traffic coming to Mormugao. At present, the share of ore transport through Mandovi and Zuari River is equal at 50%.

Presently there are about 250 barges of total capacity 390,000 T plying in Goan waters for the transport of this iron ore from the mines. All these barges in total make about 23,000 trips to transport the MPT's iron ore alone from the mines.

These barges carry a total of about 37 MT of iron ore to Mormugao Port and nearby Panjim port.

The growth of barge fleet operation during the last 10 years in Goan waters is given in **Table 2.8**;

Table 2.8 – Growth of barge fleet operation in Goan Waters

Year	No. of barges	Total Tonnes	Average Size (T)
1996	125	139978	1120
1997	141	166980	1184
1998	138	160838	1165
1999	134	163923	1223
2000	137	167230	1221
2001	147	178918	1217
2002	127	165040	1300
2003	167	224075	1342
2004	232	338125	1457
2005	247	384965	1559

2.5.4 Pipelines

This liquid cargo berth is used for discharge from vessels carrying a wide variety of cargoes like edible oils, Ammonia, caustic soda, phosphoric acid as also POL products like HSD, MS, LDO, FO, Naptha etc.

The berth is connected with pipe lines of various sizes all belonging to private parties as below;

1. 14" HSD / MS / Naptha line of M/S HPCL / IOC
2. " LSHS Line of M/S HPCL
3. 14" Black oil Line of M/S HPCL / IOC
4. 16" Black oil line of M/S HPCL / IOC
5. 10" Furnace oil line of M/S IMC
6. 12" Caustic soda line of M/S IMC
7. 8" Vegetable oil line of M/S IMC
8. 20" petroleum product oil line of M/S ZIOL (Zuvari Indian oil tanking ltd.)
9. 14" Liquid Ammonia line of M/S ZIL (Zuvari industries ltd)
10. 3" Liquid Ammonia cooling line of M/S ZIL
11. 2" Raw water/ Air service line of M/S ZIL
12. 12" Black oil line of M/S GBL M/S GBL Ganesh Benjo Plast Ltd)
13. 12" white oil line of M/S GBL

All the above pipe lines are owned, operated and maintained by the relevant users for imports leading to their tank farms on shore, some of which are within the port premises and some outside.

The port's services on the berth is limited to providing fire fighting facilities consisting of water hydrants and two tower monitors for which a dedicated fire fighting pumping station is located behind the berth. The pump house is connected to hydrants by 200mm dia water hydrant line and to the two tower monitors by a 250mm dia water-monitor line handling sea water.

2.6 Port Performance

2.6.1 Cargo Traffic

The summary of cargo traffic handled at MPT during the last 5 years is shown in **Table 2.9**.

Table 2.9 – Cargo Traffic at MPT

Cargo (million tonnes)S	2001-02	2002-03	2003-04	2004-05	2005-06
Iron ore & iron pellets	17.97	18.66	22.94	24.72	25.31
Coke/coal	2.73	2.52	2.4	3.71	4.13
POL	1.49	1.53	1.78	1.96	1.92
Fertilizers	0.16	0.16	0.13	0.17	0.23
Container cargo	0.06	0.09	0.1	0.1	0.1
TOTAL	**22.41**	**22.96**	**27.35**	**30.66**	**31.69**

Commodity-waise traffic handled along with import export break up is given in **Table 2.10** below;

Table 2.10 – Commodity-wise traffic handled at MPT

	Commodity	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
	Export					
1	Iron ore	17,466,545	18,117,985	22,758,574	24,291,132	24,931,844
2	Iron ore pellets	444,322	546,331	183,572	425,651	381,744
3	***Sub total (1+2)***	***17,910,867***	***18,664,316***	***22,942,146***	***24,716,783***	***25,313,588***
4	Bauxite	0	40,557	0	0	0
5	Ferruginous Mang. Ore	51,991	27,448	49,050	0	0
6	Manganese Ore	16,500	0	0	14,301	0
7	***Sub total (4+6)***	***68,491***	***68,005***	***49,050***	***14,301***	***0***
8	*Other cargo*					
9	Calcined allumina	123,493	165,639	155,726	107,657	176,666
10	Coke breeze	1,380	15,651	5,942	0	0
11	*Container cargo*	37,474	60,562	61,745	60,978	52,514

	Commodity	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
12	C.P.Coke	46,560	38,694	66,720	47,535	70,172
13	H.R.steel coils	37,290	201,301	73,166	26,193	0
14	Steel slabs	0	14,187	0	35,791	0
15	Steel bars	0	12,205	15,050	0	0
16	Ferrous Met. Resdiue	0	0	0	0	0
17	Fibre pipe	0	0	0	0	970
18	Lime Stone	0	1,885	0	0	0
19	Molasses	49,280	22,352	0	0	0
20	Pig Iron	34,003	4,738	36,586	18,750	0
21	***Sub total (9 to 20)***	***329,480***	***537,214***	***414,935***	***296,904***	***300,322***
22	**Total Exports**	**18,308,838**	**19,269,535**	**23,406,131**	**25,027,988**	**25,613,910**
	Import					
23	***Liquid Bulk***					
24	Caustic soda	15,266	30,364	35,881	13,264	19,462
25	Liquid Ammonia	20,009	70,000	81,801	82,353	89,309
26	Phosphoric acid	253,683	270,950	307,211	325,207	377,128
27	POL	1,134,084	1,128,427	1,321,880	1,010,283	832,543
28	Other oil	0	4,226	29,588	26,500	37,483
29	***Sub total (24 to 27)***	***1,423,042***	***1,503,967***	***1,776,361***	***1,457,607***	***1,355,925***
30	***Fertilisers***					
31	Muriate of Potash	158,465	155,730	128,600	171,688	212,086
32	Urea	0	0	0	0	15,915
33	***Sub total (30 to 31)***	***158,465***	***155,730***	***128,600***	***171,688***	***228,001***
34	***Other cargo***					
35	Bentonite	388	0	0	0	0
36	Coke raw pet	119,132	85,057	104,231	94,783	101,041
37	C.P.Coke	0	0	0	0	4,548
38	Met. Coke	539,047	715,467	514,607	553,133	676,655
39	Coking coal	2,018,364	1,570,305	1,601,980	2,731,950	2,895,246
40	Thermal coal	0	91,466	102,851	283,519	377,843
41	***Container cargo***	20,937	29,230	41,269	56,361	52,678
42	Iron and steel	0	1,798	0	0	0
43	Iron ore pellets	55,465	1,451	0	0	0
44	Limestone	187,305	180,045	175,278	183,627	264,529
45	Machinery	59	14	0	0	0
46	misc.	2,071	0	311	0	153
47	Shredded scrap	42,500	20,592	676	98,807	69,876
48	Sponge iron	32,880	24,658	21,615	0	3,092
49	Sugar	0	0	0	0	44,500
50	***Sub total (34 to 49)***	***3,018,148***	***2,720,083***	***2,562,818***	***4,002,180***	***4,490,161***
51	**Total Imports (28+32+56)**	**4,599,655**	**4,379,780**	**4,467,779**	**5,631,475**	**6,074,087**
	Transhipment					
52	Liquid cargo	18,995	0	0	0	0
53	**Total transhipment**	**18,995**	**0**	**0**	**0**	**0**
54	**Total Import and Export**	**22,908,493**	**23,649,315**	**27,873,910**	**30,659,463**	**31,687,997**
55	**Total Traffic**	**22,927,488**	**23,649,315**	**27,873,910**	**30,659,463**	**31,687,997**

2.6.2 *Performance Indices for Mormugao Port*

Performance of the port in last five years is shown in **Table 2.11**.

Table 2.11 – Performance of the Port

Year	No. of days		Percent Occupancy for handling	Quantity Handled (tons)	Avg.ouput for berthday (tons)	No. of days occupied for Non-cargo	Percent Occupancy for non-cargo handling vessels	Overall Berth Occupancy	
	Available	Occupied for handling						Days	%
2001-2002	1404	996	70.9%	15600359	15663	142	14.3%	1138	81.1%
2002-2003	1391	983	70.7%	16473380	16758	53	5.4%	1036	74.5%
2003-2004	1405	997	71.0%	16499317	16549	111	11.1%	1108	78.9%
2004-2005	1401	986	70.4%	16446071	16680	165	16.7%	1151	82.2%
2005-2006	1402	927	66.1%	15309820	16515	177	19.1%	1104	78.7%

2.7 *Cargo Dispatch and Receipt*

(a) Freight Movement through Port

Mormugoa Port (MP) mainly used for the export and import of the following freight from/to inland areas to/from different countries. The freight is being transported to/from port through road, rail, pipelines and inland water transport.

Exports

- Iron ore
- Steel
- Calcined Alumina
- Calcined Petroleum Coke

Imports

- Coal and Coke
- Liquid bulk consisting of POL Products, Phosphoric acid, Liquid Ammonia, Palm Fatty Acids, Furnace Oil etc
- Limestone
- Scrap and miscellaneous items

The export cargo at Mormugao port account for 80% of total cargo handled while import cargo contribute the rest.

Iron ore is mainly brought from Goa and Hospet-Bellary region in Karnataka and exported to Pakistan, China and Japan. It is the most important commodity for MPT constituting about 79% of total cargo handled at the port during 2005-2006. It is almost 99% of the total export cargo and all the iron ore comes to port by IWT.

Coal/Coke is imported and transported mainly to JSW steel limited at Bellary in Karnataka by rail. Liquid bulk imported is transferred to tank farms located in the port area from ships. Most of this liquid bulk is distributed in the state of Goa by road and the rest by pipelines.

General cargo is delivered mostly by trucks and occasionally by rail depending on the availability of the rail connection of the end user. Containers are primarily used for delivery/collection of general cargo from Goa. They are transported by road being short in travel distance.

Road Transport

Liquid bulk, general cargo and containers are the important commodity groups being transported to/from Mormugao port by road. The export and import cargo handled by road and all modes at Mormugao port during the last 3 years is presented below in **Table 2.12**. The past trend of export and import cargo by road is presented in **Figure 2.7.**

Table 2.12 - Import and Export Cargo Traffic at Mormugao Port (in million tonnes)

S No	Export /Import	2003-2004	2004-2005	2005-2006
Road Transport				
1	Import Cargo	1.09	1.03	1.47
2	Export Cargo	0.22	0.16	0.29
	Cargo (Road)	**1.31**	**1.19**	**1.76**
All modes of Transport				
1	Import Cargo	23.41	25.03	25.61
2	Export Cargo	4.47	5.63	6.07
	Total Cargo (All modes)	**27.87**	**30.66**	**31.69**
Road Transport (%)				
1	Import Cargo	4.6	4.1	5.7
2	Export Cargo	5.0	2.9	4.8
	Cargo (Road)	**4.7**	**3.9**	**5.6**

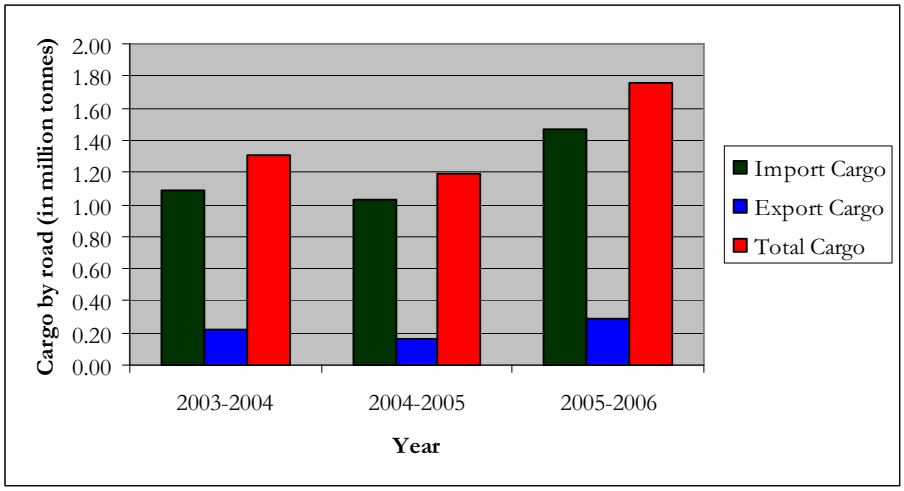


Figure 2.7 - Past Trend in Cargo Transport by Road

As observed from the above table, total cargo handled at MP by road transport is only 5.6% of total cargo handled at the port in the year 2005-2006. This has increased from 4.7% in 2003-2004. However, road transport contributes little less than 4% during 2004-2005. A comparative graph indicating the past import and export cargo by road and all modes of transport is presented in **Figure 2.8**.

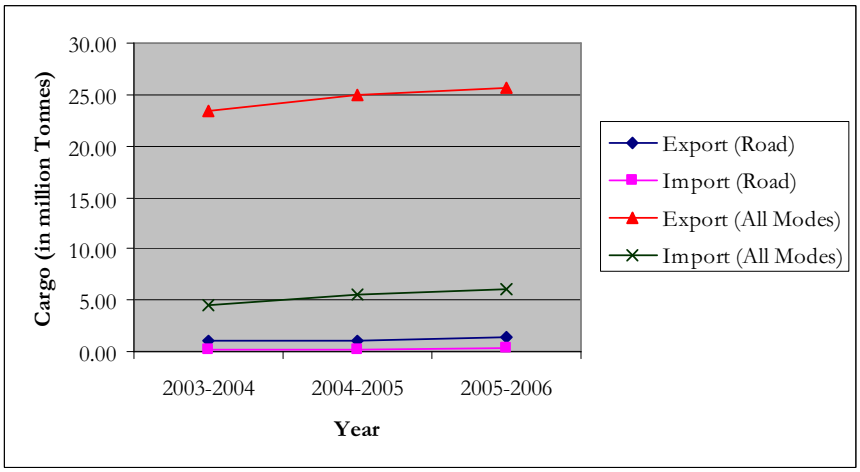


Figure 2.8 - Past Trend in Cargo Transport by Road and All modes of transport

Rail Transport

The freight is being to/from port through only rail transport as follows:

Exports:

- Iron ore
- Steel

Imports

- Coal and Coke
- Limestone
- Scrap and miscellaneous items

The Commodity wise – traffic moved by rail in previous years are given below in **Table 2.13**.

Table 2.13 - Commodities wise traffic by Rail Transport

Figures in Tonnes

Commodities	2003-04	2004-05	2005-06
S.Slabs	0	24957	0
T.Coal	1466283	2640201	2766019
Met. Coke	149000	181500	472684
I.Ore Pellets	0	43851	0
Limestone	167607	181173	286802
Alumina bags	2022	0	0
POL	458778	44608	0
H.R. Coils	73440	23393	0
Total	**2317130**	**3139683**	**3525505**

Iron ore is mainly brought from Goa mines and Hospet-Bellary region in Karnataka and exported to Pakistan, China and Japan. Almost 60% of the iron ore from Karanataka is brought by rail and is unloaded at Sanvardem / Tinaighat, since there are no wagon tippling facilities at the port. The

downloaded cargo at Sanvardem /Tinaighat is taken to barge unloading points by the exporters & through barges brought to the port. But it is vital to note that from Bellary to Sanverdam, the transporting system is through railway & thereby railway connectivity it indirectly contributes to larger share of freight movement to MPT.

Coal/Coke is imported and transported to mainly JSW at Toranagallu, Bellary in Karnataka by rail.

The above are the main commodities requiring be dispatching / receiving through rail ultimately though a little quantity of liquid bulk and general cargo are expected to use the rail connectivity.

The past trend of export and import cargo handled by rail, road & all modal transport at Mormugao port is presented in **Table 2.14**.

Table 2.14 - Modal Split of Cargo Traffic at Mormugao Port

S No	Export /Import	2003-2004	2004-2005	2005-2006
1	Rail Transport (MT)	2.32	3.14	3.53
2	Road Transport (MT)	1.31	1.19	1.76
3	Total Cargo (All modes) (MT)	27.87	30.66	31.69
4	(%) Transport			
	Cargo (Rail)	8.31	10.24	11.12
	Cargo (Road)	4.7	3.9	5.6

As observed from the above table, total cargo handled at MPT by rail transport is 11.2% of total cargo handled at the port in the 2005-2006. This has increased from 8.31% in 2003-2004. A comparative graph indicating the past import and export cargo by rail, road and all modes of transport is presented in **Figure 2.9**

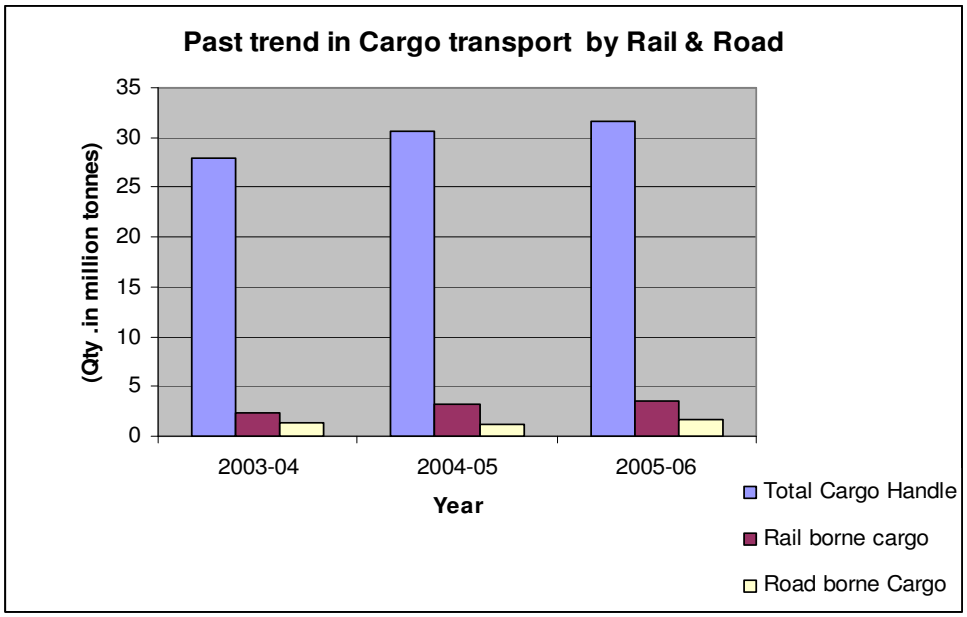


Figure 2.9 - Past Trend in Cargo Transport by Road and Rail

(b) Freight Generation/Distribution Centres

The cargo to/from MP is being transported to various locations by road, rail, pipelines and Inland water transport. The modal share of total freight carried by the different modes of transport in 2005-2006 is presented **Figure 2.10**. IWT is the major contributor in handling the freight from/to port in total freight with 79.7%. Rail has second largest share in freight traffic transport with 11.1%. Road transport contributes about 5.6%

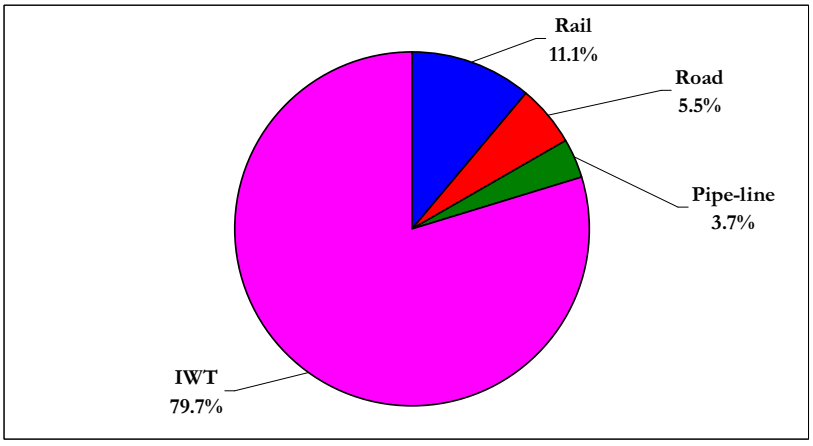


Figure 2.10 : Modal Share of Freight Movement at Mormugao Port in 2005-2006

The general cargo and liquid bulk cargo is generally dispatched by roads. A few regular port users are; IOC, HPCL, BPCL, Zuari Industries, IMC, UTTL, JR Enterprises, Ganesh Benszoplasts, etc.

Regular train services operate between Goa and Tornagallu, Karnataka (located about 340 Km from Vasco). These are for catering to JSW's inbound and outbound coal/coke cargo traffic to MP. No road transport is involved for movement of coal/coke.

Mormugao port handled about 4.09 million MT of coal/coke imports in 2005-06 which was directly sent to the JSW Steel Ltd at Bellary by rail.

JSW would use rail for export of their steel as well as is the practice now.

The other bulk cargo limestone which is again the captive cargo of JSW is also transported through rail.

Generally Bellary / Hosepet region of Karnataka is the major freight generation/distribution centres from/to MPT. This can be considered as a major influence area to generate rail traffic for Mormugao port.

Inland Water Transport is being carried out by Barges in Mormugao. They operate regularly between the barge loading points situated in River Mondavi & Zuari and Mormugao Port/Panjim port. Presently, the iron ore from Karnataka are brought by rail up to Sanvordem (40 km from Vasco). The ore is shifted to the nearby barge loading point by road and is brought to Goa by Inland Waterway system for export. The same rake after unloading at Sanvordem arrives at Mormugao port for picking up outbound coal/coke.

The liquid cargo discharged from vessels carrying a wide variety of cargoes (like edible oils, ammonia, caustic soda, phosphoric acid, POL products like HSD, MS, LDO, FO, Naptha etc.) is transferred through pipelines to tank farms on shore, some of which are within the port premises and some outside. All these pipe lines are owned, operated and maintained by the relevant users for imports. Most of the liquid cargo is being transported by road using tankers.

To identify the major distribution and generation centres for road transport, One-day Origin-Destination freight vehicle details were collected from MP. The Consultants have collected monthly travel information of trucks to/from port for the months of August, September and October 2006 and analyzed to identify the generation/dispersal locations of cargo by road and to appreciate connecting roads of these locations. The monthly details of total number of trucks used for transport of different commodities from/to port are presented in **Table 2.15**.

Table 2.15 : Monthly Truck Movement for Cargo Transport by Road

S No	Destination	Area	Commodity	No of Trucks		
				August 2006	September 2006	October 2006
a) Import						
1	Zuarinagar	South Goa	MOP	1693	1609	2625
2	Redi, Sindudhurga	Maharashtra	Met coke	319	403	2297
3	Bevanhalli, Raichur	Karnataka	Met coke	599	1180	1039
4	Costi	South Goa	Met coke	590	1845	798
5	Hospet	Karnataka	Met coke	155	27	21
6	Margao	South Goa	RP coke	0	501	561
7	Zuari Nagar	South Goa	A Ammonia	652	923	762
8	Zurari Nagar	South Goa	Urea	225	557	0
9	Ponda	South Goa	Palm oil	212	228	259
10	Ponda	South Goa	Caustic soda	67	66	71
11	Belgaum	Karnataka	Caustic soda	157	0	17
12	Dharwad	Karnataka	Coking coal	1475	442	986
13	Dodamarg	Maharashtra	Coking coal	0	1563	0
14	Kolapur	Maharashtra	Thermal coal	0	940	191
15	Bellary	Karnataka	Thermal coal	313	0	0
16	Belgaum	Karnataka	Thermal coal	74	0	0
17	Sangeum	South Goa	Thermal coal	1448	0	0
		Total trucks per month		**7979**	**10284**	**9627**
b) Export						
1	Belgaum	Karnataka	Alumina	539	41	138
2	Madgoan	South Goa	CP coke	613	570	274
		Total trucks per month		**1152**	**611**	**412**

Note : In addition to above, about 50 containers move in and out of port every day

The above data indicates that Goa, Maharashtra and Karnataka are major freight generation/distribution centres from/to MP. The various locations in these states and commodities carried are captive to Mormugao port. The total number of trucks used for transport of commodities to/from these states for the three months are summarized in **Table 2.16.**

Table 2.16 : State-wise contribution of freight traffic

S. No.	State	Total Trucks	Share (%)
Import			
1	Goa	15,692	56.3
2	Karnataka	6,485	23.3
3	Maharashtra	5,713	20.5
	Total	**27,890**	**100.0**
Export			
1	Goa	1,457	67.0
2	Karnataka	718	33.0
3	Maharashtra	0	0.0
	Total	**2,175**	**100.0**
Both Import & Export			
1	Goa	17,149	57.0
2	Karnataka	7,203	24.0
3	Maharashtra	5,713	19.0
	Total	**30,065**	**100.0**

As observed from the above table, Goa state contributes 57.0% of the total trucks, while Karnataka contributes 24.0% and the rest 19% by Maharashtra. As indicated by transport department as well as the data collected from the port, most of the containers (about 70%) have desire within Goa state from port while the rest are mainly from/to Karnataka. About 360 loaded trucks and containers come to port every day on the average for transporting freight to/from the port.

As observed from the collected traffic data, the following locations/areas within Goa, Karnataka and Maharashtra states are the major freight generation/distribution centres for the port. These locations are graphically represented in **Figure 2.11**.

- Goa : Zuari Nagar, Costi, Madgoan, Marmugoa, Ponda, Sanguem
- Karnataka : Raichur, Hospet, Belgaum, Dharwar, Bellary
- Maharashtra : Sindudhurga, Kolapur

Figure 2.11 : Major Freight Generation and Distribution Centres

Goa, Maharashtra and Karnataka states can be considered major influence area states for Mormugao port.

3 Vision, Goals & Objectives

3.1 Introduction

The vision, goals, targets and strategy together comprise a strategic plan. The vision and goals are developed and adopted by the senior management of Mormugao Port Trust (MPT), so that all subsequent decisions are made with the aim of achieving the overall objectives. The vision and goals must carry the conviction of management to be meaningful.

In essence the strategic plan is a 'signpost' to help the management to run the business. It contains the vision, which encapsulates the ambition of MPT and expresses how MPT wish to be seen by others. The objectives support the vision and are the key goals that management should seek in every decision they make.

A meeting was held with the senior management of MPT, at which the vision and goals were developed. The initial results are given below. First, however, a SWOT (strengths, weaknesses, opportunities and threats) analysis was undertaken with senior management to set the framework within which to develop the vision and goals for the port.

3.2 SWOT Analyses

MPT's competitive position was analysed by means of a SWOT analysis and the results are given in **Table 3.1** and **Table 3.2** .

Table 3.1 – Strengths and Weaknesses

Strengths	Weaknesses
– Partially Natural harbour – Bestowed Inland Water Ways – Substantial captive traffic – Private participation and investment – Profitable – Peaceful & harmonious industrial relation – Management committed and sincere – Preferred employer in Goa for direct and indirect employment – Moderate financial Capability	– Lack of readily available expansion space – Fishermen occupied water area very close and adjacent to the cargo port – Lack of dedicated berth for non cargo vessels – Inadequate Qualified technical man power – Workforce not well motivated – Not able to fully attract the potential hinterland traffic – Not well maintained infrastructure facilities within the Port – Inadequate road and rail connectivity – Unions not permitting private labours – Unbalanced man power deployment – Excessive Overtime

Table 3.2 – Opportunities and Threats

Opportunities	Threats
– Improve existing facilities – Vasco Bay & Baina Bay development – Attract more coal and liquid bulk traffic – Cruise Traffic – Base for Offshore Supply Vessels – Navy and Coastguard vessels – Industrial development in North Karnataka	– Iron ore traffic vulnerable to Chinese demand & may reduce – Competition from Panjim, New Mangalore and also from Ennore / Chennai & Krishnapatnam possibly – Co-operation not in full vigour from local authorities

3.3 Vision

During the meeting, several concepts were aired, with a number of key themes emerging from the discussion.

The recurring themes included:

- Preferred port for Goa and the region, or just Goa, or just the region, or the West Coast
- Ultimate in port facilities, total port solutions
- Efficient, most modern port, service at its best
- Environmentally conscious – clean

4 Traffic Forecasts & Competitive Positions

4.1 *Project Throughput 2006 - 2014*

To arrive at the traffic forecasts for Mormugao Port Trust, an assessment of the factors that influence the trade in iron ore, coal, POL and containers were made, which currently account for more than 90% of the total traffic handled by MPT. The factors that influence the trade in each of these commodities are very different making a unified forecasting approach ineffective. Hence we have used different methods for demand forecasting of each of these major cargo constituents. We have used both primary and secondary research data to arrive at our forecasts. The traffic forecasts have been made under three scenarios – namely low, medium and high. The assumptions involved in each of these scenarios include general economic and industry trends, competitive situation between the ports, factors that could be addressed by Mormugao port like tariff and port related infrastructure and those that require a concerted effort by many other stakeholders like road / rail infrastructure. In addition to these scenarios, considering the importance of revenues from handling iron ore to Mormugao Port Trust, the iron ore forecasts have been made under the backdrop of three settings. They involve assumptions with regard to increase in capacity of the Mechanical Ore Handling Plant, reducing the tariff to compete Panjim port and minimizing the procedural issues. The summary of these forecasts for the period 2006-2014 has been provided in **Annexure 4.1** with commodity wise breakup.

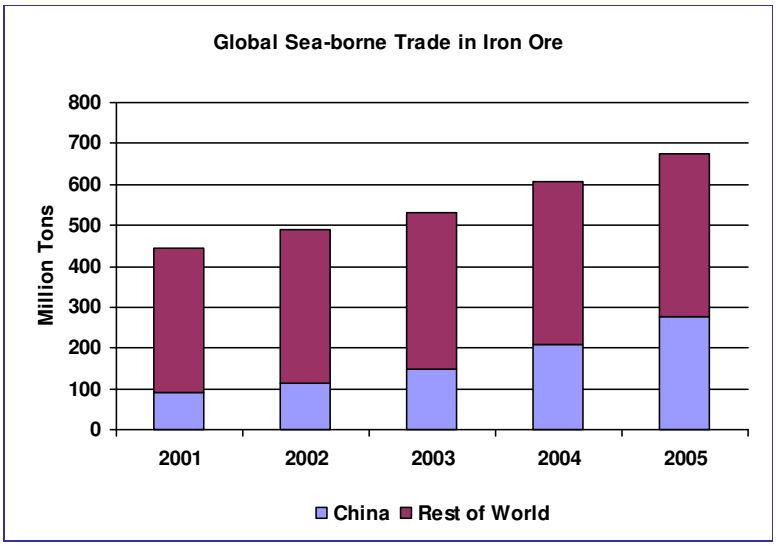
4.2 *Long term forecast (over term of financial instruments)*

The cyclical nature of the major industries that use Mormugao port – Steel industry using iron ore and coal for export import requirements, makes the forecast of throughput over long term less dependable. However, forecast of the Indian macro economic indicators like GDP have been used to arrive at the long term forecast for the period 2014 – 2027. The throughput of Coal/coke, Liquid Bulk and general cargo is estimated to grow at the forecasted GDP of 5% in the long run. However, considering the current low level of traffic in containerised cargo coupled with the phenomenon of increasing containerisation in India in lines of other developed nations, the traffic in this segment is estimated to grow at an average of 7.5%. Iron ore exports, in the wake of increasing competition from other countries like Australia and Brazil is expected to increase at a lower than GDP rate of 2%. The forecast for the long term (2014-27) is provided in **Annexure 4.2** with commodity wise breakup.

4.3 Traffic forecast

4.3.1 Iron Ore

Global trade in iron ore has increased from 445 million tons in 2001 to 675 million tons in 2005 at a compounded annual growth rate of 11%. Iron ore imports by the rest of the world has grown by only 3% while the Chinese demand for iron ore has grown by 31%.



Source: CVRD

Figure 4.1 - Globle Sea-borne Trade in Iron Ore

(a) Chinese Iron Ore Industry

China has its substantial iron reserves but these are of low quality as shown in the **Table 4.1** below;

Table 4.1 – World Iron Ore Reserves and Reserve Base (Figures in Mn Tons)

	Crude Ore		Iron Content	
	Reserves	**Reserve Base**	**Reserves**	**Reserve Base**
Brazil	23,000	61,000	16,000	41,000
Russia	25,000	56,000	14,000	31,000
Australia	15,000	40,000	8,900	25,000
Ukraine	30,000	68,000	9,000	20,000
China	21,000	46,000	7,000	15,000
Kazakhstan	8,300	1,900	3,300	7,400
India	6,600	9,800	4,200	6,200
Other Countries	31,100	87,300	16,600	34,400
World Total	160,000	370,000	79,000	180,000

Source: US Geological Survey
Note: The reserves as estimated by Indian Bureau of Mines is much higher at 23 billion tons

As seen above, while China's reserves are significant, they are reduced by a third when it is adjusted for iron content.

Table 4.2 – World Iron Ore Production -2005

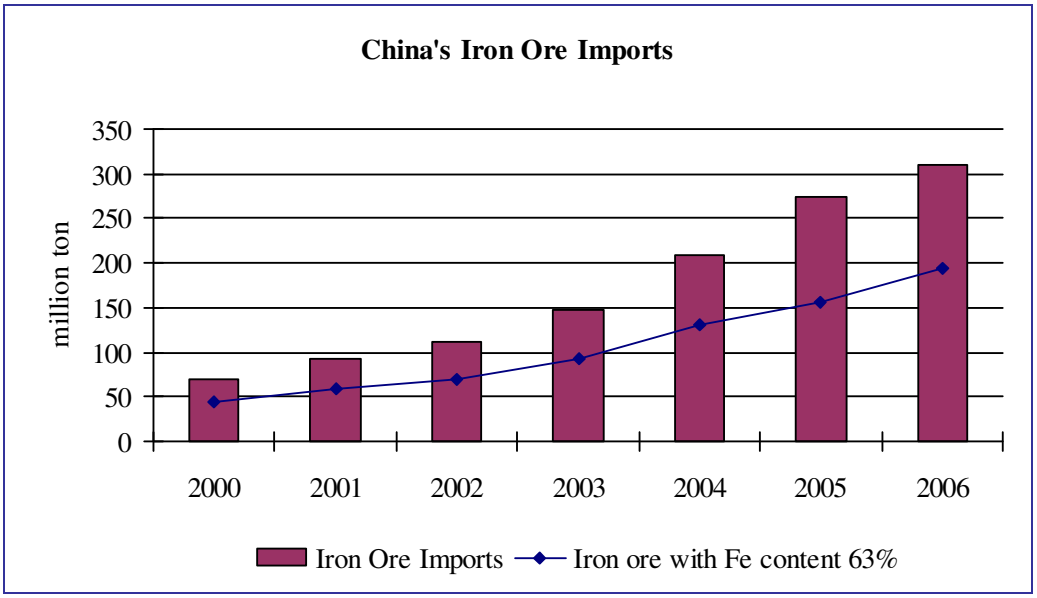
Country	Production (Million Tons)
China	370
Brazil	300
Australia	280
India	140
Russia	95
Ukraine	69
USA	55
South Africa	40
Others	171
Total	1520

Source: US Geological Survey

In line with its reserve base and steel production capacity China is the largest producer of iron ore. But, due to low iron ore content the Chinese steel industry is dependent on imported iron ore for its steel production.

The top five iron ore producing countries (other than China) account for around 60% of the iron ore production in 2005 and this is expected to go up to about 70% by 2008. There is a greater degree of concentration in the seaborne trade with the top five producers controlling 88% of the trade in 2005. The level of concentration in seaborne iron ore trade has increased over the years. The top five producing countries controlled 72% of the market in 1999 and this is expected to go up to 94% by 2008.

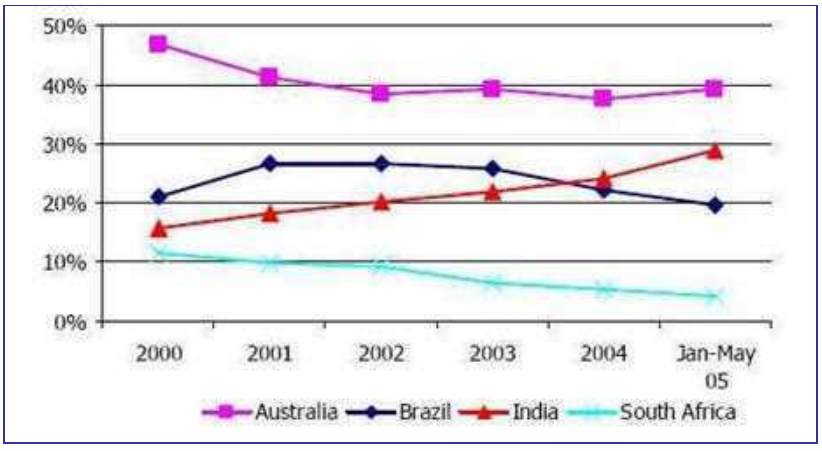
China has entered into long-term contracts with the Australian and Brazilian mines, as its own production is inferior in quality and has iron content averaging 33%. Around 63% of China's imports are high grade Iron ore with Fe content more than 63%.



