Mormugao Port Trust

Preparation of a Business Plan

FINAL REPORT

March 2007

Volume II of II
(Chapter 6 to 13)

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

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6 Proposed Facilities

6.1 General

The existing port facilities are provided in Section 2 of this report. In this section the capacity of the present facilities is assessed, together with any improvements proposed. The capacity is compared to the traffic forecast, to determine what new facilities may be required. Options for new facilities are then discussed, with preferred schemes being recommended for further analysis in subsequent sections of the report.

After the common port infrastructure components, the facilities are considered on a cargo-wise basis.

6.2 Common Port Development

6.2.1 *Breakwater*

The main breakwater at the western extremity of the port is 522m long and was constructed originally over 100 years ago. It was reported that frequent repairs are required to maintain the breakwater, principally the addition of armour 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.

The seaward side armour comprises large rectangular concrete blocks, as shown in the photographs below.

The stability analyses assessed the use of rectangular concrete blocks, similar to those used to date, or tetrapods or accropodes. The conclusion was that overtopping occurs with all models but in terms of stability, any of the shapes is acceptable. There would be an element of difficulty in switching to a new shape of armour unit due to the irregular profile on which they would be laid. In view of MPT's preference for rectangular blocks, their continuing use was endorsed.

These works comprise essential maintenance of the breakwater. As such, given the critical nature of the breakwater to the ongoing port operations, it is recommended that the port should undertake these works as a priority project.

6.2.2 *Deepening of the Approach Channel and Berth 9*

A proposal was developed and submitted to the Department of Shipping at the Ministry of Shipping, Road Transport & Highways in respect of the proposed National Maritime Development Programme for a project 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. The deepening of approach channel and berth no 9 by one meter was estimated to cost Rs.65 Cr while the proposal submitted to the Ministry of Shipping had an estimate of 161 Cr which also included the dredging and reclamation of Vasco Bay for developing additional port facilities.

The current position with regard to iron ore exports from Mormugao Port may be summarised as follows:

- Iron ore is exported from Berth 9 to the capacity limit of the MOHP, the practical limitations being principally the capacity of the receiving system (barge unloading) and the stockyard capacity. The berth occupancy at Berth 9 is at around 67% indicating that the shipping system has some additional capacity.

- Four transhippers and transfers at the mooring dolphins add a further 13 million tonnes throughput.

- Approximately three quarters of the transhippers output comprises primary loading, the remainder being uptopping of ships part loaded at berth 9 (or occasionally at the mooring dolphins).

If the channel and berth 9 are deepened, then the larger ships would be able to load additional cargo, subject to depth limitations at their destination port. However, the implications of loading this additional cargo are as follows:

- The amount of cargo to be received at the stockyard increases, causing further pre-berthing delays awaiting cargo. Ships may not berth until 90% of the cargo is ready.

- As fewer ships would load at Berth 9, even though the tonnage handled remains the same, the berth occupancy would reduce marginally due to the reduction in berthing and unberthing delays.

- The average handling rate is higher for larger ships. Consequently an increase in the average size of ships at Berth 9 would result in a reduction in berth occupancy, for the same quantity of cargo loaded. This should reduce pre-berthing delays due to the berth being already occupied.

- 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. At present, capacity increases are absorbed without the need to deepen to attract the ships, so this rationale does not apply.

- The analysis undertaken by MPT justifies the deepening on the basis of the ship's time saved by not having to wait for high tide before sailing, assuming that the ship loaded the same cargo, to the same draft. On this basis, the pre-berthing delays would not increase, the berth occupancy would decrease and the ships would remain the same. This analysis failed to justify the whole deepening cost and relied on Government support for the portion of the cost calculated to be not viable.

Consequently 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 this could give a small competitive benefit overall. Deepening would be most effective for MPT in conjunction with increased loading capacity, for which see below.

With regard to MPT, the direct benefit arising from this proposed project appears to be not significant. However there are benefits to the shippers and hence, ultimately, to the country of India as a whole.

It should also be noted that due to the additional depths provided by deepening project, the annual maintenance dredging is likely to increase to take account of the additional depth to be restored. This would mean an additional annual maintenance cost to MPT.

It is concluded that though the direct benefits to MPT at this stage by deepening 1 m appears low, there are many economic benefits arising out of this. Also, the port eventually needs to have facilities to handle a fully loaded Cape Size vessel to maintain the country's competitive position for bulk cargo export.

However, the funding options for this deepening project are covered in the subsequent section of this report to ascertain the impact of this project on MPT finance.

6.2.3 Port Crafts

The port has adequate number of tugs and no procurement of additional tugs and port crafts will be necessary for any immediate additional port development.

6.3 Iron Ore

6.3.1 Present Iron ore handling Practices at Goan waters

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 6.1** below**.**

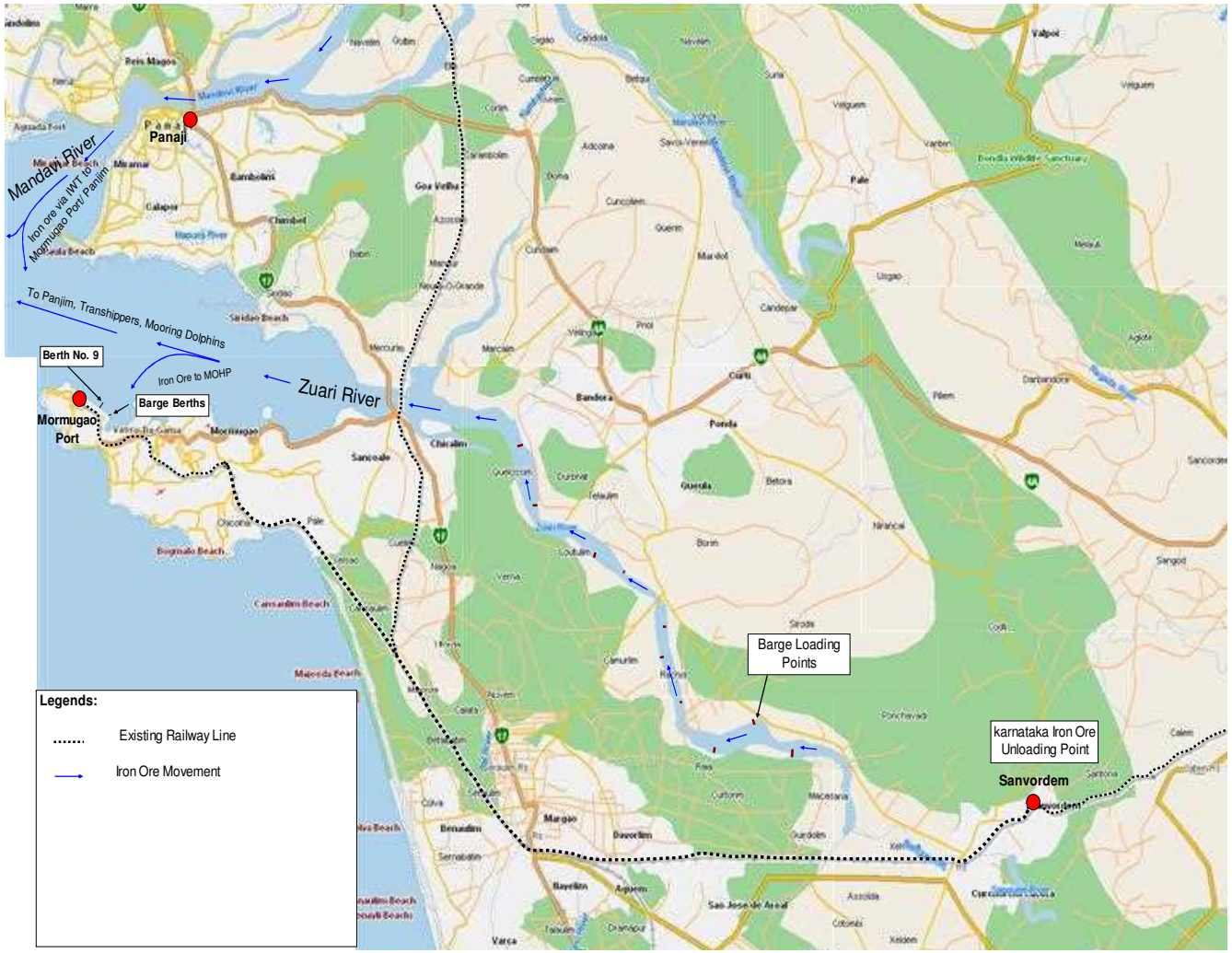


Figure 6.1 - Iron ore handling practice at Goan waters

6.3.2 *Existing Capacities & Enhancements*

Throughput of iron ore at Mormugao Port last year (2005 – 06) was as follows:

Berth 9	11.90 million tonnes
Transhippers	9.45 million tonnes
Mooring dolphins	3.74 million tonnes
Others	0.31 million tonnes
Total	**25.4 million tonnes**

a) Berth 9

Berth 9 is operating at the capacity of the receiving system. However, the equipment of the receiving system as well as the shipping system is in the process of renewal, being of a considerable age, and is being upgraded as part of the renewal process.

This upgrading will add to the capacity of the receiving and shipping systems.

The stockyard is also subject to capacity limitations. Although it has a capacity, overall, of some 1 million tonnes, in practice with multiple shippers each having an allocated area, the effective capacity is dramatically reduced. Consequently it is not possible for shippers to maintain a 'buffer' at the port, but instead must barge their iron ore to the port on a just-in-time basis. Given the vagaries of the world of dry bulk cargo ships, this just-in-time approach frequently means just-late, with ships kept waiting for the cargo to arrive at the port. The average "pre-berthing detention" averages 3.1 days per ship on account of waiting for cargo and a further 0.9 days waiting for the berth to be available (based on an analysis of 77 ships between December 2005 and July 2006).

It is estimated that the capacity of the MOHP system will increase to a figure in the region of 14 million tonnes per year, once the upgrading is completed. At that time it is to be expected that the capacity will be limited by the difficulties in managing the stockyard, manifested by long waiting times for ships awaiting cargo.

b) Transhippers

Data for the period from April 2005 to March 2006 inclusive provided by MPT reveals that the four transhippers all worked for between 183 and 194 days. Taking into account a 59 day shutdown (the transhippers do not

operate during the monsoon period) this represents average berth occupancy of 61%.

The average time taken for the transhippers to load a ship depends on the transhipper, but typically varies between 5 and 8 days for primary loading and between 2.5 and 6 days for uptopping.

The time spent by ships waiting for a transhipper to be available is not known.

If the occupancy rises to an average of 75%, this is likely to be as high as is achievable without excessive waiting times. This would represent a capacity in the region of 11.5 million tonnes per year.

c) Mooring dolphins

All year round, but in particular during the monsoon while both the MOHP system is closed and the transhippers do not operate, ship loading takes place in the river. The ships are moored between pairs of mooring dolphins.

Loading is undertaken using ships' gear, transferring iron ore from barges moored alongside.

The present handling practice at the dolphins is that barges with iron ore brought to the mooring dolphins and the ore is loaded through ship's gear with grabs. With three mooring dolphins, three vessels can berth simultaneously by using Ship's anchor for one of the vessels on one side with mooring dolphin on the other side.

Presently, the mooring dolphins are catering to berthing of iron ore vessels during non-monsoon and monsoon though their demand is high during monsoon while Berth no 9, transhippers and Panjim operations are closed.

The quantity of iron ore loaded at mooring dolphins along with the average output achieved per day is shown in **Table 6.1** overleaf for the last 2 years and the current financial year.

Table 6.1 – Iron ore loaded at Mooring Dolphins

	2004-05			2005-06			2006-07		
Months	**Tonnage**	**Effective Days**	**Output Per day**	**Tonnage**	**Effective Days**	**Out put per day**	**Tonnage**	**Effective Days**	**Out put per day**
April	351861	55.3	6363	237839	24.6	9668	400546	55.6	7204
May	349862	52.6	6651	346873	43.9	7901	577923	60.6	9537
June	9452	2.3	4109	205159	27.3	7515	435111	61.6	7063
July	67728	8	8466	230679	30.9	7465	686107	84.6	8110
August	426467	56.2	7588	527756	57.6	9162	432631	57.9	7472
Sept	296957	41.6	7138	496173	55.6	8924	628307	79.6	7893
October	403504	49.3	8145	490312	60.9	8051	497807	56.3	8842
November	241661	30.3	7976	105312	13.6	7744	209254	26.2	7987
December	147997	17.6	8409	281757	48.2	5846			
Jan	340959	43.9	7767	293766	39.3	7475			
Feb	160109	22.9	6992	186425	19.3	9659			
March	421025	64.9	6487	342821	40.9	8382			
Total (T)	**3217582**			**3744872**			**3867686**		

As per the present practice and understanding with labour union, the port is bound to engage gangs for carrying out these operations. Due to inadequate supply of gangs, the loading rate achieved is low. The handling rate achieved presently is about –7000 - 8000 TPD.

A loading rate of up to 12000 – 15000 TPD per vessel is achievable through this operation and that is not happening mainly due to Labour / Gangs problem.

This could be solved if the exporters are permitted to engage their own / private labor. The labour Union have been resisting for quite some time to permit private labours in the port. But discussions with the port authorities reveal that there are improvements in the dialogues with the union and a positive trend is appearing.

If private labours are permitted, the existing mooring dolphins can be effectively used to achieve this rate of 12000 – 15000 TPD. If the privatization of labour does not make its way, the Port will have problems supplying Gangs to the additional mooring dolphins since this problem is prevailing even for the existing dolphins

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.

Capacity

The total iron ore throughput capacity is assessed as being in the region of 28 million tonnes at present, rising to a potential of about 30 million tonnes once the upgrading of the MOHP is complete.

Pre-berthing Detention

The pre berthing detention time detail for the dry bulk mechanical cargo handled at MP during the last few years are presented below in **Table 6.2**;

Table 6.2 – Pre-berthing Detention Details for Dry Bulk Mechanical Cargo

Year	No of ships	non-availability of		Strikes	Night Navigation restriction	Lack of Cargo	Ships A/c	Total (Hrs)	Ave (Days)
		berth	tugs/ pilot						
2000-01	210	2283	0	0	67	6279	626	9255	1.8
2001-02	201	3140	0	0	23	3713	1538	8414	1.7
2002-03	183	1474	0	0	36	12742	0	14252	3.2
2003-04	198	3618	0	0	0	17042	0	20660	4.3
2004-05	207	3526	0	0	10	14092	0	17628	3.5
2005-06	197	1928	0	0	20	14690	0	16638	3.5

The vessels to be loaded by MOHP have 'lack of cargo' as the main reason attributing to 80% of the delay time and the 'non availability of berth' account to 20%. This is due to the present stack yard capacity allotted to different exporters who handle multiple grades of ore. As per present norms, the vessel could arrive at berth only when 90% of the load is ready in the stackyard. Consequently, the delay due to lack of cargo is to the shippers account not the Port's account.

Nevertheless, the pre-berthing detention time should ideally be reduced to the benefit of the vessels that call at Mormugao port.

6.3.3 Required Capacities

The traffic forecast in Section 2 above shows that the level of iron ore exports through Mormugao Port is expected to decline in both the Low Case and the Medium Case scenarios, with only the High Case scenario showing

any growth. Even in the High Case the throughput at MPT only grows in 'Case 2', implying reductions in tariff (to iron handled at mid stream and mooring dolphin) and eliminating the procedural hassles as well as an increase in MOHP capacity, to 43.65 million tonnes by 2011–2012. Under the same case or circumstances, it is assessed that MP could attract an iron ore throughput of 57.77 MT by 2025-26.

The export capacity of the combined Berth 9, transhippers and existing mooring dolphin operations is expected to be about 32 million tonnes once the MOHP upgrading is completed. In theory, this might be expected to provide sufficient capacity to respond to the forecast throughput of iron ore for Case 1, medium scenario up to 2025-26.

In practice, however, the forecast in Section 2 also describes the differences between the different cases considered, the key factor being the competition from Panjim. If capacity at the MOHP is increased and the attractiveness of MPT enhanced, then MPT can retain or even increase market share, but otherwise MPT will lose traffic to Panjim.

To avoid the dwindling iron ore export forecast in Case 0, the MOHP must be upgraded further together with other capacity increases as discussed below.

6.3.4 Additional Facilities

The following ideas are suggested or have already been proposed where additional facilities may be cost effective in improving capacity and service levels.

a) Buffer hopper

The introduction of hoppers to provide a buffer capability may assist in raising the effective productivity of the MOHP shipping system.

Hoppers could be introduced where the conveyors arrive at the quay and the material flow turns through 90 degrees.

The objective is that generally the iron ore would flow as at present directly through the hopper from one conveyor to the next without impediment. When the shiploader needs to interrupt the flow, for example to move to a different hatch, then the hopper outlet would be closed. The reclaimer would continue to operate and the hopper would fill with iron ore. A system of limit switches would advise the reclaimer to slow down and then stop if the hopper becomes full.

Once the shiploader is ready to re-commence loading, the hopper outlet would be re-opened. Iron ore would then flow to the shiploader at up to the rated flow rate of 4,000 tph, thus emptying the hopper again while the reclaimer continues to operate.

This system would minimise the delays to the loading process. As it takes 5 minutes for iron to reach the shiploader from the reclaimer, every 'stop' causes a minimum of 10 minutes delay in stopping and re-starting.

It is suggested that the hopper capacity should correspond to a stoppage of 10 minutes and the hopper should therefore have a capacity of 15 minutes supply, or about 700 tonnes.

Local strengthening of the quay may be required to carry the additional weight of the hoppers, one for each stream. In addition, the conveyor drives would need to be substantially up rated to achieve the height gain required to feed the hoppers.

It is considered that such a scheme may be cost effective if undertaken in conjunction with other schemes: if the capacity of the shipping system needs to be increased to accommodate an increase in capacity of the receiving system, this might be a suitable means. However, it is unlikely to be cost effective on its own.

b) Conversion of Berth 8 to Handle Iron Ore

Since it is perceived that 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. These three aspects (Shipping, Receiving and Storage /reclaiming) are discussed in a logical sequence below;

Shipping System

It is suggested that the berth no 8 is rebuilt to make it inline & continuous with berth 9, integrated to handle iron ore by extending the mechanical shipping system from berth 9. A new liquid bulk terminal would be constructed elsewhere and this is considered below.

The location of Berth 8 makes it eminently practical and appropriate to convert it for iron ore handling. The berths are aligned and it would be a

relatively simple matter to make the conversion and extend the mechanical shipping system to a second berth.

In view of the competition with Panjim described in the traffic forecast, an increase in capacity is required and a second berth could be a viable proposition. It could provide a more cost effective means of loading the ships with iron ore than the transhippers. Also the rebuilt berth 8 for iron ore could be designed to receive cape size bulk vessels for which MPT do not have a facility now.

The concept of rebuilding berth no 8 and integrating it with Berth no 9 is illustrated in the following **Figure 6.2** and **Figure 6.3**;

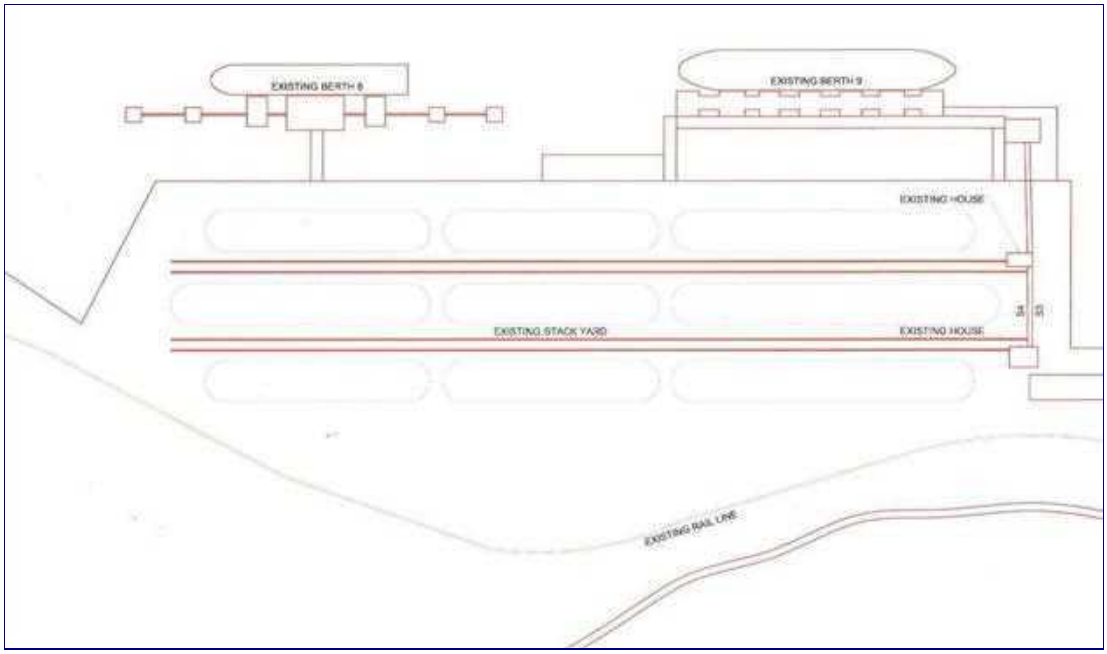


Figure 6.2 – Present Berth 8 and Berth 9

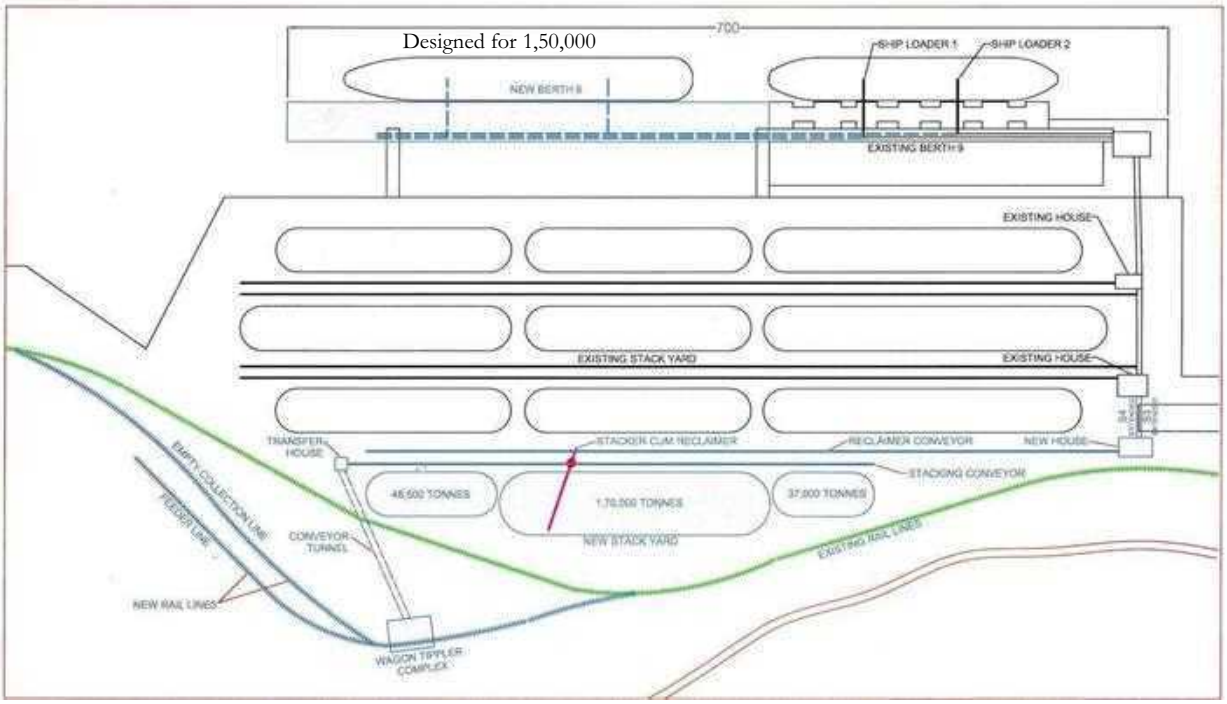


Figure 6.3 – Integration of Berth 8 with Berth 9 for iron ore handling

In the year 2005 – 06, the transhippers loaded a total of 9.4 million tonnes, of which 2.2 million tonnes was uptopping, which could not be carried out at Berth 9, due to the depth limitation. The remaining 7.2 million tonnes was primary loading, for which Berth 8 would be preferred.

If Berth 8 were converted to iron ore handling, then in the first instance it is suggested that no further shiploaders are required: if the conveyors and rails are extended along Berth 8, then the existing shiploaders could operate at Berth 8.

Operational data for the shipping system for the year 2005-06 were collected for the non monsoon period between Oct and May during which time normally 90% of MOHP through put is handled is analysed and presented below in **Table 6.3.**

Table 6.3 – MOHP Shipping System Analyses (Oct 05 – May 06)

Description	Oct 05 - May 06	Remark
Tonnage loaded	12,359,000	
No of vessels	174	
Days available	242	
Hours available	5,808	Clock hours
Stream hours	11,616	Stream hours
Service time (berthing to unberthing)	8,410	Stream hours
Service time (berthing to unberthing)	4,205	Clock hours
Berth occupancy (%)	0.72	
Average output per berth day	70,536	Day = 24 clock hours
Average output per berth hour	2,939	Clock hours - Based on berthing to unberthing time
Handling time	7,191	Stream hours
Avg output/hr based on gross handling time	**1,719**	**per stream**
Loading rate/hour, based on net time worked	**2,854**	**per stream, excluding time lost due to detentions**
Net time worked (Stream 1 and 2)	4,331	Stream hours
Total Detentions	3,049	Stream hours
Net working time	2,165	Clock hours
Net working time	51%	of the time at the berth

When the shiploaders are loading a ship, the average productivity per shiploader is in the region of 2,854 tonnes per hour (tph) based on the statistics for the period from Oct '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 move to new holds.

If the net working time of both the ship loaders are increased by making them work on two ships either one at each berth or both at one berth. It may be effective to use 2 ship loaders during prime loading at one berth. 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. Depending on the vessel size, either one ship loader or two ship loaders could be used for loading a ship. Integration of berth 8 and 9 would give such flexibility in operations that the net working time and hence the real capacity of the ship loaders would increase.

With the two ship-loaders on two berths, the loading capacity is estimated to be in the region of 20 million tonnes per year. This is based on the assumption that the net working time each ship loader would increase to 65%, the productivity of each ship loader increased to 3200 TPH and with an efficiency factor of 0.75.

The loading capacity for 240 days in a year;

240 x 65% x 2 x 3200 x 0.75 x 24 = 17.97 say 18 MT

The port normally handles 10% total MOHP shipping during monsoon. Assuming the same proportion, the loading capacity of MOHP with integration of berth 8 and berth 9 is estimated as 20 MT.

This could be an attractive option if the capacity of the receiving systems are matched so that the total throughput could be increased.

This requires an increase in receiving and storage / reclaiming capacity as the present storage and reclaiming capacity has limitations.

This increased MOHP capacity (20 MT), in conjunction with up-topping by the transhippers (11.5 MT) and operations at the mooring dolphins (7.5 MT), could respond to the traffic forecast until at least 2012-13 in all but the Case 2, Medium scenario, alternative. The remaining capacity gap need to be met with the additional mooring dolphins and by providing deploying additional transhippers for mid-stream loading provided the through put will be assured by this mode.

Receiving System

The capacity of the present barge receiving system is assessed as 14 million T. To increase the receiving system and to match with the increased shipping system due to integration of berth 8 and berth 9, a wagon tippler to receive the iron ore coming from Karnataka is suggested. This appears to be having many strategic benefits to MPT assuring that the ore brought by train is shipped from MPT and economic benefits since the same rakes that are destined to take JSW coal form MPT to Karnataka could bring iron ore to the port and go back with coal. Hence a wagon tippler system at MPT is recommended to increase the receiving capacity of iron ore.

Wagon Tippler

The iron ore from Bellary-Hospet in Karnataka is brought by rail as far as Sanvordem / Tinaighat. Owing to a lack of rail unloading facilities in Mormugao Port, the rail cars are unloaded at Sanvordem and the ore is

trucked to a barge loading point near the head of the Zuari River. 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 has been 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.

The wagon handling system if integrated with the MOHP will provide a cost effective alternative to the present means of transport via trucking and barging. Integration of a wagon tippling system with MOHP would make the present statutory requirement of blending Karnataka ore with Goan ore met easily.

However, the space constraints at port could pose a problem to devise a location for the new system and integration with MOHP but without which the scheme of integrating berth 8 with berth 9 will not be successful.

Hence it would be prudent to allocate area for wagon tippling close the present stackyard area even if requires dismantling and relocating of certain existing structures.

It is identified that Wagon Handling System / Wagon Tippler could be provided SW of the present stackyard area behind berth 9.

It is proposed that a "Tandem wagon tippler" in which two wagons are unloaded together instead of one Wagon as is usually the case in India at present, is considered for Mormgugao port. Though it is an innovative proposal in India, it is time tested and widely accepted in China, South Africa, Brazil, Australia Etc.,

The Tandem Tippler is a self powered rotating tippler with hydraulic clamps designed to unload two wagons together. The tippler would be designed as per IS 10095 and as per RDSO regulations to handle BG open wagons similar to conventional tipplers and designed to unload wagons carrying iron ore fines/ CLO/lumps etc.,

Tippler Capacity

The designed capacity the Tandem tippler would be 30 tips per hour and it can deliver at an average rate of 24 Tips per hour (80% of designed capacity) on a sustained basis taking into consideration all aspects such as operator efficiency, the movement of side arm charger etc., Hence for the purpose of

computing the capacity of Tandem tippler only 24 tips per hour is considered. Hence a Tandem Wagon Tippler with an average 24 tips per day operating for 20 hours could handle up to 16 rakes / day.

Capacity per rake

Indian Railways have standardized a rake to carry 58 BOXN wagons and each wagon ff this type have a designated carrying capacity of about 58 t. Each rake is thus expected to transport about 3500 T.

It is projected that in the initial phase a quantity of 6 Million tons per annum of Bellary- Hospet ore will be received through wagons requiring unloading through Tippler and the empty rakes will be used for coal, thermal coal Etc. In the long run when the Goan ore gradually depletes the throughput that would be received through this mode is expected to increase to 15 MT.

The No of rakes required for a throughput of 6 MTPA = 7,000,000/ 3500 = 1714 Rakes.

It is assumed that the Tippler will operate for 240 days effectively after accounting for shutdown during monsoon, annual maintenance etc.

Hence No of rakes to be handled per day is 1714/240=7.14 Rakes Say 7 Rakes per day. Considering the operating efficiency, the proposed Tandem tippler will be adequate for the expected throughput of 6 MT.

The tippler will be designed to handle BG open wagons with length over coupler faces ranging from 10.715 m to 14.428 m (covering almost all type of BG open wagons used in Indian Railways. The length of tippler house is recommended as 35 m.

Storage system for Wagon tipped cargo

Additional stackyard capacity of about 250,000 T is feasible by providing one more row of stockpile on the land side. This stockpile could store the ore arrived via rail.

The additional storage / stackyard could be integrated with MOHP by extending the present conveyors S3 and S4 and joining them with the new conveyor of the additional storage area. A stacker cum reclaimer with 50 m reach is recommended for stacking and reclaiming in this new storage area.

The existing conveyor system of the MOHP and the proposed arrangement of the additional stackyard is shown in Drawing **DCBPMP/02** and **DCBPMP/03** respectively. Wagon tippling system details are shown in **DCBPMP/04.**

It is apparent that the delays to the shipping while waiting for cargo are substantially a result of the lack of adequate storage capacity for iron ore at the port, notwithstanding the fact that these delays are charged to the shippers' account, not to the Port account.

Consequently it would be beneficial if the present storage capacity of the iron ore stockyard allotted to different shippers is managed better since there is no availability of land for increasing the storage area.

Some of the shippers share plots in the stockyard. It is recommended to extend this practice to provide fewer plots but each of a larger size. This would enable a larger shipload of ore to be prepared in readiness for a vessel arrival.

Based on the above discussion, it is recommended that berth no 8 is rebuilt and integrated with berth no 9 for iron ore handling subject to the feasibility of providing a liquid bulk berth in an alternative location.

The integration of berth no 8 & berth no 9 for handling iron ore has the following distinct advantages;

- MOHP is the most preferred option for iron ore shipping by the exporters and hence increasing MOHP capacity could retain or improve the share of iron ore export by MPT. This is expected to accrue more revenue to MPT.

- Integration of MOHP is linked to providing a wagon tippler for Karnataka iron ore brought by train meaning this might attract Karnataka iron ore on a sustainable basis for MPT. The wagon handling system if integrated with the MOHP will provide a cost effective alternative to the present means of transport via trucking and barging of Karnataka ore.

- There is a huge economic benefit because the rakes that are coming to MP for dispatching JSW's coal to their steel plant in Karnataka could bring iron ore to the port instead of coming empty

- The new berth 8 could be designed for receiving Cape size vessel – 150,000 DWT.

However, it should be noted that rebuilding Berth no 8 for handling iron ore an integrating the same with Berth no 9 would require creation of new berthing facilities elsewhere for liquid bulk and the port crafts. The existing port crafts jetty would become redundant by this conversion.

The investment required for this project and the funding options are discussed in the subsequent sections.

c) Construction of Mooring Dolphins

A possible project is under consideration to provide additional mooring dolphins to increase the capacity of this facility.

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**

If additional capacity is required, they could be provided by adding transhippers.

6.4 Coal

6.4.1 *Existing Capacities & Enhancements*

Coal is presently handled in two areas of the port, at Berths 5A and 6A and at Berth 11.

a) Berths 5A and 6A

These two berths are leased on a BOOT basis. They handle primarily coal for Jindal Steel Works Ltd, currently about 3 million tonnes per year but increasing to reach 6 million tonnes in the near future. The rated capacity is theoretically 6 million tonnes per year, compared to the minimum guaranteed throughput of 5 million tonnes per year. In addition to the coal the berth is also able to handle the steel exports from the JSW steel plant, forecast to rise to 1.5 to 2.0 million tonnes per year.

b) Berth 11

Berths 10 and 11 are the break-bulk berths, handling containers and general cargo, cruise ships and coal / dry bulk in conventional manner using ships' gear. With Berths 5A & 6A reaching its capacity with JSW's own capital cargo, the other users of coal are expected to continue using Berth 10 & Berth 11. This would be a minor quantity in the order of about 0.5 MT.

6.4.2 *Required Capacities*

The traffic forecast for coal/coke may be summarised as follows:

Table 6.4 - Traffic Forecast for coal/ coke

Scenarios	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Medium	5.70	6.90	6.90	7.15	7.40	7.65	7.90
Low	4.84	5.60	6.16	6.72	6.72	6.72	6.72
High	7.70	8.90	9.90	11.40	11.90	12.40	12.90

This forecast is based on the assumption that if JSW win the BOOT bid for Berth 7, then their throughput for the steel works will increase commensurately. Otherwise, based on their guaranteed throughput of a minimum of 5 million tonnes, the traffic is only expected to grow slowly.

The Berth 10&11 will have some spare capacity (1.5 MT) to handle coal till 2013-14 if provided with a harbour mobile crane and as a result if better productivity is achieved.

Thus if berth no 7 is assumed to be developed as 'coal' berth, the capacity of the port for handling coal will be;

Berth	Capacity (MT)
Berth 5A and 6A	6
Berth 7	2
Berth 11	1.5
TOTAL	**9.5**

6.4.3 Additional Facilities

As indicated above, if JSW win the BOOT bid for Berth 7 then they would be expected to develop this to correspond to the coal import and steel export requirements for the JSW steel works.

For other importers, the coal traffic is becoming established and an upgrade to the handling systems is required. At present coal is unloaded using ship's gear and handled to stockpiles with mechanical shovels.

A new mechanised berth will be required in the long term for the coal traffic beyond 9.5 MT.

6.5 Liquid Bulk

6.5.1 Existing Capacities & Enhancements

a) Present Operations

Liquid Bulk cargo of the port is mainly handled at Berth no 8 except phosphoric acid which is also handled at Berth no 10 and Berth no 11. The variety of liquid cargo received by the Port include Palm Oil, Crude Palm Stearin (CPS), Palm Fatty Acid Distillate (PFA), Liquid Ammonia, Phosphoric Acid, Caustic Soda, Alumina, Iron Ore, Motor Spirit, H.S.D., L.D.O., Furnace Oil, Low Sulphur High Flash, Naptha, Kerosene Oil, Acids and Sorts though not all the above commodities are consistently handled in a year.

Phosphoric acid is handled in bulk mainly at berth 8, but also at berths 10 and 11 and pipelines are provided for transfer of phosphoric acid from both Berth No. 10 / Berth no. 11 and Berth no. 8 to the storage terminal located adjacent to the port area.

All other bulk liquid products are handled at Berth no 8.

