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MASTER PLAN FOR V. O. CHIDAMBARANAR PORT

Master Plan for V.O. Chidambaranar Port

Prepared for

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1.0 INTRODUCTION

1.1 Background

The Sagarmala initiative is one of the most important and strategic imperatives to realize India's economic aspirations. The overall objective of the project is to evolve a model of port-led development, whereby Indian ports become a major contributor to the country's GDP.

As shown in **Figure 1.1**, the Sagarmala project envisages transforming existing ports into modern world-class ports, and developing new top notch ports based on the requirement. It also aspires to efficiently integrate ports with industrial clusters, the hinterland and the evacuation systems, through road, rail, inland and coastal waterways. This would enable ports to drive economic activity in coastal areas. Further, Sagarmala aims to develop coastal and inland shipping as a major mode of transport for carriage of goods along the coastal and riverine economic centres.

As an outcome, it would offer efficient and seamless evacuation of cargo for both the EXIM and domestic sectors, thereby reducing logistics costs with ports becoming larger drivers of economy.

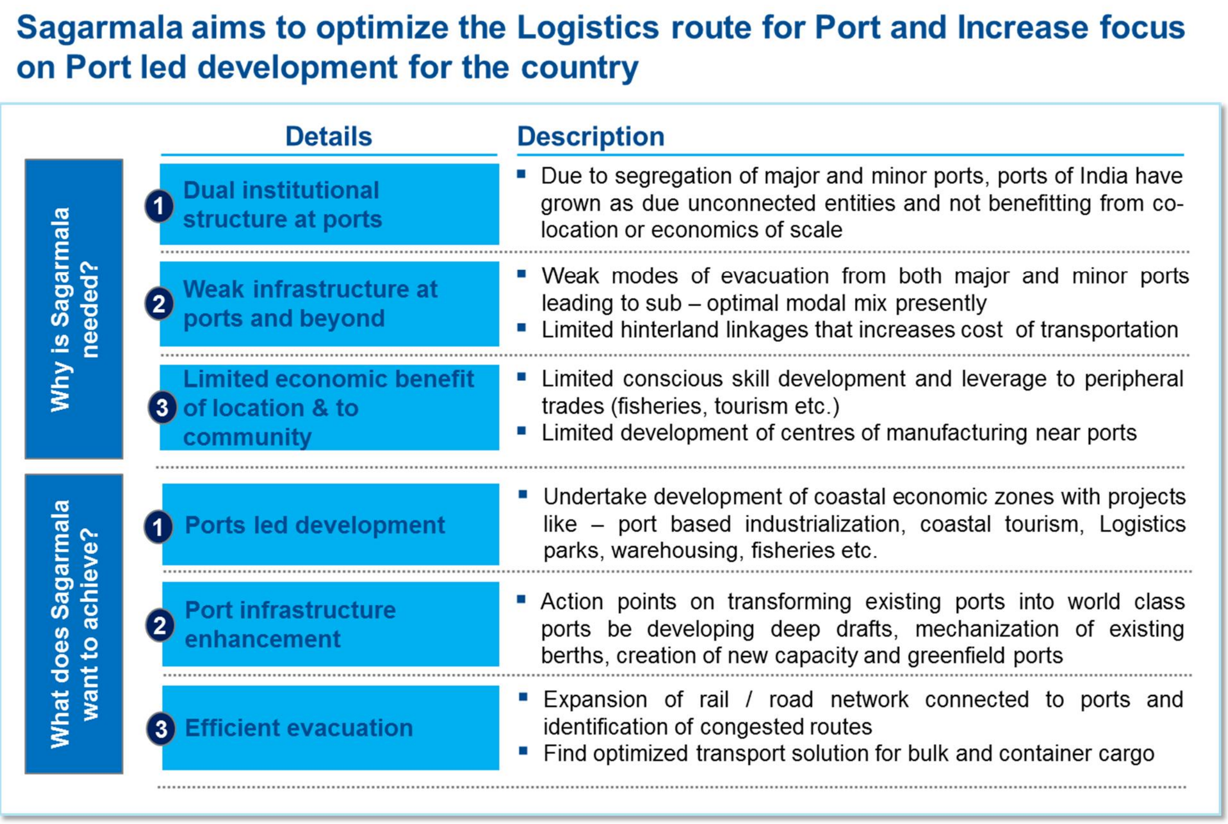


Figure 1.1 Aim of Sagarmala Development

In order to meet the objectives, Indian Port Association (IPA) appointed the consortium of McKinsey and AECOM as Consultant to prepare the National Perspective Plan as part of the Sagarmala Programme.

1.2 Scope of Work

Based on the experience in port-led development, the major engagement challenge to develop a set of governing principles for our approach is shown in **Figure 1.2**.

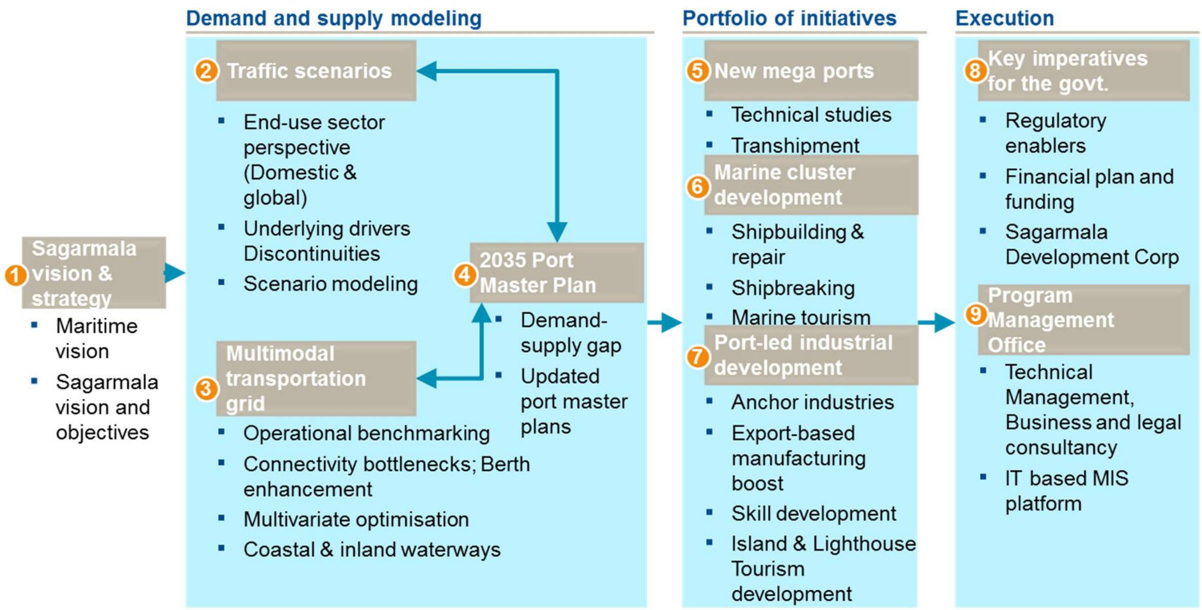


Figure 1.2 Governing Principles of Approach

As indicated above, the origin-destination of key cargo (accounting for greater than 85% of the total traffic) in Indian ports shall be mapped to develop traffic scenarios for a period of next 20 years. The forces and developments that will drive change in the cargo flows shall also be identified. This would lead to the identification of regions along the coastline where the potential for expansion of existing port exists. The various activities involved in the port led developments are charted in **Figure 1.3**.

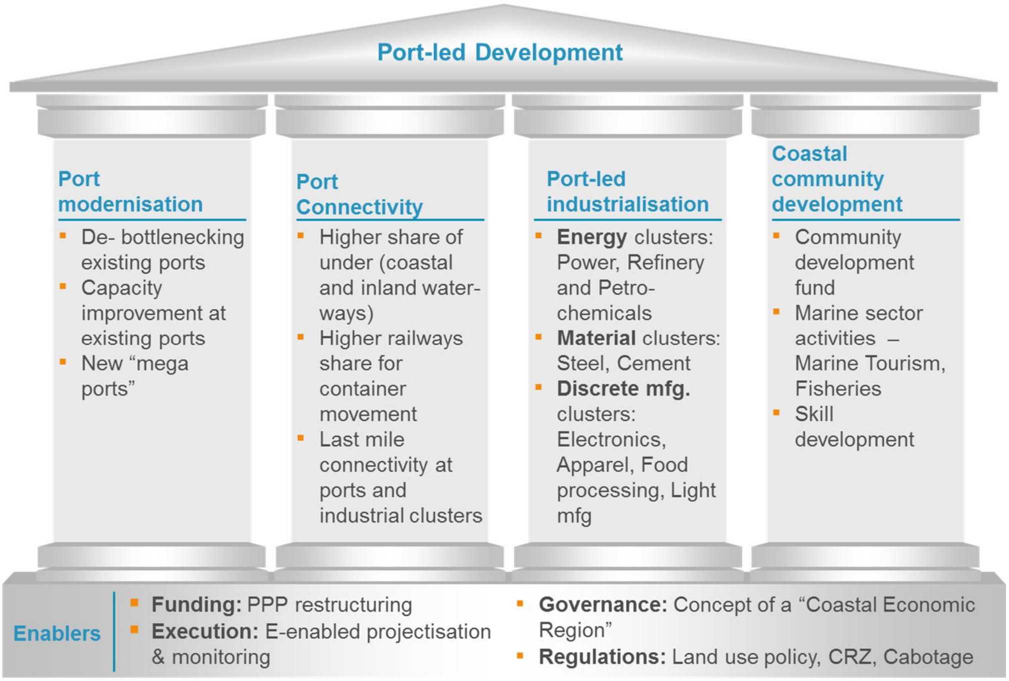


Figure 1.3 Port Led Developments

As part of the assignment, it is also expected to coordinate with the team working on “Benchmarking Operational Improvement Roadmap for Major Ports in India” study (which is being carried out simultaneously along with this assignment) and identify current and future logistic constraints (at the Major Ports) for the top 85% cargo categories based on analysis of current port capacity, productivity levels in comparison to international benchmark and evacuation bottlenecks in the logistics chain. This understanding should be an input in defining the 2035 Master Plan for each port.

Accordingly, this Master Plan report has been prepared taking into consideration the inputs provided on the future traffic and the benchmarking and operational improvements suggested for this port.

1.3 Present Submission

The present submission is the Final report for Development of Master Plan for V. O. Chidambaranar Port as part of SAGARMALA assignment. This report is organised in the following sections:

Section 1.0 : Introduction
Section 2.0 : The Port and Site Conditions
Section 3.0 : Details of Existing Facilities
Section 4.0 : Performance, Options for Debottlenecking & Capacity Assessment
Section 5.0 : Details of Ongoing Developments
Section 6.0 : Traffic Projections
Section 7.0 : Capacity Augmentation Requirements
Section 8.0 : Rail and Road Connectivity
Section 9.0 : Scope for Future Capacity Expansion
Section 10.0 : Shelf of New Projects and Phasing

2.0 THE PORT AND SITE CONDITIONS

2.1 Tuticorin Port as at Present

Tuticorin Port (08° 45‘N and 78° 13‘E) is one of the 12 major ports in India. It is an artificial, deep-water port on the East coast of India in Tuticorin district of Tamil Nadu. It is situated alongside of Palk Strait and inside Gulf of Mannar. It is situated approximately 160km North from Kanyakumari and 129 Nautical miles from Western region connecting international sea route. The location plan is shown in **Figure 2.1**.

Figure 2.1 Location Plan

VOC Port has, at present 14 berths and the port handled a total traffic of about 32 MT during 2014 – 15. The major commodities are coal (≈ 14 MT) followed by containers (≈ 11 MT); Fertilisers (≈ 1.5 MT); Copper concentrate (≈ 1.2 MT); others (≈4 MT)

The layout of port with existing berths as seen from the latest satellite picture is furnished in **Figure 2.2**.

Figure 2.2 VOCPT Port Layout Satellite Image

There are three coal berths exclusively handling thermal coal for captive power plants and one oil berth for handling POL products, LPG and chemicals. There are two exclusive container terminals each with one berth operated by two different BOT operators. The other eight berths handle all other cargo including thermal coal meant for other power plants, industrial coal, copper concentrate, fertilisers and general cargo.

While liquid cargo and containers are handled in exclusive berths with dedicated facilities, thermal coal meant for captive use of nearby power plants of TNEB & NTPL is handled in exclusive berths and conveyed through mechanized methods. However identical/similar cargoes like thermal coal meant for private power plants, industrial coal, and pet coke meant for multiple users are handled in multi-cargo berths through semi-mechanized methods for unloading, stacking and evacuation. Similarly bulk cargoes like lime stone, copper concentrate whose quantity is considerable are handled and conveyed by semi-mechanized methods. All these are bulk import cargoes having potential to cause pollution while being handled the side of food grains, fertilizers and other general cargoes in multipurpose berths.

2.2 Road Connectivity

V.O. Chidambaranar Port is connected with major National Highways connecting through three major cities/ urban centres in Tamil Nadu like Tirunelveli, Madurai and Kanyakumari.

- NH-45 beyond Tirunelveli road intersection meeting Tuticorin – Madurai (NH-45B)
- Tuticorin – Tiruchendur (NH7A) road cutover NH7 connecting to Kanyakumari

All-important destinations in India from North or East could be accessed through NH7 to travel south as shown **Figure 2.3** in below.

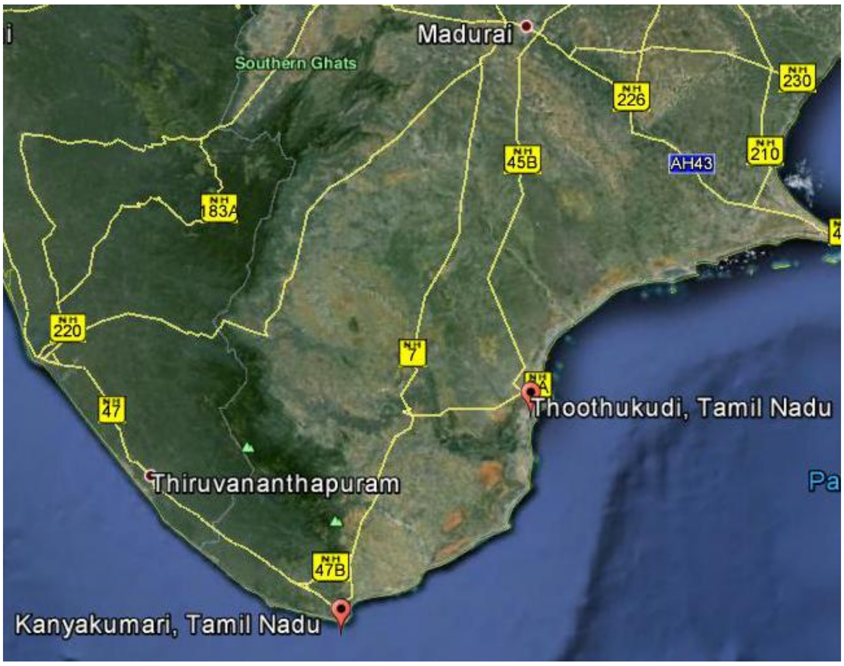


Figure 2.3 Road Connectivity to Tuticorin

2.3 Rail Connectivity

Presently a Broad Gauge single line connects the Port area originating from Milavattan Railway station. The total length of this railway line is 17.60 km as shown in **Figure 2.4**.

The distance from Milavattan Railway station to VOC wharf is 14.0 km and VOC wharf to Marshalling yard is the balance length near coal yard with a loop line with 5 no. lines available in the Marshalling yard.

Figure 2.4 Rail Connectivity to VOC Port

2.4 Site Conditions

2.4.1 Meteorology

The weather of Tuticorin constitutes extended summer and tender winter influenced by tropical hot climate. The temperature in summer varies from 25° C to 40° C. The hottest months are found to be May and June. The monsoon season commences around August and lasts till October. The mean atmospheric pressure reduced to MSL is 1010.70 mb. The monthly maximum observed mean sea level pressure is 1014.00 mb.

2.4.1.1 Winds

The governing wind direction in India is NE and SW influenced by monsoon. Monsoonal winds occur from WNW – WSW during May to August and N – ENE during November to February in this region. Prevailing winds was high during 1966 i.e. 47 days with wind speed of 40 kmph.

Annual Wind distribution percentage at Tuticorin is presented for a period of 1961-90 in **Table 2.1**.

Table 2.1 Annual Wind Distribution at Tuticorin (%)

MONTH		WIND												
		No. OF DAYS WITH WIND SPEED (KMPH)				PERCENTAGE No. OF DAYS WIND FROM								
		0	1 - 19	20 - 61	62 or more	N	NE	E	SE	S	SW	W	NW	CALM
JAN	I	0	24	7	0	66	16	1	0	0	0	0	17	0
	II	0	6	25	0	5	43	49	2	1	0	0	0	0
FEB	I	0	25	3	0	58	16	1	1	1	2	1	20	0
	II	0	8	20	0	1	25	61	10	3	0	0	0	0
MAR	I	0	29	2	0	39	20	5	2	3	7	6	17	1
	II	0	13	18	0	1	11	47	26	13	1	1	0	0
APR	I	1	28	1	0	17	13	6	5	9	13	16	18	3
	II	0	14	16	0	1	2	15	37	40	2	2	1	0
MAY	I	1	26	4	0	7	4	2	3	10	25	34	13	2
	II	0	13	18	0	0	0	2	19	44	11	22	2	0
JUN	I	0	19	11	0	1	0	0	2	10	30	51	6	0
	II	0	7	23	0	0	0	0	6	11	15	64	4	0
JUL	I	0	20	11	0	2	1	1	1	5	18	60	11	1
	II	0	9	22	0	0	0	2	10	10	10	64	4	0
AUG	I	0	20	11	0	4	3	1	1	2	13	62	14	0
	II	0	11	20	0	0	0	2	13	14	7	60	4	0
SEP	I	0	24	6	0	9	7	3	1	5	18	42	14	1
	II	0	14	16	0	1	1	2	13	28	11	40	4	0
OCT	I	0	29	2	0	19	12	3	4	4	14	23	20	1
	II	0	23	8	0	3	8	11	18	31	10	14	4	1
NOV	I	0	24	6	0	45	19	2	1	2	6	8	16	1
	II	0	19	11	0	8	32	26	14	11	3	3	2	1
DEC	I	0	23	8	0	60	22	1	0	1	2	1	13	0
	II	0	13	18	0	12	52	27	4	3	1	0	1	0

MONTH		WIND												
		No. OF DAYS WITH WIND SPEED (KMPH)				PERCENTAGE No. OF DAYS WIND FROM								
		0	1 - 19	20 - 61	62 or more	N	NE	E	SE	S	SW	W	NW	CALM
ANNUAL TOTAL OR MEAN	I	2	291	72	0	27	11	2	2	4	12	25	15	1
	II	0	150	215	0	3	15	20	14	17	6	23	2	0
NUMBER OF YEARS	I	31				31								
	II	31				31								

<u>*2.4.1.2 Rainfall*</u>

More than 70% of rainfall occurs during the month of October to December. Annual Average monthly rain distribution percentage at Tuticorin is presented for the period 1961-90 in **Table 2.2** below.

Table 2.2 Average Monthly Distribution of Rainfall

Month	RAIN FALL						
	Monthly Total	No. of Rainy Days	Total in Wettest Month with Year	Total in Driest Month with Year	Heaviest Fall in 24 Hours	Date and Year	Mean Wind Speed
	mm		mm	mm	mm		kmph
JAN	14.9	1	155.8 1961	0	90	11, 1961	19
FEB	17.6	1.1	99.2 1959	0	51.8	28, 1974	17.9
MAR	36.5	1.9	164.4 1971	0	71	7, 1971	15.2
APR	56.6	3	162.1 1970	0	126	2, 1961	12.6
MAY	20.9	1	163.1 1972	0	94.4	9, 1977	13.4
JUN	3.1	0.3	21.0 1970	0	21	4, 1970	16.7
JUL	10.8	0.7	142.1 1964	0	66.1	28, 1964	17.1
AUG	7.3	0.7	37.1 1971	0	30.2	12, 1972	16.8
SEP	17.7	1.2	101.7 1979	0	58.3	6, 1979	14.6
OCT	157.1	7.3	485.4 1972	23	167.4	28, 1957	11.7
NOV	206	8.3	441.1 1961	34.8	163.2	25, 1978	13.2
DEC	92.2	5	301.9 1955	14.6	188.2	3 1955	16.7

2.4.1.3 Air Temperature

The mean daily maximum and minimum temperature were observed to be 35.8° C and 21.30° C respectively. The maximum temperature at Tuticorin ranges between 41.1° and 33.3° C, while minimum temperature varies between 21.3° to 15.3° C. Month wise Maximum and Minimum Temperature at the port vicinity is presented in **Table 2.3** below.

Table 2.3 Maximum and Minimum Temperature - Monthwise

Month	MEAN						EXTREMES			
	Dry Bulb	Wet Bulb	Daily Max	Daily Min	Highest in the Month	Lowest in the Month	Highest	Date and Year	Lowest	Date and Year
	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
JAN	24.4	21.9	28.6	21.3	29.9	18.8	33.3	12	15.3	15
	27.2	23.9						1955		1990
FEB	25.6	23	29.5	22.3	31.5	19.6	35.8	9	17.2	4
	28.1	24.6						1965		1989
MAR	27.9	24.9	31.2	24.2	33.4	21.2	34.8	28	15.6	2
	29.6	25.8						1961		1989
APR	29.9	26.2	32.9	25.6	35.3	23	39.1	29	19.9	12
	30.9	26.9						1973		1984
MAY	30.7	25.9	34.9	26.5	38.4	23.8	41.1	14	21.1	26
	32.2	27						1956		1986
JUN	30.3	25	35.8	26.1	38.3	23.8	39.8	8	21.3	4
	32.5	25.3						1987		1970
JUL	29.8	24.4	35.2	25.8	37.8	23	39.4	11	20.4	15
	31.8	24.9						1987		1986
AUG	29.8	24.3	35	25.8	37.6	23.3	39.3	19	20.7	24
	31.5	24.9						1990		1969
SEP	29.6	24.4	34.1	25.3	37.5	23	38.7	5	20.7	30
	30.9	25.3						1980		1987
OCT	28.1	24.7	32.1	24.2	35.8	21.5	38.6	7	17.7	19
	29.3	25.4						1990		1984
NOV	26.4	23.9	30	23.2	32.4	20.8	34.9	9	17.8	17
	28.1	24.9						1969		1986
DEC	25.1	22.8	29	22.1	30.8	19.6	33.3	7	15.6	14
	27.4	24.4						1972		1984

2.4.1.4 Visibility

Generally, the visibility is comprehensible; visibility in the monsoon normally deteriorates during rains and occasional squalls. Visibility data are recorded at Tuticorin daily and observation records are available since 1961-1990. Analysis of the average visibility ratio for every month is carried out based on I.M.D. maintained data for a period of 30 years. Around the year more than 84% of the days the visibility is explicit even over 20 km. On an average only one day over the years is visible up to 4 km and around 5 days up to 10 km.

2.4.1.5 Relative Humidity

The average humidity ranges from nearly 79% in December to about 59% in June.

2.4.2 Oceanography

2.4.2.1 Tides

The tide range at Tuticorin relative to the Chart Datum (CD) is as follows:

• Lowest Low Water Level	(LLWL)	+ 0.11 m
• Mean Lower Low Water Springs	(MLLWS)	+ 0.25 m
• Mean Low Water Springs	(MLWS)	+ 0.29 m
• Mean Low Water Neaps	(MLWN)	+ 0.55 m
• Mean Sea Level	(MSL)	+ 0.64 m
• Mean High Water Neaps	(MHWN)	+ 0.71 m
• Mean High Water Springs	(MHWS)	+ 0.99 m
• Highest High Water Level	(HHWL)	+ 1.26 m

The above levels are with respect to chart datum, which is approximately the level of Lowest Astronomical Tide.

2.4.2.2 Currents

North/ South current are created at the approach channel of range 0.5 – 1.0 Knots due to seasonal wind. The current direction is southwards during Dec – Mar, East – North East during May – Sep. During monsoon predominant direction is SSE (South South East) to SSW (South South West) for NE monsoon. The current magnitude ranges around 0.5 – 1.0 Knot most of the time during NE monsoon. During SW monsoon the directions are wider with magnitude of 0.5 Knots and less for most of the period.

2.4.2.3 Cyclone

Cyclone might occur during NE monsoon at Tuticorin. Tuticorin is not a frequent cyclone prone area. Even then on Nov 13th, 1992 at 1610 IST the port was hit directly by a cyclone with 113Kmph from ESE direction. In Dec 2000 port experienced shadow effects of the cyclone that passed nearby Tuticorin. NIOT managed to record a maximum wave height of 3 m off Tuticorin during this cyclone.

2.4.3 Geotechnical Data

Borehole data collected at Tuticorin Port trust as reported in the report of I-Maritime, 2013 for DPR of Outer Harbour indicates that the seabed profile for BH 12 at 11.1m CD generally comprises of hard limestone between11.10m – 12.51 m CD and soft limestone at 12.5m – 12.89 m CD. Whereas BH 27 profile at 6.85 m CD comprises of clayey sand between 6.85 m – 7.85 m CD, Silty sand between 13.85m – 21.05 m CD and Calcareous Sandstone between 7.85 m – 13.85 m; 21.05 m – 25.10 m CD.

3.0 DETAILS OF EXISTING FACILITIES

3.1 General

Tuticorin Port presently handles commodities such as thermal coal, coking coal, limestone, iron ore, fertilizers and other break bulk cargo. The port also handles substantial quantities of POL at a dedicated jetty through pipelines. The total land area of the port is 2597.70 acres; Water spread area is 960 acres and is located south of Old Tuticorin Harbour.

The V. O. Chidambaranar port has an artificial harbour protected by two rubble mound breakwaters and is connected to deep water by a dredged channel.

The locations of the berths are shown in the following **Figure 3.1.**

Figure 3.1 Existing Facilities

The features of the existing harbour are as shown in below **Table 3.1**.

Table 3.1 Details of Breakwater and Channel

Breakwater	
• North Breakwater	4086 m
• South Breakwater	3876 m
Approach Channel	
• Length	3800 m
• Width	230 m
• Depth	14.7 m below CD
Entrance Channel	
• Length	300
• Width	153 m
• Depth	14.7 m below CD
Turning Basin	
• Diameter	488 m
• Depths	14.1 m below CD

3.2 Existing Jetties and Quays

The present berthing infrastructure at Tuticorin port can be divided into two categories (**Figure 3.1**) viz., coal & oil berths/jetties along the lee of North breakwater and container, multipurpose & shallow draft berths along the lee of South breakwater. There are 4 general cargo berths within a dock like basin at the North West side of Southern breakwater kink and 2 others parallel to it. Two privatised container terminals and a deeper draft quay are reclaimed next to general cargo berths. On the northwest side of the reclaimed quay shallow berths are assigned for construction materials. A small finger jetty exists adjacent to shallow berths. One deeper coal berth, two coal jetties and one oil jetty are being operated alongside the North breakwater. **Table 3.2** provides details of all the berths at V.O. Chidambaranar Port.

Table 3.2 Details of Berthing Infrastructure

S. No.	Berth Description	Length (m)	Draft (m)	Cargo Handled
1.	Berth No I	168.0	9.30	General Cargo
2.	Berth No II	168.0	9.30	General Cargo
3.	Berth No III	192.0	10.70	General Cargo
4.	Berth No IV	192.0	10.80	General Cargo
5.	Berth No V	168.0	8.60	General Cargo
6.	Berth No VI	168.0	9.30	General Cargo
7.	Berth No VII	370.0	10.90	Container
8.	Berth No VIII	345.0	12.80	Container
9.	Berth No IX	334.5	12.80	General Cargo
10.	Oil Jetty	228.0	12.80	POL
11.	Coal Jetty I	185.0	12.80	Thermal Coal For TNEB
12.	Coal Jetty II	210.0	12.80	Thermal Coal For TNEB
13.	SDB (Shallow Draft Berths)	140.0	5.85	Coast Guard Utility
14.	NCB I (North Cargo Berth I)	306.0	12.80	Thermal Coal for NTPL
15.	Finger Jetty	121.0	4.50	Port Craft Utility

3.2.1 Berth I – IV

It has a quay length of 732 m with four berths viz. Berth I, Berth II, Berth III and Berth IV. Berth I can handle 25,000 DWT, Berth II can handle 40,000 DWT, Berth III can handle 50,000 DWT and Berth IV can handle 50,000 DWT size vessels. All these are multi-purpose berths are handling industrial coal, cement, fertilizers, and other bulk cargos.

3.2.2 Berth V – VI

This quay has two berths (Berth V & VI) with a length of 168 m each and draft of 8.6 m and 9.3 m respectively. These berths are multipurpose berths and can accommodate vessel sizes of 40,000 - 45000 DWT handling logs, construction materials, stones/rocks and other general cargoes.

3.2.3 Berth VII

This quay is a single berth having 10.9 m draft and 370 m of quay length facing perpendicular to Berth V–VI. It is a container berth operated by M/S PSA SICAL on BOT basis since July 1998. This berth is capable of accommodating container vessel sizes up to 50,000 DWT.

3.2.4 Berth VIII

This berth has a draft of 12.8 m and 345.50 m of quay length. It is also a container berth and operated by M/s. Dakshin Bharat Gateway Terminals on BOT basis. This berth is capable of accommodating container vessel sizes up to 60,000 DWT.

3.2.5 Berth IX

Berth IX is one of the deeper berths at VOCPT and is located next to Berth VIII. It has a draft of 12.8 m and the length of 334.5 m. Similar to berths VII and VIII this berth has a reclaimed backup area of approximately 6 Ha behind it and is used as container stack yard.

3.2.6 Coal Jetties (CJ-I & CJ-II)

The Port has two coal jetties at the northern end of north breakwater lee operated by TNEB (Tamil Nadu Electricity Board). Each jetty has a draft of 12.8 m. The main jetty length of CJ I & II are 185 m and 210 m respectively. The lengths of the jetties from dolphin to dolphin facilities are 340 m each. It can accommodate vessel sizes up to 50,000 to 60,000 DWT. These berths are equipped with shore reception hopper facilities for unloading of coal and are connected to conveying system leading to the power plant stack yard.

3.2.7 Oil Jetty (POL)

VOCPT has an oil jetty with a draft of 12.8 m with jetty head of 30.3 m with dolphins of size 15 m X 15 m at each side of berth at 11.35 m from jetty head located in the lieu of north breakwater. This berth handles petroleum, oil and lubes (POL) LPG and Liquid Ammonia. This berth can handle tankers up to 65,000 dwt with Length Overall (LOA) up to 229 m.

3.2.8 NCB-I (North Cargo Berth)

North cargo berth has commenced operations recently is located along the lee of Northern breakwater. This berth being a deep a draft berth of 14.1 m depth can handle Panamax vessels up to a draft of 12.8 m. This is a captive berth for unloading thermal coal meant for NTPL power plant.

3.3 Cargo Handling System

3.3.1 Coal Handling System

Coal handling through Tuticorin Port is basically imports of thermal coal for Power Plants located in the vicinity of Port. Presently there are two main power plants as below.

1. Tuticorin Thermal Power station (TTPS) of TANGEDCO Located in Port Estate - 1050 MW consisting of five units of 210 MW each.
2. NTPL Power plant near TANGEDCO power plant – 1000 MW Power plant consisting of 2 units of 500 MW

In addition to the above there are a few small/mini thermal power plants in and around Tuticorin all owned by private industries some of which are meant for captive use of the specific industries.

Further coal is also imported by private traders for use of various industries like cement plants, sugar plants, paper industry etc., in the hinterland.

The coal jetties CJ1 and CJ2 handle coal meant for TANGEDCO power plant through a two mechanical coal handling conveyor system is available from the respective berths of Tuticorin Port to the power plant's stack yard direct with any transit stacking with annual throughput of around 6 MT. The berths CJ1 and CJ2 were constructed by the port authority the top side facilities like Hoppers for receiving coal from the ship's cranes and the conveyor system are owned, operated and maintained by Tangedco.