Source- UNCTAD, IISI, Canaccord Capital Estimates

Figure 4.2 - China's iron Ore Imports

Until 2003, Brazil and Australia were the dominant suppliers to China but India has supplanted Brazil in 2004 and accounted for 25% of total Chinese imports behind Australia with 40%. Brazil was the third largest supplier, delivering about 19% of total imports. Exports from Australia were comparatively low as Australia experienced about five hurricanes in the first quarter of 2005, which drastically affected iron ore production in the first quarter. It is due to this, China's imports from India increased last year. However, Australia, Brazil and South Africa have now invested heavily to increase their output. Indicative expansion plans of the major Australian and Brazilian producers are provided in a separate section later.



Source- Canaccord Research Reports

Figure 4.3 - Exporters of Iron ore in the world

(b) Indian Iron Ore Industry

India is one of the largest exporters of Iron ore in the world. It caters to both the domestic industry as well as export markets and hence functions as resource industry as well as feeder industry where the captive mines of the steel plant operate as the feeder sources.

(c) Iron Ore Reserves in India

India's iron ore reserves are estimated at about 22bn tons (different from the estimates made by the US Geological survey) — 10.43bn tons of hematite and 10.68bn tons of magnetite. This figure may be on the lower side as 'Probable and Indicated" categories remain to be further explored. According to the Indian Bureau of Mines, more than 50% of the hematite ore is of medium to high grade having ferric content of more than 62%. High Grade Hematite constitutes around 14% of the total iron ore reserves.

The hematite reserves are located largely in Eastern/ Central India — Jharkhand, Orissa, and Chhatisgarh. Magnetite ore is largely confined to Karnataka in south India. Some hematite deposits are also found in Goa. A map listing the major iron ore producing areas in India is provided in **Figure 4.4**.

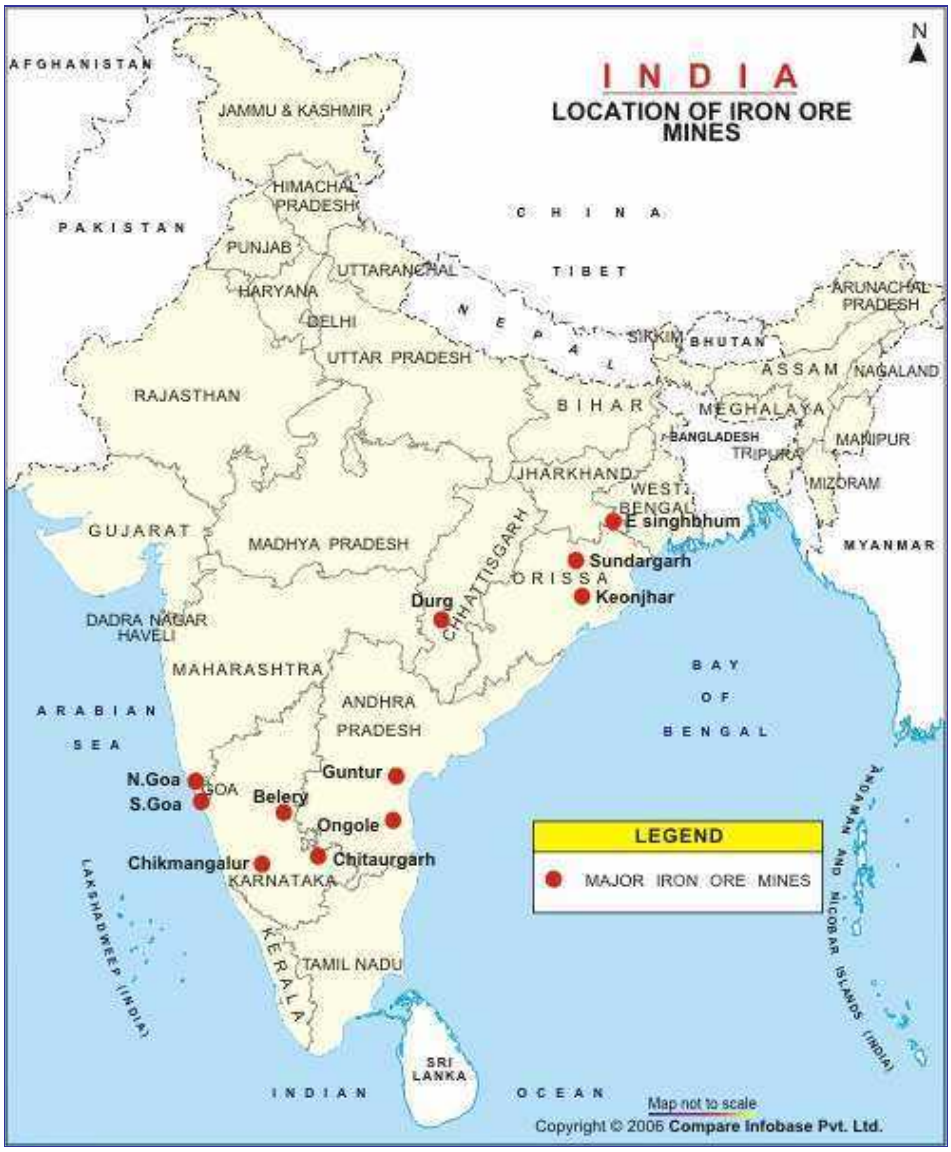
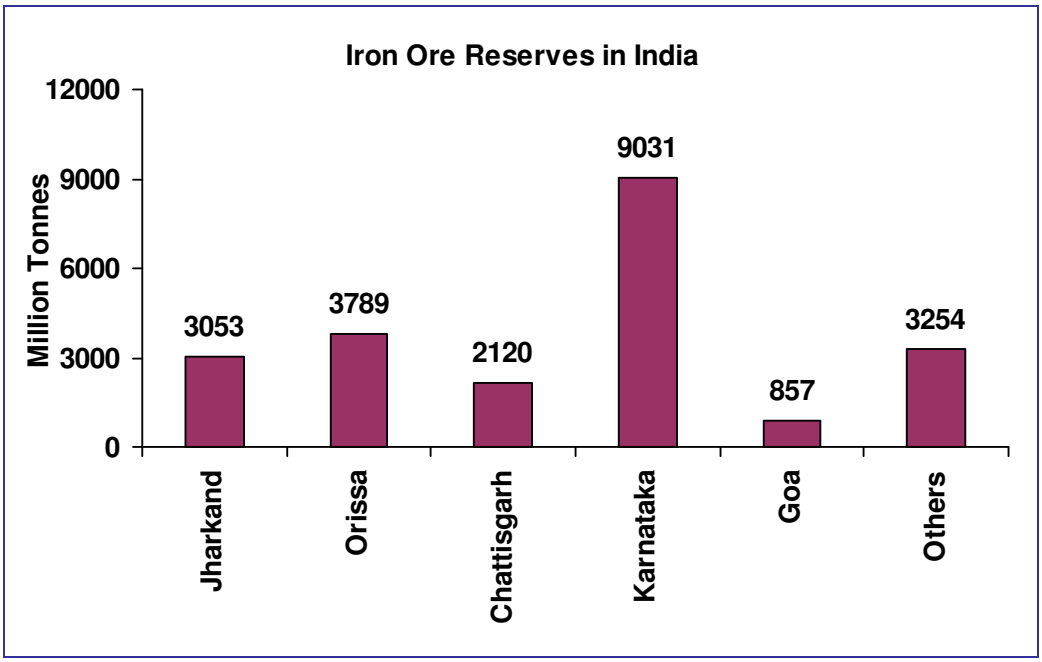


Figure 4.4 - Major Iron Ore Mines in India

Total Iron ore reserves in Goa are estimated 857 million tones. At a current extraction rate of 20 million tones per year, Goan Iron ore reserves are expected to last for 43 years.



Source: Indian Bureau of Mines

Figure 4.5 - Iron Ore Reserves in India

The mines in operation in each state are provided below in **Table 4.3**;

Table 4.3 - The mines in operation in each state

	No of Mines
India	215
Public Sector	3
Private Sector	178
Andhra Pradesh	3
Chattisgarh	9
Goa	47
Jharkhand	15
Karnataka	57
Madhya Pradesh	6
Maharashtra	4
Orissa	77
Rajasthan	1

(i) Iron Ore Production in India

Iron Ore production in the country has been increasing steadily since 2001. Increase in production of iron ore has been principally driven by exports and came from existing mines which were either closed (Chitradurga-Tumkur region in Karnataka and Reddi area in Maharashtra) or by increasing production from mines that were not operating at their full capacity (Orissa/Jharkhand and Bellary-Hospet in Karnataka).

Production of Iron Ore in private sector mines increased by 31% whereas the production in public sector mines decreased by 1%. In captive mines, production increased by about 5% reflecting slow growth in the domestic steel industry. Non captive mines contributed an increase of about 21%.

Table 4.4 - State wise production of Iron Ore (in million tons)

States	2001-02	2002-03	2003-04	2004-05
Andhra Pradesh	0.39	0.68	0.74	0.86
Chattisgarh	18.41	19.42	22.01	25.52
Goa	13.81	17.45	19.77	22.93
Jharkhand	13.21	13.65	15.49	17.95
Maharashtra	22.00	38.00	48.00	55.00
Orissa	16.41	21.46	24.30	28.18
Rajasthan	6.00	14.00	15.00	16.00
Total	84.39	96.70	109.54	127.00

Source:

(ii) Exports from India

India is the third largest exporter of iron ore in the world after Australia and Brazil. Around 89.3 million tons of iron ore was exported from India in the year 2005-06. After a decline of 7% in FY1999 over FY1998, there was a sharp increase in iron ore exports during FY2000-06. Following the surge in global demand for steel, the global demand for iron ore rose as well. Consequently, the exports rose at 26% and 13% on y-o-y basis in FY2005 and FY2006 respectively. Iron ore exports grew at a CAGR of 25% during FY2000-FY2006. Share of exports in total domestic production of iron ore that had remained range bound between 44%-50% during FY1997 - FY2005, went up to 65% in FY2006. The trend in Iron Ore exports from India is provided in the chart below in **Figure 4.6**;

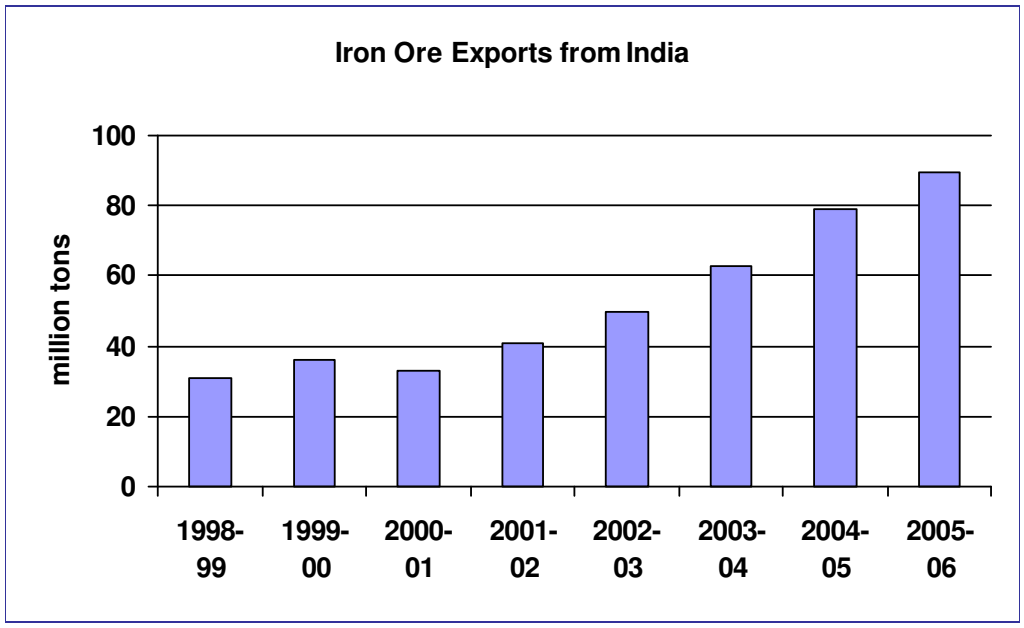
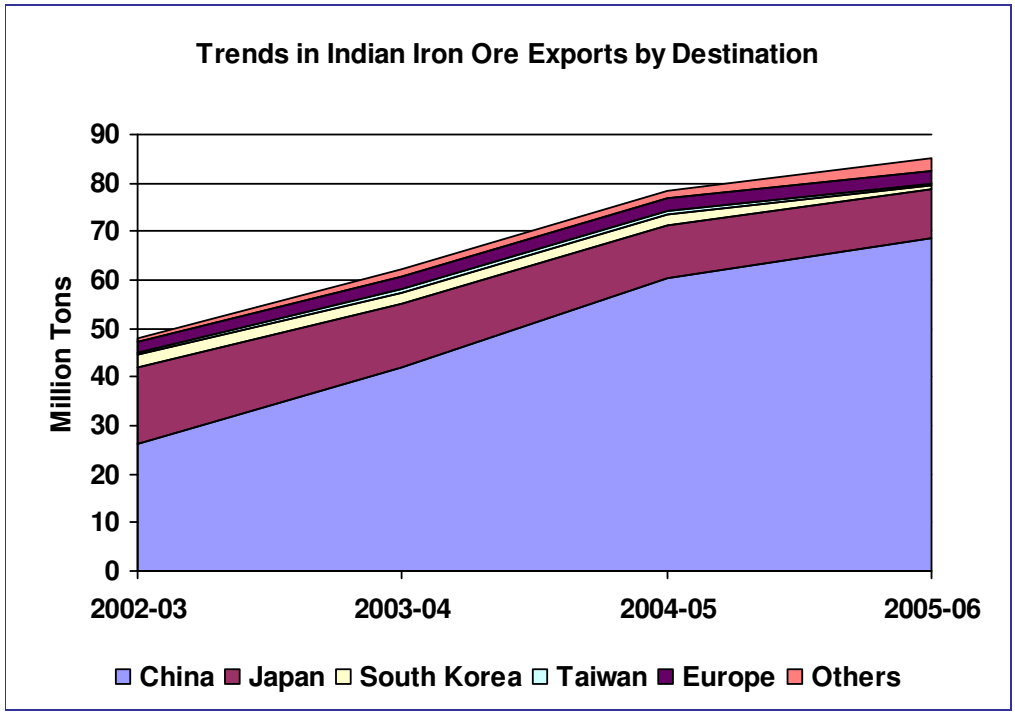


Figure 4.6 - Iron Ore Exports from India

China has been the prime driver behind the growth of Indian exports. The impact of dependence on the Chinese markets is shown in the **Figure 4.7** below;



Source: MMTC, ABN Amro

Figure 4.7 - Trends in Indian Iron Ore Exports

In 2002-03, 55% of India's exports were directed towards China. By 2005-06 this had increased to 81%. The compounded annual growth rates for India's major iron ore export destinations are provided in the chart below.

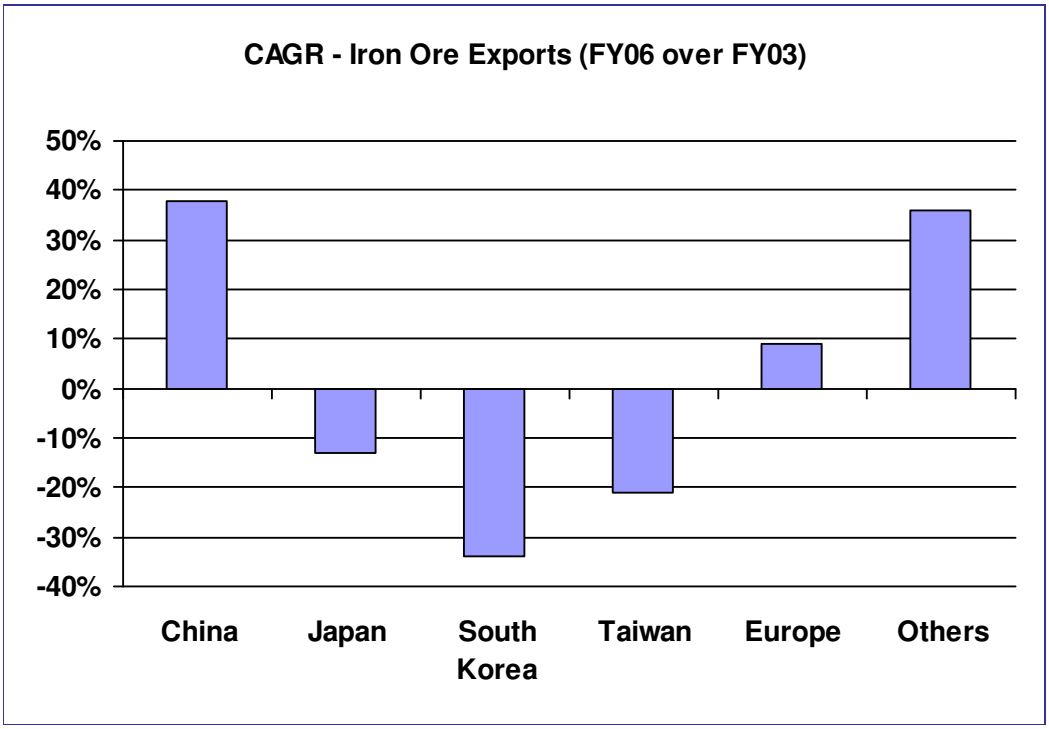
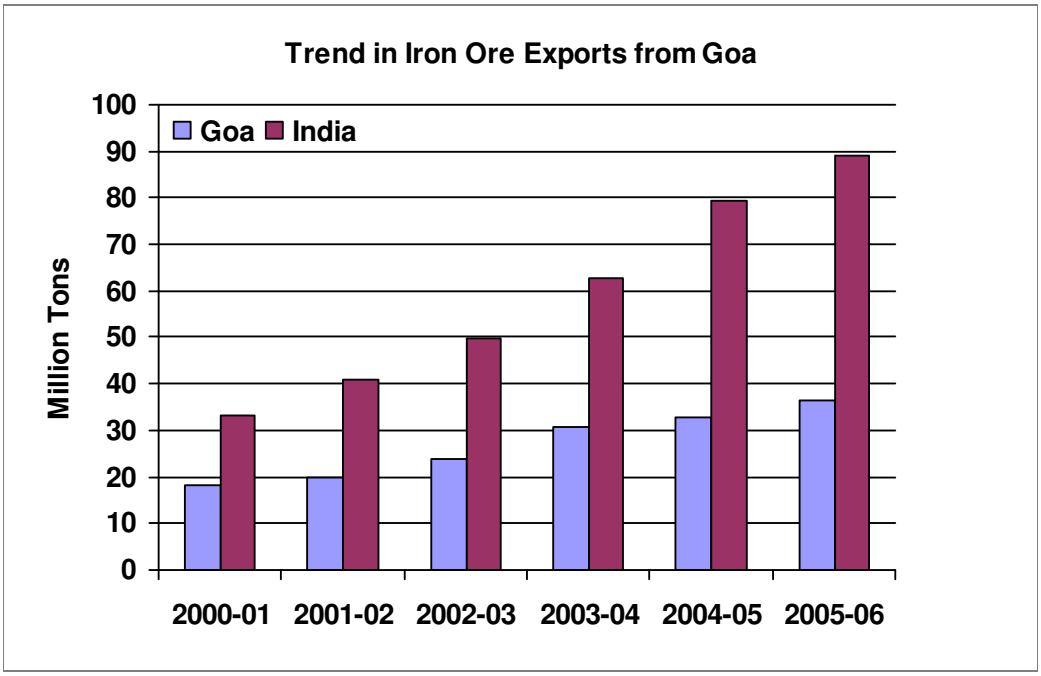


Figure 4.8 - Iron Ore Exports (FY06 over FY03)

As the Indian iron ore export industry has become more dependent on China's steel industry a slowdown in China's exports would necessarily adversely affect Indian exports and also intermediaries in the iron ore trade. Iron ore exports from India are also threatened by expansions at major mines in Australia (which is closer to China) and in Brazil (though at a greater distance is able to narrow the delivered cost due to logistical advantage). Therefore, it is necessary to forecast the outlook for the Chinese steel industry to project iron ore demand from India and the traffic at MPT.

(iii) Exports from Goa

In the year 2005-06, Goa exported about 36.27 million tones of Iron Ore, which constitutes around 41% of the total Iron Ore exports from India. Exports to China were to the tune of 26.09 million tons.



Source: GMOEA

Figure 4.9 - Iron Ore Exports From Goa

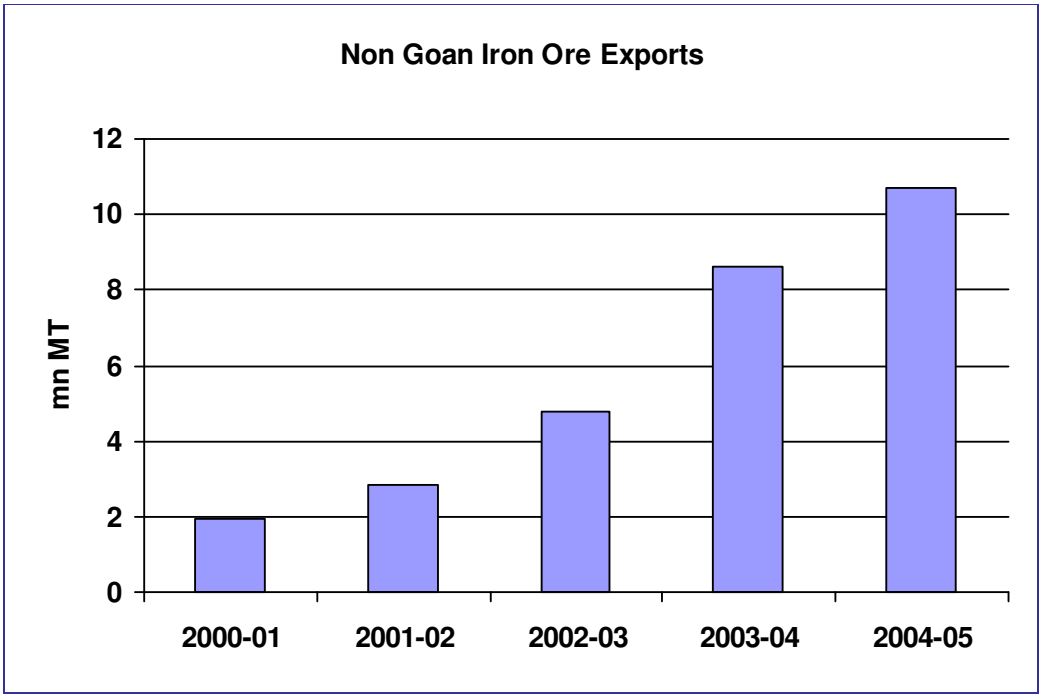
During the period from FY2001 to FY2006, iron ore exports from Goa grew at a compounded annual growth rate of 15% while total iron ore exports from India increased at 22%. Thus Goa's market share in Indian iron ore exports has reduced over the years.

Table 4.5 - Destination wise Iron Ore exports from Goa

Destination	Quantity in tons (2005-06)
China	26,094,771
Japan	6,074,140
South Korea	608,000
Taiwan	144,252
Pakistan	1,015,546
Kenya	19,879
Qatar	46,000
UAE	41,300
Kuwait	127,088
Rumania	737,984
Netherlands	923,547

Destination	Quantity in tons (2005-06)
Belgium	209,897
Turkey	229,246
Total	36,271,650

In 2005-06, the total Goan production was more than 20 mn MT. Goan Iron Ore has low Fe content and is therefore not preferred by local steel producers and hence the entire ore produced is exported. While countries like Japan and Pakistan buy the ore as produced in Goa, Chinese buyers prefer to buy blended ore with a higher Fe content. Therefore, Goan iron ore exporters obtain high-grade iron ore from Bellary and other adjoining districts of Karnataka and blend it with the low-grade Goan iron Ore for Chinese buyers. Around 30% of the exports comprised non-Goan Iron Ore. Exports of Non Goan iron ore has increased at a CAGR of 90% over a period of five years.



Source- Goan Mineral Ore Exports, GMOEA

Figure 4.10 - Non Goan Iron Ore Exports

The bulk of the iron ore exports from Goa are to China and Japan with China's share being about 72% of the total and Japan accounting for about 17%.

The major iron ore exporters with the quantity exported are;

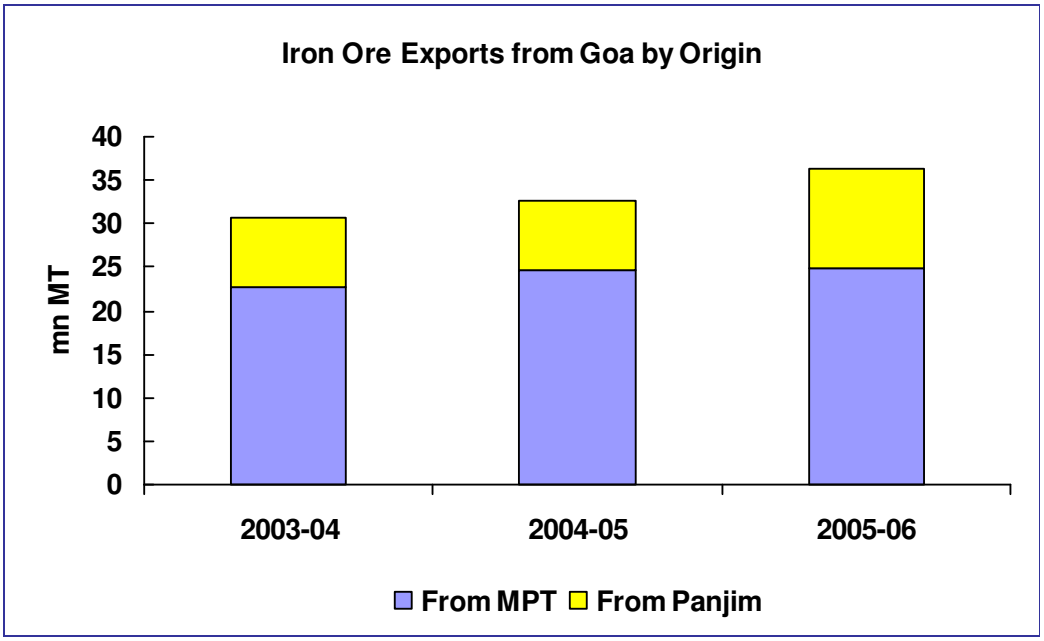
Table 4.6 - Major Iron Ore Exporters

Shipper	2003-04	2004-05	2005-06
Sesa Goa Pvt Ltd	4.44	5.52	5.44
Chowgule & Co Pvt Ltd	3.32	2.73	3.59
V.M Salgaonkar & Co Pvt Ltd	2.83	2.74	2.76
V.S Dempo & Co Pvt Ltd	3.15	3.43	3.21
Sociedade de Fomento Industrial Pvt. Ltd.	0.91	1.25	1.15
Lindsay Internal Pvt Ltd	0.76	1.10	0.48
MMTC	1.45	0.77	0.93
Bharat Mines & Minerals Ltd	1.01	1.14	0.67
Timblo Pvt. Ltd.	1.33	0.60	0.81
VGM/VMCPL	0.65	0.19	0.04
V.M Salgaonkar Sales International	0.36	0.62	0.40
Orient Goa Ltd	0.39	0.21	0.20
Others	2.28	4.37	5.57
Total	22.88	24.67	25.25

Source- MPT

The iron ore export industry shows a high degree of concentration with the top 4 exporters accounting for nearly 60% of the total ore exports. The exports of Goan iron ore have increased by 5% per annum with much of the increase being contributed by the smaller producers. Amongst the larger exporters only Sesa Goa and Sociedade de Fomento Industrial Pvt. Ltd have grown faster than the rate at which Goan exports have increased.

The contribution from Mormugao port was 25.30 million tons and 11.30 million tons was from Panjim port. Iron ore is the most important commodity for MPT constituting about 79% of the cargo handled at Mormugao port is iron ore.



Source- Goan Mineral Ore Exports, GMOEA

Figure 4.11 - Iron Ore Exports from Goa

Iron ore is the primary input for the production of steel and 98% iron ore mined is used in steel making[1]. As a result, demand for iron ore is linked directly to the production of steel and the availability of high-quality ferrous scrap.

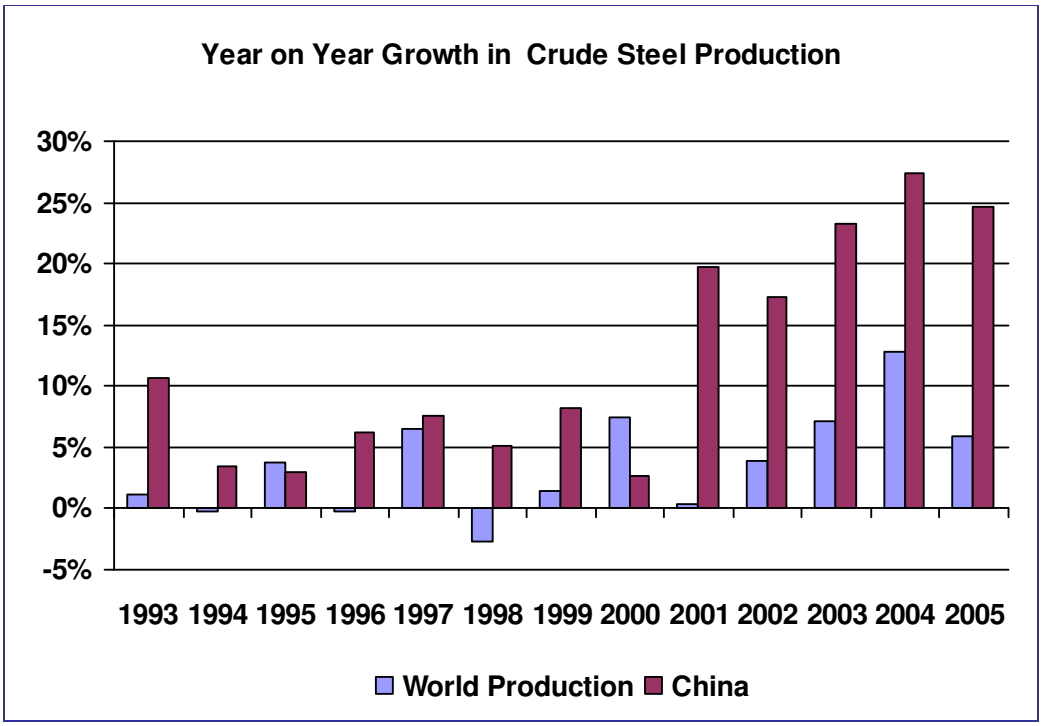
(iv) Global Steel Industry

The global steel production capacity is 1403.7 million metric tons. Asia accounts for 50% of the steel making capacity with China, Japan, South Korea and India accounting for more than 60% of the Asian steel capacity. China's capacity of 340-348[2] million tons per annum (in 2004) and 450-470 million tons per annum (in 2005) tons makes it the largest steel producer while India with a production capacity of 38 million tons (in 2004) ranks 8th in the global steel capacity rankings.

Asia's share in terms of global production is also at about 50% of the total global production. China not only has the largest capacity but also leads in steel production accounting for 31% of global production in 2005. Total global production increased by 6% in 2005 while China's production

[1] The remaining 2% of iron ore not used for steel making is used in the manufacture of cement, heavy-medium materials, pigments, ballast, agricultural products, or specialty chemicals.
[2] The capacity estimates vary depending on the source and the estimates provided above seem to be in the range agreed to by most industry analysts.

increased by 25%. A comparison between Chinese steel production and global steel production is provided in the chart below.



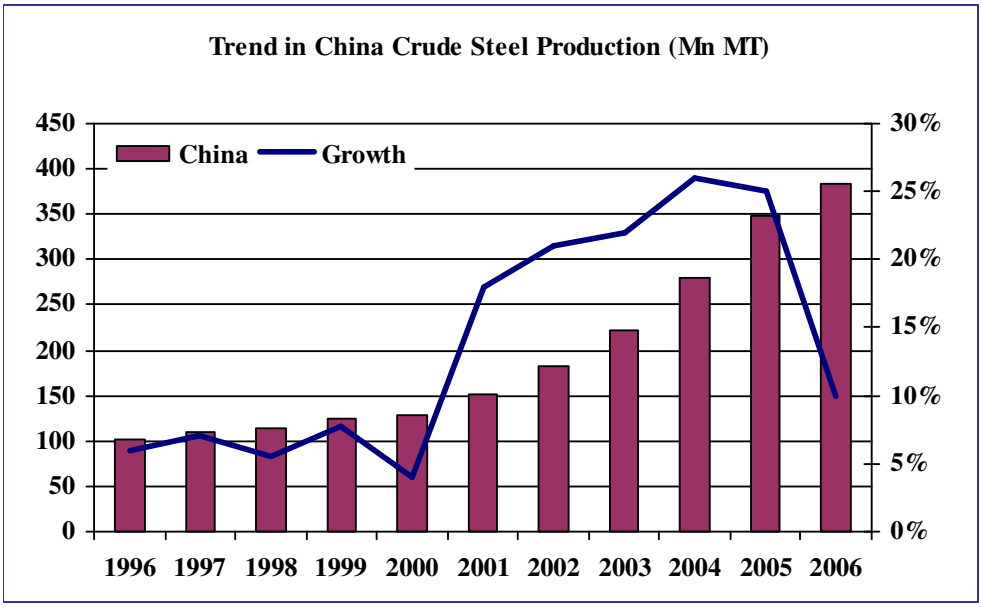
Source: IISI, China Steel Industry; Citigroup

Figure 4.12 - Growth in Crude Steel Production

As is seen from the chart above, Chinese steel industry has been the driver for the global steel industry with its average growth rates in the last 5 years being well ahead of the global steel industry average growth. China therefore has been the main driver for sea-borne trade in iron ore.

(v) Chinese Steel Industry

China is the dominant player in the global seaborne iron ore market, commanding almost half of the trade and hence fortunes of the world's largest iron ore exporters are tied to China's steel industry.



Source- National Steel Statistics, CISA

Figure 4.13 - China crude Steel Production

From a production of 89.54 million tones in the year 1993, China's crude steel production has gone up substantially to hit 385 million tons in 2006 but the rate of growth has begun to show a decline.

Salient Features of the Chinese Steel Industry –

- China's continued capacity expansion has resulted in over capacity in the local markets

- China's small steel mills are growing at a faster rate than the large enterprises. In 2005, the top ten mills accounted for 35.4% of China's steel output. In 2005 China's share of world steel output was 30.9%, up from 26.3% in 2004.

- China's steel output increased at a CAGR of 22% over 2000-2005. With the rise in steel product prices in the past few years, there was a rush of investments leading to substantial increase in steel output, which drove the industry into oversupply.

In 2005, China's consumption of crude steel equivalent was 350 million tons, up by 17.30% y-o-y. It became a net exporter of crude steel at 5.88 million tons in 2005, from being a net importer in 2000-03. Consumption of finished steel was up by 12.4% to 377 million tons in 2005. China's net imports of finished steel were 5.3 million tons, down by 64.9%.

(vi) Regulatory Policy in Chinese Steel Industry

The production growth rates have continuously exceeded 20% during the past four years in spite of Government's implementation of macro economic control policy which was intended to slowdown the fresh investments in the industry. Chinese government first launched austerity measures in 2004 and followed this by further stringent Steel Industry Development Policy in 2005.