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 provided by the user Zuari Industries.

b) Present Cargo Handling Practices

The following procedures are carried out in handling the import of petroleum products at berth number 8 which is designated to handle liquid bulk:

- Tanker arrives under the control of the port authorities and docked. Passage of tanker between anchorage and berths takes normally one hour.
- IOC surveyor boards the tanker to take samples etc.
- Pre-discharge tests are carried out - 3 to 4 hours.
- Quantity assessment (dipping) - 1 hour.
- Pipeline hook-up and shore clearance to oil storage tanks.
- Hose connection between tanker and onshore pipelines undertaken concurrently during pre-discharge testing as indicated above.
- On completion of product discharge, generally the hoses are air blown to remove the product back to the first shut-off valve on the loading platform.
- Flushing of pipelines with water will be carried out after transfer of certain products. Air blowing of hoses is carried out after flushing. (1 hour)
- If the tanker cannot flush the line with water, then a water pump provided on the berth is used for flushing purposes. (2.5 hours)

- IOC surveyor checks tanks on tanker (1 hour). If only partial off-loading takes place, the surveyor takes about 1.5 hours.

- Tanker handed back to the captain and port authorities (pilot)

- Departure of tanker from berth to outside port limits is approximately one hour.

Thus a normal single parcel discharge takes about 6-8 hours of non working hours at berth once berthed.

During monsoon period (June to September) no night navigation is carried out. Generally the tankers are berthed in the afternoon, so that unloading can continue during the night. But liquid ammonia vessels are generally not allowed to berth at any time of the year between 12 AM to 5 AM.

A few tankers carry multi-products / double parcels, though it is not a regular phenomenon. Such products are Motor Spirit & HSD, HSD & SKO, CPS & PPS & PFA. While handling double parcels, if pigging is required, it takes an additional 11 - 12 hours. Simultaneous discharge of two products from the same tanker is very rarely carried out if possible.

c) Performance

The significant performance indicators berth occupancy of ships & the throughput are presented in **Table 6.5.**

Berth occupancy, by itself, cannot be a true indicator of a port's performance. Higher berth occupancy may be due to various reasons such as large number of ship calls, low productivity, equipment breakdown, other non-working time, weather downtime, or even due to reasons not attributable to the port. Nevertheless for berths where ship-calls are at random, the berth occupancy taken in conjunction with ships' working at berth could give a clearer picture of the performance. Similarly berth occupancy reviewed along with the pre-berthing detention could give an indication of the level of congestion at the port.

The berth occupancy for Berth No 8 for the past 5 years have been presented in **Table 6.5.**

Table 6.5 - Liquid Bulk Cargo (Performance Indicator)

Year	No. of days		% occupancy for cargo handling	Quantity handled in tons	Avg.ouput for berthday (tons)	% occupancy for non-cargo handling vessels	Overall Berth Occupancy %
	Available	Occupied for Cargo handling					
2001-02	365	212	58.10%	1457120	6873	15.90%	74.00%
2002-03	365	177	48.50%	1498163	8464	15.10%	63.60%
2003-04	366	183	50.00%	1670537	9129	13.90%	63.90%
2004-05	365	176	48.20%	1390476	7900	14.80%	63.00%
2005-06	365	179	49%	1314432	7343	14.20%	63.30%

The berth occupancy table indicates that the level of berth occupancy for berth 8 is high at 49 % for a relatively small through put of 1.3 million tonnes.

Apart from a low cargo handling rate and productivity, low parcel sizes also may attribute to such high berth occupancy for a small throughput. Hence an analysis to calculate the present average parcel sizes per tanker established from port records during the last 3 years are given in **Table 6.6;**

Table 6.6 – Average Parcel Size of Liquid Bulk commodities

	Average Parcel Size (T)		
Product name	**2003-04**	**2004-05**	**2005-06**
Other Vegetable Oils		3581	3333
Palm Oil	2772	3500	3750
Crude Palm Stearin	-	-	2513
Palm Fatty Acid Distillate	-	-	3166
Liquid Amonia	4834	4825	3967
Phosphoric Acid	8768	9112	9731
Caustic Soda	5963	4237	4839
Motor Spirit	8331	8475	7967
H.S.D.	20098	11494	9428
L.D.O.	8059	8541	7746
Furnace Oil	5910	5976	7479
Low Sulphur High Flash			16628
Naptha	8954	13412	16110
Kerosene Oil	16030	17839	-
Acids and Sorts	2000	-	-

Maximum parcel size of oil products presently handled at the berth is 30,000 tons, although the average parcel size on incoming tankers is much lower, approx. 9,000 tons.

The break-up details for the pre-berthing detention for the last 3 years are furnished in **Table 6.7.**

Table 6.7 – Liquid Bulk Vessels Pre Berthing Detention Time Details

Year	No of ships	non-availability of			Strikes	Night Navigation restriction	Lack of Ullage	Others	Ships Account	Total(Hrs)	Average (Days)
		berth	tugs	pilot							
2001-02	183	2224	0	0	0	157	0	0	769	3150	0.7
2002-03	158	2015	0	0	0	44	142	0	612	2813	0.7
2003-04	184	3191	0	0	0	72	601	0	310	4174	0.9
2004-05	172	3739	0	0	0	58	297	0	46	4140	1
2005-06	162	2300	0	0	0	52	140	0	352	2844	0.7

The above statistics indicate that the main reason attributable to pre-berthing detention of liquid cargo vessels is 'non availability of berths' which accounts to 70 – 90% of the delay caused with these values at 80 – 90% during the last 2 years. The non availability of berths could be due to the occupation of berth by non cargo vessels for about 15% of the year which is significantly high.

Hence the pre-berthing detention for liquid bulk vessels could be reduced by restricting the berth for use of non-cargo vessels and by when an additional berth is available within an acceptable berth occupancy factor.

d) Possible Performance Improvement / Capacity Enhancement

Presently, the unloading rate achieved varies between 150 – 1000 TPH depending on the commodity. The present unloading rates seem to be low for certain commodities. The unloading rate is restricted due to the present diameter of the pipelines.

Improvements in the unloading rates can be achieved by providing larger diameter pipelines when they are due for replacement.

Present productivity can also be improved by increasing the parcel sizes of the commodities that are delivered to the terminals especially the POL products since they constitute 60% of the total liquid bulk throughput.

Thus, the capacity enhancement at this berth can be achieved by;

- By providing larger diameter pipelines thus targeting a higher flow rate
- By increasing the parcel sizes
- Sampling of POL products by IOC conducted before the tanker arrives the berth so that the unloading can commence without much delay

6.5.2 *Required Capacities*

The traffic forecast for Liquid Cargo may be summarised as follows in **Table 6.8**:

Table 6.8 - Traffic forecast for Liquid Cargo

Figures in Million T

	Low			Medium			High		
Commodity	**2007-08**	**2012-13**	**2025-26**	**2007-08**	**2012-13**	**2025-26**	**2007-08**	**2012-13**	**2025-26**
POL Products	1.09	1.32	2.49	1.12	1.60	3.02	1.13	1.66	3.12
Phosporic acid	0.64	1.03	1.95	0.64	1.03	1.95	0.64	1.03	1.95
Liquid Ammonia	0.18	0.35	0.67	0.18	0.35	0.67	0.18	0.35	0.67
Palm Fatty Acids	0.06	0.06	0.11	0.06	0.06	0.11	0.06	0.06	0.11
Furnace Oil	0.09	0.09	0.17	0.09	0.09	0.17	0.09	0.09	0.17
Others	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.02
TOTAL	**2.06**	**2.87**	**5.41**	**2.10**	**3.15**	**5.94**	**2.10**	**3.21**	**6.04**

6.5.3 *Additional Facilities*

The berth requirements for the above traffic forecasts are calculated and presented in the following paragraphs.

It is expected that by 2007-08, minor improvements will be achieved in productivity and by 2012-13, if new liquid bulk berth(s) are provided with larger diameter of piles, the flow rates will improve significantly resulting in better productivity.

The following flow rates have been assumed while calculating the Berth requirements.

Table 6.9 - Flow Rates (in TPH)

Year	POL Products	Phosphoric Acid	Liquid Ammonia	Palm fatty acids	Furnace Oil	Others
2007-08	600	500	600	125	300	300
2012-13	600	500	600	125	300	300
2025-26	1200	1000	600	125	300	300

It is assumed that by 2025-26, unloading arms would be provided for the major commodities POL and Phosphoric acid which is expected to produce better productivity.

Requirement of berths

It will be necessary to provide additional berths for the bulk liquids, in addition to increasing the parcel sizes at the existing berths and also the flow rates. Calculations for berth requirements have been prepared for various scenarios and are given below in ;

Table 6.10 - Liquid Bulk - Number of berths (Berth Occupancy Factor)

Year	Low	Medium	High
2007-08	1 (67%)	2 (73.4%)	1 (73.6%)
2012-13	1 (95.9%) or 2 (48%)	2 (55%)	2 (55%)
2025-26	2 (62.5%)	2 (73.3%)	2 (74.2%)

The detailed calculations for Berth Occupancy are presented in **Table 6.11** for the medium scenario.

Table 6.11 – Berth Occupancy Calculations for Liquid Bulk Cargo (Medium Scenario)

Particulars	Units	2007-08						2012-13						2025-26					
		POL Products	Phosphoric Acid	Liquid Ammonia	Palm fatty acids	Furnace Oil	Others	POL Products	Phosphoric Acid	Liquid Ammonia	Palm fatty acids	Furnace Oil	Others	POL Products	Phosphoric Acid	Liquid Ammonia	Palm fatty acids	Furnace Oil	Others
Liquid Traffic	000T	1120	637	178	60	90	12	1,602	1,033	355	60	90	12	3020	1950	670	110	170	20
Parcel size	000T	15	12	8	8	8.00	5.00	15	10	5	5	8	5	15.0	10.0	5.0	5.0	8.0	5.0
Vesselcalls	Nos	75	53	22	8	11	2	107	103	71	12	11	2	201.3	195.0	134.0	22.0	21.3	4.0
Pumping Rate	TPH	600	500	600	125	300	300	600	500	600	125	300	300	1200.0	1000.0	600.0	125.0	300.0	300.0
Service Time	Hrs	25.0	24.0	13.3	64.0	26.7	16.7	25	20	8	40	27	17	12.5	10.0	8.3	40.0	26.7	16.7
Additional time	Hrs	6	6	6	6	6	6	6	6	6	6	6	6	6.0	6.0	6.0	6.0	6.0	6.0
Total time at Berth	Hrs	31.0	30.0	19.3	70.0	32.7	22.7	31.00	26.00	14.33	46.00	32.67	22.67	18.5	16.0	14.3	46.0	32.7	22.7
Number of working Hrs	Hrs	20	20	20	20	20	20	20.00	20.00	20.00	20.00	20.00	20.00	20.0	20.0	20.0	20.0	20.0	20.0
Berth day per ship	Days	1.6	1.5	1.0	3.5	1.6	1.1	1.55	1.30	0.72	2.30	1.63	1.13	0.9	0.8	0.7	2.3	1.6	1.1
Required Berth days	Days	115.75	79.68	21.53	26.25	18.38	2.66	165.54	134.24	50.81	27.60	18.38	2.79	186.2	156.0	96.0	50.6	34.7	4.5
Available berth days	Days	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.00	360.0	360.0	360.0	360.0	360.0	360.0
Berth occupancy	Nos	0.32	0.22	0.06	0.07	0.05	0.01	0.46	0.37	0.14	0.08	0.05	0.01	0.52	0.43	0.27	0.14	0.10	0.01
Total Berth Occupancy	%	0.73						1.11						1.47					
No. of berths (Berth occupancy factor)	1	**73.40%**						1.11						1.47					
	2	36.70%						**0.55**						**0.73**					
	3	24.47%						0.37						0.49					
	4	18.35%						0.28						0.37					
	5	14.68%						0.22						0.29					

6.6 Break Bulk & Containers

Generally planning of the facilities for break bulk / general cargo requires careful optimization of various parameters like a variety of cargo that could be handled with a combination of different types of equipment, storage capacity, movement of cargo, etc,. Because, these complexities influence the productivity and hence the throughput, berth occupancy, ship waiting time, etc.

6.6.1 *Existing Capacities & Enhancements*

Alumina, Fertilizers, Fertilizers Raw Material, Coal, Coke, Bauxite, Food grains, finished steel, HR coils, Scrap, Containers and the specific liquid bulk - phosphoric acid are the main commodities handled at the general cargo berths presently. These cargoes are handled at berth 10 and berth 11 of the port. There are no equipments provided for loading / unloading cargo and the operations are carried out using ship's gear.

a) Present handling Practices

- *Alumina (Export)*

The export cargo arrives in the port as jumbo bags of 750 kg size which are either transferred to storage using FLTs or directly loaded into the ships using ship's gear. The average berth-day out put for this cargo is about 1700 – 1800 TPD. The average parcel size of the vessels bringing this cargo is about 12,000 t.

The port has proposed to set a productivity norm of 2500 TPD.

- *Raw Sugar (Export)*

A meagre quantity of this commodity is handled at times and during 2005-06, there was one shipment. This export cargo arrived in the port as bulk in trucks and was transferred to storage and then loaded into the ships using ship's gear. This cargo was loaded with a berth day output of 5300 TPD.

- *Muriate of Potash (MOP) & Urea (Import)*

Presently, Muriate of Potash (MOP) is the main Fertiliser Raw Material (FRM) imported by Zuari Industries. Ureas import has dwindled in the recent past although last year a little quantity was handled.

These cargoes arrive in bulk although some bagged urea was handled in the past occasionally. 10-men gangs shovel the bulk fertilizer into slings on board and ship's hooks discharge it directly on the quay. The pay loaders then transfer fertilizer into tipper trucks for carriage into sheds, for later dispatch to the cargo destination by road trucks and as bulk.

Earlier bagging these cargoes on the quay itself was carried out and it is not permitted now because it is a labour and equipment oriented operation with a poor daily output.

The average parcel size for this cargo is of the order 17000 t in the recent years.

The average berth-day output achieved for MOP is 3000 TPD. Recently the port has proposed a productivity norm of 3500 TPD.

- *Scrap (Import)*

This is handled as bulk unloaded using Ship's gear with grabs and kept in open storage before dispatching by road. During 2005-06 two shipments were handled with a berth day out put of 4800 TPD. This is considered a good berth-day output as it is even higher than the Port's desired norm of 3000 TPD.

- *Coal and Coke (Imports)*

Coal is handled with ships' grabs at a daily berth day output of 5,000 T. This is discharged directly on to the quay.

Calcined Petroleum Coke is handled through ship's gear with grabs onto the quay at a rate of 1,000 to 1,800 TPD. From there it is transferred by front-end loaders to an open storage yard and thereafter to the plant by lorries.

Raw Petroleum Coke and Metallurgical coke is also handled with a berth day output of about 5000 – 5700 TPD.

Presently about 30% of the Coal / Coke received at general cargo berths (berth 10 and 11) are dispatched through rail and the remaining by road.

During the last 3 years, the average parcel size for these cargoes has undergone a significant change as given overleaf;

	Parcel size (t)		
	2003-04	**2004-05**	**2005-06**
Raw Coke	12000	10500	5500
Coal	23000	11000	11000
CP Coke	7300	8500	5790

The reduction is on account of the fact that after commissioning of Jindal Berths 5A and 6A, their captive cargo got shifted and the cargo that remains with MPT is of the small users who bring the cargo in small parcel sizes.

It is expected to continue like this.

- *Containers (Export and Import)*

The port does not have specialized equipment for handling containers. Transfer of containers to and from ship is carried out by the ship's crane.

Container cargo are received / dispatched through 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.

Transfer of containers to and from ship is carried out by the ship's derrick. During the last three years, the average container exchange per ship call has been 150- 200 TEUs.

The port is taking all possible steps like priority berthing to attract this traffic. Sometimes other ships are removed from the berth to accommodate the container ships, if necessary. Shipside arrangements appear to be adequate for present workloads.

b) Cargo Handling Operations:

The port engages dock workers drawn from a statutory body, the Dock Labour Board (DLB) that was set up in 1948 for this purpose. Presently DLB is reorganized as Cargo Handling Labour Department (CHLD). A pool of labour is available under this department from which stevedores are obliged to draw their requirements. In the event the CHLD cannot supply the required labour, the stevedores can meet their requirements through private labours.

The labour force is strongly unionized with nine (recognized and un-recognized) separate unions in the port.

However industrial relations appear to be good with no manday lost during the last few years due to strike.

But, slow working is more prevalent. Restrictive practices exist to the detriment of overall efficiency. An hour is lost at the start of each shift because the place of signing is away from some berths and stevedores are not

willing to provide transport. Extended meal breaks beyond the designated times and leaving the workplace before the shift closure is prevalent.

The equipment used for general cargo handling is traditional with a minimum of mechanization. Stevedores provide shovels and slings, pick axes, reach-stacker and other hand items.

The port provides hoppers and FLT's for use on the dock if required.

It is the idea of the Port that the private sector should progressively take over these activities.

c) Productivity at Berths:

The significant performance indicators are:

- Berth occupancy
- Berth throughput
- Ship output

Berth Occupancy

The operational data for handling break bulk / container cargo over the period April 2003 to March 2006 was analyzed and is presented below along with a discussion on the results of the analysis. Berth occupancy, by itself, cannot be a true indicator of a port's performance. Higher berth occupancy may be due to various reasons such as large number of ship calls, low productivity, equipment breakdown, other non-working time, weather downtime, or even due to reasons not attributable to the port. Nevertheless for general cargo berths where ship-calls are at random, the berth occupancy taken in conjunction with ships' working at berth could give a clearer picture of the performance. Similarly berth occupancy reviewed along with the pre-berthing detention could give an indication of the level of congestion at the port.

The gross berth occupancy for the general cargo berths 10 & 11 for the past 5 years have been presented in **Table 6.12.**

The break-up details for the pre-berthing detention for the last 5 years are furnished in **Table 6.13.**

Table 6.12 - Present Berth Occupancy (%) of Berth 10 & 11

Berth 10 General Cargo

Year	Available Days	Occupied for handling (Days)	Percent Occupancy for handling	Quantity handled in tons	Days occupied for non- cargo handling vessels	Occupancy for non-cargo handling (%)	Overall Berth Occupancy %
2001-2002	365	285	78.10%	1188888	34	9.30%	87.40%
2002-2003	365	307	84.10%	1284085	13	3.60%	87.70%
2003-2004	366	273	74.60%	1068510	21	5.70%	80.30%
2004-2005	365	289	79.20%	954994	44	12.10%	91.20%
2005-2006	365	252	69	822089	57	15.60%	84.70%

Berth 11 General cargo

Year	Available Days	Occupied for handling (Days)	Percent Occupancy for handling	Quantity handled in tons	Days occupied for non- cargo handling vessels	Occupancy for non-cargo handling (%)	Overall Berth Occupancy %
2001-2002	365	298	81.60%	2114931	20	5.50%	87.10%
2002-2003	365	304	83.30%	2119057	11	3.00%	86.30%
2003-2004	366	303	82.80%	2030503	17	4.60%	87.40%
2004-2005	365	296	81.10%	1691232	32	8.80%	89.90%
2005-2006	365	292	80.00%	1268868	44	12.10%	92.10%

Note: Non commercial vessels include Naval ships, survey ships, Research ships etc., but excludes port crafts

Source : MPT Administrative Records

Table 6.13 - Break-Up Details Of Pre-Berthing Detention (Berth 10 & 11)

Container

Year	No of ships	non-availability of		Strikes	Night Navigation restriction	Draft restriction	Lack of Cargo	Others	Ships Account	Total (Hrs)	Average (Days)
		berth	tugs/ pilot Crew								
2001-02	54	85	0	0	44	0	0	0	7	136	0.1
2002-03	80	293	0	0	29	0	0	0	0	322	0.2
2003-04	62	151	0	0	8	0	0	0	0	159	0.1
2004-05	37	125	0	0	25	0	0	0	0	150	0.2
2005-06	38	135	0	0	28	0	0	0	15	178	0.02

Break Bulk

Year	No of ships	non-availability of		Strikes	Night Navigation restriction	Draft restriction	Lack of Cargo	Others	Ships Account	Total (HRS)	Average (Days)
		berth	tugs/ craft								
2001-02	11	1096	0	0	0	0	474	0	0	1570	5.9
2002-03	23	1029	0	0	0	0	119	0	71	1219	2.2
2003-04	15	632	0	0	0	0	0	0	226	858	2.4
2004-05	7	611	0	0	0	0	87	0	0	698	4.2
2005-06	6	596	-	-	-	-	-	-	95	691	4.8

It can be seen from the above tables that the occupancy levels of berths 10 and 11 are very high. It can also be seen that the pre-berthing detention rapidly increases, with the increased berth occupancy during the last 3 years.

For break bulk cargo vessels, as much as 85% of the pre-berthing detention has been due to the non-availability of berths and 15% due to ships / agents account & lack of cargo, as can be seen from the figures 2005-06. This is understandable with the high berth occupancy figures for these berths 10 & berth 11.

The container vessels do not have pre-berthing delays since they are given priority berthing.

In addition to handling cargo vessels, the port, being in a strategic location on the western coast, is obliged to meet the berthing requirements of special vessels belonging to the Defense, National Institute of Oceanography,

Antarctic expedition and other interests. Berthing requirements of vessels of Navy, Geological Survey of India, Fisheries Survey of India, Coast Guard are on the increase.

Their occupation in these berths amount to an average of about 13.5% in a year (as per 2005-06 figure) and this is quite high.

The port has recently commissioned a jetty for port crafts and likewise it will be worthwhile planning a dedicated berth for non cargo vessels which are occupying the cargo berths at present (Berth no 8 – 14.2%, Berth no 9 – 7.8%, Berth no 10 – 15.6% and Berth No 11 – 12.1%) as per 2005-06 records.

d) Performance of Ships

In order to study this, the actual performance of the port (Break-bulk and Containers) during the last 3 years is furnished in the following **Table 6.14.**

Table 6.14 – Performance of Ships (Break bulk and Containers)

Description	2003-04		2004-05		2005-06	
	Break bulk	Container	Break bulk	Container	Break bulk	Container
No of ships	15	62	7	37	6	38
Avg.turn round time (in days)	5.42	1	9.28	1.49	11.15	1.44
Parcel size (in tonnes)	7170	1661	11441	3157	8713	2702
Stay at berth (in days)	2.95	0.81	5.04	1.23	6.27	1.17
Avg. working time (in days)	2.52	0.73	4.44	1.14	5.64	1.08
Avg. idle Time (in days)	0.43	0.08	0.6	0.08	0.63	0.08
Working time (%)	85.42%	90.12%	88.10%	92.68%	89.95%	92.30%
Idle Time (%)	14.58%	9.88%	11.90%	6.50%	10.04%	6.84%
Avg. output /berth day(T)	2431	2051	2270	2567	1390	2309

It can be seen from the above table that the idle time at berth varies is between 6 – 10 % in the recent past and this is not alarming. There has been an improvement with this idle time at berth reducing over the previous year.

The idle time for break bulk cargo and containers is in the acceptable range.

e) Constraints

However the present constraints identified with general cargo berths of the port are;

- Limited storage space for these berths
- Availability of gang and any times the gangs supplied are less than 'demanded'
- Double handling of certain cargoes like coal, MOP etc, first discharged on the quay and then transferred to storage.
- The dwell time for coal / coke is about 30 days which is very high
- Restriction on movement of heavy vehicles through the town during day time

f) Productivity Improvements

After a review of data on productivity, the present operating practices, the limitations / constraints being faced, the scope for possible improvements that are achievable are discussed hereunder:

Present general cargo operations indicate that the berth occupancy is very high and much higher than the prescribed norms. From the berth utilization records it is noted that the berth requirements for non-cargo vessels are on the increase. These vessels are using general cargo berths thus reducing their otherwise productive utility. By providing separate berths for such vessels, the productivity in cargo berths can be increased. Priority is given to the passenger vessels and defence vessel.

The berths 10 & 11 are not provided with cranes for ship to shore cargo transfer. Deployment of harbour mobile crane would enable faster handling of the cargoes form ship to shore and vice versa.

While the structural design of berth 10 does not allow deployment of any mechanised equipment, the preliminary analyses of the design of berth 11 (based on the information supplied by MPT) indicate that a harbour mobile crane could be deployed at berth 11. Structural data of Berth 11 (though not known whether as built) were collected from the port officials and was checked for installing a harbour mobile crane. The analyses of the same indicate that a harbour mobile crane of Gottwald - make HMK 170 EG which has a heavy lifting capacity of 67 T or a similar make could be installed at Berth 11. This make is suitable for vessels up to 40,000 DWT.

The structural details of berth 11 indicate that it is suitable to accommodate a transerverse propping base of around 12 m c/c which is appropriate for the make suggested. The harbour mobile crane is tyre mounted and as such as the berth 11 does not require much surface modification for the installation of the crane. But the present surfacing layer of the Berth -11 appears to be in a damaged condition and needs to be re-laid.

The other measures that could improve productivity are;

- Making available more gangs by engaging private labours
- Reducing gang size from the present 10 or rationalizing the gang size by making it need based
- Bringing in 'half gang' concept
- Stricter enforcements of output norms

6.6.2 Required Capacities

The traffic forecast for General Cargo and Containers are given in detail in Section 2 of this report.

Out of these commodities, it is understood that Jindal's cargo like Coal, limestone and steel will be handled fully at Berths 5A and 6A.

However, the coal / coke of the small users like Kirloksar and Kalyani who are currently using berth 10 & 11 will continue to use these berths. The forecast figures for these users are given under Coal / Coke total forecast figures.

The cargoes that will have to be handed at general cargo berths may be summarised as follows in **Table 6.15** ;

Table 6.15 – Future Cargo at General Cargo Berths

Scenarios	Low		Medium		High	
Commodity / Year	**2007-08**	**2012-13**	**2007-08**	**2012-13**	**2007-08**	**2012-13**
Container in TEUS	9,999	9,999	15,258	22,709	24,999	36,353
CP Coke + Raw Pet Coke (MT)	0.18	0.21	0.19	0.24	0.20	0.29
Coking coal and coal of present users of berth 10 & 11 (MT)	0.40	0.40	0.40	0.40	0.40	0.40
MOP (MT)	0.20	0.20	0.20	0.20	0.20	0.20
Break Bulk Bagged(Alumina)-MT	0.19	0.22	0.19	0.25	0.21	0.30
Others (Scrap &Miscellaneous, others) (MT)	0.13	0.15	0.13	0.17	0.14	0.20

The above can be further summarised as in **Table 6.16.**

Table 6.16 – Summary of Future Cargo

Scenarios	Low		Medium		High	
General cargo / Year	**2007-08**	**2012-13**	**2007-08**	**2012-13**	**2007-08**	**2012-13**
Break Bulk (MT)	0.19	0.22	0.19	0.25	0.21	0.30
Dry Bulk Conventional (MT)	0.91	0.96	0.92	1.01	0.94	1.10
Containers (TEUs)	9,999	9,999	15,258	22,709	24,999	36,353

6.6.3 Additional Facilities

The berth requirements for the above traffic forecasts are calculated and presented in **Table 6.17**. It is expected minor improvements will be achieved in productivity at berth 10 and a harbour mobile crane will be installed at berth 11 by the time the 2012-13 throughput is realised. However, the existing Berth 10 will continue to use ships derricks for transfer of cargo. Based on this, an average cargo handling rates have been suitably assumed and the requirement of berths are calculated and presented below;

Table 6.17 - Berth Requirements (General Cargo & Containers)

	2007-08			2012-13			2025-26		
	Low	**Medium**	**High**	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
Number of berths (BOF)	2 (.50)	2 (.56)	2 (.69)	2(.49)	2(.66)	3 (.5)	3 (.57)	4(.64)	5 (.57)
Number of Berths with a harbour mobile crane at Berth 11 beyond 2009-10	2 (.50)	2 (.56)	2 (.69)	2(.35)	2(.44)	2(.57)	2 (.59)	3(.56)	4(.58)

The detailed calculations for Berth Occupancy are presented in **Table 6.18** for the medium scenario**.**

The above indicate that with improvements in productivity and installation of a Harbour Mobile Crane at Berth 11, the two existing berths 10 & 11 shall be adequate the traffic forecasts up to 2025-26 medium scenario. It is required to plan one more multipurpose or a dedicated container berth by 2025 depending on the realisation of traffic.

Table 6.18 – Berth Occupancy Calculations (general Cargo and Containers) – Medium Scenario

		2007-08			2012-13			2025-26		
Description	**Unit**	**BB**	**Dry bulk conventional**	**Container(TEUs)**	**BB**	**Dry bulk conventional**	**Container(TEUs)**	**BB**	**Dry bulk conventional**	**Container(TEUs)**
Cargo volume	'000T.	190	920	15258	250	1008	22709	470	1380	58145
Parcel size	Tonnes	10000	12000	200	10000	12000	200	10000	12000	200
Vessel calls	No.	19	77	76	25	84	114	47	115	291
Cargo handling rate	TPD	1800	6000	150	2500	12000	300	2500	12000	300
Effective working hrs./day	Hours	20	20	20	20	20	20	20	20	20
Service time per vessel	days	5.6	2.0	1.3	4.0	1.0	0.7	4.0	1.0	0.7
Additional hrs. at berth	days	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total time per vessel	days	5.81	2.25	1.58	4.25	1.25	0.92	4.25	1.25	0.92
Required berthdays / year	days	110	172	121	106	105	104	200	144	266
Working days / year	days	360	360	360	360	360	360	360	360	360
Berth occupancy		0.31	0.48	0.34	0.30	0.29	0.29	0.55	0.40	0.74
Total berth occupancy		1.121			0.876			1.694		
No. of berths (Berth occupancy factor)	**1**	1.12			0.88			1.69		
	2	**0.56**			**0.44**			**0.85**		
	3	0.37			0.29			0.56		
	4	0.28			0.22			0.42		

6.7 Non Cargo Vessels Berth

6.7.1 Berth Requirement

Non cargo vessels including cruise vessels are on the increase at Mormugao Port and presently these are berthed at cargo berths as there is no dedicated berthing facility available for these vessels. The occupation of non cargo vessels at the cargo berths during 2005-06 are as follows;

Berth no 8 – 14.2%

Berth no 9 – 7.8%

Berth no 10 – 15.6%

Berth No 11 – 12.1%

The total occupancy is significantly high hence calls for a dedicated berthing facility for these vessels.

Apart from these, there appears to be good potential for Offshore Supply Vessels using this port. Initially the OSVs which normally require a draft of 6-6.5 m could be combined and handled along with non cargo vessels and converted to a dedicated OSV berth at a later stage depending on the growth.

6.8 Additional Berths Requirements Summary

6.8.1 Berth Requirements

The berth requirements envisaged at Mormugao Port in line with the current traffic forecasts as discussed are above are summarised in **Table 6.19** up to the year 2025-26;

Table 6.19 – Summary of Berth Requirements

	Design ship			Required Berth Size		Total Additioanl berths Required				Total Berth length Required (m)	Back-up area length requried (m)	Back up area required (Sq.m)	Total Berth length Required (m)	Back-up area length requried (m) / berth	Back up area required (Sq.m)	Remark
	DWT or TEU	LOA	Draft	Berth length	Berth depth	2012-13		2025-26		2012-13 (High)			2025-26 (High)			
						Medium	High	Medium	High							
Iron ore	150,000	290		320		0			0	0						
Coal	70,000	225	14.0	250	15.4	0	1	1	3	250	600	150,000	750	600	450,000	
General Cargo + Containers	30,000	193	11.2	215	12.3	0	0	1	2	0	700	0	430	700	301,000	Depending on the traffic realisation, one of the new berths can be planned as dedicted container berth
Liquids	50,000	200	13.0	220	14.3	1	1	1	1	220	50	11,000	220	50	11,000	Tank farm area not included
Cruise		216	7.0	240	7.7	1	1	1	1	240	100	24,000	240	100	24,000	
Navy		227	8.8	250	9.7	1	1	1	1	250	100	25,000	250	100	25,000	
Port craft		40	6.0	45	6.6	5	5	5	5	225	50	11,250	225	50	11,250	
OSV		110	6.0	130	6.6	1	1	1	1	130	100	13,000	130	100	13,000	
										1,315		**234,250**	**2,245**		**835,250**	

In the above, initially the berthing facility for non cargo vessels like Navy, coast gurad etc and OSVs could be combined in one & if the traffic realisation justifies, a dedicated berthing facility could be created for OSVs.

From the above it is summarised in **Table 6.20** that by 2012-13, Mormugoa Port need to create the following additional berthing facilities to keep in pace with traffic potential expected based on the current forecasts;

Table 6.20 – Phase-I Development Plan for Mormugao Port (by 2012 – 13)

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

The planning of the above port facilities for Phase –I (2012-13) and up to 2025-26 is discussed in the following section.

6.9 Planning of Port Facilities

6.9.1 Sites Available

Following previous studies which have been carried out into the future development of Mormugao Port, it is clear that there are three possible sites for future port development in the area of Mormugao Port.

Any other location along the coast line of Goa like Betul would involve not only huge investment with respect to port navigation and berthing facilities, would also involve huge capital costs for onshore land area development and for connectivity (Road & Rail). Hence, unless there is cargo assurance justifying the huge investment, this kind of green field port development will not materialise.

Hence the sites near Mormugao Port that are close to the existing road and rail connectivity to the Mormugao Port where port facilities could be created are identified as Vasco Bay, Baina Bay and to the West of the breakwater.

These sites are shown in the satellite image below;

Figure 6.4 – Site locations

A brief description about these potential sites for extending the port's facilities is given in the following paragraphs;

a) Vasco Bay

Vasco Bay is protected against S-W monsoon waves and exposed to waves from NW direction. Hence originally it was thought that protection in the form of a island breakwater of length 1000 m would be required to protect Vasco Bay from NW direction. However NW waves are less severe in heights compared to SW waves. The mathematical model study by CWPRS have confirmed that this island breakwater of 1000 m would be required as the tranquillity conditions are favourable for port development without the island breakwater making this site more advantageous for port development.

The strength of the currents in Vasco bay is of the order of 30 to 40 cm/sec.

Vasco Bay is close to the existing navigation channel and turning circle. Sea approach would be through the existing channel and harbour basin in front of barge berths and multipurpose berths 10 & 11. For ships to manoeuvre for berthing and departing, a new turning circle will be provided at the centre of the basin.

Vessels will need to be under tug control while turning and when berthing/ de-berthing. A basin could be formed by providing berthing facilities along the shoreline (southern and eastern side) with a backup space for storage, cargo movement and general access to the harbour.

Alternatively, berths could be provided in two docks oriented in NS and EW. The area between the docks would be reclaimed for storage and back up facilities.

Berthing facilities on the northern side of the basin could be provided by reclaiming an area of about 40 Ha towards Alparqueiros Pt. The development of port facilities in Vasco Bay would require the construction of about 100 m wide access corridor in a N-S alignment along the western foreshore of the Alparqueiros Peninsula. This access corridor would serve the commercial port facilities as well as fishing traffic. This access corridor

would be connected to the NH - 17 A. A railway siding would be required to be extended from the existing port rail network to serve the additional facilities.

Facilities for the fishing crafts would need to be constructed during the first phase of development. Discussion with the port authorities reveal that the shifting of fishermen from Vasco bay has progressed in a positive way and a consensus has been arrived between the Port Trust , fishermen involving the State Government authorities to rehabilitate them to Chikalim in Goa.

If this does not become successful and fishermen need to remain around the present location, then the ideal location is to develop facilities for fisheries on the eastern side of the northern reclamation fill. However, by a careful planning their movements could be kept separated from the Mormugao Port's vessels movement.

b) Baina Bay

Baina Bay (also referred to as Chikolna Bay), to the South of the Mormugao headland, provides a good location for future port facilities. Baina Bay is exposed to waves from all directions. The currents are of the order of about 1 knot.

There are two options available for development of additional port facilities at Baina Bay:

(i) A basin development with a North-West entrance channel

This development would require two breakwaters at the western side, one from the Mormugao headland in a SW alignment of about 650 m long and the other from Pequeno Island in a NW alignment of about 1500 m long. Both the breakwaters need to be constructed in the first phase of development.

The entrance to the basin would be from NW direction. The length of entrance channel in the lee of breakwater would be sufficient to allow tugs to fasten before vessels enter the turning circle, providing a fully controlled stopping manoeuvre.

As the site is away from the existing channel, a new approach channel, turning circle and navigational aids are required to be provided. The channel lies in almost an NW-SE direction considering the predominant wave direction. As the current will be at right angles to the channel, the vessel course to steer will be 3° to 5° into the current to maintain the course along the centre line of the channel to reduce the drift.

The berths and harbour basin would be fully protected against waves from SW sector. Waves from NW will enter the harbour basin through the entrance channel. There would be some down time due to these waves.

This basin would provide a berthing space of about 800 m along the Northern side of basin, 1300 m along eastern side of basin and 600 m along SW breakwater.

The area behind these berths would be reclaimed to provide adequate space for onshore cargo handling storage and associated facilities.

(ii) A basin development with a South-South-East entrance channel.

The construction of a breakwater running from the South-western promontory of the Mormugao headland to Pequeno Island (length approximately 1800 m, water depth 8 to 9 m), and another breakwater spur from Pequeno Island in SE direction (length about 500 m, water depth at the breakwater head about 10m) would be required to create a well protected basin.

The channel is aligned in NNW - SSE direction considering the current, wind and wave directions. With this channel alignment, the disturbance will be less and the vessel will have the shelter of Grandi Island to a certain extent.