The salient features of the conveyor system from CJ-I are given in **Table 3.3**:

Table 3.3 Coal Handling System at CJ-I

S. No	Conveyor No.	Length	Power		Belt Used	Belt Width	Speed	Capacity
		(m)	(KW)	(KV)	(Material)	(mm)	(m/s)	(TPH)
1.	13	252.00	150.0	415.0	Nylon	1400	3.300	2000
2.	13A	255.00	150.0	415.0	Nylon	1400	3.300	2000
3.	14	300.00	150.0	415.0	Nylon	1400	3.300	2000
4.	15	837.60	336.0	6.6	Nylon	1400	3.300	2000
5.	16	847.00	336.0	6.6	Nylon	1400	3.300	2000
6.	17	1,240.00	485.0	6.6	Nylon	1400	3.300	2000
7.	19	265.00	300.0	6.6	Nylon	1400	3.300	2000
8.	BFD-8	26.40	45.0	415.0	Nylon	1800	2.500	2000
9.	RBFD-11	9.35	30.0	415.0	Nylon	2000	1.000	2000
10.	45	101.20	300.0	6.6	Nylon	1800	2.450	2000
11.	46	76.45	115.0	6.6	Nylon	1800	2.500	2000
12.	43	107.92	240.0	6.6	Nylon	1800	2.500	2000
13.	47	101.53	300.0	6.6	Nylon	1800	2.450	2000
14.	62	174.94	115.0	415.0	Nylon	1800	1.250	900

The salient features of the conveyor system from CJ-II are given in **Table 3.4.**

Table 3.4 Coal Handling System at CJ-II

S. No	Conveyor No.	Length	Power		Belt Used	Belt Width	Speed	Capacity
		(m)	(KW)	(KV)	(Material)	(mm)	(m/s)	(TPH)
1.	65	284.00	255.0	6.6	Nylon	1800	2.500	2000
2.	66	167.75	160.0	6.6	Nylon	1800	2.500	2000
3.	67	996.19	485.0	6.6	Nylon	1800	2.500	2000
4.	68	127.70	160.0	6.6	Nylon	2000	2.000	2000
5.	69	669.90	416.0	6.6	Nylon	1800	2.500	2000
6.	70	711.30	436.0	6.6	Nylon	1800	2.500	2000
7.	71	549.96	365.0	6.6	Nylon	1800	2.500	2000
8.	72	885.33	604.0	6.6	Nylon	1800	2.500	2000
9.	73	97.63	188.0	6.6	Nylon	1800	2.500	2000
10.	48A	192.45	209.0	6.6	Nylon	1800	1.300	1100
11.	48B	194.68	209.0	6.6	Nylon	1800	1.300	1100
12.	48A1	252.23	175.0	6.6	Nylon	1400	2.417	1100
13.	48B1	262.23	175.0	6.6	Nylon	1400	2.417	1100
14.	61	157.30	236.0	6.6	Nylon	1800	2.500	2000
15.	64	49.722	118.0	6.6	Nylon	1800	2.500	2000

The locations and plan of the conveyor system from jetty to the plant stack yard is shown in detail in **Figure 3.2** & **Figure 3.3** for CJ-I & CJ-II.

Figure 3.2 Converyor Plan from Coal Jetty CJ2 upto the Port Limit

Figure 3.3 Converyor Plan from Coal Jetty CJ2 to the Port Limit and to their Yard

Similarly the coal meant for NTPL power plant is handled exclusively from their captive berth NCB1 through a fully mechanized handing system consisting of gantry grab unloaders and conveyor system leading to their power plant direct without any intermediate stack yard inside the port. The berth NCB1 and the entire handling system is installed and operated by NTPL on BOT basis

3.3.2 Container Handling System

The port does not own any container handling systems as the container berths are privatised on BOT basis. Each container berth has their own equipment based on their requirement.

Terminal VII (PSA SICAL) has a capacity of 4,50,000 TEU and terminal VIII (DBGT) has a capacity of 6,00,000 TEU. The equipment deployed at the terminals as of now are listed in **Table 3.5**

Table 3.5 Major Container Handling Equipment Deployed by BOT Operators as of Now

BOT Operator Description	Quantity (No.)	Rated Capacity (T)
Equipment Deployed by M/S PSA SICAL		
• Rail Mounted Quay Crane	3	40
• Rubber Tyre Gantry Crane	8	40
• Tractor Trailers	12	55
Equipment Deployed by M/S DBGT		
• Reach Stackers	2	45
• Prime movers & Trailers	8	50
• Harbour Mobile Crane	1	200
• Harbour Mobile Crane	2	100

3.3.3 Other Equipment

Apart from the mechanized Coal and Container handling terminals, the port has some own and other equipment deployed on BOT basis for efficient loading/unloading operations. The details are outlined in **Table 3.6**

Table 3.6 Other Loading/ Unloading Equipment in VOCPT

Equipment Description	Quantity (No.)	Rated Capacity (T)
Equipment Deployed by VOCPT		
• Wharf Crane	2	6
• Wharf Crane	2	10
• Wharf Crane (Grab)	3	20
• Floating Crane	1	4
Equipment Deployed by BOT Operator		
• Harbour Mobile Cranes	2	124
• Floating Crane	1	35
• Self-Propelled Barge	3	2000

It is pertinent to note that besides these, certain other private equipment is permitted from time to time as necessary.

3.4 Storage Facilities

The logistic operations are supported by storage arrangements by V.O. Chidambaranar Port Trust. In addition to the open stack yard, there are transit Sheds, warehouses and other storage facilities inside and outside the Port area as presented in **Table 3.7** below.

Table 3.7 Details of Storage Facilities

Description	Quantity	Location	Capacity		Commodity
			Dry	Liquid	
OWNED BY PORT					
• Warehouses	3	Inside	14,940.00 m^2		
• Transit sheds	2	Inside	10,800.00 m^2		
• Dangerous Cargo Sheds	1	Inside	733.00 m^2		
• Fumatorium	1	Inside	739.00 m^2		
• Open area	1	Inside	5,53,000.00 m^2		
OWNED BY PRIVATE PARTIES (In Port's Leased Land)					
• Warehouses	14	Outside	4,23,000.00 m^2		
• Warehouses	2	Outside	36,000.00 m^2		
• Tank	3	Inside		15,000.00 m^3	Phosphoric acid
• Tank	1	Outside		13,700.00 KL	Naphtha
• Tank	1	Outside		13,800.00 KL	Naphtha
• Tank	1	Outside		14,100.00 KL	Naphtha
• Tank	3	Outside		25,500.00 KL	Furnace oil
• Tank	1	Outside		750.00 KL	LSFO
• Tank	1	Outside		540.00 KL	LSHFHSD
• Tank	3	Outside		7,800.00 KL	Petrol
• Tank	2	Outside		15,000.00 KL	HSD
• Tank	2	Outside		10,830.00 KL	Kerosene
• Tank	2	Outside		7,790.00 KL	EDC
• Tank	1	Outside		15,000.00 KL	LPG
• Tank		Outside		2,000.00 m^3	VCM
• Tank	1	Outside		5,000.00 m^3	VCM
• Tank	1	Outside		10,000.00 m^3	Ammonia

3.5 Pilotage and Towage Facilities

Pilotage is compulsory for all vessels having capacity of more than 200 MT Gross Tonnage. The port has tugs, launches and mooring boats for pilotage and towage operations as listed in **Table 3.8**.

Table 3.8 Floating Crafts

Description	Quantity	Capacity	Owned/ Hired/ Lease
Tugs	1	32T BP	Own
Tugs	1	45T BP	Own
Tugs	1	50T BP	Hired
Tugs	1	50T BP	Hired
Launches	1	20 knots	Hired
Launches	1	48 GRT	Own
Launches	1	48 GRT	Own
Launches	1	2x640 BHP	Own
Launches	1	20 Knots	Hired
Mooring Boats	2	1x54 BHP	Own

4.0 PERFORMANCE, OPTIONS FOR DEBOTTLENECKING & CAPACITY ASSESSMENT

4.1 General

The total cargo handled through the existing facilities, during the past 5 years ending March 2015, is presented in the following **Table 4.1**.

Table 4.1 Cargo Handled During Last 5 Years

S. No.	COMMODITY	2010-11	2011-12	2012-13	2013-14	2014-15
IMPORT (MTPA)						
1.	Liquid cargoes	1.15	1.29	1.21	0.94	1.11
2.	Fertilizer	1.16	1.11	0.49	0.39	0.42
3.	F.R. Materials	0.73	0.89	0.56	0.79	1.05
4.	Coal	8.19	9.28	10.62	12.15	13.80
5.	Pet coke	0.07	0.11	0.07	0.20	0.21
6.	General Cargo	2.49	2.56	2.88	2.06	2.76
7.	Other General Cargo	1.36	1.22	0.55	0.56	0.25
8.	**Total Imports**	**15.16**	**16.46**	**16.37**	**17.09**	**19.60**
EXPORT (MTPA)						
1.	Dry Cargoes	0.72	0.43	0.46	0.48	0.30
2.	Liquid Cargoes	0.54	0.47	0.70	0.55	0.40
3.	Food Grains	0.04	0.30	0.13	0.05	0.06
4.	General Cargo	1.05	1.06	0.95	0.34	0.96
5.	Other General Cargo	0.06	0.15	0.27	0.01	0.06
6.	**Total Export**	**2.40**	**2.42**	**2.52**	**1.42**	**1.78**
LIGTHERAGE AT (MTPA)						
1.	Old Harbour	0.78	0.68	0.04	0.12	0.13
2.	V.O.Chidambaranar Port Trust	0.21	0.26	0.30	0.07	0.26
3.	**Total Lighterage**	**0.99**	**0.94**	**0.33**	**0.19**	**0.40**
CONTAINER TRAFFIC						
1.	Import (Mil TEUs)	0.23	0.23	0.23	0.25	0.29
2.	Export (Mil TEUs)	0.24	0.25	0.24	0.26	0.27
3.	**Total Traffic (Mil TEUs)**	**0.47**	**0.48**	**0.48**	**0.51**	**0.56**
4.	**Total Traffic (MTPA)**	**8.17**	**9.23**	**9.37**	**10.13**	**11.03**
TOTAL TRAFFIC (MTPA)						
1.	Old Harbour	0.78	0.68	0.04	0.12	0.13
2.	V.O. Chidambaranar Port Trust	**25.94**	**28.36**	**28.56**	**28.71**	**32.68**
	Total	**26.71**	**29.05**	**28.59**	**28.83**	**32.81**

4.2 BCG Benchmarking Study

BCG, as part of their benchmarking study, has looked into the operation of the berths and has suggested various measures for improving the performance. The report of BCG pertaining to V. O. Chidambaranar Port is given in the **Annexure 1**. The key observations are as follows:

According to them VOCPT has Potential to handle additional cargo volume but it is constrained by low productivity and draft constraints. The findings and suggestion for the Tuticorin port are as follows-

4.2.1 Cargo Volume Analysis

The Tuticorin port has handled 32 MT in 2015 which is an increase over 5 year CAGR of 6%. Due to recently commissioned power plants in and nearby Tuticorin port, the coal cargo volume demand has been increasing. Both coal and container has shown traffic growth consistently for the past 5 years. The percentage of occupancy of the coal berths as calculated are found to be very high, mainly due to the increase in volume for newly operating power plants and this is expected to grow much more in the coming years. Once the new power plants are installed as planned operate to their full capacity, the demand for coal is expected to increase by 43% by 2017-19.

4.2.2 Berth Occupancy

The berths approximately have occupancy of 75% presently. The highest occupied berth is IX and the other general cargo berths have occupancy of around 65%. (Refer to **Figure 4.1** for detailed occupancy berth-wise).

4.2.2.1 Coal Berths

The Tuticorin port handles coal for TNEB in CJ-I and CJII. Coal meant for other than TNEB is handled at berth IX, which is the only deep draft multi-purpose berth (12.8 m draft). The port actually faces certain constraints for handling coal since fully loaded Panamax vessels cannot be brought into port unless unloaded partially at anchorage. The partially unloaded Panamax vessels are again partially unloaded at berth IX due to draft constraints before taken to other multi-purpose berths.

Productivity at the anchorage is significantly lower than at berths due to rough weather, higher handling cost etc. Comparison on cost of offloading Panamax vessel at nearest deeper port (Karaikal) shows anchorage offloading is cheaper. To the present floating crane and 3 barges an additional floating crane by a third party invited by the port is suggested.

4.2.2.2 Container Berths

The Tuticorin port handles container at two berths namely VII & VIII. Occupancy of berth VII is optimal due to consolidated cargo i.e. occupancy is nearly maximal and there is limited scope of traffic growth. Limitation in berth strength to take higher capacity cranes on quay is a drawback. PSA owned berth VII works on royalty based model with VOCPT. Productivity is higher than TAMP norms and profit margin is reduced every year due to high royalty.

Occupancy of berth VIII is less for now due to absence of handling equipment despite of 12.8 m draft. Due to this it could not get the needed attention form international shipping lines. However this terminal is expected to be equipped with container quay cranes by 2016-17.

4.2.2.3 Fertilizer Berths

The Tuticorin port handles fertilizer at multi-purpose berths namely II, III, IV VI and IX. The scope of traffic growth for fertilizers is dependent on increase in agricultural activities. Approximate traffic of 1.7 MT is handled at VOPCT in all the above mentioned berths in total. The low productivity at berths II, III, IV and VI is due to vessels lightened at berth IX. The other reason influencing low productivity is limitation in the capacity of cranes available for ship to shore operations.

4.2.3 Key Findings & Recommendations

4.2.3.1 Coal Handling Productivity

1. Panamax vessels with over 12.8 m draft cannot enter the port.
2. All Panamax vessels with a loaded draft of more than 12.8 m have to resort to lighterage operations at anchorage till they attain the permissible draft.
3. Coal handling capacity needs to be improved on productivity to create additional capacity.
4. Average productivity at anchorage is approx. 8000 T/day against 20,000 T/day at berth.
5. At present Cape size vessels cannot enter the port due to channel width constraints, however suggested to handle the entire cargo at anchorage (approx. 0.11 MT)
6. Increase in cost of offshore coal handlings are high due to tariff of floating crane, high stevedoring cost and additional vessel chartering cost due to low handling rate.
7. Old Tuticorin port cannot be an alternative unloading point due to draft constraints, port locality and distance from the anchorage.
8. Berth IX (12.8 m draft) is highly in demand being the only option for partially loaded Panamax vessel resulting in increasing pre-berthing delay
9. After MHC’s installed at coal handling berths, the expected productivity will be 17,000 T/day (11,000 T/day currently).
10. 2 Nos. of 125T MHC at berth IX can result in increased utilisation to produce 28,000 T/day, if shallow draft coal berths are equipped as required (19,000 T/day currently).
11. By limiting maximum of 3 shifts of stay at Berth IX with fully utilised MHC achieving vessel draft reduced to 10.4 m (required) shall unlock up to 1.4 MT of productivity.

4.2.3.2 Mechanisation of Berths III & IV

1. Low capacity equipment and high reliance on vessels gear are the reasons for low productivity at the berths
2. Incapable of shifting gearless vessels and absence of required crane capacity also a reason for the low productivity of the berths
3. Due to high occupancy at berth IX the potential of these shallow draft coal berths are not revealed
4. VOCPT to invite a third party for an additional MHC at each of these berths are suggested

5. Additional MHC will result in increase of 50% productivity (17,000 T/day) leading to unlock additional berth capacity of 1.6 MT

4.2.3.3 Mechanisation of Berths IX

1. Vessel handling is convenient since both discharge rate of vessel and evacuation rate at the berth is 17,000 T/day
2. Present discharge rate at berth is 18,000 T/day
3. In case of gearless vessels the discharge rate is 23,000 T/day resulting in berth cluttered upon departure
4. Piling of coal at berth is undesirable due to cluttered berth hindering MHC and reduces its productivity up to 20% and it creates difficulty to heap the next vessel's cargo
5. With capital cost of approx. 60 Cr INR conveyors from berth to storage yard shall be planned with IRR of 48%
6. On deploying conveyors the MHC shall be used to discharge into hoppers

4.2.3.4 Additional Capacity by Traffic Relocation

1. TNEB's demand constraints and lack of infrastructure leads to CJ-I and CJ-II limitation of productivity to 11,000 T/day.
2. With present condition it can achieve 15,000 T/day and can increase to 25,000 T/day by the following:
   - Widening and strengthening the berth
   - Installation of shore cranes
   - Conveyor overhauling
3. The additional capacity unlocked can be used to handle non TNEB coal and can be stacked in different location by an additional diversified conveyor branch from the existing.
4. This also benefits TNEB by logistic cost by gearless vessels and productivity increase.
5. Three phase possibility to unlock 3-7 MT is also suggested:
   - Incentivise TNEB to improve productivity with no overhaul
   - Take over and refurbish one berth
   - Take over one berth and refurbish both

4.2.3.5 Dedicated Berth for Copper Concentrate (Berth VIII)

1. Berth VIII was planned for container berth but resulted in low occupancy (approx. 55%) due to absence of quay cranes.
2. This berth can be a short term alternative for lack of deeper draft berths to handle dry bulk
3. Clean the commodity to prevent dust accumulation on berth and equipment.
4. To be planned for bulk handling along with existing container handling.
5. Release of approx. 0.3 MT Copper concentrate from berth IX impacts in additional handling of coal (approx. 1.5 MT/year).

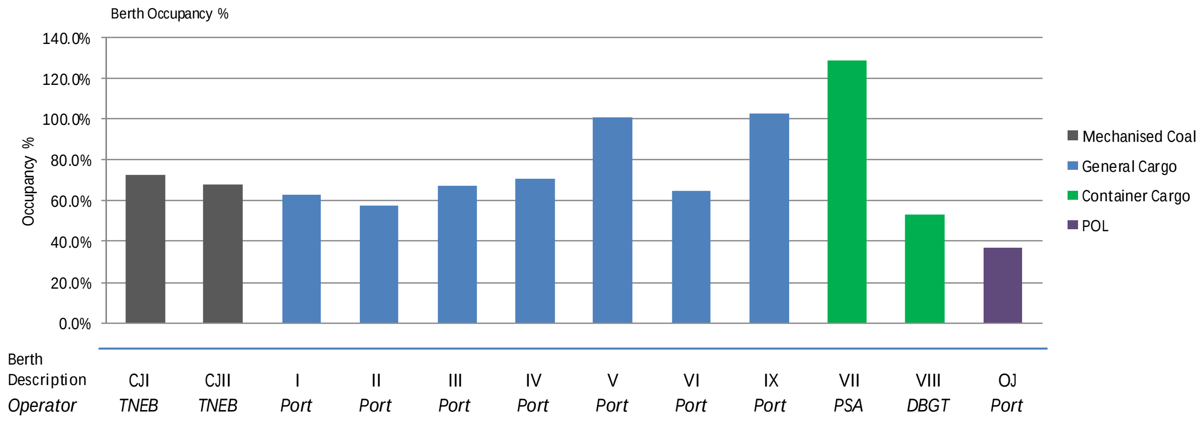


Figure 4.1 Berth Occupancy %

4.2.3.6 Coal Handling at Anchorage

The port is presently carrying out lighterage operations for coal due to current limitations of drafts and navigation as below:

1. The present harbour entrance which has a width of 153 m cannot allow navigation of vessels with a beam wider than 32.2 m.
2. The depth of channel and the coal handling berths is 14.7 m which means Panamax vessels with loaded draft of 12.8m only can be handled.
3. Any further deepening of the berthing area beyond (-) 14.7 m will infringe on the toe line of the existing coal handling berths CJ1, CJ2 and berth IX which are all constructed on piles thus endangering on their stability.

Since it make considerable economic sense to bring bulk coal panamax vessels to their full load draft up to 14.5 m, the importers bring them fully loaded.

In order to handle fully loaded Panamax vessel the port does partial offshore transhipment until the vessel is lightened to the permissible draft. Anchorage handling is not cost effective as compared to handling at the berths. Apart from multiple handling the lack tranquil conditions at anchorage leads to significantly low productivity.

At present the lightening operation is executed with one floating crane and three barges. Average productivity at anchorage is approx. 8000 T per day as compared to productivity up to 20,000 TPD possible at the berth. The cargo wise tonnage at the anchorage for the FY 2014-15 is shown in **Table 4.2.** This causes increase in turnaround time leading to additional cost of charter. The handling cost at anchorage is high due to the following:

1) High cost of floating crane used for lighterage operations.
2) High stevedoring cost
3) Additional vessel charter cost due to low productivity

Table 4.2 Cargo Handled in Anchorage for FY 2014-15

Cargo	Qty (T)	Avg. Output (T)
Cu. Concentrate	445	445
Iron Ore	9,329	3,165
Lime Stones	8,833	4,417
Peas (Yellow)	1,000	1,000
Steaming(Non-Coking)Coal (I.Coal)	91,906	2998
T. Coal	23,104	1679
Total	**1,34,617**	

Also the lighterage operations during the year were limited to just 21 vessels. Thus the impact of lighterage operations in the overall traffic was limited during the year. The significant reason for this appears to be that imported coal from foreign countries is the main commodity that is brought in fully loaded Panamax vessels. It is further found that this happens when the importer buys the cargo on high seas and when the importer charters the vessel from load port itself with a planned intent to bring cargo to Tuticorin this does not happen much.

4.3 Performance of Existing Facilities

4.3.1 General

The cargo handling capacity of port facilities is based on many factors like the vessel size, fleet mix, equipment provided and the possible handling rates, time required for peripheral activities, capacity of stack yard, number of users, grades, capacity of evacuation system etc.

The capacity of existing berths is assessed assuming the mix of cargo being currently handled at these berths and the corresponding parcel sizes.

Another factor that is important in arriving at the berth capacity is the allowable Berth occupancy, which is expressed as the ratio of the total number of days per year that a berth is occupied by a vessel (including the time spent in peripheral activities) to the number of port operational days in a year. High levels of berth occupancy will result in bunching of ships resulting in undesirable pre-berthing detention. For limited number of berths and with random arrival of ships, the berth occupancy levels have to be kept low to reduce this detention. The norms generally followed for planning the number of berths in modern port to minimise the pre-berthing detention are given in **Table 4.3**.

Table 4.3 Recommended Berth Occupency

No. of Berths	Recommended Berth Occupancy Factor
1	60 %
2	65 %
3 & above	70 %

The performance of the berths are analysed and presented in the sections below.

4.3.2 Performance of Coal Handling Berths

The performance of coal berths CJ1 and CJ2 exclusively handling coal meant for TANGEDCO is provided in **Table 4.4**. Other coal is widely handled in various other berths like II, III, IV, V, VI and IX. A small quantity was also handled at the eastern arm during the non-availability of shallow berths. The performance of dedicated coal handling berths of TNEB during 2014-15 is shown in **Table 4.4**.

Table 4.4 Performance of Coal Handling Berths

S. No.	Berth Description	Total Cargo Handled (MT)	Total No. of Ships	Avg Parcel Size (T)	Standard Berth Days	Berthing/ De-Berthing Days	Total Berth Days	Berth Occupancy (%)
1.	CJI	3.10	74.00	41,915.34	252.46	12.33	264.79	**72.5%**
2.	CJII	3.18	68.00	46,730.01	236.76	11.33	248.09	**68.0%**

4.3.3 Performance of Container Berths

Berth VII operated by PSA has a high occupancy level where as berth VIII operated by DGBT has low occupancy for now as it is not yet equipped with container quay cranes. Their performance is outline in brief in **Table 4.5**.

Table 4.5 Performance of Container Berths

S. No.	Berth Description	Total Cargo Handled (MT)	Total No. of Ships	Avg Parcel Size (T)	Standard Berth Days	Berthing/ De-Berthing Days	Total Berth Days	Berth Occupancy (%)
1.	VII	7.54	781.00	9,648.19	339.16	130.17	469.33	**128.6%**
2.	VIII	1.34	235.00	5,701.12	155.94	39.17	195.10	**53.5%**

4.3.4 Performance of Oil Jetty

OJ operated by IOCL for their POL has a low occupancy despite having water depth of 14.1 m. Performance is studied in brief as shown in **Table 4.6**. The berth has two unloading arms for handling POL leading to the IOCL tank farms as also unloading arms for handling LPG and Liquid Ammonia.

Table 4.6 Performance of Oil Jetty

S. No.	Berth Description	Total Cargo Handled (MT)	Total No. of Ships	Avg Parcel Size (T)	Standard Berth Days	Berthing/ De-Berthing Days	Total Berth Days	Berth Occupancy (%)
1.	OJ	0.64	83.00	7,686.76	120.89	13.83	134.73	**36.9%**

4.3.5 Performance of Multipurpose Berths

Berth I, II, III, IV, V & VI are operated by VOCPT and have a fair occupancy but the shallow draft has a low occupancy. Berth wise Performance for the multipurpose berths is as shown in **Table 4.7.**

Table 4.7 Performance of Multipurpose Berths

S. No.	Berth Description	Total Cargo Handled (MT)	Total No. of Ships	Avg Parcel Size (T)	Standard Berth Days	Berthing/ De-Berthing Days	Total Berth Days	Berth Occupancy (%)
1.	I	0.48	131.00	3,634.80	207.35	21.83	229.19	**62.8%**
2.	II	0.73	119.00	6,140.26	190.13	19.83	209.96	**57.5%**
3.	III	2.30	108.00	21,303.15	226.14	18.00	244.14	**66.9%**
4.	IV	2.52	116.00	21,681.89	238.53	19.33	257.86	**70.6%**
5.	V	0.71	250.00	2,837.62	327.73	41.67	369.40	**101.2%**
6.	VI	0.98	138.00	7,117.60	212.52	23.00	235.52	**64.5%**

4.4 Capacity Assessment of Existing Facilities

The capacity of any existing port facilities depends on a combination of number of factors like the type of cargo handled, the DWT of the vessel, the vessel parcel size, the permissible berth occupancy, the type of handling facilities, the productivity of human resources both handling and managerial, the traditions and practices obtained etc., This being a complex matrix, the overall capacity of the existing port facilities is assessed as about 43 to 45 Million tonnes for the current cargo mix and infrastructure.

5.0 DETAILS OF ONGOING DEVELOPMENTS

5.1 General

VOC Port Trust has planned for various developmental projects which are in various stages of implementation to meet the port's traffic forecast from time to time. The locations of these projects in the layout of the existing harbour are indicated in **Figure 5.1**

Figure 5.1 Location of On Going Projects in VOCPT – As Per Current Plans

5.1.1 Development of North Cargo Berth II for Coal: 7.2 MTPA

The Concession Agreement with M/s. Tuticorin Coal Terminal Limited which is an SPV of ABG – LDA Bulk Handling Private limited entered on 11.09.2010 with revenue share of 52.17 %. The civil works for NCB II was commenced on 01.03.2012 with about 90% progress as on date. The three nos Gantry grab unloaders of 1800 TPH are in place. The conveyor system from berth to stack yard is to be installed. The installation of yard stacking and reclaiming equipment is taking place. It is understood that the concessionaire has sought time till end of July 2016 to complete construction phase. The terminal is expected to be commissioned during 2016-17..

5.1.2 Development of North Cargo Berth III for Coal: 9.15 MTPA

Concession Agreement was signed with M/s. Transstroy North Cargo Berth Pvt Ltd on 08.10.2013 with revenue share of 30%. Environmental clearance for the berth was received on 02.01.2015 with conditions. However, the agreement has since been cancelled and the port authority has already invited EOI, which is going to be followed by a tender to finalise a concessionaire.

5.1.3 Development of North Cargo Berth IV for Coal: 9.15 MTPA

Concession Agreement was signed with M/s. Transstroy North Cargo Berth India Pvt Ltd on 30.01.2013 with revenue share of 30%. Environmental clearance for the berth was received on 02.01.2015 with conditions. However the agreement has since been cancelled.

Port is planning to develop this berth as a container terminal for which EOI has already been invited.

5.1.4 Mechanization of Berth I-IV & IX: 8.72 MTPA (Addition)

Agreement was signed between the port and M/s IMC – PSTS Ltd on 25.03.2012 with revenue share of 26.55%. Also a concession agreement was signed with M/s CREW for mechanizing the unloading and conveying of coal and limestone in bulk from berth no. IX to the present multi-user coal stack yard (with a revenue share of 28%) and this is expected to be commissioned in 2016-17.

5.1.5 Development of Shallow Berth for Multipurpose Cargo : 2.67 MTPA

Concession Agreement was signed with M/s. Transstroy North Cargo Berth India Pvt Ltd on 17.04.2013 with revenue share of 22% for developing it as cement berth. Environmental clearance for the berth was received on 31.03.2014 with conditions. However the agreement has been cancelled and the project is expected to go through a process of retender for developing it as Multipurpose berth.

5.1.6 Development of Shallow Berth for Construction Materials: 2.0 MTPA

This project was tendered but not yet awarded. Presently the project is under litigation.

5.1.7 Rail Connectivity Projects

5.1.7.1 Port Marshalling Yard to Hare Island

For the evacuations of the bulk cargoes from the North Cargo Berths II, III and IV estimated around 25.3 MTPA stack yards are identified on Hare Island. Connectivity from Hare Island to Port Marshalling Yard is proposed and M/s. RITES Ltd was awarded for PMC on 17.08.2015.

5.1.7.2 Renovation of Existing Rail between Marshalling Yard to V.O.C Wharf

All the 5 tracks within the marshalling yard and near the berths I, II, III and IV upgradation was commenced on 20.04.2015. This upgradation also includes the siding into the stack yard near the green gate.

Apart from the above the port has upgraded the main connectivity road in the port into a four lane road recently

5.1.8 Road Connectivity Related Projects

5.1.8.1 Proposed Truck Parking Yard Adjacent to NH 7A

Outside the port limits adjacent to NH 7A opposite to Fisheries College a truck parking yard has been planned by the port trust. It is planned with 4.2 Ha for minimum of 200 trucks at a time as shown in **Figure 5.2**. It also comprises facilities like insurance agents, lorry booking offices, truck operator office, branches of corporate buildings etc. The land allotted for the parking is a low lying area approx. 3m down from adjoining road level with a 10m wide canal in between NH and the land. Since it is away from port limits the area is prone to encroachments. It has the advantage of being on the national highway. The basic development cost is studied by a third party consultant by the port to be 8.3 Cr INR and planned to develop on PPP mode. The total construction cost shall be about 24 Cr INR which includes RCC retaining wall, sand filling and consolidation, compound wall and fencing, 2 RCC bridge over canal and shifting of HT wire.

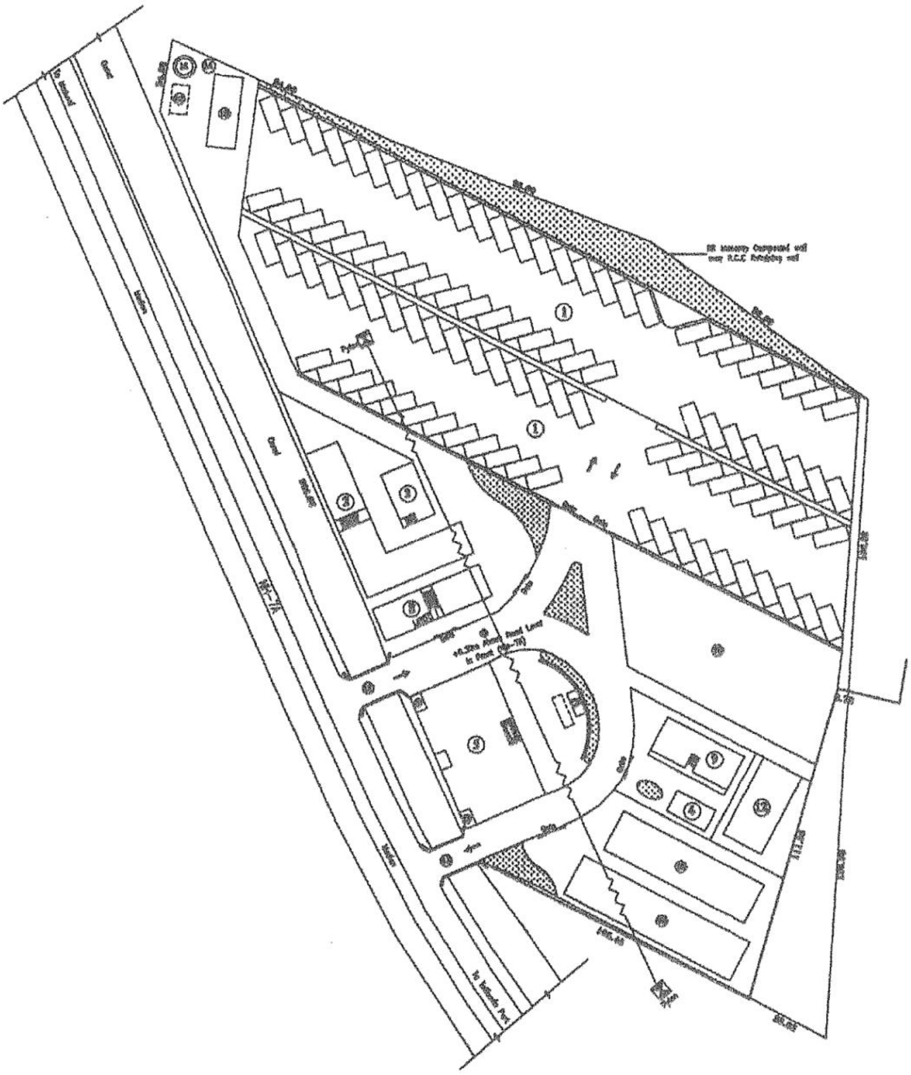


Figure 5.2 Proposed Truck Parking Yard Layout

5.1.8.2 Proposed Truck Parking Yard Adjacent to NH 7A

Within the port limits adjacent to VOC park lorry parking area is been proposed. The advantage of the location is it's near the intersection of harbour highway extension and VOC road. The total area allocated for parking yard is 23,750 m^2. The project has been awarded to M/s HPCL who will develop the yard with retail outlet as shown in **Figure 5.3**.