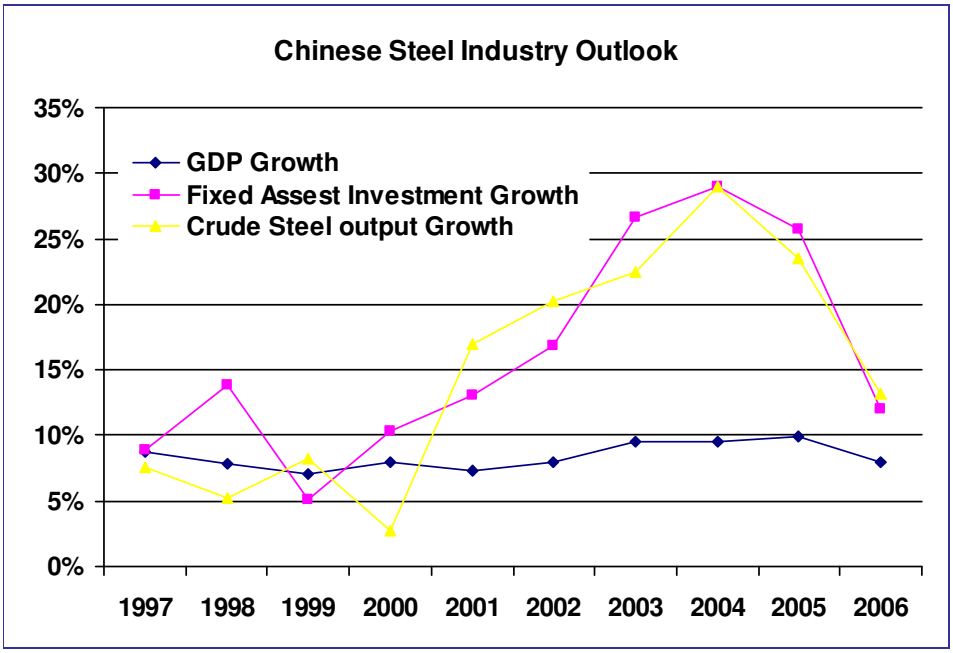
Table 4.7 - Regulatory Policy in Chinese Industry

Vision 2015	
Sector consolidation	10 steel groups accounting for 50% of China's steel capacity by 2010F and two companies with 30 million tons capacity each
Moving up the value chain	Increasing production of higher quality products
Leveraging Geographical advantage	Locating large-scale mills along the coast for port access. Inland mills to use domestic resources and aim for sustainable production
Overseas expansion	Major steel groups encouraged to develop overseas resources supply bases

Source- NDRC

Another reason for the over production is due to the Chinese trade policy. The iron and steel processing trade in China was free from tariffs and value added-taxes on raw material imports and finished products exports. More importantly the Chinese government now plans to limit the country's overall steelmaking capacity to 400 million tons during the 11th five year (2006-2010) and intends to eliminate existing backward upstream facilities i.e. about 100 million tons of iron making capacity and 55 million tones of steel making capacity in line with the New Steel Policy.

As discussed earlier in this note, the government will also encourage steel makers through consolidation and cross shareholdings to reduce their numbers. In order to curb the surging steel exports, the government has already implemented some restrictive measure. The government removed a 13% tax rebate for steel billet and ingot exports in April 2005. It also slashed the tax rebate for exports of steel products from 13% to 11% and in May 2005 prohibited steelmakers in China from making steel products for foreign clients with imported iron ore provided by overseas firms.



Source: CEIC, China Steel Industry; Citigroup

Figure 4.14 - Chinese Steel Industry Outlook

As seen in the chart above the demand for steel is closely correlated to GDP growth and the fixed asset investment. Fixed asset investment peaked in 2004 and has dropped marginally in 2005 and is expected to drop further in 2006. Consequently the growth in steel consumption is also expected to reduce from the levels seen between 2002 and 2005.

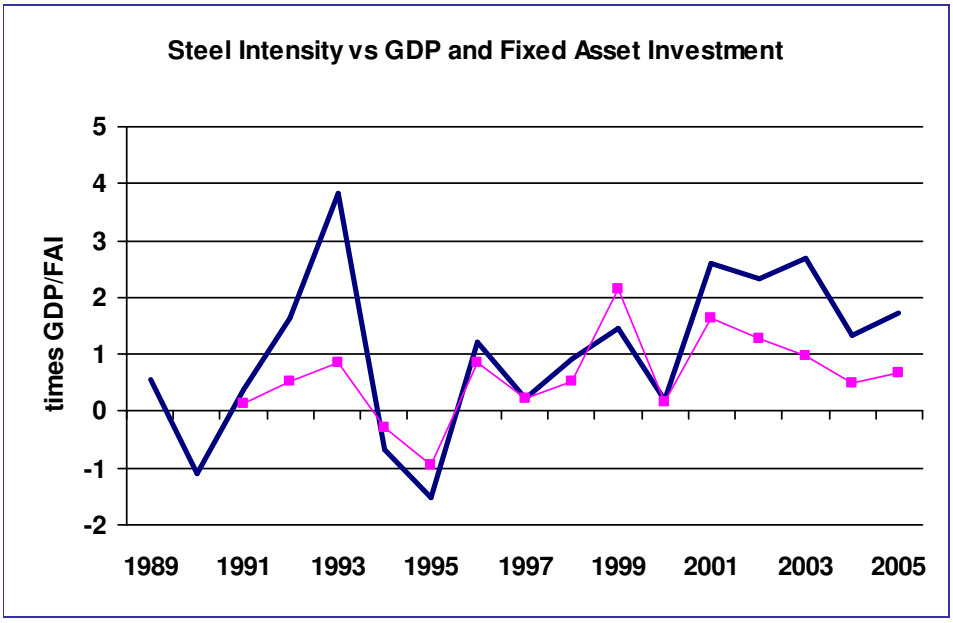


Figure 4.15 - Steel Intensity vs GDP and fixed Asset investment

There is also a structural shift in the steel usage and the intensity of steel consumption to GDP is showing a declining trend due to the structural changes in the GDP. The decline in steel intensity is due to the shift in GDP growth from secondary to primary and tertiary industries.

Table 4.8 – China Steel Intensity of Use during Business Cycles

	1991-2005	1991-2004	1991-96	1991-93	1994-96	2002-04
GDP Growth	9.70%	9.70%	11.60%	12.30%	10.90%	9.00%
Fixed Asset Investment (FAI)	22.70%	22.50%	32.10%	43.40%	20.80%	23.90%
Steel Intensity vs GDP	1.27	1.23	0.83	1.99	0.33	2.13
Steel Intensity vs FAI	0.60	0.60	0.19	0.51	0.13	0.86

Source: Citigroup; China Steel Industry

As shown in the table above, analysis of the steel intensity was about 0.81x during period 1991-1996 which represented one full steel cycle and 1.19x which covers many investment cycles and increases are correlated to periods when investment led capital expenditures were undertaken. We forecast steel intensity to be about 0.81x for the next 3 years. Based on this and GDP estimates the crude steel demand output growth as depicted in the **Table 4.9** below;

Table 4.9 – Crude Steel Forecast

	2006	2007	2008
GDP	8.0%	8.5%	9.5%
Steel Intensity	0.81	0.81	0.81
Consumption of crude steel	395.5	410.0	442.0
Crude Steel output Growth	13.2%	3.7%	7.8%

Source: EY

Therefore, we expect steel demand to drop from levels seen between 2002-2004 and crude steel production to drop alongside.

In light of all these developments, it is expected that the Chinese government would shut down some of the smaller steel mills. However the top steel companies have been increasing their output through M&A and investment in Greenfield projects, in line with the Chinese Government's intention of consolidating the steel industry. For instance, the two major steel mills, Tangshan Group and Wuhan Group have been expanding by acquiring neighboring mills.

(vii) Chinese Iron Ore Demand Outlook

Due to its huge production base, China is world's largest Iron ore importer. China's iron ore imports grew at a compounded annual growth rate of 31% between 2001 and 2005.

Due to the expected slowdown in the steel production, exports and the increase in its own iron ore production, imports are expected to slow down. China's domestic iron ore production has increased and expected to increase by 3% to 5% which is driven by the need to help offset the high cost of imported iron ore.

In August 2006, China's iron ore imports reached 32.80 million tons, up 42.1% compared to the same period last year. But, Indian exporters did not benefit from the increase. As per the data from the China Chamber of Commerce of Metals, Minerals and Chemical Importers and Exporters, Brazil and South Africa are two countries that contributed most to this dramatic increase. In August 2006, China imported 7.74 million tons of iron ore from Brazil, up 97.6%, 1.53 million tons from South Africa, up 92.1% from the same period a year earlier. During January-August period, China imported 219 million tons of iron ore from foreign countries, up 24.5%, and China imported 48.80 million tons of iron ore from Brazil, up 45.9% from the same period a year earlier which further confirms that China's import from India, especially low grade iron ore from Goa would not increase.

China's domestic iron ore production is expected to increase by 110-115 million tons in 2006. The Chinese government has decided by cut the pig iron production capacity by 43 million tons this year, which would result in reduction of iron ore demand by 60 million tons. The Government has taken decision to decrease Iron ore imports, which is reflected in Government's macro economic control policy as the increased iron ore imports have resulted in stockpiling of iron ore. Official statistics show that the port stockpile of iron ore totalled more than 33 million tons and the corporate stockpile reached 10 million tons.

Considering, the slowing down of GDP growth, structural change in the pattern of GDP and the consequent reduction in steel intensity and increased supplies from Australia and Brazil of growth we forecast that China's iron ore demand from India will not increase over the next 7 years.

(viii) Major Expansions of Big Iron Ore Producers

- BHP Billiton Western Australia

BHP Billiton's Western Australian Iron Ore operation (BHP B WAIO) is the third biggest iron ore producer in the seaborne market with its share of

FY2005 production at 90 million tons per annum. BHP Billiton Iron Ore Pty Ltd. manages three major joint ventures, Mt Newman, Mt Goldsworthy and Yandi.

Table 4.10 - Shareholdings and Production

Joint Venture	Shareholdings	Production
Mt Newman	85%	25.7 million tons
Yandi	85%	35.7 million tons
Mt Goldsworthy Mining Associates	85%	4.7million tons
Jimblebar deposit	100%	6.4 million tons
Mining Area 'C'	85%	16.6 million tons

Source- EY Research

Mining Area 'C' commenced production in Q1 FY03 after US$201m of capexand contains more than 800mt of goethitic/Marra Mamba iron ore in seven separate deposits. It's attributable resources of low phosphorous iron ore is 6,248 million ton with an average iron grade of 60.5%. The company plans to expand its production capacity to 154 million tons per annum by mid 2008 from its current production capacity of 118 million tons per annum.

Table 4.11 - Expansion Plans

	mtpa	$ million	$/t pa
Nameplate Capacity in 2003	85		
Mining Area "C" Start up which included	15	201	40.5
Products and Capacity Expansion		313	
WA Iron Ore accelerated expansion		94	
Rapid Growth Plan (RGP 1)	10	119	11.9
Capacity (Mid 2005)	110		
RGP 2 (June 2006)	8	575	71.9
Long Term Expansion (LTE) June 2008	42	2,370	56.4
Total of all expansions by mid 2008	75	3,672	49.0
Goldsworthy Closure around mid 2006	-6		
WA Iron Ore long term capacity	154		

Source- Company Reports

- Samarco

BHP Billiton and CVRD each own 50% of Samarco Mineracao SA, a Brazilian company that operates a complex of open-pit iron ore mines in the state of Minas Gerais. It also operates a concentrator at Germano and pelletizing operations and a port at Ponta Ubu.

Ore is transported from the mine to the Germano concentrator via a five-kilometer conveyor. The oncentrator has capacity of 15.5mtpa of iron concentrate, and from there concentrates are slurried 396 kilometers to Ponta Ubu for pelletizing. The two pelletizing plants have total capacity of 13mtpa of pellets (60:40 blast funace to direct reduction pellets) and up to 2mtpa of fines.Samarco's iron ore resources total 3,036mt grading 45.5% Fe which is sufficient for 90 years of production at the proposed expanded rate currently under consideration of 21mtpa. Samarco is considering an expansion at Ponto Ubu of 7mtpa, bringing pellet capacity up to 21mtpa by mid 2008, plus associated screen products of say 2-3mtpa for an indicative cost of $790 million.

- Companhia Vale Do Rio Doce (CVRD)

CVRD is the largest seaborne exporter of iron ore, accounting for about 30% of iron ore traded in 2005. Operating in Brazil, CVRD operates two fully integrated systems for producing and distributing iron ore, consisting of mines, railroads and port and terminal facilities. A third system consists of Caemi's mines and port facilities only, with railroad freight contracted to MRS Logística in which CVRD has a 38.76% minority interest.

Proven and probable reserves at end-2004 were 4.5bt grading 51.7% Fe in the Southern system, 1.8bt grading 66.7% Fe in the Northern system and 0.6bt grading 65.8% Fe in the Caemi System. Southern System ores have high ratios of 35-65% itabirite ore relative to 66% hematite. Concentration is required to give shipping grade of 65-66%. The high average iron ore content at the Northern System eliminates the need for concentration. Beneficiation is only for sizing. Hence the Northern System is lower cost, although CVRD reports financials for both systems combined. Fines dominate CVRD's iron ore sales. For the period 2002-2004,

Brazilian GAAP accounts indicated the lump:fines ratio averaged 13%:87%. By the end of 2004, CVRD had signed contracts with clients for supply of a total of 644mt of iron ore (and 18mt of pellets) over periods of up to 10 years, including 70mt of iron ore to both Nippon Steel and JFE Steel of Japan, 100mt of fines to Posco of South Korea and 156mt to Baosteel of China, (to 2016), and 100mt to Arcelor of Europe.

CVRD plans to expand its production capacity from 211 mtpa in 2005 to 287 mtpa in 2008.

It also operates 10 iron ore pellet-producing facilities, six of which are JVs with international partners, mostly steel companies. Brazilian JVs are Hispanobrás (nominal capacity 3.8mtpa), Itabrasco (3.3mtpa), Kobrasco (4.3mtpa) and Nibrasco (8.4mtpa) is the Southern System. GIIC (4.0mtpa) is in Bahrain. CVRD also has a 50% interest in the Samarco JV (14.0mtpa) with BHP Billiton, owning and operating a further two palletizing plants.

CVRD has announced an expansion plan for its palletizing capacity to 54 mtpa by mid 2008 from 53 mtpa.

- CSN- Casa De Pedra

The other major iron ore project currently under construction in Brazil is CSN's Casa de Pedra expansion, which the company advises should increase production from 14.1mt in 2003 and 16mt in 2004 to 40mtpa by Q2/07. 2005 and 2006 production guidance is 16mt and 18mt. The company expects all 24mtpa of incremental capacity to go to export markets.

Under the terms of the unraveling of cross share holdings in 2001, CVRD has a right of first refusal to all CSN iron ore sales excess to that CSN's own steel-making needs through to 2031, and has already exercised that right once. So while Casa de Pedra sales would ease export market tightness, they would not necessarily loosen the market grip of the dominant producers.

- Rio Tinto

Rio Tinto's Iron Ore Group wholly owns Hamersley Iron in Western Australia and operates the 60%-owned Channar mine, a joint venture with an Australian subsidiary of the China Iron & Steel Industry & Trade Group Corporation and the 54%-owned Eastern Range mine, a joint venture with Shanghai Baosteel Group Corporation.

Total production from facilities in Western Australia is set to rise from 100mtpa in 2001 before commissioning of Robe River's West Angeles mine, to 176mtpa in 2007. Output from IOC is unlikely to change significantly from current levels.

- Hamersley Iron

Hamersley Iron has a total resources of 2,178 mtpa with an average grade of 60.5% Fe which is equivalent to around 20 years of production. In addition, Hamersley controls 7,115 million tons of undeveloped resources averaging 62.1% Fe, 62 years of production.

Hamersley Iron has announced plan to expand its mine production by 37 mtpa. Stepwise Capacity expansion to 116 mtpa for Hamersley Iron

Table 4.12 - Hamersley Iron's Expansion Plans

	mtpa	$ million	$/t pa
Nameplate Capacity in 2003	74		
Infrastructure expansion to 116 mtpa			
Port at Dampier's parker point to 42 mtpa		700	
Rail double track for 145 km main line	42	200	21.4
Production expansion			
Yandicognia from 24 mtpa to 36 mtpa (mid 2005)	12	220	18.3
Eastern Range start up in 2004	10	67	6.7
HI expansion incl. Nummuldi from early 2006	15	290	19.3
Total announced production expansions	37	1,477	39.9
Hamersley Iron delivery capacity	116		

The company started its expansion projects started in 2004 with an upgrade of its parker point loading facility designed to lift capacity at the Port of Dampier by 42 mtpa from 74 mtpa to 116 mtpa. To match this capacity, rail system is being upgraded from single track to double track for most of the 145 main line as part of integration with Robe River's rail system, now under one operator, the Pilbara Rail Company. This integration allows for more efficient and flexible utilization of the combined port capacity of Hamersley's port of Dampier and that of Robe River at Cape Lambert.

- Robe River Mining Associates

Total capacity of the Robe River iron ore production system is around 60 mtpa.

- Commissioning and Expansion of West Angeles

Table 4.13 - Commissioning and expansion

	mtpa	$ million	$/t pa
Commissioning capacity in 2002	20	450	22.5
Expansion 20 mtpa to 25 mtpa announced in Dec 2003	5	105	21.0
Robe River on Delivery capacity	25	555	22.2

Robe River has a total reserve of 2,430 mtpa with an average iron content of 59.9% to support mining to 41 years at a production of 59 mtpa.

- Kumba Resources

Kumba Resources is the leading South African producer of iron ore. The principal iron ore asset is the mine at Sishen (Northern Cape), with a much smaller mine at Thabazimbi (Limpopo). The combined resources of these mines exceed two billion tons. Together, the mines produce 30 mtpa of iron ore.

Kumba produced over 30.1million tons of lumpy and fine iron ore during 2004, of which 20.9mt was exported. Sishen in particular is one of the largest single open-pit mines in the world, and is linked by a 861km railway to a dedicated deep-water port and bulk-loading facility at Saldanha. In 2005 Kumba Resources approved a project to increase export capacity from 21.7mtpa to 33.2mtpa by 2009.

The project will utilize current waste material and an average 10mtpa new material to increase run-of-mine from the current 34mtpa to 50mtpa. The 16 mtpa feed to the new plant will be processed through a newly-built plant to produce about 10mtpa of saleable ore with an average iron content of 64% compared with the 66% iron content of normal Sishen product, in the process reducing the long-term stripping ratio from 2.9:1 to 1.9:1.

The Sishen expansion project will begin delivery of product by mid-2007, ramping up to full capacity by the beginning of 2009. Further expansion, such as the development of Sishen South will be guided by availability of export channel capacity, via either Saldanha or Coega.

- Emerging Iron Ore Producers

The Iron Ore industry has seen many new entrants looking to capitalize on the heightened state of iron ore market by capturing a portion of the market share of the three dominant producers, which together control 67% of the global export market. List of emerging iron ore producers and their major projects are listed below;

Table 4.14 - List of emerging iron ore producers & their projects

Company	Project	Current Resources	Production	Development Stage
Aztec Resources	Koolan Island	47mt @ 64.7%	4mpta	Bankable feasibility
Baffinland IronOre Mines	Mary River	143mt @ 67.3%	10mtpa	Scoping Study
Cape Lambert Iron Ore	Cape Lambert	2500mt @ 30%	5-10mtpa	Evaluation
Fortescue Metals Group	Chichester Range	2,118,t @ 58.1%	45mtpa	Bankable feasibility
Gindalbie Metals	Blue Hills	200mt @ 35%	4-7mtpa	Pre-feasibility
Grange Resources	Southdown	83.3 mt	6.5mtpa	Bankable feasibility
Midwest Corporation	Koolanooka/ Blue Hills	9.1mt@ 58%	1mtpa	Development
	Koolanooka	430mt@ 35%	4.5mtpa	Pre-feasibility
	Weld Range	132mt @ 55.6%	15-20mtpa	Pre-feasibility
Mount Gibson Iron	Tallering Peak	22mt @ 63.5%	3mtpa	Operating
	Mount Gibson	15.4mt @ 63%	3mtpa	Conceptual
	Extension Hill	248mt	5mtpa	Bankable feasibility
Murchison Metals	Jack Hills (Stage 1)	67mt @ 62.0%	1.2-1.8mtpa	Development
	Jack Hills (Stage 2)	67mt @ 62.0%	20-25mtpa	Pre-feasibility
New Millenium Capital	LabMag	1,806mt @ 30%	10mtpa	Pre-feasibility
Sphere Investments	Guelb el Aouj	225mt @ 36%	7mtpa	Bankable feasibility

Source- Bloomberg, Company Reports

It is expected that some projects may get assistance from the Chinese Steel Industry as it seeks to diversify its supply sources, some may opt for consolidation with their peers to share massive infrastructure costs, while the majority may remain undeveloped for decades.

(ix) EXIM Policy

o General

The key features of the iron ore export import policy are as follows:

1. The present EXIM policy permits export of iron ore from Goa and Redi sector to all destinations by the iron ore producers; irrespective of the iron content.

2. KIOCL is the canalizing agency for its own products (iron ore concentrates and iron ore pellets) since it is a 100% E.O.U. (export oriented unit).

3. The export of iron ore with Fe content above 64% is canalized through MMTC.

4. Export of Iron of Goa origin to China, Europe, Japan, South Korea and Taiwan (irrespective of Fe content) and Export of ore from Redi region to all markets (irrespective of Fe content) is not canalized.

5. However, some types of high-grade iron ore (Fe content above 64%) from specific areas like Bailadila in Chattisgarh are allowed to be exported with restrictions on quantity imposed primarily, with a view to meet domestic demand on priority.

Present quantitative ceiling of iron ore fixed by the Govt. are as under:

Table 4.15 - Quantitative ceiling of iron ore

Area	Annual Quantity (in Million Tons)
Bailadila Lumps	Not Exceeding 3.00 MT
Bailadila Fines	Not Exceeding 3.80 MT
High Grade Lumps (Bellary-Hospet Sector)	No limit
High Grade Fines (Bellary-Hospet Sector)	No limit

o Regulatory Issues

The Centre is likely to curtail the rights of states to grant iron ore mining leases to companies by framing divergent guidelines and selection criteria for according priority allotment basically to check growth of regionalism and state orientation in grant of mining leases for major minerals that is more often than not influenced by favouritism.

In the past Government had appointed many committees of which the most recent ones are, Dang Committee and Hoda Committee, to study the issue of iron ore policy including exports an allocation of mining leases and for formulating guidelines for the preferential grant of mining leases for iron ore, manganese ore by state government. Dang Committee recommendations include a scheme of preference for grant of iron ore mining leases. It puts applicants in two groups — the first comprising steel makers in the public and private sector in that order. It recommendations that domestic steel utilities be given priority along with those who intend to set up greenfield projects of more than 10 million ton capacity. Dang Committee recommendations include a scheme of preference for grant of iron ore mining leases and it also favoured the phase-out of iron ore exports over the long haul.

Hoda Committee was constitution of High Level Committee to Review the National Mineral Policy under the National Mineral Policy under the Chairmanship of Mr. Anwarul Hoda, Member, Planning Commission. It recommended that steel capacities that do not have captive mines should be given preferential treatment in the allocation of iron ore mines. Such steel plants would not have to go through the auction procedures. It also recommended changing the system of royalty charged on minerals mined from the present specific charges to ad-valorem system. It favoured seamless transition of reconnaissance permit (RP) to prospecting licence (PL) to mining lease (ML) as that would encourage companies to invest funds in taking up reconnaissance activities. It recommended that exports of iron ore be continued without any restrictions.

If implemented, Hoda Committee report would remove many hindrances faced by the mineral industry and attract significant direct foreign investment. As it favors iron ore exports, we assume that there will be no restrictions on export of iron ore.

(d) Approach for Forecasting Iron Ore Exports

(i) Method – 1 – Based on China Steel Industry Forecast

We have forecast the iron ore exports from Goa and then forecast the market share which MPT can target. The exports of iron ore from Goa are based on the projected demand from China as it is the largest iron ore importer from Goa. The second biggest importer is Japan but there is no distinctive trend in Japanese imports. Therefore, we have assumed that Japanese iron ore imports will remain at 2005-06 levels as will those of other importers who account for a very small proportion of total iron ore exports from Goa.

We forecast Chinese iron ore imports from Goa not to increase from its current levels due to the following:

1. Decrease in rate of growth in steel production in China due to steel over supply

2. Increase in iron ore exports from Australia, Brazil and South Africa as the major iron ore producers are based out of these countries. They have also announced capacity expansion which means there will an increase in the supply of higher grade iron ore.

3. Increase in China's own iron ore production

We have projected three scenarios, high, low and medium for iron exports based on our estimates of decline in China's iron ore imports from Goa. The key assumptions on Chinese iron ore exports for each of the three cases is provided below.

Table 4.16 – Scenarios for Iron Ore Forecast (Figures in Mn Tons)

	China		Japan		Others	
	FY07	FY13	FY07	FY13	FY07	FY13
Low	29.09	20.20	6.87	6.87	4.44	6.06
Medium	29.09	29.09	6.87	6.87	4.44	6.06
High	29.09	34.73	6.87	6.87	4.44	6.06

Source: EY

In the low case, China's exports decline to 69% of the level to be seen in 2007, in the medium case they increase to remain at the current levels, and in the high case they increase to 119% of the FY07 levels.

(ii) Method -2 – Based on Discussions with Exporters

We have also contacted all leading iron ore exporters from Goa to understand their outlook for iron ore exports. Based on the discussions we had, it is expected that this year 40.40 million tons of Iron ore would be exported from the Goan Ports out of which 65% would be exported from Mormugao Port.

Table 4.17 - Shipper wise export

Shipper wise Exports	2006-07	MPT	Panjim
Sesa Goa Pvt Ltd	6.50	6.50	0.00
Chowgule & Co Pvt Ltd	3.64	3.50	0.14
V.M Salgaonkar & Co Pvt Ltd	4.20	2.00	2.20
V.S Dempo & Co Pvt Ltd	4.50	2.10	2.40
Sociedade de Fomento Industrial Pvt. Ltd.	5.00	1.00	4.00
Lindsay International Pvt Ltd	1.00	0.50	0.50
MMTC	2.50	2.50	0.00
Bharat Mines & Minerals Ltd	1.00	1.00	0.00
Timblo Pvt. Ltd.	2.00	1.20	0.80
VGM/VMCPL	1.60	1.10	0.50
V.M Salgaonkar Sales International	0.80	0.60	0.20
Orient Goa Ltd	0.70	0.60	0.10
Others	6.96	3.48	3.48
Total	40.40	26.08	14.32

Source: EY

As per our discussions with the users, around 29 million tons would be exported to China. Quantity exported to Japan would remain constant at 6.87 million tons and we do not see any decline in the quantity exported to Japan as some of the Goan exporters have long-term contracts with the Japanese steel mills. New markets like Middle East, Indonesia are expected to open up. Currently around 4.5 million tons of ore is exported to countries like Pakistan, South Korea, Netherlands, Kuwait, Belgium etc., we have assumed that the quantity would increase to 6 million tons in the next seven years.

(iii) Impact of Regulatory Policy

We have assumed that Iron Ore Trade policy will not have significant impact on the quantity of exports as there are no restrictions on the Goan and the Bellary-Hospet Iron Ore exports.

(iv) Summary of Iron Ore Forecast for Goa

Table 4.18 - Forecasts under Low, Medium and High Cases (Figures in Mn MT)

Mn tons	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Low Case	40.40	38.95	37.49	36.04	34.58	33.13	33.13
Medium Case	40.40	40.72	41.05	41.37	41.69	42.02	42.02
High Case	40.40	41.60	42.82	44.07	45.34	46.65	47.66

Source: EY

(v) Forecast for MPT

The figures provided above forecast the total iron ore exports from Goa. However, MPT will compete with Panjim for a share of these exports. Exports from Panjim are through transshippers while MPT exports iron ore through the MOHP, transhippers and mooring dolphins. They key differentiator for MPT is the MOHP and therefore we have developed three scenarios involving MOHPs and developed high, medium and low forecasts for these three options.

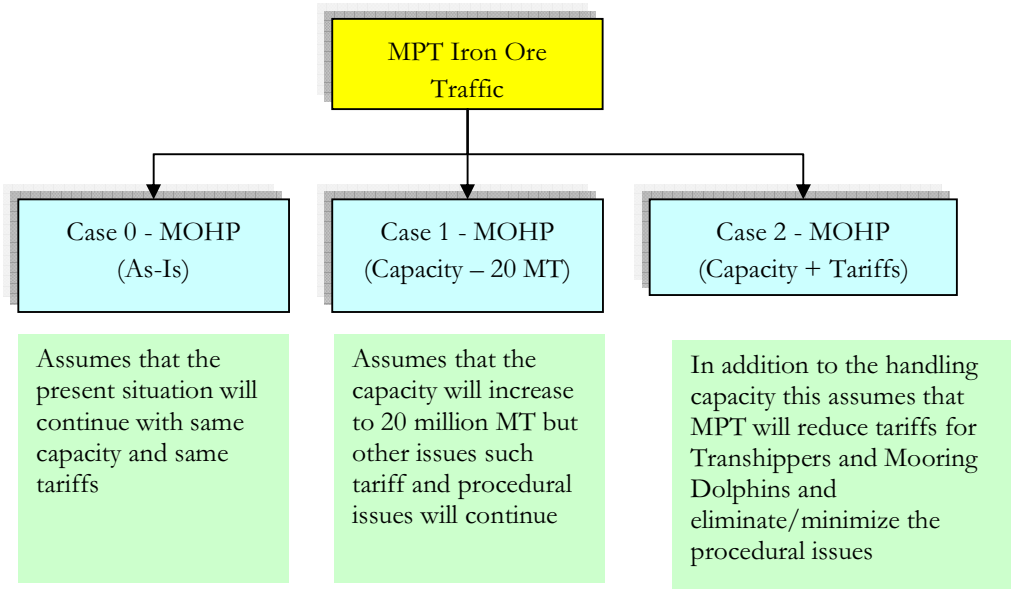


Figure 4.16 - MPT Iron Ore Traffic

The traffic projections for each of the three cases are provided below.

Table 4.19 – Iron Ore Traffic for MPT – Case 0 – As-Is

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Low Case	26.08	23.23	20.89	18.67	16.57	14.58	14.58	14.87
Medium Case	26.08	24.29	22.88	21.44	19.98	18.49	18.49	18.86
High Case	26.08	24.81	23.87	22.84	21.73	20.53	20.97	21.39

Table 4.20 – Iron Ore Traffic for MPT – Case 1– MOHP Capacity Expanded

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Low Case	26.26	24.02	21.87	19.82	19.02	18.22	18.22	18.58
Medium Case	26.26	25.11	23.94	22.75	22.93	23.11	23.11	23.57
High Case	26.26	25.65	24.98	24.24	24.94	25.66	26.21	26.73

Table 4.21 – Iron Ore Traffic for MPT – Case 2 – MOHP Capacity Expanded and Tariffs Reduced

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Low Case	26.26	35.95	34.49	33.04	31.58	30.13	30.13	30.73
Medium Case	26.26	37.72	38.05	38.37	38.69	39.02	39.02	39.80
High Case	26.26	38.60	39.82	41.07	42.34	43.65	44.66	45.55

4.3.2 Coal

(a) Background

Mormugao Port currently handles coal / coke traffic in berths 5A and 6A and also in the general cargo berths 10 and 11. Berths 5A and 6A were licensed to ABG Goa Port Ltd (Presently known as South West Ports Ltd) on a BOOT basis for 30 years in 1999 and commenced operations from January 2005. The license agreement allows SWPL to handle any bulk cargo at the berths. However, the principal cargo remains to be coal and coke a large part of which is meant for its group company JSW Steel Limited at Tornagallu in Karnataka.

Mormugao port handled about 4.09 million MT of coal/coke imports in 2005-06 and has witnessed a CAGR of 16% in the last 5 years.

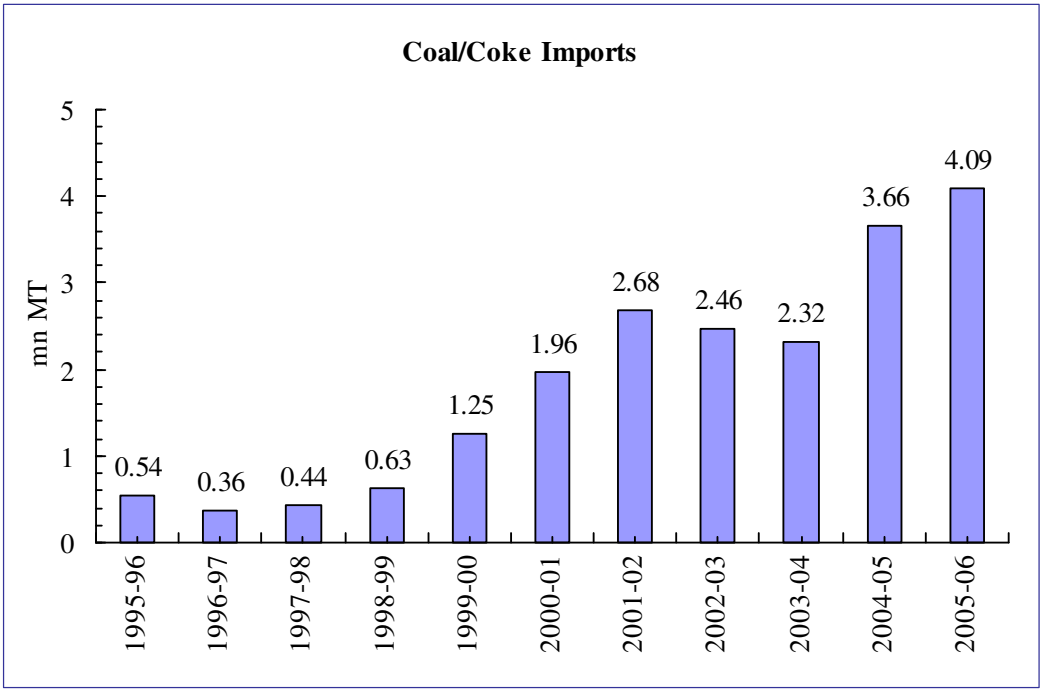


Figure 4.17 - Coal/Coke Imports

Out of the total coal and coke imported in 2005-06, around 1.20 million MT was used within the State. The balance 2.89 million tonnes, received at Berth No 5A & 6A, was directly sent to the JSW Steel Ltd at Bellary by rail.

Table 4.22 - Berth wise Breakup of the traffic handled in MPT

Million tonnes

Coal/Coke (mn MT)	2004-05	2005-06
Berths 5A & 6A	2.14	3.06
Berths 10 & 11	1.52	1.03
Total	3.66	4.09

Source: MPT

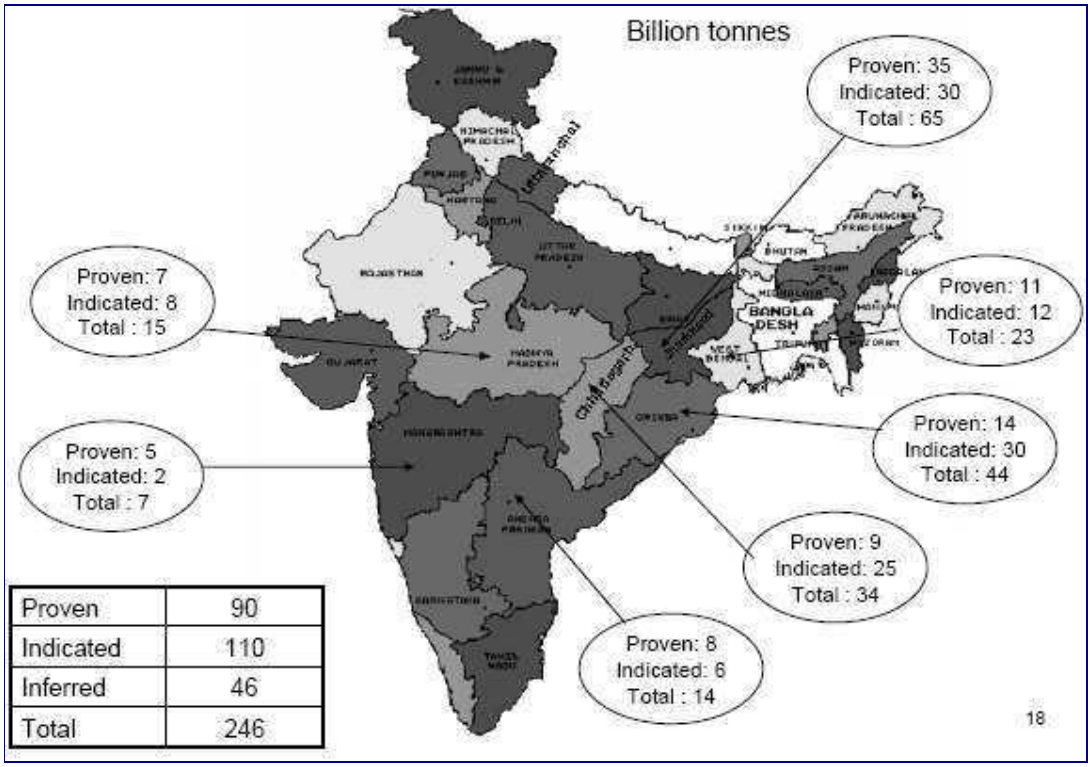
The various captive consumers / traders for imports of coal/coke are Agarwal Coal Corporation, Aparant Iron and Steel Pvt Ltd., Bhatiya International, Maheshwari, Kalyani Steel Ltd., Mukund Steel Ltd., Tata Mettallics Ltd. However, the major non-captive customer, JSW Steel Ltd contributed to over 71% of the coal/coke imports in 2005-06. The growth in the imports of coal/coke during the last two years could primarily be attributed to the increased imports of JSW steel Ltd through Mormugao port.