Vessels would need to be under tug control during the stopping manoeuvre and when berthing / deberthing. The basin would provide about 1200 m berthing space along the western breakwater and more than 2000 m berthing space along the northern and eastern sides of the basin, allowing for the area behind these berths to be reclaimed over a distance of 400 - 500 m to provide adequate space for onshore cargo handling and storage.

Baina Bay could be developed in Phase – I with the following facilities;

- With 6 berths and 77 Ha of reclamation
- 1100 m long Breakwater in Phase – I
- A protected beach for developing recreational facilities

A layout for the development of Baina Bay is shown below in **Figure 6.5**;

Figure 6.5 – Baina Bay Layout

In Phase – I development 6 berths it is possible to accommodate 6 berths with 2 on the Western side along the breakwater 3 on N side and 1 on the E side of the basin. A back up area of 500 m long is kept behind the dry cargo berths. This would be adequate providing the rail loading / unloading facilities are created elsewhere.

It is suggested that berths that do not require storage immediately behind like liquid bulk, Navy, etc are provided along the breakwater. The tankfarms could be located elsewhere and connected by the pipelines. A cruise berth with 250 m back up length is provided along the beach to facilitate easy movement of passengers to city without passing through the port cargo facilities. This location is suitable for cruise berth since it is adjacent to the protected beach.

A preliminary estimate of basic investment required for Phase – I Baina Bay development indicate the following;

Table 6.21 - Basic Investements - Baina Bay Phase - I Development

S.No	Item description	Cost (INR millions)	Remark
1	Dredging	940	About 7 million cum of dredging is anticipated
2	Breakwater 1100 m long	600	The breakwater to be created at an average depth of -8 m CD
3	Reclamation	1440	About 80 Ha land reclamation. It is assumed that 5 million cum out of dredged material would be available & the remaining would be borrowed external fill.
	Total	**2980**	

c) West of the Breakwater

This alternative involves the development of a harbour basin 800 m wide by providing a breakwater of about 600 m long to the west of, and parallel to, the existing breakwater.

This site is exposed to waves from all directions. The protection provided by the western breakwater to this new development area would be limited as incoming wave energy from western directions would diffract around the head of the breakwater and enter the eastern part of the basin, reflecting from the seaward slope of the existing breakwater.

The basin is exposed to waves from the North-West. Since the basin is exposed to waves from West and North-West, ship manoeuvring, berthing

and deberthing will suffer disruption. An earlier study has indicated that a mole similar to the existing one would be needed to achieve the required tranquillity from NW waves.

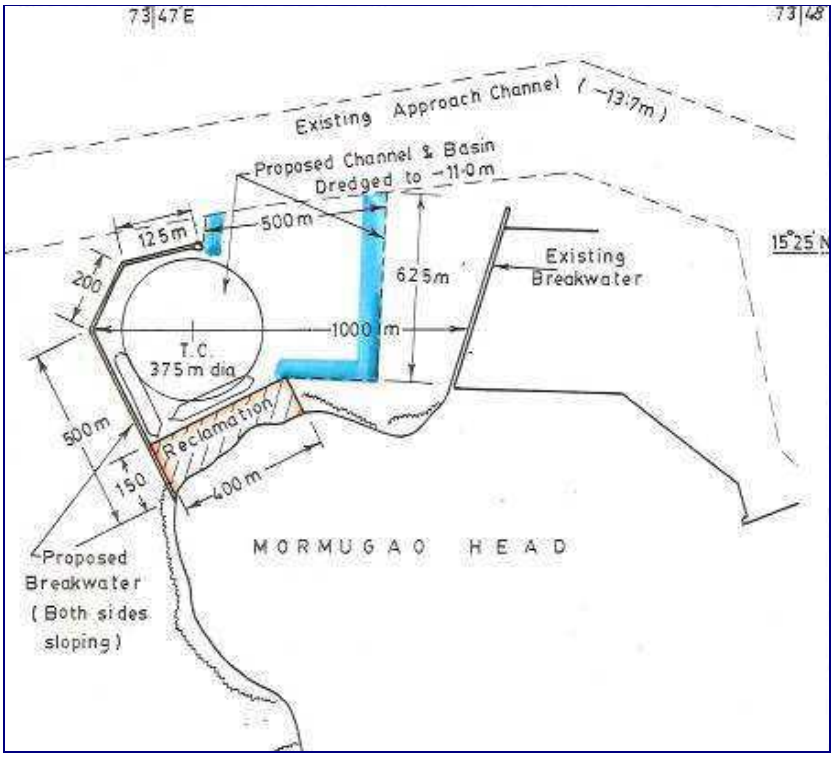


Figure 6.6 – West of Breakwater Layout

The approach to this site is through the existing navigation channel, which is at right angles to the entrance to this basin. For ships to manoeuvre, berth and deberth, a turning circle is required, which would encroach into the full width of the existing channel. Moreover, no protected stopping distance can be provided. These are adverse conditions for the movement of ships.

Berthing facilities would be provided along the southern shoreline and the new breakwater. The area behind the berths would be reclaimed to provide onshore cargo handling, storage and associated facilities. There no ready onshore area available for port development.

In this alternative, only a limited number of berths can be accommodated. This is not a preferred alternative for long term development. An earlier

study has confirmed that the development of this site would not be a financially viable option.

6.9.2 *Preferred Site*

The principal advantages and disadvantages of the three locations are compared in the **Table 6.22** below.

Table 6.22 – Advantages and Disadvantages of various sites

	Vasco Bay	Baina Bay	West of Breakwater
Navigation	Excellent – sheltered, and minimal capital dredging	Good, but long breakwaters needed, Capital dredging involved	Poor, significant breakwater required, minimal capital dredging required
Berths	Ample space for berths	Limited shoreline restricts overall development	Limited to a small area
Onshore facilities	Good, space for reclamation	Good, space for reclamation	Poor, limited space
Hinterland connections	Good, easy connection to NH17A, rail from existing port network	Acceptable, road connection via new bypass; rail requires new spur	Good, through existing port
Phasing	Good, potential for phased expansion	Breakwater must all be provided in first phase	Poor, breakwater in first phase, limited scope
Environmental	OK, no particular causes for concern	OK, no particular causes for concern	OK, no particular causes for concern
Social	Fishing fleet to be relocated	Fishermen to be rehabilitated	OK, no impact

The analysis on the advantages and disadvantages of the various sites indicate that development of Vasco Bay in Phases would be an appropriate option since it would involve the minimum capital cost and hence can attract Private Investment. However, Baina Bay development has to be considered seriously by MPT if they fail to progress with VascoBay development.

6.9.3 *Layout of Facilities*

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) as that is to be redeveloped to form an extension to the iron ore export berth, Berth 9. A second berth will be required before 2012 as the traffic rises.

- Non-cargo berths – a berth is required to handle cruise vessels. At present the cruise vessels are handled at Berth 10, which is unsatisfactory and Berth 10 is needed for the general cargo. Another berth is required for visiting naval vessels, bit Indian Navy and visiting navies.

- Vasco Bay – Alternative I

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 mole. Alternatively, port crafts jetty can be accommodated in Vasco Bay – Phase I development and the Cruise berth could be developed near Breakwater mole. But this requires a back up area for cruise terminal to be developed by reclaiming a part of the land on the West of BW.

The Phase I 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.

This scheme is shown below schematically;

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 subsequent phases of development are shown below;


0m
250m
1000m
Phase 2

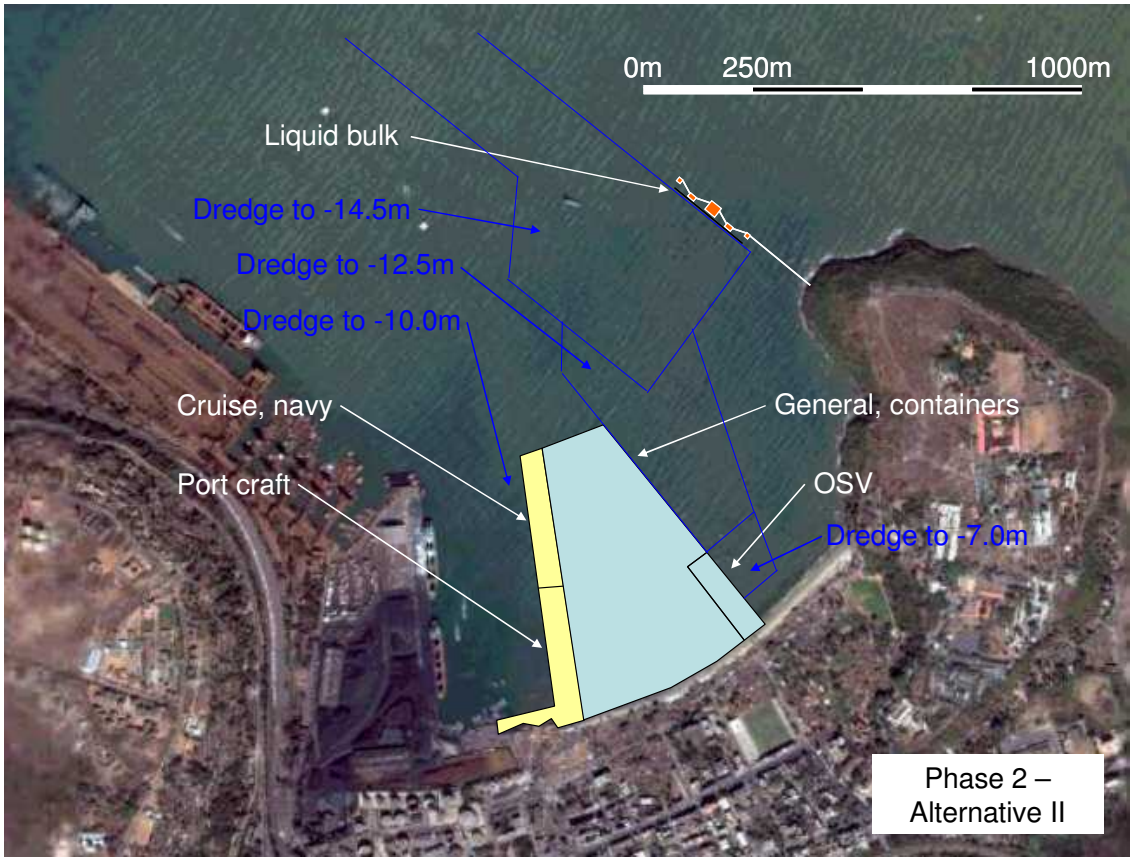

0m
250m
1000m
Phase 3

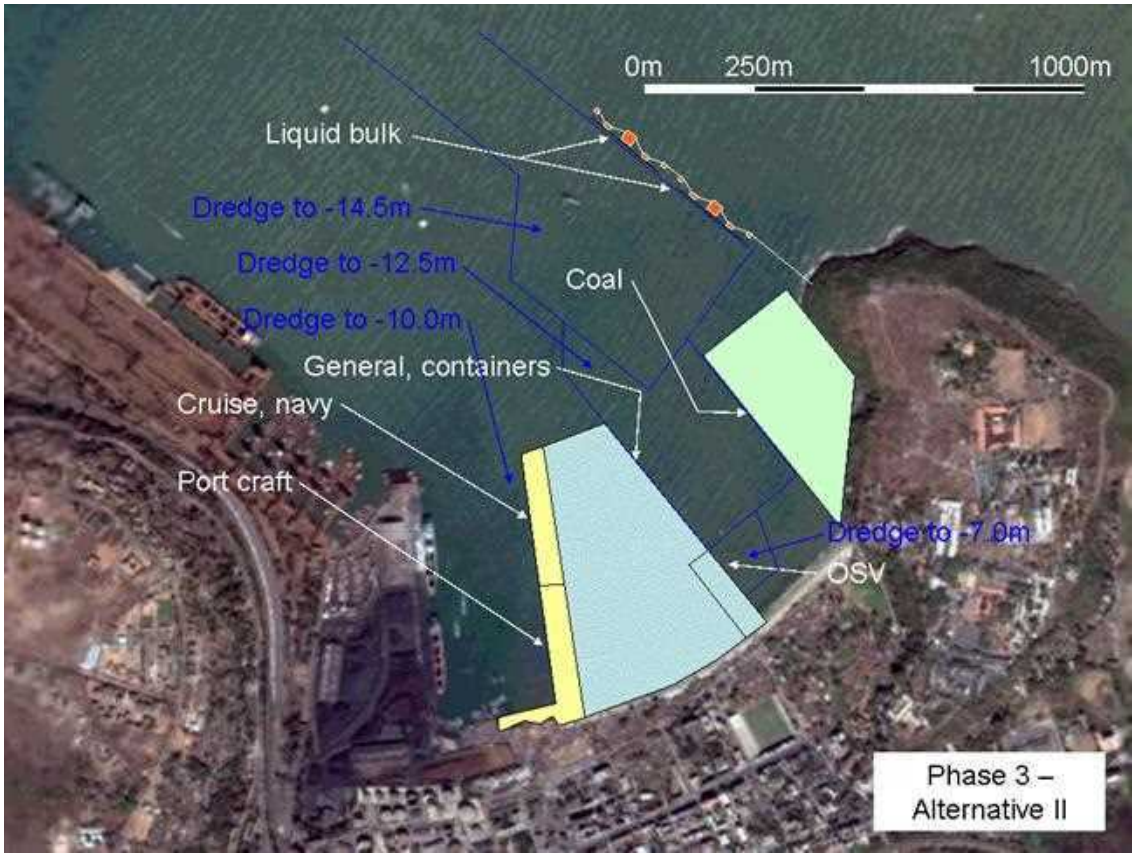
Vasco Bay – Alternative II

Alternatively, it is generally desired that the liquid bulk berth is kept away from the other developments. This would feasible by shifting the liquid cargo berth SE towards the end of Vasco Bay. This concept is shown below;

This would require longer pipelines and also shifting of fisher men from both the sides of the bay.

The subsequent phases of development would be as follows;





Considering the feasibility of development in Vasco Bay, Alternative-I is recommended.

6.10 Preliminary Land use Plan

a) Introduction

This section describes the general land use and development policies that are recommended in relation to the development of the port facilities in the future.

These recommendations are shown on **Drawing DCBPMP/05** at the end of this report.

The image in **Figure 6.7** is a part copy of the Mormugao Planning & Development Authority's Outline Development Plan of Vasco da Gama Planning Area, valid until 2011. This shows the current zoning and land use of the port area.

Figure 6.7 – MPDA Outline Development Plan

In summary, the principal waterfront zoning recommended is as follows:

The shore in the port area on the northern side of the peninsula is already highly industrial, and will inevitably remain so. It should continue to remain as an industrial zone. The west to south-west coastline of the peninsula should be kept as a 'green' area.

Vasco Bay and Baina Bay should be reserved for future port use in the short to medium and the long term respectively. These are valuable areas, close to deep water and already near to port and port related activities. There is commercial development adjacent to these sites, which is compatible with port use. The residential nature of some development, particularly near to Baina Bay, should be discouraged.

Further to the east in the Zuari River, the recreational character and the natural ecosystems should be preserved for the citizens and tourists of Goa. This shore should therefore not be allocated for industrial development, but kept as open space.

b) Land Use Development Plans

It is proposed that the land use policies and future intentions would be incorporated within revised MPDA development plans. Land use policies

should be updated towards the end of the current validity period, towards 2011.

The land use zoning proposals would be applied as a future development control tool and land use changes would be determined by the MPDA and the Mormugao Port Trust in accordance with the defined zoning policies and statutory planning regulations. It is strongly recommended that the MPT be included in the development control system: the prior approval of the MPT should be obligatory for all developments along the shore to ensure that such development conforms to a coherent long term strategy and protects appropriate sites for future port development.

c) Land Use Proposals

The following changes to the land use patterns are recommended:

Zuari River area

- The area immediately to the east of the port is to be reclaimed and developed as a port area in the short to medium term. This area is currently used by fishermen who should be displaced to a new location further east.
- In view of the proximity of this port development to the commercial district of Vasco da Gama, the new port area must have adequate landscaping, both soft tree landscaping and hard materials (road surfaces, pavement areas and general hard landscaping).
- Care will be needed with regard to future crane and tall building design at the port particularly in the areas closest to the urban city areas to the south of the port; a good tourism and conservation image is essential for the future of Goa.

Vasco da Gama area

- The improvement of the road connection between the port and the main NH17 / NH17A road should occur as soon as possible. Appropriate signing and landscaping should be incorporated with any new road schemes to improve the port access highway provision.
- In terms of development principles, the south to south-west shore of the headland should be maintained in its current "green" state with woodland areas together with residential properties.

Baina Bay area

- It is recommended that the whole of the Baina Bay area be zoned for future port related use. This area is already extensively developed for commercial use and is a valuable area close to deep water. To the south, the coastline comprises sandy beaches which should be retained for

tourist and residential use, with a 'buffer' of open space separating the port development from tourist or residential areas.

- The traffic levels do not justify such a development now, but the site should be retained for this future purpose.

Conclusions

The above policies should be incorporated into any land use management plans, and as previously stated, adopted in the MPDA's Development Plans for the future. A review of the land use plans should occur within five years.

7 Hinterland Connectivity

7.1 General

A comprehensive port planning study needs to address to connectivity aspects taking into account estimated future traffic. Cargo handling shall inter-alia also include the requirement of forward/or backend linkages around the port, adequacy or otherwise road and rail linkages etc. Synergy will be established with agencies providing road and rail connectivity to ports, with a view to ensuring smooth backward integration in ports infrastructure a dedicated rail and road net work between ports and its hinterlands.

7.2 Road Connectivity

(a) Prevailing Traffic Levels

Quantum of freight transported by trucks has been collected from MPT Port authorities for the period 2004 to 2006 and the details are presented in **Table 7.1**.

Table 7.1 : Freight Movement Details by Road

Year	2003-2004	2004-2005	2005-2006
Total traffic by road (Tonnes)	13,09,623	11,89,343	17,61,979
Average movements per day (loaded)	307	279	414

Considering a 355 days operational for trucks in a year and average payload 12 tonnes per truck, the number of truck movements (loaded) to and from Mormugao port are estimated. It was estimated that about 300 loaded trucks per day were plying to/from port during 2003-2004 while it has increased to 400 trucks during 2005-2006. Recently collected data indicates about 461 trucks per day on 5th September 2006. These trucks account for loaded trucks only, total truck movement is twice the above figures.

NH-17A and NH-17 B are the primary connections for port bound truck traffic movement between MP and the freight generation/distribution centres. Traffic volume levels on these two roads are studied to assess the present traffic levels and impact of increase in future freight traffic by road. Traffic data was collected from MoRTH web site and NH division, Madgoan for 2006. The observed traffic levels in 2006 on NH-17, NH-17A and NH-17B is presented **Table 7.2**.

Table 7.2 : Traffic Volume in 2006

Road Section	2 Wheelers	Cars	Buses	Trucks	Slow Vehicles	Total	PCUs
NH-17 (Cortalim – Verna)	8642	9729	1309	2550	305	**22535**	**24195**
NH-17A (Cortalim– Mormugao)	6608	6989	814	785	93	**15289**	**14820**
NH-17B (Verna – Vasco)	4081	3855	502	2042	122	**10602**	**13029**

NH-17A has about 15000 PCUs compared to 13000 PCUs between Verna & Vasco on NH-17B. Freight traffic was observed to be low on NH-17A when compared with almost 4 laned NH-17B while passenger traffic is high on NH-17A. Heavy vehicle traffic uses NH-17B to reach Mormugao port from southern Goa side while traffic from Maharashtra and northern Goa uses NH-17A. NH-17 section between Cortalim and Verna has about 24200 PCUs.

7.2.2 Traffic Forecasts

As discussed in the previous sections, a number of corridors provide connectivity for the port from the states of Goa, Karnataka and Maharashtra. However the main impact of future port traffic would be on NH-17A and NH-17B which are directly connected to the port and NH-17. From NH-17, traffic dispersal takes place based on location of freight generation/distribution centres. Port traffic impact on the rest of the corridors would be minimal. Hence, future traffic levels only on NH-17A and NH-17B are studied to assess the impact of future road bound port traffic.

(a) Freight Traffic Forecasts

Freight traffic forecasts for Mormugao port have been prepared and presented in Chapter 4.0 of this report for various scenarios upto the year 2013. The summary of the freight traffic forecasts for medium case scenario which has the highest probability of occurrence are reproduced here in **Table 7.3**.

Table 7.3 : Port Freight Traffic Forecasts (in million tonnes/TEUs) – Medium Case

Import/Export	Commodity	Mode	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
A) Dry Bulk (MT)									
Exports	Iron Ore	IWT /Rail	26.08	23.23	20.89	18.67	16.57	14.58	14.58
Imports	Coal/Coke	Rail	5.70	6.70	6.90	6.90	7.15	7.40	7.65
	Total		**31.78**	**29.93**	**27.79**	**25.57**	**23.72**	**21.98**	**22.23**
B) General Cargo (MT)									
Exports	Alumina / Petroleum coke	Road	0.26	0.27	0.29	0.30	0.32	0.33	0.35
Exports	Steel	Rail	1.30	1.50	1.50	1.50	1.50	1.50	1.50
Imports	Lime stone/ Coke raw pet	Road	0.55	0.64	0.65	0.66	0.67	0.68	0.70
Imports & Exports	Others	Road	0.05	0.05	0.06	0.06	0.06	0.07	0.07
	Total		**2.16**	**2.47**	**2.50**	**2.52**	**2.55**	**2.58**	**2.61**
C) Containers (TEUs)									
Imports & Exports	-	Road	10113	15258	17538	19088	20364	21576	22709
D) Liquid Bulk (MT)									
Imports	-	Road tankers /Pipe lines	1.82	2.10	2.37	2.69	2.83	2.99	3.15

The above freight forecasts are used for assessing the port traffic on the existing roads.

(b) Forecasting Assumptions

The various assumptions made for assessing road freight traffic volumes from port are discussed below.

(i) Modal Share

The total freight for port is transported to/from port by rail, road, IWT and the pipelines. The likely use of the modes for carrying different commodities has been assessed from prevailing modal share by commodity and expected modal shift as listed below.

- Iron ore

Almost the entire iron ore is received by IWT / barges at Mormugao Port. The iron ore from Karnataka (about 6 million T per annum as per 2005-06 data) is brought 60% by rail and 40% by road upto Sanvardem / Tinighat, about 50 km from Vasco. From there onwards, they are brought by barges to Mormugao Port or to Panjim port. Though the same rakes after unloading iron ore continue to come to MP to get loaded by coal, they come empty to

MP because the port does not have the facility of Wagon Tippler and enough storage to unload the cargo brought by rail.

In future, with the port's plan to install wagon tippler, the iron ore is expected to arrive by Inland Water Transport (IWT) or by rail.

- Coal/Coke and Steel

All coal / coke import and steel slab /finished steel export is expected use rail transport only

- Liquid Bulk

The majority of the liquid bulk cargo is dispatched by pipelines up to the tank farms and from there by road tankers or pipe lines. It is assumed 70% of the total cargo is expected to use road transport and the rest through pipelines for distribution.

- General Cargo and Containers

Other general cargo like alumina, fertilizer raw materials, etc and the containers are assumed to arrive or dispatch by road trucks.

Based on the above assumptions, the cargo for road transport is estimated and presented in **Table 7.4**.

Table 7.4 : Estimated Forecast of Freight for Road Transport

S No	Commodity	Units (in million)	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
1	General Cargo	Tonnes/year	0.86	0.97	1.00	1.02	1.05	1.08	1.11
2	Liquid Bulk	Tonnes/year	1.82	2.10	2.37	2.69	2.83	2.99	3.15
3	Containers	TEUs/year	0.01	0.02	0.02	0.02	0.02	0.02	0.02

- Empty Trucks

The trucks arriving at the port with export cargo go back empty after delivering in the port. Similarly the trucks come empty for receiving import cargo at port and transport its destination. However, in case of containers, there is a possibility that a multi axle truck coming loaded / empty may again go back empty / loaded. It is assumed that about 50% multi axle trucks come empty to receive cargo and another 50% go back empty after unloading at the port.

(ii) Growth Rates

The following vehicle-wise growth rates as observed on national highways are used for forecasting traffic other than port freight traffic. Forecasts of traffic on NH-17, NH-17A and NH-17B are done upto the year 2013.

Passenger Vehicles (2 wheelers, Cars, buses) : 4.0%

Freight Vehicles (LCVs, 2/3-axle and Multi axle trucks) : 5.0%

Tractors and Cycles : 2.0%

Animal Drawn vehicles and others : -2.0%

(iii) Other Assumptions

The average pay load carried by LCVs, 2/3-Axle trucks and Multi-axle trucks is assumed to be 7.5, 12 and 20 tonnes respectively. Traffic composition of these vehicles is assumed as observed on NH-17A and NH-17B.

It is assumed that 355 days in a year are operational days for trucks and the rest take into account possible strikes, holidays etc

(c) Port bound road traffic

Based on the above listed assumptions, the average freight traffic generated by port for road transport is estimated for low, medium and high case scenarios is presented in **Table 7.5**. These forecasts include empty trucks also.

Table 7.5 : Freight Traffic generated by Port for Road Transport

Figures are in Nos.

Year	LCVs	2/3-Axle	MAVs	Total
Low Case				
2007	59	854	84	**997**
2008	63	955	90	**1108**
2009	64	1035	91	**1190**
2010	66	1131	91	**1288**
2011	67	1168	92	**1327**
2012	68	1206	93	**1367**
2013	69	1246	94	**1409**
Medium Case				
2007	65	881	91	**1037**
2008	73	1008	119	**1200**
2009	75	1105	130	**1310**

Year	LCVs	2/3-Axle	MAVs	Total
2010	77	1219	138	**1434**
2011	79	1276	145	**1500**
2012	81	1337	152	**1570**
2013	84	1401	159	**1644**
High Case				
2007	78	940	139	**1157**
2008	87	1074	171	**1332**
2009	91	1179	187	**1457**
2010	94	1303	201	**1598**
2011	98	1370	212	**1680**
2012	102	1443	223	**1768**
2013	107	1520	234	**1861**

This port traffic is assigned to NH-17A and NH-17B based on the estimated diversion on these roads from Origin-Destination data obtained from port authorities. It was observed that 81% of port traffic is captive to NH-17B and the rest 19% to NH-17A. It is assumed that 85% of the total port traffic would use NH-17B after construction of missing links and only the rest 15% will use NH-17A, due to good condition of NH-17B, congested road stretch of NH-17A at Vasco and narrow 2 lane NH-17A. The estimated traffic levels on NH-17, NH-17A and NH-17B for medium case are presented in Table 7.6, Table 7.6 and Table 7.7

Table 7.6 : Traffic Forecasts on NH-17 (Cortalim – Verna): Medium Case

Year	2 Wheelers	Cars	Buses	Trucks	Slow Vehicles	Total Vehicles	PCUs
2006	8642	9729	1309	2550	305	**22535**	**24195**
2007	8988	10118	1361	2678	311	**23456**	**25219**
2008	9347	10523	1416	2811	317	**24415**	**26287**
2009	9721	10944	1472	2952	324	**25413**	**27400**
2010	10110	11382	1531	3100	330	**26452**	**28561**
2011	10514	11837	1593	3255	337	**27535**	**29772**
2012	10935	12310	1656	3417	343	**28662**	**31036**
2013	11372	12803	1723	3588	350	**29836**	**32353**

Table 7.7 : Traffic Forecasts on NH-17A (Cortalim – Vasco): Medium Case

Year	2 Wheelers	Cars	Buses	Trucks	Slow Vehicles	Total Vehicles	PCUs
2006	6608	6989	814	785	93	**15289**	**14820**
2007	6872	7269	847	839	95	**15921**	**15478**
2008	7147	7559	880	897	97	**16580**	**16171**
2009	7433	7862	916	949	99	**17259**	**16866**
2010	7730	8176	952	1006	101	**17966**	**17592**
2011	8040	8503	990	1055	103	**18690**	**18316**
2012	8361	8843	1030	1107	105	**19446**	**19076**
2013	8696	9197	1071	1162	107	**20232**	**19864**

Table 7.8 : Traffic Forecasts on NH-17B (Vasco – Verna): Medium Case

Year	2 Wheelers	Cars	Buses	Trucks	Slow Vehicles	Total Vehicles	PCUs
2006	4081	3855	502	2042	122	**10602**	**13029**
2007	4244	4009	522	2224	124	**11124**	**13861**
2008	4414	4170	543	2430	127	**11684**	**14784**
2009	4591	4336	565	2595	129	**12216**	**15580**
2010	4774	4510	587	2773	132	**12776**	**16422**
2011	4965	4690	611	2907	135	**13308**	**17145**
2012	5164	4878	635	3048	137	**13862**	**17898**
2013	5370	5073	661	3197	140	**14441**	**18688**

As observed from the above tables, NH-17 with 2 lane is to be widened to 4-lanes at the earliest as it is shortly exceeding the capacity of 2 lanes. 2 lane NH-17A is expected to serve the traffic and it does not require any widening before 2013. NH-17B also has low traffic volume and it would serve the traffic with desired level of service as it already has 4 lane carriage way.

7.2.3 Future Road Connectivity

Mormugao port's influence area mainly extends to Karnataka and Maharashtra states beyond Goa. The connectivity aspects and improvements are discussed below.

(a) Immediate Road Connectivity

The immediate road connectivity at the port is provided by NH-17, NH-17A and NH-17B. The widening requirements for these roads are discussed

above. NH-17A and NH-17B would not require any further widening before 2013 as traffic levels don't warrant the same.

NH-17B was recently developed as 4 lane dual carriage way under port connectivity projects by National Highways Authority of India (NHAI). However, part stretches of NH-17B between Varunapuri & Sada and Verna & Ponda are not constructed, which force port bound traffic along NH-17B to use alternative routes.

If the stretch of NH-17B between Varunapuri and Sada is constructed and flyover is provided between NH-17B and Gate No 9 as shown in **Figure 7.1**, port bound traffic can bypass Vasco town, which is a major bottleneck at present. If the missing link between Verna and Ponda is also constructed, the traffic from Belgaum, Dharwar, Raichur, Hospet and Bellary would provide shorter route to port. These two missing links are to be constructed immediately.

NH-17 would need to be widened to 4 lanes immediately as traffic level is exceeded the 2 lane capacity. NH-17 is identified for widening by NHAI under National Highway Development Programme (NHDP), Phase III-B. Similarly NH-4A between Panaji and Belgaum is also identified for upgradation under the same programme. They are shortly expected to be developed on BOT basis.

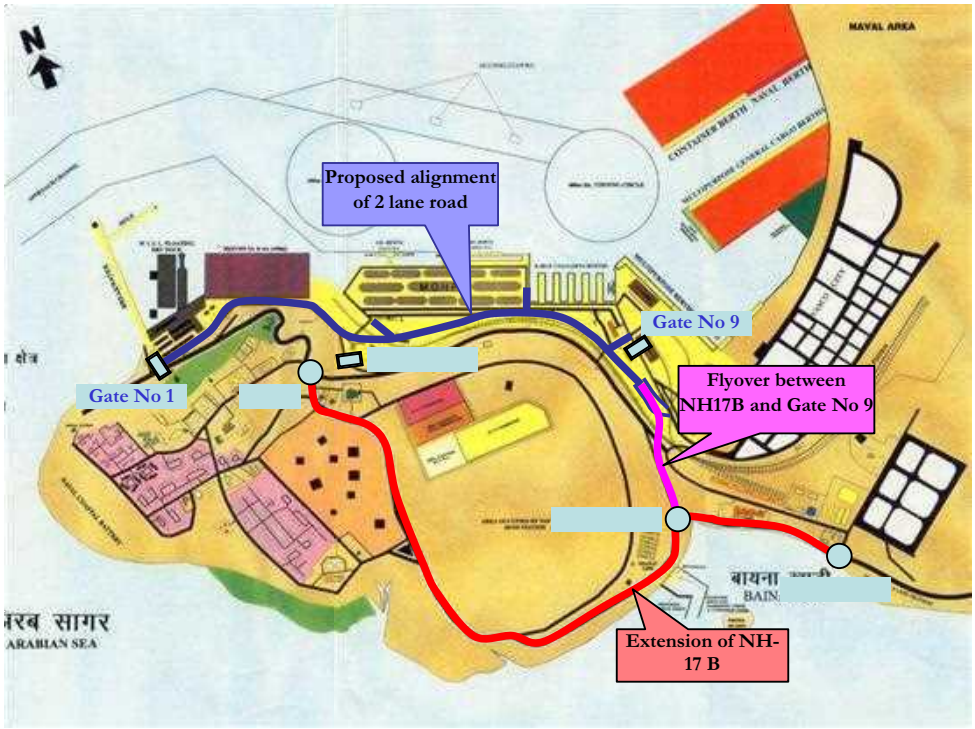


Figure 7.1 : Road Improvements in and around Port area

(b) Regional Road Connectivity

Important road corridors in the regional road network for port include the following.

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

NH-4 is already is being developed as 4 lane dual carriage way and 62.4% of the stretch between Mumbai and Chennai is upgraded. Rest of the sections are under upgradation. Rest of the roads NH-63 and NH-206 are recently declared as National Highways and they have 2 lane configurations. These roads cater to very little of port traffic, being away from Mormugao port and 2 lane roads would be sufficient till the year 2013. However, the geometric improvements for stretches wherever multi-axle truck movement is not possible are to be done, especially in hilly areas.

(c) Internal Road Improvements

The internal road improvements are discussed separately for existing port area and the proposed expansion at Baina bay

(i) Existing Port Area

The port has a poor network of internal roads between the berths. Though most of these internal roads are not used for cargo traffic movement, they need to be improved to bring the port to international standards. The port officers' vehicles, service / maintenance vehicles, vehicles for transporting international passengers arriving by cruise vessels use the internal roads extensively.

As the internal roads were not constructed with hierarchy, all the roads are used by prevailing passenger and freight traffic. To provide smooth movement of traffic inside port area, it is required to develop a 2 lane concrete road from Gate No 9 to Gate No 1 and connect this road with rest of the access roads to different facilities in the port. All the roads should have required traffic signs (regulatory, mandatory and information signs) to guide the traffic movement within the port area. The tentative alignment of this road is shown in **Figure 7.1**. However the alignment of the same is to be planned in line with proposed rail connection between Gate No 9 and Gate No 1.

(ii) Baina Bay

Baina Bay is located on southern side of existing port and is planned to be used for expansion of port activities. The internal roads are to be planned with atleast 2 lane configuration (which provide access to proposed facilities in Baina Bay) and all connect to a main road. This main road should be connected to the proposed extension of NH-17B between Varunapuri and Sada. The exact location of entry/exit for the port from NH-17B is to be decided in line with the layout of the internal roads in the expansion plan. The investment cost required for provision of internal roads is not included in this report as the expansion is not finalized.

7.2.4 *Investment Requirement*

The broad cost required for improvement of both internal roads within the port and external roads connecting the port is estimated based on unit costs of road/flyover construction. The required investment details are presented below in **Table 7.9**.

Table 7.9 : Investment required for improvement of road connectivity

S No	Item	Investment required (Rs million)
1	Construction of 4 lane missing link of NH-17B between Varunapuri and Sada (about 3.5 Km)	230.00
2	Construction of flyover from Tariwada on NH-17B to Gate No 9	260.00
3	Construction of 2 lane road between Gate No 9 to Gate No 1 within existing port area	105.00
	Total Investment	**595.00**

It is estimated that 595 million rupees is required for improvement of important projects related to road connectivity. The investment required for Baina bay expansion is not included as expansion plan is yet to be finalized. The cost required for widening of national highways i.e NH-17, NH-17B (between Verna and Ponda), NH-4A etc is also not considered and this will be borne by NHAI/BOT operators.

7.2.5 *Benefits to Port bound Traffic*

The following are the major benefits to port bound traffic movement due to improved road connectivity;

- Construction of remaining stretch of NH-17B at Vasco and connection between NH-17B and Gate No 9 would result in smooth traffic

movement to/from port. It avoids the congested Vasco town preventing delays and accidents due to urban traffic movement.

- The freight traffic movement along 4 laned NH-17B is smooth and safe when compared with 2 lane narrow NH-17A which is in rolling terrain with blind curves
- Presently truck parking is being done at Chicalim when entry restrictions to Vasco town are imposed. If road connectivity is improved, the delays due to entry restrictions can be avoided as port bound traffic will directly enter into port premises.
- People in Vasco town will also benefit with low traffic volumes on urban roads due to diversion of port bound truck movement to NH-17B.
- Provision of new 2 lane road Gate No 9 to Gate No 1 in the existing port area would ease the traffic movement within the port area avoiding the usage of access roads to various facilities.

7.3 *Rail Connectivity*

This particular section deals with rail connectivity aspects under the following heads.

- Prevailing scenario of port freight transport by rail connectivity.
- Port freight traffic forecasts, forecasting assumptions and derived traffic levels on rail corridor.
- Future rail connectivity recommendations.