Figure 5.3 Proposed Parking Yard Near VOC Park

6.0 TRAFFIC PROJECTIONS

6.1 General

Tuticorin port is located in the southern part of Tamil Nadu and is the second biggest port in the state after Chennai. The port mainly handles containers, catering to the industrial regions in Central and Southern Tamil Nadu, and thermal coal for the power plants in the hinterland.

Tuticorin handled 32.5 MTPA of cargo traffic during year 2014-2015. Key commodities include thermal coal and containers. Thermal coal contributes ~42% to the total traffic while containers contribute another ~34%. Going forward, the total cargo is expected to increase to ~54 MTPA by 2020 and 75-83 MTPA by 2025.

The materialisation of projected traffic will however depend upon many factors such as growth of economy as assumed and certain specific events like installation of some of the power plants which are on the anvil. It can be seen that thermal coal and industrial coal imports constitute bulk of the cargoes. The trend in historical traffic at Tuticorin and the traffic forecast is shown below.

The origin-destination of key cargo (accounting for greater than 85% of the total traffic) for all Indian ports and development of traffic scenarios for a period of next 20 years has been carried out by **McKinsey & Co.** as mandated for this project. Accordingly, based on a macro-level analysis the future traffic for Tuticorin up to 2035 has be derived as presented in this section.

The trend in historical traffic at Tuticorin can be seen in **Figure 6.1** and the traffic forecast for VOCPT is shown in **Figure 6.2**.

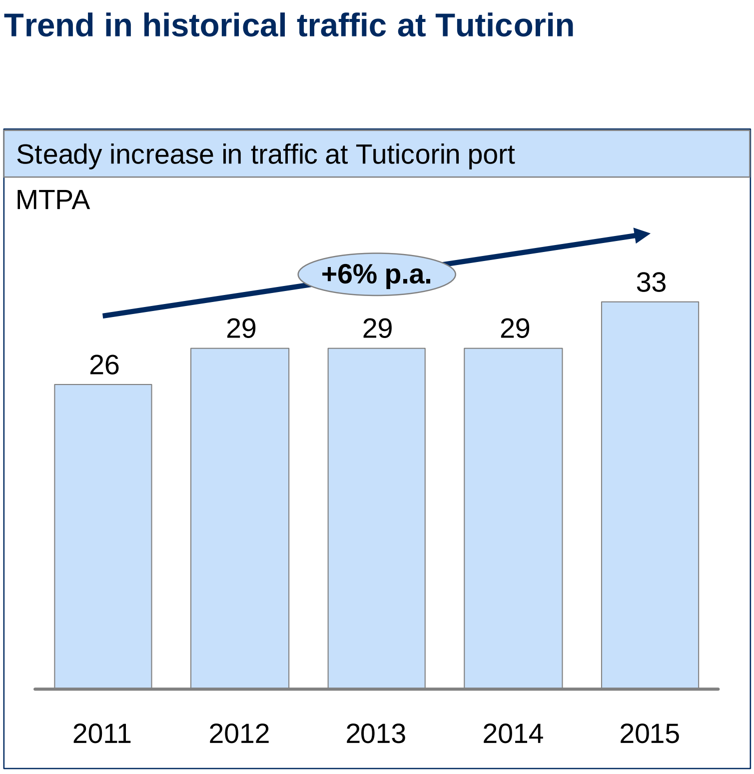


Figure 6.1 Historical Traffic Trend - Tuticorin

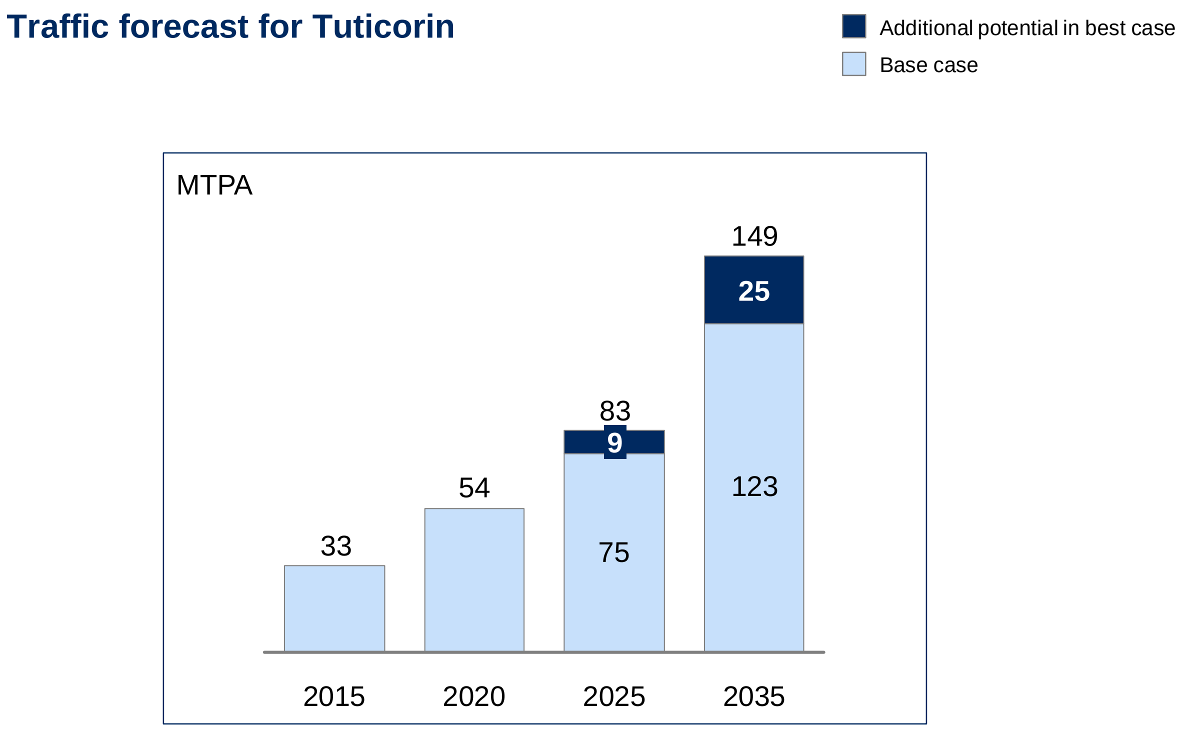


Figure 6.2 Traffic Forecast – VOCPT

6.1.1 Major Commodities and their Projections

Although there are a number of bulk cargoes that are handled through the port, the majority of those bulk cargoes as listed below are identified for handling through mechanized methods. They are also the most enduring part of the cargoes of port. All of them are import cargoes and has potential to generate dust during handling hence, prone to cause pollution when handled through semi-mechanized methods.

They consist of –

1. Thermal Coal
2. Industrial coal
3. Copper Concentrate
4. Pet Coke
5. Limestone

Coal of all types is classified as one cargo and copper concentrate is included in other ores.

6.2 Bulk Cargoes - Handled by Fully Mechanized Systems

6.2.1 Thermal Coal

Thermal coal imports through VOC Port can be classified as -

- Thermal coal meant for captive users
- Thermal coal meant for others

The thermal coal meant for captive users form the major quantity which consists of coal meant for TNEB Power plant and NTPL power plant both of which are handled through captive jetties and though conveyors.

In addition thermal coal meant for M/s. Coastal Energen (whose plant is located at about 30 km from port) whose first of the two units each of 600 MW was commissioned in 2014-15 and coal meant for 160 MW power plant of M/s Sterlite Industries which are handled by semi-mechanised methods through multipurpose berths can also called as captive thermal coal for the port.

Further M/s SEPC is putting up a 525 MW power plant close to the port in the Harbour estate itself and this is expected to go to operation near future. The thermal coal import on account of this will also be captive coal for the port.

The above account most of the total thermal coal imports through the port.

Currently, the port imports 13.8 MTPA of thermal coal primarily for the consumption of power plants. Out of this, 4.4 MTPA is coastally shipped coal for Tuticorin thermal power plant. 9.3 MTPA is imported coal catering to Tuticorin thermal power plant, Coastal Energen, Ind Bharath power plant, DCW, Sterlite, NTPL and other non-power customers. With the power sector growing resulting in higher PLFs, and the new capacity expected to come up around Tuticorin, along with import substitution on the back of rising domestic coal production, thermal coal imports can reach ~27 MTPA by 2020 and 38-42 MTPA by 2025. The plant wise projected thermal coal traffic through Tuticorin is as shown in **Figure 6.3**.

Thermal coal volumes

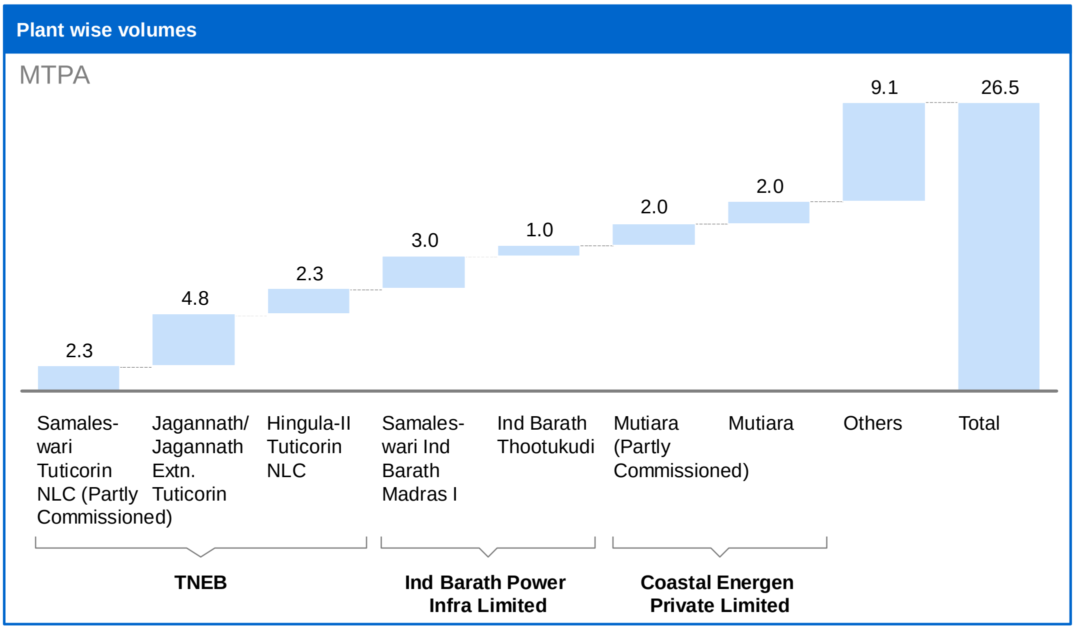


Figure 6.3 Plant Wise Project Thermal Coal Traffic for VOC Port

6.2.2 Copper Concentrate

It is a captive cargo of the port as it is imported as raw material for the use of nearby Sterlite copper. The annual throughput requirement of Copper concentrate is 1.2 MTPA and is nearly a fixed quantity for now as it is dependent of the capacity of this particular industry.

6.2.3 Industrial Coal

VOC Port has emerged as preferred port in the region for import of industrial coal meant for cement plants, paper industry, Foundries etc. with increasing throughputs over the years.

6.2.4 Pet Coke

Petroleum coke mainly used by Aluminium and anode making industries is imported through the port. Though its quantity is not very large has reasonable volume.

6.2.5 Lime Stone

Lime stone has of late emerged as a sizeable bulk cargo basically imported by cement industry.

The projections for commodities like iron-ore, limestone and other ores in the base case scenario has been arrived at by taking a GDP multiplier of 1.14 and an estimated growth rate of 5.88%. In the optimistic scenario, same GDP multiplier and an estimated GDP growth rate of 7% has been assumed.

6.2.6 Traffic Pattern of Coal of Different types

The traffic pattern of Coal of different types coal and Pet coke for the last 3 years is as below in **Table 6.1**.

Table 6.1 Traffic Pattern of Coal Traffic for Last 3 Years

S. No.	Cargo	2012-13	2013-14	2014-15
1.	Thermal Coal	66,60,692	66,43,688	86,12,589
2.	Industrial Coal	39,57,099	55,03,190	51,91,288
3.	Pet Coke	68,299	2,02,387	2,12,482
	Total	**1,06,86,090**	**1,23,49,265**	**1,40,16,359**

In addition Limestone is emerging as a major bulk over the years. The traffic projections for coal for the Master plan period are consistently increasing and large as can be seen in **Table 6.2**. The traffic for 2015-16 is based on port's estimates, while the projections for 2020, 2025 and 2035 are as per origin and destination study for ocean bound traffic of all the major ports as part of this master plan by M/s Mckinsey.

Table 6.2 Traffic Projection of Major Bulk Cargoes Over Master Plan Period (in MT)

S. No.	Cargo	2015-16	2020-21	2025-26		2035-36	
				Base Scenario	Optimistic Scenario	Base Scenario	Optimistic Scenario
1.	Coal of All Types	17.1	26.6	38.3	42.3	63.4	75.8
2.	Limestone	1.1	1.1	1.5	1.6	2.7	3.1
3.	Copper Concentrate	1.2	1.2	1.2	1.2	1.2	1.2
	Total	**18.4**	**28.9**	**41.0**	**45.1**	**67.3**	**80.1**

6.3 Containers

The port primarily caters to industrial districts of Southern and Central Tamil Nadu – Salem, Mettur, Namakkal, Karur, Coimbatore, Tuticorin, and also some parts of Karnataka. Currently the port handles 0.56 Mn TEUs of containers. Tuticorin generates ~55% of the container cargo for the port. Tuticorin, other regions of Tamil Nadu and the secondary hinterland of Bangalore are expected to grow at 9-11% GDP CAGR. Industrial activity is expected to increase at a healthy rate in Tamil Nadu, and the container volumes is expected to touch 0.99 Mn TEUs and 1.18-1.45 Mn TEUs by 2020 & 2025 respectively. For the projections till 2025, it is estimated that the GDP of above mentioned hinterland are expected to grow at 9% CAGR in the base case and 11% CAGR in the optimistic case. Post 2025 till 2035, growth rate of 5% in projected volume has been assumed in the base case and 6% in the optimistic case.

Tuticorin port is a feeder port and the containers are transhipped at international locations like Colombo and Singapore. If a transhipment port comes up at the southern tip of India, it can severely impact of the container volumes at Tuticorin as part of the cargo would directly go to the transhipment port via road. The evolution of container traffic through the port for the last five years is presented in **Table 6.3**.

Table 6.3 Container Traffic in VOCPT During the Last Five Years

Description	2010-11	2011-12	2012-13	2013-14	2014-15
No. of Vessels Handled	NA	365	351	399	491
Import TEUS.	2,26,230	2,31,457	2,34,098	2,51,038	2,88,503
Export TEUS.	2,41,522	2,45,639	2,41,501	2,56,697	2,71,224
Total TEUs	**4,67,752**	**4,77,096**	**4,75,599**	**5,07,735**	**5,59,727**

It can be seen that the increasing trend in container traffic through the port has been consistent and robust. **Figure 6.4, Figure 6.5** & **Figure 6.6** exhibits show the split of cargo from the different hinterlands and the projected traffic growth.

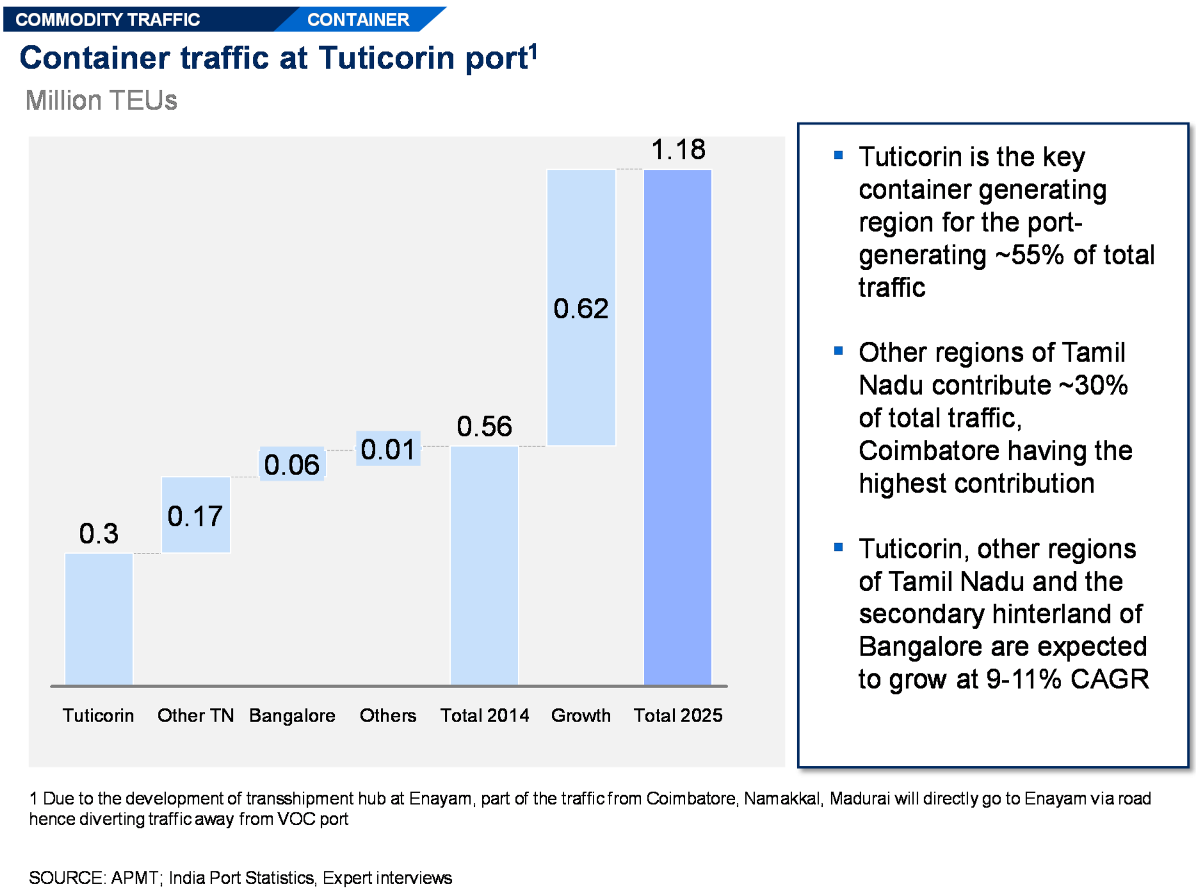


Figure 6.4 Container Traffic – VOC Port

COMMODITY TRAFFIC | CONTAINER

Tamil Nadu is the primary hinterland of Tuticorin port with small traffic from Bangalore

Primary hinterland of port

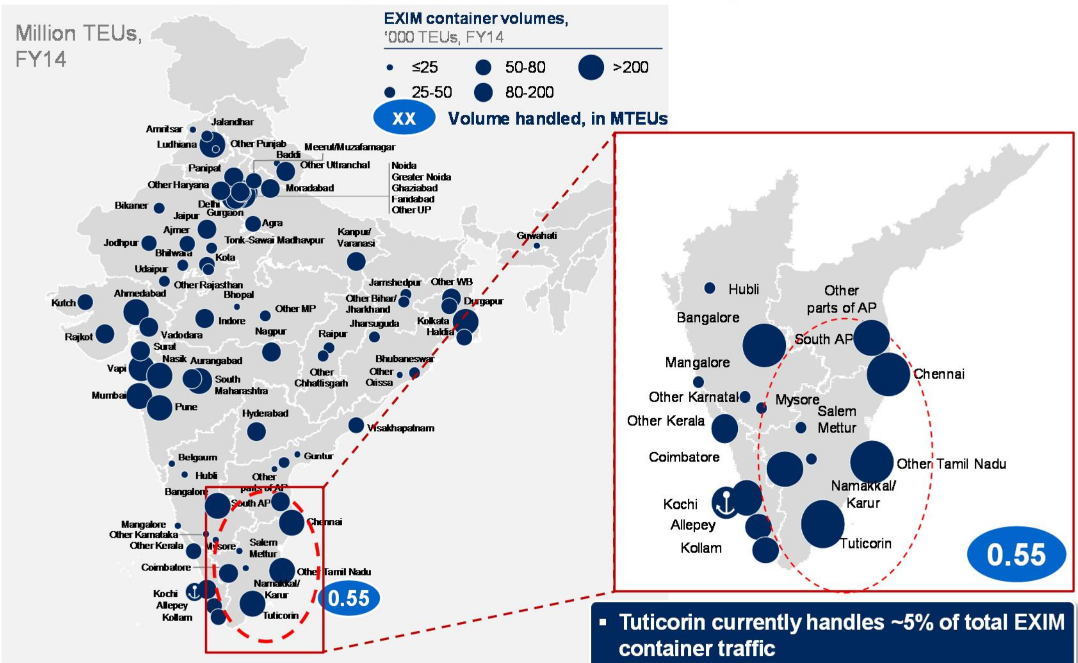
EXIM container volumes, '000 TEUs, FY14	JNPT	Mundra	Chennai	Pipavav	Tuticorin	Haldia	Cochin	Visakha-patnam	Mangalore
NCR+Punjab	936	1,264	0	329	0	0	0	0	0
Maharashtra	2,121	54	0	0	0	0	0	0	0
Tamil Nadu	0	0	1,240	0	484	0	0	0	0
Gujarat	552	262	0	169	0	0	0	0	0
Uttar Pradesh	228	274	0	107	0	0	0	0	0
West Bengal	0	0	0	0	0	458	0	0	0
Rajasthan	43	448	0	60	0	0	0	0	0
Karnataka	94	0	163	0	66	0	0	0	50
Kerala	0	0	0	0	0	0	351	0	0
Andhra Pradesh	75	0	65	0	0	0	0	110	0
Madhya Pradesh	43	70	0	14	0	0	0	29	0
Bihar/Jharkhand	0	0	0	0	0	85	0	8	0
Uttaranchal	95	0	0	0	0	0	0	0	0
Orissa	0	0	0	0	0	12	0	69	0
Chhatisgarh	15	18	0	14	0	0	0	15	0
North East	0	0	0	0	0	7	0	0	0
Port total	4,202	2,390	1,468	693	551	562	351	263	50

SOURCE: APMT; Expert interviews

Figure 6.5 VOC Port Hinterland

COMMODITY TRAFFIC | CONTAINER

EXIM container generating hinterlands for Tuticorin port



SOURCE: APMT; IPA statistics; Stakeholder interviews

Figure 6.6 EXIM Container Hinterland – VOC Port

6.4 Break Bulk Cargo

The traffic data pertaining to General/Break Bulk Cargo for the last 5 years is furnished in **Table 6.4**.

Table 6.4 General Cargo - Imports & Exports - During Last Five Years

S. No	COMMODITY	2010-11	2011-12	2012-13	2013-14	2014-15
IMPORT (MTPA)						
1.	Fertilizer	1.16	1.11	0.49	0.39	0.42
2.	F.R. Materials	0.73	0.89	0.56	0.79	1.05
3.	General Cargo	2.49	2.56	2.88	2.06	2.76
4.	Other General Cargo	1.36	1.22	0.55	0.56	0.25
	Total Imports	**5.74**	**5.78**	**4.48**	**3.8**	**4.48**
EXPORT (MTPA)						
1.	Dry Cargoes	0.72	0.43	0.46	0.48	0.3
2.	Liquid Cargoes	0.54	0.47	0.7	0.55	0.4
3.	Food Grains	0.04	0.3	0.13	0.05	0.06
4.	General Cargo	1.05	1.06	0.95	0.34	0.96
5.	Other General Cargo	0.06	0.15	0.27	0.01	0.06
	Total Export	**2.41**	**2.41**	**2.51**	**1.43**	**1.78**
Breakbulk Cargo – Total Import & Export		**8.15**	**8.19**	**6.99**	**5.23**	**6.26**

6.4.1 Imports

The import of fertilizer is mainly import of Urea, MOP and DAP. The fertilizer raw materials imports mainly are sulphur and rock phosphate. The general cargo under imports includes copper concentrate whose volume is about 1.2 MTPA during 2014-15. Import under the head general cargo and other general cargo includes the following.

1. Limestone
2. Gypsum
3. Cashew nuts
4. Timber
5. Iron and steel materials
6. Palm Oil
7. Caustic soda lye.
8. Vinyl Chloride monomer (VCM)
9. Others

Limestone imports alone constitute about 0.8 MT during 2014-15. Palm oil imports during the same period is about 0.3 MT. Timber in log form constitutes about 0.5 MT. VCM, Caustic soda Lye and peas (yellow) have a quantity of about 0.1 Million each. The rest are highly fragmented. VCM is handled through Shallow berth I as the pipe line for this cargo is located in that berth.

6.4.2 Exports

The general cargoes and other general cargoes under exports include

1. Construction materials for Maldives
2. Cement mainly for Maldives
3. Granite
4. Stone dust
5. Oil cake and Copra
6. others

The exports of construction materials and cement to Maldives have a quantity of about 0.4 MT which are handled through shallow berths. The rest are highly fragmented.

6.4.3 General Cargo – Traffic Projections

The traffic projection by M/s McKinsey in respect of General cargo is presented in Table 6.6. They include some dry cargoes in bulk like fertilizers, Copper concentrate in the figures for 2014-15.

Table 6.5 Dry and Break Bulk Cargo (To be Handled in Multipurpose Berths)

Commodity	Current 2014-15	2020-21	2025-26		2035-36	
			Base	Optimistic	Base	Optimistic
Iron Ore	0.05	0.06	0.08	0.09	0.14	0.17
Other Ore	Nil	1.7	2.2	2.3	3.7	4.2
Fertilizers	1.5	1.6	2	2.1	3.1	3.4
Others	3.5	4.4	5.9	6.2	9.7	11.1
Total (MTPA)	**5.05**	**7.76**	**10.18**	**10.69**	**16.64**	**18.87**

This **Figure 6.7** summarizes the traffic potential for key commodities for Tuticorin port.

Units: MMTPA (except Containers)

Tuticorin Port - Traffic Projections

xx Base Scenario | xx Optimistic Scenario

Commodity	2014-15	2020	2025 (Base)	2025 (Optimistic)	2035 (Base)	2035 (Optimistic)	Remarks
Liquid Cargo							
POL	0.6	0.8	1.3	1.8	2.0	2.5	
Dry and Break Bulk Cargo							
Thermal Coal (Loading)	0.0	0.0	0.0	0.0	0.0	0.0	
Thermal Coal (Unloading)	13.8	26.5	38.3	42.3	63.4	75.8	▪ Increase in coastal shipping
Coking Coal	0.0	0.0	0.0	0.0	0.0	0.0	
Iron Ore	0.05	0.06	0.08	0.09	0.14	0.17	▪ Mostly imports
Limestone	0.8	1.1	1.5	1.6	2.7	3.1	
Other Ore	1.2	1.7	2.2	2.3	3.7	4.2	
Fertilizers	1.5	1.6	2.0	2.1	3.1	3.4	
Containers and other Cargo							
Containers (MnTEU)*	0.56	0.99	1.18	1.45	1.95	2.44	▪ Traffic projections for the port may reduce post development of transshipment hub in Enayam
Others	3.5	4.4	5.9	6.2	9.7	11.1	▪ Highly fragmented, no particular commodity with significant volume
Total (MMTPA)	**32.5**	**55.7**	**74.5**	**85.0**	**123.2**	**148.6**	

* Due to the development of transshipment hub at Enayam, part of the traffic from Coimbatore, Namakkal, Madurai will directly go to Enayam via road hence diverting traffic away from VOC port

Conversion Factor Used for Containers Projections: 1 TEU = 19.7 Tons

Figure 6.7 VOC Port Traffic Projection

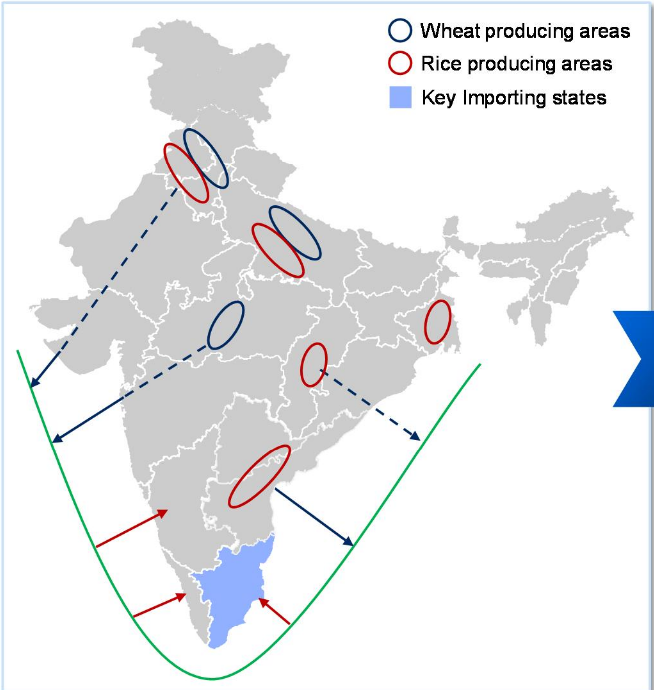
6.4.3.1 Coastal Shipping Potential

Apart from the above mentioned traffic, there is additional opportunity of coastal shipping that can be potentially tapped. Food grains provide a significant opportunity with small volumes possible for other commodities as well.

Food grains: ~1-2 MTPA of food grains can be coastally shipped to Tuticorin port by 2025 from Andhra Pradesh, Madhya Pradesh, Punjab and Haryana as shown in **Figure 6.8**.

COASTAL SHIPPING FOODGRAINS

~1-2 MTPA of food grains can be coastally shipped to Tuticorin Port by 2025



1 Small quantities will move on a number of other routes via Tuticorin port

Key ODs with coastal shipping potential to Tuticorin Port

Route[1]	Volume, '000 TPA
Andhra Pradesh to Tamil Nadu	536
Madhya Pradesh to Tamil Nadu	343
Punjab to Tamil Nadu	190
Haryana to Tamil Nadu	171

Figure 6.8 Coastal Traffic Hinterland – VOC Port

Figure 6.9 summarizes the potential of coastal movement for key commodities.