(b) Coal Market in India

(i) Reserves and Production of Coal in India

- Reserves of coal in India

Coal is one of the important and abundant fossil fuel in India. India has the world's fourth largest coal reserves after United States, Russia and China. A cumulative total of approx 263 billion tonnes of coal resources upto a depth of 1200 mts. have been established in the country as on 1st Jan 2006 including proved reserves of 95.87 billion tonnes. The coal deposits are spread over 27 major coalfields and are mainly confined to eastern and south central parts of the country. In addition to coal, India has around 36 billion tonnes of lignite reserves which is largely located in Tamil Nadu.



Proven	90
Indicated	110
Inferred	46
Total	246

Figure 4.18 - Distributions of Coal Reserves in India

Source: Directorate for Science, Technology and Industry Steel Committee

Despite significant reserves of coal, India has very limited resources of coking coal. Only 17% of India's proven coal reserves are of coking coal quality, with just 4.8% in the prime coking category.

Table 4.23 - Typewise coal reserves as on Jan 1, 2006

Million tonnes

	Proved	Indicated	Inferred	Total
Prime	4,614	699		5,313
Medium	11,445	11,751	1,880	25,076
Semi	482	1,003	222	1,707
Coking coal	16,541	13,453	2,102	32,096
Non-coking coal	79,325	106,316	35,564	221,205
Coal Reserves	95,866	119,769	37,666	253,301

Source: ICRA

- Production of coal in India

The production of coal in India increased at a 5 year CAGR of 5% to around 383 million tonnes in financial year 2005. Increase in the production of coal has almost entirely from non-coking coal and production of coking has declined.

Table 4.24 - Coal Production in India

Million tonnes

	2000	2001	2002	2003	2004	2005
Production – mt	300.00	309.6	322.6	336.9	355.7	382.6
Coking coal	33.3	31.0	28.7	30.5	29.4	30.2
Non coking coal	266.7	278.7	294.0	306.4	326.3	352.4

Source: ICRA

(ii) Demand for Coal in India

Coal has a relatively high importance to India's energy production and consumption and accounted for approx. 52% of the total production of primary energy in India in FY 2005. Despite the availability of various alternative fuels for power generation like liquid fuels (heavy oil, light oil, naphtha, etc), gaseous fuels (natural gas including liquefied natural gas), nuclear and other renewable sources of power, coal still holds a dominant position due to its cost advantage and widespread availability in India.

Table 4.25 - Share of coal and lignite in the production of primary sources of conventional energy in India

Petajoules

	1995	2000	2001	2002	2003	2004	2005
Coal & lignite	4,935	5,454	5,683	5,948	6,126	6,496	6,855
Petroleum	1,350	1,338	1,358	1,341	1,383	1,397	1,423
Natural Gas	750	1,096	1,135	1,145	1,209	1,231	1,224
Electricity	3,181	3,384	3,286	3,350	3,003	3,349	3,658
Total	10,216	11,272	11,462	11,784	11,721	12,473	13,160
% share of coal in Total	48.3%	48.4%	49.6%	50.5%	52.3%	52.1%	52.1%

Source: ICRA

The Indian coal sector has a diversified user base. However, there are three prominent user sectors - power, steel and cement that account for approx 87% of India's coal demand. While the power sector accounts for around 75% of total coal demand other sectors like steel and cement are heavily dependent on coal for its process and energy requirements and consume 8% and 4% of India's coal demand respectively.

Table 4.26 - Total Demand

Million tonnes

Sector	Total Demand					
	2000	2001	2002	2003	2004	2005
Power houses	236.2	252.9	265.2	267.9	280	305.3
Steel Plants and Cokeries	22.7	30.7	30	30.6	29.7	34.5
Cement Plants	9.5	15.3	14.8	16.4	16.6	18.1
Total Demand	311.8	333.9	354.3	366	380.9	405.5

Source: ICRA

(iii) Regulations in India

The domestic coal industry is dominated and controlled by public sector enterprises who mine and market coal. It is a non-traded commodity in the country and majority of the coal produced by the various public sector enterprises is allocated to the various sectors and thereby individual

companies / power plants by the government through Standing Linkage Committee (SLC) operating in the Ministry of Coal. However, over the decade, attempts have been made to deregulate the sector. Captive mining has been allowed for power, steel and cement industries, which will be allocated by SLC.

(iv) Import of Coal

o Poor Quality of Indigenous Coal

Indian coal is generally low in sulphur, however, high in ash content (30-50%) and low in calorific value making it undesirable for many uses. About 90% of the coal production in India is non-coking coal and about 3/4th of it is of lower grades with an ash and moisture content of 28.7% to 47% and useful heat value of 3360 to 4200 Kcal/kg. Also much of the coking coal is of poor quality with high ash content and difficult to wash.

Table 4.27 - Comparison of coal production in major countries (2003)

Country	Production (MT)	Production (Quadrillion btu)
China	1,635	32.09
US	1,069	22.31
India	403	6.63
Australia	373	7.58
Russia	294	5.52
South Africa	264	5.62

Source: ICRA

o Non Availability of Adequate Resources

Although a high growth has been registered in the domestic coal production from 300 million tonnes in 2000 to 403 million tonnes in 2006 (6 year CAGR of 5%), production of coal has not kept pace with the demand, which increased from 312 million tonnes in 2000 to 449 million tonnes in 2006 (6 year CAGR of 6%). The gap between domestic production and demand has widened considerably from 20 MT in year 2001 to 46 MT in year 2006.

Table 4.28 - Historical Production and Demand for Coal

Million tonnes

	2000	2001	2002	2003	2004	2005	2006E
Domestic Production	300	314	328	341	361	382	403
Demand	312	334	354	366	381	405	449
Surplus / (Deficit)	(12)	(20)	(26)	(25)	(20)	(23)	(46)

Source: ICRA

- Coal Imports

Due to the poor quality of coal available in India and the non-availability of adequate coking coal, many coastal companies find it beneficial to import coal. Considering the shortage of indigenous resources, Government of India is also encouraging setting up of power plants based on imported coal. In the recent Import policy, government has allowed imports of coal under Open General License by the consumers themselves. The government has also reduced duties on imported coal (9.2% to 5% and further to 0% on coking coal and 30% to 15% and further to 5% on non-coking coal) in the mini-budget 2004 (January 2004) and February 2004.

Coal imports of India have increased considerably in recent years to 28.6 MT in the fiscal 2005 from 22 MT during 2000. The total import of coal in India accounted for about 7% of the domestic consumption. The share of coking coal is higher at 55% of the total coal imports. Imported coal scores over domestic coal due to its better calorific value, lower ash and sulphur content and are generally used for blending with indigenous coal for process and energy requirements. The main sources for imported coal at the various ports in India are Australia, China, Indonesia and South Africa. For consumers located in the south, north and west that are at a distance from domestic coal reserve imported coal becomes economically viable.

Table 4.29 – Import of coal

Million tonnes

Import of coal	2000	2001	2002	2003	2004	2005
Coking coal	10.99	11.06	11.11	12.95	12.99	14.57
Non coking coal	8.86	9.87	9.44	10.31	8.69	11.56
Coke	2.17	2.42	2.28	2.25	1.89	2.51
Total	22.01	23.35	22.83	25.51	23.57	28.64

Source: ICRA

The demand supply gap of coal is expected to increase in the coming years. Based on the revised Mid-term Appraisal (MTA) of Planning Commission, the demand for coal is expected to increase to 620 MT by 2011-12 and domestic supply is expected to increase to only 525 MT by that time. This would leave India with demand-supply gap of 95 MT in 2012 as against 46 MT in 2006, which needs to be met through imports.

- Forecasting Demand for Coal

Based on the usage pattern, the long-term demand for coal will be determined by

- the demand for electricity along with the share of coal based electricity generation to total electricity generation
- the domestic production of steel
- the domestic production of cement

Since the usage of coal by other industries is relatively small, the impact from them is only marginal over the long term.

(v) Power Sector

- Capacity and Demand Position in India

There has been a significant process in the power sector in India since the process of planned development in the country. Over the years the installed capacity of power plants has increased remarkably from 1,713 MW in 1950 to 123,668 MW in 2005.

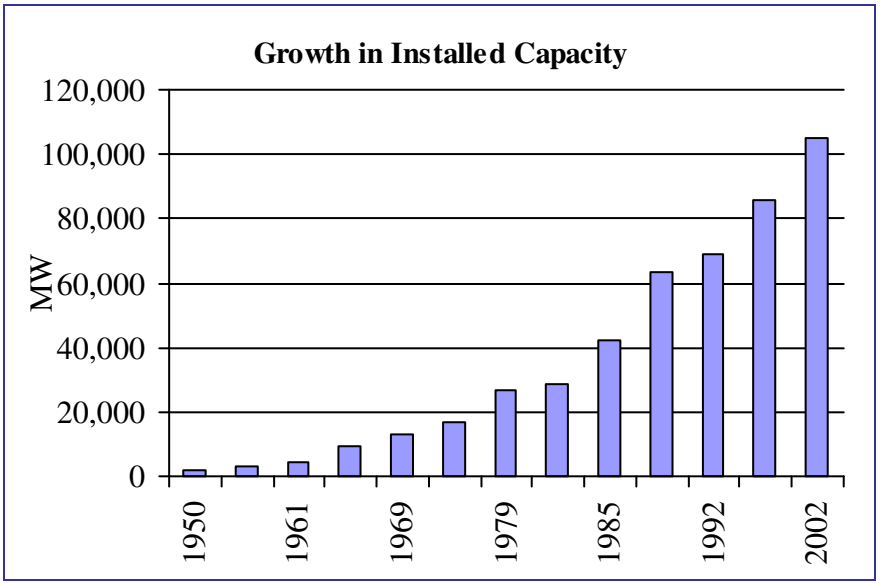
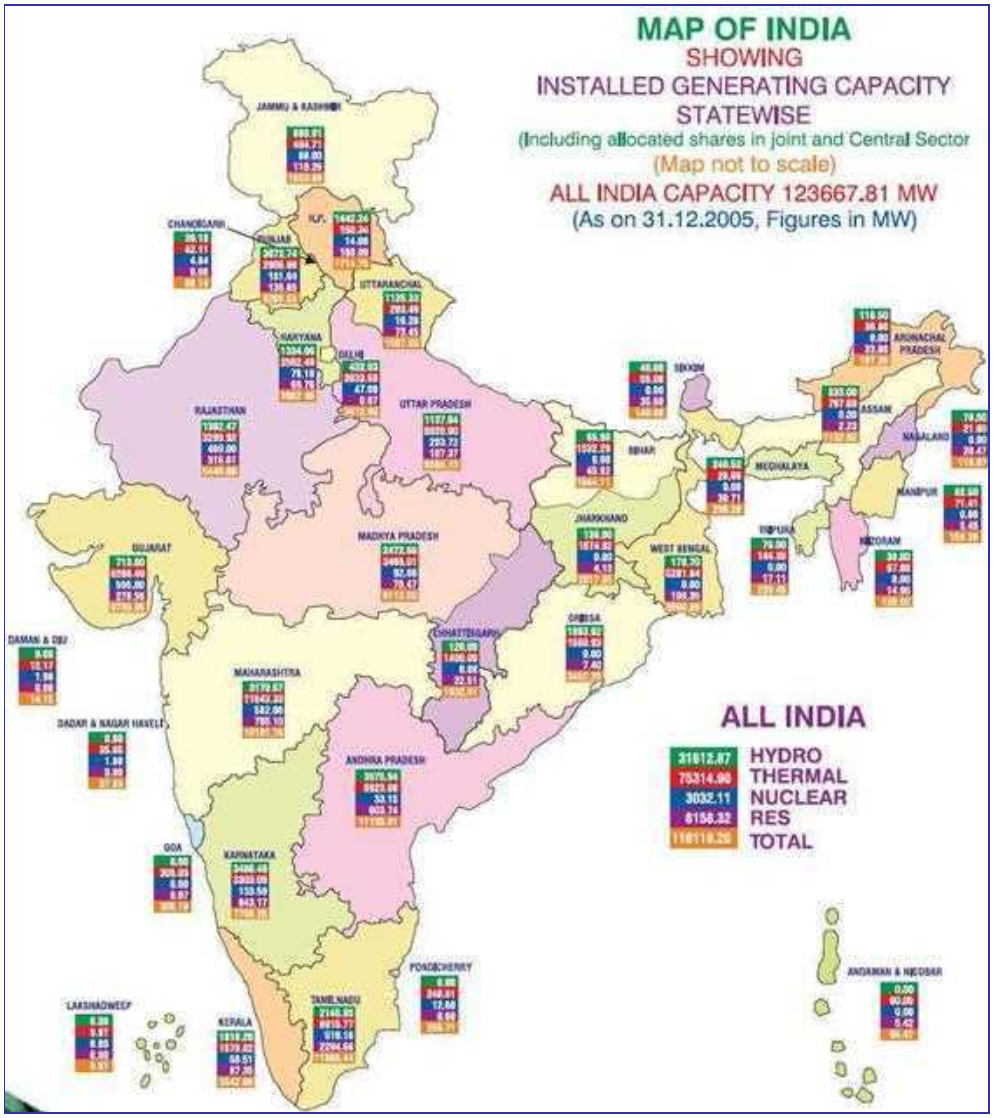


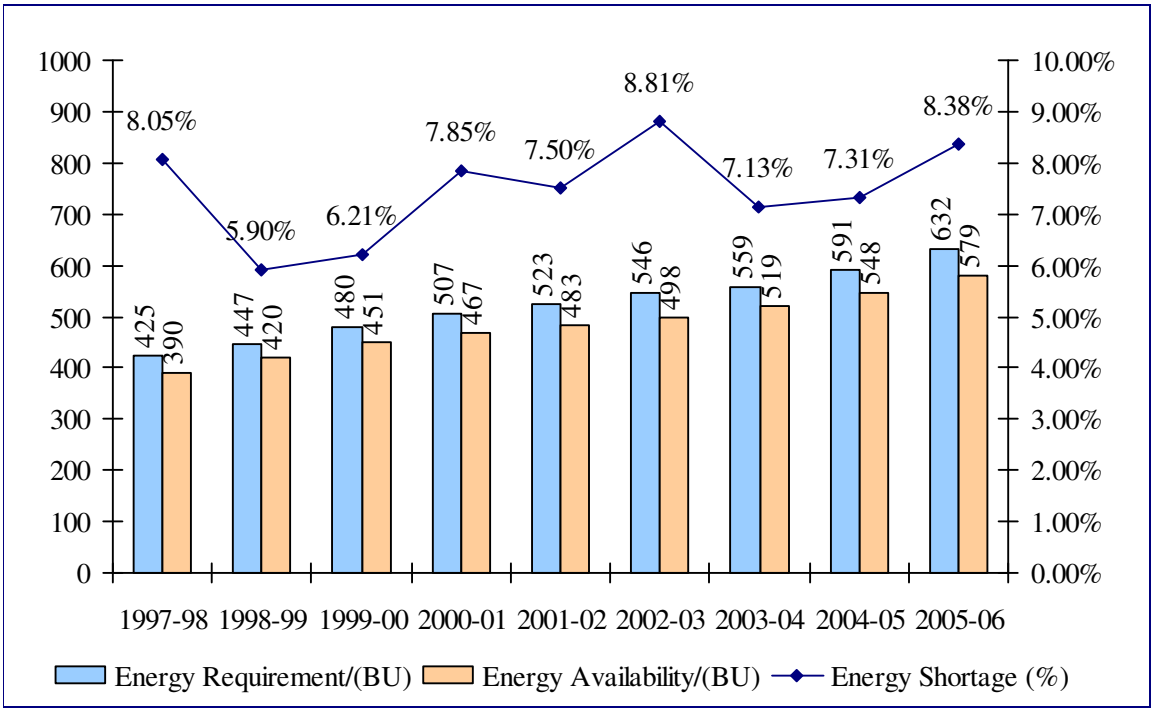
Figure 4.19 - Growth in Installed Capacity



Source: Ministry of Power

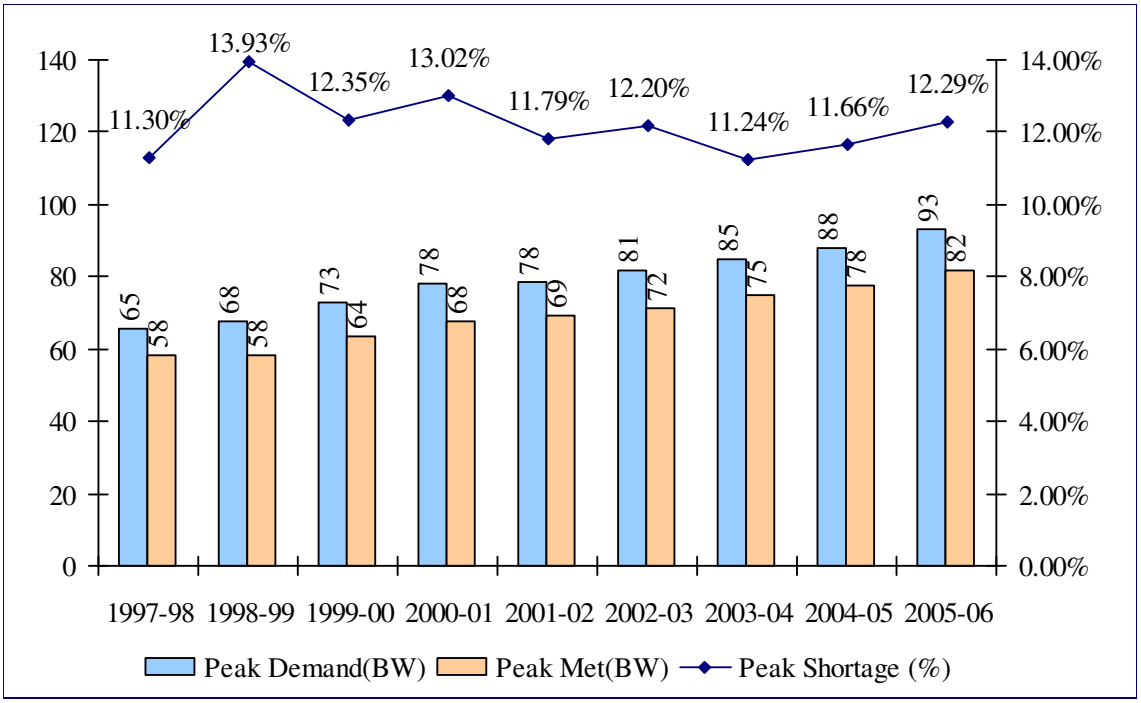
Figure 4.20 - Installed Generating Capacity Statewise

However, India's power generation capacity is inadequate, given the increasing demand and the large losses during transmission & distribution. The all-India power deficit was around 8.4% (52,938 million units) and the peak time power deficit was 12.3% (11,463 million units) during the year 2005-06.



Source: Ministry of Power, Infraline

Figure 4.21 - Power Supply Position – All India

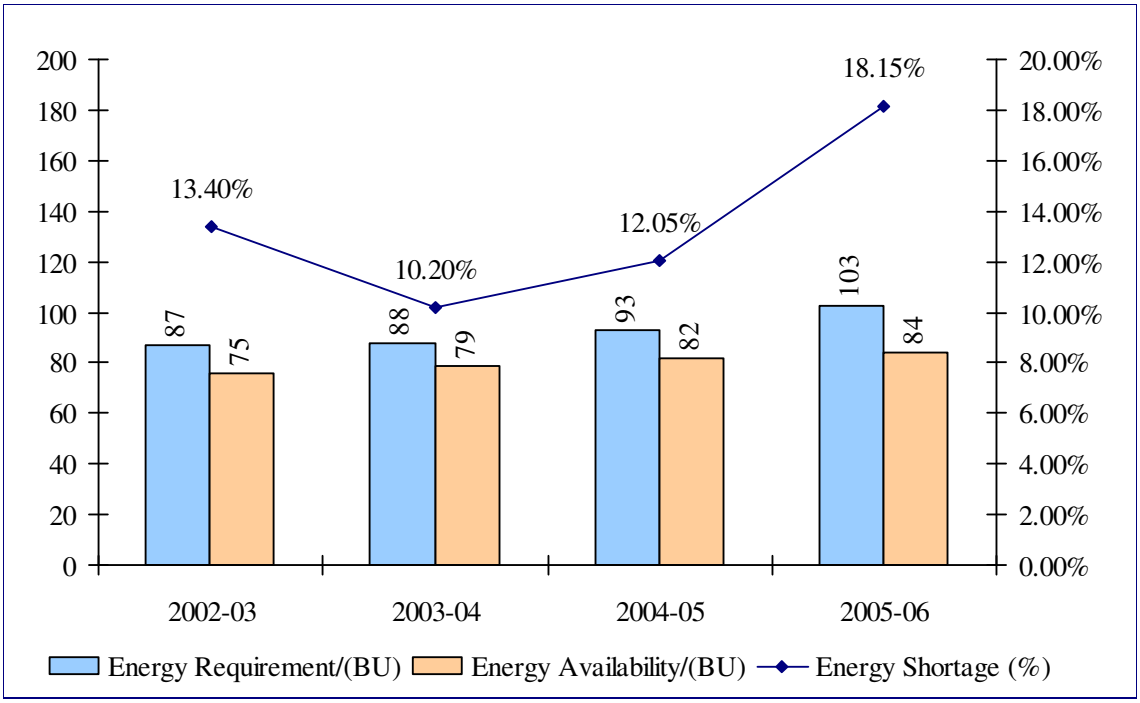


Source: Ministry of Power, Infraline

Figure 4.22 - Peak Demand Supply Position – All India

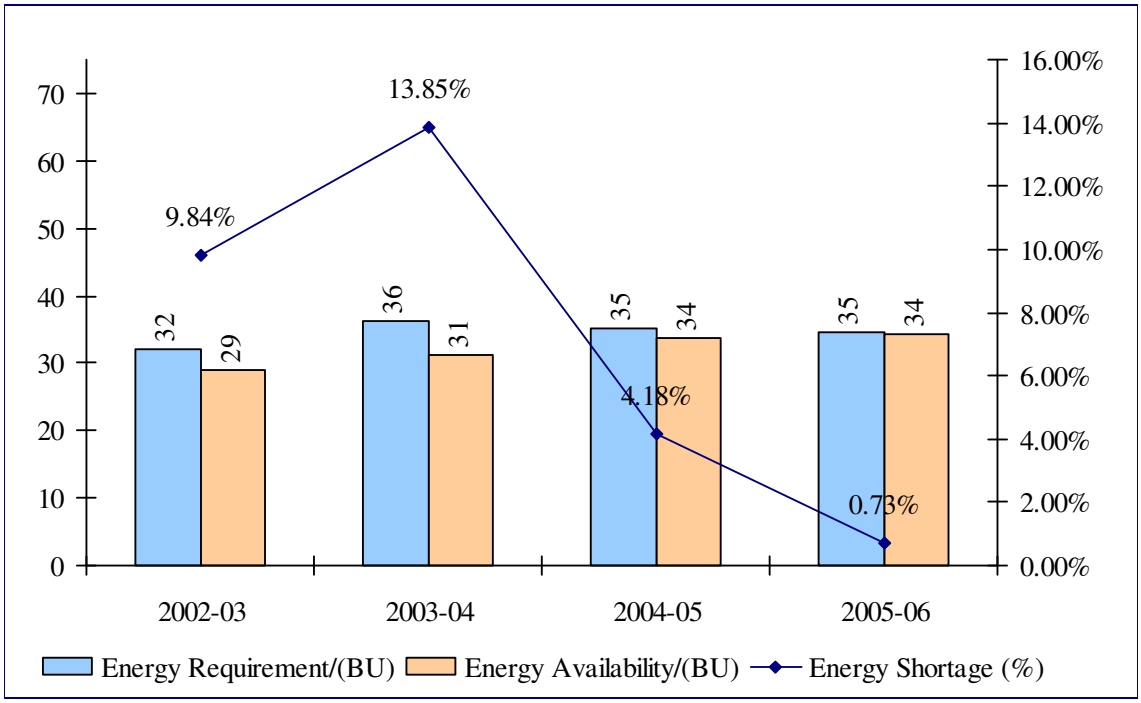
- Capacity and Demand Position in Maharashtra, Karnataka and Goa

The cumulative energy requirement in the hinterland region of Mormugao Port comprising three states - Maharashtra, Karnataka and Goa has increased from 121,170 MW in 2002-03 to 139,704 MW in 2005-06, widening the deficit from 14,845 MW to 18,900 MW. While the state of Goa does not face any shortage of energy, the state of Karnataka has reduced the gap between the requirement and availability of power from a deficit of 3,165 MW in 2002-03 to a deficit of meager 252 MW in 2005-06. However, the deficit situation in Maharashtra has worsened from 11,680 MW (13.4%) in 2002-03 to 18,648 MW (18%) in 2005-06.



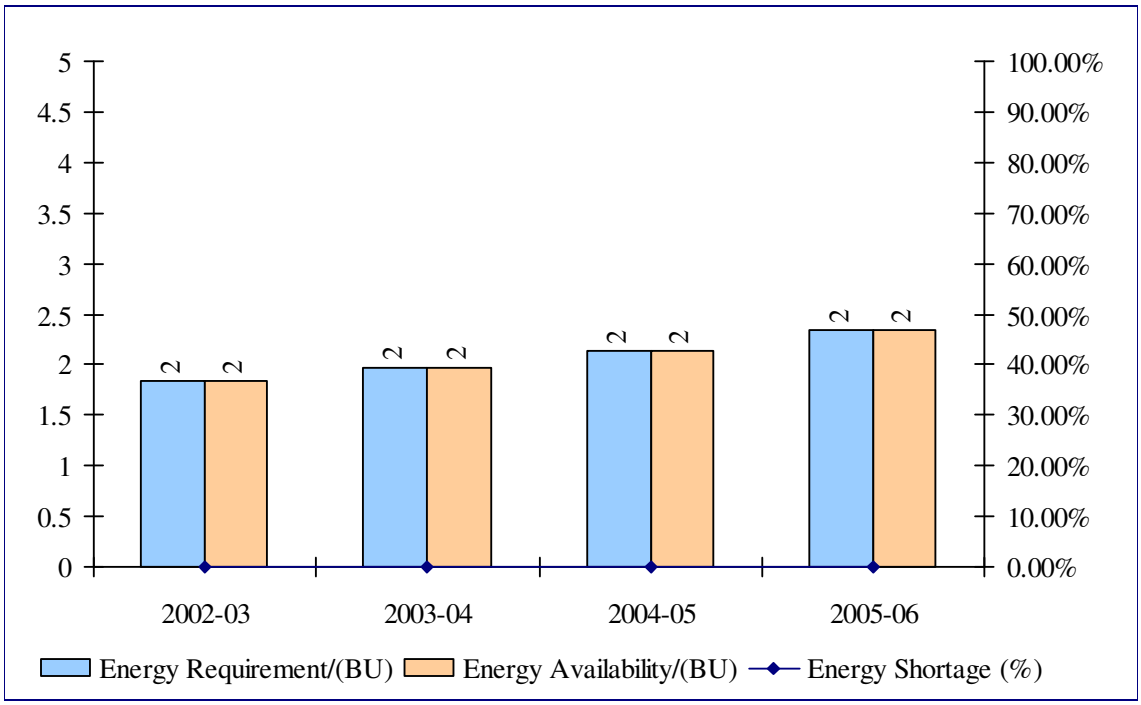
Source: Infraline

Figure 4.23 - Power Supply Position – Maharashtra



Source: Infraline

Figure 4.24 - Power Supply Position – Karnataka



Source: Infraline

Figure 4.25 - Power Supply Position – Goa

- Installed Capacity in Maharashtra, Karnataka and Goa

The installed capacity in these three states cumulate to 24,172 MW out of which coal based thermal plants account for 12,519 MW (52%) of capacity. However, without considering the allocation from the joint and central sector, the coal based thermal plants account for 9,805 MW of capacity (48% of the overall power generation capacity). Among the three states, Maharashtra relies heavily on the coal based power generation accounting for 58% of the state's installed capacity. However, Karnataka and Goa have only 27% and 0% of their power generated from coal based power plants respectively.

Table 4.30 - Installed capacities of Power Utilities

In MW

State / Ownership	Hydro	Thermal		Nuclear	Renewable	Total
		Coal	Others		Sources	
Maharashtra						
State	2,723.67	6,425.00	912.00	0.00	270.58	10,331.25
Private	447.00	1,650.00	920.00	0.00	434.52	3,451.52
Central	0.00	1,339.05	397.28	582.06	0.00	2,318.39
Total Maharashtra	3,170.67	9,414.05	2,229.28	582.06	705.10	16,101.16
Karnataka						
State	3,431.20	1,470.00	0.00	0.00	563.86	5,465.06
Private	55.20	260.00	454.42	0.00	279.31	1,048.93
Central	0.00	1,118.67	0.00	133.59	0.00	1,252.26
Total Karnataka	3,486.40	2,848.67	454.42	133.59	843.17	7,766.25
Goa						
State	0.00	0.00	0.00	0.00	0.05	0.05
Private	0.00	0.00	48.00	0.00	0.02	48.02
Central	0.00	257.03	0.00	0.00	0.00	257.03
Total Goa	0.00	257.03	48.00	0.00	0.07	305.10

- Present and Proposed Coal based Thermal Power Plants in Maharashtra, Karnataka and Goa

There are 9 fully commissioned coal based thermal power plants in Maharashtra in which 2 are privately owned. One ultra mega power project is proposed as a coastal plant in Sindhu Durg with an installed capacity of 4,000 MW. Also two private sector projects of Tata Power and Central India Power are proposed to be commissioned with an installed capacity of 1,000 MW in Raigad district and 1,082 MW in Chandrapur disctrict respectively.

Table 4.31 - Coal Based Thermal Power Projects in Maharastra

Name of the Project	Location	Capacity (in MW)
Fully commissioned		
Bhusawal Thermal Power Station	Bhusawal, Jalgaon	478
Chandrapur Super Thermal Power Station	Chandrapur	2,340
Khaperkheda Thermal Power Station, Nagpur	Khaperkheda,Tal Saoner, District Nagpur	840
Koradi Thermal Power Station	Koradi, District Nagpur	1,080
Nashik Thermal Power Station	Nasik	910
Paras Thermal Power Station	Paras, District Akola	58
Parli Thermal Power Station	Parli-Vaijnath, District Beed	690
Trombay TPP	Thane District	1,150
Dahanu TPP	Thane District	500
Proposed Projects		
Tata Power Company	Raigad District	1,000
Central India Power Company	Bhadrawati, Chandrapur	1,082
Proposed Coastal Projects		
Ultra Mega Project Sindhu Durg	Sindhu Durg	4,000

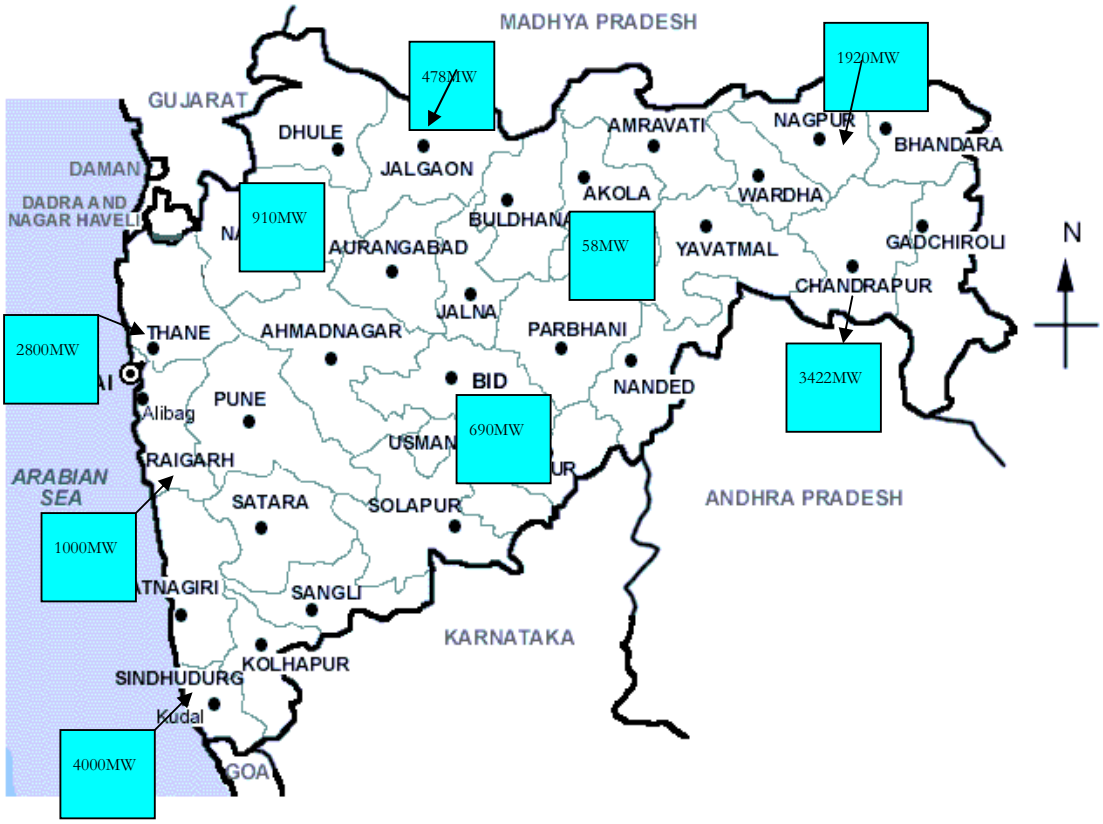


Figure 4.26 - District wise Coal Based Thermal Power Generation Projects in Maharashtra

There are only 2 fully commissioned coal based thermal power plants in Karnataka out of which 1 is owned by JSW Energy Ltd (JSWEL). JSWEL is also proposing to commission another unit of 600 MW in Bellary. Two coastal coal based thermal power plants are also proposed to be set up with capacities of 1015 MW and 4000 MW in Tadri and Mangalore respectively.