7.3.1 *Prevailing Traffic Levels*

Rail Freight movement for Mormugao port is shown for last 3 years in **Table 7.10.**

Table 7.10 - Past Wagon Movements Commodity Wise

Commodities	2003-04		2004-05		2005-06	
	No. of Wagons	Tonnes per wagon	No. of Wagons	Tonnes per wagon	No. of Wagons	Tonnes per wagon
Steel Slabs	0	-	430	58	0	-
T.Coal	25040	59	43611	61	44010	63
Met. Coke	2980	50	3630	50	7527	63
I.Ore Pellets	0	-	746	59	0	-
Limestone	2868	58	2989	61	4302	67

Commodities	2003-04		2004-05		2005-06	
	No. of Wagons	Tonnes per wagon	No. of Wagons	Tonnes per wagon	No. of Wagons	Tonnes per wagon
Alumina bags	36	56	0	-	0	-
POL	8592	53	832	54	0	-
H.R. Coils	1418	52	431	54	0	-
Total	**40934**	**57 (Ave)**	**52669**	**60 (Ave)**	**55839**	**63 (Ave)**

Considering a 355 days operational for rail movement in a year and average payload 58 to 63 tonnes per wagon, the number of rail movements (loaded) to and from Mormugao port are estimated. It has observed from above table that on an average about 4 loaded rakes per day were plying to/from port during 2003-2004 while it has increased to 6 rakes during 2005-2006.

Recently collected data indicates that this average has increased to about 7 rakes per day since June 2006.

As mentioned before, Bellary / Hosepet is the primary freight generation/distribution centres for port traffic. Hence Traffic volume levels on this Goa - Bellary are studied closely to assess the present traffic levels and impact of increase in future freight traffic by rail on this section including any development in rail capacity.

7.3.2 Traffic Forecasts

a) Rail Freight Traffic Forecasts

Rail Freight traffic movements to Mormugao Port is calculated based on the cargo traffic forecast for the port up to the year 2013 for various scenarios and based on the following criteria.

b) Forecasting Assumptions

The various assumptions made for assessing rail freight traffic volumes to / form port are discussed below.

(i) Iron ore

The iron ore from Karnataka (about 6 million T per annum as per 2005-06 data) is brought 60% by rail and 40% by road upto Sanvardem. The rakes do not come up to the port / berth because the port does not have the facility (Wagon Tippler) and enough storage (not yet planned) to unload the cargo brought by rail/road.

It is uneconomical to transport a bulk commodity like iron ore by road and hence the entire Karnataka iron ore to port can economically be transported to the port if a wagon tippling facility is available at the port. This concept does not require additional rakes movement since the iron ore is to be brought from the same region where Coal form the port is supposed to be dispatched. Hence continuing the wagons presently bringing iron ore from Karnataka upto the port will prove to be economical. The maximum limit of iron ore that could be brought by rail would be capped by the amount of coal that will be dispatched from port which is likely to be about 6 million tonnes based on the present capacity of berths 5A and 6A.

(ii) Coal/Coke and Steel

All coal / coke import and steel slab /finished steel export are expected use rail transport only. However the wagon type would be different for coal / coke and steel. Hence separate rake movements are assumed to be required.

c) Port bound Rail traffic

Based on the above listed assumptions, the freight traffic generated by port for rail transport is estimated for low, medium and high case scenarios is presented in **Table 7.11**.

Table 7.11 – Rake Movement Requirements

			Traffic by rail (MT)		Rake movements (No.)	
Low Scenario						
Commodity	**Single Wagon Capacity (T)**	**Rake carrying capacity (T)**	**2006-07**	**2012-13**	**2006-07**	**2012-13**
Coal/coke	59	3245	4.84	6.72	1492	2071
Limestone	59	3245	0.3	0.35	93	107
Steel Slab/steel	58	3190	1	1.2	313	376
				Total	**1898**	**2554**
				Average Rakes per /day	**5**	**7**
Medium Scenario						
Coal/coke	59	3245	5.7	7.65	1757	2357
Limestone	58	3190	0.37	0.45	117	143
Steel Slab/steel	58	3190	1.3	1.5	408	470
				Total	**2281**	**2970**
				Average Rakes per /day	**7**	**8**
High Scenario						
Coal/coke	59	3245	7.7	12.9	2373	3975
Limestone	58	3190	0.54	0.62	168	194
Steel Slab/steel	58	3190	1.3	2	408	627
				Total	**2949**	**4797**
				Average Rakes per /day	**8**	**14**

The rake requirements in one direction may be summarised as follows;

Year	2006-07	2012-13
Low	5	7
Medium	7	8
High	8	14

d) Peak Demand for Rail traffic (Passenger trains + goods Rakes)

Distance from Vasco(km)	29	182	344	20	68	142
Weeks/Station	Vasco-Madgaon	Madgaon-Dharwar	Madgaon-Belgaum	Dharwar - Hubli--	Hubli - Bellary	Belgaum-Hubli
Sunday	3	2	1	8	8	6
Monday	2	1	2	11	7	8
Tuesday	3	2	1	9	8	6
Wednesday	3	2	1	8	8	6
Thursday	2	1	1	8	7	6
Friday	4	3	1	9	8	7
Saturday	3	2	1	10	8	6
Average passenger movement	**3**	**2**	**1**	**9**	**8**	**6**

Traffic data was collected from Indian railway web site for the passenger flying trains on this route latest by 2006. Analysis of these data indicates that average passenger train movement is 8 per day / direction in the critical section Hubli - Bellary.

	Goods train		Total traffic movement	
Year	2006-07	2012-13	2006-07	2012-13
Low	5	7	13	15
Medium	7	8	15	16
High	8	14	16	22

As observed from the above tables, that future demand on this section will be having about 15 pairs trains plying on the section, & this section needs upgradtaion to meet the demand which is described in the following section.

7.3.3 *Future Rail Connectivity & Suggestions*

a) Immediate Rail Connectivity

The immediate Rail connectivity at the port through Bellary to Vasco is the prime concern. Information gathered reveal that this section has gradient problems and super saturation levels of the traffic faced.

Considering the present level of traffic and future traffic demand this section needs to be doubled. However, since doubling this entire section of Bellary – Vasco of 300 km at one stretch would involve huge capital investment and hence doubling can be carried out in two Phases with only the critical sections in this route doubled in Phase I with adequate number of loop sections and the other sections doubled in Phase II.

The capacity enhancement in this section could be carried out in Phases as explained below;

Phase–I

i. *Create a proper R&D yard* capable of dealing with the anticipated traffic-Vasco Railway Yard and remodelling of the present R&D yard.

ii. *Kulem-Castle Rock Section (26kms)*

Construction of a new railway line from Kulem to Gunji to doubling of track at ghat section where it is expected to increase the line capacity by 21/2 times of present capacity at a cost of Rs.600 Crores

iii. *Londa- Dharwar Section*

Doubling of Londa - Dharwar route of 70 kms at an.approx. cost of Rs.175 crores.

iv. *Hubli- Hospet Section*

Doubling of hubli-Gadag route of 58 km at a cost of around Rs.145 crores.

Phase-II

i. Doubling of balance sections line capacity which mainly includes doubling of Gadak –Hospet sections line of 85kms at a cost around Rs.210 crores.

ii. Increase in train holding capapcity in Vasco-Hospte Section of 10 pairs of additional good trains have to be introduced if there would be 20 additional train rakes in the circuit at any given time, which reuires additional class B & C stations with adequate no. of loops lines at a cost of around Rs.230 crores (Rs.176 crores +Rs.54 crores)

The doubling and yard improvements are expected to cost around Rs.2000 Crores.

Railways have already taken up the project of line doubling nd the survey is already is already in completion stage.

Apart from this, the Railways are also exploring the possibility if line doubling by avoiding the ghat section i.e from Gunji to Kolamb, though this alternative is likely to face the problem of Environmental clearance. None the less, the Railways would be going ahead with either of these projects and once completed the movement from the port to any destination would be fast and efficient.

Railways are operating 54 wagons and in exceptional cases 58 wagons. Completion of construction of 3 loops station in ghat section will make it possible to run rakes with 58 wagons. This will also help to run more number of trains in the ghat section.

b) Internal Rail Improvements & Suggestions

The infrastructure will have to be designed within the port itself, keeping in mind the average movement of about 16 rakes in both the directions or a maximum of 12 rakes in one direction.

8 Human Resources

8.1 Technical Description

8.1.1 Organisational Structure

The management and administration of the Mormugao Port Trust is carried out by the Chairman for and on behalf of the Board of Trustees constituted under the provisions of the Major Port Trusts Act, 1963. The Board includes representatives of Customs, Railways, defence, state government, representatives of major political parties, representatives of labour unions, the Chairman and Deputy Chairman. The Chairman is assisted by Dy.Chairman and Heads of Department.

The port has an overall staff strength of 3127 with the following break up;

Table 8.1 - Overall Staff Strength as on May 2006

Class I	Class II	Class III				Class IV	
		Technical		Clerical		Technical	Other than Technical
		Supvy	Non-Supvy	Supvy	Non-Supvy		
144	84	249	1001	128	372	492	657
Total: 3127							

For administrative convenience, working of the Port is divided broadly among various departments and staff strength as given below;

(a) General Administration Department (204)

(b) Traffic Department (246)

(c) Civil Engineering Department (348)

(d) Finance Department (140)

(e) Medical Department (249)

(f) Mechanical Engineering Department (1144)

(g) Marine Department (344)

(h) Planning & Management Services Department (36)

(i) Materials Management Department (100)

(j) Cargo Handling Labour Department (316)

The general port management structure is shown in **Figure 8.1**

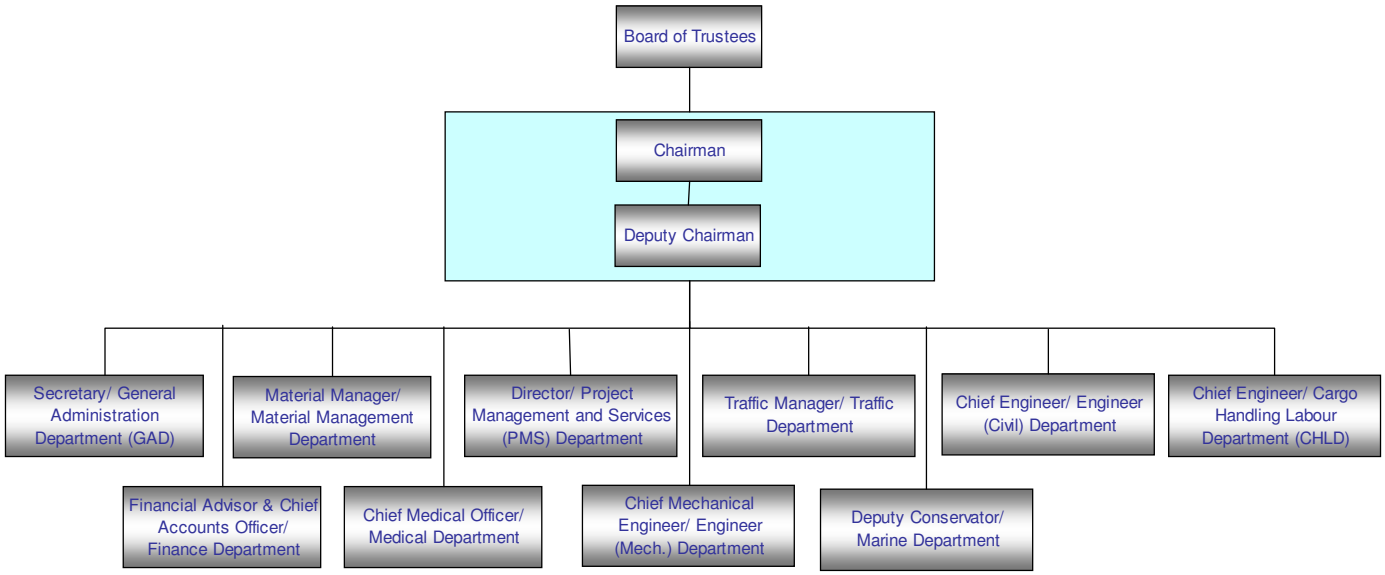


Figure 8.1 – Organisation Structure in Port

Each "Head of Department" who is appointed by the Ministry of Surface Transport, functions within the powers delegated to him under the provisions of the Major Port Trusts Act, 1963.

The following observations can be made about the organization structure

- The overall analysis of the staff strength in various departments suggests a bottom heavy pyramidal structure of the organization.
- Such a structure would create sluggishness or slow work processes and hence decision making.
- 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.
- Redeployment and lateral job rotation after assessment of interest and ability of employees and training will result in better productivity and also ensure that employees are able to contribute meaningfully.

8.1.2 *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. These targets according to the view of senior management of MPT are stretched and not easily achievable.

Given overleaf is the analysis of Dock Labour Productivity and Shore Labour Productivity from figures given in the Annual Report of MPT for the last five years. CHLD is presently managing both shore labour and dock labour in an interchangeable fashion as both the work men are deputed interchangeably.

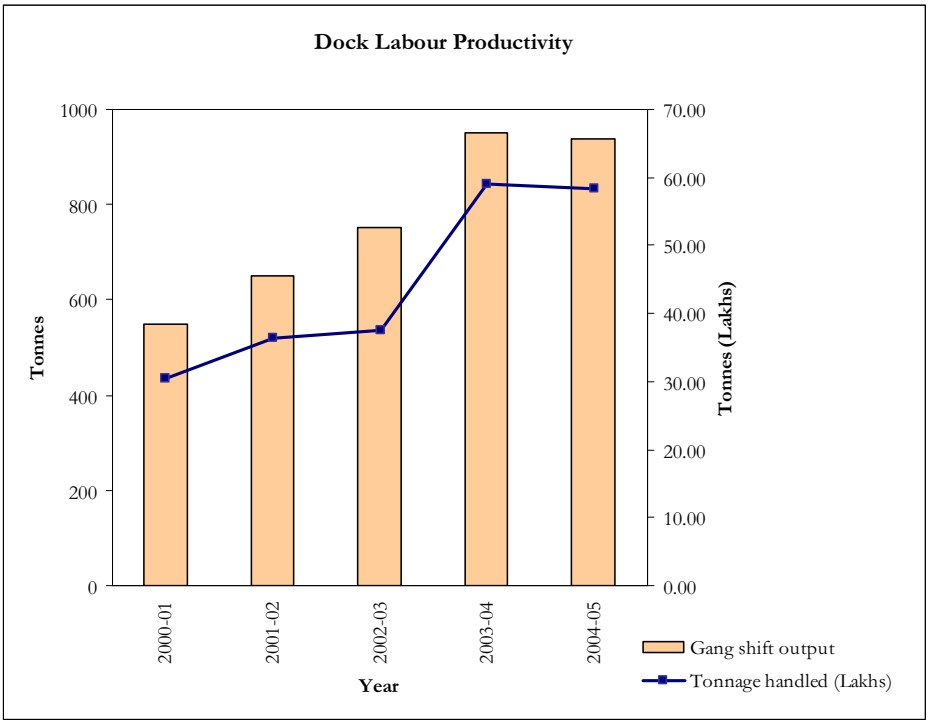


Figure 8.2 – Dock Labour Productivity

Figure 8.3 – Shore Labour Productivity

Dock labour Productivity has gone up but shore labour productivity has gone down. It could be because of some tonnage being handled by the BOT or some inefficiencies in managing the required labour at the required time.

MPT has been able to meet these set productivity targets so far. There are some constraints that MPT is working under, all new recruitment has been frozen by the Ministry of Shipping, both in the administrative side and the operations (dock and shore labor). In the administrative side conforming to this has not been a problem. However in the operations side it is difficult to manage the workload with the existing workers. The entry level workers are most in need especially in MOHP but cannot be recruited and there is no clear career path that can be offered to the senior level workers to create a vacancy down the line. Perhaps this freeze on recruitment can be flexibly applied so that entry level workers can be hired particularly in the likelihood of increased throughput.

The management is hence considering hiring private labour in CHLD but the union is not entirely cooperative of the idea. A tribunal directive has recently been decided for manning skills for CHLD and that will be implemented. However for MOHP this has not come.

8.1.3 *Union – Management Relations*

A total number of nine unions are presently functioning in the Port, the major ones being Goa Port & Dock Employees' Union(Recognized). Mormugao Port & Railway workers' Union(Recognized) and the Mormugao Port Trust M.O.H.P Workers' Union (Unrecognized). The Management deals largely with the two recognized Unions which has contributed to the emergence of a mature relationship between the management and the two recognized unions. Problems and important issues are tackled in a mature and non-acrimonious fashion. The management has tried to create a healthy and enduring relationship and the Union has reciprocated and has contributed to building a positive and progressive Industrial Relations Situation.

However the following issues are resulting in less than optimum productivity:

- Slow working is prevalent
- There is excessive overtime being claimed especially in MOHP
- Considerable time is lost during change of shifts
- Workmen are not fully accountable for their time

Recommendations

- Introduction of an automated sign in/sign out system which logs the number of hours of work put in by workmen will result in more accountability of their time.
- A study to improve scheduling such that there is no loss of time and work is not interrupted during change of shifts or gangs are not short of people when needed.

8.1.4 *Bureaucracy*

There are a lot of positives in the office environment that one observes. The culture in the MPT is characterized by informality, teamwork and a positive approach. MPT is an ISO 9001-2000 Port. It has been able to meet and sometimes exceeds the ISO time benchmarks for resolution of paper work. However any paper has to go through 7 persons before it is resolved because only 3 persons starting from the officer level have the authority and decision making powers to deal with it. Therefore, the total time taken is more than actually needed. Most inter-departmental communication is still through paperwork.

The following interventions will be effective in tackling bureaucracy;

- 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.

8.1.5 Training and Human Resources Development

MPT has a Training Cell for the last 15 years and an HRD Centre has been started 1.5 years back. At the beginning of the year the HRD Department gets a list of 20-30 training programmes from each department that they would send their employees. They then make a training calendar with discussions with the Department Head on priority of the programme. 7-8 programmes per month for managers and supervisors. 1.8 mandays of training per employee is the norm. The following tables give a summary of the kind of training programmes held.

a) External Training

Table 8.2 – Training Programmes held for External Training

Operational	Managerial	Medical	IR	Others
Port equipment familiarization	Strategic Port management for Senior Port Manager	Endoscopic surgery for surgeons	Programme on Arbitration and Conciliation	
Training on dredging for civil engineers	Programme on peak performance	Clinical and technical update for nursing staff of MPT		
Railway workshop			Contract management and dispute resolution	
Barge equipment operations and maintenance				
Trends in bulk handling for Traffic department				

b) Internal Training

Table 8.3 – Training Programmes held for Internal Training

Operational	Managerial	Medical	IR	Others
On Auto cad training	Induction training for fresh recruits	Program on Health awareness		Right to Information Act
Circuit breakers of electrical in operational area	Port regulations and norms			First Aid
Port operational network software	ISPS Code			Dock safety for Port staff Safety in cargo handling for stevedores
	Positive thinking by Brahma Kumaris			
	On-site emergency plan			
	Conflict management and team building			
	Stress Management			

Employees are sent on external training programmes also. Given below are the figures for training programmes attended.

Table 8.4 – Training Programmes attended – Managerial & Supervisory

Year	Managerial			Supervisory		
	In-house	Outside Programme		In-house	Outside Programme	
		India	Abroad		India	Abroad
2004-05	72	30	-	286	91	-
2003-04	62	36	-	296	80	-
2002-03	66	34	-	330	71	1
2001-02	14	20	-	259	65	-
2000-01	8	18	1	231	56	-
1999-00	4	20	1	87	68	-

Table 8.5 – Training Programmes Attended – Technical & Others

Year	Technical			Other Types		
	In-house	Outside Programme		In-house	Outside Programme	
		India	Abroad		India	Abroad
2004-05	381	86	-	1617	79	-
2003-04	363	78	-	1637	86	-
2002-03	371	73	-	1958	91	-
2001-02	231	69	-	1218	84	-
2000-01	214	54	-	1281	98	-
1999-00	150	95	1	1232	33	-

c) Total Training Programmes

Table 8.6 – Total Training Programmes

Year	In-house	Outside programmes-India	Outside programmes-Abroad
2004-05	2356	286	0
2003-04	2358	280	0
2002-03	2725	269	1
2001-02	1722	238	0
2000-01	1734	226	1
1999-00	1473	216	2

The Working Group for the Port Sector for the Tenth Five Year Plan has identified the following thrust areas for training at the port level:

- Retraining of cargo handling workers in handling of containers and bulk cargo.
- Training of equipment operators in high capacity general cargo handling equipment, containers handling equipment and bulk cargo handling equipment.
- Training of skilled and semi skilled employees in maintenance of container handling equipment, bulk handling equipment and state of the art other cargo handling equipment.
- Training of skilled and unskilled crew members working on floating craft such as, tugs, dredgers, launches, etc.
- Workshops and seminars on current developments in the ports such as, corporatisation, commercialization, privatization schemes such as BOT, BOOT, etc.

Training of staff in computers, EDI, VTMS and other computer based operations.

Indian Institute of Port Management, Calcutta (IIPM) and National Institute for Port Management, Chennai (NIPM) which cater to the training needs of port personnel conduct training courses only for port personnel in the officer cadre and training for those in senior level supervisory category is given occasionally. There is a lacuna in the training facilities available to operating staff. MPT does technical training for its operating staff but should focus on assessment of training effectiveness and its translation into improved productivity at the site of work. International experience shows that this will result in substantial increase in productivity.

d) Training for cruise tourism

The future plans for MPT include the creation of a dedicated cruise ship terminal. Specific training initiatives should be taken for development of the knowledge, skills and attitudes towards the cruise tourism industry.

The following aspects should be covered under the special training programme for handling Cruise Tourism:

- Awareness in the field of cruise tourism
- Communication and hospitality skills
- Food & beverages etc.
- First aid
- Management & Public relations skills
- Computer literacy
- Security and law enforcement rules
- Environmental aspects
- Customer Orientation
- The cruise/port relationship

e) Budgets

- 10-15 lakh per annum should be invested in various organizational improvement interventions

- The training budget should be increased by at least 50% to 30 lakhs per annum in view of planned growth.

8.1.6 *Computerization*

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.

Web based on line system installed in the port has improved the operational efficiency as Port users registered under this system have access to required information. There are about 20 terminals connected to these servers. 2 nos. terminals have been installed in remote locations at Central Control Panel of Mechanical Ore Handling Plant. The remote terminals are connected using line drivers and the data is fed on-line from these remote terminals.

There are about 150 Personal Computers linked to the Local Area Network and about 125 stand alone computers for the total work force of the port. All the computers in the LAN network do not have permission to enter data but could view the data on limited basis depending on the permission level set. Data access is restricted depending on the requirement and level of data needed for each department / user linked to the LAN.

Human Resources of the port are not computerized except for the pay roll. The other pertinent data arrives to IT cell in hard copy and then entered into the computer.

The port has various software applications in various departments for improving the operational efficiency. Marine department has software installed in the signal station for guiding and tracking of vessels movements inside the harbour. The port has other stand alone software applications 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. Facility for messaging within the computers is available though again it is for limited users only.

The Emailing facilities and concept of emailing for internal communication need to be improved to improve the operational efficiency.

The port's immediate plans include computerization of labour booking. MPT supplies gangs to stevedoring agents. The request to gangs is sent 3-4 days in advance. Right now the allocation and availability of labor is tracked manually since it has not been computerized.

The Port has installed a Electronic Data Interchange (EDI) system and has installed its own server for EDI application where in the EDI users could log on to this server through Remote Access Servers. There are about 75 users and 7 banks registered for the EDI system.

The following communication equipment is available in the port.

1. EPABX and BSNL landline telephones and Fax
2. Mobile Phones
3. Email system through VSNL service provider.
4. VHF sets
5. INMARSAT mini-M satellite communication system with voice, fax and data calls

The signal station does not have facility for sending and receiving e-mails & as per the current plans it will be provided with the same in near future. It is aiming to convert Financial Accounting, Payroll and Materials Management to new RDBMS and integrate it with Port Operations.

The Port should aim for an integrated computerisation approach rather than stand alone packages for various needs. Port needs to be more competent in database administration and support for maintenance. The integrated and a good intranet facility should be used to establish emailing as a routine communication for inter-department interactions. This will improve productivity.

Procurement of additional 150 computers associated with adequate licensed softwares, printers are recommended as immediate requirement with regard to port computerisation. Development of an integrated computerisation system might require the replacement of the present window based server with a UNIX based RISC or any equivalent Server. Certain existing software like UNIX needs to be upgraded with the latest version.

An investment of INR 41 million is envisaged for developing an integrated computerization system & other associated computer facilities as explained above at MPT.

9 Environmental Management

9.1 General

This chapter covers aspects related to the present environmental protection and issues of Mormugao Port and the future environmental management plan for the anticipated port development. Certain baseline envirionmental conditions like waves, wind, currents, tides, etc have been covered in Chapter 2 of this report and the remaining ones like air pollution, water pollution, ship wastes, etc are covered in the following section before addressing the Environmental Management Plan.

9.2 Baseline Environmental Condition

9.2.1 *Air Pollution*

Air pollution in the vicinity of the Port is measured by the State Pollution Control Board who has two respirable air samplers, one on the Fire Station in the Port and the other in Vasco City. The Port only receives the data from these samplers some 2 weeks after the event and so is unable to immediately respond to deteriorating quality when this is shown by the monitors. The Port has data from the last 2 years from these samplers but this has not been analyzed to date.

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. Indeed a group of citizens is currently suing the port over the dust pollution which the citizen's claim to be coal dust, although it may well be a mixture of coal and iron ore dust. The final hearing of the court case is pending but the Port have filed an affidavit confirming 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.

Coal stacks are sprayed at berths 5a and 6a by the berth lessee using recycled port water and at berths 10 and 11 by a contactor. 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 is also planning to set up its two air samplers of its own, one at the end of berth 11 and the other on the headland next to the Port's guest house, however, these will be high volume samplers and will not thus give the same level of detail as the Pollution Control Board's Samplers. It would be ideal if a mechanism could be established for the Pollution Control Board to report the readings of its samplers to the Port Authorities in real time, particularly when high readings are obtained, to enable the Port Authorities to realize that an issue has developed and to immediately mitigate it by whatever means required.

9.2.2 Water Pollution

Aquatic pollution from the port may result from local discharges from the port and ships and the potential for major spills.

Monitoring of pollution in the estuary of the Zuari river on which the port is situated on has been carried out by the State Pollution Control Board. Two stations were established in the estuarine regions of the river. While the station Cortalim in Zuari represents the seawater-end, the station at Panchwaddi is situated towards the freshwater-end of the Zuari. Monitoring of water quality at these stations has been carried out regularly on monthly basis since 1991. The parameters measured are: water temperature, pH, DO, BOD, COD, Turbidity, Nitrate-N, Nitrite-N, Total Coliform and Faecal Coliform. Analysis of the results of monitoring at the two estuarine stations, during the past 6 years (1999-2000 to 2004-2005), indicates that:

- The average annual pH was relatively higher (7.4-7.8) at the Cortalim station which is closer to the mouth of the Zuari, as compared to the Panchwaddi station towards the freshwater side, where the average annual pH varied between 6.4 and 7.3. On an annual basis, the average pH at Cortalim does not show much variation, whereas at Panchwaddi the pH varied between 6.4 and 6.8.

- The DO concentrations showed a general trend of increase between the years 2001-02 and 2004-05 at both stations.

- The most noticeable change however, was observed in case of faecal coliforms, which steadily increased from a 2-3 MPN/100ml in 1999-2000 to 12-13 MPN/100ml in 2004-05. The reasons for this rapid rise over a period of 5-6 years need to be investigated.

The Central Pollution Control Board adopted the Water Quality Criteria for the designated best use in respect of freshwaters and coastal/estuarine waters, and communicated the same to the various states in 1978-79. The water quality parameters for each of these classes were established. A comparison of the data of the estuarine stations and freshwater stations with the corresponding Primary Water Quality Criteria for class "C" and "SW-II" of fresh and estuarine waters respectively, indicates that the quality of both the categories of water is generally good and meets the water quality requirements for the designated best use for the respective category of waters.

Hence it would appear that the port is not added any major pollutants to the river. There is concern as to the levels of Faecal Coliform in the estuary of the river and it will be important to check what the source of this pollution is, however as shown below, the Port's sewage treatment facilities would appear to be more than adequate and so it is assumed that this is the result of pollution from adjacent urban areas.

Potable water for the port is checked monthly to ensure that it is potable. This water is used for the Port's own purposes in the Port area and on the headland for its colonies. The Port does not have sufficient water to supply to ships, and hence ships are arranging their own water through their agents who arrange for water to be supplied to them by tankers.

All sewage water from the port is treated.

The sewage from the colonies on the headland (apart from some houses which cannot achieve gravity flow to the treatment plant which have septic tanks) is treated in a 1,200 m3/day sewage treatment plant. The effluent from this has a normal BOD level of less than 10 although on occasions this has risen to 25/26, however these figures are well below the discharge consent levels for discharges to coastal water of 100 and for discharge to land of 30. At present about one third of the effluent from the treatment works is sold to Jindal's for coal stack spraying (dust suppression) at berths 5a and 6a and the rest is discharged to the Sea. The effluent is sold at INR 9 per M3, which interestingly is enough to cover the cost of the treatment plant in 4 years. The port plan to use the balance of the flow, which is currently being discharged to the sea, for irrigation of parts of the headland and dust suppression in other parts of the Port, e.g. the coal stacks at berths 10 and 11 for which spraying is currently contracted out and for which the contractor has to import water from local wells.

The Hospital also has its own sewage treatment plant. Within the actual port area all sewage is treated in local septic tanks.

Water is not currently used for iron ore stack spraying as the stacks generally have a high enough moisture content not to require spraying, however, as described above, in the pre monsoon months, spraying may be required.

One area of concern is that when berths are cleaned the waste is reportedly swept directly into the sea and will likely contain both oils and particulate coal and iron ore matter. This needs to be avoided.

The port is also understood to be constructing recharge pits at the headland for water harvesting.

9.2.3 Solid Waste

The port has installed an 8 ton capacity incinerator to handle it's solid waste after segregation is carried out at source and at the plant. In addition the port has a vermi-composting plant consisting of a solar powered digester and electrically operated shredder to treat 100 kgs of bio-degradable waste per day. This is located at the main administrative building to cater to structures in the vicinity.

9.2.4 *Ship Waste*

The following facilities are available at Mormugao Port for dealing with ships waste;

Oily Waste:

- A dumb barge of 50 m^3 capacity for receiving oily waste and slops, the use of this has to be paid for by the Ship's Agent.
- As shore based tank of 5 m^3 capacity for the collection of oily bilge water from barges and other small craft, the use of this is free to encourage barge users to use it.
- Tanker services for the removal of oily wastes. Only licensed private contractors are allowed to provide this service.

Sewage:

- The port only provides sewage facilities to ships at the berths – no facilities are available for ships out at the moorings. Sewage facilities are provided to the ships by the Mormugao Municipal Council who provides the use of a 3,000 litre sewage truck with a 36m hose and pumps. A nominal charge is levied for this service.

Garbage:

- Four licensed private contractors are allowed to collect ships garbage.

9.2.5 *Oily Waste*

One major risk to the marine environment and the tourism industry of Goa would be that of a major oil spill resulting from a ship running aground, a collision or an accident during loading or unloading at the port. In recent memory no such incident has taken place at Mormugao Port.

At present, MPT has the following Oil Response Equipment;

- Floating Rigid Oil Boom- 300 meters with connectors(As per a recent study on Risk Assessment and Oil Spill Response Plan, this would need to be replaced at the earliest opportunity)
- Oil Dispersant Chemical Spray Unit with arms-2 nos. (One portable and fixed on tug "Dona Paula-II")
- Oil Skimmer (Capacity 31.8 m3/hr)
- Dumb Barge for collection oil (50 tonne capacity)- 1 No with pumping facility.
- Dispersant chemical Type 3-2000 ltrs.

- Incinerator (Installed on shore for the disposal of dry waste, oily sludge, garbage, etc)

The recent study on Risk Assessment and Oil Spill Response Plan for MPT has recommended the procurement of the following additional equipment;

- Externally attached float boom: 600m length
- Portable Lightweight Rotary Disc type Skimmer: (03) in Number
- Oil spill kits: (20 nos)
- Absorbent booms: (20 bales)
- Boom washing machine: (01)
- Oil Spill Response Vessel (01)

However, there have been no significant oil spills in recent years at Mormugao, but there has been one major spill at Goa Minor Port. On 23 March 2005 a collision took place between a 70,000-tonne cargo ship and an iron ore barge just 5 nautical miles off Panaji. This caused a major oil slick, 110 metric tonnes of oil having been spilled out of the tanks of the cargo vessel Maritime Wisdom which was hit by a Goa barge during ore loading operations at the Panjim outer port. The accident was caused by rough seas, which shows the risk inherent in this type of operation. The Panamanian size cargo ship chartered by the North China Shipping Company was carrying 1,400 metric tonnes of fuel. It managed to salvage a bulk of the oil by transferring it to other tanks on board. The Coast Guard and Mormugao Port Trust pollution response teams responded and were able to disperse the slick within about 6 days. Luckily no oil reached the beeches as the slick blew south along the coast luckily rather than on to the beaches.

9.3 Impact Assessment

The **Table 9.1** summarizes the possible general environmental impacts due to proposed construction activities.

Table 9.1 - Summary of Environmental Impacts

Source of impact	Resources affected	Impact assessment
Interference to other users of the marine environment	Marine traffic, Fishing activities	Interference will be for less that two months in duration and restricted to the exclusion zone at the construction site and along the mobilisation demobilisation route
Combustion emissions form DG Sets, fugitive emissions of VOCs	The local atmospheric environment	Insignificant impact. Dispersion will be rapid.
Disposal of construction wastes	Water and sediment quality, biota	The use of a low toxicity water based drilling fluid, the discharge directly to the sea bed and the small amount of construction material produced will prevent long term effect occurring on water quality or biota. Impacts on water quality will be intermittent during construction and impacts on the seabed are confined to a small area and are predicted to last for less than 1 year.
Disposal of Solid Wastes	Land, water quality	The waste produced by the construction is required to be handled and disposed of appropriately so that this not to cause unacceptable impacts or regulatory non-compliance.
Oil Spill	Water and sediment quality, habitats and species	Minor oil spill are most likely to be of diesel. Natural dispersion will prevent serious impacts to marine and coastal resources. A major oil spill is predicted to be a very unlikely event, however the sensitive coastal habitats are very likely to impacted. A range of natural and socio economic resources are likely to be affected and recovery may take in excess of 5 years for highly vulnerable and sheltered resources
Socio economic benefit	minor inputs to the local economy	
	Generation of revenues for the Govt of India	Generation of revenues for the Government of India and economical growth

9.4 Environmental Management Plan

The environmental management plan would include all the measures along with proposed up gradation during planning. However following measures are required to be followed:

- Reducing the existing dust concentration levels in the air by 30% in general cargo berth area and 10% in MOHP area.
- Ensuring the oil bilge from port crafts are brought on shore for separation and further disposal.
- Upgrading the STP to achieve treatment as per regulatory requirements
- Conserving Power by 5%
- Conserving fuel by 5%
- Conserving water by 5%
- Planting 3000 (approx.) trees annually

9.4.1 *Municipal waste dumping site*

A municipal waste dumping site (with out any design)) is located close to port office, land owned by port. This site caters the disposal of municipal waste for the town. As far as location of existing disposal site, this dumping site is located with in populated area as well as close to sensitive location (hospital).

The photographs above show the proximity of the dumping site to the hospital. 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. The potential of CERs shall be depend on the methane potential of existing disposal site. To have the potential, site should be enough old (about 10 years) and contain sufficient amount of biodegradable component for methane to be extracted.

Therefore, we need to examine the history of existing waste disposal site with the following relevant data;

- Depth, height and area
- Year from which solid waste is being dumped to this site
- physico-chemical characterization of existing site to assess its energy potential

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.

Moreover the location shall be clean and beautified with green belt development and grass cover on abandoned site along with two green energy generating projects.

Based upon the above discussion, it is suggested 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

9.4.2 Environmental Management Measures

A summary of the various management measures during the various stages of the project is provided in the following sections.

Construction Stage

This will be the most crucial and active stage for the Environmental Management Plan. In addition to the monitoring of the construction activity itself for the pollution levels to be within permissible limits. In addition, the need for a balanced evaluation and planning for risks associated with construction activities such as accidental spillages and consequent damage to the surrounding environment in terms of loss of flora and fauna, worse fertile land, continues to grow in importance. Other possible locations where a risk assessment will be useful include the locations of spillage of fuel and labour-camp sites.

Operation Stage

The operation stage will essentially entail monitoring activity along the ship route. Monitoring for pollutants specified in the Monitoring Plan will serve two purposes. In addition to checking the efficacy of the protection/mitigation/enhancement measures implemented, this will help to verify or refute the predictions made as a part of the impact assessment. Thus, it will complete a very important feedback loop for Port Authorities.