Tuticorin Port – New Opportunities Possible via Coastal Shipping

Units: MMTPA (except Containers)

Commodity	2020	2025	2035
Steel (Loading)	-	-	-
Steel (Unloading)	0.40	0.54	0.96
Cement (Loading)	-	-	-
Cement (Unloading)	0.44	0.59	1.06
Fertilizer (Loading)	0.57	0.70	1.03
Fertilizer (Unloading)	0.02	0.03	0.04
Food Grains (Loading)	0.01	0.01	0.02
Food Grains (Unloading)	1.27	1.54	2.28

Figure 6.9 Coastal Traffic Possibilities – VOC Port

7.0 CAPACITY AUGMENTATION REQUIRMENTS

7.1 General

The capacity augmentation requirement shall be based on the difference between the project traffic for the particular commodity and the capacity of the port available (after debottlenecking and physical improvements) for handling that particular commodity. The capacity assessment of the existing / planned for various cargos like coal, containers and breakbulk has been carried out as below:

7.2 Coal Handling Facilities

7.2.1 Type of Present Facilities for Coal handling

For the purpose of the present analysis, coal may be broadly segregated as thermal coal meant for power plants of TNEB & NTPL which is handled through conveyors and remaining coal.

7.2.1.1 Thermal Coal for TNEB & NTPL Power Plants

This thermal coal is unloaded in bulk and conveyed direct to the power plants in the vicinity through conveyor systems without any transit stack yard.

The thermal coal under this head is entirely for the Power plants of TNEB and NTPL. For handling this traffic there are three dedicated jetties. Of them Coal jetty 1 and Coal jetty 2 together handle about 6.3 MTPA feeding to the 1050 MW Power plant of TNEB. The jetty NCB 1 handles coal meant for NTPL power plant of 1000 MW Capacity. Of these two power plants, while the TNEB power plant has been in operation for a long time, the NTPL power plant commissioned during 2014-15, is new one and is yet to work to its full capacity.

7.2.1.2 Coal – Others

This consists of thermal coal meant for private power plants, industrial coal for cement plants, paper industry etc., This coal is handled in multi-cargo berths located on the south side. It is unloaded by ship gear/shore electric cranes /Harbour mobile cranes and transported by dumpers to stack yards and is stacked by semi-mechanised methods. It is similarly loaded out of stackyards and evacuated through dumper Lorries.

7.2.2 Rationalisation of Berths Handling Coal for TNEB Power Plant

The thermal coal for TNEB power plant is handled through two captive coal jetties CJ1 & CJ2 with each handling about 3 to 3.3 MTPA. The coal jetties CJ1 & CJ2 commissioned during 1983 and 1995 respectively were originally designed to handle handy/handymax vessels. Subsequently they have been deepened to a dredged depth of 14.1 m, adequate to handle Panamax vessels with a loaded draft of 12.8 m. But the two jetties have no onshore equipment to handle gearless vessels.

In both jetties the unloading of coal is done by ship bound cranes with grabs discharging into hoppers on the jetty from where the coal is conveyed by belt conveyors. The two jetties CJ1 & CJ2 are equipped with two independent conveyor systems each leading to the same power plant and both the conveyor systems have a designed capacity of 2000 TPH.

While the conveyor systems have a designed capacity of 2000 TPH, the average and maximum unloading rate per jetty was about 12,300 TPD and 17,500 TPD respectively. The berth occupancy was about 73% in 2014-15, which was the best over the years.

During 2014-15, the jetties CJ1 & CJ2 have handled a total quantity of 6.69 MT the highest so far with an average parcel size of 47,250 T. While each coal jetty is equipped with conveyors to transfer coal with a capacity of 2000 TPH, they actually handle an average of 12,300 TPD which roughly means about 500 TPH plus. This is due to the fact that the jetties handle mostly handy/ handymax vessels and few Panamax vessels and have no on-shore unloading equipment and unloading is done by ship's cranes which have limited capacity.

7.2.3 Upgradation of CJ2 Initially

While the captive coal jetties CJ1 & CJ2 were constructed by the port authority, the top side facilities consisting of shore hoppers and conveyor system are installed and operated by the captive user viz. TNEB. The thermal coal imported through these two jetties is meant for their "Tuticorin Thermal Power Plant" (TTPS) which has a capacity of 1050 MW.

It is envisaged that the coal now being imported through two jetties CJ1 & CJ2 may be imported by using just one jetty viz. CJ2. This would involve the following.

a. Upgrading of coal jetty CJ2 to handle Panamax vessels with construction of a new coal jetty of about 25 m width and about 300 m length for which purpose enough space is available.
b. Equipping the new jetty with two shore unloaders each of 2000 TPH capacity.
c. Modifying the existing conveyor system to upgrade its capacity from the present 2000 TPH capacity to 4000 TPH capacity. This will involve changing of drives and conveyor belt with the rest of the conveyor system intact. This is technically feasible as the existing Coal conveyor with a width of 1800 mm running at a speed of 2.5 m/s needs to be modified to run at 4.2 m/s. This would also require change of conveyor belt to take care of the increased starting and running tensions consequent to increased capacity.

It may be noted that this jetty area already has adequate dredged depth of (-)14.1 m and hence no further expenditure on dredging is involved.

7.2.3.1 Benefits

To the Port:

1. The port will be able to handle entire 6.2 to 6.5 MT of thermal coal required for TNEB power plant with just one jetty and the second jetty will be available for other developments.
2. The port will be able to make full use of the existing depth of 14.1 m and handle gearless Panamax vessels with a draft of 12.8 m.
3. The number of vessel movements will get reduced.

To the TNEB:

1. There will be a saving of about Rs 75/- per T or even more on ocean freight for TNEB due to handling fully loaded Panamax vessels (subject to further deepening of harbour).
2. Only one conveyor needs to be operated and maintained instead of two now, saving in operation and maintenance cost and effort.
3. The modifications to be made for conveyors are simple and not very expensive.

Common Benefit to Both Port and TNEB:

The requirement of TNEB power plant may be of the order of 6.5 MT per annum (depending on grade of coal and number of power plant utilisation days). But the actual capacity of this jetty after the proposed construction will be 8 to 8.5 MT. As such there will be a spare capacity of about 1.5 to 2 MT which can be used by port for other users. This would however require an arrangement between port and TNEB and a take-off conveyor from the TNEB conveyor junction house to a stackyard in Hare Island. This will enable additional revenue for both.

7.2.4 Constructing New Coal Berth at CJ1

With modifications proposed to CJ2 by way of constructing a new berth in front of existing jetty and equipping it with two unloaders each of 2000 TPH, then that single jetty will be adequate to handle the entire coal requirement of TNEB for the present plant. If the port authority can take up construction of similar new jetty at CJ1 for handling fully loaded Panamax vessels, then it will have a similar capacity of 8 to 8.5 MT. This would however require mutual understanding between Port authority and TNEB.

7.2.5 Limitations of Proposals

The above proposals viz., construction of new berthing structures in front of the existing CJ1 and CJ2 and equipping them with on shore unloaders have the following implications.

1. Construction of new berthing structures in front of the existing CJ1 and CJ2 will have a cost implication of Rs 100 Crores each. The length of berthing structure may be limited to about 200 m sufficient to cater to the span of hatches of a Panamax vessel which is of the order of 165 m. The possibility of using the existing mooring structures while handling a fully loaded panamax vessel need to be examined.

2. The TNEB has to be persuaded and convinced of the benefits that will accrue to them by way of savings in ocean freight and operating and maintaining only one conveyor instead of two as at present. The TNEB has to come forward to make a capital investment towards the cost of two Gantry grab unloaders, providing HT power supply required for operation of gantry grab unloaders and modifications to increase the speed of the conveyors which will all cost about Rs 120 Crores. They may also have to invest on certain other replacements like crushers and stacking equipment at the power plant end.
3. During the intervening period of when such modifications and construction of new berth structure are taken up, the TNEB has to have a contingency plan by way of handling their coal requirement through the second jetty and the remaining from NCB1 with provision of an interconnecting conveyor system between NTPL and TNEB conveyors.

7.2.6 NCB 1 – Utilisation of its Full Capacity

The 1000 MW capacity NTPL power plant consists of two units each of 500 MW. Of them the first unit was commissioned in June 2015 and the second unit in august 2015. The estimated coal requirement for NTPL is about 6 MT and this will be exclusively handled in NCB 1 which is a captive berth for NPTL. This is a new berth constructed by NTPL in which coal meant for their 1000 MW power plant is directly led through an exclusive conveyor from berth to power plant.

Presently the berth has a depth of 14.1 m and is capable of handling panamax vessels with a draft of 12.8 m.

The berth is equipped with two gantry grab unloaders each of 2000 TPH capacity. Technically this berth has a capacity of 8 to 8.5 MT. Against this the actual requirement of NTPL is only 6 MT, thus leaving a spare capacity of 2 to 2.5 MT. The port and NTPL may jointly evolve a strategy to utilise the spare capacity of this berth by way of putting up a take-off conveyor from the transfer tower near the port boundary. This may bring additional revenue to both Port and NTPL.

7.2.7 NCB II under Construction

The port is developing NCB 2 under DBFOT basis for handling coal and other bulk cargoes for which it has entered into a concession agreement with Tuticorin Coal terminals Pvt Ltd(TCTPL) a subsidiary of ABG Infralogistics group (with a revenue share of 52.17 per cent). This work awarded in 2010 is in an advanced stage of construction. It consists of a berth of 306 m length and 22.9 m width, is located adjacent to NCB I and designed to handle fully loaded Panamax vessels. The berth is being equipped with 3 no of gantry grab unloaders each having a capacity of 1800 TPH and mounted on 18 m gauge rails. The two conveyors from berth to stack yard have a belt width of 1600 mm each. The stackyard equipped with stackers is located in the Hare Island. The port's assessed capacity of this terminal is 7 MTPA. This terminal is likely to be commissioned in 2016.

7.2.8 Construction of North Cargo Berths III

The port has plans to award NCB3 berth on DBFOT basis to a concessionaire. The berth is planned to handle about 9 MTPA of coal.

7.2.9 Capacity Assessment of Bulk Cargo Handling

7.2.9.1 Scenario 1

This is an optimistic scenario with berths NCB **III** and NCB **IV** as planned earlier, with reconstruction of CJ1 and CJ2 as now proposed and on an assumption that TNEB and NTPL will be agreeing to operate these berths to their full capacity and share with port. The detailed scenario is presented below in **Table 7.1**.

Table 7.1 Existing Harbour- Capacity of Bulk Cargo Berths When Fully Developed

S. No.	Berth	Capacity (MT)	Remarks
1.	CJ1	8	These two jetties were constructed by port and are for captive use of TNEB. They now have a combined capacity of 6.5 MTPA. The jetties were constructed by port. The actual requirement of TNEB is limited to 6.5 MT per annum totally. The capacity indicated is after their reconstruction and with provision of unloaders.
2.	CJ2	8	
3.	NCB1	8	The actual capacity requirement of NTPL (for whom this a captive berth) is 6.0 MTPA. Hence there will be a surplus capacity. The guaranteed throughput for this berth is 4.00 MTPA.
4.	NCB2	7	This is a BOT berth under construction meant for multiple users. The guaranteed through put for this berth is 4.00 MTPA
5.	NCB3	9	This is expected to be a BOT berth meant for multiple users. The guaranteed throughput for this berth is expected to be fixed as 4.00 MTPA
6.	Berth 9	6	With mechanization of this berth with Harbour Mobile cranes and conveyors for which BOT agreement was already entered into and expected to be completed in 2016-17
	Total	**46**	

The projected traffic for 2025 for bulk cargoes consisting of Coal of all types, copper concentrate, Limestone and also Rock Phosphate is 42 MTPA and 46 MTPA for base and optimistic scenarios respectively. The facilities proposed in the Master plan as above therefore adequately takes care of the projected traffic up to 2025 beyond which the port has to expand to outer harbour.

7.2.9.2 Scenario 2

This is a scenario which envisages that the projected traffic will materialise and is another type of optimistic scenario, but with the following riders.

1. That TNEB will not come forward to upgrade their handling facilities to handle their entire cargo requirement from one jetty and instead would like to continue with the present arrangement of two jetties CJ1 & CJ2. Hence their combined capacity will be limited to 6.5 MTPA which is the requirement of TNEB.
2. NCB1 being a captive berth of NTPL will operate only to their requirement. Hence its capacity will be limited to 6 MTPA.
3. That the NCB 2 will operate to its full capacity and there will be enough cargo generated and that the bulk and dusty import cargoes from existing multipurpose berths will be shifted to this berth.

4. That the mechanization of berth 9 now on way will be completed and will operate to its capacity.

In this scenario the capacity of bulk cargo handling berths in the existing harbour will be as given in **Table 7.2**.

Table 7.2 Existing Harbour - Capacity of Bulk Cargo Berths When Fully Developed-Scenario 2

S. No.	Berth	Capacity (MT)	Remarks
1.	CJ1	6.5	It is assumed that TNEB will continue with the present system and there will be no reconstruction of CJ1 & CJ2
2.	CJ2		
3.	NCB1	6	NTPL will operate this captive berth to its capacity which is their plant's requirement as well
4.	NCB2	7	The berth will operate to its capacity for multiple users and traffic will materialise.
5.	NCB3	9	This is expected to be a BOT berth meant for multiple users.
7.	Berth 9	6	With mechanization of unloading, conveying and stacking now taken up on BOT basis
	Total	**34.5**	

7.2.9.3 Preferred Scenario for Planning

The preferred scenario for this master planning is scenario 2. Based on this the traffic projections of bulk cargoes up to 2025-26 can be handled in inner harbour. This includes coal of all types, Limestone and copper concentrate.

Beyond this, the facilities for handling of bulk cargoes, more particularly coal will have to be created in the outer harbour. As such construction of outer harbour beyond 2025-26 is imperative. This also envisages development of bulk cargo berths on the northern side of outer harbour and the berths will be developed to handle mini cape size vessels (draft of 16 m). Initially two bulk cargo berths mainly for handling coal of all types will be developed and each berth will have a capacity of 10 MTPA. There will be two closed conveyors each of a capacity of 5000 TPH and will be fed by two unloaders each having a capacity of 2500 TPH. In the second stage of outer harbour development for bulk cargoes, two more berths will be added.

The coal will be received and stockpiled in the Hare Island for NCB III and evacuated through railway system proposed for connecting the Hare Island. For handling the projected traffic of 2035, more bulk coal unloading berths in the outer harbour have to be developed with similar connectivity closed conveyor system. The stackyard area at this stage will be located at the reclaimed area of Hare Island.

7.3 Container Handling

7.3.1 Berth VII

This berth was given on BOT basis to M/s Tuticorin Container Terminals Pvt Ltd., jointly promoted by PSA international and SICAL. The berth has a length of 370 m and a depth of 11.9 m with a backup area of 10 acres. The berth is equipped with 3 container Quay cranes and the capacity of the terminal is about 0.45 Million TEU.

7.3.2 Berth VIII

This berth was given to Dakshin Bharat Gateway Terminal (DBGT) a subsidiary of ABG Container Handling Private Limited. The berth though formally started operations during May 2014 is not yet equipped fully. The terminal is expected to shortly receive its 64 T capacity container quay cranes with 47 m outreach, and when fully developed will have a capacity of 0.6 Million TEUs.

7.4 Break Bulk Cargo

7.4.1 Based on Present Handling

During the year 2014-15, of the total port traffic of 31.3 MT, 11.03 MT is the share of container and 6.24 MT is thermal coal handled in the captive jetties on the north. The remaining 13.4 MT of cargo is handled in the multipurpose berths on the south side of harbour basin viz., in berth no 1 to 6, the shallow berths, the E Arm and berth IX. A small part of this was also handled in container berth no VIII whenever it was free. Also a small quantity is handled through lighterage operations.

Of this 13.4 MT, the Industrial coal, pet coke and thermal coal for private power plants account for 5.24 MT, copper concentrate another 1.13 MT, Limestone a quantity of 0.8 MT all these totalling to 7.17 MT.

Table 7.3 further illustrates the quantity handled by multipurpose berths I to VI and their berth occupancy during 2014-15. It can be seen that the quantity handled is 7.72 MT. Therefore it can be taken that the berth IX, the E arm and the shallow berth and lighterage operations have together handled 5.68 Million tons.

Table 7.3 Multipurpose Berths I – VI Performance

S. No.	Berth	Total Cargo Handled (MT)	Total No. of Ships	Avg Parcel Size (T)	Standard Berth Days	Berthing/ De-Berthing Days	Total Berth Days	Berth Occupancy (%)
1.	I	0.48	131.00	3,634.80	207.35	21.83	229.19	**62.8%**
2.	II	0.73	119.00	6,140.26	190.13	19.83	209.96	**57.5%**
3.	III	2.30	108.00	21,303.15	226.14	18.00	244.14	**66.9%**
4.	IV	2.52	116.00	21,681.89	238.53	19.33	257.86	**70.6%**
5.	V	0.71	250.00	2,837.62	327.73	41.67	369.40	**101.2%**
6.	VI	0.98	138.00	7,117.60	212.52	23.00	235.52	**64.5%**

The quantity of 7.78 MT handled includes copper concentrate, lime stone and industrial coal whose total quantity is assessed as about 4 Millions. This master plan envisages handling of all copper concentrate, limestone, thermal coal for private users, all industrial coal, pet coke through the mechanized bulk berths on the north and berth IX. The E arm and shallow berth will handle construction materials, cement and VCM; the quantity of remaining general cargoes handled by these six berths is found to be about 3.68 MT.

The capacity of any multipurpose berth depends upon the type of cargo handled, the vessel parcel size, the mode of handling, the capacity of equipment deployed, the speed of evacuation and so on. Taking all this into consideration and assuming that handling remaining bulk cargoes and more particularly fertilizer and fertilizer raw material will all be done using high capacity electrical level luffing wharf cranes and mobile harbour cranes, the combined capacity of the existing 6 multipurpose berths is assessed to as 9 MT.

7.4.2 Capacity based on Average Parcels Size and Average Handling Rate

As indicated earlier, the capacity of a berth depends on parcel size and speed of handling. On this basis certain assumptions have been made in respect of these two variables to arrive at the capacity a multipurpose berth as provided in **Table 7.4**.

Table 7.4 Capacity of a Typical Multipurpose Berth

S. No.	Particulars	Units	With MHCr		With Ship Gear/High Capacity Shore Electric Cranes	
			Bulk	Break-Bulk	Bulk	Break-Bulk
1.	Average Parcel size	T	45,000	15,000	45,000	15,000
2.	Average handling rate	TPD	20,000	8,000	12,000	6,000
3.	Handling time	Days	2.25	1.88	3.75	2.50
4.	Berthing, Deberthing and Miscellaneous time	Days	0.25	0.25	0.25	0.25
5.	Total time per ship	Days	2.5	2.13	4	2.75
6.	Total berth days available per annum	Days	350	350	350	350
7.	Maximum allowable berth occupancy	Percent	70	70	70	70
8.	Optimum berth occupancy days	Days	245	245	245	245
9.	Capacity of berth (2x8)	MT	4.9	1.96	2.94	1.47
10.	Percentage weightage	Percent	10	90	10	90
11.	Capacity for each range	MTPA	0.49	1.756	0.294	1.33
	Capacity	**MTPA**	**2.246**		**1.624**	
	Assumed Capacity	**MTPA**	**2**		**1.5**	

In line with the above it can be deduced that the combined capacity of the present multipurpose berth group consisting of 6 berths alone without the shallow draft berths and E arm may be taken as 9.0 MTPA. The capacity of each berth is taken as 1.5 MT and not 2 MT is on the understanding, that once all the major bulks except fertilisers and FR are shifted they have to contend with highly fragmented cargoes.

7.5 Liquid Cargo

The port has an exclusive liquid cargo jetty called OJ for handling POL products and LPG. During the last financial year i.e. 2014-15 a quantity of 0.637 MT was handled at this jetty. During this period it had an occupancy of 132 days which means occupancy of 37.7%. The jetty has depth of 14.1 m below CD which means it is capable of handling POL tankers drawing a draft of 12.8 m.

The jetty is presently handling Naphtha, LPG, Liquid ammonia, Furnace oil and diesel. Furnace oil is however handled in some of the multipurpose berths also (like berth V, VI etc.). Of them only Naphtha has average parcels size of about 15,000 tons plus. All other remaining cargoes have low parcel size of 6,000 T and less.

Even with the present cargo mix and parcel sizes this jetty alone is capable of handling POL cargoes of 1.25 MT. And by increasing the size of pipe lines and higher parcel sizes which can be expected when the throughput increases, this jetty can handle about 2 MTPA of POL products. As is already noted the furnace oil is already handled at other multipurpose berths. In fact even diesel can be handled in a multipurpose berth like berth 6 with certain precautions.

As such for the traffic projection by 2025 viz., of 2 to 2.1 MTPA of Liquid cargoes no additional berthing infrastructure is necessary.

In this connection it is pertinent to note that liquid cargoes like Palm oil are handled in multipurpose berths and VCM is handled in shallow berth. Beyond 2025 when POL liquid cargo projections increase to 3 to 3.3 MT as projected for 2035, then some of the POL products like furnace oil can he handled in multipurpose berths.

7.6 Requirement for Capacity Expansion

The requirement for future expansion of facilities for various phases of development has been worked out as in **Table 7.5**.

Table 7.5 Capacity Augmentation Requirements

Commodity	Current Capacity (MTPA)	2020		2025		2035	
		Forecast Traffic (MTPA)	Capacity Augmentation required over current (MTPA)	Forecast Traffic (MTPA)	Capacity Augmentation required over current (MTPA)	Forecast Traffic (MTPA)	Capacity Augmentation required over current (MTPA)
Dry Bulk	**14.2**	26.5	12.3	38.3	24.1	63.4	49.2
Break Bulk	**13.7**	8.9	0.0	11.7	0.0	19.3	5.6
Containers (TEUs)	**1.1**	1.0	0.0	1.2	0.1	2.0	0.9
Liquid Bulk	**2.0**	0.8	0.0	1.3	0.0	2.0	0.0
Total	**50.6**	**55.7**	**12.3**	**74.5**	**26.6**	**123.2**	**72.5**

1 TEU = 19.7 T

The projected traffic for VOCPT for the year 2020 is estimated to be 55.7 MTPA. The increase in traffic is majorly due to dry bulk cargo demand. The total growth is expected to raise high up to 74.5 MTPA by 2025 and 123.2 MTPA by 2035. The required additional capacity of 72.5 MT would be needed by 2035.

Various options for achieving the capacity augmentation like inner harbour development and outer harbour development are discussed in subsequent sections.

8.0 RAIL AND ROAD CONNECTIVITY

8.1 Road Connectivity

8.1.1 Present Scenario

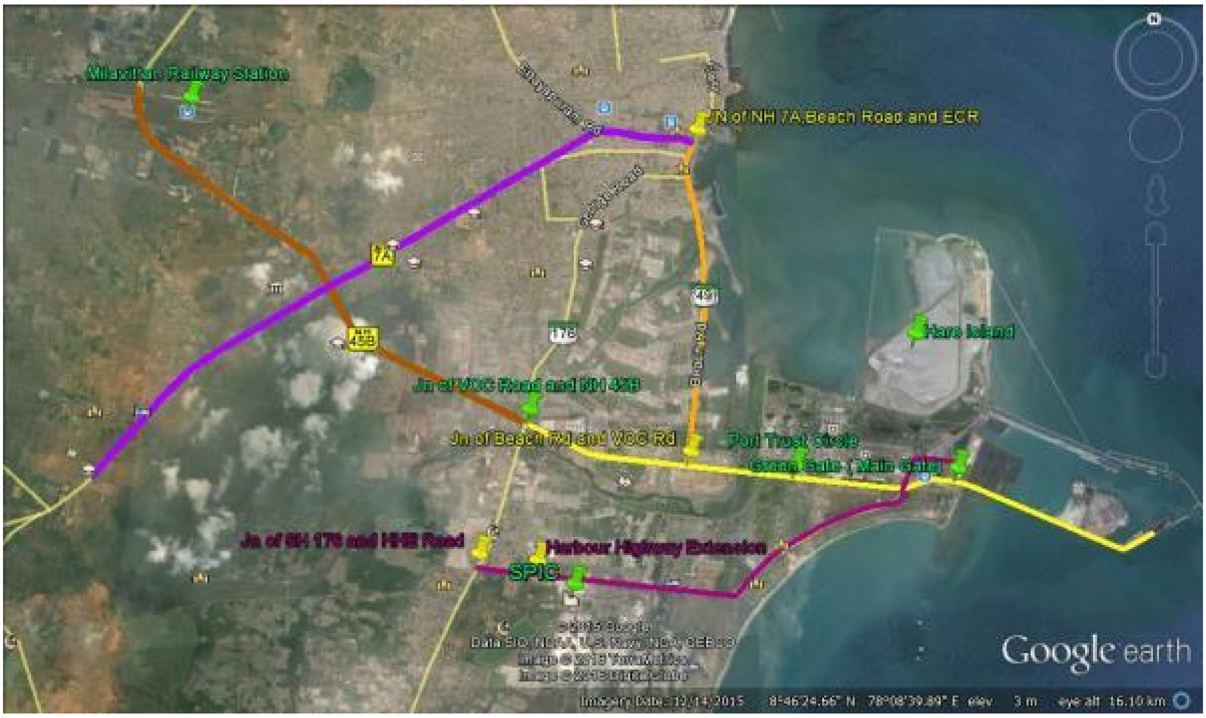


Figure 8.1 Road Connectivity VOCPT

The two important National Highways NH 7A and NH 45 B pass near the port as shown in **Figure 8.1**. These two cater to the major port bound traffic movement from the Hinterland. From the junction presently all traffic moves through the VOC road and passes through the Green Gate.

8.1.1.1 VOC Road (SH 200)

This road is the major arterial road for present port bound traffic movement. Presently the road is having the 4 lane divided carriageway with paved shoulder as shown in **Figure 8.2**. Truck queuing is observed on the road along with the uncontrolled cross overs thro median opening near the Green gate. Presently one major bridge is there on the road.

Figure 8.2 VOC Road (SH 200)

8.1.1.2 State Highway 49

State Highway 49 originating from the VOC road (known as Beach Road) meets with NH 7A after traversing a length of about 5 km as shown in **Figure 8.3**. Presently, this is a two lane road and passes through congested built up section. Connectivity from Tuticorin railway station is also from Beach Road.

Figure 8.3 State Highway 49

8.1.1.3 State Highway 176

State Highway 176 crosses NH 45B and further it meets with the Beach Road. It is a 2 lane road.

8.1.1.4 Harbour Extension Road

This road originates from SH 176 and traverse towards South direction. It crosses VOC Road; moves further east and come to Green Gate as shown in **Figure 8.4**. This road is having 2 lane configurations and presently not much traffic is observed. A pipeline is observed at the left side of the road

Figure 8.4 Harbour Extension Road

8.1.1.5 Proposed Vehicle Evacuation by the Port Authority

1. Gate Details

There are 4 existing gates for the port.

a) **Green Gate:** It takes care of the Entry / Exit for most of the present port bound traffic. It is on the VOC road which is having the 4 lane configuration.
b) **Red Gate**: It takes care of the cargo that passes through the Conveyor.
c) **Yellow Gate:** It takes care of the evacuation of the coal yard traffic. The vehicle from proposed NCB 1 -4 will use the road for evacuation purpose and also the officials' vehicle will use the gate
d) **Blue Gate:** Presently the gate is closed. Will be used for any kind of emergency in future

2. **Ongoing / Recently Completed Road Project**

a) 4 lane road from Hare Island to Red gate

b) Red gate to TTPS circle 4 lane road (Rigid pavement)

8.1.2 Consultant' Proposal for Future Road Connectivity

For the better connectivity in future following new road connectivity has been proposed.

- New 4 lane road connectivity in between Harbour Extension Road and National Highway 7A as shown in **Figure 8.5**.

Figure 8.5 Proposed Connectivity to NH7A

- The Harbour Highway Extension road in between node A and B will have divided 4 lane configurations (about 5 km length) as shown in **Figure 8.6**.

Figure 8.6 Proposed Widening of Harbour Highway Extension Road

- From node A to VOC road junction of the HHE road will be used by the traffic who wants to get into the port through green gate only as shown in **Figure 8.7**. Once the VOC road as well as new road connecting HHE road and NH 7A is operational SH 176 has to be carried out.

Figure 8.7 Proposed Road for Traffic through Green Gate

- It is proposed to provide divided 8 lane configuration of VOC road in between port trust circle and the junction with NH 45 B as shown in **Figure 8.8**.
- New bridge over the creek (parallel to the existing bridge) on VOC road to match with the VOC road configuration.

Figure 8.8 Proposed Widening of VOC Road (8 Lane)

- It is proposed to widen the existing NH 7A as shown in **Figure 8.9**.

Figure 8.9 Proposed Widening of NH 7A

- Presently Green gate is handling both the Entry as well as Exit of the vehicles. Long queue of the traffic on VOC road is observed which leads to the major congestion. After the proposed road from Hare Island will become functional, the traffic movement will be worsening further on VOC road. To remove the bottleneck near the Green gate following measurement is proposed

  a) Staggered Entry and Exit gate location to provide the exclusive entry and Exit to reduce the waiting period at Gate.

  b) Elevated Road on VOC Road (About 2 km) for the traffic coming out of the port.

  c) The traffic from Hare Island will have the up ramp (2 lane configuration) to meet with the elevated road on VOC.

  d) Elevated road on VOC will be 2 lane road configurations from the exit gate and after the merger of the ramp from Hare Island it will have 4 lane configurations as shown in **Figure 8.10**.

  e) The elevated road will have down ramp (2 lanes) for the vehicles intended to go for Harbour Highway Road.

  f) The elevated road will continue further and meet with the VOC road after crossing the port trust circle.

  g) Harbour Highway Road will further meet with VOC road. Traffic comes from NH 7A and intend to go to Hare island will only follow this route as shown in **Figure 8.11**.

Figure 8.10 Proposed Elevated Road Above VOC Road

Figure 8.11 Connecting Road Between VOC and Hare Island

8.1.3 Trucking Parking Facilities

Based on the land use plan studied and proposed by RITES India Ltd for VOC Port, out of the total existing land available with the port 32.85 ha is allocated only for truck parking facility. Four different locations have been identified for truck parking facility within the port limit as listed below and shown in **Figure 8.12**:

1) Area I – Near the intersection of harbour highway extension and VOC road (allotted 3.9 Ha)
2) Area II – Near the junction of beach road and VOC road, next to the existing rail line (allotted 1.3 Ha)
3) Area III – Near the junction of beach road and VOC road, next to the existing rail line (allotted 1.3 Ha)
4) Area IV – At the south west area of the Hare Island to be developed (allotted 20.75 Ha).

Figure 8.12 Planned Locations for Truck Parking Facilities

8.2 Railway Connectivity

8.2.1 Present Scenario

Figure 8.13 Railway Connectivity VOCPT

Presently one single Broad Gauge line comes to Port area after originating from Milavattan Railway station. The total length of the railway line is 17.60 km as shown in **Figure 8.13**.

From Milavattan Railway station to VOC wharf is 14.0 km and VOC wharf to Marshalling yard is having the balance length near coal yard a loop line is there and 5 nos. lines are available in the Marshalling yard.

8.2.2 Proposed Railway Option by the Port Authority

a) It is proposed to have railway line from Hare Island to Marshalling Yard (Approximate length 5.9 km) – The detailed plan submitted to the Railways for approval
b) New railway line is also proposed from Marshalling Yard to Red Gate (2 lines Approximate length 1.8 km)

8.2.3 Consultants Proposal on Railway Option

The Madurai – Dindigul double line is under progress and the doubling of Madurai – Tuticorin section is proposed. To have better access with the hinterland it is proposed to have electrification and doubling of the existing Milavattan Railway station to Marshalling yard line. The same is also proposed for existing Line from Milavattan railway station to Tuticorin section.

9.0 SCOPE FOR FUTURE CAPACITY EXPANSION

9.1 Development Possible within the Existing Harbour

9.1.1 Existing Harbour – Limitations and Planned Developments

The port has a dredged depth of 14.1m below CD in the inner channel, coal jetties CJ1, CJ2, Coal berth NCB1, NCB2 which are all on the north side of harbour. On the south side similar depth of 14.1 m is available in container berth 8 and berth 9. All these berths can handle Panamax vessels with a loaded draft up to 12.8 m, leaving an under keel clearance of about 1.3 m. As regards the remaining existing berths it is not feasible to deepen further due to their design limitations.

The currently planned layout of the inner harbour is shown in **Figure 9.1**.