Table 4.32 - Coal Based Thermal Power Projects in Karnataka

Name of the Project	Location	Capacity (in MW)
Fully commissioned		
Raichur Thermal Power Plant	Raichur	1470
Jindal Thermal Power Company Ltd	Bellary	260
Proposed Projects		
Jindal Thermal Power Company Ltd	Bellary	600
Bellary Power Station	Bellary	500
Proposed Coastal Projects		
Nagarjuna TPS	Mangalore, Udipi	1015
Ultra Mega Project in Tadri	Tadri	4000

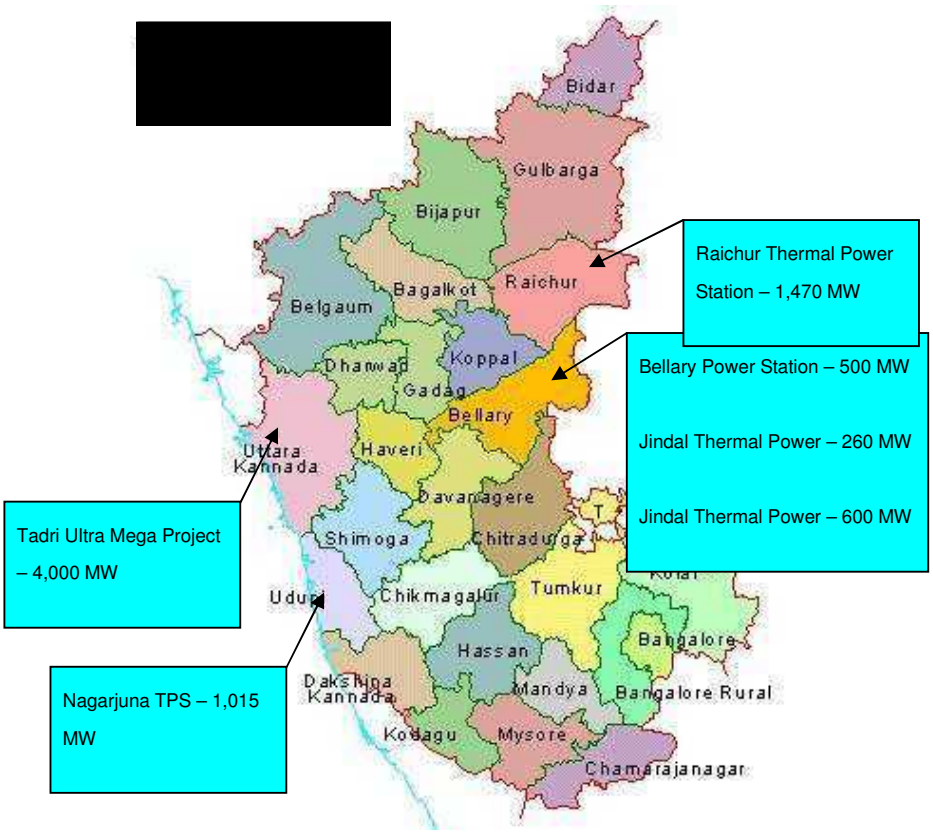


Figure 4.27 - District wise Coal Based Thermal Power Generation Projects in Karnataka

There is only 1 fully commissioned power plant in Goa, that of Reliance Salgaocaor Power Corporation Ltd, however, using naphtha as fuel. Due to high costs of Naphtha, the company has proposed to convert its boiler to run on imported coal. The plant has a capacity of 48 MW.

- Forecast for Mormugao Port

The power projects using imported coal in each of these states are expected to receive them through Mormugao Port only if they are geographically closer to the port to make it cost effective. Considering this, it is expected that the following power projects may possibly uses Mormugao port for receiving imported coal.

Table 4.33 - Projects

Project	Location	Capacity	Coal Requirement (E)
Tadri Ultra Mega Project	Uttara Kannada, Karnataka	4,000 MW	12 MT per annum
Tata Power Company	Raigad District, Maharashtra	1,000 MW	3 MT per annum

Ultra Mega Project Sindhu Durg	Sindhu Durg, Maharashtra	4,000 MW	12 MT per annum
JSW Energy Ltd	Bellary, Karnataka	860 MW	2.6 MT per annum
Reliance Salgaocar Power (RSPCL)	Goa	48 MW	0.15 MT per annum

A Tadri Ultra Mega Project

The project is currently under hold due to local agitation on environmental reasons. However, even if the project was to be commissioned, the developer for this project would develop necessary port facilities for import of coal near Tadri port by taking up some dredging work and construction of jetties. The developer is also expected to construct further transportation facilities of coal to project site through Conveyor belts or Merry-Go- Round (MGR) System. Hence the possibility of the imported coal being received through Mormugao Port is remote.

B Tata Power Company

The project consists of 2 units of 500 MW each with the first unit expected to be commissioned in Dec 2007 and the second in Mar 2009. It was earlier proposed to receive the imported coal at Dharamtar (already operational port) and proposed port at Rewas. However, as on July 2006, Tata Power has started looking for an alternate coastal site for its upcoming power project at Vile, Maharashtra after facing logistical problems at the identified site. Also based on discussions with the Tata Power, it was understood that the company might consider Mormugao Port for receiving imported coal for its project. The requirement of coal for a 1000 MW plant would be around 3 MT per annum. The import requirements as indicated by Tata power as shown below also confirms to this.

Table 4.34 - Import requirement from Tata Power

Million Tonnes

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Import requirement				0.50	1.00	1.50	2.00

Source: Tata Power

C Ultra Mega Project Sindhu Durg

The project will consist of 5 units of 800 MW each and will require to import coal to the extent of about 12 MT per annum after completion. The successfuld developer of this project has to develop necessary port facilities for import of coal and its further transportation to project site through Conveyor belts or Merry-Go- Round (MGR) System. The Government of Maharashtra has to take decision with regard to development of a full-fledged Port at Girye with a provision of a dedicated jetty for the project for receiving coal. Considering this, the possibility of the imported coal being received through Mormugao Port is less and is not incorporated in our forecast.

D JSW Energy Ltd

JSWEL is an IPP located at Toranagallu near Bellary in Karnataka with an installed capacity of 2X130 MW. The Company has completed five years of successful operations. The thermal plant generates power using corex gas as main fuel (which is a by-product in the steel manufacturing unit of JVSL) and imported coal supplied by JVSL as supplementary fuel. JSWEL plans to set up an IPP of 600 MW capacity in Toranagallu near Bellary with imported coal as the main fuel. It is estimated that for the 600 MW plant, JSWEL will require 2 MT pa of coal to be imported. The project is proposed to start functioning in 36 months. The import requirements as indicated by JSWEL is shown below.

Table 4.35 - Import requirement from JSWEL

Million Tonnes

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Import requirement			1.00	2.00	2.00	2.00	2.00

Source: JSWEL

E RSPCL

RSPCL currently has a Naphtha based power generation unit in Goa. However, due to the increasing cost of Naphtha, RSPCL plans to modify the existing facility to enable the unit to generate power from coal. The company is planning to import high grade coal for usage in the power plant on environmental considerations. Due to the proximity to power plant, the entire requirement of RSPCL is expected to be imported through Mormugao port. RSPCL also confirmed the plans to import coal through Mormugao Port Trust.

Table 4.36 - Import requirement from Tata Power

Million Tonnes

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Import requirement		0.20	0.20	0.20	0.20	0.20	0.20

Source: RSPCL

(vi) Steel Sector

The global steel production is to the tune of 1,130 million tonnes and India ranks 8th with a production of 38.1 MT in 2005.

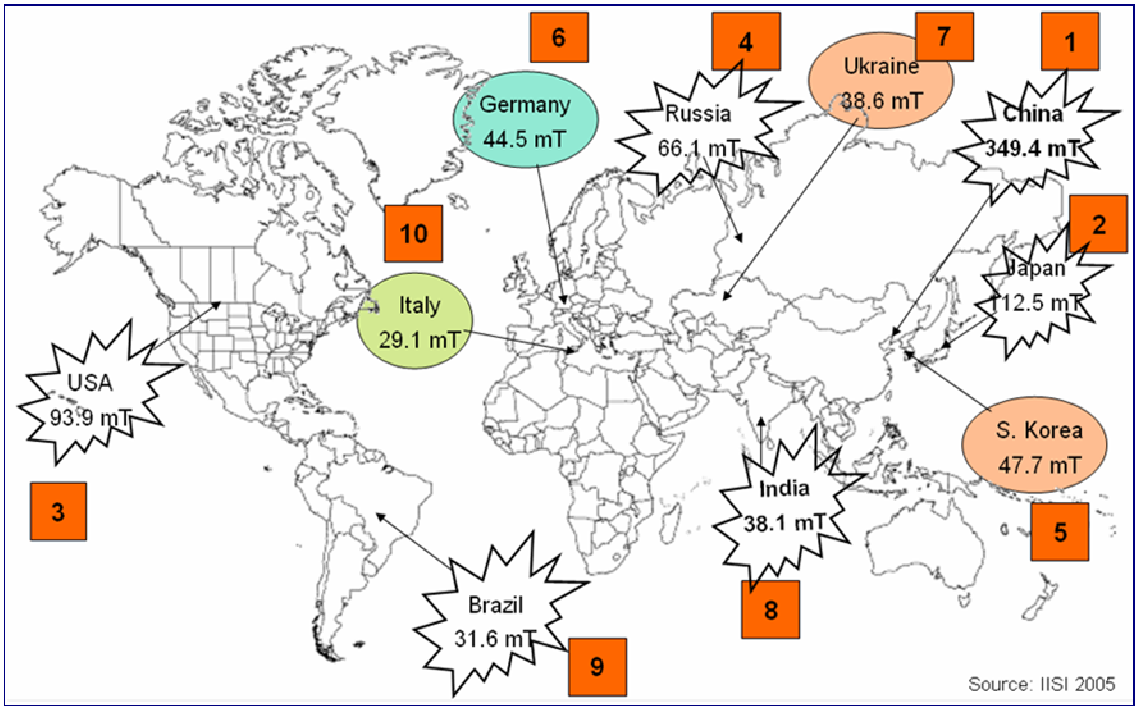


Figure 4.28 - Top ten countries in the world based on the steel production during 2005

About 8% of India's coal demand and 5% of domestic offtake is from the steel sector. The demand for coal from steel sector has increased at a CAGR of 7% in the last 5 years, but the domestic offtake of coal has declined. Despite the huge domestic iron ore reserves, the Indian steel industry's growth is constrained due to coking coal shortages from domestic sources. The washed coal (with ash content in the range of 18-20%) obtained from high ash raw coking coal mined in India needs to be blended with low ash imported washed coal (with ash content below 10-12%) for achieving reasonable performance of blast furnaces of the steel plants. Hence steel producers have to supplement the domestic production of coking coal with

imports of high grade coking coal. Currently the steel industry imports around 19 MT of coking coal annually, and procures 7.5 MT from indigenous sources, including captive mines. The steel industry also consumed about 8 MT of non-coking coal, excluding thermal coal for captive power plants.

In the National Steel Policy approved by Government of India in 2005, the steel production in India is targeted at 110 MT by 2019-20 from its current level of 38 MT in 2004-05. Major emphasis has been given on the availability of raw materials which is estimated as follows:

Table 4.37 - Estimated availability of raw materials

Million tonnes

	2004-05	2019-20	Increase	
			Mn Tonnes	%
Coking Coal	27	70	43	159%
Non Coking coal	13	26	13	100%

Out of total requirement of 70 MT of coking coal, 85% (59.5 MT) is projected to be met by imports. The requirement of non-coking coal will be met primarily by the domestic production, and only the high grade non-coking coal is projected to be imported. About 98 MT pa of capacity expansion in the steel sector has already been planned to meet the targets set by National Steel Policy. Many of the projects are proposed to be set up in Eastern India, due to the proximity to raw materials.

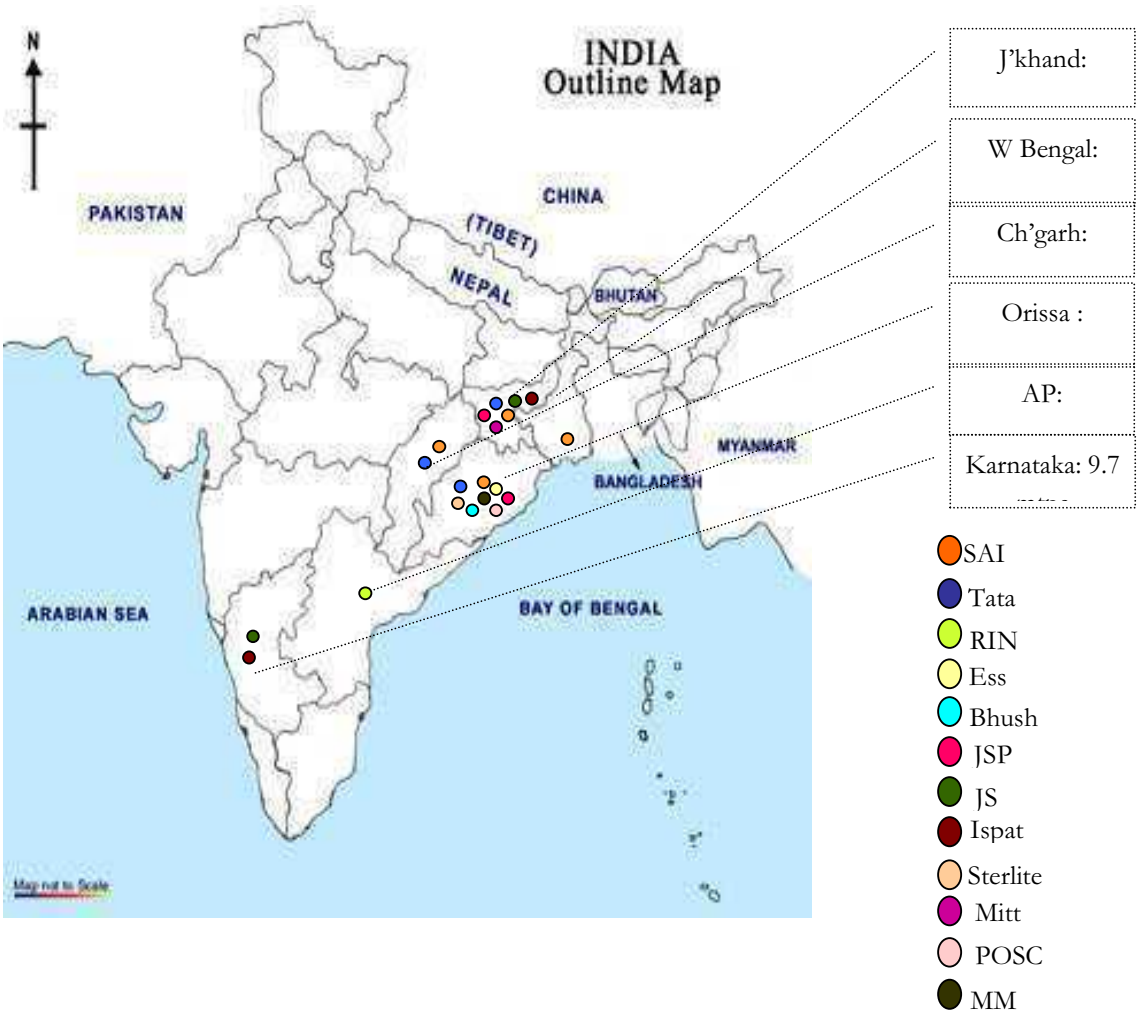


Figure 4.29 - Statewise capacity additions upto 2012

There are only 3 projects cumulating to 13 million tonnes p.a. in south India. Of these, the project in Andhra Pradesh will use the port in that state and the other two in Karnataka may use either Mormugao Port or Mangalore Port. However, the ISPAT unit is closer to Mangalore and is expected to use that port for import of coal.

- Forecast for Mormugao Port

The capacity of the consumers who depend on the coal imports, from MPT except JSW steel Ltd is small in relation to the size of the Indian steel industry. Moreover, as shown in the statewise capacity addition map above, there are no significant steel production expansion plans announced in the hinterland of Mormugao Port. In this situation, a correlation between the coal imports and steel production may not provide a reasonable degree of correlation. Therefore, we have projected the demand for coal incorporating

the expansion plans of the current consumers and likely imports from new steel plants in the hinterland of Mormugao Port like JSW steel Ltd.

A JSW Steel Ltd

The major importer of coal for production of steel is the non-captive user – JSW steel Ltd. JSW has planned to increase its steel-making facility from 2.5 to 3.7 million tonnes (expected to be operational fully by 2nd Quarter of 2006-07) and further to 7 million tonnes by 2008. The coal requirement of JSW, based on their announced expansion plans, would grow to about 7.5 million tonnes by 2008. Also during our interactions with SWPL and JSW Steel Ltd the import requirements were conveyed to us as 8 MT pa in 2008 which would grow upto 10 MT pa in 2010 due to further capacity expansions. However, we expect the import requirements of JSW steel to stabilize at 7.5 mn tonnes from 2008.

Table 4.38 – Import Requirements

Million Tonnes

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Import requirement	0.54	0.62	0.62	0.62	0.62	0.62	0.62

Source: SWPL

Presently, JSW imports its requirements of coal through the Chennai and Mormugao port. JSW is also exporting steel from the Chennai port. Since the berths 5A and 6A have been licensed to South West Ports Ltd., it acts as a captive facility for handling its coal imports. The company also proposes to export steel from 2007-08. The export of steel and import of coal from Mormugao port will enable JSW to reduce costs due to synergy benefits like optimal usage of the rail wagons in both directions. Thus, Mormugao Port offers considerable cost advantage to JSW steel over other ports (especially Chennai port) because of its usage as a captive facility. In a measure to benefit further from low costs, SWPL has bid for the license of berth 7 and has plans to operate it for additional requirements of JSW steel as well. Considering this, the entire import requirement of coal can be attracted to Mormugao Port should proper cost-effective infrastructure be offered to them.

B Other Captive Consumers

The other captive consumers of the port include the steel producers located in the hinterland of Mormugao port. The requirement of the captive consumers is fragmented and is low relative to the total traffic handled by the

port. Also there are no substantial expansions planned by these steel manufacturers. Hence we have not assumed any change in the import requirement from these consumers. The import traffic from these minor importers is expected to remain at 1.20 MT pa.

(vii) Cement Sector

o Cement Industry in India

India is the second largest producer of cement in the world next only to China, accounting for 6.4% of the global production of 2.22 billion tonnes (142 million tonnes). India's cement industry has grown significantly in the past three decades, with production increasing at an average rate of 8.1% per year between 1981 and 2004-05. India's cement production increased at an annual average of 8.2% during financial years 1996 to 2006, as compared with 6.9% during financial years 1986-96.

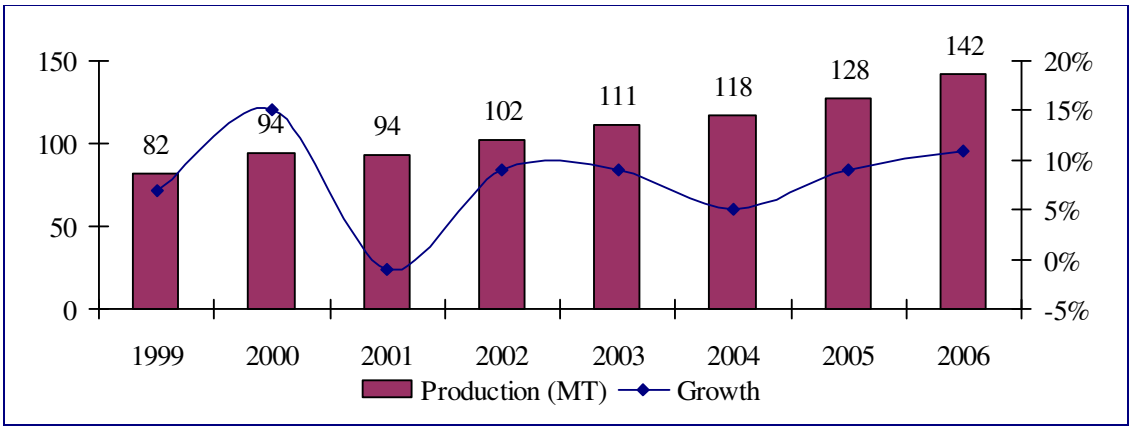


Figure 4.30 - Cement Production in India

Although the cement industry in India is highly fragmented, there is a heavy concentration in the top players, who account for 93% of the total installed capacity in India.

o Patterns of Regional Production

Cement is a high bulk and low value commodity and keeping the costs of production low is a key to profitability. Limestone is the important ingredient in the manufacture of cement and cement sector accounts for consumption of over 75-80% of limestone produced. About 1.4 – 1.5 tonnes of limestone is needed for every tonne of clincker. Hence for 1 million tonne cement plant 50-60 mt of cement grade limestone reserves should be available in the vicinity. Given these constraints, the growth of cement industry has been around the limestone deposits to ensure low cost of transportation of the heavy limestone.

Presently, there are seven clusters in India:

1) Satna (Madhya Pradesh)
2) Chandrapur (North Andhra Pradesh and Maharashtra)
3) Gulbarga (North Karnataka and East Andhra Pradesh)
4) Chanderia (South Rajasthan, Jawad and Neemuch in Madhya Pradesh)
5) Bilaspur (Chattisgarh)
6) Yerraguntla (South Andhra Pradesh) and
7) Nalgonda (Central Andhra Pradesh)

- Forecast for Mormugao Port Trust

The closest limestone cluster to Mormugao Port is the Gulbarga cluster spreaded in North Karnataka and East Andhra Pradesh. Plants located in this cluster tend to source coal from colleries in Andhra Pradesh and Madhya Pradesh which are at a distance of about 620 Kms from Mormugao port. The potential for coal imports from cement plants appears low at this point unless there are significant pricing differences between domestic and imported coal.

- Forecast Scenarios

The coal traffic for Mormugao Port Trust has been forecasted under three scenarios – low, medium and high. The assumptions forming the basis for each of these scenarios are provided below:

Table 4.39 – Forecast Scenarios

Scenario and	Low	Medium	High
Sector			
Power Sector			
Tata Power	Tata power project does not materialise / all the imports are made through other ports.	Tata power imports only 50% through Mormugao port and the rest through other ports	Tata power imports all 100% through Mormugao port.
RSPCL	RSPCL imports 0.2 million tonnes of coal	RSPCL imports 0.2 million tonnes of coal	RSPCL imports 0.2 million tonnes of coal

Scenario and	Low	Medium	High
Steel Sector			
JSW steel and JSWEL	Imports of coal reduce by 45% of the base case	JSW steel and JSWEL import as targeted by JSWPL at 6MT per year after stabilisation and 5 MT in 2006-07	JSW steel and JSWEL imports all their requirement from Mormugao Port (10MT at full capacity)
Other minor steel producers	Import requirement of coal does not change from its present levels	Import requirement of coal does not change from its present levels	Import requirement of coal does not change from its present levels

Based on the above assumptions the forecast of traffic in each of the scenarios are:

Table 4.40 - Forecasts Import of Coal

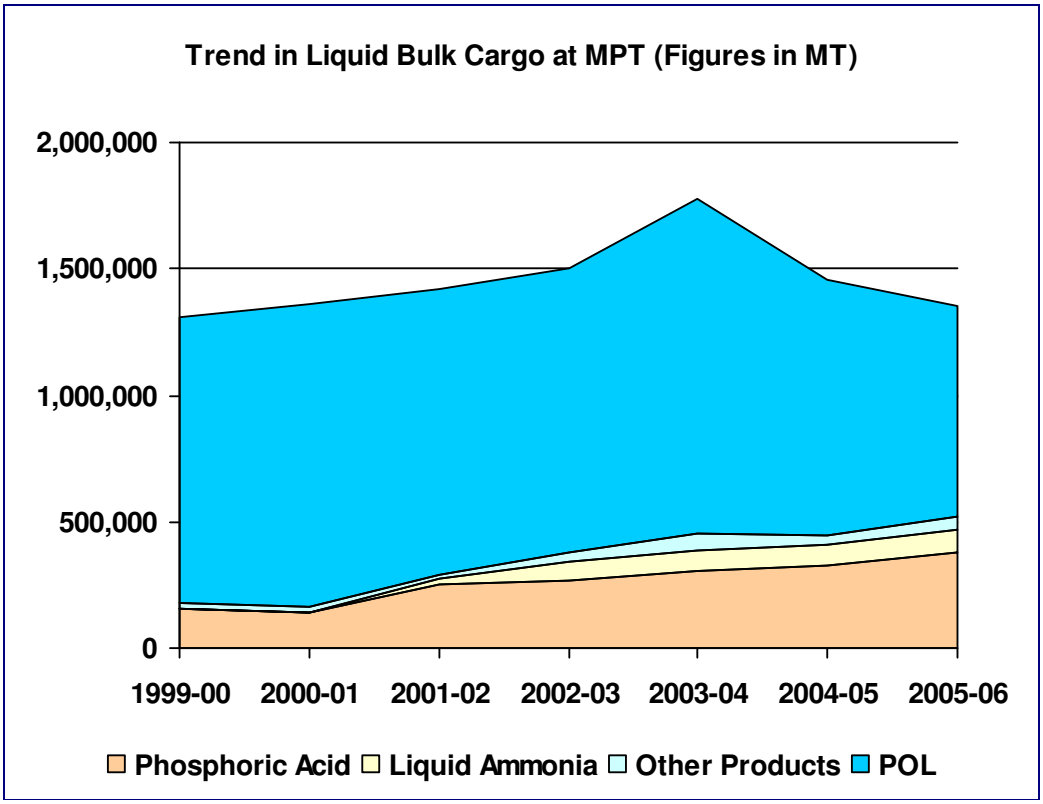
Million tonnes

Forecasts - Import of Coal	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Low case	5.70	5.60	6.16	6.72	6.72	6.72	6.72	7.06
Medium case	5.70	6.70	6.90	6.90	7.15	7.40	7.65	8.03
High case	5.70	8.90	9.90	11.40	11.90	12.40	12.90	13.55

4.3.3 Liquid Bulk

The liquid bulk cargo handled at MPT comprises Petroleum Oil Lubricants [POL], Phosphoric Acid, Liquid Ammonia, and Caustic Soda.

The total liquid bulk traffic has grown by a Compounded Annual Growth Rate [CAGR] of 1% between 1999-2000 and 2005-06.



Source: MPT

Figure 4.31 - Liquid Bulk Cargo at MPT

POL is the largest component of liquid bulk cargo and accounted for about 61% of the total liquid bulk cargo handled at MPT. The slow rate of growth liquid bulk cargo has been due to the decline in POL traffic at the port due to the shift in IOCs imports. IOC accounts for around 50% of the total POL imports. IOC's imports declined in the last three years due to the automation and system revamping work at the IOC handling terminal at Mormugao. During the pendency of the system upgradation at its Mormugao terminal, IOC is handling the cargo at its terminal in Karwar. The cargo handling operations for these customers will be shifted back to MPT as soon the facility at Mormugao is repaired.

In 2005-06, MPT handled 1.35 million MT of Liquid bulk. Of the total about 90,000 MT was through the coastal movements.

(a) Basis for Projections

The liquid bulk forecasts are based on a trend analysis and also interactions with users. All the major importers of liquid bulk cargo were contacted to understand their expansion plans and future demand. The following users were met during the engagement;

1) Indian Oil Corporation [IOC]

2) Hindustan Petroleum Corporation Limited [HPCL]

3) Bharat Petroleum Corporation Limited [BPCL]

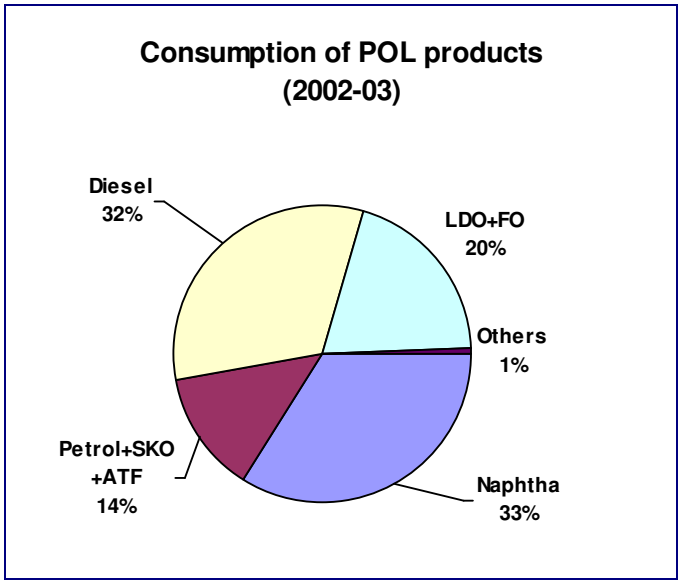
4) Indian Molasses Company [IMC]

5) Zuari Industries Limited [ZIL]

(b) Trend Forecasts for Petroleum Oil Lubricants [POL]

The POL handled at MPT is primarily coastal trade and is used to meet the demand for petroleum products in Goa and North Karnataka. Therefore, POL imports are largely correlated to the economic activity in the State. In addition to imports through MPT[3], a small amount of Aviation Turbine Fuel is also transported by road from Maharashtra to meet the demand in the State. There are no reliable estimates of this amount but our discussions with the national oil companies indicated that this amount is small and can be ignored.

The consumption pattern of the various POL products is provided below.



Source: Petroleum Planning and Analysis Cell, New Delhi

Figure 4.32 - Consumption of POL products

[3] POL movements from Karwar are by road but as this is temporary and will be discontinued after the reopening of the IOC facility at MPT we have ignored the temporary increase in road movement.

POL products for industrial use (naphtha, Fuel Oil and Light Diesel Oil) and for transportation needs each accounted for about half of the total consumption of POL in the State.

POL imports through MPT grew at a rate of 4% per annum between 1999-2000 and 2003-04. The rate of growth of petroleum products has been slower than GSDP growth rates for the following reasons:

1) Slow down in tourist inflows after 2001

2) Greater contribution of non-energy intensive sectors of the tertiary economy to GSDP growth

3) Slowdown in consumption of POL products such as naphtha

Since 2003-04, naphtha prices have increased substantially and consumption of naphtha has decreased. Prices of transportation fuel have increased as well during the same period but these fuels are relatively less price sensitive compared to naphtha and therefore rate of growth in these fuels continues. We therefore expect diesel and petrol sales to have increased at the rate of growth of GSDP while that of naphtha to have declined resulting in an average growth rate of 4%.

We forecast POL consumption to grow at GSDP rates on the following grounds

1) Higher demand in the mining industry

2) Revival in the tourism sector

3) Increased industrial growth leading to increased demand for POL products

We have therefore projected POL consumption to increase by 8% for the next 7 years in line with the projected GSDP growth rate of about 7-8%.

(c) Forecasts of Major Importers for Petroleum Oil Lubricants [POL]

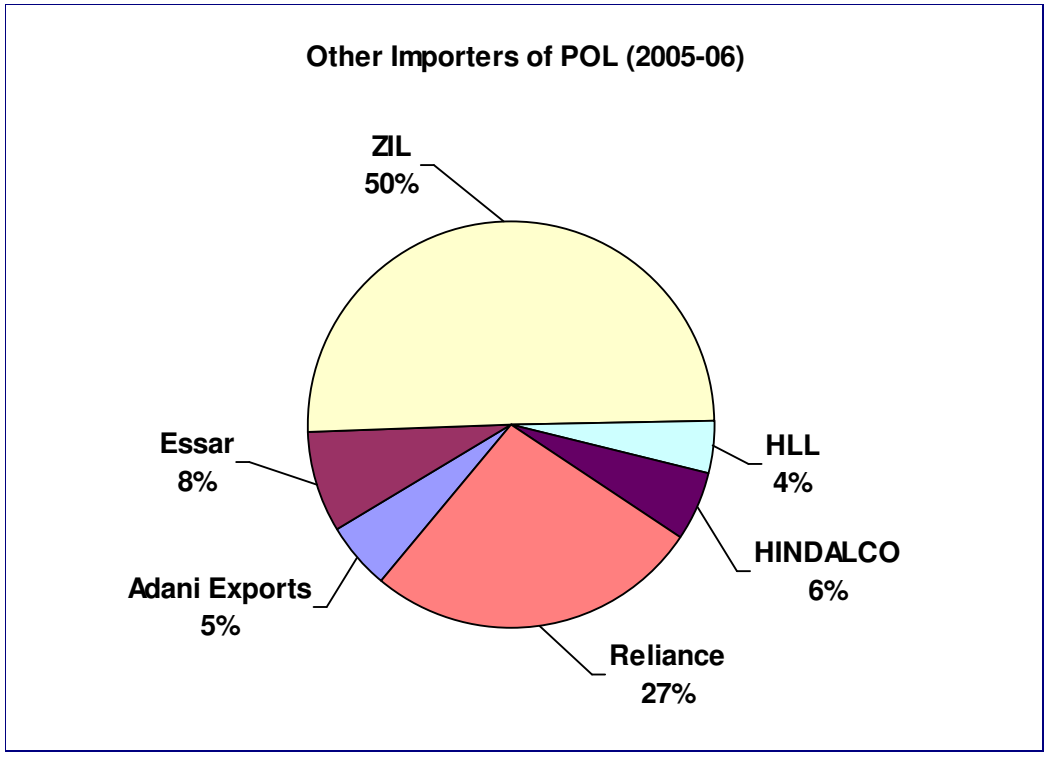
In addition to the trend analysis, we also met with the three major, Indian Oil Corporation [IOC], HPCL and BPCL POL importers of POL to understand their expansion plans and demand projections.

(i) IOC, BPCL and HPCL.

As mentioned earlier, IOC has shifted its POL cargo to Kawar on account of the refurbishment at the MPT terminals used by IOC. The revamping work is expected to finish by January and hence the imports are expected to increase by 45% this year. Thereafter IOC expects its imports to increase by 8%. BPCL and HPCL also expect POL imports to grow by 8%.

(ii) Other Importers

Besides the three major national oil companies, POL imports are undertaken by Adani, Essar Oil, Zuari Industries Limited, Hindustan Level and HINDALCO. The largest importer amongst these is ZIL as indicated in the chart below.



Source: MPT

Figure 4.33 - Other Importers of POL (2005-06)

These imports do not show any distinct trend and therefore we have assumed it will in line with the historical trend in POL growth of 4%.

Table 4.41 – Project POL Traffic (Figures in Mn MT)

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Total POL	1.04	1.12	1.20	1.29	1.39	1.49	1.60

Source: EY, IOC, HPCL, BPCL

(iii) Zuari Industries Limited - Phosphoric Acid and Ammonia

Zuari Industries Limited imports phosphoric acid and ammonia for its fertilizer manufacturing facility.

Imports of phosphoric acid have increased at a compounded annual growth rate of 16% between 1999-00 and 2005-06. This rate of growth in imports shows an erratic trend with a large increase in 2001-02 when imports trebled from 68,000 MT to 219,000 MT. If this increase in excluded and the growth in imports is measured for the period from 2001-02 to 2005-06, the compounded annual growth rate for phosphoric acid works out to 10% per annum. ZIL expects phosphoric acid imports to increase by 20% for next three years. Thereafter, imports are expected to increase by 4% per annum. On an overall basis the trend growth in imports over the next 7 years (from 2006-07 to 2013-14) works out to 11% per annum which is comparable to the trend growth rate. As this is line with the trend growth the same has been used for forecasting phosphoric acid throughput.

Imports of liquid ammonia have grown by 18% between 1999-00 and 2005-06. In a manner similar to phosphoric acid, liquid ammonia imports trebled from 20,000 MT in 2001-02 to 70,000 MT in 2002-03. If the initial year is adjusted to exclude this one time increase, the compounded annual growth rate of imports is 8% per annum.

ZIL plans to expand its production capacity and would require more raw materials. ZIL plans to double its imports in two years. Therefore, liquid ammonia imports are expected to increase by 33% for three years and thereafter by 4%. Between 2006-07 and 2013-14 (the next years) liquid ammonia imports are projected to increase at a compounded average annual growth rate of 13% which is higher than the trend growth rate but is due to the expected doubling of capacity.

The summary of the traffic projections for ZIL are produced below.

Table 4.42 – Summary of ZIL Traffic Projections (Figures in Mn MT)

Mn tons	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Phosphoric Acid	0.48	0.64	0.76	0.92	0.95	0.99	1.03
Liquid Ammonia	0.13	0.18	0.24	0.32	0.33	0.34	0.35

Source: EY, ZIL

(iv) Others

The Indian Molasses Company [IMC] also uses MPT for handling liquid cargo. The cargo handled by IMC has changed due to regulatory reasons. While IMC used to handle molasses till 2002-03, it had to stop handling molasses due to the restrictions on molasses export. IMC started handling 3rd party cargoes from 2002-03 and has increased the volumes handled for third parties. It currently handles Palm fatty acids and CFS for Hindustan Lever Limited and Caustic Soda lye and furnace oil for HINDALCO.

HLL imports 60,000 tons of Palm Fatty Acids and CFS while HINDALCO imports around 90,000 tons of Caustic Soda lye and furnace oil. While IMC believes that it could increase throughput, it is constrained by the availability of land for expanding its storage capacity. Therefore, it expects throughput to remain at present levels in the near future.

Hence we have assumed that together IMC would handle 1,50,000 tons for the next seven years.

Table 4.43 – Projections for IMC Cargo (Figures in Mn MT)

Mn tons	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Palm fatty Acid	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Caustic Soda lye and Furnace Oil	0.09	0.09	0.09	0.09	0.09	0.09	0.09

Source: EY, IMC

There are small quantities of other liquid bulk cargoes which are handled at the port and these aggregate to about 11,000 MT in 2005-06. There is no distinct trend in these cargoes and therefore it has been assumed that they will grow at about 1% per annum.