A general environmental mitigation action plans are given in **Table 9.2.**

Table 9.2 - Environmental Management Actions

Issue	Associated Impacts	Management actions	Monitoring
Mobilisation and demobilisation	Interference with other marine users of the area.	Notice on the locations of the construction will be issued to mariners i.e. Ports and harbours and local fishing authorities communities will be undertaken	Records of consultations will be kept for reference.
Presence of construction activity	Aesthetic Impact	As above	None required
Disposal of Solid Wastes	Impacts on Water and Sediments	Waste will be segregated into the following different waste types: • non-degradable metals • general (galley waste, paper and wood) • hazardous waste, oil and oily contaminated rags Appropriate storage will be used in each case specifically metaliferous and general wastes will be stored in skips and disposed of to an appropriate facility onshore. Oil and oily contaminated waste (including rags and absorbent materials) will be stored in sealable containers and transported to shore for appropriate disposal. Training and information will be provided for operational staff responsible for waste disposal to ensure that wastes are not disposed of indiscriminately.	Facilities will be examined for suitability prior to mobilisation. Regular auditing on the construction for complying with the management actions.

Issue	Associated Impacts	Management actions	Monitoring
Discharge of domestic effluent and machinery wastewater	Impacts on water quality	Engines are to be provided with drip pans and the oil deck drainage is to be routed through oil separateing traps. Domestic effluent to be treated in a regular sewage treatment plant onboard.	The deck drainage and water treatment systems will be inspected prior to mobilisation. The performance of the oily water separator will be checked to ensure that the water discharge complies with MARPOL.
Oil Spill	Impacts on coastal habitats and water quality	Oil spills are not expected. However, in the event of any spill following blow out and kicks Operational procedures will be implemented to reduce the risk of oil spillage. PMRs will be established for critical equipment. In particular the drainage and bunding system will be thoroughly maintained and tested. Records of all spillage will be kept and appropriate disposal of spilt oil will be ensured. During fuel oil transfer: • The vessel fuel transfer hoses will be equipped with break away cut off valves and flotation collars. • The capacity of receiving tanks will be checked before receipt. • Critical equipment ie hoses and gauges will be maintained. • Provision of appropriate equipment, implementation of oil spill response measures and training of personnel will be ensured. Oil spill response equipment for a Tier 1 spill event will be carried on board the standby vessel and includes dispersent and absorbant material. The Coast Guard will respond to Tier 2 spills (10-100 tonnes) with a response time of 6-8 hrs. The oil spill response contractor will respond to Tier 3 spills (>100) within 24 hours.	Oil spill preparedness will be assessed prior to mobilisation. Oil Spill Contingency Plan will be reviewed and corrective actions identified for preparedness during emergency.

9.4.3 *Environmental Monitoring*

The environmental monitoring programme provides such information on which management decision may be taken during construction and operational phases. It provides basis for evaluating the efficiency of mitigation and enhancement measures and suggest further actions that need to be taken to achieve the desired effect.

The monitoring includes:

- Visual observations;
- Selection of environmental parameters at specific locations;
- Sampling and regular testing of these parameters.

9.4.4 *Environmental Management – Budget*

The environmental budget for the various environmental management measures proposed in the EMP is estimates as about Rs.2 Crores. A break up for this is provided in **Table 9.3.**

There are several environmental issues that have needs to be addressed as part of good engineering practices. The budget reflects this and while retaining the types of enhancement suggested, allows the selection of the locations at the discretion of the Environmental Engineer of the port.

Table 9.3 - Environmental Management Budget

Sl. No.	Item	Quantity	Estimated Unit Rate (Rs.)	Total Cost (Rs.)
	Part I: Monitoring			
I	**Air (Construction & Operation Phase)**			
1	Monitoring at construction site	Twice a week, 4 weeks in a season and 4 times in a year for 4 years i.e.96 x 6 locations (total 576 samples)	5,000	2,880,000.00
2	Monitoring during operation	Twice a week,4 weeks in a season and 3 times in a year for 4 years i.e. 96 x 2 locations (total 192 samples)	5,000	960,000.00
II	**Water Quality (Construction & operation phase)**			
3	monitoring during construction & operation	4 samples/year, once a year, before construction (3 season),during construction (4 years) and during operation (3 years) for 2 locations.(total 84 samples)	5,000	960,000.00
III	**Noise (construction & operation Phase)**			
4	Monitoring during construction	At equipment yards, as and when necessary (6 samples)	4,000	24,000.00
5		As directed by Environmental Engineer, twice a year for 4 years at 2 locations (total 16 samples)	4,000	64,000.00
6	Monitoring during operation	Twice a year for 4 years at 2 locations (16 samples)	4,000	64,000.00
IV	**Soil & Sediments(construction & operation phase)**			
7	Monitoring during construction	At productive land, to be decided by Environmental Engineer	L.S.	400,000.00
8	Monitoring during operation	At accident/spill locations involving bulk carrying hazardous material, to be decided by the Environmental Engineer	L.S.	300,000.00

Sl. No.	Item	Quantity	Estimated Unit Rate (Rs.)	Total Cost (Rs.)
9	Trees (pre construction & operation phase)-a) Monitoring during preconstruction and operation phase	All along the corridor and at location of compensatory plantation for 7 years	L.S	500,000.00
	Total (I)			**6,152,000.00**
V	**Part II: Mitigation/Enhancement cost**			
10	Tree plantation	3000 trees/year	Rs. 300/tress (including 3 years maintenance) for 4 years	3,600,000.00
11	Water sprayer/watering for dust suppression	Arrangement for sprinkling water using sprayers and watering along haulage roads @ Rs. 45,000/	Lump Sump	1,000,000.00
12	Sewage disposal during construction	Provision of soak pits for disposal of sewage at 10 soak pits	5000	350,000.00
13	Waste disposal at service centre	Provision of shallow soak wells of disposal of waste from service centres (total 7)	15000	105,000.00
14	Noise Barriers/green barriers for silence zones	Plantation of vegetation and trees for reducing noise levels at sensitive receptors. One barrier with 200 numbers of trees per barriers	300	360,000.00
15	Habitat enhancement: Policy development	L.S.	L.S.	500,000.00
16	Environmental and safety policy development	L.S.	L.S.	500,000.00
17	Study on alternative municipal disposal site, wind farm and CDM credits	L.S.	L.S.	5,000,000.00
	Total II			**11,415,000.00**
	Total I+II			17,567,000.00
	Contingencies @ 10 %			1756700
	Grand Total Costs			**19,323,700.00**
				SAY, INR 20 million

10 Investments

10.1 General

The infrastructure development plans & organisation improvements required for Mormugao Port in tandem with the traffic forecasts have been identified in the previous sections. Based on these, the capital and operating investment required have been estimated and presented in this chapter.

The rates for the items have been worked out based on in-house data and current rates of similar works prevailing in the project area. The estimates of cost for mechanical works-equipment etc. are based on discussions with the suppliers/manufacturers and on in-house data.

10.2 Cost Estimates

10.2.1 *Capital Investments*

For the reasons discussed in the previous sections on various developmental works for Mormugao Port, the items (Port related and Connectivity related) requiring a major capital investment are identified and listed below.

a) Common Port Development works

- Breakwater Repairs & Strengthening
- Capital Dredging for deepening of approach channel and Berth 9 by 1m

b) Capital Investments Related to Cargo Handling

- Providing Harbour Mobile Crane at Berth - 11
- Integration of berth no 8 with with berth 9 for iron ore handling along with increased stackyard area & a wagon tippling system
- Replacement of MOHP present equipments
- Construction of additional mooring dolphins
- Construction of Berth no 7 as new berth 7
- Construction of a new Port crafts jetty

- Development of Vasco Bay (Phase – I) with one finger jetty capable of accommodating 2 liquid cargo berths, 1 berth for Navy+OSV+Non cargo vessel and one berth for cruise vessels including the associated capital dredging involved.

Of the above projects, it is almost certain at this stage that construction of new berth 7 will be on BOT basis while on the remaining all, MPT might invest money depending on its Cash Flow availability which is discussed in the subsequent section.

c) Connectivity Aspects

Roads

- Construction of the remaining 5 km stretch NH-17B between Vernapuri and Sada
- Construction of flyover from Tariwada on NH-17B to Gate no 9
- Construction of 2 lane road between Gate no 9 and Gate no 1 within the existing port area

Rail

- Doubling of Bellary - Vasco Section in two phases
- Yard improvements to Vasco Railway yard including remodelling of present R&D yard

d) Human Resources Aspects

- Computerisation - including a new server and software for integrated computerisation
- Adding additional 150 computers for staff
- Upgrading existing software like Oracle to the latest version
- Procuring allied computer facilities like printers, licensed software, etc

e) Environmental issues

- Environmental management
- A feasibility study to ascertain the recovery potential of methane gas from the existing disposal site near the new Hospital

- 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

All the above have been cost.

It is also assumed that;

- There are adequate number of harbour crafts like tugs and launches with MPT and no additional capital investment is envisaged.
- For the proposed liquid bulk berth at Vasco Bay, the pipelines connecting to the tankfarms would be provided by the end user and no investment is envisaged at this stage.

In the capital cost estimate, a provision (of 5%) of the capital cost has been made towards detailed engineering, project management, administrative and preoperative expenses. In addition provision (5 – 10%) has been kept for contingencies to cover unforeseen items and minor deviations during detailed engineering. However, these estimates do not cover any local duties, taxes, etc.

The capital cost estimates for the projects identified with the existing port facilities and for the immediate development of Vasco Bay are presented below in **Table 10.1** ;

Table 10.1 - Capital Investments

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 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**

The break up of the above costs for item B, the main engineering works for the port with expansion schemes is presented in **Annexure 10.1.**

10.2.2 Operating and Maintenance Cost

The operating and maintenance cost are estimated as percentage of the capital cost and it is presented below in **Table 10.2.**

Table 10.2 - Operational and Maintenance Cost Estimates

All Cost in Million Rs.

S.No	Item Description	Captial Cost	O&M %	O&M cost
WORKS RELATED TO EXISTING PORT FACILITIES				
1	Modernisation / Equipment Replacement of MOHP	1842	10%	184.2
2	Integration of berth No 8 with Berth no 9 for Iron ore handling	463	1%	4.6
3	Providing Wagon Handling System & additional stackyard area near berth no 9			
3A	Wagon Tippler System	261	10%	26.1
3B	New stackyard development	347	3%	10.4
4	Providing Harbour Mobile Crane at Berth 11	151	8%	12.1
5	Construction of additional Mooring Dolphins	220	10%	22.0
6	Construction of Port crafts jetty near BW mole	25	10%	2.5
VASCOBAY DEVELOPMENT (PHASE I)				
7	Dredging in Vasco Bay up to -14 m CD for one liquid bulk berth and 1 non cargo vessels berth	159	10%	15.9
8	Liquid bulk berth with double berthing facilities, 300m x 20 m			
a	Berth Cost	334	1%	3.3
b	Liquid Bulk Handling Equipment for one berth	70	10%	7.0
c	Pipelines including valves and fittings	0		0.0
d	Buildings	4	1%	0.0
e	Utilities	170	8%	13.6
9	Non cargo vessels berth (250 X 20m & double berthing) including cruise at Vasco Bay	164	2%	3.3
	Total	**4211**		**305.1**

Apart from the above annual operating and maintenance expenditure related to Proposed Phase – I investments, it is expected that there will be additional maintenance dredging expenses due to deepening of approach channel by 1 m.

Also it has been suggested in Human Resources section that the budget for the training is increased to INR 3 million from the current expenditure of INR 2 million and an additional sum of INR 1 million is spent on undertaking organizational improvement interventions. Similarly Environmental Management is expected to cost about INR 20 million. This has been appropriately considered under the Financial Aspects of this report while determining the cash flow for the Port Trust.

11 Targets, Strategies & Action Plan

Targets and strategies are proposed in this Business Plan and they are for MPT's senior management to review and update periodically.

The targets are proposed to help management to assess progress towards meeting the objectives. Targets should be specific, measurable and achievable and expressed with a time limit. Strategies are suggested which are specific policies and actions which management can implement with the intent of meeting the targets.

11.1 Targets

Targets are proposed to help management to assess progress towards meeting the objectives. Of necessity, targets could be developed once the objectives, goals and future development plans of the port are in place and hence are proposed below.

Targets could be of either measurable ('hard') or non measurable ('soft') like a simple statement implying a necessary action to be carried out.

Both the types of target are required for achieving the progress towards the set goals and objectives.

After reviewing the present port capabilities, organisational set up, future plans and MPT's set goals, the following targets are proposed to achieve the objectives and goals.

- Set detailed productivity targets
- Equipment replacement at MOHP as planned
- Implement management information system
- Prepare a marketing plan
- A work study to determine inefficiencies in work flow
- Equipping internal training managers to undertake training need identification exercise and provide focused training programs.
- 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.
- Progress with /begin Vasco Bay development during 2007-08
- Improve port capacity for cargo handling
- Make better use of Information Technology

11.2 Strategies

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

The following strategies are suggested to meet the targets set above.

- 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
- Establish 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 periodically

11.3 Action Plan

The common 'Vision', Targets and Strategies identified for MPT need to be translated in a Plan of Action to meet the objectives and goals in time.

Concrete action lines are required to achieve the identified development goals set in this report including port expansion plans, Human Resources related and environmental issues.

A detailed action plan is required to ensure a systematic process to implement projects and to monitor progress. The action plan needs to be regularly updated, say on an annual basis, to reflect recent achievements, changes in performance, and shifting priorities.

Ideally an action plan should have

- Tasks/Action Steps describing what will be done,
- Responsibilities implying Who Will Do It?
- Resources (Funding/Time/People/Materials)
- Timeline by When? (Day/Month)

As far as MPT is considered, it is presumed that MPT staff would be responsible for the tasks achievement thought it is required to split the responsibilities into the various departments headed by the Chairman.

Hence a preliminary action steps along with timeline is suggested in the following paragraphs;

11.3.1 Infrastructures Related

(a) Ports Related

The following action plans are suggested to meet the port expansion plans suggested in this report;

- Initiate construction of additional mooring dolphins
- Completion of Vasco Bay Phase – I development (Finger Jetty) by March 2009
- Dismantling and rebuilding new berth 8 integrated with 9 by Sep 2011 including additional stack-yard area and a wagon tippling System
- Replacement of all equipment of MOHP by March 2010
- Channel deepening and Berth no 9 deepening by 1 m by Sep 2009

(b) Connectivity Related

- Completion of remaining stretch of NH-17 B
- Internal infrastructure improvements by Sep 2010

- Improvements to Vasco R&D yard by March 2009

11.3.2 *Environmental issues*

One of the objectives of MPT is to make the port more environmental friendly for which the following action plans are suggested.

The following action plan is required with regard to environmental issues

- A feasibility study for recovery potential of methane gas from the existing disposal site (By Dec 2007)
- Initiate steps to arrange for establishment of wind farm energy (By March 2008)
- Initiate steps to locate/select another disposal site as per MSW regulations 2002 and initiate construction of a engineered landfill disposal site (By March 2007)

11.3.3 *Human Resources*

The future planning over 5-7 years includes creation of new berths and enhancement in present activities .A useful framework for MPT would be the one given by Baltazar and Brooks (2001) who have classified Port activities into Regulator, Landlord and Operator. With respect to its private operators MPT will have to perform both the landlord and regulator functions.

Regulator- Public	**Landlord- Public/private**	**Operator- private**
• Licensing and permitting • Vessel Traffic Safety • Customs & Immigration • Port Monitoring • Emergency Services • Protection of Public interest on behalf of the community • Determining Port Policy and environmental policies applicable	• Waterside maintenance (dredging etc.) • Marketing of location ,development strategies and planning • Maintenance of Port access • Port security • Land acquisition and disposal	• Cargo and passenger handling • Pilotage and towage • Line Handling • Facilities security, maintenance and repair • Marketing of operations • Waste disposal • Landside and berth capital investment

This clear demarcation makes possible the necessary changes in the organization structure which will encompass all the above activities and can facilitate future planning.

With regard to a concrete action plan, the following are suggested;

- Identification of training needs and focussed training efforts to result in greater productivity (By Dec 2008)
- Creation of interdepartmental task forces along with external consultants to ensure involvement and result orientation (By Dec 2008)
- Integrated computerization to result in speedier response to issues and situations (By March 2008). Develop domestic policies to ensure that Information and Communication Technologies are fully integrated in support of port administration and management.
- Increased commercial and customer orientation which is necessary for competing with other domestic and international ports (By Dec 2007).

11.3.4 Implementation of Action plan

To implement the action plan set out and to achieve the objectives and goals, the following steps are suggested;

Awareness — MPT may make aware at all levels of the organization for Port management objectives and goals.

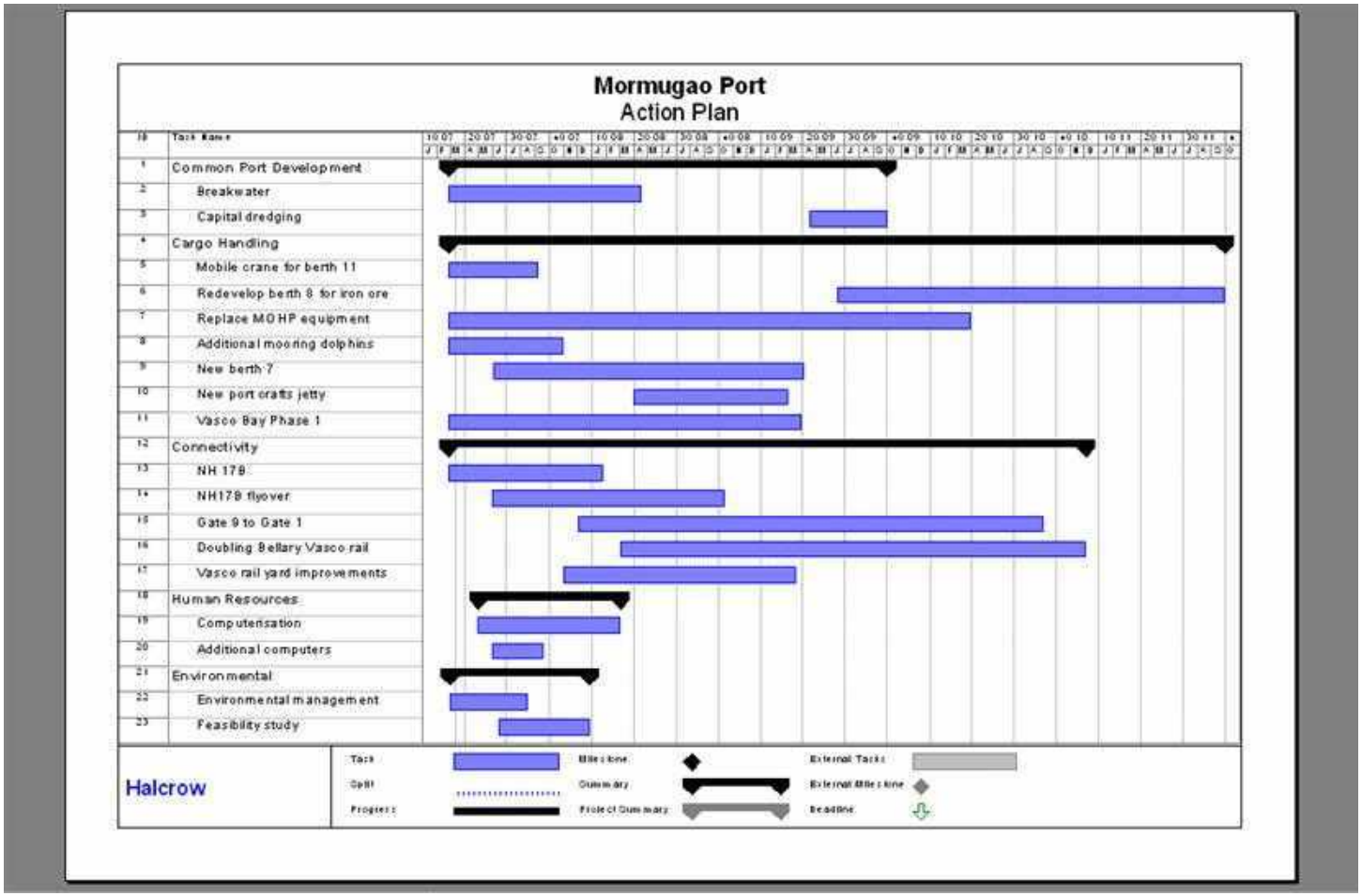
Build capacity — Through training, access to information, and transfer of successful practices, procedures, and technologies, MPT can expand the capacity of their staff.

Motivate — Create incentives that encourage staff to improve performance to achieve goals.

Track and monitor — Develop a tracking system and Using the tracking system to track and monitor progress regularly.

A schedule of Action plan for Mormugao Port with associated timelines is presented in next page in Error! Reference source not found..

Figure 11.1 – Schedule of Action Plan



12 Financial Aspects

12.1 Financial Modelling Assumptions

12.1.1 Scenario

The traffic forecasts have been made under three scenarios – low, medium and high. These scenarios are dependent on a combination of external macro-economic factors and the port's efforts. However, the traffic forecasts under the scenario that is most likely to occur – Medium case has been considered for the financial modelling exercise. The traffic forecasts for iron ore has been dealt with in three cases, in addition to the low, medium and high scenarios. It was recommended, based on the financial analysis of the three cases (as discussed in chapter 4 of this report), that the Port reduce the tariff for certain iron ore operations, increase the capacity of the Mechanical Ore Handling Plant (MOHP) to 20 million tonnes and reduce the procedural hassles experienced by the users of the port. The financial modelling has been made considering the recommended 'Case-2' of the traffic forecasts for iron ore.

12.1.2 Constant Pricing

The model does not consider the increase in rates and cost of service due to inflationary pressures. All costs and revenues are represented at the base year of 2006-07 levels. This will enable comparison of performances across years without letting the inflation distort the analysis.

12.2 Development Plans

12.2.1 Projects Identified

The development activities that have been identified by the Business Plan consultants for the port and the allied project cost are given in the following **Table 12.1**;

Table 12.1- Details of Development Activities

Rs in million

Project Description	Project Cost
Related to Cargo Handling	
Breakwater Repairs & Strengthening	270
Capital Dredging for deepening of approach channel and Berth 9 by 1 m	650
Providing Harbour Mobile Crane at Berth - 11	151
Wagon handling system	261
Integration of berth no 8 with with berth 9 for iron ore handling along with increased stackyard area	810
Replacement of MOHP present equipments	1,842
Construction of additional mooring dolphins	220
Construction of Berth no 7 as new berth 7	1,400
Construction of a new Port crafts jetty	25
Development of Vasco Bay - Phase - I with 1 finger jetty (excl dredging)	742
Development of Vasco Bay - Dredging	159
Connectivity Aspects	
Construction of the remaining 5 km strech NH-17B between Vernapuri and Sada	230
Construction of flyover from Tariwada on NH-17B to Gate no 9	260
Construction of 2 lane road between Gate no 9 and Gate no 1 within the existing port area	105
Doubling of Bellary - Vasco Section in two phases and yard improvements to Vasco Railway yard including remodelling of present R&D yard	20,000
Human Resources Aspects	
Computerisation - including server and software for integrated computerisation	33
Adding additional 150 computers for Class III & Class IV staff	8

12.2.2 Plan and Non-plan Expenditure

The port had obtained approvals for various Plan capital expenditure schemes and had also considered various non-plan capital expenditure plans, as illustrated below:

Table 12.2 - Details of Plan Capital Expenditure

Rs in million

Particulars	Estimated Cost	Sanctioned Cost
A. Continuing schemes	**3,835**	**1,435**
Deepening of berth no 9 and the approach channel	250	239
Construction of 100 bedded hospital	122	122
Construction of general cargo berths / passenger vessel terminal	1,850	1
Additional stacker with lines	238	238
Replacement of remaining 4 nos barge unloaders	400	160
Replacement of 1 no Bucket wheel reclaimer	170	170
Replacement of 1 no ship loader	150	-
Replacement of 2 nos stackers	150	-
Acquisition of tugs	405	405
Extn of Broad guage rly from marshalling yard to harbour	100	100
B. New Schemes	**1,210**	**-**
Capital dredging (-) 15.10 channel, (-) 15.40 berth	650	-
sConstruction of berth 7 fr coastal cargo	200	-
Strengthening of break water	200	-
Construction of mooring dolphins	80	-
Extension of 2 nos barge berths	80	-
Total Plan Schemes	**5,045**	**1,435**

The development activities identified for the port encompasses all the above mentioned planned capital expenditures. Hence the plan expenditures have not been considered for the financial modelling exercise.

Table 12.3 - Details of Non Plan Capital Expenditure

Rs in million

Particulars	Estimated Cost	Sanctioned Cost
A. Continuing schemes	312	190
A. New schemes	157	19

The Port is estimated to spend about Rs. 105 million per annum on non-plan expenditure based on past trends.

12.3 Calculation of additional throughput and revenue

Before carrying the Financial Model for the Port Trust, the financial viability of the proposed developmental projects directly impacting port investment and revenues were carried out & the same is presented in this section.

The proposed development activities / projects are identified under 2 main categories and four different projects as given under;

I. Works related to existing port facilities

   i. Strengthening of Breakwater.

   ii. Increasing the capacity of general cargo berth

   iii. Increasing the Iron Ore handling capacity at the port.

II. Development of Vasco Bay

   i. Developing the Vasco bay to handle liquid bulk traffic and Non cargo vessels.

The projects have been analyzed by comparing the incremental financial cash flows generated over the next 20 years with their capital expenditure requirements. The financial analysis has been made by working out the internal rate of return at the project level and at the equity level (after considering the leverage in the capital structure). Also the Net present value for each of the projects is provided separately.

12.3.1 *Project 1: Strengthening of Breakwater*

The strengthening of breakwater would involve a capital expenditure of Rs. 270 million to Mormugao port. However, considering that this exercise is

important to the present operations and that there are no returns identifiable as separately generated from this investment, a financial analysis for this project is not feasible.

12.3.2 *Project 2: Increasing the Capacity of General Cargo Berth*

The handling capacity of the general cargo berth can be increased by providing a harbour mobile crane at berth No.11 at a cost of Rs. 151 million. Considering the forecasted increase in the container traffic along with general cargo and the limited capacity of the berth, gangs supplying being an issue, provisioning of a mobile crane is considered basic necessity at the port. Financial analysis for this project is not feasible as no specific returns are specifically identifiable against this project.

12.3.3 *Project 3: Increasing the Iron Ore handling capacity at the port*

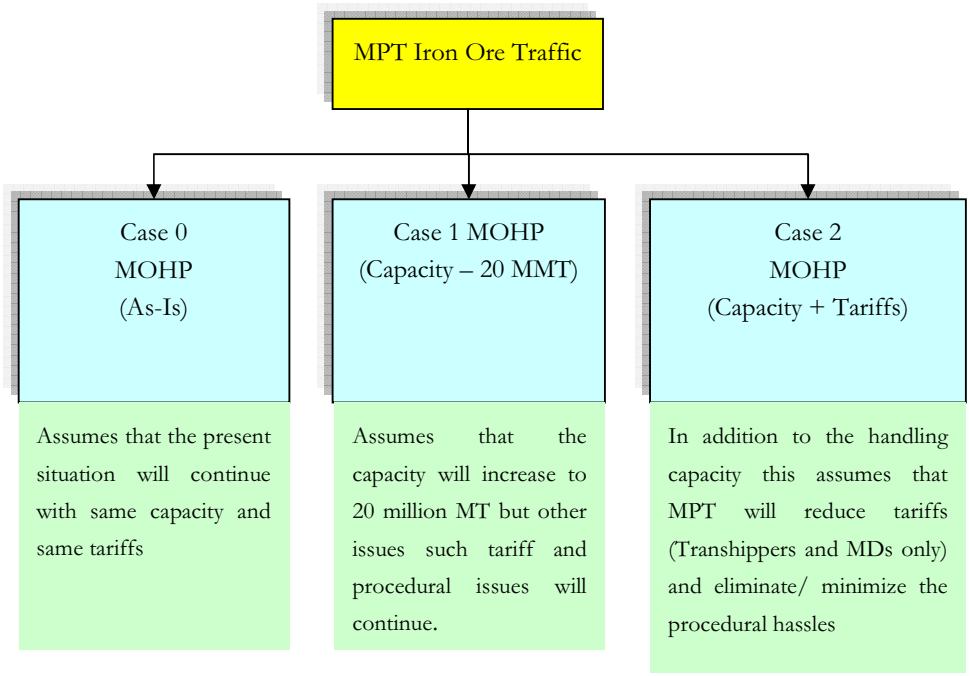
The project of increasing the iron ore handling capacity at the port will involve a capital expenditure of Rs 3,310 million as given below:

Table 12.4 – Capital Expenditure of increasing the Iron Ore Handling Capacity

Capital Expenditure	Cost (Rs. million)
Modernisation / Equipment Replacement of MOHP	1,842
Integration of berth No 8 with Berth no 9 for Iron ore handling	463
Wagon Tippler system	261
New Stack yard Development	347
Construction of additional Mooring Dolphins	220
Construction of Port Craft Jetties	25
Total	3,159

The present mechanical ore handling plant at the port has a capacity / throughput of 14 million tonnes. The integration of berth 8 and 9 and the installation of the additional / new equipments for handling iron ore will allow Mormugao Port to handle 20 million tonnes of iron ore per annum. As given in the analysis on the traffic forecast for iron ore, it will be beneficial for the exporter to use MOHP to handle the traffic that is presently loaded midstream using mooring dolphins and transhippers. This scenario is dealt with in case 1 of our analysis. However, the increase in the capacity of MOHP is not a sufficient condition to attract traffic that is being lost to Panjim port. The port has to reduce tariff of handling iron ore at midstream to competitive levels (expected at 50% of the current tariffs on iron ore handling) in addition to other efforts discussed in the traffic forecast section. This situation is dealt with in case 2 of our analysis. Also the construction of additional three mooring dolphins will increase the iron ore handling capacity at mooring dolphins to 16.5 million tonnes per annum. The addition of

mooring dolphins has been considered in both Cases 1 and 2 of our analysis. The total port capacity after the addition of capacities to MOHP and Mooring dolphins is assessed at 48 million tonnes per annum. However, the traffic forecasted in Case 2 – medium and high scenarios exceed the 48 million tonnes capacity. It is recommended (and also considered for this financial analysis) that the additional requirement is met through adding private transhippers. This would ensure that the port does not spend on the capital expenditure and also meet the requirements. The base case, with no addition in the handling capacity of Mormugao port and no changes in tariffs, is termed as case 0.



The analysis considers the incremental cash flows from handling iron ore at MOHP, mooring dolphins and transhippers under two cases (case 2 and case 1 compared with case 0) and three scenarios – low, medium and high. The provisioning of wagon tipplers will also enable the port to charge additionally for its usage which is also considered in our analysis. While all other cargo related and vessel related charges have been considered, the pilotage revenues are not taken as revenues of the project as that will not be a service rendered by operations at the terminal. The incremental expenses that are expected to be incurred in the operation and maintenance and administration are Rs. 249.9 million and Rs. 62.5 million respectively.

The results of the analysis are tabulated below.

Table 12.5 – Financial Analyses for Integration of Berth No 8 and Berth no 9 – Case 1

Case 1 Vs Case 0	Low scenario	Medium Scenario	High Scenario
Project IRR	-Ve	0%	4%
Equity IRR	-Ve	-Ve	2%
Project NPV @ 10%	-2,863	-1,893	-1,190

Table 12.6 – Financial Analyses for Integration of Berth No 8 and Berth no 9 – Case 2

Case 2 Vs Case 0	Low scenario	Medium Scenario	High Scenario
Project IRR	16%	13%	13%
Equity IRR	20%	16%	16%
Project NPV @ 10%	1,138	600	674

The above equity IRR has been arrived at assuming that the debt : equity in the capital structure is 1:1. The project returns in case 2 in the medium and high scenarios are marginally lower than that in case 2 - low scenario because

- The additional MOHP capacity of 6 million tonnes will become operational only after four years. Though the forecast exports of iron ore is higher in the medium and high scenario in case 2, during these initial years, the Port will not be able to cater to this opportunity due to constraints in the capacity.

- The incremental traffic between various scenarios in Case 2, over and above the capacity of the MOHP, yield a lower return (Rs. 2.70 to Rs. 4.70 for midstream handling as against Rs. 69.30 in MOHP) as compared to the incremental traffic between the respective scenarios in Case 0.

The analysis reveals that the project returns a negative or no return in the low and medium cases of case 1 Vs Case 0. However, the project returns an IRR of over 10% in all the scenarios only in case 2, with the least being 13% in medium scenario.

12.3.4 Project 3: Vasco bay Development to handle Liquid Bulk and Non cargo vessels

The project of developing Vasco bay for handling liquid bulk and non-cargo vessels involves the following stages and capital expenditure of Rs.901 million as given in the table below.

Table 12.7 – Capital Expenditure for Vasco Bay Development

	Cost (Rs million)
Dredging in Vasco Bay up to -13 m CD for one liquid argo vessels berth	159
Liquid bulk berth with double berthing facilities, 300m x 20 m	
Berth Cost	334
Liquid Bulk Handling Equipment for one berth	70
Buildings	4
Utilities	170
Non cargo vessels berth (250 X 20m) including cruise at Vasco Bay	164
Total	**901**

The financial analysis of the Vasco bay development project has been carried out considering the revenues generated from the liquid bulk operations and the non-cargo vessel operations, including cruise vessels, ships of Coast Guard and Indian Navy. While all other cargo related and vessel related charges have been considered, the pilotage revenues are not taken as revenues of the project as that will not be a service rendered by operations at the terminal. The expenditures estimated on the handling of these traffic at Vasco bay are Rs. 43.2 million for operation and maintenance and 10.8 million for administrative expenses.

The results of the analysis are tabulated below;

Table 12.8 – Financial Analyses for Vasco Bay Development

	Low scenario	Medium Scenario	High Scenario
Project IRR	29%	32%	33%
Equity IRR	38%	44%	45%
Project NPV @ 10%	1,391	1,716	1,785

The above equity IRR has been arrived at assuming that the debt: equity in the capital structure is 1:1. The analysis reveals a project IRR of about 30% and equity IRR of about 40% in each of the scenarios.

12.3.5 Revenue Gains and Losses to Existing Operations

Mormugao Port Trust gains from additional revenues by way of pilotage charges in each of the above projects for the excess traffic handled. Also the existing facility loses the revenues from handling liquid bulk to the Vasco Bay terminals, which could have otherwise been handled at Berth No 8. The

lost revenue from cruise vessels are not considered as the increment in revenues in the medium and the high scenarios will be feasible only when the new terminal is constructed. Hence the combined cash flows to Mormugao Port Trust in the above projects in each of the scenario are assessed to judge the viability of the project in total.

The results of the analysis is tabulated below

Case 1 Vs Case 0	Low scenario	Medium Scenario	High Scenario
Project IRR	-Ve	2%	5%
Project NPV @ 10%	-3,186	-2,024	-1,230

Case 2 Vs Case 0	Low scenario	Medium Scenario	High Scenario
Project IRR	15%	13%	14%
Project NPV @ 10%	1,271	935	1,240

In order to keep pace with competition from the Panjim and other ports in the region and to attract the traffic of iron ore from Karnataka based exporters, Mormugao port has to increase its handling capacity at the MOHP facility and Mooring Dolphins. It is found from the foregoing analysis that the projects have financial return justifying their execution, however, only under case 2 (reduction in tariffs to Transhippers Handling & Mooring Dolphins cargoes and elimination/minimization of procedural issues in addition to increasing the MOHP and Mooring Dolphins capacity). It can also be observed that only under case 2, the project IRR of the Iron ore terminal in all scenarios remains over 10%.

The detailed financial model for the above analyses is enclosed in **Annexure 12.1.**

12.4 Funding Capability for the New Projects

12.4.1 Cash Position

The financial strength and the cash flows of the Port for the next four years were analysed to estimate the extent of development activities that could be carried out by the port on its own and through debt funding on its books. The free cash and investment resources available to the port as at 31st Mar 2006 were Rs. 1,230 million. Assuming a modest growth of 3%, the port is estimated to earn over Rs. 800 million in each year as operating surplus. Other miscellaneous income is estimated at Rs. 40 million, Interest on the unrestricted investments is estimated at Rs. 40 million in 2006-07. The Port, in the recently issued scale of rates by TAMP, is eligible to charge an additional levy of 7% on all the income from the users of the port facilities for a period upto 2008-09. This additional revenue is expected to compensate the port's pension commitment partly and the rest would be contributed by port's internal funds. However, the liability as per actuarial valuation of the

gratuity trust fund has already been paid by the port and no fresh contributions on this account will be required from the port.

Table 12.9 - Details of Contribution to Pension Trust Fund

Rs in million

Pension and Gratuity Liability	Amount
Actuarial Valuation on liability	3,373
Balance as on 31 Mar 2006	1,206
Balance contribution required	2,167
Contribution from the additional charge on port users	433
Expected Interest (@ 8%) on investments	833
Contribution from Port's internal accruals	901

The port has an existing secured loan of Rs. 250 million from State Bank of India and the outstanding of Rs. 116 million as at the beginning of fiscal 2007 has to be paid off over the next three years in quarterly instalments along with interest at 6.5%. The free cash and investment resources available with the port is expected to reach Rs. 1,559 million in Mar 2007, Rs. 1,949 million in Mar 2008, Rs. 2,383 million in Mar 2009 and Rs. 2,683 million in Mar 2010 which could be used to fund the port's development activities.