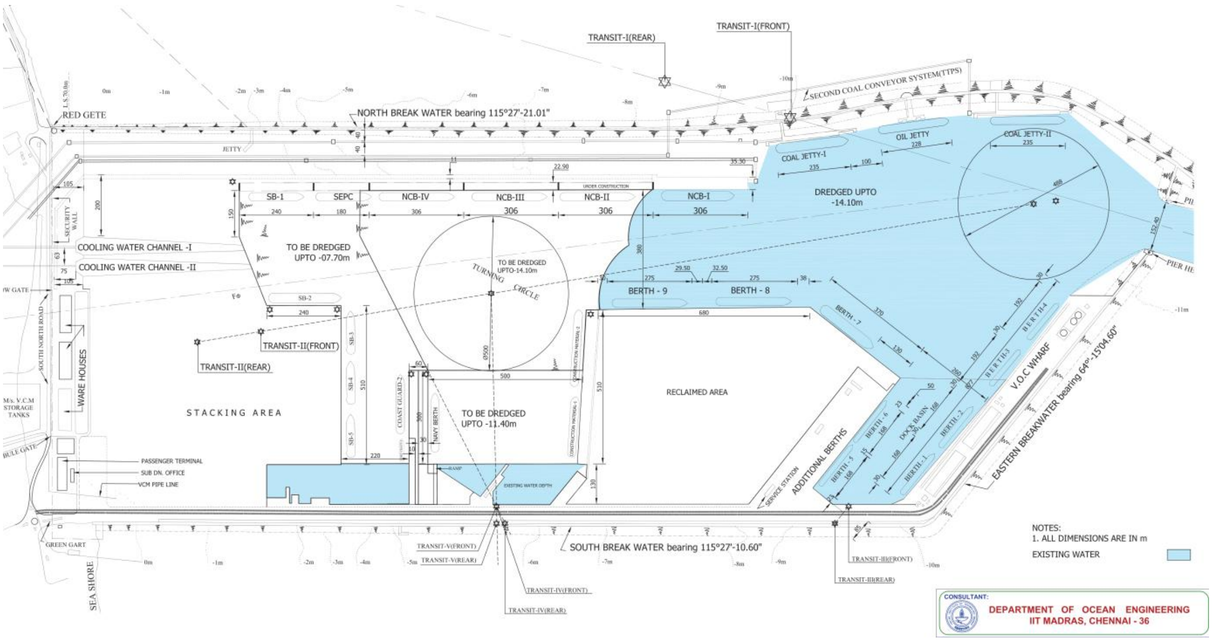


Figure 9.1 Planned Layout of VOC Port Inner Harbour

9.1.2 Options for Development of Existing harbour

9.1.2.1 General

In order to develop the suitable alternative layouts for the inner harbour development of VOC port, following facts are to be duly taken into account:

1. The concessions for NCB3, NCB4 and cement berths have been cancelled and port would be calling for fresh tenders.

2. The planned shallow water berth perpendicular to berth 9 is under litigation and if the tender process is cancelled, the same shall be available for development for handling required commodities.

3. The port has firmed up plans for development of coastal berth and also a finger jetty perpendicular to the south breakwater has been allocated to Navy and coast guard as shown in **Figure 9.2**.

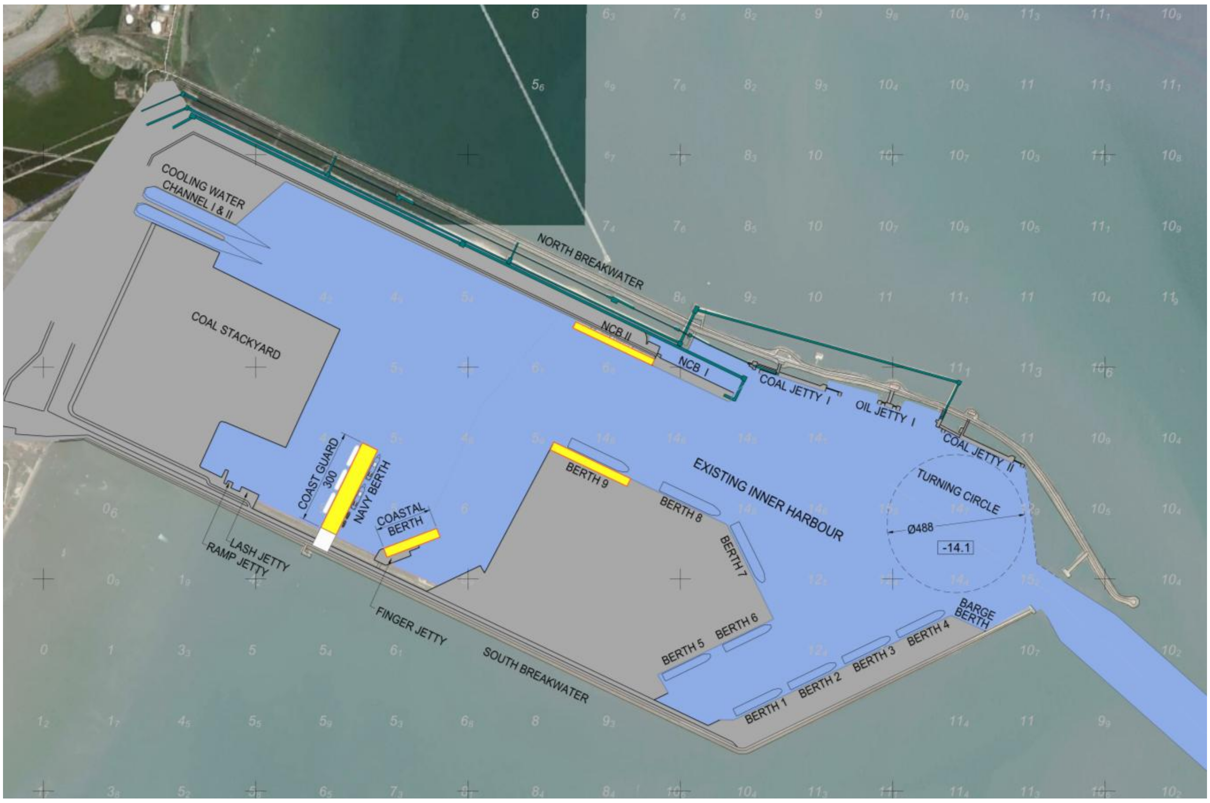


Figure 9.2 Layout Showing Current Inner Harbour and Confirmed Plans of Additional Berths

4. As regards berth 9, the contract for O&M for handling and transferring bulk cargo to bulk stackyard through conveyor system has already been awarded. Therefore the location of berth for handling bulk cargo through conveyor etc. as already envisaged cannot be changed.

5. Though the location of berth 9 is not ideal for handling of dry bulk cargo due to presence of container berths nearby, this is the only deep water berth available at present for handling the bulk cargo other than coal. At the time of renewal of O&M contract now under implementation and once the same expires, after 10 years the handling operations now being installed could be shifted to other berth, if needed.

6. The coastal berths being developed by port does not allow a “Green Channel” i.e. the entry/exit to this berth still has to pass through the custom bound area and thus do not meet the objective fully.

9.1.2.2 Alternative 1

This alternative is basically similar to the plans of the port currently being pursued has regarding berths located along the north breakwater in which NCB 3, NCB 4 and SPEC berths which shall be built along the north breakwater.

Currently dredging has already been carried out by port for the shallow water berth and in the next phase the deepening would take place for the turning circle and berthing areas for NCB 3 and 4 berths. As the deeper water (i.e. -14.1 m CD) would be available at turning circle, with little extra dredging it would be possible to create deeper draft at the location of currently proposed shallow water berth so that the same could be instead used as a deep water berth for handling containers or bulk cargo.

On the opposite side of the container berth, taking the advantage of deeper water available due to dredging in the turning circle, another berth for handling coal could be developed with minimal quantity of dredging. The reclaimed area on the western end could be extended to create more space for stacking of coal.

It is also proposed that the coastal berth could be further extended parallel to proposed Navy berth so as to provide berthing facility to handle two barges simultaneously. This would optimally utilise the harbour area.

Similar to alternatives 1 and 3 the east side of bulk stackyard shall be developed a deep water bulk berth, which would meet the requirement of port to handle other dry bulk apart from coal. This berth is optimally located as the stackyard is adjacent to this berth. This alternative layout is shown in **Figure 9.3**.

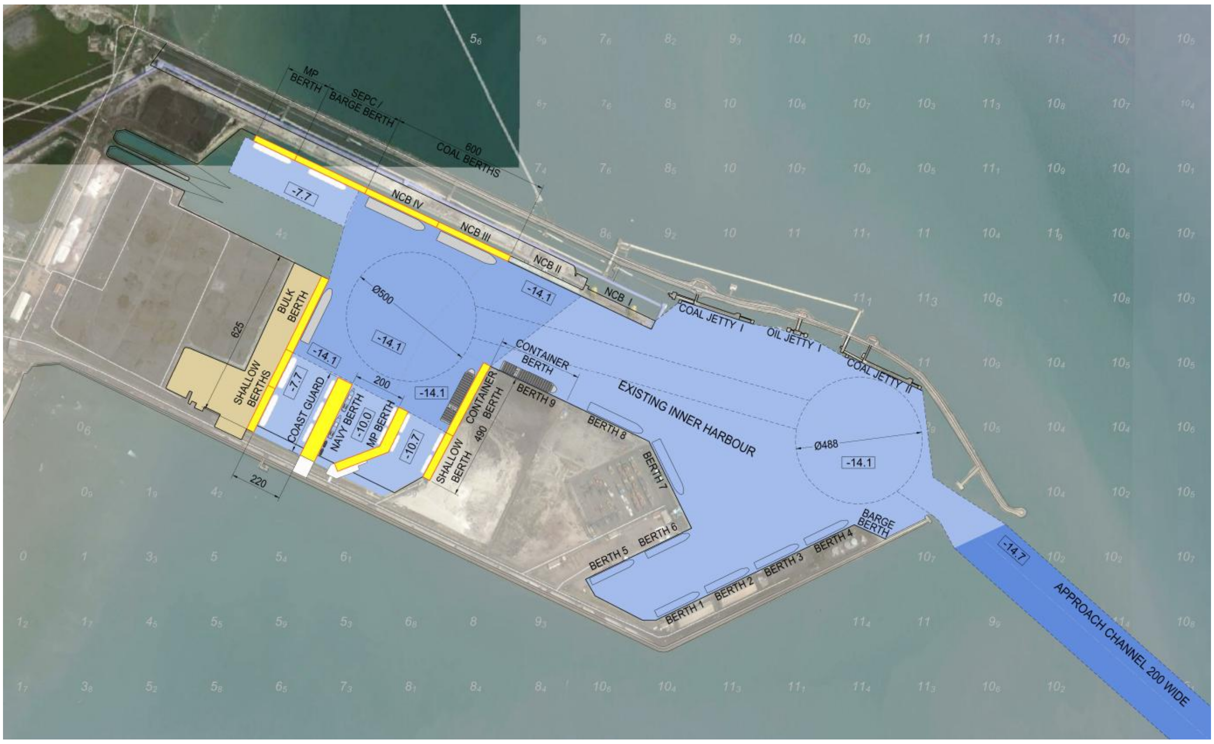


Figure 9.3 Options for Development of Existing Harbour – Alternative 1

With the provision of two additional coal berths and one dry bulk berth within the inner harbour, the berth 9 could later be released developing the container berth, after the expiry of the current concession of the O&M contract (now under implementation). Apart from that a berth perpendicular to berth 9 could also be built for handling containers. This berth 9a can utilise the same yard as for berth 9 and with proper circulation plan could add additional container handling capacity. Also this perpendicular berth can be either a container or a bulk berth.

This layout has the following benefits:

1. Utilises the deeper water depths proposed to be created for only two berths (NCB 3 and NCB 4) to enable two more deep draft berths with minimal additional dredging.
2. Consolidates the container handling at berths 7, 8, 9 and 9a berths with adequate backup area.
3. Allows separation of clean cargo and dirty cargo area. This has large impact on the user perception about a port particularly for containers.

The only issue could be that the berth 9 would only be available after 10 years after the expiry of current O&M contract for dry bulk cargo handling.

9.1.2.3 Alternative 2

In alternative 2, it is proposed that a quay length of 900 m could be created parallel to NCB I and II, as shown in **Figure 9.4**.

This would enable providing one coal berth and two container berths, towards west of NCB 2. The existing reclaimed area near the root of north breakwater could be extended to allow space for container yard. The quay perpendicular to berth 9 shall also be used as a deep draft bulk berth due to availability of deeper depths

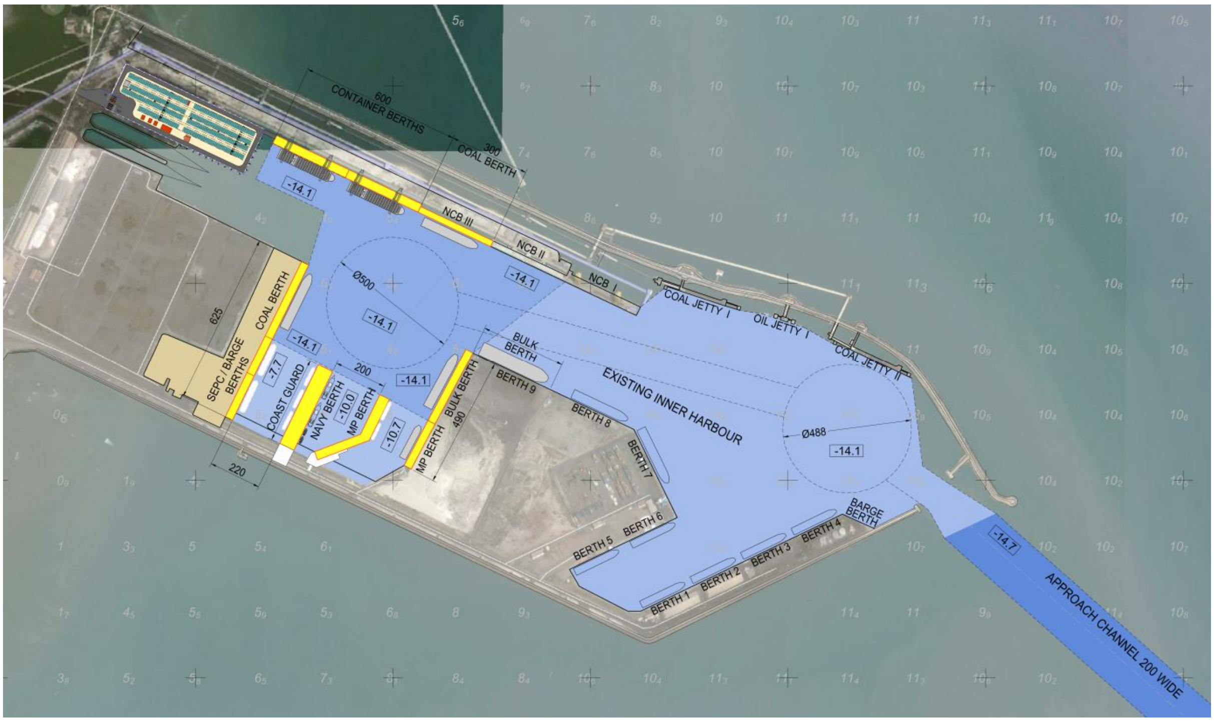


Figure 9.4 Options for Development of Existing harbour – Alternative 2

SEPC berths (for barges of draft limited to 7 m) and a deep draft coal berth are proposed in the existing stackyard area towards west of harbour basin.

Only issue in layout is likely to be the limited space available for the proposed two berth container terminal along the north breakwater. Therefore the proposed container terminal as part of this alternative is analysed further to assess its suitability.

Based on the area available a tentative layout of the container terminal has been developed as shown in **Figure 9.5**. It is assessed that about 1700 ground slots for stacking of containers would be possible for using RTGs. Considering the dwell time of 3 days this translates to a terminal capacity of 550,000 TEUs only. Hence the limited yard area can support only one full-fledged container berth rather than two.

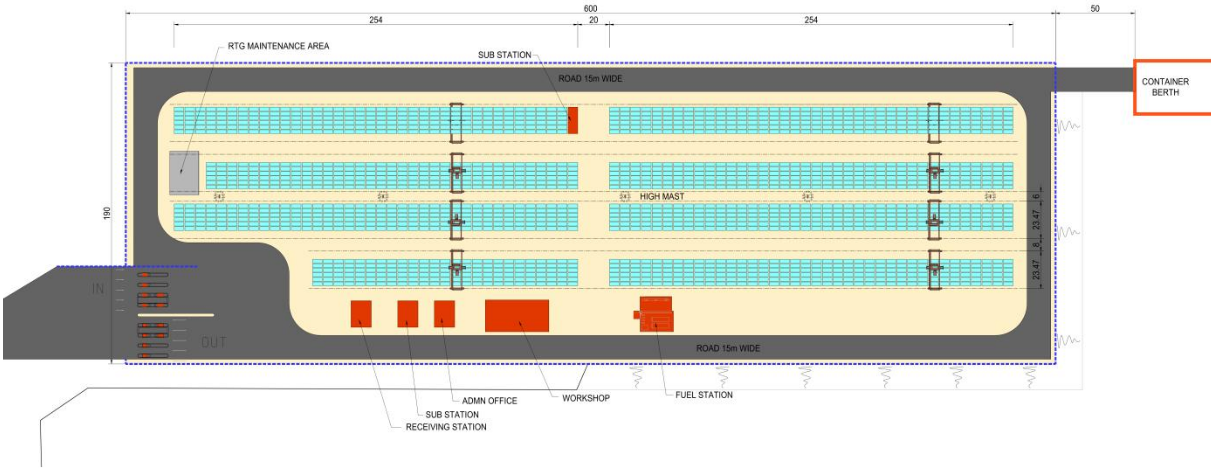


Figure 9.5 Layout of Container Yard along North Breakwater

As per the traffic projections the need for additional coal berths is likely to be earlier than the need for container berths and therefore reduction of 1 bulk berth in this alternative is not suitable. This also has an issue that the container handling facilities and coal handling facilities are spread all over without proper segregation. Only advantage in this case is that in and out movement to the proposed container yard is through a separate access.

9.1.2.4 Alternative 3

The proposed layout is similar to the alternative layout 2 with the exception that only one container berth is provided along the north breakwater (NCB 4). The reason of considering NCB 4 as container berth instead of the berth on its north side is that additional dredging will not be needed in the initial stage of container berth development. The following options would exist for developing the berth north to NCB4:

1. To develop this as a container berth to complement NCB 4. This would be possible only if it is later found that the existing yard can service two container berths due to lower dwell time.
2. To develop this as a container berth as a replacement to NCB 4, which shall be later converted to a coal berth, if the demand of coal picks up. To pursue this option it would be preferable that the container cranes provided at NCB 4 are of 20 m rail gauge which is also the rail gauge for the coal unloaders.
3. To develop this berth as a clean cargo berth

A suitable decision in this regard could be taken at a later stage depending on the traffic growth scenario.

Further it is suggested that the additional deep water berths i.e. NCB 3, NCB 4, berth 9, bulk berth, new container berth and existing berth NCB 2 are all deepened to handle fully loaded panamax vessel with draft of 14.5 m as shown in **Figure 9.6**.

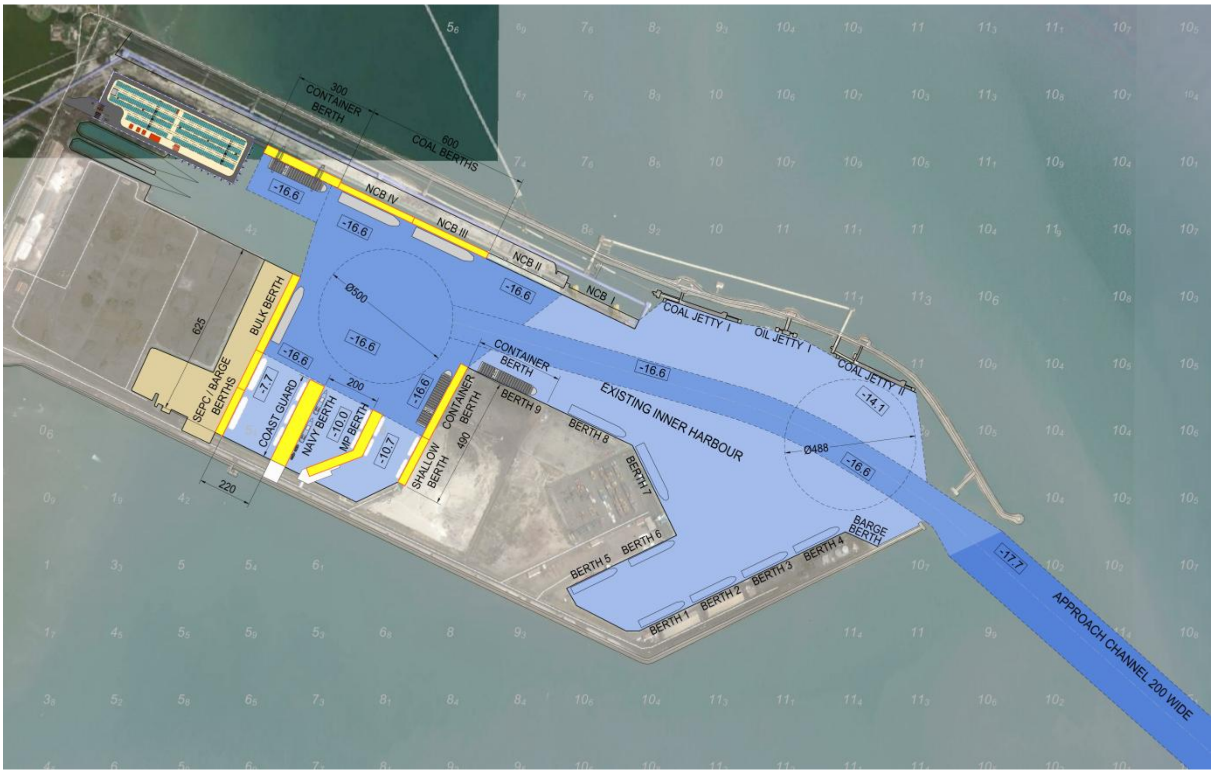


Figure 9.6 Options for Development of Existing Harbour – Alternative 3

This would significantly reduce the logistics cost of handling coal as fully loaded panamax size ships with draft of 14.5 m would be able to directly able to call at the port. Currently, they have to incur significant waiting time and cost at anchorage operations to light load the ship up to allowable harbour draft of 12.8 m.

However, this option involves significant cost of capital dredging in rock, though much less than the outer harbour development. Therefore the phasing for deepening could be decided duly evaluating the financial viability.

Earlier also the possibility of dredging to deepen the existing harbour up to 16.1 m depth to cater to fully loaded Panamax vessels was examined and in our opinion possible due to following reasons:

a. As regards to the impact on the existing berths due to deepening, it could be seen from **Figure 9.6** that the proposed area of deepening is away from the existing berths and therefore does not endanger their stability.

b. The deepening is proposed so that fully loaded panamax ships could be brought to the port. Even currently panamax vessels are brought to the port using the same entrance width and therefore entrance width cannot be considered as a constraint for about 1.7 m deepening.

c. However in case the ports feel that the current entrance width is tight even for panamax vessel, which are currently visiting the port, then appropriate measures are technically possible to increase the entrance width.

d. Due to the relatively benign wave conditions at site, as compared to other ports along east and west coast, the current entrance width of 153 m is very narrow from the wave tranquillity point of view and it is felt that the same could be widened to about 200 m without affecting the tranquillity at the berths.

Considering the benefits that the harbour deepening offers to the port, it is recommended that port should seriously pursue the option of further deepening of harbour to handle fully loaded panamax ships at the significantly large proportion of berths.

9.1.3 Recommended Plan for Development of Inner Harbour

Based on the currently executed projects particularly the mechanisation of berth 9, it is assessed that alternative 3 is more appropriate. This would however require wider harbour entrance. The recommended layout is as shown in **Figure 9.7**

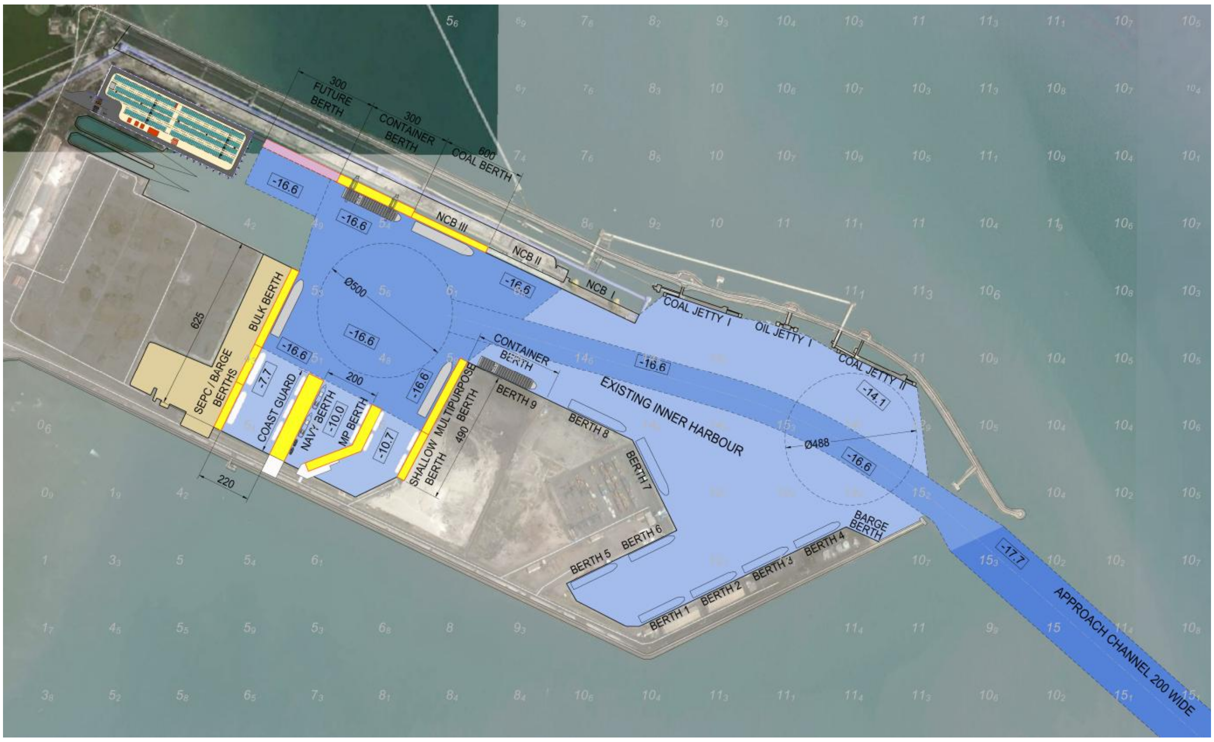


Figure 9.7 Recommended Layout of Inner Harbour

From the above discussions, it can be seen that the thrust of recommended layout of Inner harbour envisages the following.

a. The inner harbour shall be developed to its full and optimal potential.
b. The inner harbour to be developed to handle fully loaded panamax vessels.
c. The entrance of inner harbour be widened
d. The consequent dredging of Approach Channel outside the present harbour entrance will eventually be useful for outer harbour dredging whenever such outer harbour materialises.
e. It will cater to the natural growth of exim container and import coal traffic that may be expected by the time Outer harbour becomes operational.
f. In alignment with the policy of government of India to reduce dependence on foreign coal imports, the coal import through Tuticorin port will be mostly through coastal movement of coal for which fully fully-loaded panamax vessels will be the optimal vessels size. The development of inner harbour as proposed will perfectly align with this objective. Further the length and cost of conveyors for coal berths developed in the optimised layout of inner harbour will be more economical.

9.2 Outer Harbour

With the above scheme of inner harbour development the projected traffic forecast up to year 2025 could be handled. As per current projections beyond this there would be a need for development of outer harbour as far as cargo handling capacity is concerned. Also as per the recommended scheme, it would be possible to handle fully loaded panamax bulk carriers within inner harbour with adequate number of container and bulk berths in inner harbour. Therefore any advancement of outer harbour development would be only be needed if the large container vessels having draft of 16 m or bulk cape carriers of draft 18.3 m are required to be catered to achieve the overall logistics advantage.

9.2.1 Basis for Port's Outer Harbour Development Proposal

The port has developed the master plan proposals and layout on the basis of traffic forecast as per DPR (by I-maritime) and refined by IPA. However, a recent national level Origin-Destination study of the cargo being handled at ports across the country carried out as part of Sagarmala (by McKinsey) has projected different traffic figures. The broad comparison of two studies is mentioned in **Table 9.1** below.

Table 9.1 Coal - Traffic Forecast as per VOCP (Validated by IPA)

Commodity	Unit	Year 2019/2020		Year 2024/2025		Year 2035/2036	
		I-Maritime	McKinsey	I-Maritime	McKinsey	I-Maritime	McKinsey
Coal	(MT)	26.9	26.6	42.1	38.3	75.3	63.4
Containers	(MTEU)	1.2	0.9	1.7	1.2	3.1	2.0

It could be clearly seen from Table 9.1 that as far as coal is concerned, it is established that Tuticorin port offers great potential for handling of coal brought to the port using coastal movement and in this regard the projected traffic numbers are more or less similar in both the studies. The numbers for hinterland containers projected by McKinsey are slightly lesser as compared to those projected by I-Maritime. But the projections by McKinsey duly consider the current scenario in which the proposed container port at Vizhinjam is under construction and that at Enayam has already been approved by Government and DPR is under preparation. These two ports apart from handling transshipment containers would definitely have their share of hinterland containers also eating away the share of Tuticorin and Cochin.

The major difference is in the traffic for the transshipment containers. It may not be out of place to mention that as part of Sagarmala assignment, a separate report on the suitable location of transshipment terminal has been prepared and basis which site at Enayam has been selected. As the construction of Vizhinjam has started and DPR for Enayam underway by VOC port itself, it would be very unreasonable to assume significant transshipment traffic at VOC port requiring very large outer harbour development. Even the IPA report mentions the following:

"The Team strongly recommends that serious and due consideration may be given by the port to the concept of Satellite port as the first expansion alternative of the port and take an informed decision before considering Outer harbour option."

The layout of Port's Master Plan for Outer harbour is shown in **Figure 9.8.**

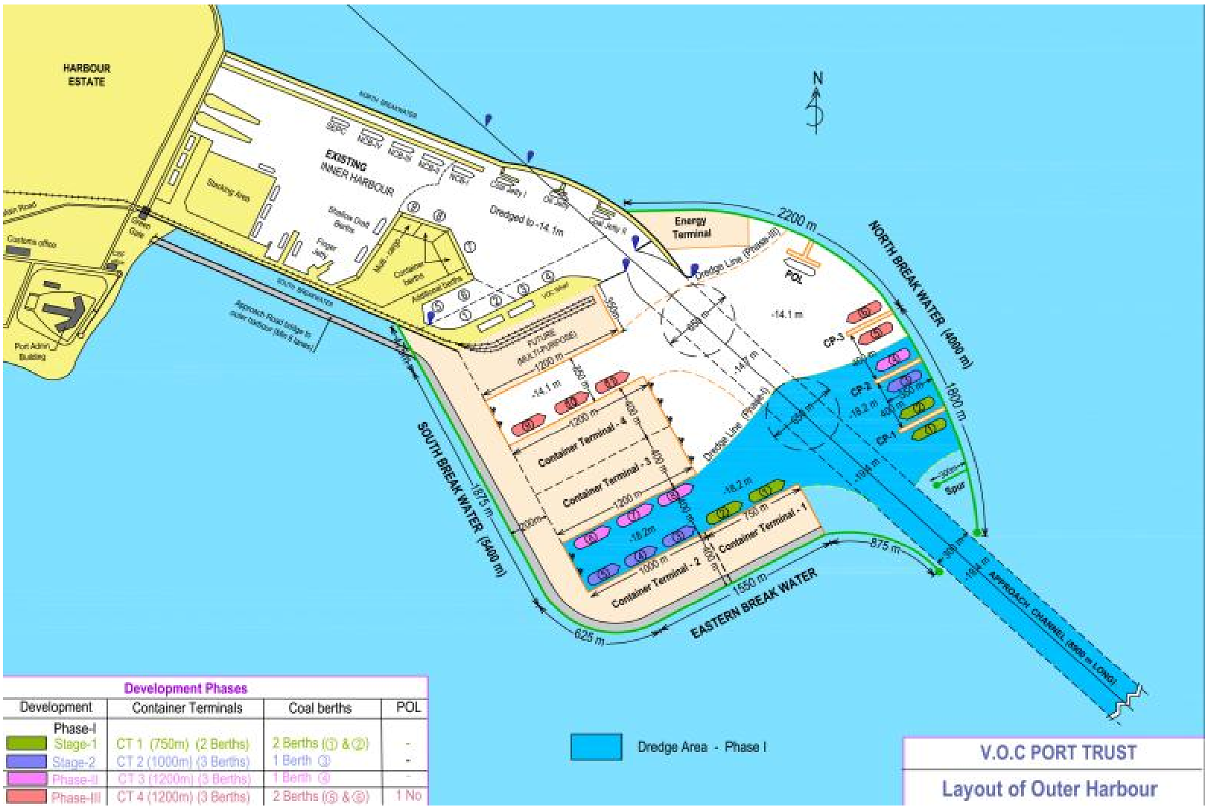


Figure 9.8 Layout of Port's Master Plan for Outer Harbour

As could be seen the layout proposed by the port envisages development of 14 container berths, which are basically necessitated on account of projected 7.4 MTEUs of transhipment container traffic.