(d) Summary of the Liquid Bulk Forecasts

The medium scenario forecast for liquid bulk cargo at MPT is provided below.

Table 4.44 – Summary of Liquid Bulk Forecasts – Medium Scenario

(Figures in Mn MT)

Mn tons	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
POL	1.04	1.12	1.20	1.29	1.39	1.49	1.60	1.68
Phosporic acid	0.48	0.64	0.76	0.92	0.95	0.99	1.03	1.08
Liquid Ammonia	0.13	0.18	0.24	0.32	0.33	0.34	0.35	0.37
Palm Fatty Acids	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Furnace Oil	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Others	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total	1.82	2.10	2.37	2.69	2.83	2.99	3.15	3.31

The key difference in assumptions between the high case, low case and medium case are provided in the table below.

Table 4.45 – Differences in Assumption between Low, Medium and High Case

	Other POL	POL (from FY08)
Low Case	4%	4%
Medium Case	4%	8%
High Case	8%	8%

Accordingly, the forecast of traffic in the liquid bulk category in the low and high scenarios has been forecasted as shown below:

Table 4.46 – Forecasts under Low Case (Figures in Mn MT)

(Figures in Mn MT)

Mn tons	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
POL	1.04	1.09	1.13	1.17	1.22	1.27	1.32	1.39
Phosporic acid	0.48	0.64	0.76	0.92	0.95	0.99	1.03	1.08
Liquid Ammonia	0.13	0.18	0.24	0.32	0.33	0.34	0.35	0.37
Palm Fatty Acids	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Furnace Oil	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Others	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total	1.82	2.06	2.29	2.57	2.67	2.77	2.87	3.01

Table 4.47 – Forecasts under High Case (Figures in Mn MT)

(Figures in Mn MT)

Mn tons	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
POL	1.04	1.13	1.22	1.31	1.42	1.53	1.66	1.74
Phosporic acid	0.48	0.64	0.76	0.92	0.95	0.99	1.03	1.08
Liquid Ammonia	0.13	0.18	0.24	0.32	0.33	0.34	0.35	0.37
Palm Fatty Acids	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Furnace Oil	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Others	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total	1.82	2.10	2.38	2.71	2.86	3.03	3.21	3.37

Table 4.48 – Forecasts under Low, Medium and High Cases (Figures in Mn MT)

Mn tons	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Low Case	1.82	2.06	2.29	2.57	2.67	2.77	2.87	3.01
Medium Case	1.82	2.10	2.37	2.69	2.83	2.99	3.15	3.31
High Case	1.82	2.10	2.38	2.71	2.86	3.03	3.21	3.37

Note: The first year figures are the same in all three scenarios as the change in growth for the POL products has been assumed only from FY08. The figures for FY07 include the shifting of IOC from Karwar and therefore the scenario analysis only starts from FY08.

4.3.4 Containerised Cargo

(a) Background

(i) Traffic and Vessels

The containerised cargo traffic in Mormugao port has been increasing over the last five years from 6,247 TEUs (58,000 tonnes) in 2001-02 to 9,456 TEUs (106,000 tonnes) in 2005-06. However, the container traffic in Mormugao Port is pitiably low in comparison with other ports on the west coast like JNPT, which accounts for about half of the total Indian containerized cargo traffic of 4.61 million TEUs. Container vessels are handled at multipurpose general cargo berths 10 and 11 as there is no dedicated berth available for containerized cargo. The containerized cargo received at the Mormugao port is largely captive to Goa.

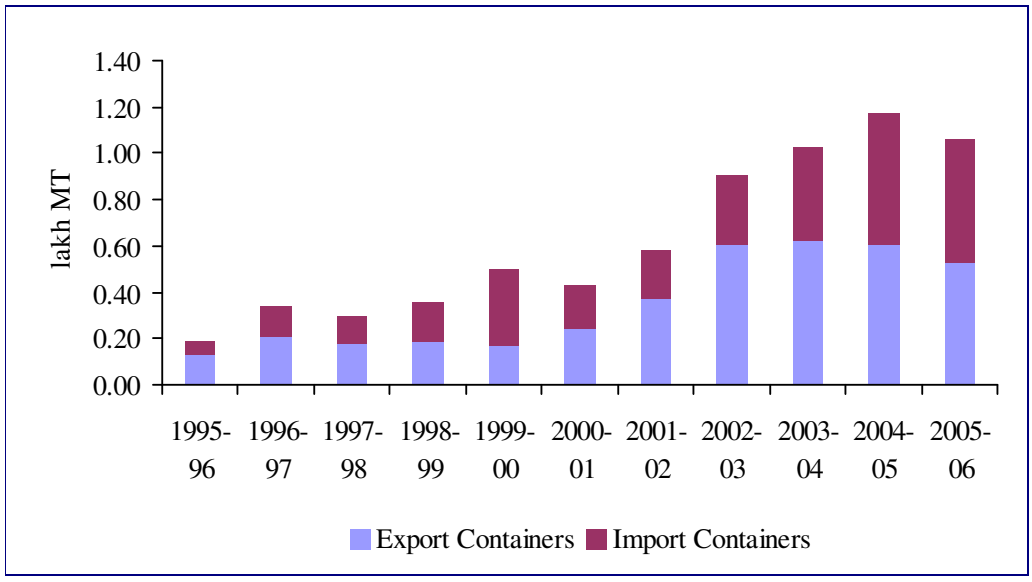


Figure 4.34 - Container exports and imports through MPT

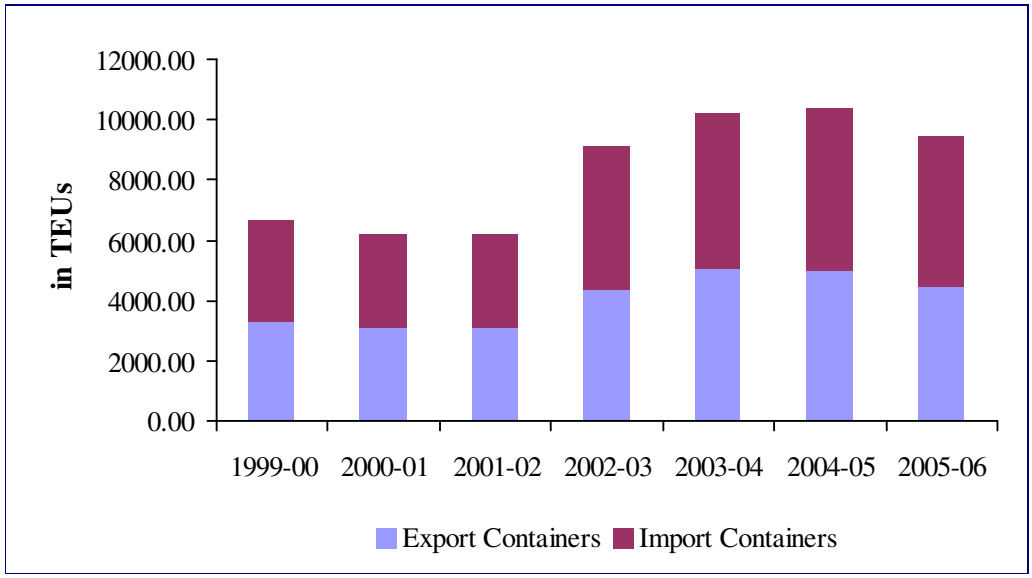


Figure 4.35 - Container exports and imports through MPT

The major container line agent in Goa is Aspinwall & Co which handles 100% of the total containers exported from MPT. Containers vessels call at the port once in a week. Bengal Tiger, the only container vessel calling at the port is a feeder vessel. It carries cargo to the New Mangalore Port and from there to Colombo. Size of the vessels generally ranged below 10,000 DWT.

Table 4.49 - Container Vessels calling at Mormugao Port Trust

DWT Size	No of Ships	Quantity in mn MT	% Share
Below 10,000	37	0.10	97%
10,000-20,000	1	0.05	3%

Source- Planning and Management Services Department, MPT

(ii) Commodity wise containerized cargo Traffic

Imports of containers contributed to about 55% of the total container throughput and no particular commodity accounted for more than 6.3% of the imports in 2005-06. However in exports, frozen fish accounted for 25% of the total exports, followed by brass strips at 16% in 2005-06.

Table 4.50 - Commodity wise Traffic of Containerised Cargo

in TEUs

Commodity wise	2002-03	2003-04	2004-05	2005-06
Imports				
Copper cable scrap & Cathodes	28	219	235	268
Computer parts	240	224	249	200
Photographic paper	-	81	177	139
Microwave Owen	-	-	42	106
X-ray films	77	109	104	106
Zink metal	257	192	135	104
Others	2,099	2,726	3,433	3,304
Total Imports	2,701	3,551	4,375	4,227
Exports				
Frozen fish	699	649	775	866
Brass strips	668	542	545	558
Iron casting	137	255	351	317
Com. For IWT	170	393	294	142
Agiolax	-	-	60	132
Maggi Noodles	49	63	86	116
Gherkins	320	339	224	109
Silico Manganese	-	21	112	105
Thiamethoxam Tech	-	-	46	100
Others	1,578	1,608	1,514	991
Total exports	**3,621**	**3,870**	**4,007**	**3,436**
Empty containers	2,807	2,759	1,983	1,793
Total	**9,129**	**10,180**	**10,365**	**9,456**

(b) Mormugao Port Hinterland

The hinterland of Mormugao port stretches beyond Goa to include certain parts of North Karnataka. However, the hinterland for Mormugao Port Trust is considerably reduced to certain areas of adjoining districts of Belgaum and Uttara Kannada in Karnataka due to;

- Existence of JNPT as a dominant port in handling container traffic. Handling containerized cargo through JNPT offers exporter /

importer the benefits of higher frequency of feeder vessels, availability of empty containers and lower ocean freight rates.

- Constraints in access to hinterland by road / rail due to the Ghat section.

(c) Goa

(i) Goa's Economy

Goa's economy (as measured by the Gross State Domestic Product [GSDP]) has grown at a rate of 7.3% between 1996-97 and 2003-04. In comparison, the All-India Gross Domestic Product [GDP] has grown by 6% during the same period.

Table 4.51 - GSDP of Goa at constant prices (Figures in Rs. Lakh)

Year	GSDP
1996-97	311,883
1997-98	320,734
1998-99	393,187
1999-00	401,475
2000-01	429,747
2001-02	447,198
2002-03	480,843
2003-04	510,662

Source: Economic Survey, 2005-06, Directorate of Planning, Statistics and Evaluation

The tertiary sector is the most significant segment of the state's economy accounting for close to half of the total Gross State Domestic Product [GSDP] followed by secondary sector with a share of 39%. Primary sector accounts for only 12% of the state's GDP.

Table 4.52 - Sectoral Composition of GSDP at constant (1993-94) prices – Goa (Figures in Rs. Lakh)

	2000-01	2001-02	2002-03	2003-04
Primary	49,916	53,222	58,305	60,874
Secondary	158,840	178,105	184,780	200,165
Tertiary	219,991	215,871	221,687	249,623
Total	428,747	447,198	464,772	510,662

Source: Economic Survey, 2005-06, Directorate of Planning, Statistics and Evaluation

(ii) Primary Sector

o Agriculture

The most significant component of the primary sector is the agriculture which accounts for two-third of the total economic activity in the primary sector. Agriculture supports about 17% of the population and about 37% of the total area is dedicated to agriculture. The main crops are rice, coconut, sugarcane, cashewnuts and arecanut. Sugarcane, cashewnuts and arecanuts are cash crops and therefore fetch higher realisations as compared to the cultivation of cereals. The production of the agriculture sector is consumed largely within the state or within India and therefore the activity in this sector is not of great importance to MPT.

o Fisheries

Goa is a maritime state and fisheries are also an important part of the primary sector. The annual fishing catch and the export of marine products is provided in the table below.

Table 4.53 - Annual Fish Catch in MT

Year	Marine	Inland	Total
1997	91,277	3,270	94,547
1998	67,236	3,474	70,710
1999	60,075	3,365	63,440
2000	64,563	3,570	68,133
2001	69,386	3,749	73,135
2002	67,563	3,684	71,247
2003	83,756	4,283	88,039
2004	89,932	4,396	94,328
2005	103,091	4,196	107,287

Source: Economic Survey, 2005-06, Directorate of Planning, Statistics and Evaluation

Of the total fish catch, only about a tenth is exported and the share of exports has not varied much over the years except for 1999, 2000 and 2002. The fish catch has been erratic over the years due to depletion of fish stocks on account of over exploitation, degradation of breeding grounds, fishing during the period when it is banned, discarding of low value fish. However, the State proposes to formalise a policy on fisheries to ensure sustainable development of the sector. The State government has also proposed the setting up of a fish processing industrial estate for the commercial production of value added products. These measures should ensure a steady increase in the production and exports of fish and value added products from Goa.

Table 4.54 - Exports of Marine Products

Year	Quantity (MT)	Value (In Rs. Lakhs)
1997	14,248	6,608
1998	6,175	2,910
1999	9,054	3,491
2000	10,732	3,357
2001	7,714	3,007
2002	15,594	5,620
2003	10,288	3,273
2004	8,856	3,909

Source: Economic Survey, 2005-06, Directorate of Planning, Statistics and Evaluation

The fish catch in Goa is exported in an unprocessed form and hence the exports from this sector is highly seasonal corresponding to the period of fish catch that extends from August to December each year. There major players in this sector has increased from just 2 in year 2002 to 7 in 2006.

Table 4.55 - Major Exporters of Frozen Fish

Company	TEUs (2005-06)		
	MPT	Other Ports	Total
Goan Bounty	88	312	400
Rahul foods	-	160	160
Ulka sea foods	233	20	253
Cham ocean treasures	-	200	200
Quality food	201	100	301
Atlanta sea foods	-	200	200
Corlim Marine	216	34	250
Total	738	1026	1764

Source: Mormugao Port Trust and Companies

(iii) Forecast of export / import traffic from agricultural and Fish products.

Despite agriculture accounting for 2/3rd of the primary sector output, the production of the agriculture sector is consumed largely within the state or within India and therefore the activity in this sector is not of great importance to MPT. However, fisheries in Goa exported about 1,750 TEUs of fish in 2005-06 and have the largest share of container traffic in Mormugao Port Trust. Given the seasonality of exports of fish products and depletion of fish stocks over the years, the relevant method to identify the

potential for exports from this sector would be to understand the expansion and export plans of the major exporters. During our interactions, these major players indicated the following export plans.

Table 4.56 - Export Plans of Major Exporters of Frozen Fish

In TEUs

Company	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Goan Bounty	460	465	480	500	500	500	500	500
Ulka sea foods	303	453	603	703	703	703	703	703
Quality food	300	450	500	500	500	500	500	500
Corlim Marine	300	330	360	400	400	400	400	400
Others	760	460	419	432	450	450	450	450
Total	2,123	2,158	2,362	2,535	2,553	2,553	2,553	2,553

Source: Companies

(iv) Secondary Sector

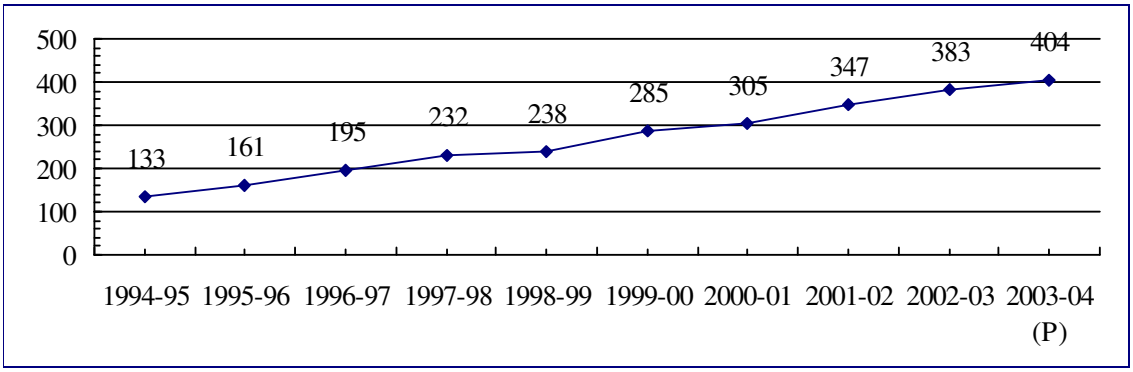
The secondary / manufacturing sector has grown at compounded annual growth rate of 8% between 2000-01 and 2003-04. This growth is significantly higher than the overall growth rate of the State's economy during the same period.

Table 4.57 - GSDP at Factor Cost by Industry of Origin at 1993-94 prices (Figures in Rs. Lakh)

	2000-01	2001-02	2002-03	2003-04	CAGR
Manufacturing	124,813	137,407	143,000	156,017	7.7%
Electricity, Gas and Water Supply	7,209	8,825	9,024	10,383	12.9%
Construction	26,818	31,873	32,756	33,765	8.0%
Total	158,840	178,105	184,780	200,165	8.0%

Source: Economic Survey, 2005-06, Directorate of Planning, Statistics and Evaluation

The manufacturing index of Goa increased from 133 in 1994-95 to 404 in 2003-04 implying a robust growth in the industrial activity in the state.



Source: Economic Survey, 2005-06, Directorate of Planning, Statistics and Evaluation

Figure 4.36 - Manufacturing Index of Goa (Base 1993-04 = 100)

Goa has about 7,029 Small Scale Industrial units [SSI], 154 Large and Medium Scale Industries and has developed / established 20 industrial estates. Many of the small scale and medium scale industrial units are located in the industrial estate which have been developed by Goa Industrial Development Corporation (GIDC). The industry wise distribution of SSI is provided below.

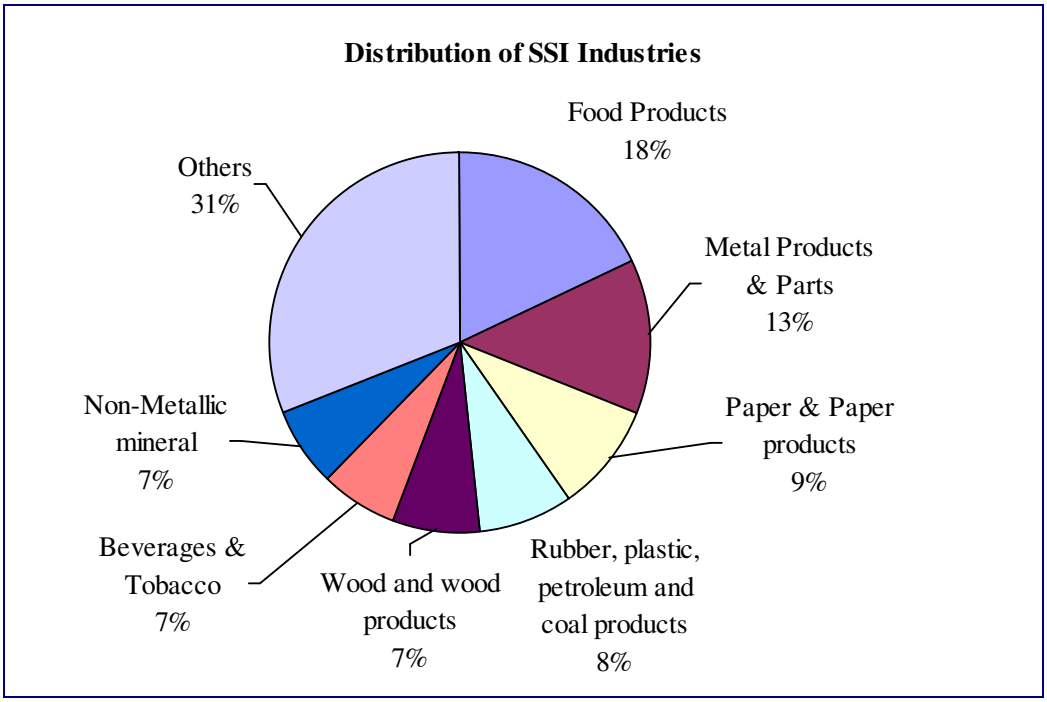


Figure 4.37 - Distribution of SSI Industries

GIDC has established 22 industrial estates – Corlim, Margao, Sancoale, Daman, Mapusa, Tivim, Bicholim, Kakoda, Honda, Bethora, Canacona, Kundaim, Diu, Tuem, Verna, Cuncolim, Pilerne, Marcaim, Pissurlem,

Colvale, Shiroda, Sanguem and other places. Most of the estates are situated within 30 km from the seashore. Besides, there are some industrial parks and zones like the Pharma Park, Biotechnology Park, Apparel Park and Gems and Jewellery Park in Goa.

Figure 4.38 - Goa Industrial Estates

Goa does not have any approved or functioning SEZs, however, the state cabinet has approved the setting up of a Special Economic Zone (SEZ) in a 1,500 hectare area in Keri, Arambol and Morjim. Goa proposes to go in for product specific special economic zones (SEZs) such as pharma, jewellery and biotech parks. The country's second largest pharmaceutical company, Cipla is in the initial state of developing Goa's first pharma special economic

zone (SEZ) in Bhootkhamb near Keri in Goa and would invest about Rs. 650 crore in the new unit.

Industrial activities in the State of Goa encompass about 50 sub sectors including tourism, pharmaceuticals and electrical sectors. Goa's industry policy is oriented towards attracting non-polluting industries to ensure that industrial development does not affect the tourism potential of the state. The major industries in the state are in pharmaceuticals, electronics and food products.

- Pharmaceutical Industry

Goa is the largest drug manufacturing location in India. Goa has around 403 units including loan-licensed units, with about 295 registered pharmaceutical producers. Of this, 108 are independent units. There are only nine manufacturers in the ISM sector in Goa. Many of the leading pharmaceutical companies such as CIPLA, Ranbaxy, Lupin etc. have production facilities in Goa. The annual production of drugs and pharmaceuticals from Goa is over Rs.2800 crore and Goa accounts for about one-tenth of the total Indian pharma production. About Rs.550 crore worth drugs are exported every year. The pharmaceutical industry imports and exports goods from the ports at JNPT and Goa. The major pharmaceutical players having presence in Goa include Madaus Pharmaceuticals, Cipla, Wyeth, Ranbaxy, Watson, Merck, Lupin, Ratiopharm and Pfizer. Most of these players export drugs and other products and import some of the chemicals accounting for approx. 2,000 TEUs of containerized cargo. However, due to the non-availability of a Resident Drug Controller in Goa, almost all of the captive cargo to Mormugao port is shipped through JNPT and other western ports.

- Forecast of export / import traffic from agricultural and Fish products.

Based on the continuing investments in pharmaceutical sector in Goa and also considering the initiatives by the Government in the setting up of Pharma SEZ, the export / import requirement of pharmaceutical companies is expected to triple from the current 2,000 TEUs to about 6,000 TEUs. The expansion and export / import plans of individual Pharma companies located in Goa were obtained through interactions with them.

Table 4.58 - Forecasted Container Export / Import throughput of Major Pharma Companies

In TEUs

Company	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Pharma	2,568	3,293	4,236	4,645	5,095	5,590	5,862	6,148

Source: Companies

o Electronics Industry

Electronics industry is one of the major industries in the state of Goa. The major players in the electronics industry in Goa include D-Link (India) Ltd., Zenith Computers Ltd., IFB Industries Ltd., Computer Graphics Litimited. During 2005-06, approx 1400 TEUs of cargo were imported by the major players in electronics industry. The import traffic expected from these players, based on interactions with the players is provided below:

Table 4.59 - Forecasted Container Export / Import throughput of Major Pharma Companies

In TEUs

Company	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
D-Link (India) Ltd.	512	640	768	922	1,106	1,106	1,106	1,106
Zenith Computers Ltd.	366	403	443	487	511	537	564	592
IFB Industries Ltd.	500	600	700	775	850	900	1,050	1,050
Computer Graphics Litimited	181	208	239	263	289	318	350	385
Total	1,559	1,851	2,150	2,447	2,756	2,861	3,070	3,133

Source: Companies

o Others

The other sectors in Goa that has potential importance for Mormugao Port Trust include film manufacturing, glass fiber, metals casting and steel. These sectors together contributed to about 6,400 TEUs of containerized cargo exports and imports. Based on interactions with the players the containerized cargo throughput is forecasted as follows:

Table 4.60 - Forecasted Container Export / Import throughput of other Industries

In TEUs

Company	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Other industries	7,279	8,983	10,050	10,937	11,627	12,399	13,200	13,805

Source: Companies

(v) North Karnataka

Regions close to the borders of Goa in the districts of Belgaum and Uttar Kannada in North Karnataka comprise the hinterland for Mormugao Port. There are about 9 KSSIDC industrial estates and 3 KIADB industrial areas in

these two districts. However, the minor port of Karwar and the JNPT compete with Mormugao port for container cargo from 4 KSSIDC industrial estates and 3 KIADB industrial areas. Hence effectively, the containerized cargo from the industries in Belgaum and Hubli can be potentially be attracted to Mormugao port.

Figure 4.39 - Industrial Areas of Karnataka

Belgaum and Hubli are among the fastest growing cities in the northwest part of Karnataka. The district of Belgaum borders two states, Maharashta and Goa. Belgaum has several large industries, important among them is the INDAL Aluminium Factory and the Polyhydron Pvt. Ltd. Belgaum acts as a trade centre for food grains, sugarcane, cotton, tobacco, oilseed, and milk products. Industries include leather, clay, pottery, soap, cotton, and precious metals. Belgaum district has about 611 establishments across various industries.

Table 4.61 - Statistical Scenario of the Industries in Belgaum District

Taluka Name	Type of Industry				
	Clothes	Chemicals	Engineering	Others	Total
Athani	1	1	1	5	8
Bailhongal	-	-	-	31	31
Belgaum	8	1	144	245	398
Chikodi	1	2	6	58	67
Gokak	38	1	4	17	60
Hukkeri	-	1	2	8	11
Khanapur	-	-	-	10	10
Raybag	-	-	-	2	2
Ramdurg	-	-	-	8	8
Saundatti	1	-	-	15	16
Total Number of Industries	49	6	157	399	611

Despite the concentration of industries in Belgaum district, many of the players do not have considerable size of exports and imports. The consignments are shipped on LCL basis (Less than container load) and even after consolidation, the container throughput from these players do not translate to a sizeable quantum to justify transporting through rail in frequent intervals. Moreover, the poor state of road infrastructure that connects Mormugao port to the hinterland reduces the opportunity available to Mormugao port. Hence we have, for the container traffic forecasts, only considered the potential traffic generated by players with sizeable import / export requirements – Hindalco, Shree Renuka Sugars and Ken Agritech. These companies generate a traffic of about 7,000 TEUs which is expected to grow to 12,500 TEUs in 7 years time.

Table 4.62 - Forecasted Container Export / Import throughput from North Karnataka

In TEUs

Company	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Belgaum and Hubli	7,700	8,470	9,317	10,249	10,761	11,299	11,864	12,457

Source: Companies

(d) Containerised Cargo Forecast and Scenarios

The containerized cargo traffic for Mormugao Port has been forecasted under three scenarios – low, medium and high. The assumptions forming the basis for each of these scenarios are provided below:

- *Low case*: No efforts are made by the port to increase the traffic.
- *Medium case*: Improvements are made by MPT on areas including (a) Upgradation of Port equipments, (b) Increasing frequency of feeder vessels and lowering of ocean tariff to equal JNPT, (c) Increasing berthing and terminal storage capacity adequately, and (d) Labour related issues.
- *High case*: Establishing good connectivity between North Karnataka and the port through rail / road for container movements in addition to Improvements as provided in medium case.

Based on the above assumptions the forecast of containerized cargo traffic in each of the scenarios are:

Table 4.63 - Forecast of containerized cargo traffic

TEUs

Scenarios	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Low case	8,281	8,695	8,695	8,695	8,695	8,695	8,695	9,347
Medium case	8,794	13,268	15,250	16,598	17,708	18,762	19,747	21,228
High case	16,494	21,738	24,567	26,847	28,469	30,061	31,611	33,982

* Forecasts are only for laden containers. Approx. 15% of the above forecasts can be considered as import / export of empty containers.

4.3.5 General Cargo

(a) Background

Mormugao Port currently handles general cargo traffic in general cargo berths 10 and 11. License is also given to ABG Goa Port Ltd (Presently known as South West Ports Ltd) on a BOOT basis allowing it to handle any bulk cargo at berths 5A and 6A. However, berths 5A and 6A are presently handling only coal and coke and the entire general cargo is handled from berths 10 and 11. Mormugao port handled about 0.73 million MT of general cargo in the year 2005-06, of which about 66% were imports.

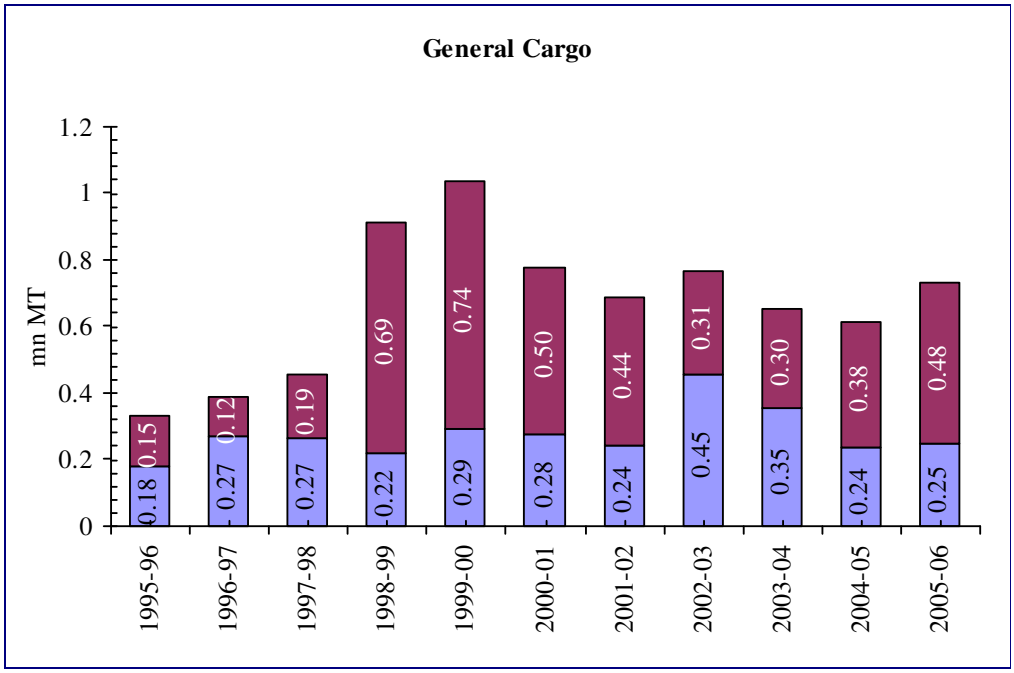


Figure 4.40 - General Cargo

The major commodities exported as general bulk cargo are calcined alumina and petroleum coke. In the year 2005-06 these two categories accounted for almost 100% of the general cargo exports. However, the exports of these two principal commodities in the past have varied considerably year on year.

Table 4.64 - Major Commodities Exported Among General Cargo

Million tonnes

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Calcined Alumina	139,659	123,493	165,639	155,726	107,657	176,666
Petroleum Coke	46,543	46,560	38,694	66,720	47,535	70,172
Total Exports	278,343	242,726	454,300	353,190	235,926	247,808
% of Total Exports	45%	63%	66%	100%	80%	89%

Source: MPT

The major alumina exporters in the hinterland of Mormugao port are Hindalco and Indian Aluminium Co. However, considerable exports from these exporters are shipped through ports other than Mormugao Port Trust.

Imports of general cargo aggregated to 0.48 mn tonnes during the year 2005-06. Major commodities imported among the general cargo category are raw pet coke and limestone, which accounted for 75% of the total general cargo imports. Imports of limestone and raw petroleum coke are primarily for use in the domestic steel industries.

Table 4.65 - Major Commodities Imported Among General Cargo

Million tonnes

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Raw Pet Coke	78,295	119,132	85,057	104,231	94,783	101,041
Limestone	133,409	187,305	180,045	175,278	183,627	264,529
Total Exports	498,625	441,871	310,615	302,105	377,217	484,739
% of Total Exports	42%	69%	85%	93%	74%	75%

Source: MPT

(b) General Cargo Forecast

The general cargo accounts for only 2% of the present throughput of Mormugao Port Trust. The forecast for this category has been made based on an analysis of historical trends of cargo throughput in Mormugao Port Trust. However, the prime cargo of limestone and potential exports of steel have been adjusted for new developments in the industrial scenario in Goa and the secondary hinterland as provided below.

(i) Steel Exports

- Background

The exports of steel through Mormugao port had peaked to 0.2 million tonnes during 2002-03, however, only to decline to 0.06 million tonnes in 2004-05 and none in 2005-06. The export of steel through Mormugao Port Trust has shown an erratic trend during the past years, thereby making them very difficult to forecast.

Table 4.66 - Steel Exports

Million tonnes

Steel Exports	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
H.R Steel Coils	70,547	37,290	201,301	73,166	26,193	-
Steel Slabs	-	-	14,187	-	35,791	-
Steel Bars	-	-	12,205	15,050	-	-
Total	70,547	37,290	227,693	88,216	61,984	-

Source: MPT

- Forecast for Exports of Steel

A Production and Exports of Steel in India

Presently, the global production of steel is to the tune of 1,130 million tonnes and India ranks 8th with a production of 38.1 MT in 2005.

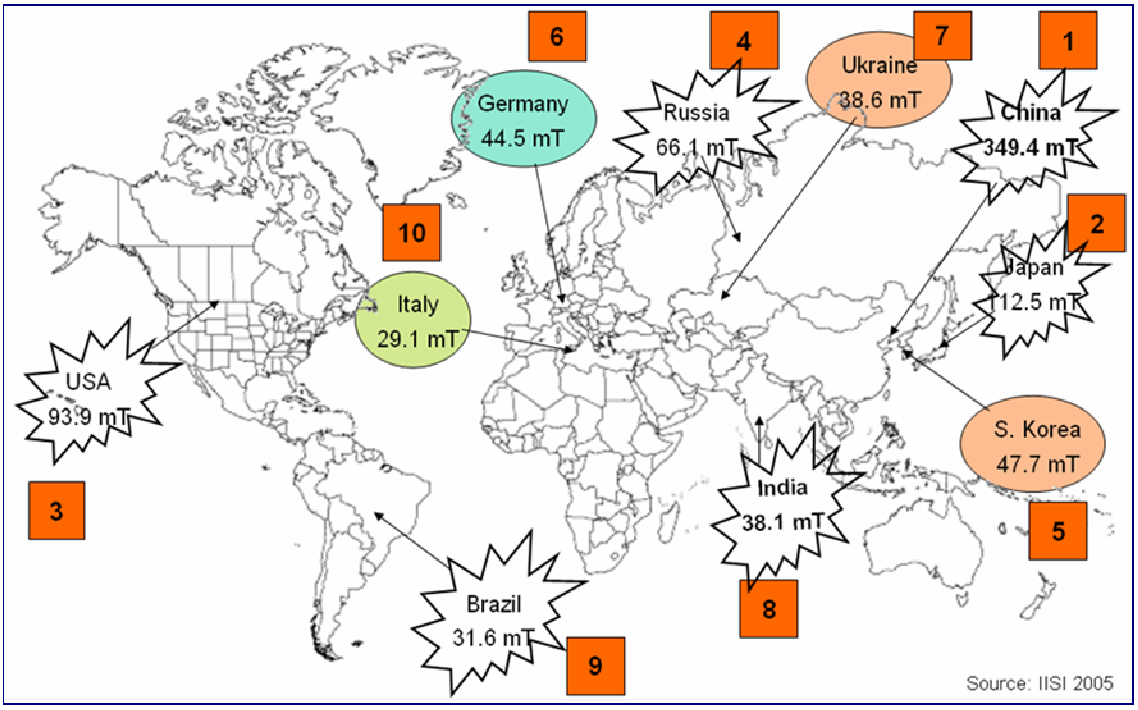


Figure 4.41 - Top ten countries in the world based on the steel production during 2005

India's per capita consumption of steel is about 33 kg, which compares poorly against the world average of 181 kg. Despite having significant reserves of iron ore in India, India presently only produces about 38MT of steel. The National Steel Policy approved by Government of India in 2005, has laid emphasis on increasing the production of steel in India and has targeted 110 MT of steel production by 2019-20 from the existing level of 38 MT in 2004-05. Export of steel is targeted to grow from the present 4 million tonnes in 2004-05 to 26 million tonnes by 2019-20.