Table 12.10 - Preliminary analysis of Cash and Investment Resources Available for Funding Projects

Rs in million

Particulars	2006-07	2007-08	2008-09	2009-10	2010-11
Free Cash resources at the start of the year	1,230	1,559	1,949	2,383	2,683
Projected operating surplus (3% YoY growth rate assumed)	812	836	861	887	914
Add: Depreciation	128	128	128	128	128
Add: Finance and miscellaneous income	82	92	105	119	129
Less: Additional salary costs	(17)	(131)	(135)	(139)	(143)
Less: Finance & miscellaneous expenses (except interest on loans, contribution to Pension and gratuity	(233)	(240)	(247)	(255)	(262)

Particulars	2006-07	2007-08	2008-09	2009-10	2010-11
trust funds)					
Less: Contribution to pension and gratuity trust funds	(270)	(126)	(112)	(314)	(79)
Less: Increase in working capital (considered a growth of 3% YoY on working capital)	(9)	(9)	(9)	(9)	(9)
Cash flow before investing and funding activities	**1,723**	**2,109**	**2,540**	**2,800**	**3,361**
Less: Committed ongoing capital expenditure					
Plan Schemes not covered under development activities	-	-	-	-	-
Non-Plan Schemes	(105)	(105)	(105)	(105)	(105)
Less: Repayment of loans with interest	(59)	(56)	(52)	(13)	-
Cash Available for Proposed projects	**1,559**	**1,949**	**2,383**	**2,683**	**3,256**

12.4.2 Debt Capacity

The Port, in addition to its own funding has the ability to fund certain of its development activities through debt. The port's networth as at the start of fiscal 2007 was Rs. 4,366 million. The port is expected to add additional 373 million to its networth in fiscal 2007 from its net surplus. The port has an outstanding loan to the tune of Rs. 112.5 million at the end of the fiscal 2007.

Table 12.11 - Debt Capacity of the Port

Rs in million

Debt Capacity of the Port	2006-07
Networth as at 31 Mar 2006 as per books	4,366
Estimated increase in networth in FY 2006-07	373
Less: Liability for Gratuity and Pension estimated to be provided from internal accruals	(901)
Networth as at 31 Mar 2007	3,838
Debt capacity considering Debt : Equity ratio of 0.6:0.4	5,757
Less: Value of Outstanding Loan	113
Fresh Debt capacity	**5,645**

The Port's debt capacity is estimated at a Rs. 5,645 million at at 31st Mar 2007. However, the port would be expected to contribute atleast 30% (Debt : Equity of 0.7: 0.3) of the cost of any project by the funding institution. However, on a conservative note, it is estimated that the funding institution would expect the Port to contribute equally in all the projects (Debt : Equity of 0.6:0.4).

12.4.3 Project Funding

The development activities that fall outside the premises of the Port like connectivity to the port through road/ rail are expected to be funded by the Centre / National Highways Authority of India. Since the operations of liquid bulk berth and the wagon handling system are considerably profitable, it is suggested that the development of Vasco bay and installation and operation of wagon tipplers be done by MPT without any private partnership. The project of developing berth No. 7 as a bulk cargo berth has a clear and separable revenue generating ability and can be expected to be funded through private – public partnership on a BOT basis. Moreover, the cost of the project of developing berth No. 7 is Rs. 1,400 million which the port may not be able to fund through its own resources. 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 and is estimated to cost about Rs. 650 million. 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.

Table 12.12 - Funding Pattern

Rs in million

Project Description	Funding			
	Centre	Private BOT Operator	MPT Own Funds	MPT Debt Funds
Connectivity Aspects				
Construction of the remaining 5 km strech NH-17B between Vernapuri and Sada	230			
Construction of flyover from Tariwada on NH-17B to Gate no 9	260			
Construction of 2 lane road between Gate no 9 and Gate no 1 within the existing port area			42	63
Doubling of Bellary - Vasco Section in two phases and yard improvements to Vasco Railway yard including remodelling of present R&D yard	19,800		80	120
Related to Cargo Handling				
Breakwater Repairs & Strengthening			108	162
Capital Dredging for deepening of approach channel and Berth 9 by 1 m	650			
Providing Harbour Mobile Crane at Berth - 11			60	91
Wagon handling system			104	157
Integration of berth no 8 with with berth 9 for iron ore handling along with increased stackyard area			324	486
Replacement of MOHP present equipments			737	1,105
Construction of additional mooring dolphins			88	132
Construction of Berth no 7 as new berth 7		1,400		
Construction of a new Port crafts jetty			10	15
Development of Vasco Bay - Phase - I with 1 finger jetty (excl dredging)			297	445
Development of Vasco Bay – Dredging			64	95
Others – Human resources development			16	25
Total	**20,940**	**1,400**	**1,930**	**2,895**

The port has the ability to fund the above identified projects to the tune of Rs. 1,930 million from its own source and Rs. 2,895 million from debt sources over the period of next four years. Although in the preliminary analysis (refer **Table 12.10**) the cash and investment resources available with the port is estimated as Rs. 3,256 million as at 2010-11, the projects identified for the port consumes cash for operations during the initial years. Hence the cash available with the port, after spending on operating expenditure would be sufficient to only make an investment of Rs. 1,930 million on capital equipments.

12.5 Profit and Loss Account

12.5.1 Revenues

The revenues have been categorised as Port Dues, Other Dues, Stevedoring revenue, Storage and Wharf Handling, Concession Fee and Other Operational Income as per the guidelines provided. The revenues are calculated based on the tariff stipulated in the scale of rates published by TAMP on 27th Nov 2006 in gazette number – 175.

The operations in berths 5A/6A and berth 7 are assumed to be carried out on by private operators and the port is expected to get revenue share of 18% and lease rent as is the case in the agreement with South West Ports Limited for operations of Berth 5A/6A agreement.

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 by the Tariff Authority for Major Ports. It is expected that the rates of handling iron ore at MOHP and wharfage for liquid will be reduced by 80% from 2011-12 and 2012-13 onwards, respectively.

Table 12.13 - Forecast Break up of Revenues

Rs in million

Revenue Break-up	**2006-07**	**2010-11**	**2015-16**	**2020-21**	**2025-26**
Port Dues	87	169	199	232	271
Other Dues	545	737	904	993	1,096
Stevedoring revenue	269	312	306	392	482
Storage and Wharf Handling	1,160	1,269	1,488	1,577	1,692
Concession Fee	149	247	246	246	246
Other Operational Income	265	335	583	596	614
Additional levy for pension	43	-	-	-	-
Total Operating Revenues	**2,519**	**3,069**	**3,726**	**4,036**	**4,401**

12.5.2 *Costs*

Costs incurred by the Port for the fiscal 2005 was analysed and is summarised below:

Table 12.14 -Break up of Cost – 2004-05

Rs in million

Expense Head	Profit / Cost centre					Total
	Cargo Handling & storage	Port and dock facilities	Railway working	Rentable lands & buildings	Mgt & general admin	
Salaries and wages	202	93	17	17	240	570
Stores	86	21	4	0	10	123
Electric power	150			1	4	155
Hire of tugs, boats and launches		50				50
Dredging expenses		99				99
Sundry expenses	43	20	2	19	25	110
Depreciation	32	43	13	3	23	114
Other operating & general admin costs	10	30	2	5	126	174
Total Operating and general admin costs	**523**	**357**	**39**	**46**	**429**	**1,394**
Retirement benefits						209
Ex-gratia and EL encashment						15
Pension trust fund						300
Gratuity trust fund						50
Other Finance & miscellaneous expenses						13
Finance and miscellaneous expenses						**587**
Total Expenses	**523**	**357**	**39**	**46**	**429**	**1,981**

Salaries and wages is the major cost for the Port accounting for over 41% of the operating and general administration costs. Increase in cost of salaries and wages is an annual phenomenon due to the annual increments (about 3%) and dearness allowance matching to the scale of inflation. Also the pay scales are revised once in 10 years and the average expected pay hike falling

due in 2008-09.is about 20%. The financial model does not consider dearness allowance as it is a proxy to the inflation. However, increments at 3% and revision in pay-scale of 20% are considered appropriately.

Expenses that are projected to increase substantially due to the new projects are

a) Electricity charges for operations of the increased capacity (6 million tonnes) of MOHP

b) Annual maintenance dredging to be done for the approach channel and berth 9.

c) Depreciation charge, due to the increase in the gross block of assets.

The other direct costs (quoted under the four profit centres) are expected to vary with the traffic estimates, and the indirect costs are projected to remain constant. The port had contributed Rs. 300 million in the year 2004-05 towards pension and gratuity trust funds. However, as mentioned earlier, the contribution towards pension liability will be reduced by additional charge on users of the port.

Table 12.15 - Break up of Projected Costs

Rs in million

Projected Costs	**2006-07**	**2010-11**	**2015-16**	**2020-21**	**2025-26**
Salaries	627	1,017	1,232	2,019	2,794
Social Charges and Pension Premiums	559	94	114	177	239
Running Costs	590	932	934	935	937
Administrative Costs	174	257	257	257	257
Depreciation	127	310	324	348	336
Finance and miscellaneous income	94	147	336	608	919
Interest	9	253	133	10	-
Total	**2,180**	**3,010**	**3,330**	**4,354**	**5,482**

12.5.3 *Net Surplus*

Tax on income is not considered as port's request for exemption u/s. 11 of Income Tax Act, 1961 has been upheld by Income Tax Appellate Tribunal, Panaji bench in a recent judgement.

The net surplus for the port for the various years is shown below:

Table 12.16 – Net Surplus

Rs in million

Projected Profit and Loss account	2006-07	2010-11	2015-16	2020-21	2025-26
Net earnings	527	354	1,069	899	756
Total Operating Revenues	2,519	3,069	3,726	4,036	4,401
Net Margin	21%	12%	29%	22%	17%

12.6 *Balance Sheet*

12.6.1 *Assets*

Addition to fixed assets is considered as provided in the section on 'New Projects'.

Table 12.17 - Capital Asset Additions

Rs in million

Block of Asset	2006-07	2007-08	2008-09	2009-10	2010-11
Capital Dredging	-	159	-	-	-
Building, sheds and other structures	-	-	405	405	-
Wharves, roads, boundaries	-	53	53	-	-
Railway and rolling stock	-	-	100	100	-
Docks, sea walls, piers, navigational aids	-	490	742	25	-
Cranes and vehicles	-	151	-	-	-
Plant and machinery	105	1,947	105	366	105
Electricity, telecom and firefighting	-	41	-	-	-
Total	**105**	**2,839**	**1,404**	**896**	**105**

Current assets are projected to vary in proportion to the revenues of the port. However, for this purpose the extraordinary charge for pension liability is excluded. Current liabilities are projected to vary in proportion to the total operating costs of the port.

Table 12.18 - Asset Projections

Rs in million

Assets	**2006-07**	**2010-11**	**2015-16**	**2020-21**	**2025-26**
Fixed Assets	3,207	7,314	6,265	5,095	3,944
Current assets	777	947	1,149	1,245	1,357
Liquid Means	2,889	2,207	6,372	11,159	16,707
Total assets	**6,873**	**10,467**	**13,786**	**17,499**	**22,008**

12.6.2 Liabilities

Specific reserves are maintained to meet the liabilities of provident fund, pension fund, general insurance fund and employees welfare fund. Investments and cash are earmarked against these specific reserves and fresh funds are invested based on each year's contribution to these specific reserves. Contribution from the Port in each year is worked upon after considering the interest that is earned by these investments. However, these investments are not marked to market in certain cases. These investments are employee related and the reserves are expected to vary in sync with the wages and salaries that the employees draw. The investments against these specific reserves are aggregated with the general investments and are shown as liquid means in the asset side of the balance sheet. However, free cash and investment reserves available to the port will stand reduced to the tune of accumulated liabilities on specific reserves.

Mormugao Port has taken a loan from State Bank of India and the outstanding balance on this account is Rs. 162.5 million as at 31st Mar 2006. This loan is expected to be repaid in the next 2.25 years. Fresh funds are expected to be taken on debt for funding the capital expansion plans at an interest rate of 9%.

Table 12.19 - Existing Loan Schedule

Rs in million

Existing Loan	2006-07	2007-08	2008-09	2009-10
Opening Balance	163	113	63	13
Drawdown	-	-	-	-
Repayments	50	50	50	13
Interest of existing loan	9	6	2	0
Closing Balance	113	63	13	-
Total payment	59	56	52	13

Table 12.20 - Schedule of Fresh Project Loans

Rs in million

Project Loans	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Opening Balance	-	1,641	2,421	2,895	2,731	2,489
Drawdown	1,641	780	475	-	-	-
Repayments	-	-	-	164	242	290
Closing Balance	1,641	2,421	2,895	2,731	2,489	2,200
Interest	74	183	239	253	235	211
Total payment	74	183	239	417	477	501

12.7 Cash Flow

12.7.1 Sources of Funds

The considerable outflow on capital expenditure in the initial four years is partly sourced by the debt funding. However, the operations of the port generate surplus cash to the extent of Rs. 1,960 million in the four years to enable the funding of the capex plans.

Table 12.21 - Sources of Funds

Rs in million

Particulars	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Net earnings	527	330	(10)	161	354	817	836
Depreciation	127	245	278	305	310	306	309
Loans	-	1,641	780	475	-	-	-
Total Source of funds	**655**	**2,215**	**1,047**	**940**	**664**	**1,123**	**1,145**

12.7.2 *Use of Funds*

The capital expansion plan consumes most of the funds generated through operations and through external sources followed by the loan repayments. A moratorium period of 3 years is considered for the loans and hence the repayment of the fresh project loans would begin only from the year 2010-11. The change in the working capital varies considerably year on year due to the changes in the cost structure year on year basis. The salary cost is expected to increase in the fiscal 2008 due to the revision in pay scale which would depress the working capital position, with another revision in the financial year 2018. However, the increase in revenues from MOHP and liquid bulk operations and the letting the operations of berth No 7 to a private operator on BOT basis are expected to increase the working capital requirements of the port.

Table 12.22 - Use of Funds

Rs in million

Use of Funds	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Investments	105	2,839	1,404	896	105	105	105
Increase in working capital	(10)	(104)	(113)	169	77	132	(15)
Repayment of loans	50	50	50	13	164	242	290
Total Use of Funds	**145**	**2,786**	**1,341**	**1,077**	**345**	**478**	**379**

The net flow of funds is positive from the financial year 2010-11, however, the three major investment years of 2007-08 to 2009-10 consume about R.s 1,000 million cash from the port.

12.7.3 *Liquid means*

The liquid means represent the cash and investment resources available with the port that are free cash and also investments specifically earmarked against specific reserves. The total liquid means available with the port as at 31st Mar 2006 was Rs. 2,379 million and free cash available was Rs. 1,230 million. Because of the capital expansion projects of the ports, the liquid means available with the port dip to a low of Rs, 1,888 million in the year 2009-10 and in which year the free cash available dips to just about Rs. 39 million. This free cash available with the port along with the other current assets represent about 5.5 months of expenses and would be sufficient to carry on the operations of the port. Beyond the fiscal 2010, the port's new investments start to generate earnings and the liquid means and the free cash of the port grows consistently. At the end of the projected period of 2025-26 the liquid means available with the port is projected to increase to Rs. 16,707 million and the free cash available is projected to increase to Rs. 11,577 million. 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.

The detailed financial analysis for above projections (profit loss account, balance sheets and flow of funds) is enclosed in **Annexure 12.2**.

13 Conclusions and Recommendations

13.1 General

The study of the existing port facilities & operations, fresh traffic forecasts and identification of future prospective projects has led to the following conclusions. Recommendations have been given following the conclusions to make Mormugao Port more cargo efficient & to win competition.

13.2 Conclusions

13.2.1 Cargo Traffic

a) The percentage contribution of Dry bulk cargo (Coal & Coke) to the total traffic handled at the port has been consistent during the last 3 years at about 92% and is expected to remain as predominant cargo in the coming years too.

b) The nearby Goan State port of Panjim is the main competitor to Mormugao port for Goan iron ore. For Karnataka iron ore, apart form Pajim port, the other competing ports are identified as Chennai/ Ennore, New Mangalore & Krishnapatnam.

c) Of the various modes of handling iron ore like MOHP, mooring dolphins and midstream loading from transhippers – the preferred order of loading by the exporters remains as MOHP, Transhippers and Mooring Dolphins.

d) An augmentation of MOHP capacity, elimination of procedural hassles existing at present, reduction of Tariffs at mooring dolphins & for midstream loading could result in Mormugao Port continuing to be a premier iron ore handling port retaining its share of traffic in India and in Goa.

e) The other commodities that are likely to gain prominence in the immediate term are coal/coke and liquid bulk.

f) 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.

g) It is estimated that there is no promising potential for the container traffic from the hinterland of MPT 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.

h) 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.

i) The summary of most probable traffic forecast (Medium Scenario) for the immediate Phase I term is estimated as below;

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 (MT)	0.86	0.97	1.00	1.02	1.05	1.08	1.11	1.17
Break Bulk (MT)	1.30	1.50	1.50	1.50	1.50	1.50	1.50	1.58
Containers (TEUS)	10,113	15,258	17,538	19,088	20,364	21,576	22,709	24,412
Liquid Bulk (MT)	1.82	2.10	2.37	2.69	2.83	2.99	3.15	3.31
Cruise and non cargo vessels (Nos.)	170	191	222	252	265	277	290	305

13.2.2 SWOT Analyses & Vision

a) The port's main strengths are identified as bestowed inland water ways, substantial captive cargo, profitable port, peaceful & harmonious industrial relation, committed & sincere management and moderate financial capability to invest in projects.

b) The main weakness are; Lack of readily available expansion space, lack of a dedicated berth for non cargo vessels, workforce not well motivated, not well maintained infrastructure facilities within the port, Unions not permitting private labours and inadequate hinterland connectivity especially the rail connectivity to Bellary Hospet region in Karnataka state.

c) The major opportunities are; more coal traffic, cruise traffic, Non cargo vessels like offshore supply vessels, navy & coast gurad, Karnataka iron ore, other industrial development in North Karnataka

d) The serious threats are identified as competition from Panjim, reduction in iron ore demand since it vulnerable to Chinese demand, cooperation not in full vigour form local authorities.

e) The vision for the port in consensus with the Port Management is formulated as *"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.*"

13.2.3 Port Operations

a) The MOHP shipping system is presently operating to its full capacity and the port's proposal to replace & upgrade all the equipment of MOHP is likely to result in slight increase in capacity.

b) The major bottle neck with regard to iron ore handling is the limited stockyard space available to handle different grades of iron ore by allotting separate plots for the exporters.

c) The net working time of the ship loaders at Berth no 9 is low at 51 % and the reasons for this is identified as due to each ship loader waiting for other to finish loading a hatch, loaded ship waiting for tide to sail out, maintenance required of the shiploaders due to its age. The average productivity per ship loader is in the order of 2854 TPH and if the delays / idle time during loading are taken into account the average productivity falls to 1719 TPH.

d) The present output per day at mooring dolphins is in the range of 7000 – 9000 tonnes which appears to be low and reason attributed to this is "gangs' problem.

e) The mooring dolphins for loading iron ore are in more demand during monsoon when the other loading options like MOHP and Transhippers are closed. The demand for mooring dolphins can be made consistent & they can be used to their full capacity if there is traffic to Goan ports by reducing the tariff and by giving preference in monsoon to those exporters who use it during non monsoon also.

f) Lack of adequate storage space leading to delay due to lack of cargo is one of the main reasons for the high pre berthing detention (average for the port is 2.4 days in 2005-06) at Mormugao Port. The delay due to lack of cargo is to the shippers account and not to the Port's account.

g) The liquid cargo berth (Berth no 8) has low berth-day out put (7300 T in 2005-06) for the throughput handled due to small parcel sizes, lower pumping rates due to present diameter of pipelines, time lost due to sampling procedures, etc.

h) The major operational constraints with respect to Berth 10 & Berth 11 are the supply of 'Gangs' and non availability of a shore based crane for handling cargo. Many times the Gangs supplied are less than demanded.

13.2.4 Human Resources

a) 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.

b) Productivity targets are set by the Ministry of Shipping, on the basis of previous year target, usually a percentage increase & 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.

c) Union –Management relations are largely cordial and mature. However, slow working, excessive overtime, loss of productive time during change of shifts, etc. are resulting in productivity less than optimum level.

d) The port is presently only partially computerised with limited computers and various stand alone packages. The concept of Emailing for inter-departmental communication is not established at all.

e) Annually about 2350 in house and 275 outside training programmes covering various classes of employees are conducted by MPT.

13.2.5 Environmental Aspects

a) MPT is taking efforts to minimise pollution inside the city caused by handling mainly the dry bulk commodities like coal and iron ore. Still reportedly the port does get complaints about dust during the dry season when the wind direction is towards Vasco City. The port's present environmental management plan is in line with meeting their objective of becoming 'Environmentally more friendly and clean'.

b) 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. This is against the MSW notification in year 2002, where it was notified that Municipal corporations/councils should establish a separate engineered landfill site as per norms prescribed away from sensitive locations.

13.2.6 *Connectivity*

a) The rail connectivity appears to be having more influence on cargo movement at Mormugao port than the road as most of the major import cargo coal is evacuated by Rail. The major export cargo, iron ore, is received by Inland Waterways System. However, the iron ore from Bellary Hospet mines of Karnataka state could be brought by rail directly up to the port if a wagon tippling system with storage facilities is installed at the port. Currently the Karnatak iron ore coming by rail is unloaded at about 50 km distance from the port and brought to Goan ports by IWT.

13.2.7 *Financials*

a) The free cash and investment resources available with the port are expected to reach Rs. 1,559 million in Mar 2007, Rs. 1,949 million in Mar 2008, Rs. 2,383 million in Mar 2009 and Rs. 2,683 million in Mar 2010 which could be used to fund the port's development activities.

b) The port's networth as at the start of fiscal 2007 was Rs. 4,366 million. The Port's fresh debt capacity is estimated at a Rs. 5,645 million at 31st Mar 2007 after considering estimated increase in net worth in FY 2006-07 & port's Liability from internal accruals for Gratuity and Pension.

13.3 Recommendations

13.3.1 *Common Port Development Works*

a) Breakwater – Currently, frequent repairs are required to maintain the breakwater & 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. These works comprise essential maintenance of the breakwater; hence it is recommended that the port should undertake these works as a priority project.

b) Deepening of the Approach Channel and Berth no 9 – The port is considering a proposal to deepen the approach channel and Berth no 9 by one metre at cost of INR 650 million. 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. 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.

13.3.2 *Projects recommended for development*

The following developmental works are recommended for implementation by MPT to cater to traffic forecast upto 2013-14. These recommendations have been made after analysing the present port operations, suggestion for

improvements and the new facilities required to meet with the traffic demand predicted.

The developmental works recommended are given below under different categories;

a) Directly related to Port's investment and benefits

- Providing Harbour Mobile Crane at Berth – 11 (INR 151 million)
- Integration of berth no 8 with berth 9 for iron ore handling along with increased stackyard area & a wagon tippling system (INR 1071 million)
- Replacement of MOHP present equipments (INR 1842 million)
- Construction of additional mooring dolphins (INR 220 million)
- Construction of Berth no 7 as new berth 7 (INR 1400 million)
- Construction of a new Port crafts jetty (INR 25 million)
- Development of Vasco Bay (Phase – I) with one finger jetty capable of accommodating 2 liquid cargo berths, 1 berth for Navy+OSV+Non cargo vessel and one berth for cruise vessels including the associated capital dredging involved. (INR 901 million)

The Vasco Bay is recommended for development to create additional berths after analysing the merits & demerits of all possible sites for development like Vasco Bay, Baina Bay & West of Breakwater.

It is recommended that while Vasco Bay is developed with new liquid bulk berths, the new pipelines for transferring the cargo to the tank farms are to be of larger diameter. Also unloading arms are recommended for POL products and phosphoric acid at the new berths to increase the productivity. It is also recommended that the sampling procedures are carried out by IOC before the vessels arrive at the berth to improve the berth day output.

Apart from enforcement strict productivity norms at Berth 10 & Berth 11, installation of a harbour mobile crane suiting to the design of berth is recommended to improve the productivity and to solve the Gangs problems.

b) Connectivity Aspects

The projects required to be implemented related to connectivity aspects are;

Roads

- Construction of the remaining 5 km stretch NH-17B between Vernapuri and Sada (INR 230 million)
- Construction of flyover from Tariwada on NH-17B to Gate no 9 (INR 260 million)
- Construction of 2 lane road between Gate no 9 and Gate no 1 within the existing port area (INR 105 million)

Rail

- Doubling of Bellary - Vasco Section in two phases (INR 19, 800 million)
- Yard improvements to Vasco Railway yard including remodelling of present R&D yard (INR 200 million)

13.3.3 Funding options

After considering the profitability potential of the projects and its importance to MPT, free cash & investment resources available with the port, the net worth of the port and its debt capacity the funding options are recommended as follows;

- Breakwater maintenance, Installation of harbour mobile crane at berth no 11 and replacement of MOHP equipments are recommended to be funded by MPT by their very nature.
- Since the operations of liquid bulk berth and the wagon handling system are considerably profitable, it is suggested that the development of Vasco bay and installation and operation of wagon tipplers be done by MPT without any private partnership.
- The project of developing berth No. 7 as a bulk cargo berth has a clear and separable revenue generating ability and can be expected to be funded through private – public partnership on a BOT basis. Moreover, the cost of the project of developing berth No. 7 is Rs. 1,400 million which the port may not be able to fund through its own resources.
- It is understood that the Government will invest in doubling the Bellary – Vasco section while the yard improvements to Vasco yard needs to be carried out by MPT. The yard improvement works are estimated to cost about INR 200 million.

- Construction of the remaining 5 km stretch NH-17B between Vernapuri and Sada & Construction of flyover from Tariwada on NH-17B to Gate no 9 is expected to be funded by the Government.

- MPT will be required to invest on the Construction of 2 lane road between Gate no 9 and Gate no 1 within the existing port area

- The expenses related to human resources improvements like computerisation etc will have to be invested by MPT

- Similarly MPT should be ready to fund the feasibility studies required for environmental aspects related to assessing the potential of earning carbon credits from the existing garbage dumping ground near the hospital.

- Although the deepening of channel and berth no 9 by 1 m 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. However, should the funding from the centre not be granted, the port may defer this project to carry out from its internal accruals beyond 2010-11 based on actual cash availability then.

Based on the above it is estimated that Centre will spend about INR 20, 940 million mainly related to connectivity projects, BOT developer about 1400 million on the development of new berth no 7 and MPT about INR 4, 825 million out of which INR 1930 million on its own funds and INR 2895 million from MPT debt funds.

13.3.4 Net Surplus

Based on the above investments by MPT, the net surplus are worked out considering all the cost and revenues as below;

Projected Profit and Loss account	**2006-07**	**2010-11**	**2015-16**	**2020-21**	**2025-26**
Net earnings	527	354	1,069	899	756
Total Operating Revenues	2,519	3,069	3,726	4,036	4,401
Net Margin	21%	12%	29%	22%	17%

13.3.5 *Human Resources Aspects*

a) The port adopts an integrated approach for computerisation instead of developing stand alone packages.

b) 150 more computers are added to increase the staff : computer ratio to 4:1.

c) Make better use of technology advancement in Information Technology. The concept of emailing for intra communications needs to be well established and the staffs are trained to start getting used to the new establishment. This will improve productivity and minimise paper works.

d) Training in MPT should have the thrust areas 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. To that extent it is recommended that budget spent on training is increased from the present INR 2 million to INR 3 million.

13.3.6 *Environmental issues*

a) A feasibility study to ascertain the recovery potential of methane gas from the existing disposal site near the new Hospital is initiated immediately.

b) Initiate steps to arrange for establishment of wind farm energy.

c) Initiate steps to locate/select another disposal site as per MSW regulations 2002 and initiate construction of a engineered landfill disposal site

13.3.7 *Other recommendations*

a) Improve port's internal infrastructures to international standards in phases.

b) Increased commercial and customer orientation is identified as necessary for competing with other domestic and international ports.

c) Policy reforms which would encourage the local government to extend full support are considered by the Center

d) 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.

ANNEXURE 10.1

Break Up of Capital Cost Estimates

PROJECTS AND FACILITIES DEVELOPMENT AT MORMUGAO PORT
BREAK UP OF CAPITAL COST ESTIMATES

Sl. No.	Item description	Qty.	Unit	Unit Rate (Rs.)	Cost (Rs. in millions)
A	**WORKS RELATED TO EXISTING PORT FACILITIES**				
1	**Modernisation / Equipment Replacement of MOHP**				
a	Replacement of remaining 4 barge unloaders	4	No.	90,000,000.0	360.0
b	Replacement of bucket wheel reclaimer	2	No.	200,000,000.0	400.0
c	Replacement of shiploaders with a higher cap of 5000 TPH each	2	No.	180,000,000.0	360.0
d	Replacement of stackers	3	No.	150,000,000.0	450.0
e	Upgrading S1 to S6 shipping conveyors to 5000 TPH capacity		LS		60.0
	Contingency and spares (8%)				130.4
	Engineering and Establishment @ 5%				81.5
	Sub total (1) - Equipment Replacement at MOHP				**1,841.9**
2	**Integration of berth No 8 with Berth no 9 for Iron ore handling**				
a	Dismantling of berth 8 Super structure	4000	Sqm	12,000.0	48.0
b	Removal of pipelines from Berth no 8		LS	10,000,000.0	10.0
c	Construction of new berth of size 300 x 25 m including all accessories	7500	Sq.m	38,000.0	285.0
d	Extension of conveyors from berth no 9 to berth no 8 including the support structures	600	m	100,000.0	60.0
f	Contingency (10%)				40.3
g	Engineering and Establishment @ 5%				20.2
	Subtotal(2) - Integration of Berth No 8 with berth no 9				**463.5**
3	**Providing Wagon Handling System & additional stackyard area near berth no 9**				
3A	**Wagon Tippler System**				
a	Tandem Wagon tippler including side arm charger	1	No.	150,000,000.0	150.0
b	Apron feeder with scraper conveyors		LS	15,000,000.0	15.0
c	Tippler house including tunnel civil construction		LS	30,000,000.0	30.0

d	Electrical System		LS	5,000,000.0	5.0
e	New Conveyor System from tippler complex till stackyard including support structures	120	m	100,000.0	12.0
f	Dust suppression system		LS	5,000,000.0	5.0
g	Laying Feeder and empty collection Railway lines for 0.75 km	750	LS	11,000.0	8.3
h	Modification to existing railway yard		LS	5,000,000.0	5.0
i	Transfer house including all equipment		LS	1,000,000.0	1.0
j	Contingency (8%)				18.5
k	Engineering and Establishment @ 5%				11.6
	Subtotal (3A)				**261.3**
3B	**New stackyard development**				
a	Stackyard area site development		LS	2,000,000.0	2.0
b	Stacking conveyor (405m) including support structures	405	m	50,000.0	20.3
c	Reclaiming Conveyor (645m) including support structures	645	m	50,000.0	32.3
d	New Transfer House(100sqm)		LS	1,000,000.0	1.0
e	Extension of S3 & S4	40	m	50,000.0	2.0
f	Stacker cum Reclaimer with 50 m reach capacity	1	No.	250,000,000.0	250.0
g	Contingency (8%)				24.6
h	Engineering and Establishment @ 5%				15.4
	Subtotal (3B)				**347.5**
	Sub total (4) - Providing Wagon Tippler at Berth no 9				**608.8**
4	**Providing Harbour Mobile Crane at Berth 11**				
	Providing harbour Mobile Crane of make HMK 170 EG of Gottwald or equivalent at Berth 11 including installation but excluding duty, etc	1	No.	140,000,000.0	140.0
	Contingency and Engineering (8%)				11.2
	Subtotal (4) - Providing Harbour Mobile Crane at Berth 11				**151.2**
5	**Construction of additional Mooring Dolphins**				
a	Construction of 3 additional mooring dolphins for handing iron ore incluidng the dredging cost		LS		200.0
b	**Contingency and Engineering (10%)**				20.0
	Subtotal (5) - Construction of additional mooring dolphins				**220.0**

6	**Construction of Port crafts jetty near BW mole**				
a	Construction of Port crafts jetty near BW mole of size 225 x 5	1125	sqm	20,000.0	22.5
b	Contingency and Engineering (10%)				2.3
	Subtotal (6) -Construction of Port Crafts Jetty near BW				**24.8**
B	**VASCOBAY DEVELOPMENT (PHASE I)**				
7	**Dredging in Vasco Bay up to -14 m CD for one liquid bulk berth and 1 non cargo vessels berth**				
	Dredging in Soft Soil	1125000	cum	125.0	140.6
	Contingency (10%)				14.1
	Engineering & Establishment (3%)				4.2
	Sub total (7) - Dredging in Vasco Bay				**158.9**
8	**Liquid bulk berth with double berthing facilities, 300m x 20 m**				
a	**Berth Cost**				
i	Bored cast in situ piles (1000 dia)	204	No.	650,000.0	132.6
ii	Super structure	6000	Sq.m	10,000.0	60.0
iii	Fenders	100	No.	800,000.0	80.0
iv	Quick Release Mooring Hooks	8	No.	1,500,000.0	12.0
v	Cat ladder, etc.,	LS	LS	5,000,000.0	5.0
vi	Towers for Monitors on the jetty	2	No.	500,000.0	1.0
	Contingecny (10%)				29.1
	Enginnering and establishment (5%)				14.5
	Sub total (8a) - Berth cost				**334.2**
b	**Liquid Bulk Handling Equipment for one berth**				
	Unloading arms				
	12 inch arm for phosphoric acid	1	No.	17,000,000.0	17.0
	16 inch for POL	2	No.	22,000,000.0	44.0
	Contingency (10%)				6.1
	Engineering and Establishment @ 5%				3.1
	Subtotal (8b) - Liquid Bulk Handling Equipment				**70.2**

c	**Pipelines including valves and fittings**				
	Pipelines including valves and fittings of various users (Connecting the berth and tankfarms or connecting to existing pipelines at somepoint)	**To be provided by IOC and variuos other end users**			
	Contingency and spares @ 8%				
	Engineering and Establishment @ 5%				
	Subtotal (8c) - Pipelines				
d	**Buildings**				
i	Electrical Substation	200	Sq.m.	5,500.0	1.1
ii	Pump House	200	Sq.m.	5,500.0	1.1
iv	Amenities Block & Toilet Blocks, Gatehouse etc	200	Sq.m.	5,500.0	1.1
	Contingency (10%)				0.3
	Engineering & Establishment (5%)				0.2
	Subtotal (8d) - Buildings				**3.8**
e	**Utilities**				
a	Power supply and all electrical works	LS	LS	25,000,000.0	25.00
b	Water Supply	LS	LS	10000000	10
c	Drainage	LS	LS	2000000	2
d	Sewarage	LS	LS	2000000	2
e	Communication	LS	LS	1000000	1
f	Fire fighting including equipment in Pump House	LS	LS	40000000	40
g	Pollution Control				
	Oil containment boom with accessories	2500	m	12000	30
	Oil skimmer	4	No.	1000000	4
	Oil containment boom with accessories	2500	m	12,000.0	30.0
	Oil skimmer	4	No.	1,000,000.0	4.0
	Contingency (10%)				14.8
	Engineering & Establishment (5%)				7.4
	Sub Total (8e)-Utilities				**170.2**
	TOTAL '8' (8a+ 8b+8c+8d+8e)				**578.3**

9	**Non cargo vessels berth (250 X 20m & double berthing) including cruise at Vasco Bay**				
a	Berth Cost including all accessories and utilities	3750	Sq.m	30,000.0	112.5
b	Terminal area development for the cruise berth including landscaping, etc		LS	30,000,000.0	30.0
c	Contingency (10%)				14.3
d	Engineering & Establishment (5%)				7.1
	Subtotal (9) - Non Cargo vessels berth				**163.9**
	TOTAL (1+2+3+4+5+6+7+8 +9+10)				**4,211.2**