9.2.2 Master Plan Layout based on the Current Traffic Forecast

9.2.2.1 Facility Requirements

For Coal Handling

As already indicated earlier that the preferred option is to develop coal handling capabilities within the inner harbour to the maximum extent and only after exhausting the same the development of bulk berths in the outer harbour may be taken up. This is due to the fact that as per government policy of sourcing of coal for power plants shall be 70% indigenous which means handling of Panamax vessels will be adequate.

When the inner harbour saturates for bulk handling, creating facilities in the outer harbour for bulk handling more particularly for coal is imperative.

__For Container Handling__

The current capacity of two container berths 7 and 8 together for container handling is of the order of 1.0 MTEUs and even if the additional container handling projects within the inner harbour do not materialise, the required container handling capacity for outer harbour would be only 1.0 to 2.1 MTEUs requiring maximum 3 to 4 berths.

__9.2.2.2 AECOM's Proposed Master Plan Layout__

In line with the above requirements an alternative master plan layout has been developed by AECOM as presented below in **Figure 9.9**. This layout is basically a downsized version of the layout by port.

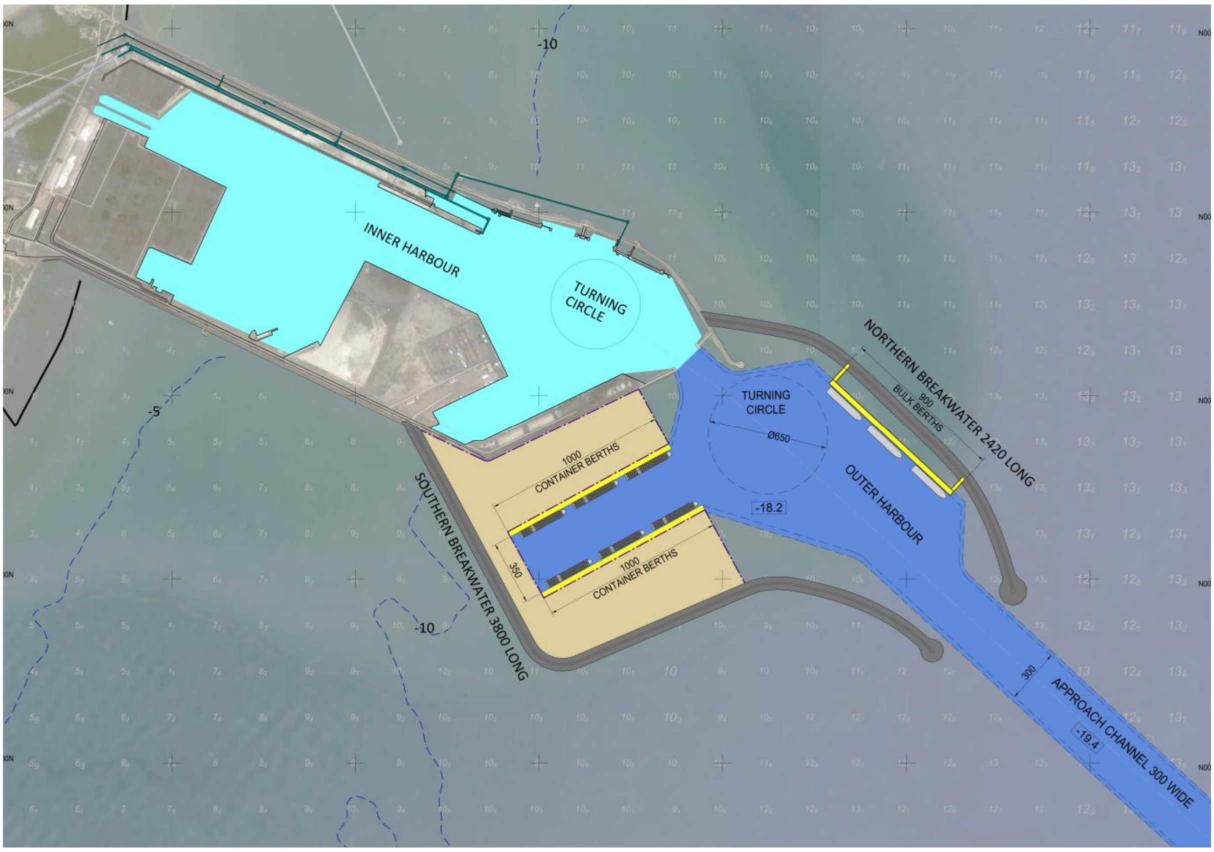


Figure 9.9 AECOM's Modified Master Plan Layout

The proposed master plan layout can provide additional container handling capacity of about 3.6 MTEU and about 30 MTPA capacities for bulk import. The approach channel and harbour would be dredged for 16 m draft ships eventually and could be planned to cater to 14.5 m draft ships initially.

9.2.3 Comparison between Port's and AECOM's Layout

9.2.3.1 Facilities in Phase 1 Development

The traffic forecast made over a time horizon of 20 years up to 2035-36 will actually develop over a period of many years depending upon the GDP growth, and industrialisation of the hinterland etc. In view of this, it is necessary to plan for the layout of outer harbour taking the ultimate traffic by 2035 and the berthing facilities as per incremental increase in traffic that can be excepted in five, ten and fifteen years in a phased manner.

It is therefore proposed to develop the outer harbour in phases with breakwater for ultimate layout in the beginning itself but the berthing structures, dredging and reclamation can happen in phases. In line with this, the layout and berthing facilities in the first phase are proposed as per the following layout.

The proposed Phase 1 layout comprises of 2 container berths and 2 coal berths. It is proposed that while the berthing structures may be designed for the 16 m or even 18 m draft ships, the dredged depths in the channel and harbour basin are to be increased in a phased manner. Initially the dredging could be carried out for 14.5 m draft ships to cater to fully loaded Panamax ships of all sizes. Subsequently, it can be increased to 16.0 m as per market demand.

9.2.3.2 Phase 1 Layout of Outer Harbour

The proposed Phase 1 layout of the outer harbour development as per the Port's Layout and that as per AECOM's Layouts are shown in **Figure 9.10** and **Figure 9.11** respectively.

Figure 9.10 Proposed Phase 1 Development of Layout by VOC Port

Figure 9.11 Proposed Phase 1 Development of Layout by AECOM

9.2.3.3 Comparison of Layouts

Considering the shorter breakwater lengths, it is estimated that about 60% of the rock quantity would be needed in the modified layout as compared to the base layout proposed by the port. Therefore Phase 1 facilities could be commissioned about 2 years earlier in the layout proposed by AECOM.

A cost comparison between the two layouts reveal that the cost of basic infrastructure in terms of breakwater, dredging and reclamation in the Phase 1 layout proposed by AECOM would be lower by about INR 500 crores i.e. about 6%.

As regards the master plan layout, the downsized version of Port's layout (even after keeping the breakwater configuration same but reducing the number of container berths) would be as shown in **Figure 9.12** below.

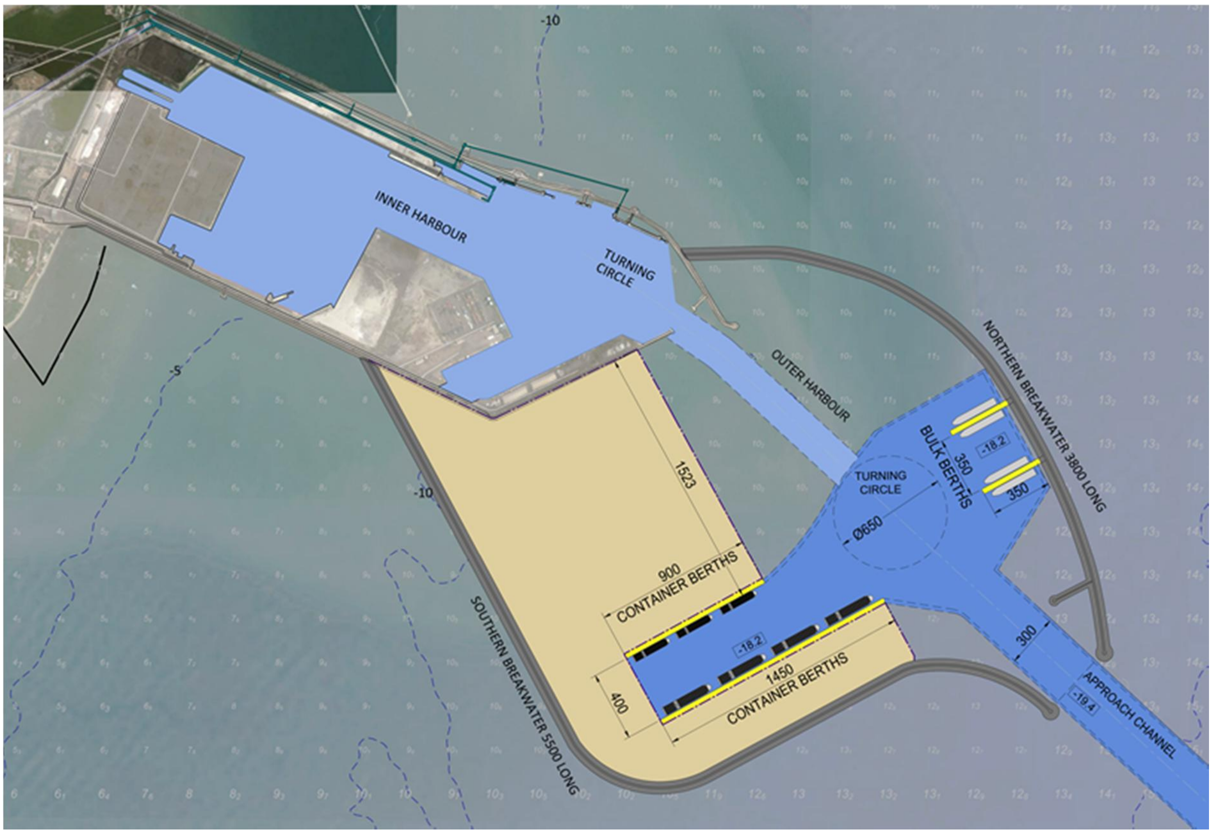


Figure 9.12 Downsized Master Plan Layout of the Outer Harbour

The additional harbour area obtained in this layout due to long breakwaters could be utilised for creating huge backup area of about 140 Ha, (beyond what is required for berthing facilities developed in outer harbour), which at present is scarce within the harbour. This area could be utilised for storage of cargo and port operations. While part of the reclaimed area could be developed by utilising the dredged material, borrowed fill would be needed to create the balance area.

9.2.4 Recommendations for Outer Harbour

The pros and cons of long breakwaters and the consequent time of construction and cost have to be duly weighed with respect to additional reclaimed area obtained while finalising the appropriate layout of the outer harbour. This could ideally be decided while arranging financing for the Phase 1 development of the outer harbour based on the firm requirements of the facilities to be created.

10.0 SHELF OF NEW PROJECTS AND PHASING

10.1 General

As part of V. O. Chidambaranar Port Master Plan several projects have been identified which need to be taken up in phased manner with the built up in traffic. The proposed phasing, capacity addition and the likely investments are discussed in paragraphs below.

It may be noted that apart from these projects there could be several other projects which port would be implementing as part of the routine operations and maintenance of the port facilities. Further the phasing proposed is not cast in stone but could be reviewed periodically and revised based on the economic scenario and demand for port at that particular point of time.

10.2 Ongoing Projects

The details of the projects which have already been awarded and development is ongoing are given below in **Table 10.1**.

Table 10.1 Ongoing Projects

S. No.	Project Name	Investment required (In Crores)	Capacity Addition (MTPA)	Mode of Implementation
1.	Construction of North Cargo berth-II for handling bulk cargoes on DBFOT basis - Tuticorin	335	7	PPP
2.	Conversion of 8th berth as container terminal on BOT basis for a period of 30 years - Tuticorin	315	7	BOT
3.	Mechanization of Berth IX	50	6	PPP

The port layout after completion of ongoing projects shall be as shown in **Figure 10.1**.

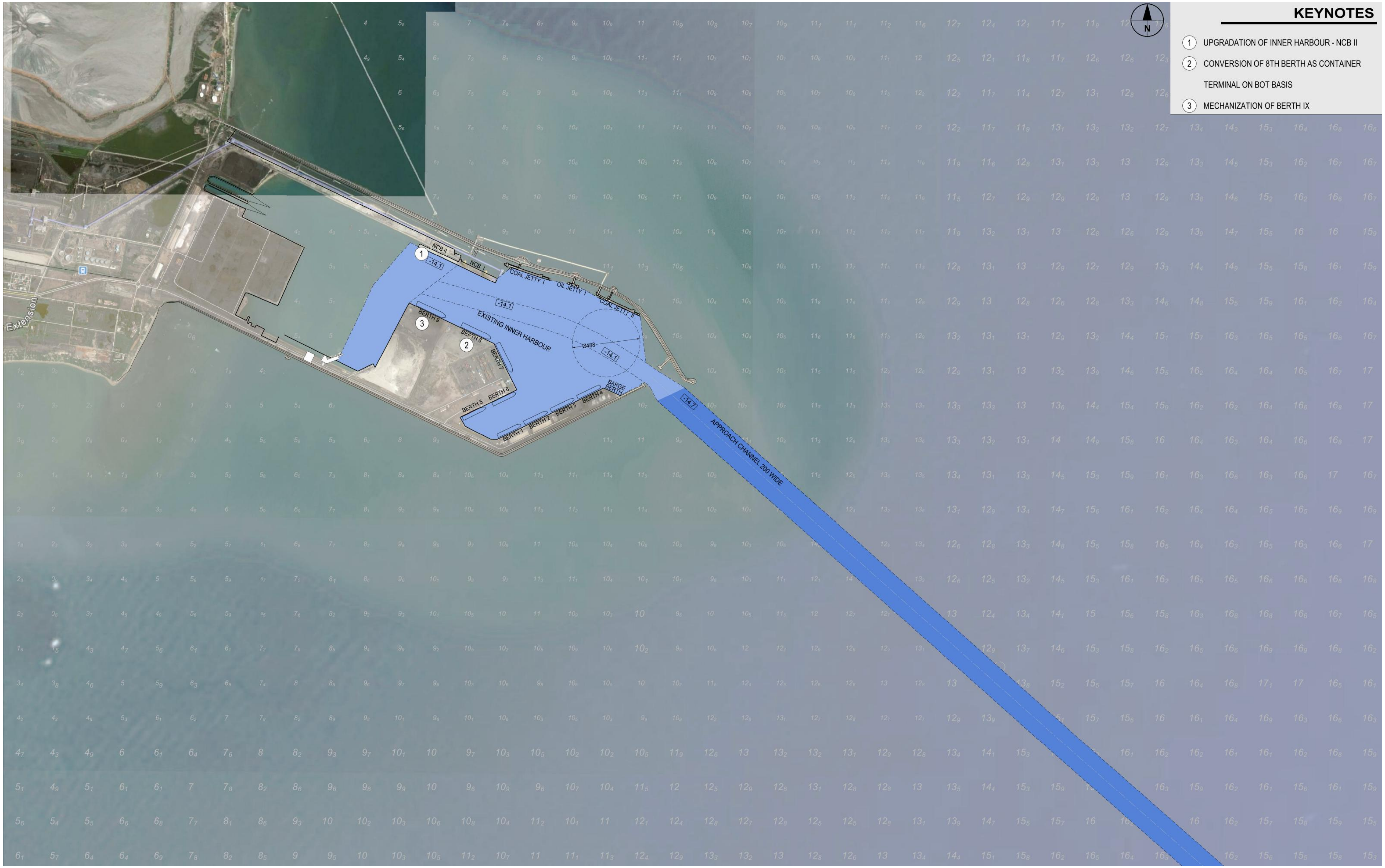


Figure 10.1 Port Layout along with Ongoing Developments

10.3 Projects to be completed by Year 2020

The details of the projects which are envisaged to be completed by the year 2020 are given below in **Table 10.2**

Table 10.2 Projects to be completed by Year 2020

S.No.	Project Name	Investment required (in croes)	Capacity	Mode of implementation
1.	Upgradation of existing coal jetty (CJ2)	250	6	Port's fund
2.	Upgradation of inner harbour NCB III	587	18	PPP
3.	Upgradation of inner harbour NCB IV – Container / clean cargo	515	0.6M TEU	PPP
4.	Upgradation of inner harbour – SEPC berth	200	4	PPP
5.	Upgradation of inner harbour – Shallow berth	126	2.6	PPP
6.	Construction of new ROB parallel to existing between TTPS to Check Post	0.3	-	Port's fund
7.	Providing Railway Track between Marshalling Yard and Hare Island	70	-	Port's fund
8.	NCB I – utilization of its full capacity at Tuticorin	-	2.5	PPP
9.	Deepening of NCB III and IV	900	-	Port's fund

The port layout after completion of planned projects till 2020 shall be as shown in **Figure 10.2**.

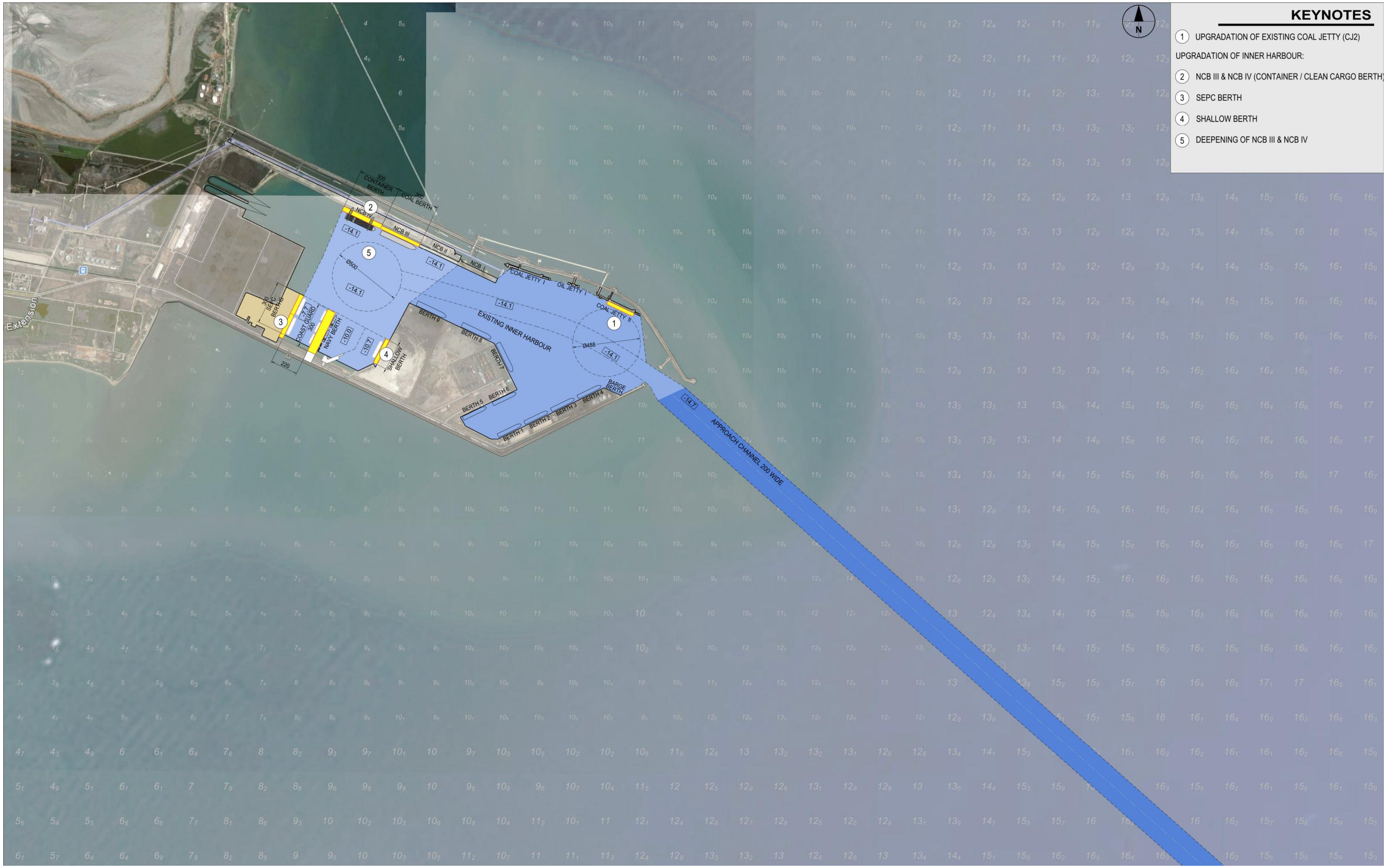


Figure 10.2 Port Layout 2020

10.4 Projects to be completed by Year 2025

The details of the projects which are envisaged to be completed by the year 2025 are given below in **Table 10.3**

Table 10.3 Projects to be completed by Year 2025

S. No.	Project Name	Investment required (In Crores)	Capacity Addition (MTPA)	Mode of Implementation
1.	Upgradation of Inner Harbour - Deep Draft Bulk Berth	330	9	PPP
2.	Upgradation of Inner Harbour – Multi-Purpose Barge Berths	100	2	PPP
3.	Upgradation of Inner Harbour - Channel and Basin Deepening for Fully Loaded Panamax Ships	1600	6	Port's funds
4.	Development of Outer Harbour-Dredging and Breakwaters	7000	0	Port's funds
5.	Development of Outer Harbour - Phase 1 (2 coal and 2 container)	1600	38	PPP
6.	New 4 lane road connectivity in between Harbour Extension Road and National Highway 7A	36	-	Port's funds
7.	Widening of harbour highway extension road (HHE Road) into 4 lane configuration (a section of about 5 km length)	30	-	Port's funds
8.	Widening of VOC road into 8 lane configuration from Port Trust Circle to NH 45B junction	16	-	Port's funds
9.	Elevated road above VOC road to take Traffic of Hare Island (about 2km)	43	-	Port's funds
10.	New railway line from Marshalling Yard to Red gate	18	-	Port's funds

The port layout after completion of planned projects till 2025 shall be as shown in **Figure 10.3**.

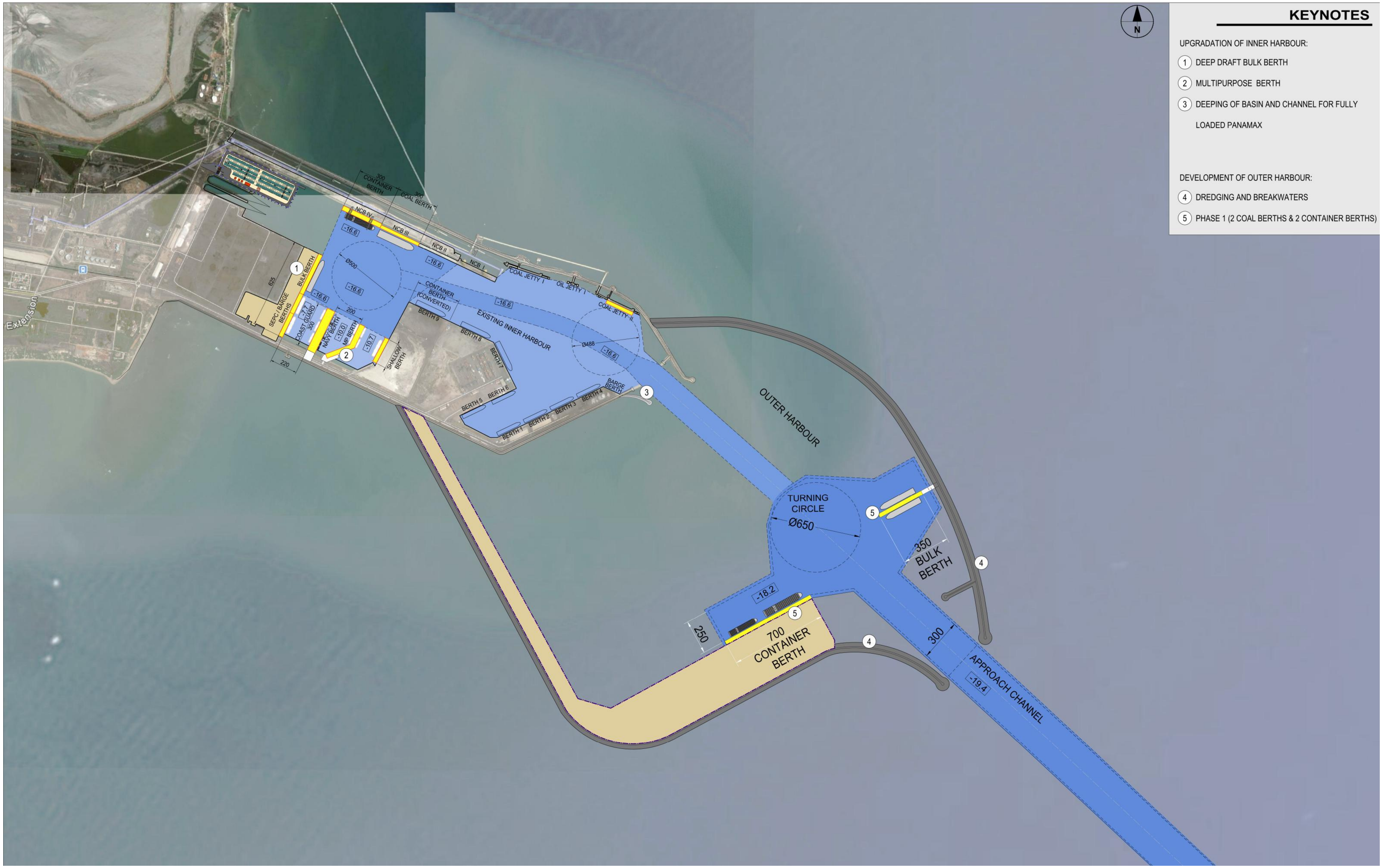


Figure 10.3 Layout Plan 2025

10.5 Projects to be completed by Year 2035

The details of the projects which are envisaged to be completed by the year 2035 are given below in **Table 10.4**.

Table 10.4 Projects to be completed by Year 2035

S. No.	Project Name	Investment required (In Crores)	Capacity Addition (MTPA)	Mode of Implementation
1.	Multi-Purpose Berth	330	9	PPP
2.	Future Berth	-	-	-
3.	Development of Outer Harbour - Phase 2 (2 coal and 5 container berths)	1600	58.25	PPP
4.	Electrification and doubling from Milavittan railway station to Marshalling yard and Milavittan station to Tuticorin station	150	-	Port's funds

The port layout after completion of planned projects shall be as shown in **Figure 10.4**.

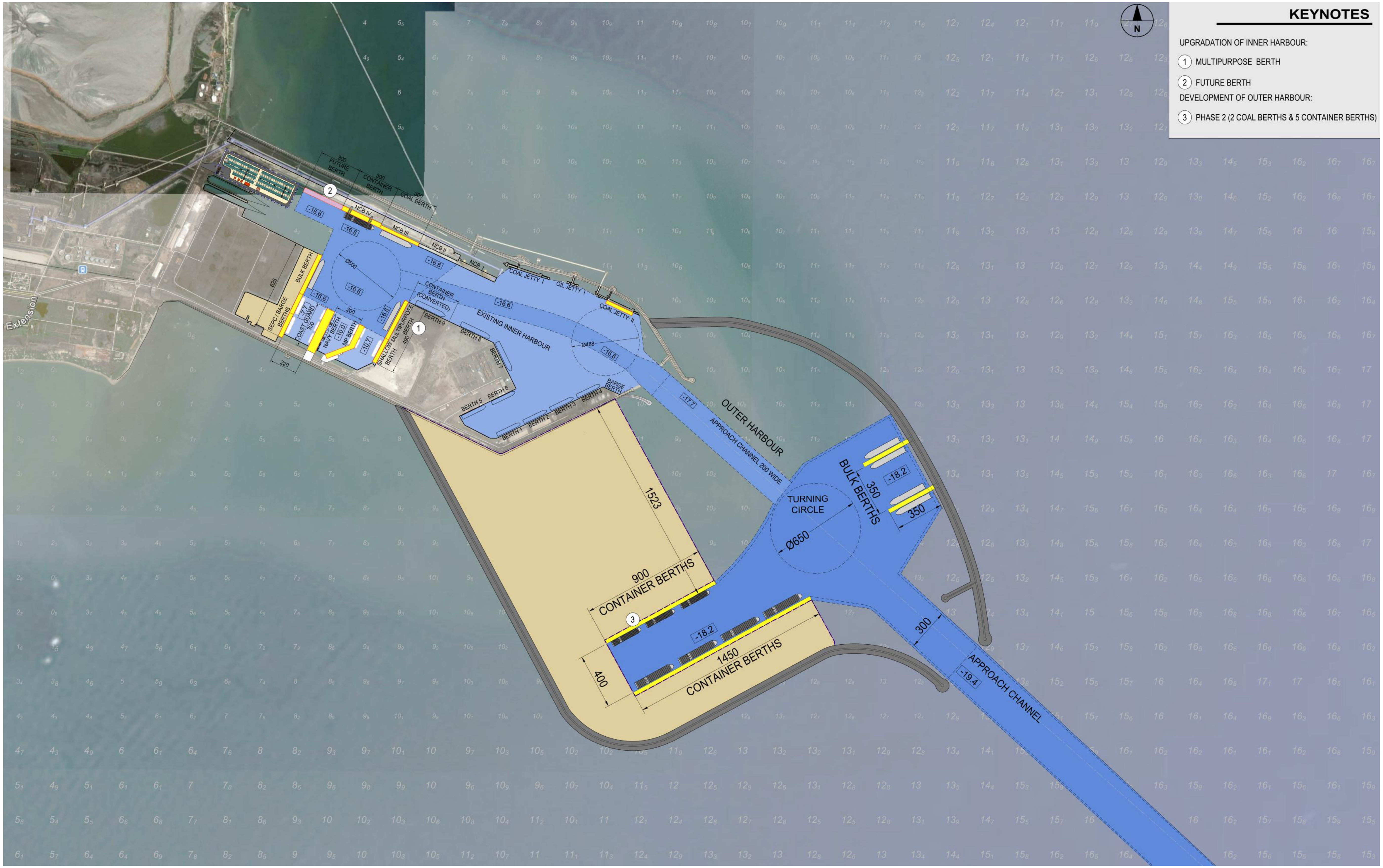


Figure 10.4 Port Layout 2035

Appendix 1 - **BCG Benchmarking Study for V. O. Chidambaranar Port**

10 VOC Port Deep-dive

10.1 Port overview

VOC Port Layout

V. O. Chidambaranar (VOC**)** port is located on the southeastern coast of India in the Gulf of Mannar. It has 13 berths for handling dry bulk, POL and container cargo. Detailed description of berth usage is as follows:

- **Dry Bulk:** Berths I – VI and berth IX are the general cargo berths at VOC, out of which berth IX is the only deep draft berth available currently.
- **Containers:** Berth VII (operated by PSA-Sical) and berth VIII (operated by DBGT) are used for container handling.
- **Mechanized Coal Handling:** Coal Jetty I and II are berths owned by Tamil Nadu Electricity Board Ltd (TNEB) with mechanized evacuation. NCB I is another mechanized berth owned by NTPL, and has mechanized discharge and evacuation capability.