Table 4.67 - National Steel Policy – 2005

Million tonnes

	Steel Production	Steel Imports	Steel Exports	Steel Consumption
2004-05	38	2	4	36
2019-20	110	6	26	90

About 98 MT pa of capacity expansion in the steel sector has already been planned to meet the targets set by National Steel Policy. Many of the projects are proposed to be set up in Eastern India, due to the proximity to raw materials.

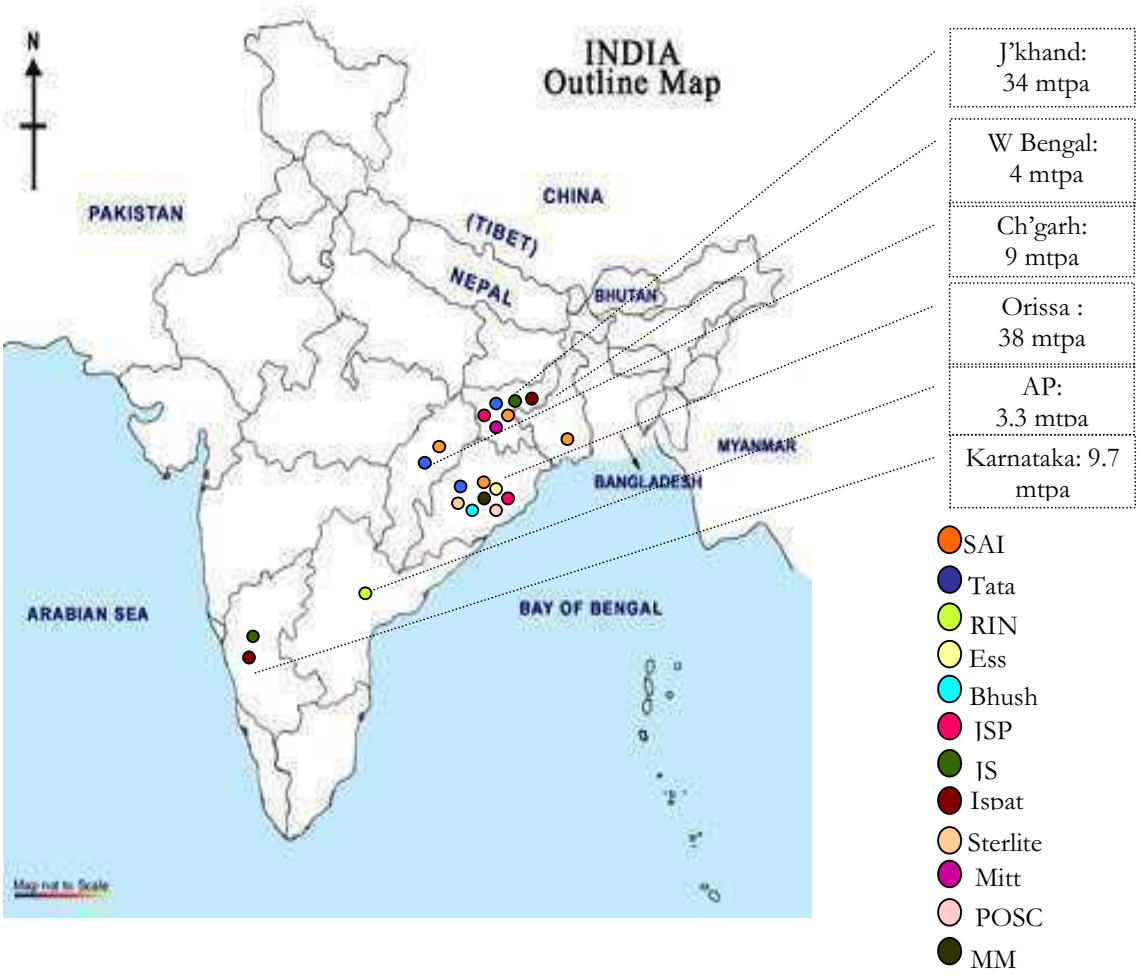


Figure 4.42 - Statewise capacity additions upto 2012

There are only 3 projects cumulating to 13 million tonnes p.a. in south India. Of these, the project in Andhra Pradesh will use the port in that state and the other two in Karnataka may use either Mormugao Port or Mangalore Port. However, the ISPAT unit is closer to Mangalore and is expected to use that port for exports of steel. Hence among the major players only the expansion plans of JSW steel and their export plans are relevant for the forecast of exports of steel.

Considering the hinterland of Mormugao Port Trust and the fact that there are no fresh capacity additions in the hinterland that could potentially be tapped by Mormugao port, the potential users of the port for exports of steel are confined to Goa based steel manufacturers and JSW Steel Ltd.

B Goa Based Manufacturers of Steel

The export of steel by smaller Goa based steel manufacturers are not considered in our forecast for the following reasons:

1) The volumes of production by these manufacturers are not significant enough to allow viable exports of steel,

2) The exports of steel from India are primarily in value added products and steel slabs segments in which the Goa-based manufacturers do not have a considerable presence.

3) The Goa-based manufacturers primarily cater to the domestic market and exports are made only if the price realizations are significantly higher to the domestic prices.

C JSW Steel Ltd

JSW Steel's exports contributed about 34% of the total sales revenues of the company in the year 2005-06. However, the company presently does not use Mormugao Port Trust for handling its exports of steel.

Berths 5A and 6A have been licensed to South West Ports Ltd. and it acts as a captive facility for handling JSW Steel import / export requirements. The company is proposing to export steel from 2007-08 from berths 5A and 6A alongside imports of coal/coke to enable it to reduce costs due to synergy benefits like optimal usage of the rail wagons in both directions. Thus, Mormugao Port offers considerable cost advantage to JSW steel over other ports (especially Chennai port) because of its usage as a captive facility. In a measure to benefit further from low costs, SWPL has bid for the license of berth 7 and has plans to operate it for additional requirements of JSW steel as well. Considering this, the entire export requirement of steel can be attracted to Mormugao Port should proper cost-effective infrastructure be offered to them. Also based on our discussions, the company has plans to export its entire consignment of steel from Mormugao Port Trust due to the cost advantage. As indicated to us by SWPL, the berths 5A and 6A can handle upto 1.5 million tonnes of steel apart from handling coal/coke.

Despite significant capacity addition plans, based on discussions with the company and SWPL, the export throughput may not increase proportionately, owing to the growing domestic demand for steel products. The planned export of steel as indicated to us by SWPL is given below, which have been considered for our forecasts:

Table 4.68 - Planned steel export

Million Tonnes

Steel	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Export requirement	1.30	1.50	1.50	1.75	2.00	2.00	2.00

Source: SWPL

(ii) Limestone Imports

o Background

The imports of limestone through Mormugao port has witnessed a 5 – year CAGR of 15%, doubling from 0.13 million tonnes in 2000-01 to 0.26 million tonnes in 2005-06.

Table 4.69 - Imports of Limestone

Million tonnes

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Limestone	133,409	187,305	180,045	175,278	183,627	264,529
Growth %		40%	-4%	-3%	5%	44%

Source: MPT

o Forecast for Imports of Limestone

Imported limestone is primarily used by the steel manufacturing units for its consumption in the production process. Presently, the only importer of limestone through Mormugao Port Trust is the non-captive user – JSW steel Ltd. As discussed in the section on forecast of coal and steel traffic, there are only 3 new steel projects cumulating to 13 million tonnes p.a. that are planned to be commissioned in south India. Of these, the project in Andhra Pradesh will use the port in that state and the other two in Karnataka may use either Mormugao Port or Mangalore Port for handling its imported limestone. However, the ISPAT unit is closer to Mangalore and is expected to use that port for import of limestone, leaving only JSW Steel and the Goa based steel manufacturers as potential users of Mormugao Port Trust for imports of limestone.

The capacities of Goa based manufacturers of steel are small in relation to the size of the Indian steel industry and import of limestone for use in their steel manufacturing process is unviable. Therefore, we have projected the demand for limestone incorporating the expansion plans of the current consumer - JSW steel Ltd

JSW has planned to increase its steel-making facility from 2.5 to 3.7 million tonnes (expected to be fully operational by 2nd quarter of 2006-07) and further to 7 million tonnes by 2008. The imported limestone requirement of

JSW, based on their announced expansion plans, would grow to about 0.62 million tonnes by 2008. Also during our interactions with SWPL and JSW Steel Ltd the import requirements were conveyed to us as 0.70 MT pa in 2008 which would grow upto 0.83 MT pa in 2010 due to further capacity expansions. However, we expect the import requirements of JSW steel to stabilize at 0.62 million tonnes from 2008.

Table 4.70 - Limestone Import Requirement

Million Tonnes

Limestone	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Import requirement	0.54	0.62	0.62	0.62	0.62	0.62	0.62

Source: SWPL

(iii) Others

In 2005-06, Mormugao Port Trust witnessed a traffic of about 0.47 million tonnes of general cargo other than limestone and steel. Dry Bulk cargo constituted about 62% and the rest were bagged cargo. The forecast of traffic from other general cargo has been assumed to grow based on the broad GSDP of the State of Goa. Goa in the recent years has clocked a GSDP growth of about 5.3% (5 year CAGR from 1998-99 to 2003-04).

Table 4.71 - GSDP of Goa at constant prices

Year	GSDP (Rs. Lakh)	Growth %
1996-97	311,883	
1997-98	320,734	2.8%
1998-99	393,187	22.6%
1999-00	401,475	2.1%
2000-01	429,747	7.0%
2001-02	447,198	4.1%
2002-03	480,843	7.5%
2003-04	510,662	6.2%

The general cargo traffic for Mormugao Port Trust has been forecasted under three scenarios – low, medium and high. The assumptions forming the basis for each of these scenarios are provided below:

Table 4.72 - Assumptions in general cargo forecast

Commodity	Low	Medium	High
Export of Steel			
JSW Steel	Exports of steel reduce by 40% of the indicated plans by JSW Steel.	Exports of steel reduce by 25% of the indicated plans by JSW Steel or exports are made to the tune of steel handling capacity at berths 5A and 6A to benefit from the resulting cost advantage.	Exports of steel is made as per the indicated plans of JSW Steel
Goa Based manufacturers	No Exports	No Exports	No Exports
Import of Limestone			
JSW steel	Imports of limestone reduce by 25% of the base case	JSW steel import as targeted by SWPL at 0.45MT per year after stabilisation and 0.37 MT in 2006-07	JSW steel imports all its requirement from Mormugao Port (0.62MT at full capacity)
Other minor steel producers in Goa	No Imports	No Imports	No Imports
Other General Cargo			
All Exports / Imports	GSDP growth rate of 3%	GSDP growth rate of 5%	GSDP growth rate of 8%

Based on the above assumptions the forecast of general cargo traffic in each of the scenarios are:

Table 4.73 - General Cargo Forecast

Million tonnes

Forecasts - General Cargo	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Low case	1.78	2.04	2.06	2.07	2.09	2.10	2.12	2.23
Medium case	2.16	2.47	2.50	2.52	2.55	2.58	2.61	2.74
High case	2.34	2.66	2.71	3.01	3.31	3.36	3.42	3.59

4.3.6 *Cruise*

Goa, being a popular tourist destination, attracts about 42% of the total cruise lines in India. About 45 cruise vessels calls were witnessed at Mormugao Port during the year 2005-06 as compared to only 7 in the year 2004-05.

Table 4.74 – Cruise Vessels Calls

Year	Vessel
1998-99	23
1999-00	20
2000-01	25
2001-02	11
2002-03	10
2003-04	10
2004-05	7
2005-06	45

Source: MPT

During the years 2001-02 to 2004-05 the number of cruise vessels calling at the Mormugao Port saw a substantial dip, primary reason being the "9/11" incidents in the US. However, the traffic rebounded in 2005-06 to 45 calls.

Presently, Super Star Libra and Ocean Cruise are the two Cruise liners calling at the port regularly. They call at the port twice in a week and twice in ten days respectively. However, the cruise stops in the monsoon season.

The cruise vessels are generally received in the general cargo berth 10 and occasionally also in the liquid cargo berth 8.

(a) Tourism Industry

(i) World Tourism Market

The Worldwide tourism industry was valued at about US $ 7.7 billion in 2000 by World Tourism Organisation (WTO) with a total of 698 million tourists. It is estimated by WTO that the domestic tourists are about 10 times that of the international tourists and international tourism has been growing at more than 5% over the last 20 years.

(ii) India Tourism Market

Tourism is an important industry in India accounting for 2.5% of GDP and ranks as the 3rd largest foreign exchange earner. The industry also makes an indirect contribution to economy with significant linkages with agriculture, horticulture, handicrafts and construction. India emerged as the 5th most

preferred destination by the world's travelers in a survey conducted across 134 countries. India is increasingly becoming a destination for many tourists as witnessed by the consistent growth in inbound tourist traffic over the last two years. International tourist arrivals in India increased by 43% in FY2005 and, according to secondary studies, the tourism industry could post double-digit growth over the next decade. The leisure travel segment in India, which is highly price elastic and under-penetrated, has significant scope for growth.

Table 4.75 - Trends in Foreign Tourism Traffic in India

	1997	1998	1999	2000	2001	2002	2003	2004
Foreign tourists (in 000s)	5.5	5.5	5.8	5.9	5.4	5.2	6.7	8.3
Growth %		1%	5%	1%	-8%	-5%	30%	24%
Leisure tourists (in 000s)	2.4	2.4	2.5	2.6	2.5	2.4		
Growth %		1%	4%	4%	-4%	-4%		

Source: Indiastat.com

The support provided by the government, in particular, the successful 'Incredible India' publicity campaign implemented by the government during 2002-04 played an important role in boosting tourist arrivals into India. The Tenth 5 year plan (2002-07) of the government considers tourism as a major engine of economic growth and employment generation and has allocated Rs. 29 billion of resources towards tourism. The Domestic tourism is also increasing on the back of growing incomes as well as improvements in tourist facilities.

(iii) Goa Tourism Market

Tourism is an important contributor to the State's economic prospects and this is reflected by the share of services sector in the overall economy. The services sector, primarily driven by the tourism in the state, contributes close to half of the State's economy. Goa's industry policy is also oriented towards attracting non-polluting industries to ensure that industrial development does not affect the tourism potential of the state.

The tourist arrivals in Goa has increased at a 20 year CAGR of 5.3% from 0.7 million in 1985 to 2.2 million in 2005. During the recent 5 years the growth in tourist arrivals in Goa has increased at an accelerated growth of 11.7% crossing 2 million tourists, primarily driven by the growth in domestic tourists.

Table 4.76 - Tourist Arrival

Year	Domestic	Foreign	Total
1985	682,545	92,667	775,212
1990	776,993	104,330	881,323
1995	878,487	229,218	1,107,705
2000	976,804	291,709	1,268,513
2001	1,120,242	260,071	1,380,313
2002	1,325,296	271,645	1,596,941
2003	1,725,140	314,357	2,039,497
2004	2,085,729	363,230	2,448,959
2005	1,879,548	326,803	2,206,351

(b) Cruise Ship Tourism Sector

(i) World Cruise Ship Tourism Sector

The cruise ship tourism, valued at US $ 17 billion in 2005, has been the fastest growing sector in the tourism industry, growing at twice the rate of overall tourism sector with an 8% annual growth since 1980. It is estimated that about 8.5 million people took cruises worldwide in 1997. The North American market (including the Caribbean) is the dominant one accounting for 80% of total cruise passengers and attracting over 5.05 million passengers in the year 1997. Caribbean is the most popular cruise ship destination accounting for 50% of the capacity in 1999 followed by Mediterranean (15%), Alaska (8%), trans – panama canal (6%), west Mexico (5%) and northern Europe (4%).

The Asian cruise tourism is relatively small to the world market. But the market has shown high growth rates and a good growth potential in the future as is evident from the fact that over 7% of the world's cruise fleet is designated on ASEAN routes. The Asian cruise ship tourism sector witnessed a strong growth during the 1990s. Singapore, with its heavy investment in infrastructure has ensured its place as the hub for Asia cruise operators. Singapore is the leading cruise port in Asia – Pacific region and has growth to 1 million from a meager 0.13 million in 1991 - an eight fold growth in 15 years.

Three big cruise companies in the world – Carnival, Royal Caribbean International and Princess collectively control over two – thirds of the North American market and over 55% of the world cruise ship tourism market. Star Cruises, the Malaysian-based and the 4th largest cruise tour operator caters primarily to the Asian tourists. These four large operators share amongst themselves a market of 74% of the total global passenger capacity.

However, the rest of the market is shared by over 45 cruise operators operating with over 125 vessels.

(ii) Indian Cruise Ship Tourism Sector

Despite having a 6,000 km coastline, the Indian cruise ship tourism market is still at its initial stages of development. An array of shortcomings like modest port infrastructure, unfriendly tax structure and lack of proper awareness about cruise tourism contributes to this lack of development in the cruise ship tourism segment. All the ports in India concentrate on cargo traffic which has largely restricted the market for cruise tourism in India. The cruise traffic in the Indian ports in the past 7 years is given below:

Table 4.77 - Cruise Traffic in Indian Ports

Year	Mumbai	Mormugao	Mangalore	Cochin	Tuticorin
1999	33	23	-	21	-
2000	20	20	-	23	-
2001	34	25	14	34	
2002	17	11	5	22	3
2003	10	10	1	11	1

However, the Indian cruise ship tourism sector has a good growth potential driven by the following:

a) The global majors in the cruise ship tourism sector are facing intense pressure to add exotic locations in their itineraries to retain their customers from competition. As a result, these players have increased their focus on the Asian tourism destinations to make it the fastest growing market in the cruise tourism segment. India with its scenic beauty along the coasts and rich cultural heritage have come under the radar of these leading players.

b) World over, the cruise sector's ability to increase its passengers has been based on its success in reaching beyond its traditional upper and upper-middle class base into the middle-class mass market. The average age of cruise passengers and their average income have fallen steadily over the years. The demographic profile of India with a large share of the population in the 20-35 years of age, the rising per capita income coupled with a decrease in cruise travel rates by the operators will induce the market to develop.

Mumbai Port is the home port for cruise tourism in India and is the only location where an overnight stay is availed. Presently, about ten cruise lines

call at the Indian ports of Mumbai, Mangalore, Kochi and Mormugao. They include Cunnard line, Holland America line, Orient line, Silversea Cruises, P & O Cruise, Pacific cruises and Norwegian Cruise line.

(c) Forecast Of Cruise Vessel Calls

Mormugao Port Trust was considering the development of a cruise-cum-container terminal facility at Baina Bay and CES was appointed for studying the feasibility of the project. In projecting the demand for cruise vessels we have depended on the conclusions of this feasibility study apart from secondary information on the cruise industry and discussions with certain cruise tour operators in India and few shipping support service providers in Goa.

(i) Conclusions of Feasibility Study

Since the past cruise vessel traffic in Goa do not reflect any trend, the forecasts in the feasibility study were made using the International tourist traffic to India. The following three approaches were used to project the international tourist traffic into India.

a) WTO forecast

b) GDP forecast

c) Growth based forecast

- WTO forecast

WTO, as per its "Tourism Vision 2020" report, forecasts the global tourism in 2010 to reach 1 billion. India's share is forecasted at 5.2 million international tourists in 2010 and 9.5 in 2020.

Table 4.78 - Indian Share in World forecast of International tourists

(in Millions)

Region	No. of International Tourists			
	1995	**2005**	**2010**	**2020**
World	560	790	1000	1560
South Asia	4.2	7.5	10.6	18.8
India	2.1	3.7	5.2	9.5

- GDP forecast

The foreign tourist traffic in India has been correlated with GDP with a linear regression model with data points of the last 12 years. A correlation of 0.93 was observed and the analysis projects the international tourists in India to grow to 3.9 million in 2010 and 6.5 million in 2020.

Table 4.79 - Foreign Tourists

Year	2005	2010	2015	2020
Tourists (in million)	3.1	3.9	5.0	6.5

- Growth Based Forecast

Based on the 10th Five year plan target of 10% annual growth in tourists upto 2010 and assuming the growth rates of 9% and 8% for the following two five year periods, the international tourists were projected to grow to 4.9 million in 2010 and 9.1 million in 2020.

Based on the past trends in (a) proportion of cruise tourists to total international tourists and (b) the average passengers per cruise ship the following ship-calls forecasts have been made under each of the approaches.

Table 4.80 – Growth Based Forecast

Year	2005	2010	2015	2020
WTO forecast	211	285	399	542
GDP based forecast	176	225	286	369
Growth based forecast	183	280	388	519

- Mormugao as a Port of Call

Based on the current patterns of cruise vessel calls and the increasing importance of Goa as a tourist destination, 50% of the overall cruise lines are expected to call at Mormugao port. However, this only accounts for the cruise traffic on account of inbound traffic.

- Mormugao as a Home Port

If port infrastructure and facilities are developed considering the expectations of cruise travellers and cruise liners, Mormugao port has the potential to become a home port for cruise lines and additionally attract the following tourist traffic.

a) Incoming international tourist arriving in India by air and take to cruising ex-Goa instead of ex-Mumbai.

b) Domestic tourists looking for cruising experience and are lost to the port in Singapore. About 22,000 Indians are estimated to take cruise tourism from Singapore and other ports.

These two segments will add another 30 to 35 cruise sailings per annum from Goa.

- Forecasts for Mormugao port

The forecasts have been made considering the above analysis as a medium case scenario.

Table 4.81 - Forecast of Ship Calls in the Medium Scenario

Year	2006	2008	2010	2013	2016	2019
As port of call	55	90	140	170	205	245
As home port	20	25	35	40	50	55
Total	75	115	175	210	255	300

In the high scenario, the traffic is expected to be 5% higher and in the low scenario, it is expected to be 20% lower.

Table 4.82 - Forecast of Ship Calls

Year	2006	2008	2010	2013	2016	2019
Low	60	92	140	168	204	240
Medium	75	115	175	210	255	300
High	79	121	184	221	268	315

(ii) Discussions with Cruise Liners and Shipping Support Service Providers

Discussions were held with the two leading cruise shipping liners in India – Star Cruise and Indian Ocean and with the local shipping support service providers – J M Baxi & Co., Elesbao Pereira & Sons. All the discussions yielded similar results:

a) The cruise liners are considering to increase the number of cruise travels in the immediate term and is also planning to call at Mormugao port.

b) The cruise liners and the shipping support service providers feel that the port requires improvement in facilities and infrastructure to enable the cruise liners to operate more frequently and to consider using Mormugao port as a home port.

Considering the fact that the CES feasibility report was made only 18 months ago, our discussions with the cruise liners indicated forecasts to be in line with the CES feasibility report. Hence, the above forecasts are considered

appropriate to be used for the current exercise of preparing business plan for Mormugao Port Trust.

4.3.7 *Others (Offshore supply vessels, shipyards, navy & coast guard vessels)*

(a) Shipyard

We have examined the prospect of developing a shipyard within the MPT port limits. The major drawbacks in setting up a shipyard in Goa are the lack of skilled manpower, non-availability of land, distance from major steel producers and equipment manufacturers. The main source of revenue for MPT from a ship repair yard would be the land rentals. In a port that has sufficient land this would be a good way to utilize the assets. However, in the case of MPT the available land would fetch better returns if used to enhance the handling capacity for coke and liquid bulk cargo.

(b) Off-shore Supply Vessels

MPT has the advantage of being located close to the Mumbai high off-shore oil fields. These fields require the supply of material and manpower which is done by off-shore supply vessels. These vessels have to undergo regular repairs and this can again form a potential market for MPT. The main source of revenue for MPT would be vessel charges and land rentals/berth hire charges. ONGC, which is the largest operator in the Bombay offshore fields utilizes a fleet of 30 offshore vessels. The other large offshore fields are located off the Andhra Pradesh coast and therefore the OSV fleet catering to the KG basin will not form a potential target for MPT. Also, no new finds have been announced on the west coast around Goa/Mumbai and potential is likely to be limited to the existing fleet. These vessels are small and therefore vessel related charges will be small and land rentals are likely to be the main source of revenue. Subject to the availability of land MPT may allocate some land/berth for OSV and we estimate the number of vessels calling at the MPT to be about 30 vessels per year.

(c) Coast Guard vessels

Presently the Coast Guard has 69 vessels, boats and crafts which are deployed across the east and west coastlines. Coast Guard envisions having 169 vessels, including 12 hovercrafts as per the 2002 - 2012 Perspective Plan. Overall, the Coast Guard has projected force-levels of 268 vessels including 173 small patrol craft, six deep-sea patrol vessels and more than 40 interceptor boats by 2017.

Table 4.83 - Coast Guard Fleet

Vessel	Nos	Displacement (in tonnes)	Propeller draught
Advance Offshore Patrol Vessels (AOPVs)	4	2,000	4.5 m
Offshore Patrol Vessels (OPVs)	9	1,224	3.6 m
Fast Patrol Vessels (FPVs)	11	215	2 m
Inshore Patrol Vessels (IPVs)	13	188	2 m
Seaward Defence Boats(SDBs)	2	185	1.8 m
Interceptor Boats (IBs)	12	32	1.2 m
Interceptor Crafts (Vadyar)	8	2.4	0.45 m
Interceptor Crafts (Bristol)	4	5.5	0.7
Hovercrafts	6	AUW-25	
Total	**69**		

Intense deployment of surveillance vessels across the coast of Maharashtra is made due to the sharp increase registered in piracy on the high seas and smuggling contrabands in the recent years. Also after the 1993 Mumbai serial blasts, Coast Guard under 'Project Swan' has enhanced coastal security and patrolling on the west coast, especially off the coast of Mumbai. Mormugao Port Trust, due to its proximity to Mumbai, has the advantage to cater to the berthing needs of the Coast Guard vessels. The sources of revenue to Mormugao Port Trust will be the vessel related charges including berthing charges. Since the sizes of the vessels in the fleet of Coast Guard are small with only 13 vessels exceeding a propeller draught of 2 m, Mormugao Port Trust's prime source of revenue will be only Land related charges. Subject to the availability of land MPT may allocate some land/berth for Coast Guard and we estimate the number of vessels calling at MPT to be about 20 vessels.

(d) Navy Vessels

Indian Navy has a large fleet of vessels ranging from research vessels and fast patrol crafts to aircraft carriers totalling to over 183 vessels.

Table 4.84 - Fleet Strength

Type Of Vessel	Fleet Strength
Aircraft Carriers	3
Guided-Missile Destroyers	11
Guided-Missile Frigates	15
Guided-Missile Corvettes	24
Frigates	4
Corvettes	4
Large Patrol Craft	12
Fast Patrol Vessels	13
Amphibious Warfare Vessels	18
Replenishment Tankers	3
Mine Countermeasures Vessels	8
Minesweepers - Ocean	12
Minesweepers - Inshore	2
Survey Vessels	11
Transport Ship	2
Research Vessels	1
Diving Support Vessel	1
Training Vessels	2
Sail Training Vessels	2
Oilers	1
Ocean Tug	2
Harbour Tug	18
Support Tankers	6
Water Carrier	2
Hospital Ship	1
Torpedo Recovery Vessel	2
Diving Tender	3
Total	183

Indian Navy's bases are located within commercial ports, with major bases in Mumbai, Vishakapatnam and Kochi. Commercial interests take up bulk of the harbour at all these ports and the space constraints in these ports prevent any expansion to allow setting up of a naval base. However, the Indian Navy had conceived an integrated strategic exclusive naval base at Karwar in Karnataka called 'Project Seabird'. The first phase was completed in 2005 and further development of the base will be done in phase II, which will double most of the existing facilities and provide enough berths for fifty vessels. This facility along with the other existing bases is considered adequate for India's security needs in the west. However, Mormugao Port Trust has been witnessing naval vessel calls frequently during the last three years.

Table 4.85 - Navy Vessel Calls

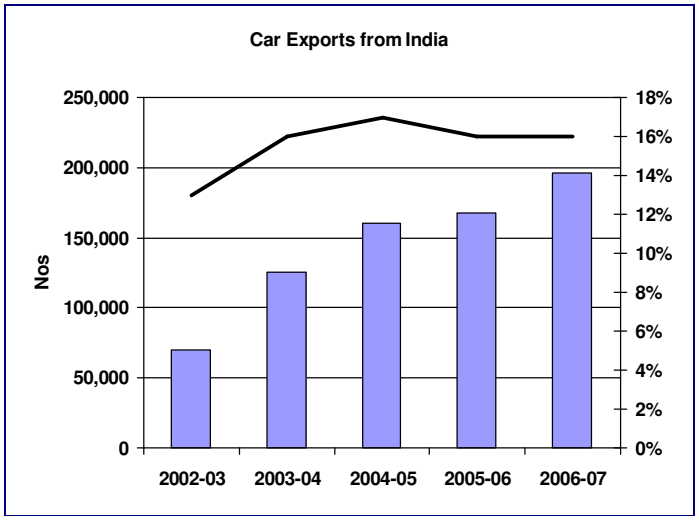
Year	2003-04	2004-05	2005-06
Navy vessel calls	29	77	50

Source: MPT

However, due to the construction of Indian Navy's base in Karwar, the vessel calls is not expected to decline in the future to about 25 vessel calls and the revenues to Mormugao Port Trust from these are not considerable.

4.4 Car Exports

The total car exports from India are provided in the chart below. Exports increased sharply between 2002-03 and 2004-05, slowed down in 2005-06 and is likely to increase rapidly during the current year. During this period the proportion of cars exported from India (as a percentage of production) also increased and touched a peak of 17% of production in 2004-05 and has leveled off at that level in the last three years.



Source: SIAM, Note figures for FY07 are for the period April 06 to August 06 and have been annualized

Figure 4.43 - Car Exports form India

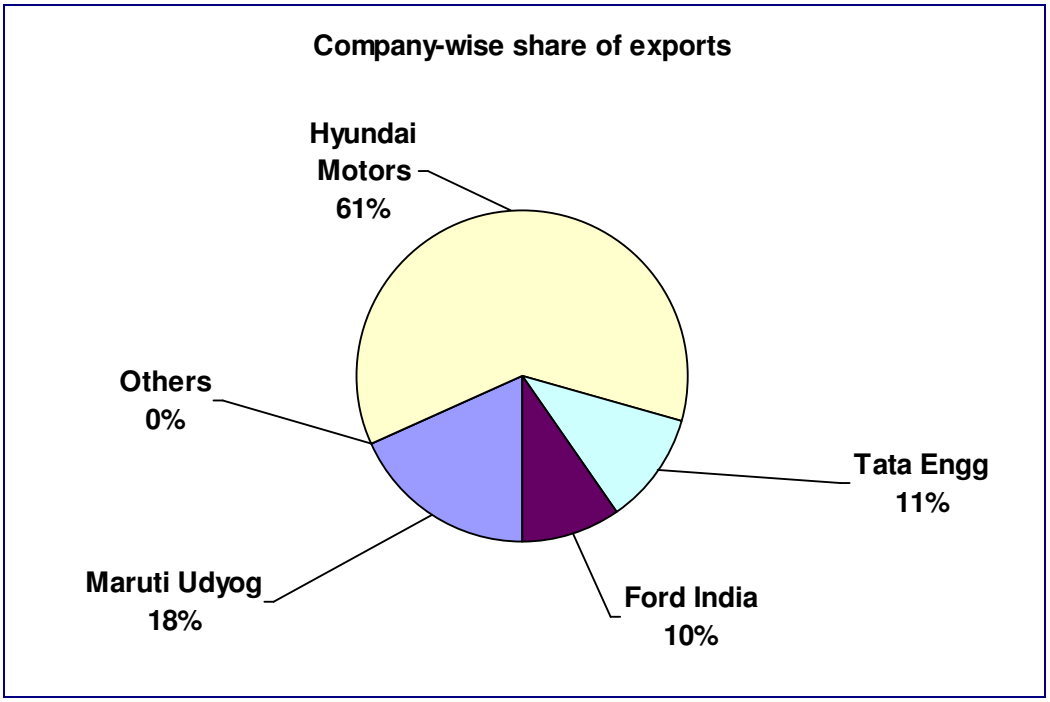
The compounded annual growth rates in car exports during the period from FY03 to FY06 was 33%.The exports of car by manufacturer is provided below.

Table 4.86 - Exports of Car by manufacturers

Year	Maruti Udyog	Fiat India	Hyundai Motors	Tata Motors	Ford India	General Motors	Hindustan Motors	Honda Siel
2002-03	31,508	0	8,966	1,968	27,372	33	104	71
2003-04	50,247	0	42,115	8,895	24,000	0	11	131
2004-05	47,663	0	82,093	8,112	22,625	0	13	158
2005-06	30,702	0	102,092	18,531	16,132	0	0	51
2006-07	12,615	5	49,521	8,528	11,191	0	8	28

Source: SIAM

Four companies (Maruti Udyog, Hyundai Motors, Tata Motors and Ford India) accounted for almost all the car exports as shown in the chart below.



Source: SIAM

Figure 4.44 - Company wise share of exports

As indicated above two companies, Hyundai and Maruti Udyog account for about four-fifths of the exports of cars from India. The location of the major manufacturing facilities is provided in the map in **Figure 4.45**.

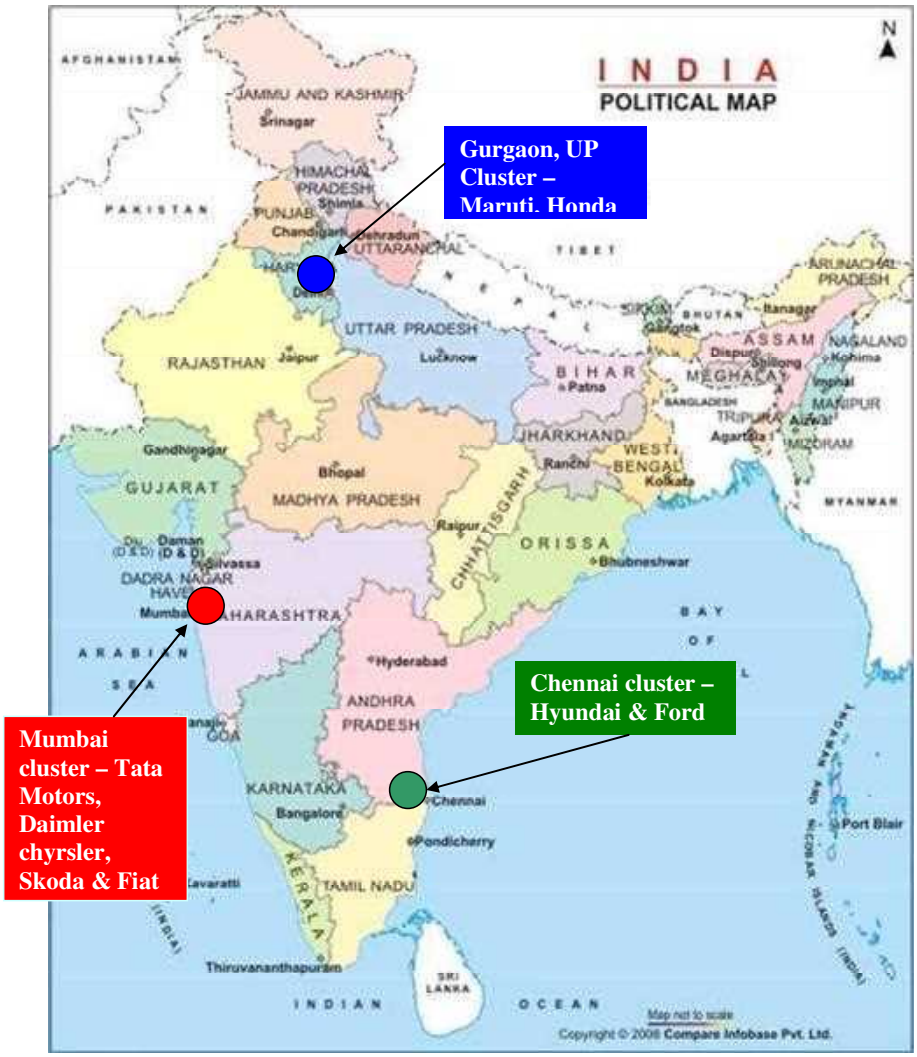


Figure 4.45 - location of the major manufacturing facilities

As seen in the map above, two of the clusters are located in the vicinity of two major ports – Chennai and Mumai/JNPT. The largest exporter is Hyundai and is located close to the Chennai port with another port; Ennore coming up in the vicinity of Chennai. The automobile cluster located in the North is close to the ports in Gujarat but due to the lack of handling capacity chooses to use JNPT.