ANNEXURE 12.1

Financial Model

Financial Analysis of Iron ore terminal : Case 1; Selected Scenario: Low

Particulars Rs in million	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
REVENUES																				
Selected case: Case 1; Selected Scenario: Low																				
Cargo handling & storage charges	1,060	1,038	1,017	997	967	926	926	945	964	983	1,006	1,035	1,064	1,094	1,124	1,155	1,186	1,218	1,251	1,285
Port & Dock charges	274	250	228	207	198	190	190	193	197	201	205	210	214	218	222	227	231	236	241	246
Total Operating Income	1,333	1,288	1,245	1,204	1,165	1,116	1,116	1,138	1,161	1,184	1,212	1,244	1,278	1,312	1,346	1,381	1,417	1,454	1,492	1,530
Case: Case 0; Selected Scenario: Low																				
Cargo handling & storage charges	1,058	1,030	1,007	950	842	741	741	756	771	786	802	818	835	851	868	886	903	921	940	959
Port & Dock charges	271	242	217	194	172	151	151	154	157	160	163	167	171	174	178	181	185	188	192	195
Total Operating Income	1,329	1,272	1,225	1,143	1,014	892	892	910	928	946	966	985	1,005	1,025	1,046	1,067	1,088	1,110	1,132	1,154
Incremental Revenues:																				
Cargo handling & storage charges	2	8	10	47	125	185	185	189	193	197	204	217	229	242	256	269	283	297	311	326
Port & Dock charges	2	9	11	13	26	38	38	39	40	41	42	43	43	44	45	45	46	48	49	50
Total Incremental Operating Income	4	16	20	60	151	224	224	228	233	238	246	259	273	286	300	314	329	344	360	376
INCREMENTAL EXPENDITURE																				
Operations and Maintenance	-	-	22	22	22	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Administrative Expenses	-	-	6	6	6	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
Direct Costs	-	-	28	28	28	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Incremental Gross Margin	4	16	(7)	33	123	(89)	(89)	(84)	(80)	(74)	(66)	(53)	(40)	(26)	(12)	2	17	32	48	64
CAPITAL EXPENDITURE																				
Modernisation / Equipment Replacement of MOHP		1,842																		
Integration of berth No 8 with Berth no 9 for Iron ore handling			232	232																
New stackyard development			174	174																
Construction of additional Mooring Dolphins		220																		
Construction of Port crafts jetty near BW mole				25																
Providing Wagon Handling System / Wagon Tippler for Iron ore near berth no 9				261																
Total Capital expenditure	-	2,062	405	692	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow	4	(2,046)	(413)	(659)	123	(89)	(89)	(84)	(80)	(74)	(66)	(53)	(40)	(26)	(12)	2	17	32	48	64
Discount Factor @ 10%	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	4	(1,860)	(341)	(495)	84	(55)	(50)	(43)	(37)	(32)	(26)	(19)	(13)	(8)	(3)	1	4	6	9	10
NPV @ 10%	(2,863)																			
Project IRR	-Ve																			
Debt (1/2 of the capital expenditure)																				
Interest rate - 10%																				
Repayment (in years) - 10 years																				
Moratorium (in years) - 3 years																				
Principal payment	-	(1,031)	(203)	(346)	158	158	158	158	158	158	158	158	158	158						
Interest payment					158	142	126	111	95	79	63	47	32	16						
Cash flow to equity holder	4	(1,015)	(210)	(313)	(192)	(389)	(373)	(353)	(332)	(311)	(287)	(258)	(229)	(200)	(12)	2	17	32	48	64
Discounted cash flows	4	(922)	(174)	(235)	(131)	(241)	(211)	(181)	(155)	(132)	(111)	(91)	(73)	(58)	(3)	1	4	6	9	10
NPV @ 10%	(2,685)																			
Equity IRR	-Ve																			
Interest coverage ratio (for the project)					0.78	(0.62)	(0.70)	(0.76)	(0.84)	(0.94)	(1.05)	(1.12)	(1.26)	(1.65)						
Return on assets					4%	-3%	-3%	-3%	-3%	-2%	-2%	-2%	-1%	-1%	0%	0%	1%	1%	2%	2%
Incremental Gross Margin Ratio					82%	-40%	-40%	-37%	-34%	-31%	-27%	-21%	-15%	-9%	-4%	1%	5%	9%	13%	17%
Debt to equity ratio					0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	-	-	-	-	-	-	-

Financial Analysis of Iron ore terminal : Case 1; Selected Scenario: Medium

Particulars Rs in million	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
REVENUES																				
Selected case: Case 1; Selected Scenario: Medium																				
Cargo handling & storage charges	1,060	1,049	1,037	1,026	1,027	1,251	1,251	1,285	1,319	1,353	1,389	1,425	1,462	1,500	1,538	1,577	1,603	1,608	1,614	1,620
Port & Dock charges	274	261	249	237	239	242	242	247	252	257	261	266	272	278	284	289	295	301	306	313
Total Operating Income	1,333	1,310	1,287	1,263	1,267	1,493	1,493	1,531	1,570	1,610	1,650	1,692	1,734	1,777	1,822	1,866	1,898	1,909	1,920	1,932
Case: Case 0; Selected Scenario: Medium																				
Cargo handling & storage charges	1,058	1,041	1,027	1,013	999	940	940	959	978	995	999	1,003	1,007	1,011	1,015	1,019	1,023	1,028	1,032	1,037
Port & Dock charges	271	253	238	223	208	193	193	196	200	205	209	213	217	222	226	230	234	239	244	249
Total Operating Income	1,329	1,294	1,265	1,236	1,207	1,133	1,133	1,155	1,178	1,200	1,208	1,216	1,224	1,232	1,241	1,249	1,258	1,267	1,277	1,286
Incremental Revenues:																				
Cargo handling & storage charges	2	8	10	13	29	311	311	326	341	358	390	422	455	489	523	558	579	581	582	583
Port & Dock charges	2	9	11	14	31	49	49	50	51	52	53	53	55	56	58	59	60	61	62	63
Total Incremental Operating Income	4	17	22	27	60	360	360	376	392	410	443	476	510	545	581	617	640	642	643	646
INCREMENTAL EXPENDITURE																				
Operations and Maintenance	-	-	22	22	22	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Administrative Expenses	-	-	6	6	6	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
Direct Costs	-	-	28	28	28	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Incremental Gross Margin	4	17	(6)	(0)	33	48	48	64	80	98	130	163	198	233	268	305	327	329	331	334
CAPITAL EXPENDITURE																				
Modernisation / Equipment Replacement of MOHP		1,842																		
Integration of berth No 8 with Berth no 9 for Iron ore handling			232	232																
New stackyard development			174	174																
Construction of additional Mooring Dolphins		220																		
Construction of Port crafts jetty near BW mole				25																
Providing Wagon Handling System / Wagon Tippler for Iron ore near berth no 9				261																
Total Capital expenditure	-	2,062	405	692	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow	4	(2,045)	(411)	(692)	33	48	48	64	80	98	130	163	198	233	268	305	327	329	331	334
Discount Factor @ 10%	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	4	(1,859)	(340)	(520)	22	30	27	33	37	42	50	57	63	67	71	73	71	65	60	55
NPV @ 10%	(1,893)																			
Project IRR	0%																			
Debt (1/2 of the capital expenditure)																				
Interest rate - 10%																				
Repayment (in years) - 10 years																				
Moratorium (in years) - 3 years																				
Principal payment	-	(1,031)	(203)	(346)	158	158	158	158	158	158	158	158	158	158						
Interest payment					158	142	126	111	95	79	63	47	32	16						
Cash flow to equity holder	4	(1,014)	(208)	(346)	(283)	(252)	(236)	(205)	(173)	(139)	(91)	(42)	8	59	268	305	327	329	331	334
Discounted cash flows	4	(922)	(172)	(260)	(194)	(157)	(133)	(105)	(81)	(59)	(35)	(15)	3	17	71	73	71	65	60	55
NPV @ 10%	(1,715)																			
Equity IRR	-Ve																			
Interest coverage ratio (for the project)					0.21	0.34	0.38	0.58	0.84	1.24	2.06	3.45	6.26	14.73						
Return on assets					1%	2%	2%	2%	3%	3%	4%	5%	6%	7%	8%	10%	10%	10%	10%	11%
Incremental Gross Margin Ratio					54%	13%	13%	17%	20%	24%	29%	34%	39%	43%	46%	49%	51%	51%	51%	52%
Debt to equity ratio					0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	-	-	-	-	-	-	-

Financial Analysis of Iron ore terminal : Case 1; Selected Scenario: High

Particulars Rs in million	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
REVENUES																				
Selected case: Case 1; Selected Scenario: High																				
Cargo handling & storage charges	1,060	1,054	1,047	1,040	1,047	1,436	1,475	1,513	1,552	1,591	1,605	1,610	1,616	1,622	1,628	1,634	1,640	1,646	1,652	1,659
Port & Dock charges	274	267	260	252	259	267	273	279	284	290	296	301	307	313	320	326	333	339	346	353
Total Operating Income	1,333	1,321	1,307	1,292	1,306	1,703	1,748	1,792	1,836	1,881	1,900	1,912	1,923	1,935	1,947	1,960	1,972	1,985	1,998	2,012
Case: Case 0; Selected Scenario: High																				
Cargo handling & storage charges	1,058	1,046	1,036	1,026	1,016	1,004	1,008	1,012	1,016	1,021	1,025	1,029	1,034	1,039	1,043	1,048	1,053	1,058	1,063	1,068
Port & Dock charges	271	258	248	237	226	213	217	222	226	230	234	239	244	249	254	259	264	269	275	281
Total Operating Income	1,329	1,304	1,284	1,264	1,242	1,217	1,226	1,234	1,242	1,251	1,260	1,269	1,278	1,288	1,298	1,307	1,317	1,327	1,338	1,349
Incremental Revenues:																				
Cargo handling & storage charges	2	8	11	14	31	432	467	501	536	571	580	581	582	583	584	586	587	588	589	591
Port & Dock charges	2	9	12	15	33	54	55	57	58	60	61	62	63	64	65	67	68	70	71	72
Total Incremental Operating Income	4	17	23	29	65	486	523	558	594	630	641	643	645	647	650	652	655	658	660	663
INCREMENTAL EXPENDITURE																				
Operations and Maintenance	-	-	22	22	22	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Administrative Expenses	-	-	6	6	6	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
Direct Costs	-	-	28	28	28	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Incremental Gross Margin	4	17	(5)	1	37	173	210	246	282	318	329	330	332	335	337	340	343	345	348	351
CAPITAL EXPENDITURE																				
Modernisation / Equipment Replacement of MOHP		1,842																		
Integration of berth No 8 with Berth no 9 for Iron ore handling			232	232																
New stackyard development			174	174																
Construction of additional Mooring Dolphins		220																		
Construction of Port crafts jetty near BW mole				25																
Providing Wagon Handling System / Wagon Tippler for Iron ore near berth no 9				261																
Total Capital expenditure	-	2,062	405	692	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow	4	(2,044)	(410)	(690)	37	173	210	246	282	318	329	330	332	335	337	340	343	345	348	351
Discount Factor @ 10%	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	4	(1,859)	(339)	(519)	25	108	119	126	131	135	127	116	106	97	89	81	75	68	63	57
NPV @ 10%	(1,190)																			
Project IRR	4%																			
Debt (1/2 of the capital expenditure)																				
Interest rate - 10%																				
Repayment (in years) - 10 years																				
Moratorium (in years) - 3 years																				
Principal payment	-	(1,031)	(203)	(346)	158	158	158	158	158	158	158	158	158	158						
Interest payment					158	142	126	111	95	79	63	47	32	16						
Cash flow to equity holder	4	(1,014)	(207)	(345)	(279)	(127)	(74)	(23)	29	81	107	125	143	161	337	340	343	345	348	351
Discounted cash flows	4	(921)	(171)	(259)	(190)	(79)	(42)	(12)	13	34	41	44	45	47	89	81	75	68	63	57
NPV @ 10%	(1,012)																			
Equity IRR	2%																			
Interest coverage ratio (for the project)					0.24	1.22	1.66	2.22	2.97	4.03	5.20	6.97	10.52	21.20						
Return on assets					1%	5%	7%	8%	9%	10%	10%	10%	11%	11%	11%	11%	11%	11%	11%	11%
Incremental Gross Margin Ratio					57%	36%	40%	44%	47%	50%	51%	51%	52%	52%	52%	52%	52%	53%	53%	53%
Debt to equity ratio					0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	-	-	-	-	-	-	-

Financial Analysis of Iron ore terminal : Case 2; Selected Scenario: Low

Particulars Rs in million	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
REVENUES																				
Selected case: Case 2; Selected Scenario: Low																				
Cargo handling & storage charges	1,001	1,032	1,034	1,030	1,025	1,574	1,574	1,577	1,580	1,583	1,586	1,589	1,593	1,595	1,598	1,600	1,602	1,605	1,607	1,610
Port & Dock charges	274	352	360	345	330	315	315	321	328	334	340	347	355	362	369	376	384	392	399	407
Total Operating Income	1,275	1,384	1,394	1,374	1,354	1,889	1,889	1,898	1,907	1,917	1,926	1,937	1,947	1,957	1,966	1,976	1,986	1,996	2,007	2,017
Case: Case 0; Selected Scenario: Low																				
Cargo handling & storage charges	1,058	1,030	1,007	950	842	741	741	756	771	786	802	818	835	851	868	886	903	921	940	959
Port & Dock charges	271	242	217	194	172	151	151	154	157	160	163	167	171	174	178	181	185	188	192	195
Total Operating Income	1,329	1,272	1,225	1,143	1,014	892	892	910	928	946	966	985	1,005	1,025	1,046	1,067	1,088	1,110	1,132	1,154
Incremental Revenues:																				
Cargo handling & storage charges	(57)	2	27	80	182	833	833	821	809	796	784	771	758	744	729	714	699	683	667	651
Port & Dock charges	2	110	142	151	158	163	163	167	171	174	177	180	184	188	191	195	199	203	207	212
Total Incremental Operating Income	(55)	112	169	231	340	996	996	988	979	971	961	951	942	932	920	909	898	887	875	863
INCREMENTAL EXPENDITURE																				
Operations and Maintenance	-	-	22	22	22	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Administrative Expenses	-	-	6	6	6	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
Direct Costs	-	-	28	28	28	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Incremental Gross Margin	(55)	112	142	203	312	684	684	676	667	658	648	639	630	619	608	597	586	574	563	551
CAPITAL EXPENDITURE																				
Modernisation / Equipment Replacement of MOHP		1,842																		
Integration of berth No 8 with Berth no 9 for Iron ore handling			232	232																
New stackyard development			174	174																
Construction of additional Mooring Dolphins		220																		
Construction of Port crafts jetty near BW mole				25																
Providing Wagon Handling System / Wagon Tippler for Iron ore near berth no 9				261																
Total Capital expenditure	-	2,062	405	692	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow	(55)	(1,950)	(264)	(488)	312	684	684	676	667	658	648	639	630	619	608	597	586	574	563	551
Discount Factor @ 10%	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	(55)	(1,773)	(218)	(367)	213	425	386	347	311	279	250	224	201	179	160	143	127	114	101	90
NPV @ 10%	1,138																			
Project IRR	16%																			
Debt (1/2 of the capital expenditure)																				
Interest rate - 10%																				
Repayment (in years) - 10 years																				
Moratorium (in years) - 3 years																				
Principal payment	-	(1,031)	(203)	(346)	158	158	158	158	158	158	158	158	158	158						
Interest payment					158	142	126	111	95	79	63	47	32	16						
Cash flow to equity holder	(55)	(919)	(61)	(143)	(3)	384	400	407	414	421	427	434	440	445	608	597	586	574	563	551
Discounted cash flows	(55)	(836)	(51)	(107)	(2)	238	226	209	193	179	165	152	140	129	160	143	127	114	101	90
NPV @ 10%	1,316																			
Equity IRR	20%																			
Interest coverage ratio (for the project)					1.98	4.81	5.41	6.11	7.04	8.34	10.26	13.49	19.93	39.21						
Return on assets					10%	22%	22%	21%	21%	21%	21%	20%	20%	20%	19%	19%	19%	18%	18%	17%
Incremental Gross Margin Ratio					92%	69%	69%	68%	68%	68%	67%	67%	67%	66%	66%	66%	65%	65%	64%	64%
Debt to equity ratio					0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	-	-	-	-	-	-	-

Financial Analysis of Iron ore terminal : Case 2; Selected Scenario: Medium

Particulars Rs in million	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
REVENUES																				
Selected case: Case 2; Selected Scenario: Medium																				
Cargo handling & storage charges	1,001	1,032	1,044	1,047	1,048	1,610	1,610	1,613	1,615	1,618	1,621	1,624	1,627	1,629	1,632	1,636	1,639	1,642	1,645	1,648
Port & Dock charges	274	352	391	400	404	407	407	415	424	432	441	449	458	468	477	486	496	506	516	527
Total Operating Income	1,275	1,384	1,435	1,447	1,452	2,017	2,017	2,028	2,039	2,050	2,061	2,073	2,085	2,097	2,109	2,122	2,135	2,148	2,161	2,175
Case: Case 0; Selected Scenario: Medium																				
Cargo handling & storage charges	1,058	1,041	1,027	1,013	999	940	940	959	978	995	999	1,003	1,007	1,011	1,015	1,019	1,023	1,028	1,032	1,037
Port & Dock charges	271	253	238	223	208	193	193	196	200	205	209	213	217	222	226	230	234	239	244	249
Total Operating Income	1,329	1,294	1,265	1,236	1,207	1,133	1,133	1,155	1,178	1,200	1,208	1,216	1,224	1,232	1,241	1,249	1,258	1,267	1,277	1,286
Incremental Revenues:																				
Cargo handling & storage charges	(57)	(9)	18	35	50	670	670	654	637	623	622	621	620	619	618	616	615	614	613	611
Port & Dock charges	2	99	153	177	195	215	215	219	223	227	232	236	241	246	251	256	261	266	271	277
Total Incremental Operating Income	(55)	90	170	212	245	885	885	873	861	850	854	857	861	865	868	872	877	880	884	889
INCREMENTAL EXPENDITURE																				
Operations and Maintenance	-	-	22	22	22	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Administrative Expenses	-	-	6	6	6	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
Direct Costs	-	-	28	28	28	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Incremental Gross Margin	(55)	90	143	184	218	572	572	560	548	538	541	544	548	552	556	560	564	568	572	576
CAPITAL EXPENDITURE																				
Modernisation / Equipment Replacement of MOHP		1,842																		
Integration of berth No 8 with Berth no 9 for Iron ore handling			232	232																
New stackyard development			174	174																
Construction of additional Mooring Dolphins		220																		
Construction of Port crafts jetty near BW mole				25																
Providing Wagon Handling System / Wagon Tippler for Iron ore near berth no 9				261																
Total Capital expenditure	-	2,062	405	692	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow	(55)	(1,972)	(263)	(507)	218	572	572	560	548	538	541	544	548	552	556	560	564	568	572	576
Discount Factor @ 10%	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	(55)	(1,793)	(217)	(381)	149	355	323	288	256	228	209	191	175	160	146	134	123	112	103	94
NPV @ 10%	600																			
Project IRR	13%																			
Debt (1/2 of the capital expenditure)																				
Interest rate - 10%																				
Repayment (in years) - 10 years																				
Moratorium (in years) - 3 years																				
Principal payment	-	(1,031)	(203)	(346)	158	158	158	158	158	158	158	158	158	158						
Interest payment					158	142	126	111	95	79	63	47	32	16						
Cash flow to equity holder	(55)	(941)	(60)	(162)	(98)	272	288	292	295	301	320	339	359	378	556	560	564	568	572	576
Discounted cash flows	(55)	(855)	(49)	(122)	(67)	169	163	150	138	128	123	119	114	110	146	134	123	112	103	94
NPV @ 10%	778																			
Equity IRR	16%																			
Interest coverage ratio (for the project)					1.38	4.03	4.53	5.07	5.78	6.81	8.57	11.49	17.36	34.96						
Return on assets					7%	18%	18%	18%	17%	17%	17%	17%	17%	17%	18%	18%	18%	18%	18%	18%
Incremental Gross Margin Ratio					89%	65%	65%	64%	64%	63%	63%	64%	64%	64%	64%	64%	64%	65%	65%	65%
Debt to equity ratio					0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	-	-	-	-	-	-	-

Financial Analysis of Iron ore terminal : Case 2; Selected Scenario: High

Particulars Rs in million	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
REVENUES																				
Selected case: Case 2; Selected Scenario: High																				
Cargo handling & storage charges	1,001	1,032	1,044	1,056	1,060	1,626	1,629	1,632	1,635	1,638	1,641	1,645	1,648	1,651	1,655	1,658	1,662	1,665	1,669	1,673
Port & Dock charges	274	352	391	428	438	455	465	475	484	494	504	514	524	534	545	556	567	578	590	602
Total Operating Income	1,275	1,384	1,435	1,484	1,497	2,080	2,094	2,107	2,119	2,132	2,145	2,158	2,172	2,186	2,200	2,214	2,229	2,244	2,259	2,275
Case: Case 0; Selected Scenario: High																				
Cargo handling & storage charges	1,058	1,046	1,036	1,026	1,016	1,004	1,008	1,012	1,016	1,021	1,025	1,029	1,034	1,039	1,043	1,048	1,053	1,058	1,063	1,068
Port & Dock charges	271	258	248	237	226	213	217	222	226	230	234	239	244	249	254	259	264	269	275	281
Total Operating Income	1,329	1,304	1,284	1,264	1,242	1,217	1,226	1,234	1,242	1,251	1,260	1,269	1,278	1,288	1,298	1,307	1,317	1,327	1,338	1,349
Incremental Revenues:																				
Cargo handling & storage charges	(57)	(14)	8	30	44	622	621	620	619	617	616	615	614	613	611	610	609	607	606	605
Port & Dock charges	2	94	143	190	212	242	248	253	258	264	269	274	279	285	291	296	303	309	315	321
Total Incremental Operating Income	(55)	80	151	220	256	863	869	873	876	881	886	889	893	898	902	906	911	917	921	926
INCREMENTAL EXPENDITURE																				
Operations and Maintenance	-	-	22	22	22	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Administrative Expenses	-	-	6	6	6	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
Direct Costs	-	-	28	28	28	312	312	312	312	312	312	312	312	312	312	312	312	312	312	312
Incremental Gross Margin	(55)	80	123	193	228	551	556	560	564	569	573	577	581	585	590	594	599	604	609	614
CAPITAL EXPENDITURE																				
Modernisation / Equipment Replacement of MOHP		1,842																		
Integration of berth No 8 with Berth no 9 for Iron ore handling			232	232																
New stackyard development			174	174																
Construction of additional Mooring Dolphins		220																		
Construction of Port crafts jetty near BW mole				25																
Providing Wagon Handling System / Wagon Tippler for Iron ore near berth no 9				261																
Total Capital expenditure	-	2,062	405	692	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow	(55)	(1,982)	(282)	(499)	228	551	556	560	564	569	573	577	581	585	590	594	599	604	609	614
Discount Factor @ 10%	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	(55)	(1,802)	(233)	(375)	156	342	314	288	263	241	221	202	185	170	155	142	130	120	109	100
NPV @ 10%	674																			
Project IRR	13%																			
Debt (1/2 of the capital expenditure)																				
Interest rate - 10%																				
Repayment (in years) - 10 years																				
Moratorium (in years) - 3 years																				
Principal payment	-	(1,031)	(203)	(346)	158	158	158	158	158	158	158	158	158	158						
Interest payment					158	142	126	111	95	79	63	47	32	16						
Cash flow to equity holder	(55)	(951)	(79)	(153)	(88)	251	272	292	311	332	352	372	391	411	590	594	599	604	609	614
Discounted cash flows	(55)	(864)	(66)	(115)	(60)	156	154	150	145	141	136	130	125	119	155	142	130	120	109	100
NPV @ 10%	852																			
Equity IRR	16%																			
Interest coverage ratio (for the project)					1.44	3.88	4.40	5.07	5.95	7.20	9.07	12.18	18.38	37.05						
Return on assets					7%	17%	18%	18%	18%	18%	18%	18%	18%	19%	19%	19%	19%	19%	19%	19%
Incremental Gross Margin Ratio					89%	64%	64%	64%	64%	65%	65%	65%	65%	65%	65%	66%	66%	66%	66%	66%
Debt to equity ratio					0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	-	-	-	-	-	-	-

Financial Analysis of Vasco bay development Project: Scenario - Low

Particulars Rs in million	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Selected Scenario: Low																				
Income:																				
Cargo handling & storage charges	-	-	-	175	181	188	195	205	215	226	237	249	262	275	289	303	318	334	351	368
Port & Dock charges	-	-	-	105	110	116	122	130	137	145	153	161	170	178	187	197	206	217	228	239
Total Operating Income	-	-	-	280	292	304	317	335	353	371	391	411	432	453	476	500	525	551	578	607
Expenditure:																				
Operations and maintenance cost				43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
Administrative expenses				11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Direct Costs	-	-	-	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
Gross Margin	-	-	-	226	238	250	263	281	299	318	337	357	378	399	422	446	471	497	524	553
CAPITAL EXPENDITURE																				
Dredging in Vasco Bay up to -13 m CD for one liquid bulk berth and 1 non cargo vessels berth		159																		
Liquid bulk berth with double berthing facilities, 300m x 20 m																				
Berth Cost			334																	
Liquid Bulk Handling Equipment for one berth			70																	
Pipelines including valves and fittings (Connecting the berth and tankfarms or connecting to existing pipelines at somepoint)		-																		
Buildings			4																	
Utilities			170																	
Non cargo vessels berth (250 X 20m) including cruise at Vasco Bay			164																	
Total Capital expenditure	-	159	742	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow	-	(159)	(742)	226	238	250	263	281	299	318	337	357	378	399	422	446	471	497	524	553
Discount Factor @ 10%	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	-	(144)	(613)	170	162	156	149	144	139	135	130	125	120	116	111	107	102	98	94	90
NPV @ 10%	1,391																			
Project IRR	29%																			
Debt (1/2 of the capital expenditure)																				
Interest rate - 10%																				
Repayment (in years) - 10 years																				
Moratorium (in years) - 3 years																				
Principal payment		(79)	(371)	45	45	45	45	45	45	45	45	45	45							
Interest payment				45	41	36	32	27	23	18	14	9	5							
Cash flow to equity holder	-	(79)	(371)	136	152	169	187	209	231	254	278	303	328	399	422	446	471	497	524	553
Discounted cash flows	-	(72)	(307)	102	104	105	105	107	108	108	107	106	105	116	111	107	102	98	94	90
NPV @ 10%	1,397																			
Equity IRR	38%																			
Interest coverage ratio (for the project)				5.01	5.87	6.95	8.35	10.39	13.27	17.62	24.92	39.61	83.83							
Return on assets		0%	0%	25%	26%	28%	29%	31%	33%	35%	37%	40%	42%	44%	47%	49%	52%	55%	58%	61%
Gross Margin Ratio				81%	82%	82%	83%	84%	85%	85%	86%	87%	87%	88%	89%	89%	90%	90%	91%	91%
Debt to equity ratio				0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	-	-	-	-	-	-	-	-

Financial Analysis of Vasco bay development Project: Scenario - Medium

Particulars Rs in million	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Selected Scenario: Medium																				
Income:																				
Cargo handling & storage charges	-	-	-	183	193	204	215	226	237	249	261	275	288	303	318	334	350	368	386	406
Port & Dock charges	-	-	-	122	130	137	145	155	164	173	183	193	203	213	224	235	246	259	272	285
Total Operating Income	-	-	-	305	323	341	360	380	401	422	444	467	491	516	541	568	597	627	658	691
Expenditure:																				
Operations and maintenance cost				43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
Administrative expenses				11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Direct Costs	-	-	-	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
Gross Margin	-	-	-	251	269	287	307	326	347	368	391	413	437	462	487	514	543	573	604	637
CAPITAL EXPENDITURE																				
Dredging in Vasco Bay up to -13 m CD for one liquid bulk berth and 1 non cargo vessels berth		159																		
Liquid bulk berth with double berthing facilities, 300m x 20 m																				
Berth Cost			334																	
Liquid Bulk Handling Equipment for one berth			70																	
Pipelines including valves and fittings (Connecting the berth and tankfarms or connecting to existing pipelines at somepoint)		-																		
Buildings			4																	
Utilities			170																	
Non cargo vessels berth (250 X 20m) including cruise at Vasco Bay			164																	
Total Capital expenditure	-	159	742	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow	-	(159)	(742)	251	269	287	307	326	347	368	391	413	437	462	487	514	543	573	604	637
Discount Factor @ 10%	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	-	(144)	(613)	189	184	178	173	168	162	156	151	145	139	134	128	123	118	113	109	104
NPV @ 10%	1,716																			
Project IRR	32%																			
Debt (1/2 of the capital expenditure)																				
Interest rate - 10%																				
Repayment (in years) - 10 years																				
Moratorium (in years) - 3 years																				
Principal payment		(79)	(371)	45	45	45	45	45	45	45	45	45	45							
Interest payment				45	41	36	32	27	23	18	14	9	5							
Cash flow to equity holder	-	(79)	(371)	161	183	206	230	254	280	305	332	359	387	462	487	514	543	573	604	637
Discounted cash flows	-	(72)	(307)	121	125	128	130	131	130	130	128	126	123	134	128	123	118	113	109	104
NPV @ 10%	1,723																			
Equity IRR	44%																			
Interest coverage ratio (for the project)				5.58	6.63	7.97	9.72	12.08	15.41	20.44	28.89	45.87	96.99							
Return on assets		0%	0%	28%	30%	32%	34%	36%	39%	41%	43%	46%	48%	51%	54%	57%	60%	64%	67%	71%
Gross Margin Ratio				82%	83%	84%	85%	86%	87%	87%	88%	88%	89%	90%	90%	91%	91%	91%	92%	92%
Debt to equity ratio				0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	-	-	-	-	-	-	-	-

Financial Analysis of Vasco bay development Project: Scenario - High																				
Particulars	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**2025-26**
Rs in million																				
Selected Scenario: High																				
Income:																				
Cargo handling & storage charges	-	-	-	185	195	207	219	230	241	253	266	279	293	308	323	340	357	374	393	413
Port & Dock charges	-	-	-	126	134	143	151	160	170	180	190	200	210	221	232	243	255	268	281	296
Total Operating Income	-	-	-	311	330	349	370	390	411	433	456	479	503	529	555	583	612	642	675	708
Expenditure:																				
Operations and maintenance cost				43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
Administrative expenses				11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Direct Costs	-	-	-	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
Gross Margin	-	-	-	257	276	295	316	336	357	379	402	425	449	475	501	529	558	588	621	654
CAPITAL EXPENDITURE																				
Dredging in Vasco Bay up to -13 m CD for one liquid bulk berth and 1 non cargo vessels berth		159																		
Liquid bulk berth with double berthing facilities, 300m x 20 m																				
Berth Cost			334																	
Liquid Bulk Handling Equipment for one berth			70																	
Pipelines including valves and fittings (Connecting the berth and tankfarms or connecting to existing pipelines at somepoint)		-																		
Buildings			4																	
Utilities			170																	
Non cargo vessels berth (250 X 20m) including cruise at Vasco Bay			164																	
Total Capital expenditure	-	159	742	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Cash Flow	-	(159)	(742)	257	276	295	316	336	357	379	402	425	449	475	501	529	558	588	621	654
Discount Factor @ 10%	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	-	(144)	(613)	193	188	183	178	173	167	161	155	149	143	137	132	127	121	116	112	107
NPV @ 10%	1,785																			
Project IRR	33%																			
Debt (1/2 of the capital expenditure)																				
Interest rate - 10%																				
Repayment (in years) - 10 years																				
Moratorium (in years) - 3 years																				
Principal payment		(79)	(371)	45	45	45	45	45	45	45	45	45	45							
Interest payment				45	41	36	32	27	23	18	14	9	5							
Cash flow to equity holder	-	(79)	(371)	167	190	214	239	264	290	316	343	371	400	475	501	529	558	588	621	654
Discounted cash flows	-	(72)	(307)	125	130	133	135	136	135	134	132	130	127	137	132	127	121	116	112	107
NPV @ 10%	1,792																			
Equity IRR	45%																			
Interest coverage ratio (for the project)				5.71	6.80	8.19	10.01	12.44	15.86	21.04	29.73	47.18	99.76							
Return on assets		0%	0%	29%	31%	33%	35%	37%	40%	42%	45%	47%	50%	53%	56%	59%	62%	65%	69%	73%
Gross Margin Ratio				83%	84%	85%	85%	86%	87%	88%	88%	89%	89%	90%	90%	91%	91%	92%	92%	92%
Debt to equity ratio				0.90	0.80	0.70	0.60	0.50	0.40	0.30	0.20	0.10	-	-	-	-	-	-	-	-

Financial Analysis of All Projects: Case 1; scenario - Low

Particulars	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Rs in million																				
Revenue Gains																				
Pilotage from incremental Iron ore vessels	-	-	-	-	14	21	21	22	22	23	24	24	25	26	27	27	28	29	30	31
Revenue Losses																				
Liquid Bulk handling charges	-	-	-	175	181	188	195	205	215	226	237	249	262	275	289	303	318	334	351	368
Liquid Bulk Vessels related charges																				
Berth hire charges	-	-	-	16	17	18	18	19	20	21	22	23	25	26	27	28	30	31	33	35
Port dues	-	-	-	20	20	21	22	23	24	25	27	28	29	31	32	34	36	37	39	41
Miscellaneous income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Gain / (Loss)	-	-	-	(211)	(204)	(206)	(214)	(225)	(237)	(250)	(263)	(276)	(291)	(306)	(321)	(338)	(355)	(374)	(393)	(414)
Net Cash Flows from Iron ore Berth	4	(2,046)	(413)	(659)	123	(89)	(89)	(84)	(80)	(74)	(66)	(53)	(40)	(26)	(12)	2	17	32	48	64
Net Cash Flows from Vasco Bay	-	(159)	(742)	226	238	250	263	281	299	318	337	357	378	399	422	446	471	497	524	553
Total Cash flow	4	(2,205)	(1,155)	(644)	157	(44)	(40)	(29)	(18)	(7)	8	27	47	68	89	110	132	155	179	204
Discount Factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	4	(2,004)	(955)	(484)	107	(27)	(22)	(15)	(9)	(3)	3	10	15	20	23	26	29	31	32	33
NPV @ 10%	(3,186)																			
Project IRR	-Ve																			

Financial Analysis of All Projects: Case 1; scenario - Medium

Financial Analysis	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Rs in million																				
Revenue Gains																				
Pilotage from incremental Iron ore vessels	-	-	-	-	17	27	27	28	29	29	30	31	32	33	34	35	36	37	38	39
Revenue Losses																				
Liquid Bulk handling charges	-	-	-	183	193	204	215	226	237	249	261	275	288	303	318	334	350	368	386	406
Liquid Bulk Vessels related charges																				
Berth hire charges	-	-	-	17	18	19	20	21	22	23	25	26	27	28	30	31	33	35	36	38
Port dues	-	-	-	20	22	23	24	25	27	28	29	31	32	34	36	37	39	41	43	45
Miscellaneous income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Gain / (Loss)	-	-	-	(221)	(216)	(219)	(232)	(244)	(257)	(271)	(285)	(300)	(315)	(332)	(349)	(367)	(387)	(407)	(428)	(450)
Net Cash Flows from Iron ore Berth	4	(2,045)	(411)	(692)	33	48	48	64	80	98	130	163	198	233	268	305	327	329	331	334
Net Cash Flows from Vasco Bay	-	(159)	(742)	251	269	287	307	326	347	368	391	413	437	462	487	514	543	573	604	637
Total Cash flow	4	(2,204)	(1,153)	(662)	86	117	122	146	169	196	236	277	319	362	406	452	484	495	507	520
Discount Factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	4	(2,004)	(953)	(497)	59	72	69	75	79	83	91	97	102	105	107	108	105	98	91	85
NPV @ 10%	(2,024)																			
Project IRR	2%																			

Financial Analysis of All Projects: Case 1; scenario - High

Financial Analysis	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Rs in million																				
Revenue Gains																				
Pilotage from incremental Iron ore vessels	-	-	-	-	22	35	35	36	37	38	39	40	42	43	44	46	47	48	50	51
Revenue Losses																				
Liquid Bulk handling charges	-	-	-	185	195	207	219	230	241	253	266	279	293	308	323	340	357	374	393	413
Liquid Bulk Vessels related charges																				
Berth hire charges	-	-	-	17	18	19	20	21	23	24	25	26	27	29	30	32	33	35	37	38
Port dues	-	-	-	21	22	23	24	26	27	28	30	31	33	34	36	38	40	42	44	46
Miscellaneous income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Gain / (Loss)	-	-	-	(223)	(213)	(214)	(228)	(241)	(253)	(267)	(281)	(296)	(311)	(328)	(345)	(363)	(383)	(403)	(424)	(446)
Net Cash Flows from Iron ore Berth	4	(2,044)	(410)	(690)	37	173	210	246	282	318	329	330	332	335	337	340	343	345	348	351
Net Cash Flows from Vasco Bay	-	(159)	(742)	257	276	295	316	336	357	379	402	425	449	475	501	529	558	588	621	654
Total Cash flow	4	(2,203)	(1,152)	(656)	100	255	298	341	386	431	449	460	470	482	493	506	518	531	545	559
Discount Factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	4	(2,003)	(952)	(493)	68	158	168	175	180	183	173	161	150	140	130	121	113	105	98	91
NPV @ 10%	(1,230)																			
Project IRR	5%																			