Figure 284: VOC port layout

Financials

VOC port revenue has been growing at approximately 14% annually since 2008. Between 2013–14 and 2014–15, there has been a sharp increase of almost 36% in revenue.

Port maintains a healthy profit margin of 38%, contributing more than Rs. 219 crores of profits in 2014-15. The profits have risen sharply last year due to additional coal handling.

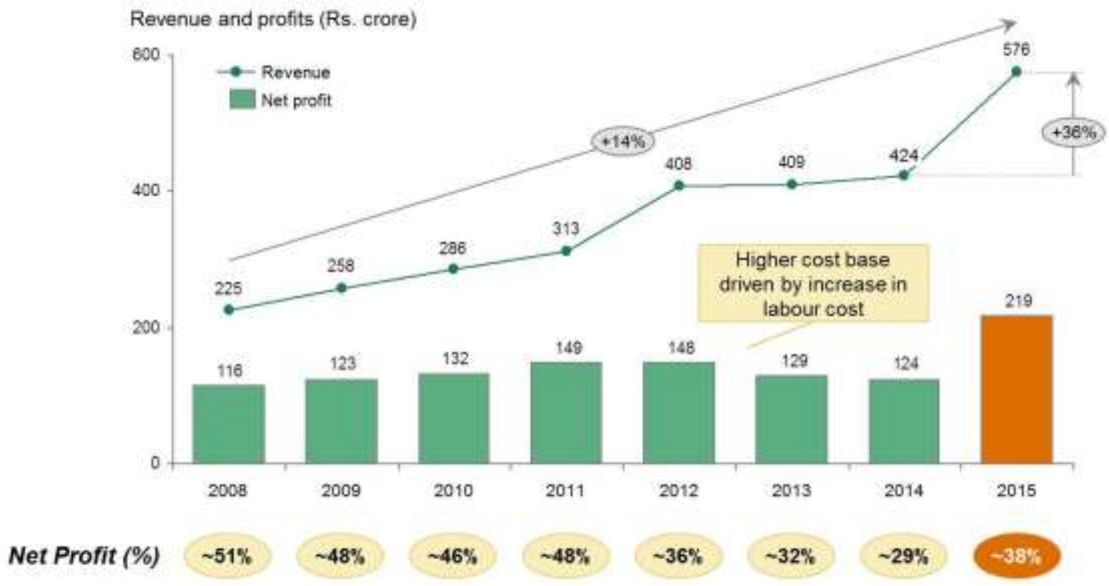


Figure 285: VOC port revenue

Cargo Volumes

With a 5-year CAGR of approximately 6%, VOC handled approximately 32 Mn traffic in 2015.

- Coal and container cargo have primarily driven growth in traffic
- Coal volumes increasing due to increased demands from recently commissioned power plants

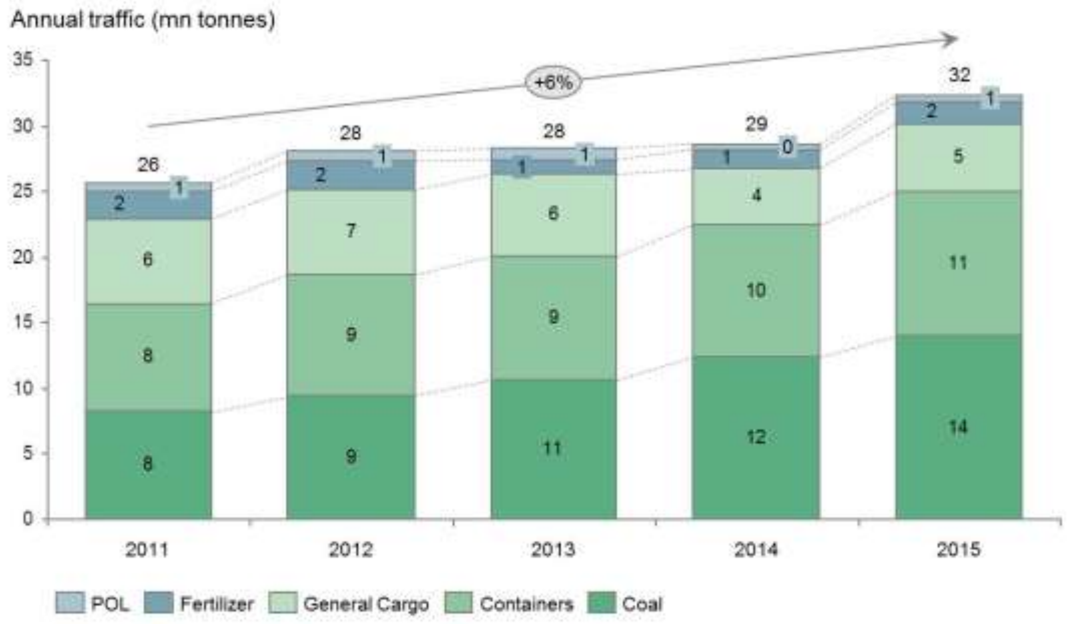


Figure 286: Cargo traffic at VOC

New and upcoming thermal power plants have driven high berth occupancy at VOC, with coal volumes expected to further increase in the next two years due to newly commissioned power plants. After new plants function at 100% capacity, coal demand is projected to increase by 43% by 2017–19.

Between 2014 and 2016, a demand of 6 million tons of coal has been added to the hinterland due to newly commissioned thermal power plants.

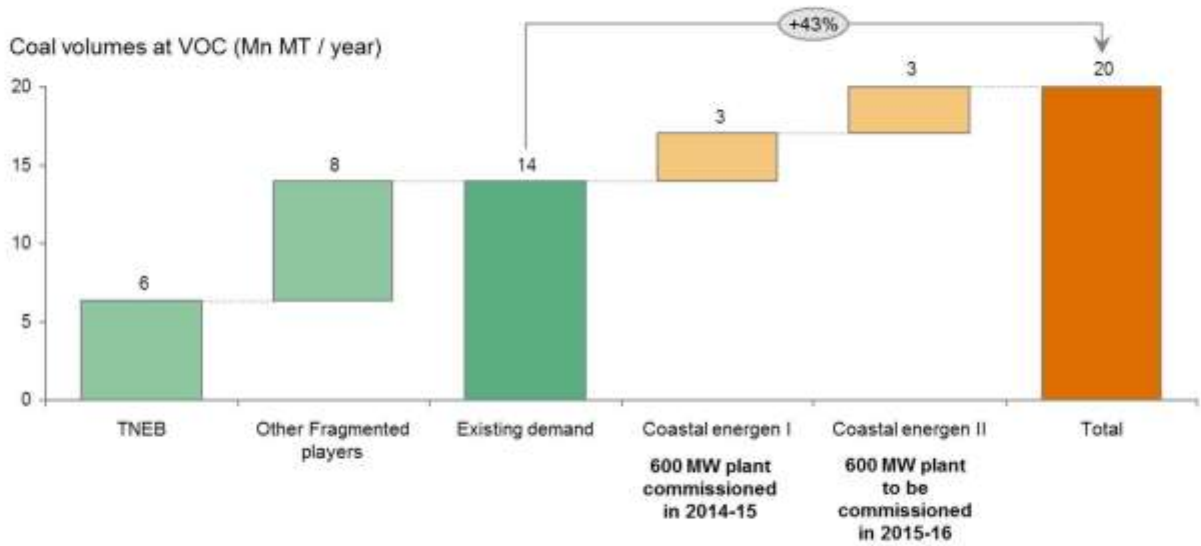


Figure 287: Coal volumes at VOC

Berth Occupancy

Port has an overall berth occupancy of ~75% with high occupancy at the deep draft berth IX, which is the major challenge in the near term.

Figure 288: Berth occupancy at VOC

Occupancy across general cargo berths is moderate (60-70%) and there is no significant challenge in the short term.

Containers

Occupancy on the container berths VII is optimal as cargo has consolidated. Occupancy for berth VIII is low despite high draft of 12.8 m due to absence of container handling equipment. DBGT had placed an order for importing cranes from ZPMC, China, which was later banned by Ministry of Defense. They have placed a new order with Leibherr and are expecting delivery in 2016-17.

DBGT terminal occupancy is primarily low because it is unable to attract liners due to absence of quay cranes.

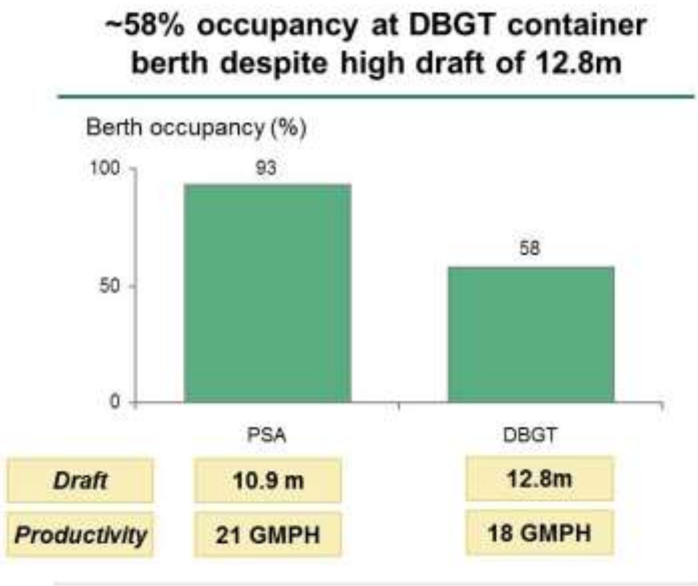


Figure 289: Low occupancy at DBGT terminal

Occupancy at PSA terminal is extremely high and there is limited scope of growing traffic. The berth strength limits higher capacity cranes, and the productivity is high within the given constraints.

Current concession agreement between PSA and port is based on a royalty per box model with an increase in royalty each year. The increase in royalty is higher than the increase in traffic and, hence, profit margins get reduced every year. Litigation is submitted to Port authority for limiting the increase in royalty.

Productivity at PSA's berth is higher than TAMP norms and there is limited scope of increasing productivity as the current container berth cannot accommodate cranes with higher lifting capacity.

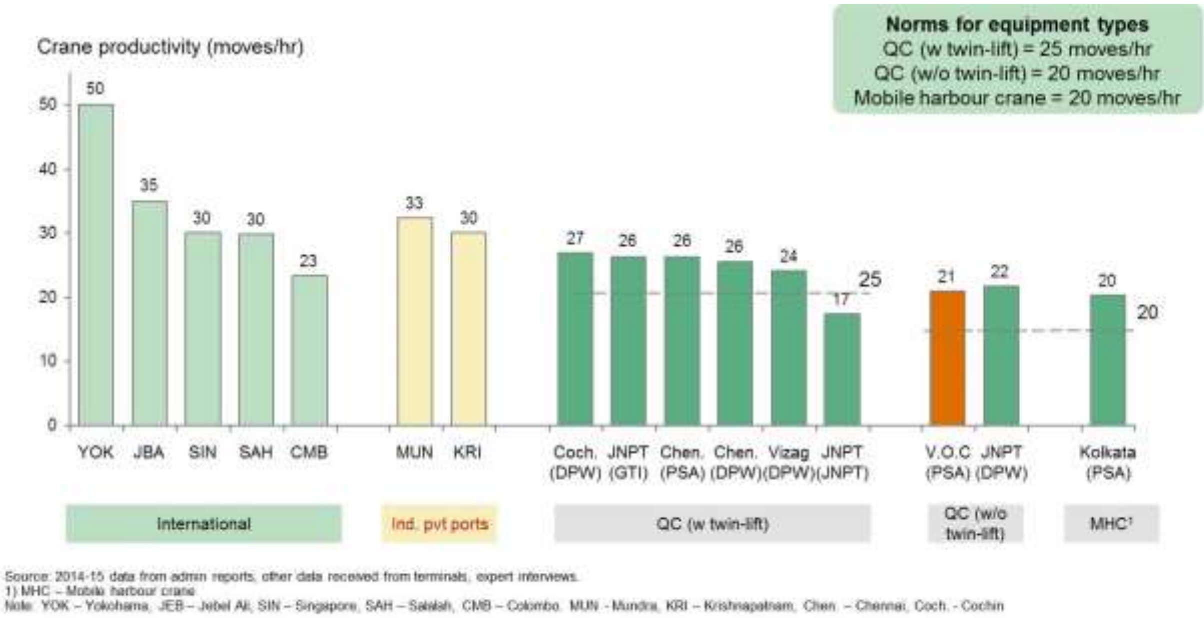


Figure 290: High crane productivity at PSA container terminal

Fertilizer

Port handles ~1.7 Million MT of fertilizer every year. Fertilizer imports are largely driven by agricultural activity and there is very limited scope of growing fertilizer volumes at VOC port.

Berth productivity for fertilizer is highest amongst peers as shown in the figure below:

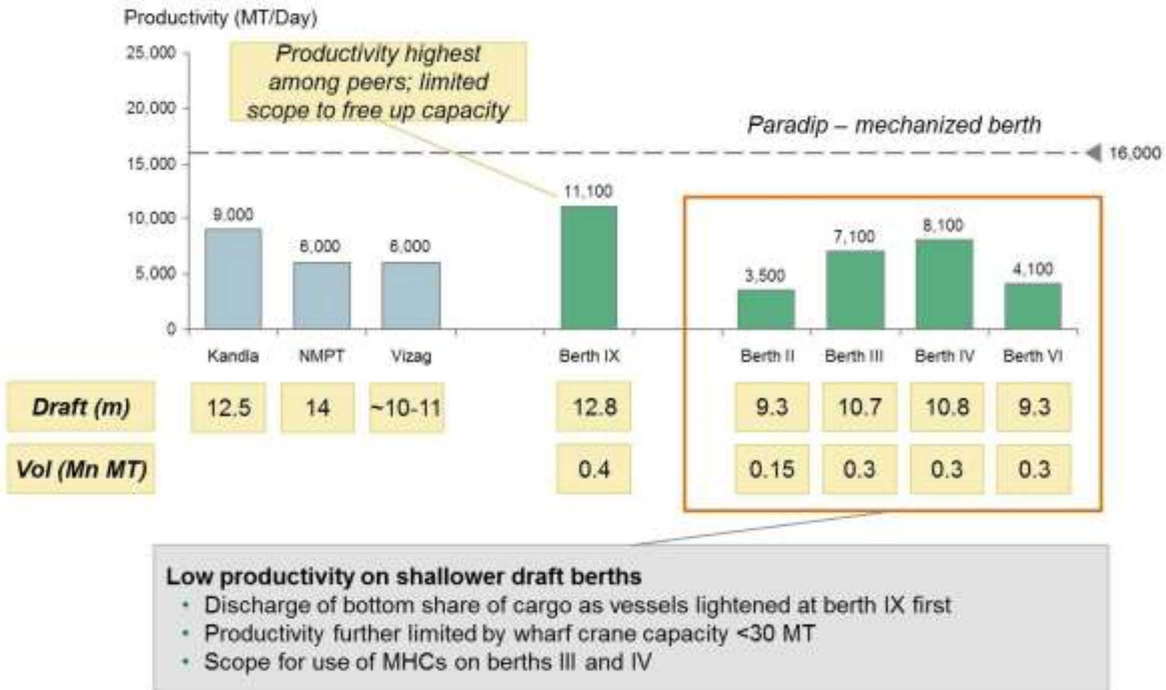


Figure 291: Fertilizer productivity benchmarking

Key Issues

VOC port is facing a shortfall of coal handling capacity due to presence of only one deep draft berth with a draft of 12.8 m. Coal vessels are majorly Panamax vessels with a parcel size of ~55,000 MT and a draft of over 12.5 m. They first perform lighterage operations at the deep draft berths, and are shifted to shallow berths after draft reduction.

Coal handling capacity needs to be unlocked through productivity improvement in the near-term—between 2016 and 2019, the port needs to add ~25 Mn MT capacity for coal handling.

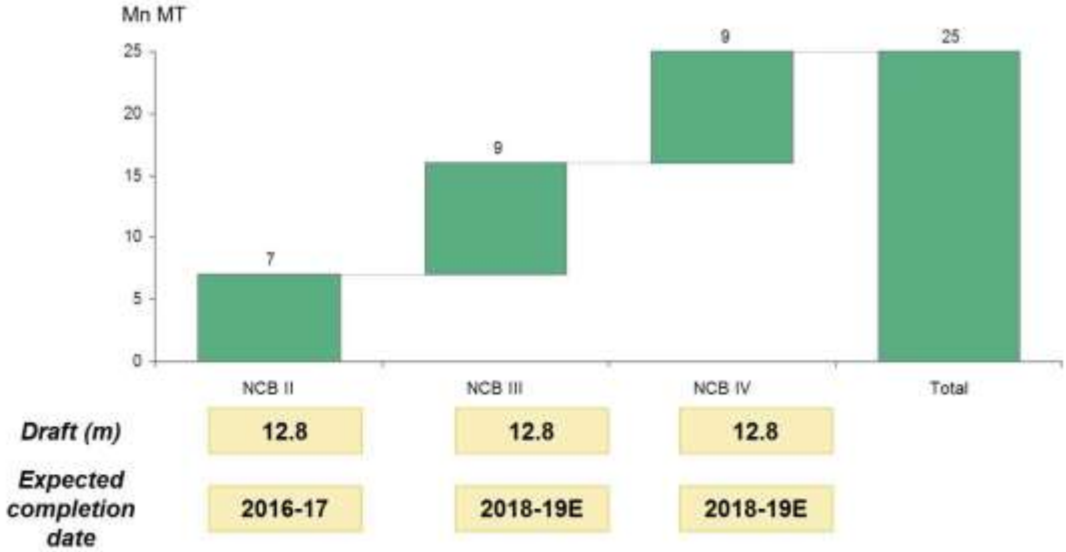


Figure 292: Coal capacity addition

With RTGC productivity of 12 moves/hour at the PSA terminal, yard productivity at VOC is higher than peers and international benchmarks of 10 moves/hour.

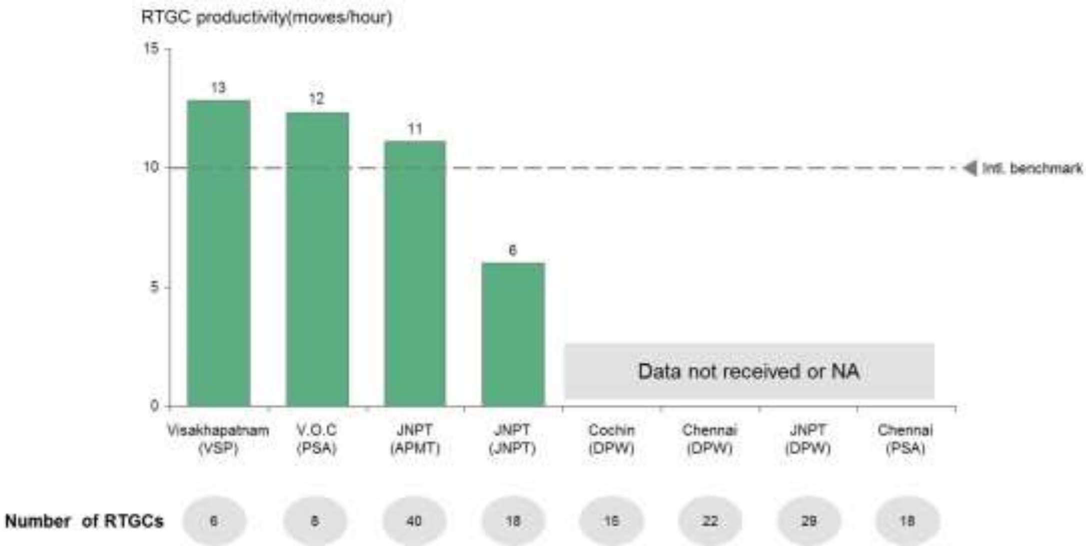


Figure 293: Berth productivity is higher than peers and international benchmark

With actual dwell time of just 2 days, there is high productivity with yard space utilization of 51% at VOC (PSA).

Figure 294: Yard space utilization

Gate lane productivity at VOC is higher than average, helping prevent bottlenecks during evacuation.

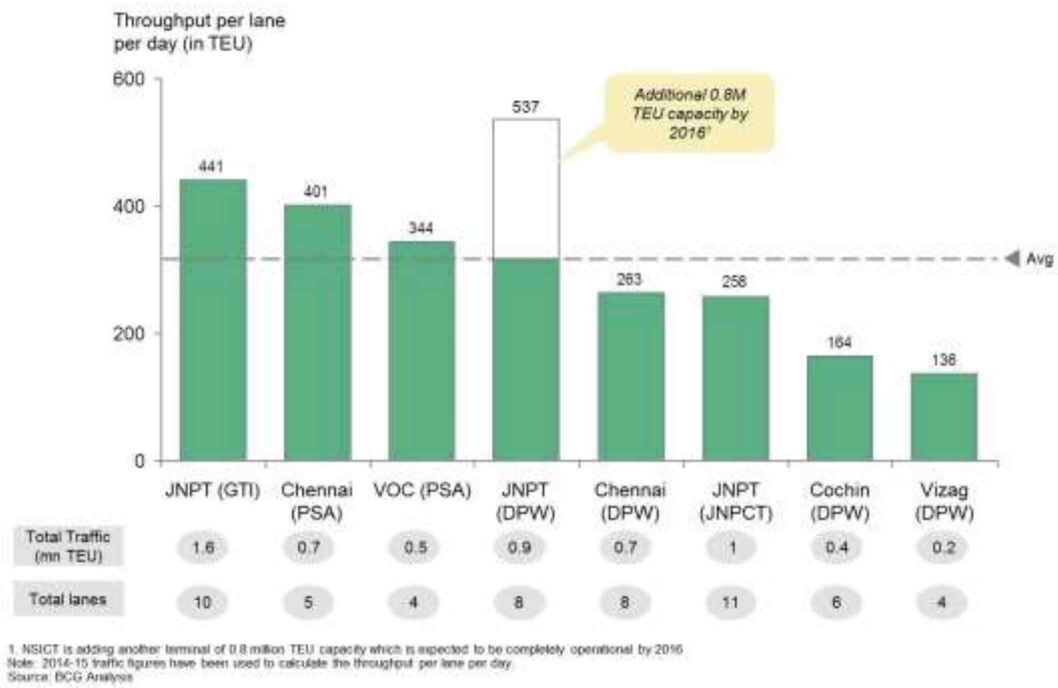


Figure 295: Gate lane productivity

Coal handling at anchorage

Overview

VOC port has a draft constraint of 12.8 m, which allows only partially loaded Panamax vessels to enter. Fully loaded Panamax vessels and cape-size vessels cannot enter the port. Shippers prefer a bigger parcel size due to savings in logistics cost.

Currently, VOC port can handle fully loaded Panamax vessels by partial offloading at anchorage (lightening operations). Cape-size vessels cannot enter the port due to channel width limitations and, hence, they need to offload the entire cargo at anchorage.

The productivity at Anchorage is significantly lower than berth due to bad weather, which increases the handling cost. We compared the cost to shipper with cost of handling at the nearest deep draft port at Karaikal. Our analysis suggests that the cost of partial offloading for Panamax vessels is lower than the cost at Karaikal, and they will choose to offload at VOC. However, the cost of handling Panamax vessels will be higher than the cost of handling at Karaikal and, hence, cape-size will not be handled economically at VOC port.

The port currently has one floating crane and three barges, and we suggest the port invites a third party to invest in another floating crane and barge to handle lighterage operations for Panamax vessels.

Key Findings

Draft constraint of 12.8 m at VOC port limits the entry of fully-loaded Panamax vessels and cape-size vessels. Partial offloading at anchorage is carried out for Panamax vessels, after which they are moved to berth IX for further offloading. Fully-loaded Panamax vessels have a parcel size of ~55,000 MT and a draft of 14.5m. This needs to be reduced to 12.8 m and requires ~20,000 MT of discharge at anchorage.

Cape-size, however, cannot enter the port due to channel width limitations and, hence, the entire parcel size of ~1,10,000 MT cargo has to be offloaded at anchorage.

Productivity at anchorage is significantly low at VOC due to bad weather. Strong winds and bad weather disrupt operations frequently, and the average productivity is significantly lower as compared to berth operations.

Average productivity achieved at anchorage is ~8000 MT per day as opposed to 20,000 at the berth. This increases the turnaround time for the ship, and the shipper has to bear additional cost of chartering the vessel.

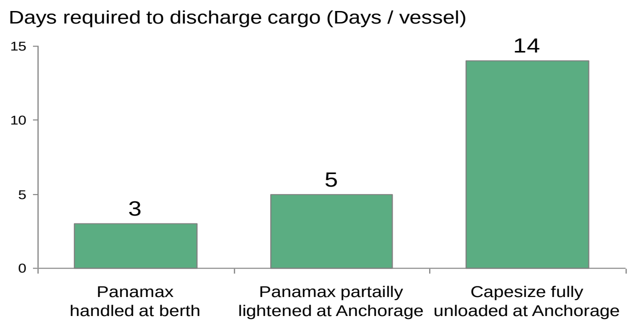


Figure 296: Time required to discharge the cargo

Several factors increase the cost of handling coal at anchorage:

- High tariff of floating crane
- High stevedoring cost
- Additional vessel chartering costs due to low productivity

Also, the uncertainty in turnaround time is high as operations are largely dependent on weather.

Handling cost comparison

We have compared the total handling costs for Panamax and cape-size vessels with the neighboring ports with deep draft to analyze if the shipper would prefer to offload it at anchorage in Tuticorin, or move it to the nearest port with deeper draft (Karaikal).

Our analysis suggests cost for lightening Panamax vessel is lower than cost at Karaikal, and shippers would prefer to use VOC for Panamax vessels. However, cost of handling cape-size vessels is higher than handling costs at Karaikal.

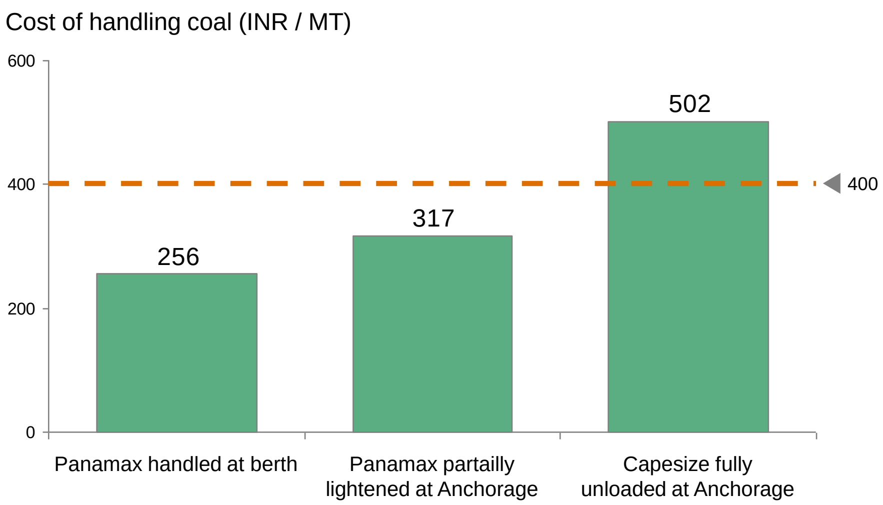


Figure 297: Cost comparison for different scenarios

Port currently has one floating crane and 3 barges to handle vessels at anchorage, which are operated by a third party. Port can invite a third party player to invest in one additional floating crane as two cranes can be deployed at once for a vessel.

Old Tuticorin Port

Old city harbor at Tuticorin is ~10 kms away from the current port basin and has a draft of 2.8 m. It is currently being utilized to handle small vessels and barges. It is used to supply daily necessities like fruits and vegetables to Maldives.

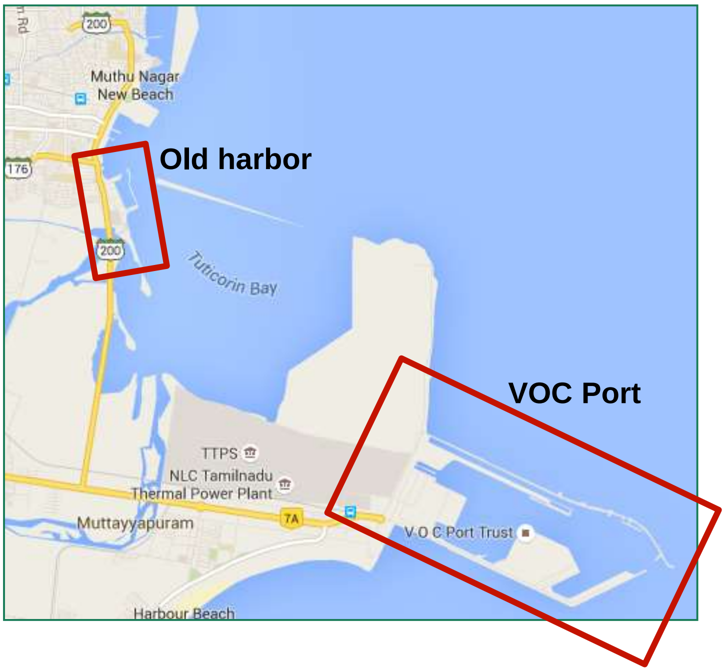


Figure 298: Location of old port

It cannot be used for handling vessels due to the draft constraints, but is capable of handling barges. It can be used for handling barges when shallow berths are not available at VOC port. However, dusty cargo such as coal and fertilizer cannot be handled as it is in the city. Hence, the potential use is limited for copper concentrate in barges.

However, it is not an attractive option as the distance from anchorage will be higher, and can only be used as a backup option.

10.2 Key findings and initiatives from deep-dive

10.2.1 Berth Productivity analysis for coal handling

10.2.1.1 Initiative: VOC 1.1 Productivity norms in berthing policy

Initiative Overview

Port requires additional coal handling capacity to reduce the pre-berthing delays for vessels with 12.8 m draft. Improvement in productivity at berth IX is required to free additional capacity since that is the only deep draft berth currently available. Productivity at berth IX can be improved if the utilization of two MHCs is increased. Hence, there is a need to mandate achievement of high productivity.

Also, currently, vessels stay at berth IX for a longer time than required for draft reduction. Vessels need to be mandatorily shifted to shallow draft berths after draft reduction.

Incorporating specific productivity norms in the berthing policy will free 1.4 Mn MT of capacity.

Key Findings

Coal volumes handled at VOC port have increased rapidly in the last one year, and number of Panamax vessels with a draft of 12.8 m have increased considerably. VOC currently only has a deep draft berth to handle vessels with draft of 12.8 m (berth IX), which is increasing the pre-berthing delay.

1. Need to increase productivity at berth IX to 28,000 MT per day

Port addresses the shortage by shifting the vessels to shallow draft berths (Berths III and IV) after draft reduction at berth IX. For optimal utilization of capacity, berth productivity of berth IX has to be double the capacity of berths III or IV.

Productivity at shallow drafts berth is currently 11,000 MT per day, and it is expected to reach 17,000 MT per day after installation of two MHCs. Thus, there is a need to increase productivity at berth IX.

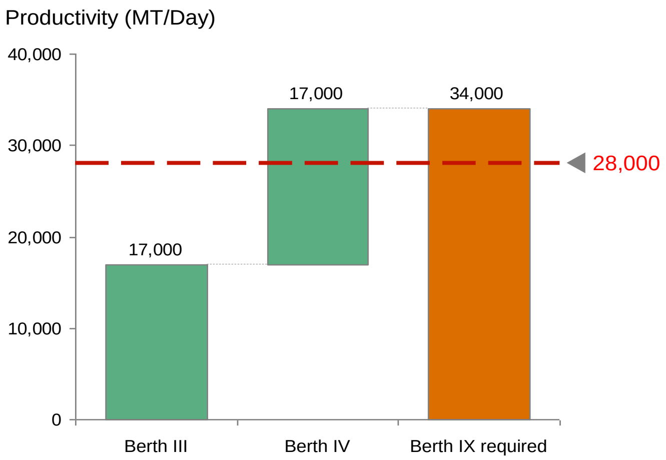


Figure 299: Required berth productivity at berth IX

Though the productivity should be as high as 34,000 MT per day, we recommend a realistic target of 28,000 MT per day, accounting for the current unloading and evacuation infrastructure.