Table 4.87 - Exports of Car by manufacturers

Company	Manufacturing Location	Closest Major Port
General Motors	Halol	Kandla and JNPT
Toyota Motors	Bangalore	Chennai, Ennore and Mangalore
Hindustan Motors	Kolkata	Kolkata

Source : EY

There are no major automobile manufacturers near Goa and most of the expansion plans announced are near the existing clusters due to the easy access to the component manufacturing units. The only large manufacturing facilities that are likely to be developed away from a major cluster are the Tata Motor's new facility in West Bengal and possible Volkswagen at Vishakapatnam. These are too far for MPT to attract and therefore from a traffic perspective these do not present any potential.

Automobile exporters are keen to ensure that their products are not affected by other dirt cargo in the vicinity. For instance Hyundai is spending about US$ 10 per car to cover it with special plastic sheet to prevent damage from iron ore and coal which is handled at Chennai Port Trust. As MPT handles similar cargo, but has the added disadvantage of distance from other major manufacturing clusters, automobile manufacturers would not be willing to bear any additional costs to export from MPT.

It may also not be viable for MPT to construct a new facility to export cars as the revenues are small. A sample computation is presented below.

Table 4.88 - Sample Calculation

MPT share of exports	10%	15%	20%
Export Volumes (Nos)	20,000	30,000	40,000
All inclusive Rate/car (as % of FoB value)	0.50%	0.50%	0.50%
Revenue per car @ FoB Value of US$ 7500 per car	1,687.50	1,687.50	1,687.50
Revenue Earned (Rs. Million)	33.75	50.625	67.5

Note: It has been assumed that car exports would account for 20% of total production and that production would be 1,000,000 cars

At the above revenue volumes, the capital expenditure that can be supported would not exceed Rs. 70 crores assuming that there are no associated expenses and that about 50-60% of the project cost financed by internal accruals.

5 Vessel Size Development

5.1 Approach

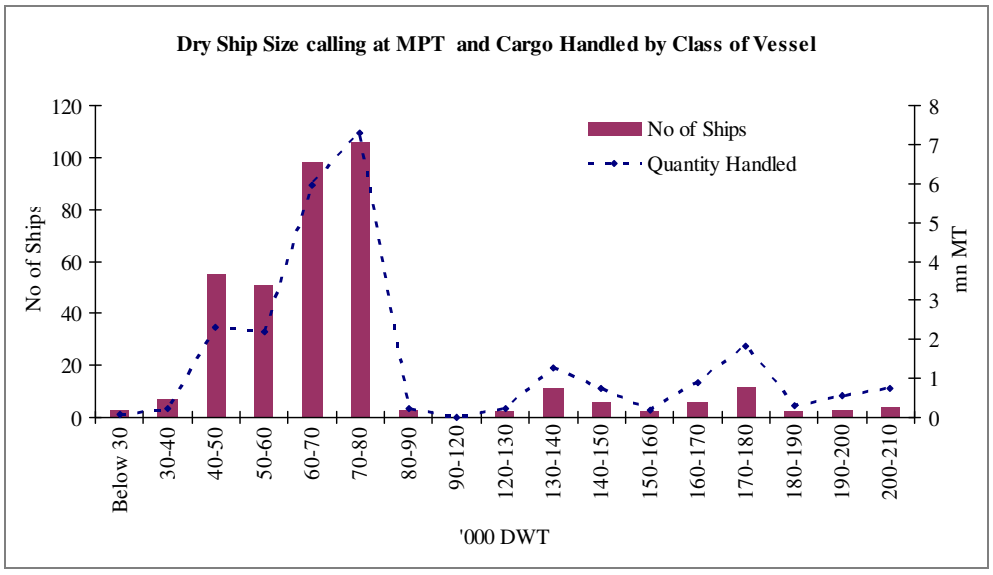
The design vessel sizes are determined on the basis of following:

- cargo and volumes handled
- trade requirements
- Optimum size of vessel for which improvement of existing facilities or establishing new facilities to be planned

The main commodities handled by Mormugao Port are Dry bulk, Liquid bulk, General cargo and Containers. Vessel sizes are analysed commodity wise and provided in the following sections.

5.2 Dry Bulk Carriers

Dry Bulk traffic at MPT primarily consists of ore for exports. MPT has dedicated facilities for handling Iron Ore, Coal/Coke which constitutes around 93% of the cargo handled by the port. The graph below reveals that the vessels calling at the port for the dry bulk exports/imports can be classified into three distinct categories namely Panamax, Capesize and Suezmax vessels.



Source- Planning and Management Services Department, MPT

Figure 5.1 – Dry Ship Size calling at MPT and Cargo Handled by Class of Vessel

As seen in the **Figure 5.1** above the bulk of the dry bulk vessels calling at MPT were in the Panamax category and there were only a few vessels that of a higher class.

Berth No 9 is the dedicated berth for iron ore handling and is dredged to 14.10 m. Berths No 5A and 6A are used for handling only Coal/Coke which allows for ships of about 70,000 DWT to be fully loaded at these berths but sailing (berth 9) and berthing (berth 5A and 6A) is only possible under favorable tide conditions. The bigger vessels are partly loaded at the berths and are topped up by transhippers at mid stream. Considering the present operations, the future size of carriers calling at the port will continue to be in the range of handymax, panamax, cape size and suezmax vessels.

Table 5.1 - Details of Dry Bulk Vessels

DWT Size	No of Ships	Quantity	% Share
Below 30,000	3	0.07	-
30,000-40,000	7	0.22	2%
40,000-50,000	55	2.30	15%
50,000-60,000	51	2.28	14%
60,000-70,000	98	5.94	26%
70,000-80,000	106	7.29	28%
80,000-90,000	3	0.23	-
90,000-1,00,000	0	0	-
1,00,000-1,10,000	0	0	-
1,10,000-1,20,000	0	0	-
1,20,000-1,30,000	2	0.24	-
1,30,000-1,40,000	11	1.25	3%
1,40,000-1,50,000	6	0.76	2%
1,50,000-1,60,000	2	0.18	-
1,60,000-1,70,000	6	9.03	2%
1,70,000-1,80,000	12	1.84	3%
1,80,000-1,90,000	2	0.30	-
1,90,000-2,00,000	3	5.45	-
2,00,000-2,10,000	4	7.67	1%

Source- Planning and Management Services Department, MPT

Table 5.2 – World wide Dry Bulk Carrier Fleet (Figures in MMdwt)

	2004	2005	2006	2007	2008
Capesize	102.1	110.8	120.4	126.0	132.8
Panamax	86.4	93.7	101.7	106.3	108.3
Handymax	61.1	66.5	72.1	76.4	79.2
Handysize	72.6	73.7	74.1	74.7	75.3
Total	**322.2**	**344.7**	**368.3**	**383.4**	**395.6**

Source: Clarkson, Jefferies & Company

The dry bulk fleet expanded more than 6.5% annually in 2004-2006, growth is likely to decelerate in 2007-2008 based on the outlook for declining deliveries and an aging fleet. The dry bulk fleet is forecasted to increase by 4.1% in 2007 and 3.2% in 2008. The slowdown is due to fewer orders for new buildings, less berth capacity for dry bulk new buildings at the major shipbuilders, and the increased likelihood for vessels to be scrapped over the next few years. Scrappings is expected to accelerate to 4-8 MMdwt per year in 2006-2008, higher than the 0-1 MMdwt per year that prevailed in 2004-2005. Based on the order book, fleet additions should total only 23.2 MMdwt in 2007 and 18.4 MMdwt in 2008, which is partially offset by scrapping of 8.0 MMdwt in 2007 and 6.3 MMdwt in 2008. Fleet growth is expected to slow to roughly 3% by 2008, short of the dry bulk demand growth estimate of 4%.

The composition of the dry bulk fleet is depicted in the **Table 5.3** below;

Table 5.3– Composition of the Dry Bulk Fleet

	2004	2005	2006	2007	2008
Capesize	32%	32%	33%	33%	34%
Panamax	27%	27%	28%	28%	27%
Handymax	19%	19%	20%	20%	20%
Handysize	23%	21%	20%	19%	19%

The handysize fleet is expected to fall while that of the capsize fleet is expected to increase due to the increase in ton-mile demand. Ton-mile demand for dry bulk shipping is likely to grow, as incremental production from Brazil supplants exports from Australia and India. Brazilian exports are expected to account for about half of the total increase while Indian exports could either drop or remain stable. Australia exports are expected to rise but as there are more mining capacity expansion projects scheduled in Brazil

than Australia Brazilian exports are set to increase. With China accounting for the bulk of the increase in worldwide iron ore consumption, the iron ore trade should closely track economic developments and steel production in China. Due to the long haul from Brazil to China the demand for capsize dry bulk capacity will increase.

5.2.1 *Projected Vessel Size for Iron Ore Traffic*

The bulk of the iron ore is carried in capsized vessels. About 63% of the total capsize fleet (by dwt) is used for iron ore trade and most of the balance is used for coal trades. In comparison only about 10% of the total Panamax fleet is used for iron ore transportation. The comparable figures at MPT are almost reversed at MPT with Capesizes accounting for about 11% of the total dry bulk cargo handled at MPT. The most economical way for sea-borne iron trade is to use Capesize vessels.

India's major competitors for iron ore are Brazil and Australia. Description of the major iron ore handling terminals at these ports is provided in the **Table 5.4** below;

Table 5.4 – Draft at Competing Iron Ore Export Regions

Port	Country	Draft (in m)
Nelson Point – Port Hedland	Australia	19
Finucane Point – Port Hedland	Australia	17
Parker Point – Port Dampier	Australia	17.2
East Intercourse Island – Port Dampier	Australia	21.5
Port Walcott – Cape Lambert	Australia	18.5-19.8
Ponta Ubu	Brazil	14.32
	China	

Source: Department of Mineral and Petroleum Resources: www.portfocus.com

As seen above the major competitors have the ability to handle capsize vessels. Also many of the newer ports in India targeting iron ore traffic in India are building capacity to handle capsize vessels. The developments with respect to competing ports in India are provided in **Table 5.5** below,

Table 5.5 – Handling Capability at Competing Indian Ports

Port	State	Existing /New	Iron Ore Capacity (mpta)	Draft (m)	Expected Date of Commissioning
Gangavaram	Andhra Pradesh	New	12	20.5	2008-09
Krishnapatnam	Andhra Pradesh	New	9	13.2	2008-09
Mangalore	Karnataka	Existing	14	17	N.A
Ennore	Tamil Nadu	New	12	18	2008-09
Dhamra	Orissa	New	10	18	2009-10

Source: EY

In order to keep pace with competition, the facilities should be designed to handle capsize vessels of about 150,000 dwt. While the Goan iron ore is unlikely to move away from MPT, the ore from Karnataka could be attracted to these ports as the cost of inland logistics is outweighed by savings in shipping costs.

5.2.2 *Projected Vessel Size for Coal and Coke Traffic*

In contrast to sea-borne trade in iron ore, coal traffic is more evenly divided between Capesize and Panamax vessels, though Capesize again leads in coal transportation. At MPT, the entire traffic in coal is through vessels which are either Panamax or smaller.

The thermal and metallurgical coal traffic is largely handled in Panamax vessels and this is likely to continue. The coal shippers can be broadly categorized into JSW Limited and others. JSW accounts for 75% of the coal imports.

For JSW the total import in 2005-06 was about 2.9 million tons. Our discussions indicate that larger vessel sizes would not be attractive for the following reasons;

- Shortage of storage space within the port and limited capacity of the rail line to evacuate the cargo
- The company plans to use the coal carrying vessels for steel exports and thus reduce the freight cost. Since the volume of steel exports will be much smaller than coal imports, there would be a mismatch between if larger sized vessels are used.

Imports by other consumers are in smaller lots and therefore would not be economical to import in larger vessels. Thus the vessel sizes are likely to continue to remain at Panamax or smaller vessel types.

5.3 Liquid Bulk Carriers

POL constitutes 61% of the total liquid bulk traffic. Oil tankers calling at the port during 2005-06 and the quantity of cargo handled can be seen in the table below. It is seen that the tanker size ranged between 10,000 DWT up to 70,000 DWT.

Table 5.6 - Tankers Calling at MPT- 2005-06

DWT Size	No of Ships	Quantity in mn MT	% Share
Below 10,000	11	0.05	7%
10,000-20,000	38	0.18	23%
20,000-30,000	42	0.29	26%
30,000-40,000	38	0.40	23%
40,000-50,000	29	0.37	18%
50,000-60,000	2	0.03	1%
60,000-70,000	2	0.02	1%

Source- Planning and Management Services Department, MPT

More than 90% of the vessels which called at the port fall within the 20-50,000 DWT. Almost all of the movement of POL products is coastal movement and Handymax vessels are generally used to transport petroleum products and crude. There is no refining capacity that is planned in Goa and the POL movement will be confined to coastal movement of products. Hence the design size for POL carriers will continue to be Handymax size vessels, with a DWT of 50,000 tonnes.

The other primary liquid bulk cargoes handled at the port are liquid Ammonia and phosphoric acid and the design vessel size for these cargoes is not likely to exceed handymax size vessels of approximately 30,000-50,000 DWT as the parcel sizes will remain at current levels.

5.4 Container Vessels

Container vessels are handled at multipurpose general cargo berths 10 & 11 as there is no dedicated berth available for containerized cargo. The size of the vessels generally ranged below 10,000 DWT as shown in the **Table 5.7** below;

Table 5.7 - Container Vessels calling at MPT

DWT Size	No of Ships	Quantity in mn MT	% Share
Below 10,000	37	0.10	97%
10,000-20,000	1	0.05	3%

Source- Planning and Management Services Department, MPT

Our projections of future volumes of container traffic at the port are not likely to be of such a magnitude that would warrant direct calls of mainline vessels at the port. Hence it is envisaged that the port will continue to operate as a feeder port. Therefore, the likely container vessels calling at the port will be feeder vessels with a capacity of 600-1200 TEUs and parcel sizes are likely to be in the order of 200-600 TEUs per week.

5.5 General Cargo Liners

Details of general cargo vessels that called at MPT during 2005-06 are given below in **Table 5.8**.

Table 5.8 - Details of General Cargo Vessels

DWT Size	No of Ships	Quantity	% Share
Below 10,000	3	3,282	0%
10,000-20,000	18	238,784	25%
20,000-30,000	15	250,526	27%
30,000-40,000	4	117,000	12%
40,000-50,000	3	109,943	12%
50,000-60,000	5	219,213	23%

Source- Planning and Management Services Department, MPT

The size of vessels ranged between 10,000 DWT and 60,000 DWT, largely the Handysize and Handymax classes. In terms of number of ship call, most of the vessels are in the 10,000-30,000 DWT category. While the vessels above this accounted for about 47% of the total cargo carried, the number of calls is much lower than the previous category. Most of the larger vessels carried sugar and scrap and it is possible that these vessels are bulk-carriers. While there will be such larger vessels that will call carrying general cargo, the numbers will continue to be small. Therefore, the design vessel size for general cargo vessels can be adopted as 30,000 DWT.

5.6 Summary Features of Design Vessels

Based on the above analysis the vessel sizes expected to call at the Port during the forecast period is provided in **Table 5.9** below;

Table 5.9 - The vessel size expected

	DWT	Parcel Size (tonnes)	Length (m)	Beam (m)	Draft (m)
Dry Bulk					
Iron Ore	150,000	135,000	302	43.0	17.0
Coal and Coke	60,000-70,000	50,000	245	35.0	11-12.0
Liquid Bulk					
POL	40,000-50,000	35,000	206	29.7	11.5
Phosphoric acid, Liquid Ammonia	30,000	15,000	180	26.3	11.2
General Cargo	30,000	15,000	180	23	10.0
Containers	600 TEUs	200 TEUs	142	18.9	8.2

ANNEXURE 4.1

Summary of the Forecast (2006 – 14)

Containers: in TEUs; Others: in Mn Tonnes

Scenarios >>>	Low								Medium								High							
Commodity / Year >>>	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
A. DRY BULK																								
Dry Bulk (Exports)																								
Iron Ore																								
Case 0 [1]	26.08	23.23	20.89	18.67	16.57	14.58	14.58	14.87	26.08	24.29	22.88	21.44	19.98	18.49	18.49	18.86	26.08	24.81	23.87	22.84	21.73	20.53	20.97	21.39
Case 1 [1]	26.08	24.02	21.87	19.82	19.02	18.22	18.22	18.58	26.08	25.11	23.94	22.75	22.93	23.11	23.11	23.57	26.08	25.65	24.98	24.24	24.94	25.66	26.21	26.73
Case 2 [1]	26.08	35.95	34.49	33.04	31.58	30.13	30.13	30.73	26.08	37.72	38.05	38.37	38.69	39.02	39.02	39.80	26.08	38.60	39.82	41.07	42.34	43.65	44.66	45.55
Total dry bulk exports (Case 2)	26.08	35.95	34.49	33.04	31.58	30.13	30.13	30.73	26.08	37.72	38.05	38.37	38.69	39.02	39.02	39.80	26.08	38.60	39.82	41.07	42.34	43.65	44.66	45.55
Dry Bulk (Imports)																								
Coal / Coke	5.70	5.60	6.16	6.72	6.72	6.72	6.72	7.06	5.70	6.70	6.90	6.90	7.15	7.40	7.65	8.03	5.70	8.90	9.90	11.40	11.90	12.40	12.90	13.55
Total dry bulk imports	5.70	5.60	6.16	6.72	6.72	6.72	6.72	7.06	5.70	6.70	6.90	6.90	7.15	7.40	7.65	8.03	5.70	8.90	9.90	11.40	11.90	12.40	12.90	13.55
TOTAL DRY BULK	**31.78**	**41.55**	**40.65**	**39.76**	**38.30**	**36.85**	**36.85**	**21.92**	**31.78**	**44.42**	**44.95**	**45.27**	**45.84**	**46.42**	**46.67**	**47.83**	**31.78**	**47.50**	**49.72**	**52.47**	**54.24**	**56.05**	**57.56**	**59.10**
B. GENERAL CARGO																								
1) Dry Bulk other than Iron ore, Coal and Coke																								
Dry Bulk (Exports)																								
Calcined Alumina [2]	0.19	0.19	0.19	0.20	0.20	0.21	0.22	0.23	0.19	0.19	0.20	0.21	0.23	0.24	0.25	0.26	0.19	0.21	0.22	0.24	0.26	0.28	0.30	0.32
Calcined Petroleum Coke	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09	0.07	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.07	0.08	0.09	0.10	0.10	0.11	0.12	0.13
Total dry bulk exports	0.26	0.26	0.27	0.28	0.29	0.29	0.30	0.32	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.36	0.26	0.29	0.31	0.34	0.36	0.39	0.42	0.44
Dry Bulk (Imports)																								
Limestone	0.37	0.35	0.35	0.35	0.35	0.35	0.35	0.36	0.37	0.45	0.45	0.45	0.45	0.45	0.45	0.48	0.37	0.62	0.62	0.62	0.62	0.62	0.62	0.65
Coke Raw Pet	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18
Scrap and miscellaneous	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09	0.07	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.07	0.08	0.09	0.10	0.10	0.11	0.12	0.13
Total dry bulk imports	0.55	0.53	0.53	0.54	0.55	0.55	0.56	0.59	0.55	0.64	0.65	0.66	0.67	0.68	0.70	0.73	0.55	0.82	0.84	0.85	0.87	0.89	0.91	0.96
Other Dry Bulk (imports and exports	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09
Total Dry Bulk	0.86	0.84	0.86	0.87	0.89	0.90	0.92	0.97	0.86	0.97	1.00	1.02	1.05	1.08	1.11	1.17	0.86	1.16	1.21	1.26	1.31	1.36	1.42	1.49
2) Break Bulk																								
Break Bulk (Exports)																								
Steel	1.30	1.20	1.20	1.20	1.20	1.20	1.20	1.26	1.30	1.50	1.50	1.50	1.50	1.50	1.50	1.58	1.30	1.50	1.50	1.75	2.00	2.00	2.00	2.10
Total break bulk exports	1.30	1.20	1.20	1.20	1.20	1.20	1.20	1.26	1.30	1.50	1.50	1.50	1.50	1.50	1.50	1.58	1.30	1.50	1.50	1.75	2.00	2.00	2.00	2.10
Total Break Bulk	1.30	1.20	1.20	1.20	1.20	1.20	1.20	1.26	1.30	1.50	1.50	1.50	1.50	1.50	1.50	1.58	1.30	1.50	1.50	1.75	2.00	2.00	2.00	2.10
TOTAL GENERAL CARGO	**2.16**	**2.04**	**2.06**	**2.07**	**2.09**	**2.10**	**2.12**	**2.23**	**2.16**	**2.47**	**2.50**	**2.52**	**2.55**	**2.58**	**2.61**	**2.74**	**2.16**	**2.66**	**2.71**	**3.01**	**3.31**	**3.36**	**3.42**	**3.59**
C. CONTAINERS																								
Container (import and export)	8,794	8,695	8,695	8,695	8,695	8,695	8,695	9,347	8,794	13,268	15,250	16,598	17,708	18,762	19,747	21,228	8,794	21,738	24,567	26,847	28,469	30,061	31,611	33,982
Empty Containers	1,319	1,304	1,304	1,304	1,304	1,304	1,304	1,402	1,319	1,990	2,288	2,490	2,656	2,814	2,962	3,184	1,319	3,261	3,685	4,027	4,270	4,509	4,742	5,097
TOTAL CONTAINERS	**10,113**	**9,999**	**9,999**	**9,999**	**9,999**	**9,999**	**9,999**	**10,749**	**10,113**	**15,258**	**17,538**	**19,088**	**20,364**	**21,576**	**22,709**	**24,412**	**10,113**	**24,999**	**28,253**	**30,875**	**32,739**	**34,570**	**36,353**	**39,079**
D. LIQUID BULK																								
Liquid Bulk (Imports)																								
POL Products	1.04	1.09	1.13	1.17	1.22	1.27	1.32	1.39	1.04	1.12	1.20	1.29	1.39	1.49	1.60	1.68	1.04	1.13	1.22	1.31	1.42	1.53	1.66	1.74
Phosporic acid	0.48	0.64	0.76	0.92	0.95	0.99	1.03	1.08	0.48	0.64	0.76	0.92	0.95	0.99	1.03	1.08	0.48	0.64	0.76	0.92	0.95	0.99	1.03	1.08
Liquid Ammonia	0.13	0.18	0.24	0.32	0.33	0.34	0.35	0.37	0.13	0.18	0.24	0.32	0.33	0.34	0.35	0.37	0.13	0.18	0.24	0.32	0.33	0.34	0.35	0.37
Palm Fatty Acids	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Furnace Oil	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Others	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total liquid bulk imports	1.82	2.06	2.29	2.57	2.67	2.77	2.87	3.01	1.82	2.10	2.37	2.69	2.83	2.99	3.15	3.31	1.82	2.10	2.38	2.71	2.86	3.03	3.21	3.37
TOTAL LIQUID BULK	**1.82**	**2.06**	**2.29**	**2.57**	**2.67**	**2.77**	**2.87**	**3.01**	**1.82**	**2.10**	**2.37**	**2.69**	**2.83**	**2.99**	**3.15**	**3.31**	**1.82**	**2.10**	**2.38**	**2.71**	**2.86**	**3.03**	**3.21**	**3.37**

Note 1:

Key to the MPTs market share of iron ore traffic are
(a) the capacity of the MOHP
(b) the differential in rates between the MOHP and charges at Panjim
(c) the investments made by exporters in transshippers and
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Case 0: assumes
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Note 2:

Forecast of alumina is considered under dry bulk although certain shipments are made as break bulk.

ANNEXURE 4.2

Summary of the Forecast (2014 – 27)

Containers: in TEUs; Others: in Mn Tonnes

Scenarios >>>	Low													Medium								
Commodity / Year >>>	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
A. DRY BULK																						
Dry Bulk (Exports)																						
Iron Ore																						
Case 0 [1]	15.17	15.47	15.78	16.09	16.42	16.74	17.08	17.42	17.77	18.12	18.49	18.86	19.23	19.23	19.62	20.01	20.41	20.82	21.24	21.66	22.09	22.54
Case 1 [1]	18.96	19.34	19.72	20.12	20.52	20.93	21.35	21.78	22.21	22.65	23.11	23.57	24.04	24.04	24.52	25.01	25.51	26.02	26.54	27.08	27.62	28.17
Case 2 [1]	31.35	31.97	32.61	33.26	33.93	34.61	35.30	36.01	36.73	37.46	38.21	38.97	39.75	40.59	41.40	42.23	43.08	43.94	44.82	45.71	46.63	47.56
Total dry bulk exports (Case 2)	31.35	31.97	32.61	33.26	33.93	34.61	35.30	36.01	36.73	37.46	38.21	38.97	39.75	40.59	41.40	42.23	43.08	43.94	44.82	45.71	46.63	47.56
Dry Bulk (Imports)																						
Coal / Coke	7.41	7.78	8.17	8.58	9.01	9.46	9.93	10.42	10.95	11.49	12.07	12.67	13.31	8.43	8.86	9.30	9.76	10.25	10.76	11.30	11.87	12.46
Total dry bulk imports	7.41	7.78	8.17	8.58	9.01	9.46	9.93	10.42	10.95	11.49	12.07	12.67	13.31	8.43	8.86	9.30	9.76	10.25	10.76	11.30	11.87	12.46
TOTAL DRY BULK	**38.75**	**39.75**	**40.78**	**41.84**	**42.93**	**44.06**	**45.23**	**46.43**	**47.67**	**48.95**	**50.28**	**51.65**	**53.06**	**49.03**	**50.26**	**51.53**	**52.84**	**54.19**	**55.58**	**57.02**	**58.50**	**60.02**
B. GENERAL CARGO																						
1) Dry Bulk other than Iron ore, Coal and Coke																						
Dry Bulk (Exports)																						
Calcined Alumina [2]	0.24	0.25	0.26	0.28	0.29	0.31	0.32	0.34	0.35	0.37	0.39	0.41	0.43	0.27	0.29	0.30	0.32	0.33	0.35	0.37	0.39	0.40
Calcined Petroleum Coke	0.10	0.10	0.10	0.11	0.12	0.12	0.13	0.13	0.14	0.15	0.15	0.16	0.17	0.11	0.11	0.12	0.13	0.13	0.14	0.15	0.15	0.16
Total dry bulk exports	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49	0.52	0.55	0.57	0.60	0.38	0.40	0.42	0.44	0.47	0.49	0.51	0.54	0.57
Dry Bulk (Imports)																						
Limestone	0.38	0.40	0.42	0.44	0.47	0.49	0.51	0.54	0.57	0.59	0.62	0.65	0.69	0.50	0.53	0.55	0.58	0.61	0.64	0.67	0.71	0.74
Coke Raw Pet	0.14	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.25	0.16	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23
Scrap and miscellaneous	0.09	0.10	0.10	0.11	0.12	0.12	0.13	0.13	0.14	0.15	0.15	0.16	0.17	0.11	0.11	0.12	0.13	0.13	0.14	0.15	0.15	0.16
Total dry bulk imports	0.61	0.65	0.68	0.71	0.75	0.78	0.82	0.86	0.91	0.95	1.00	1.05	1.10	0.77	0.80	0.84	0.89	0.93	0.98	1.03	1.08	1.13
Other Dry Bulk (imports and export	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11
Total Dry Bulk	1.02	1.07	1.12	1.18	1.23	1.30	1.36	1.43	1.50	1.58	1.65	1.74	1.82	1.23	1.29	1.35	1.42	1.49	1.56	1.64	1.72	1.81
2) Break Bulk																						
Break Bulk (Exports)																						
Steel	1.32	1.39	1.46	1.53	1.61	1.69	1.77	1.86	1.95	2.05	2.16	2.26	2.38	1.65	1.74	1.82	1.91	2.01	2.11	2.22	2.33	2.44
Total break bulk exports	1.32	1.39	1.46	1.53	1.61	1.69	1.77	1.86	1.95	2.05	2.16	2.26	2.38	1.65	1.74	1.82	1.91	2.01	2.11	2.22	2.33	2.44
Total Break Bulk	1.32	1.39	1.46	1.53	1.61	1.69	1.77	1.86	1.95	2.05	2.16	2.26	2.38	1.65	1.74	1.82	1.91	2.01	2.11	2.22	2.33	2.44
TOTAL GENERAL CARGO	**2.34**	**2.46**	**2.58**	**2.71**	**2.84**	**2.99**	**3.13**	**3.29**	**3.46**	**3.63**	**3.81**	**4.00**	**4.20**	**2.88**	**3.02**	**3.17**	**3.33**	**3.50**	**3.67**	**3.86**	**4.05**	**4.25**
C. CONTAINERS																						
Container (import and export)	10,048	10,802	11,612	12,483	13,419	14,425	15,507	16,670	17,920	19,264	20,709	22,262	23,932	22,820	24,532	26,372	28,350	30,476	32,762	35,219	37,860	40,700
Empty Containers	1,507	1,620	1,742	1,872	2,013	2,164	2,326	2,501	2,688	2,890	3,106	3,339	3,590	3,423	3,680	3,956	4,252	4,571	4,914	5,283	5,679	6,105
TOTAL CONTAINERS	**11,555**	**12,422**	**13,353**	**14,355**	**15,432**	**16,589**	**17,833**	**19,171**	**20,608**	**22,154**	**23,816**	**25,602**	**27,522**	**26,243**	**28,212**	**30,328**	**32,602**	**35,047**	**37,676**	**40,501**	**43,539**	**46,805**
D. LIQUID BULK																						
Liquid Bulk (Imports)																						
POL Products	1.46	1.53	1.60	1.69	1.77	1.86	1.95	2.05	2.15	2.26	2.37	2.49	2.61	1.77	1.85	1.95	2.04	2.15	2.25	2.37	2.49	2.61
Phosporic acid	1.14	1.20	1.26	1.32	1.38	1.45	1.53	1.60	1.68	1.77	1.85	1.95	2.04	1.14	1.20	1.26	1.32	1.38	1.45	1.53	1.60	1.68
Liquid Ammonia	0.39	0.41	0.43	0.45	0.48	0.50	0.52	0.55	0.58	0.61	0.64	0.67	0.70	0.39	0.41	0.43	0.45	0.48	0.50	0.52	0.55	0.58
Palm Fatty Acids	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.10
Furnace Oil	0.10	0.10	0.11	0.11	0.12	0.13	0.13	0.14	0.15	0.15	0.16	0.17	0.18	0.10	0.10	0.11	0.11	0.12	0.13	0.13	0.14	0.15
Others	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
Total liquid bulk imports	3.16	3.32	3.49	3.66	3.85	4.04	4.24	4.45	4.67	4.91	5.15	5.41	5.68	3.47	3.65	3.83	4.02	4.22	4.43	4.66	4.89	5.13
TOTAL LIQUID BULK	**3.16**	**3.32**	**3.49**	**3.66**	**3.85**	**4.04**	**4.24**	**4.45**	**4.67**	**4.91**	**5.15**	**5.41**	**5.68**	**3.47**	**3.65**	**3.83**	**4.02**	**4.22**	**4.43**	**4.66**	**4.89**	**5.13**

				High												
2023-24	2024-25	2025-26	2026-27	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
22.99	23.45	23.91	24.39	21.82	22.25	22.70	23.15	23.62	24.09	24.57	25.06	25.56	26.07	26.60	27.13	27.67
28.73	29.31	29.89	30.49	27.27	27.81	28.37	28.94	29.52	30.11	30.71	31.32	31.95	32.59	33.24	33.91	34.58
48.51	49.48	50.47	51.48	46.46	47.39	48.34	49.31	50.29	51.30	52.33	53.37	54.44	55.53	56.64	57.77	58.93
48.51	49.48	50.47	51.48	46.46	47.39	48.34	49.31	50.29	51.30	52.33	53.37	54.44	55.53	56.64	57.77	58.93
13.08	13.74	14.43	15.15	14.22	14.93	15.68	16.46	17.29	18.15	19.06	20.01	21.01	22.06	23.17	24.32	25.54
13.08	13.74	14.43	15.15	14.22	14.93	15.68	16.46	17.29	18.15	19.06	20.01	21.01	22.06	23.17	24.32	25.54
61.60	**63.22**	**64.90**	**66.63**	**60.69**	**62.33**	**64.02**	**65.77**	**67.58**	**69.45**	**71.39**	**73.38**	**75.45**	**77.59**	**79.81**	**82.10**	**84.47**
0.43	0.45	0.47	0.49	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49	0.52	0.54	0.57	0.60
0.17	0.18	0.19	0.20	0.13	0.14	0.15	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24
0.59	0.62	0.65	0.69	0.47	0.49	0.51	0.54	0.57	0.60	0.63	0.66	0.69	0.72	0.76	0.80	0.84
0.78	0.82	0.86	0.90	0.68	0.72	0.75	0.79	0.83	0.87	0.92	0.96	1.01	1.06	1.11	1.17	1.23
0.24	0.26	0.27	0.28	0.19	0.20	0.21	0.22	0.23	0.24	0.26	0.27	0.28	0.30	0.31	0.33	0.34
0.17	0.18	0.19	0.19	0.13	0.14	0.15	0.15	0.16	0.17	0.18	0.19	0.20	0.20	0.22	0.23	0.24
1.19	1.25	1.31	1.38	1.01	1.06	1.11	1.17	1.22	1.28	1.35	1.42	1.49	1.56	1.64	1.72	1.81
0.12	0.12	0.13	0.14	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.16	0.17
1.90	2.00	2.10	2.20	1.57	1.64	1.73	1.81	1.90	2.00	2.10	2.20	2.31	2.43	2.55	2.68	2.81
2.57	2.69	2.83	2.97	2.21	2.32	2.43	2.55	2.68	2.81	2.95	3.10	3.26	3.42	3.59	3.77	3.96
2.57	2.69	2.83	2.97	2.21	2.32	2.43	2.55	2.68	2.81	2.95	3.10	3.26	3.42	3.59	3.77	3.96
2.57	2.69	2.83	2.97	2.21	2.32	2.43	2.55	2.68	2.81	2.95	3.10	3.26	3.42	3.59	3.77	3.96
4.47	**4.69**	**4.92**	**5.17**	**3.77**	**3.96**	**4.16**	**4.37**	**4.58**	**4.81**	**5.05**	**5.31**	**5.57**	**5.85**	**6.14**	**6.45**	**6.77**
43,752	47,033	50,561	54,353	36,531	39,270	42,216	45,382	48,786	52,445	56,378	60,606	65,152	70,038	75,291	80,938	87,008
6,563	7,055	7,584	8,153	5,480	5,891	6,332	6,807	7,318	7,867	8,457	9,091	9,773	10,506	11,294	12,141	13,051
50,315	**54,088**	**58,145**	**62,506**	**42,010**	**45,161**	**48,548**	**52,189**	**56,103**	**60,311**	**64,835**	**69,697**	**74,924**	**80,544**	**86,585**	**93,078**	**100,059**
2.74	2.88	3.02	3.17	1.83	1.92	2.01	2.11	2.22	2.33	2.45	2.57	2.70	2.83	2.97	3.12	3.28
1.77	1.85	1.95	2.04	1.14	1.20	1.26	1.32	1.38	1.45	1.53	1.60	1.68	1.77	1.85	1.95	2.04
0.61	0.64	0.67	0.70	0.39	0.41	0.43	0.45	0.48	0.50	0.52	0.55	0.58	0.61	0.64	0.67	0.70
0.10	0.11	0.11	0.12	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12
0.15	0.16	0.17	0.18	0.10	0.10	0.11	0.11	0.12	0.13	0.13	0.14	0.15	0.15	0.16	0.17	0.18
0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
5.39	5.66	5.94	6.24	3.53	3.71	3.90	4.09	4.30	4.51	4.74	4.97	5.22	5.48	5.76	6.04	6.35
5.39	**5.66**	**5.94**	**6.24**	**3.53**	**3.71**	**3.90**	**4.09**	**4.30**	**4.51**	**4.74**	**4.97**	**5.22**	**5.48**	**5.76**	**6.04**	**6.35**

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