Financial Analysis of All Projects: Case 2; scenario - Low

Financial Analysis	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Rs in million																				
Revenue Gains																				
Pilotage from incremental Iron ore vessels	-	-	-	-	88	91	91	94	96	99	102	105	108	112	115	118	119	116	112	108
Revenue Losses																				
Liquid Bulk handling charges	-	-	-	175	181	188	195	205	215	226	237	249	262	275	289	303	318	334	351	368
Liquid Bulk Vessels related charges																				
Berth hire charges	-	-	-	16	17	18	18	19	20	21	22	23	25	26	27	28	30	31	33	35
Port dues	-	-	-	20	20	21	22	23	24	25	27	28	29	31	32	34	36	37	39	41
Miscellaneous income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Gain / (Loss)	-	-	-	(211)	(131)	(136)	(145)	(154)	(163)	(173)	(184)	(195)	(207)	(220)	(233)	(247)	(265)	(287)	(311)	(336)
Net Cash Flows from Iron ore Berth	(55)	(1,950)	(264)	(488)	312	684	684	676	667	658	648	639	630	619	608	597	586	574	563	551
Net Cash Flows from Vasco Bay	-	(159)	(742)	226	238	250	263	281	299	318	337	357	378	399	422	446	471	497	524	553
Total Cash flow	(55)	(2,109)	(1,006)	(474)	419	798	803	803	803	802	801	801	800	799	797	795	792	784	776	768
Discount Factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	(55)	(1,917)	(832)	(356)	286	496	453	412	374	340	309	281	255	231	210	190	172	155	140	126
NPV @ 10%	1,271																			
Project IRR	15%																			

Financial Analysis of All Projects: Case 2; scenario - Medium

Financial Analysis	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Rs in million																				
Revenue Gains																				
Pilotage from incremental Iron ore vessels	-	-	-	-	109	120	120	122	119	116	112	108	105	101	97	93	88	84	80	75
Revenue Losses																				
Liquid Bulk handling charges	-	-	-	183	193	204	215	226	237	249	261	275	288	303	318	334	350	368	386	406
Liquid Bulk Vessels related charges																				
Berth hire charges	-	-	-	17	18	19	20	21	22	23	25	26	27	28	30	31	33	35	36	38
Port dues	-	-	-	20	22	23	24	25	27	28	29	31	32	34	36	37	39	41	43	45
Miscellaneous income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Gain / (Loss)	-	-	-	(221)	(124)	(126)	(139)	(150)	(167)	(185)	(203)	(223)	(243)	(264)	(286)	(310)	(334)	(360)	(386)	(414)
Net Cash Flows from Iron ore Berth	(55)	(1,972)	(263)	(507)	218	572	572	560	548	538	541	544	548	552	556	560	564	568	572	576
Net Cash Flows from Vasco Bay	-	(159)	(742)	251	269	287	307	326	347	368	391	413	437	462	487	514	543	573	604	637
Total Cash flow	(55)	(2,131)	(1,005)	(477)	363	734	739	737	728	722	728	735	743	750	757	765	773	781	790	799
Discount Factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	(55)	(1,937)	(830)	(358)	248	456	417	378	340	306	281	258	237	217	199	183	168	155	142	131
NPV @ 10%	935																			
Project IRR	13%																			

Financial Analysis of All Projects: Case 2; scenario - High

Financial Analysis	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Rs in million																				
Revenue Gains																				
Pilotage from incremental Iron ore vessels	-	-	-	-	142	156	156	159	155	150	146	141	136	131	126	121	115	109	104	97
Revenue Losses																				
Liquid Bulk handling charges	-	-	-	185	195	207	219	230	241	253	266	279	293	308	323	340	357	374	393	413
Liquid Bulk Vessels related charges																				
Berth hire charges	-	-	-	17	18	19	20	21	23	24	25	26	27	29	30	32	33	35	37	38
Port dues	-	-	-	21	22	23	24	26	27	28	30	31	33	34	36	38	40	42	44	46
Miscellaneous income	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Gain / (Loss)	-	-	-	(223)	(93)	(93)	(108)	(118)	(136)	(155)	(175)	(195)	(217)	(240)	(264)	(288)	(314)	(341)	(370)	(400)
Net Cash Flows from Iron ore Berth	(55)	(1,982)	(282)	(499)	228	551	556	560	564	569	573	577	581	585	590	594	599	604	609	614
Net Cash Flows from Vasco Bay	-	(159)	(742)	257	276	295	316	336	357	379	402	425	449	475	501	529	558	588	621	654
Total Cash flow	(55)	(2,141)	(1,024)	(464)	411	753	765	779	786	793	800	807	813	820	827	835	843	851	859	868
Discount Factor	1.00	0.91	0.83	0.75	0.68	0.62	0.56	0.51	0.47	0.42	0.39	0.35	0.32	0.29	0.26	0.24	0.22	0.20	0.18	0.16
Discounted cash flows	(55)	(1,946)	(847)	(349)	280	468	432	400	367	336	309	283	259	238	218	200	183	168	155	142
NPV @ 10%	1,240																			
Project IRR	14%																			

ANNEXURE 12.2

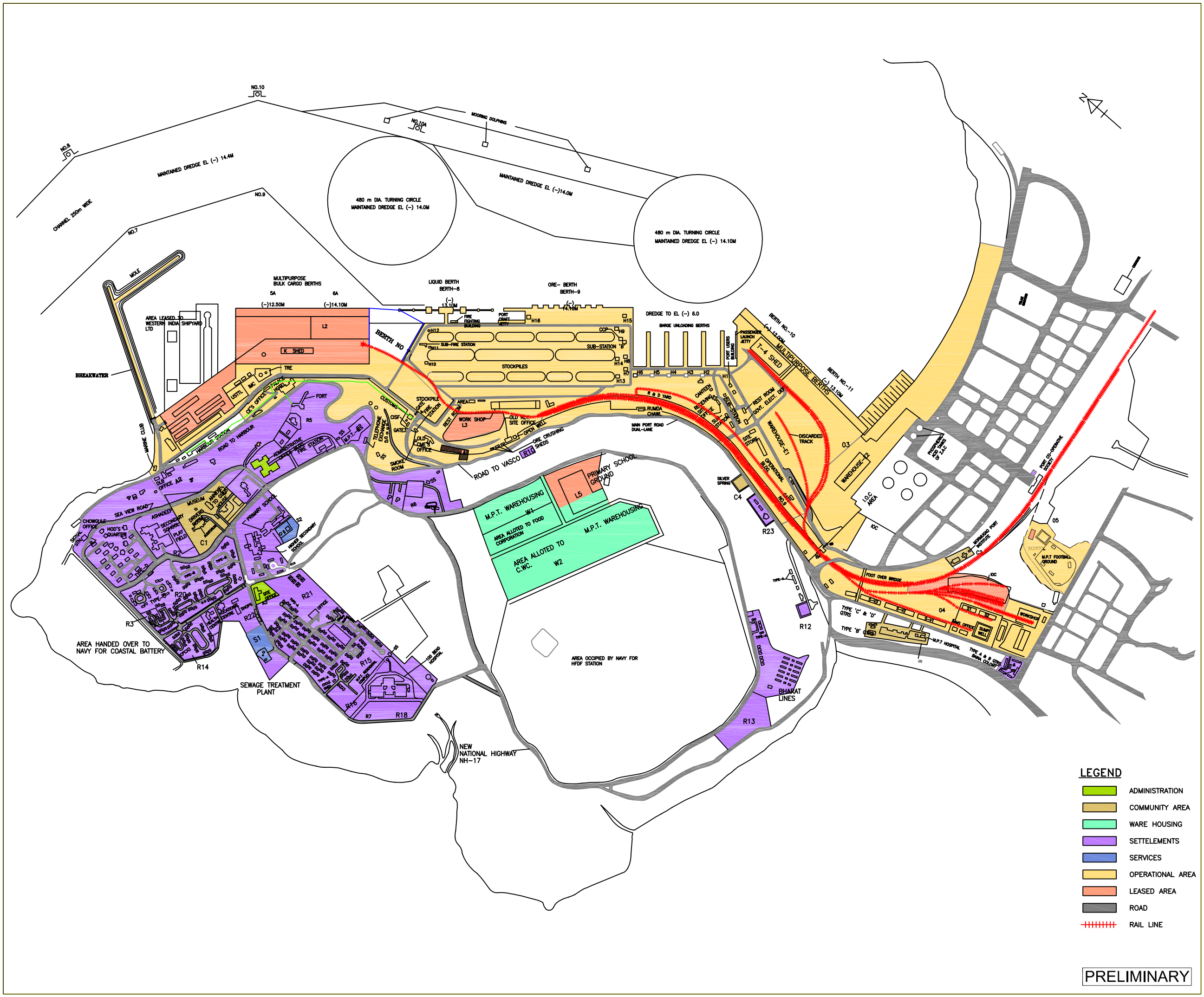
Financial Analysis

Projected Profit and Loss account		2006-07	2010-11	2011-12	2012-13	2015-16	2020-21	2025-26
Year >>>		1	5	6	7	10	15	20
REVENUES								
Port Dues		87	169	174	178	199	232	271
Other Dues		545	737	830	840	904	993	1,096
Stevedoring revenue		269	312	232	235	306	392	482
Storage and Wharf Handling		1,160	1,269	1,465	1,435	1,488	1,577	1,692
Concession Fee		149	247	247	246	246	246	246
Other Operational Income		265	335	530	539	583	596	614
Additional levy for pension		43	-	-	-	-	-	-
Total Operating Revenues	**A**	**2,519**	**3,069**	**3,478**	**3,473**	**3,726**	**4,036**	**4,401**
EXPENSES								
Salaries		627	1,017	1,002	1,033	1,232	2,019	2,794
Social Charges and Pension Premiums		559	94	95	98	114	177	239
Running Costs		590	932	932	932	934	935	937
Administrative Costs		174	257	257	257	257	257	257
Other Costs		0	0	0	0	0	0	0
Total Operating Costs	**B**	**1,949**	**2,299**	**2,286**	**2,320**	**2,537**	**3,388**	**4,227**
Operational net earnings before depreciation, interest and tax	**C=A-B**	**569**	**770**	**1,193**	**1,153**	**1,190**	**648**	**174**
Depreciation	D	127	310	306	309	324	348	336
Net earnings before interest and tax	E=C-D	442	460	886	844	866	300	(162)
Finance and miscellaneous income	F	94	147	165	203	336	608	919
Interest	G	9	253	235	211	133	10	(0)
Net earning before tax	H=E-F-G	527	354	817	836	1,069	899	756
Tax	I	-	-	-	-	-	-	-
Net earnings	**J = H-I**	**527**	**354**	**817**	**836**	**1,069**	**899**	**756**
Appropriation:								
Net Deferred tax asset		-	-	-	-	-	-	-
Employees welfare fund		1	1	1	1	1	2	2
Insurance Fund		2	4	4	4	4	7	10
Transferred to General reserve and other reserves		525	349	812	831	1,064	890	744

Projected Balance Sheets		2006-07	2010-11	2011-12	2012-13	2015-16	2020-21	2025-26
Year >>>		1	5	6	7	10	15	20
ASSETS								
Fixed Assets	A	3,207	7,314	7,112	6,908	6,265	5,095	3,944
Current assets	B	777	947	1,073	1,071	1,149	1,245	1,357
Liquid Means	C	2,889	2,207	2,851	3,617	6,372	11,159	16,707
Total assets	**D=A+B+C**	**6,873**	**10,467**	**11,036**	**11,596**	**13,786**	**17,499**	**22,008**
EQUITY AND LIABILITIES								
Equity	E	-	-	-	-	-	-	-
Reserves	F	4,790	4,910	5,752	6,533	9,149	12,367	15,176
Total own equity	G=E+F	4,790	4,910	5,752	6,533	9,149	12,367	15,176
Provisions / other liabilities / specific reserves	H	1,186	1,899	1,875	1,929	2,285	3,721	5,130
Long term loans	I	113	2,731	2,489	2,200	1,331	47	(0)
Short term liabilities	J	785	926	920	934	1,021	1,364	1,702
Total equity and liabilities	K=G+H+I+J	6,873	10,467	11,036	11,596	13,786	17,499	22,008

Projected Flow of Funds		2006-07	2010-11	2011-12	2012-13	2015-16	2020-21	2025-26
Year >>>		1	5	6	7	10	15	20
SOURCE OF FUNDS								
Net earnings	A	527	354	817	836	1,069	899	756
Depreciation	B	127	310	306	309	324	348	336
Cash Flow	C=A+B	655	664	1,123	1,145	1,393	1,247	1,093
Loans	D	-	-	-	-	-	-	-
Total Source of funds	E=C+D	655	664	1,123	1,145	1,393	1,247	1,093
USE OF FUNDS								
Investments	F	105	105	105	105	105	105	105
Increase in working capital	G	(10)	77	132	(15)	(8)	(30)	(54)
Repayment of loans	H	50	164	242	290	290	125	-
Total Use of Funds	I=F+G+H	145	345	478	379	386	200	51
Balance flow of funds	J=E-I	510	318	645	766	1,006	1,047	1,042
Liquid means (1st April)		2,379	1,888	2,207	2,851	5,366	10,112	15,665
Liquid means (31st Mar)		2,889	2,207	2,851	3,617	6,372	11,159	16,707
Increase / (decrease) in liquid means		510	318	645	766	1,006	1,047	1,042

DRAWINGS



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

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

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PROJECT

PREPARATION OF BUSINESS PLAN

DRAWING

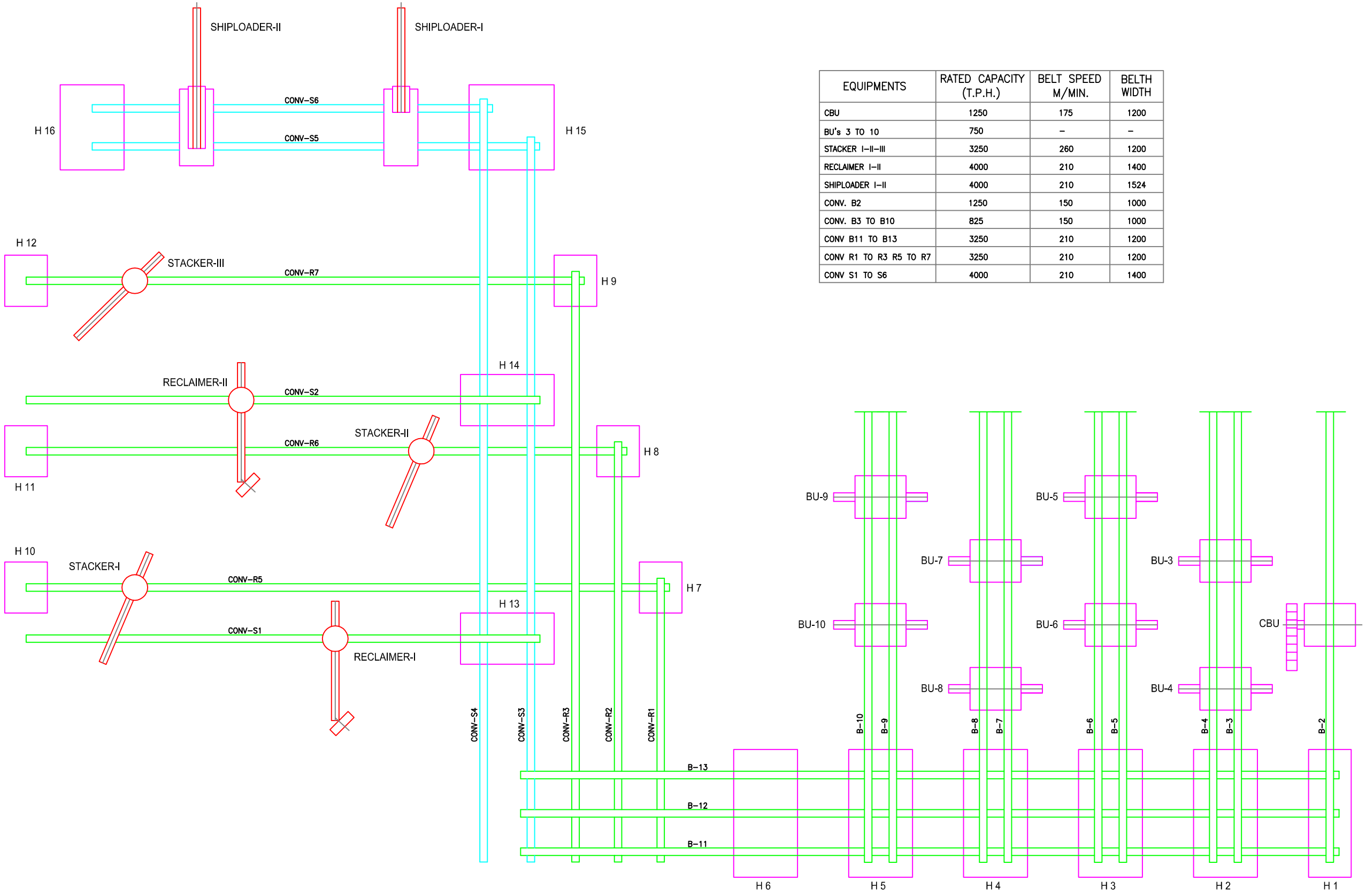
PORT LAYOUT

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

DRAWING No. DCBPMP/01 | Revision 0

Drawing Scale: N.T.S

CAD filename: DCBPMP/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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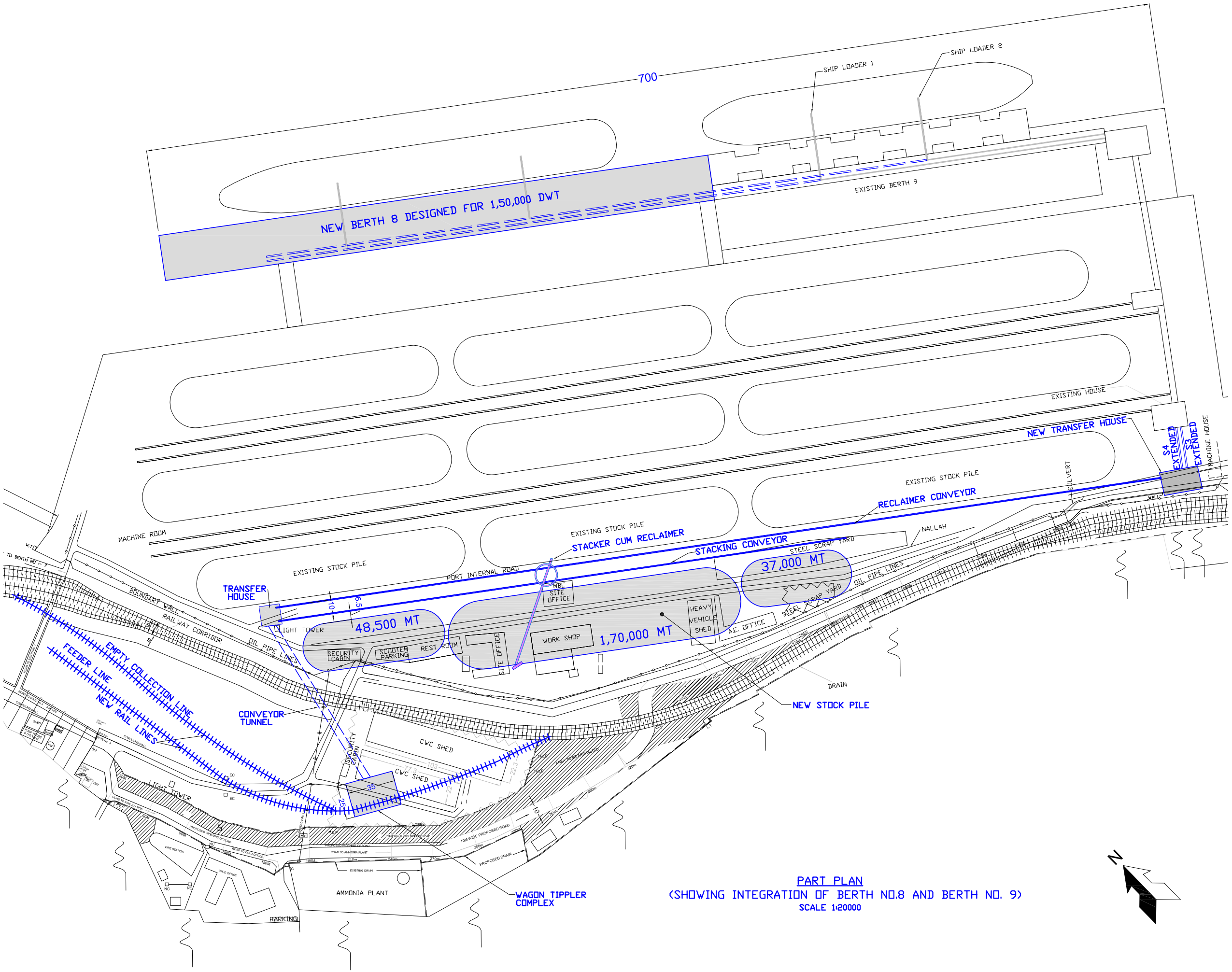
PROJECT
PREPARATION OF BUSINESS PLAN

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. DCBPMP/02
Revision 0

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



PART PLAN
(SHOWING INTEGRATION OF BERTH NO.8 AND BERTH NO. 9)
SCALE 1:20000

Key Plan:

Notes:

1) ALL DIMENSIONS AND LEVELS ARE IN METRES.

-	-	-	-	-	-
Rev	By	Chkd	Apprvd	Date	Description

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PREPARATION OF BUSINESS PLAN

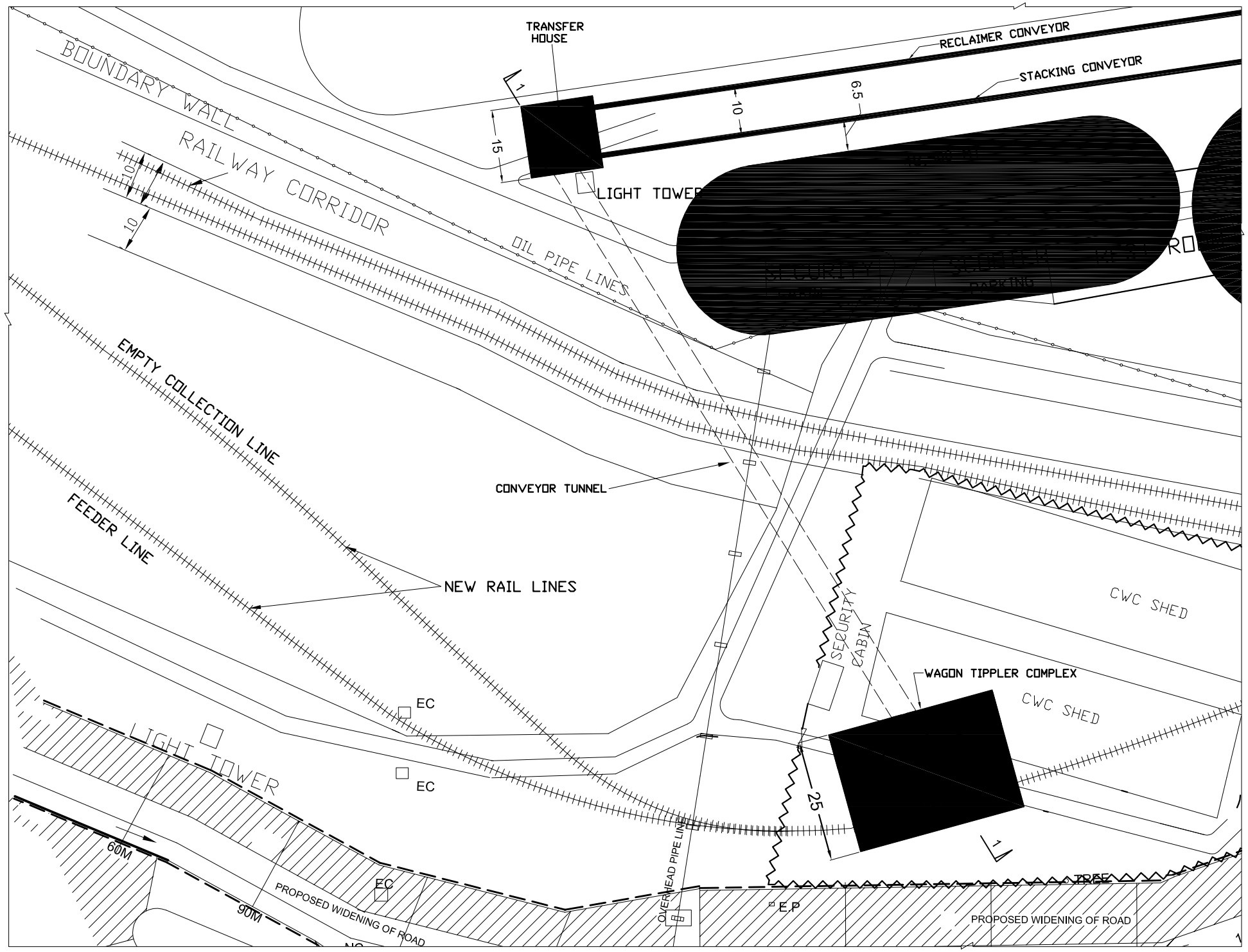
Drawing

INTEGRATION OF
BERTH 8 AND BERTH 9

Drawn by:	TUSHAR	Date: -	JAN 2007
Checked by:	SSI	Date: -	JAN 2007
Approved by:	SSI	Date: -	JAN 2007

Drawing No.	Revision
DCBPMP/03	- R0

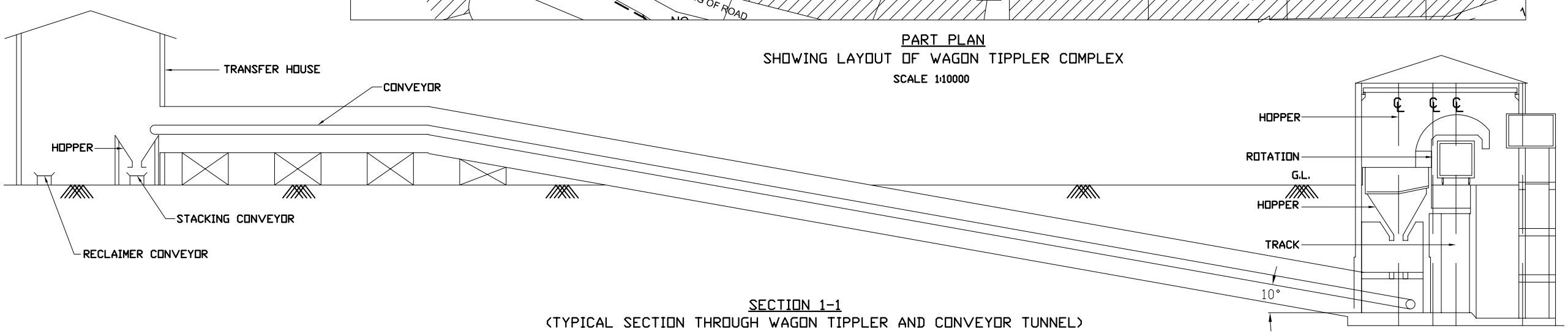
Drawing Scale: at A3 1 : 20000



PART PLAN

SHOWING LAYOUT OF WAGON TIPPLER COMPLEX

SCALE 1:10000



SECTION 1-1

(TYPICAL SECTION THROUGH WAGON TIPPLER AND CONVEYOR TUNNEL)

SCALE 1:5000

Key Plan:

Notes:

1) ALL DIMENSIONS AND LEVELS ARE IN METRES.

-	-	-	-	-	
Rev.	By	Chkd	Apprvd	Date	Description

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PREPARATION OF BUSINESS PLAN

Drawing

DETAILS OF
WAGON TIPPLING
SYSTEM

Drawn by:	TUSHAR	Date: - JAN 2007
Checked by:	SSI	Date: - JAN 2007
Approved by:	SSI	Date: - JAN 2007

Drawing No. DCBPMP/04

Revision - R0

Drawing Scale: at A3

READ THIS DRAWING IN CONJUNCTION WITH DRG. NO. DCBPMP/05 SHT. 1 OF 2

PRELIMINARY

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

Revision	By	Checked	Approved	Date	Description
R1	AKS	VS	SI	SEPT.'06	PRELIMINARY LAYOUT
0	AKS	VS	SI	AUG.'06	PRELIMINARY LAYOUT

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PROJECT
PREPARATION OF BUSINESS PLAN

DRAWING
LAND USE PLAN

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

DRAWING No. DCBPMP/05 | Revision R1

Drawing Scale: N.T.S | Drawing Sheet 1 of 2

CAD filename: DCBPMP/05 | Plot scale: N.T.S

Legends:-

1. MARINE CLUB – STOPPED 6 MONTHS BACK–NOT IN USE (VACANT).
2. DLB OFFICE/CHLD – CARGO HANDLING LABOUR DEPARTMENT.
3. OLD ADMINISTRATIVE BUILDING – ON RENTAL BASIS FOR PVT. PARTIES.
4. ADMINISTRATIVE BUILDING –
5. FIRE STATION – PRESENTLY USED AS A TRAINING CENTRE
6. OFFICERS CLUB – IN USE – EARLIER IT WAS BUNGLOW–6
7. FORT – NOT UNDER MPT.
8. BUNGLOWS – FIRST ONE IS REMOVED (ONLY H4,H5)
9. CANTEEN – DEMOLISHED
10. IN CONSTRUCTION – EARLIER PORT HEALTH ORGANISATION–NOT UNDER MPT.
11. HARBOUR SHOPPING COMPLEX –
12. HATBOUR STATION – NOT IN USE
13. OLD CE'S OFFICE – RENTED TO PVT. PARTY
14. OLD PALACE HOTEL – NOT IN USE
15. LAND IS ON LEASE – TANK
16. LAND IS ON LEASE – TANK
17. LAND IS ON LEASE – TANK
18. TELEPHONE EXCHANGE –
19. OLD QUARTORS (SUB STANDARD) – FOR DEMOLITION
20. SULABH SAUCHALAYA –
21. CUSTOM OFFICE –
22. CHECK POST – GIVEN TO CISF & CUSTOM NEWLY CONSTRUCTED
23. OLD CMES OFFICE – FOR PORT USE AS SUBSECTION FOR DIFFERNET DEPT.
24. SMOKE ROOM –
25. LEASE TO ZIL –
26. FIRE STATION (NEW BUILDING) –
27. WORKSHOP – FOR CHEIF MECHANICAL DEPT.
28. SHIPPING SITE OFFICE –
29. REST ROOM –
30. ORC CRUSHING SHED – PRESENTLY NOT IN USE – SHIFTED TO SOME PLACE SOMETHING ELSE HAS BEEN CONSTRUCTED–VACANT
31. OLD RAILWAY STATION – NOT EXISTING
32. OPEN WELL –
33. RUMDA CHAWL – DEMOLISHED–ONE STRUCTURE IS THERE
34. CANTEEN –
35. RECEIVING SITE OFFICE –
36. SUB STATION –
37. IDLER SHED –
38. SUB STATION –
39. PORT USERS BUILDING –
40. REST ROOM –
41. GOVT. ELECT. DEPT. –
42. T–4 SHED – FOR STOCKING PURPOSE
43. WARE HOUSE – E1 –
44. SITE STORE –
45. OPERATIONAL BUILDING –
46. GATE NO. 9 –
47. WARE HOUSE – E2 –
48. GATE POST –
49. FOOT OVER BRIDGE –
50. SUBSTANDARD QUARTER – DEMOLISHED – NOTHING
51. NOT UNDER PORT – NAVAL BASE WORKSHOP
52. SHEDS (3– SHEDS) – STORAGE PURPOSE
53. MMS (MATERIAL MANAGEMENT SERVICES) – OFFICE
54. MMS STORE – STORE
55. SUMP WELL –
56. SHEDS (2 – SHEDS) –
56(A). WORSHOP OFFICE –
57. SHOPS –
58. STORE (SMALL STORES) –
59. POWER WORKS – REPAIRING, WELDING ETC.(TRUCKS, CARS, MOTOR)
60. MATA SCHOOL – MPT PROPERTY
61. SPORTS ACADEMIC BUILDING –
62. TYPE C & D QURATERS – OLD HOSPITAL COMPLEX
63. TYPE B QUARTERS – OLD HOSPITAL COMPLEX
64. OLD HOSPITAL – NOT IN USE
65. TYPE A & B QUARTERS –
66. INSTITUTE HALL – MP INSTITUTE
67. INSTITUTE BUILDING – MP INSTITUTE
68. RECREATION CENTRE – A SMALL ROOM
69. PORT–CO–OPERATIVE SOCIETY – PRESENTLY VACANT NO USE
70. INCINERATOR – FOR BURNING THE WASTE
71. BHARAT LINES CHAWLS –
72. BHARAT LINES CHAWLS – SUBSTANDARD QUARTERS
73. TYPE A QUARTERS –
74. TYPE A QUARTERS –
75. CHURCH – NOT UNDER MPT
76. OPEN SPACE – MIGHT BE SOME STEPS
77. PORT – QUARTERS – IN USE
78. 100 BED HOSPITAL (NEW) –
79. RESIDENTIAL BUILDINGS –
80. SULABH SAUCHALAYA –
81. SITE OFFICE – CHIEF ENGINEER MAINTAINANCE OFFICE
82. SHOPPING COMPLEX –
83. AMBEDKARI VOCATIONAL CENTRE –
84. HEALTH CENTRE – VACANT
85. SEWAGE TREATMENT PLANT –
86. B–TYPE QUARTERS –
87. C–TYPE QUARTERS –
88. B–TYPE QUARTERS –
89. C–TYPE QUARTERS –
90. B–TYPE QUARTERS –
91. SECONDARY SCHOOL –
92. BUNGLOWS (8–BUNGLOWS) –
93. SIGNAL STATION –
94. CHOWGLE OFFICE – NOT IN MPT ASSETS
95. PLAY FIELD –
96. SUBSTANDARD QUARTER – PARTLY IN USE – ABOUT TO BE DEMOLISHED
97. CISF REST HOUSE – IN USE
98. SUBSTANDARD QUARTER – NOT IN USE
99. PRIMARY SCHOOL –
100. WATER TANK –
101. RESRVOIR –
102. HIGHER SECONDARY SCHOOL –
103. A–TYPE QUARTER –
104. AUDITORIUM – IN USE
105. MUSEUM –
106. DRIVERS REST ROOM –
107. GUEST HOUSE –
108. ANNEXTURE TO GUEST HOUSE –
109. CHAIRMAIN BUNGLOW –
110. SULABH SAUCHALAYA – IN USE
111. D–TYPE QUARTERS – IN USE
112. 2–BUNGLOW – IN USE
113. SUBSTANDARD CHAWL – VACANT – NOT IN USE
114. SUBSTANDARD QUARTER – IN USE – PARTLY
115. SUBSTANDARD QUARTER – VACANT WOULD BE DEMOLISHED IN FUTURE
116. POST OFFICE – NOT UNDER MPT
117. POLICE STATION – NOT UNDER MPT
118. OLD ACCOUNTS OFFICE – RENTED TO PVT. PARTIES – ON LEASE
119. NOT EXISTING –
120. NOT EXISTING –
121. URDU SCHOOL – NOT UNDER MPT
122. VACANT –
123. NASARUL ISLAM SOCIETY – NOT UNDER MPT
124. LEASED OUT TO FOOD CORPORATION –
125. LEASED OUT TO CWC –
126. VACANT –
127. LEASED OUT –
128. VACANT –
129. NOT TEXISTING –
130. CUSTOMS BUILDING – NOT UNDER MPT
131. NOT EXISTING –
132. MARINE WORKSHOP – IN USE
133. NOT EXISTING –
134. TRANSIST SHADE – FOR STOCKING OF EXPORTS & IMPORTS
135. PWD WATER TANK – UNDER MPT
136. WARI INDIAN OIL TANKING LTD. – LEASED
137. RAILWAY STATION – NOT UNDER MPT
138. NOT EXISTING –
139. SILVER SPRING – MINI CHURCH
140. SUB STANDARD QUARTERS –
141. NOT UNDER MPT – MAY BE TO RAILWAYS

Sr. No.	NAME OF THE LESSEE
1	ABG GOA PORT LTD.
2	M/s WESTERN INDIA SHIPYARD LTD.
3	M/s UNITED STORAGE TANKS & TERMINALS LTD.
4	M/s J.R. ENTERPRISES
5	M/s ZUARI INDUSTRIES LTD.
6	M/s INDIAN CORPN. LTD.
7	M/s ZUARI INDUSTRIES
8	M/s FISHERY SURVEY OF INDIA
9A	M/s CENTRAL WAREHOUSING CORPN. AT HEADLAND
9B	M/s CENTRAL WAREHOUSING CORPN. AT LAND
10	M/s FOOD CORPORATION OF INDIA
11	M/s HANESH BENZOPLAST
12	M/s INDIAN OIL CORPN.
13	M/s CHOWGULE EDUCATION ASSOCIATION (MATA SCHOOL)
14	M/s INDIAN MOLLASSES
15	St. CHRISTOPHER CHURCH
16	DEPT. OF TELECOM

READ THIS DRAWING IN CONJUNCTION WITH DRG. NO. DCBPMP/05 SHT. 2 OF 2

PRELIMINARY

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

Revision	By	Checked	Approved	Date	Description
R1	AKS	VS	SI	SEPT.'06	PRELIMINARY LAYOUT
0	AKS	VS	SI	AUG.'06	PRELIMINARY LAYOUT

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PROJECT
PREPARATION OF BUSINESS PLAN

DRAWING
LAND USE PLAN

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

DRAWING No. DCBPMP/05 | Revision R1

Drawing Scale: N.T.S | Drawing Sheet 2 of 2

CAD filename: DCBPMP/05 | Plot scale: N.T.S

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