For speedy draft reduction, the port has facilitated availability of two harbor mobile cranes of 125 MT capacities at berth IX. However, the utilization of these cranes is low and increasing it could significantly impact berth productivity. Currently, the stevedores deploy either one MHC or use it for only a limited amount of time.

Current productivity of 19,000 MT per day can be increased to 28,000 MT per day if both MHCs are deployed for the full duration of vessel stay at the berth.

2. Need to mandatorily shift vessels to shallow draft berths within 3 shifts of stay at berth IX

With the increased productivity, vessels shall be able to achieve the required draft reduction to 10.4 m well within 3 shifts of stay at berth IX with complete MHC utilization. Hence, it shall be made mandatory for vessels to be shifted to shallow draft berths within 3 shifts. This shall free 0.6 Mn MT of coal handling capacity.

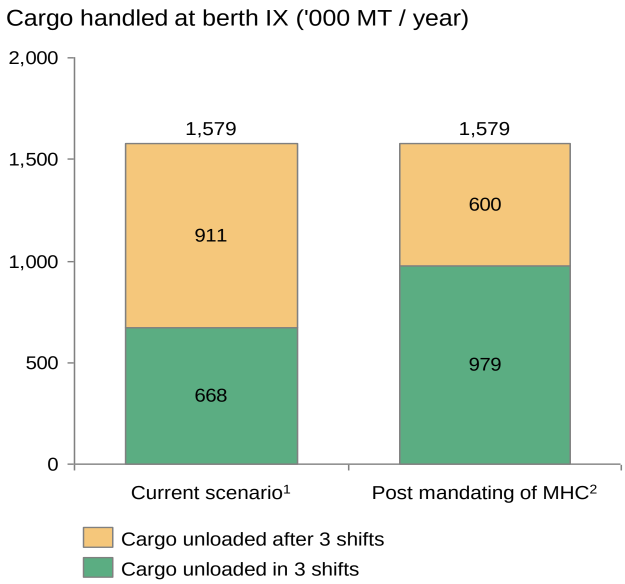


Figure 300: Mandatory vessel shifting after 3 shifts to unlock 0.6 Mn MT capacity

Recommendations

In order to increase productivity at berth IX, minimum productivity has to be specified in the berthing norms. Also, to shift coal vessels to lighter berths after draft reduction, maximum time spent at berth IX has to be specified. Hence, port should amend the berthing policy to incorporate the following performance parameters and norms:

- Minimum berth productivity of 28,000 MT per day to be achieved on coal at berth IX
- Berth IX to be available only for 3 shifts per vessel, by which time the draft required is to be below 10.4 m; vessel to be subsequently shifted to berths III and IV
- Two MHCs to remain available at berth IX to facilitate achievement of required draft reduction within 3 shifts

Expected Impact

Incorporating the two norms will increase coal handling productivity at berth IX to 28,000 MT per day. Increased productivity, combined with vessel shifting, is likely to unlock 1.4 Mn MT of coal handling capacity at berth IX.

10.2.1.2 Initiative: VOC 1.2 Installation of two Mobile Harbour Cranes at berths III and IV

Initiative Overview

The port is unable to realize full potential of shallow draft berths due to two major issues:

- Low productivity at berths III and IV due to high reliance on vessel gear
- Inability to shift gearless vessels due to absence of high capacity mobile harbor cranes

Installing two 100 MT MHC's at berths III and IV can potentially unlock 1.6 Mn MT capacity per year, enabling handling of gearless vessels at shallow draft berths. Shifting of gearless vessels will further unlock capacity at berth IX, and enable utilization of unused capacity at shallow draft berths.

Key Findings

As discussed before, there is capacity shortfall at VOC port for deep draft berths, and the shortage is being addressed by shifting vessels from berth IX to berth III and IV upon draft reduction. However, the port is unable to realize the full potential of shallow draft berths due to absence of high power MHCs at berths III and IV. Hence, the vessels have to rely only on vessel gear for discharging.

Inability to shift gearless vessels increasing the berth occupancy at berth IX

Gearless vessels cannot be handled at shallow draft berths due to absence of high power cranes and, thus, they have to offload their entire cargo at berth IX. Recent increase in coal demand is largely propelled by gearless vessels, which is the reason for high berth occupancy of ~90% at berth IX.

- Gearless vessels stay at berth IX for an average duration of 58 hours as opposed to 32 hours for a geared vessel
- Enabling shifting of gearless vessels will transfer coal handling from berth IX to shallow draft berths as vessels will only offload 45% of their cargo at berth IX
- Berth occupancy for berth IX will drop down to 80% by transferring the load to shallow draft berths

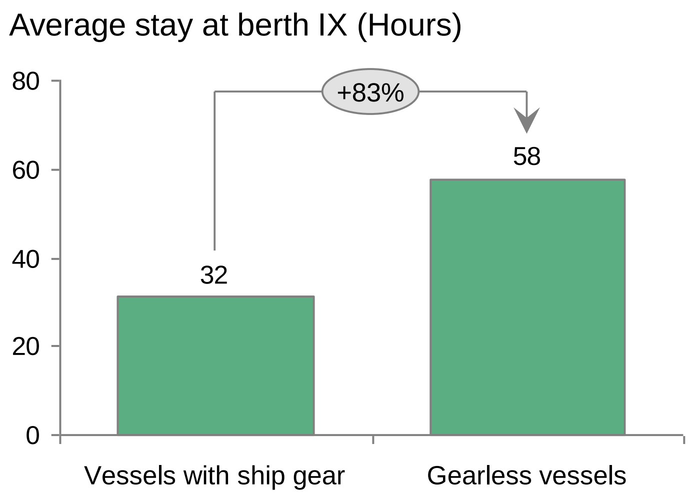


Figure 301: Average stay of gearless vessels at berth IX

Share of gearless vessel in total traffic is expected to grow significantly in the future as shippers have a significant cost advantage of Rs. 75 per MT of coal handled.

- Cost advantage of ~Rs. 120 per MT by charting a gearless vessel
- Total advantage of ~Rs. 75 after adjusting for cost of MHC handling

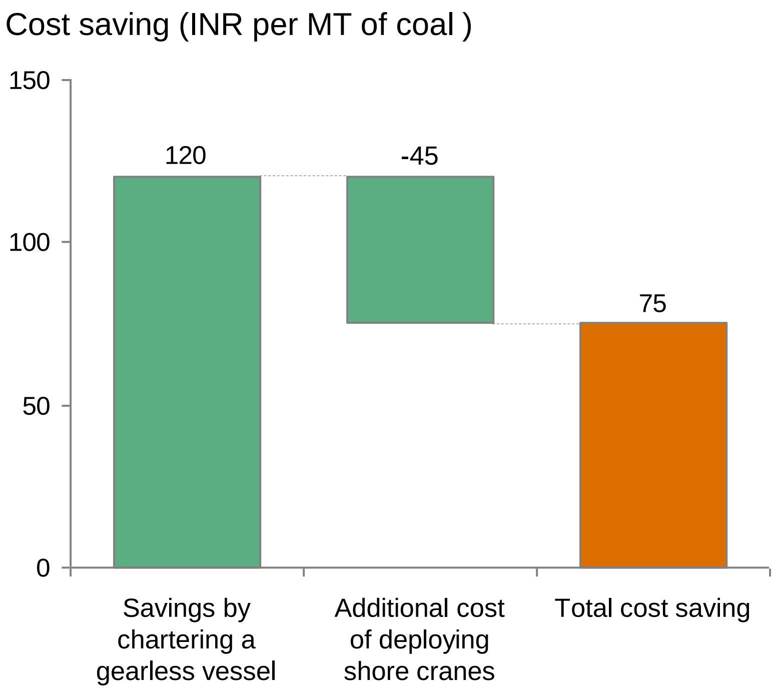


Figure 302: Cost advantage of charting a gearless vessel

Recommendations

VOC port should invite a private party to setup two additional mobile harbor cranes at the junction of berths III and IV. Existing private party can install additional cranes, or an open tender can be floated for installation of 2 MHCs.

Expected Impact

Installing two mobile harbor cranes at berths III and IV will increase productivity by 50%

- Productivity to increase from 11,000 MT to 17,000 MT by use of MHCs
- Increased productivity will enable additional handling of 1.6 Mn MT of coal every year

Total spare capacity available at shallow draft berths to increase from 0.6 Mn MT to 2.2 Mn MT. Installation of MHCs will enable gearless vessels, resulting in utilizing existing spare capacity of 0.6 Mn MT to generate new capacity of 1.6 Mn MT per year.

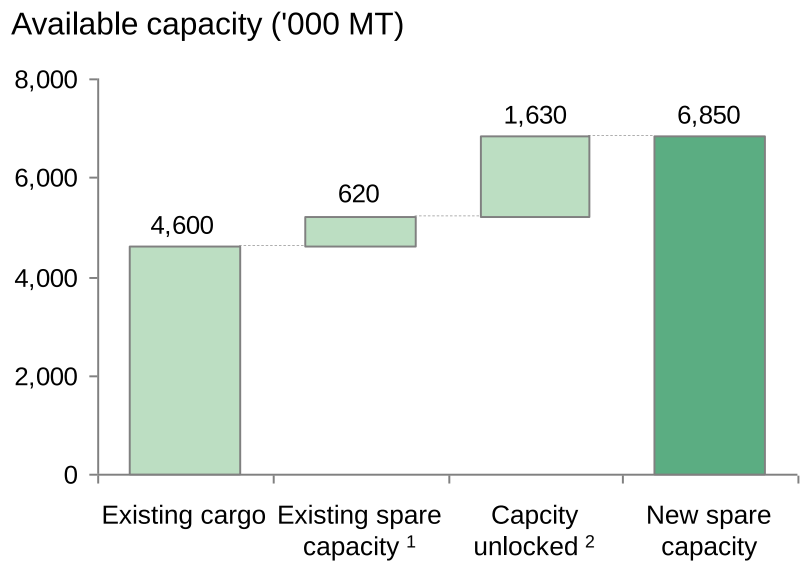


Figure 303: Total available capacity after installation of MHCs

10.2.1.3 Initiative: VOC 1.3 Mechanization of evacuation at berth IX

Initiative Overview

Evacuation from berth IX to the storage yard is carried out with trucks and pay loaders. Current evacuation rate is 17,000 MT per day and it will not be able to increase to 28,000 MT per day by pay loaders. Mismatch between evacuation and unloading capacity would lead to piling up of coal at the berth, which hinders the crane movement, and limits discharge productivity.

With increased discharge productivity, relevant infrastructure will be required to maintain evacuation pace. Mechanization can facilitate evacuation productivity of up to 48,000 MT per day without disrupting port operations. Since the storage yard is only 3 kms away from the berth, cost of setting up conveyors would be economical.

Key Findings

Berth productivity is a function of discharge and evacuation productivity. Slower of the two actions is the bottleneck and limits the total productivity.

- Current evacuation rate is 17,000 MT per day and average discharge rate is 18,000 MT per day
- Discharge rate for geared vessels is 17,000 MT per day, which matches the evacuation rate and, hence, they can be handled conveniently
- Discharge rate for gearless vessels is 23,000 MT per day and the berth is cluttered upon departure of gearless vessels

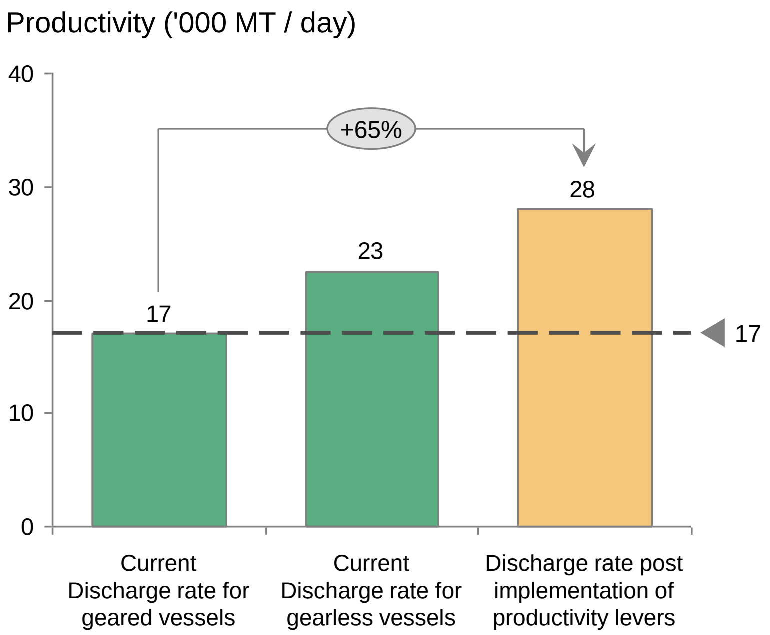


Figure 304: Currently, evacuation is a bottleneck for gearless vessels

Piling up of coal at the berth is not desirable for two reasons:

- Cluttering of the berth hinders the crane movements and reduces crane productivity by up to 20%
- It creates challenges for the next vessel as heaps cannot be mixed

Current loss in productivity is very low as the over stay of coal after vessel departure is limited to only gearless vessels, and the share of gearless vessels is low. With increased productivity of 28,000 MT per day, evacuation will be the major bottleneck limiting realization of full unlocked capacity.

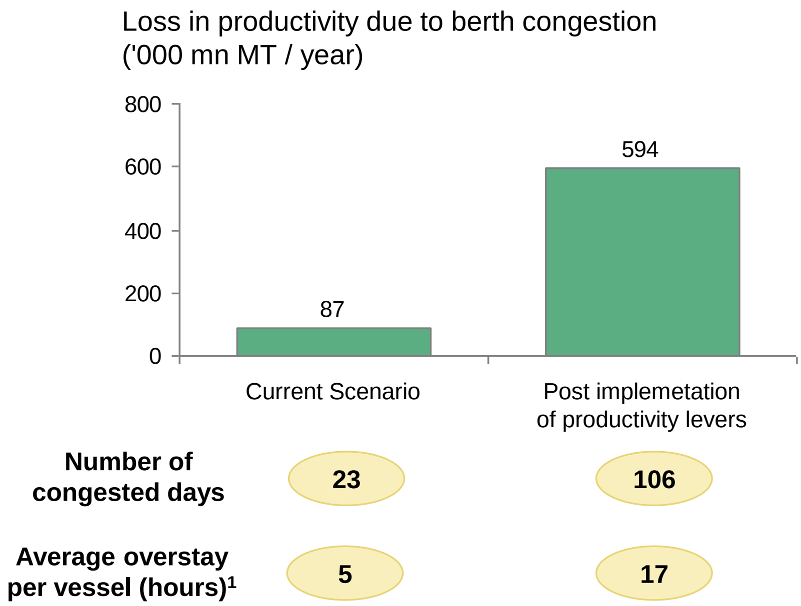


Figure 305: Loss in capacity due to evacuation

Recommendations

Evacuation from berth IX has to be mechanized with the help of conveyors. ~Rs. 60 crores capital expenditure is required for mechanized evacuation.

Evacuation can be mechanized by constructing conveyors from berth to storage yard:

- Conveyors and hoppers to be installed at berth IX
- Existing MHCs to discharge coal into hoppers
- Third party to build and operate the conveyors at TAMP-approved rates of handling

Attractive IRR of 48% to be realized on the investment of Rs. 60 crores.

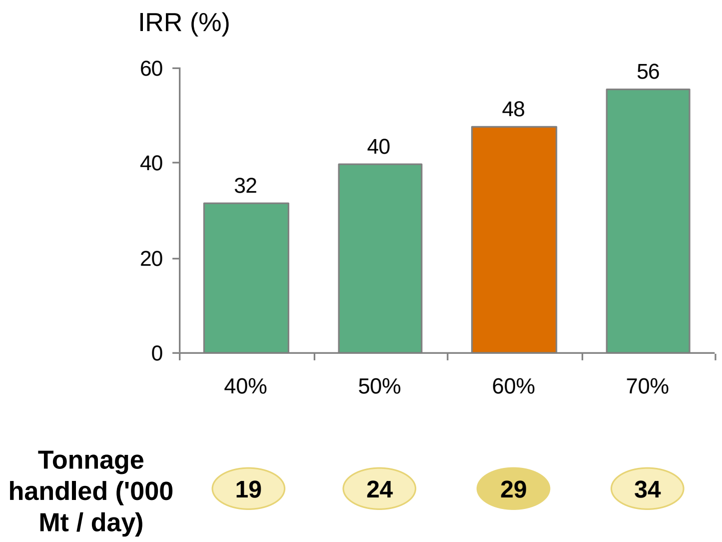


Figure 306: IRR on capital expenditure for mechanization

Expected Impact

Evacuation productivity to increase to 48,000 MT/day, which is sufficient to support the discharge rates and, hence, there will be no cluttering at the berth. Crane productivity will not be affected due to piling up of coal at the berth, and coal handling will run seamlessly.

10.2.2 Unlocking additional capacity by traffic reallocation

10.2.2.1 Initiative: VOC 2.1 Consolidation and improvement of spare capacity at Coal Jetties

Initiative Overview

Productivity at Coal Jetty I and II is lower than other mechanized berths across major national and international ports, primarily because of TNEB's demand constraints and lack of infrastructure like shore cranes.

TNEB's demand constraints limit the productivity to 11,000 MT per day. Our analysis suggests that coal jetties can demonstrate productivity as high as 15,000 MT per day with existing infrastructure, and it can be increased to 25,000 MT per day by taking the following steps:

- Widening and strengthening of the berth
- Installing shore cranes
- Conveyor overhauling

With increased productivity, the port can handle non-TNEB coal in the newly created capacity by establishing a branch-out conveyor to handle evacuation of Non-TNEB coal to the port's yard.

TNEB will be able to handle its coal on one berth and, hence, the port can take back control of the other berth. The process of unlocking additional capacity has been explained in three phases with varying capex and capacity unlocked:

- Phase 1: Incentivizing TNEB to improve productivity with no overhaul can unlock 2.5 Mn MT capacity with a capex of Rs. 25 crores
- Phase 2: Port taking over one berth, refurbishing it and incentivizing TNEB to improve productivity on the other, will unlock 4.5 Mn MT capacity at a capex of Rs. 70 crores
- Phase 3: Port taking over one berth and refurbishing both berths will unlock a capacity of 7 Mn MT at a capex of Rs. 95 crores.

Key Findings

Productivity at coal jetties is significantly lower than mechanized berths across other ports. There are two primary reasons for low productivity:

1. TNEB's demand constraint
   - Coal jetty I and II are operated by TNEB to fulfill the coal requirement of Tuticorin Thermal power station and, hence, the productivity is linked to the daily coal requirements of TTPS.
2. Lack of infrastructure
   - Lack of shore cranes limits vessels to use ship gear and, hence, the productivity is low.

Scope of improving productivity

1. With existing infrastructure (15,000 MT per day)

There exists a significant variance in individual vessel productivity demonstrated by different vessels at CJ I and II. Highest productivity is 17,000 MT per day and frequent instances of 15,000 MT per day suggest that productivity can be increased to 15,000 MT per day with existing infrastructure.

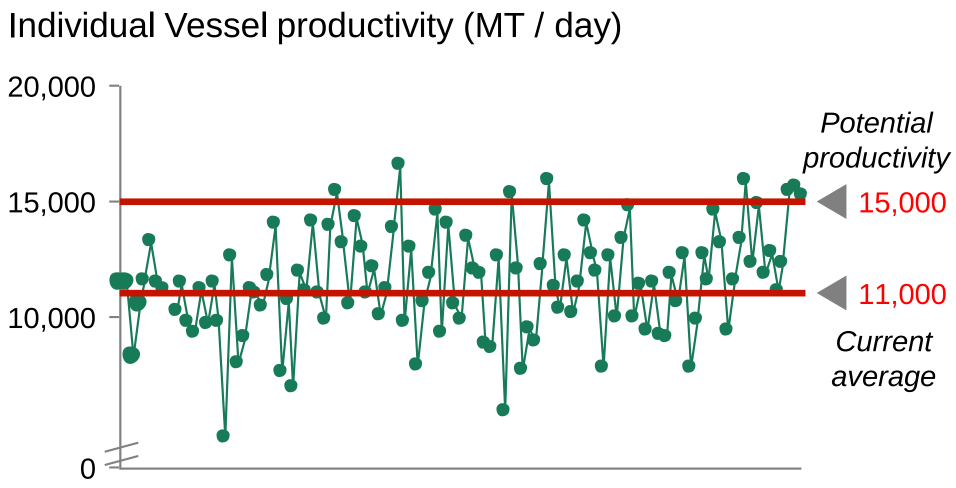


Figure 307: Individual vessel productivity demonstrated at Coal Jetties I and II

2. With improved infrastructure (25,000 MT per day)

As discussed before, productivity is constrained because of reliance on vessel gear at CJs and, hence, there is a need to install harbor mobile cranes. Currently, the berths are incapable of supporting the MHCs due to lack of space for maneuvering and insufficient strength. The following four steps need to be taken to improve berth productivity to 25,000 MT per day:

- Berth strengthening and widening (capex of ~Rs. 20 crores): Civil work needed to accommodate an MHC / shore off loader
- Invite a third party to setup a mobile harbor crane or a shore off loader
- Over haul conveyors on CJ I (capex of Rs. 30 crores)

Evacuation of non-TNEB coal to be addressed by building a branch-out conveyor

As discussed above, current infrastructure at Coal jetties is operated by TNEB and it evacuates coal directly to TTPS via conveyors. Since TNEB's coal demand is limited, the additional capacity will be used to accommodate non-TNEB coal. For evacuation to the port's storage yard, a branch-out conveyor needs to be constructed.

The port can choose to create a new yard or can use the new infrastructure for handling coal that needs to be evacuated directly outside of the port without interim storage.

Figure 308: Layout for the proposed branch-out conveyor

Benefits to TNEB

There are two key benefits to TNEB with the proposed coal handling plan at coal jetties:

1. **Logistics cost savings by use of gearless vessels:** As discussed before, use of gearless vessels results in a saving of Rs. 75 per MT of coal in logistics cost. Savings accrued from use of gearless vessel are different for different phases and are quantified later for individual phases.

2. **Productivity incentive:** Port will need to provide a discount on vessel related charges to TNEB as an incentive to increase productivity to 15,000 MT per day on TNEB operated berths. We have quantified cost saving by assuming a 20% discount, but the exact value of discount can be negotiated by the two parties during contract renegotiation.

Three phases to unlock 3-7 Mn MT of capacity

We have listed down the three different phases in which the port can unlock capacity from coal jetties. The phases are incremental in terms of the unlocked capacity and the required capex, and the port can choose the requisite level by estimating the additional required capacity based on demand projections of coal and other new infrastructure coming up at the port.

1	2	3
Incentivise TNEB to improve productivity with no overhaul	**Take over and re-furbish one berth**	**Take over one berth but re-furbish both berths**
Capex : 25 crores	**Capex : 75 crores**	**Capex : 95 crores**
Capacity unlocked : ~2.5 Mn MT	**Capacity unlocked : ~4.5 Mn MT**	**Capacity unlocked : 7 Mn MT**
Berths continue to be owned and operated by TNEB with allowance for Port to handle non-TNEB cargo on one berth • Branch out conveyor required to the existing yard • Productivity based incentives to TNEB to improve productivity on both berths to ~ 15,000 MT • TNEB to consolidate vessels on one berth to free up capacity on second berth	**Port to take over one berth and overhaul it:** • Strengthen and widen it • Install MHCs • Replace the conveyor **TNEB to be incentivized to improve productivity on own berth** • Maximize own handling to 4.6 Mn MT coal • Remaining 1.6 Mn TNEB coal to be handled at the port operated berth	**Port to take over CJ I but strengthen and widen both berths to increase capacity** • Port to overhaul conveyors and install MHCs on its own berths • TNEB to install MHCs on their berth • Capacity of berth increases to 7 Mn MT enabling TNEB's to handle all coal on one berth • TNEB to gain a cost saving f ~76 Rs per MT by chartering gearless vessels
Revenue: 26 crores	**Revenue: 70 crores**	**Revenue: 98 crores**

Figure 309: Summary of three phases

Phase 1: Incentivize TNEB to improve productivity with no overhaul

Berths continued to be owned and operated by TNEB with an allowance to handle non-TNEB cargo on one berth.

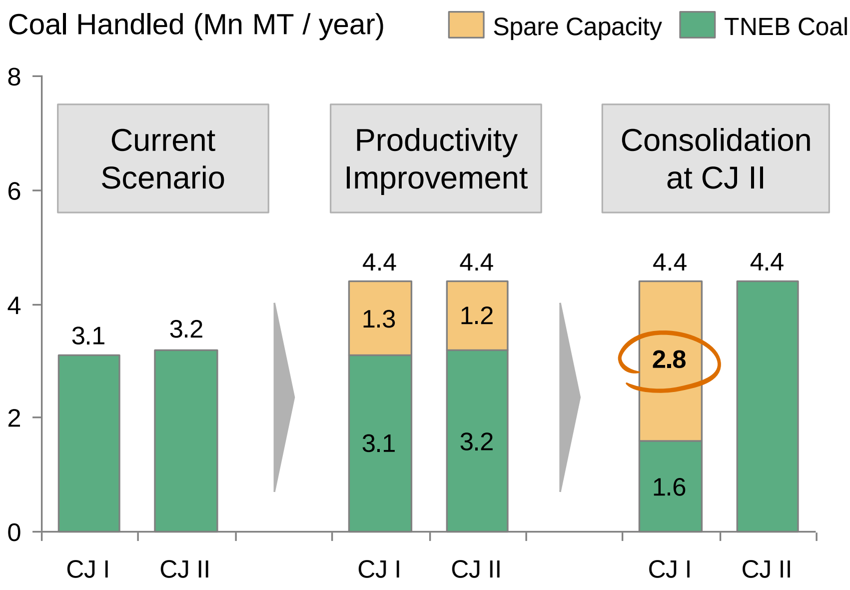


Figure 310: Phase 1 capacity unlocked

Key steps required for Phase 1:

1. Renegotiate contract to allow handling of non-TNEB coal at one berth
2. Construct a branch-out conveyor to handle evacuation to the port's yard
3. Incentive TNEB to improve productivity at their berths
4. TNEB to consolidate coal handling at one berth to free up capacity at another berth

Benefits to TNEB from Phase 1:

1. TNEB to collect berth hire charges from all vessels unloading non-TNEB coal
2. Productivity incentive as a 20% discount on all vessel related charges for achieving a productivity of 15,000 MT per day

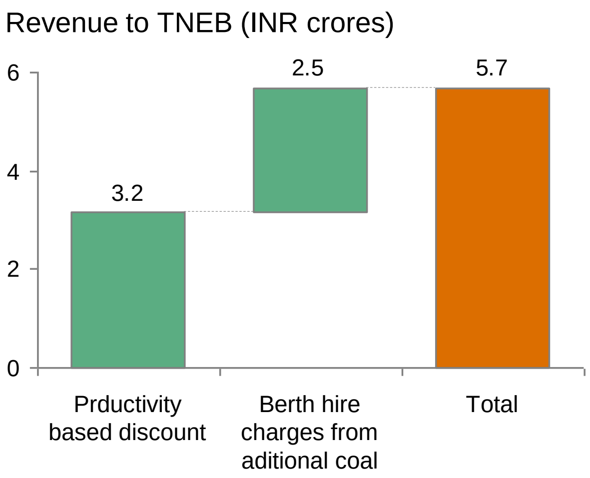


Figure 311: Phase 1 benefits to TNEB

Return on Investment from Phase 1

1. Port to incur a capex of Rs. 25 crores in setting up the branch out conveyor
2. Port to earn an internal rate of return (IRR) of 33% on the investment made as explained in the Figure below

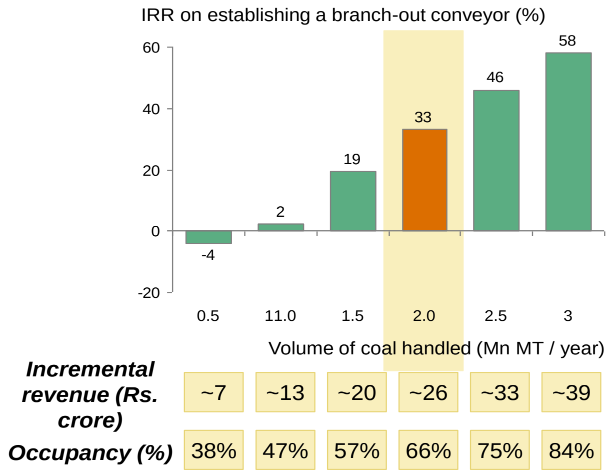


Figure 312: Return on Investment from Phase I

Phase 2: Port to take over one berth and refurbish it

Port to take over one berth and refurbish it to increase capacity to 25,000 MT per day, and incentivize TNEB to increase productivity to 15,000 MT per day with equipment overhaul at their berth.

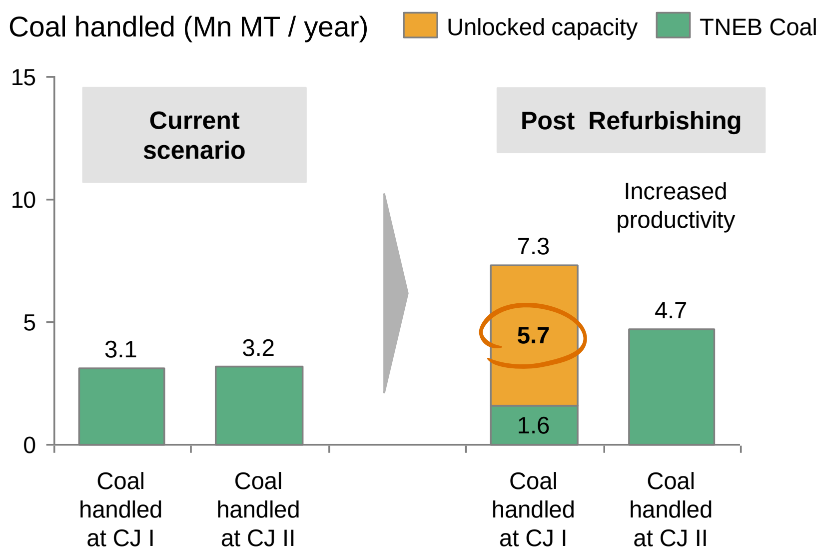


Figure 313: Phase 2 capacity unlocked

Key steps required:

1. Renegotiate contract to take back control of one berth
2. Incentivize TNEB to improve productivity at their berth and subsequently consolidate vessels on their berth
3. Construct a branch-out conveyor to handle non-TNEB coal evacuation to the port's storage yard
4. Strengthen and widen the berth to accommodate an MHC / shore offloader
5. Invite a private player to setup an MHC / shore offloader
6. Overhaul the conveyors of the renovated berth

Benefits to TNEB from Phase 2:

1. TNEB to save Rs. 75 per MT on logistics cost by chartering gearless vessels for 1.6 Mn Mt coal handled at the refurbished berth
2. TNEB to get a productivity incentive in the form of 20% discount on all vessel related charges

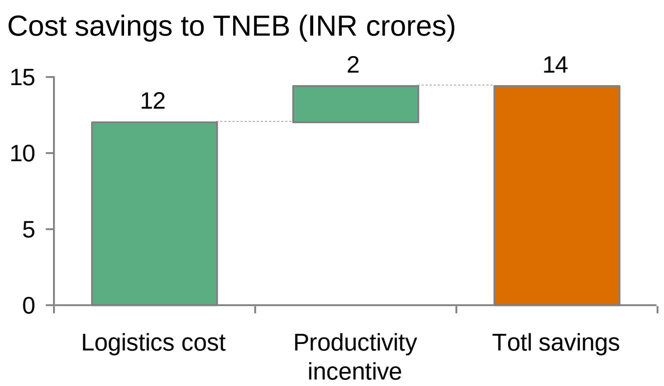


Figure 314: Phase 1 benefits to TNEB

Return on Investment from Phase 2:

1. Port to incur a total capex of Rs. 75 crores for phase 2 (break-up given in the Figure below)

2. Port to earn an attractive IRR of 38%

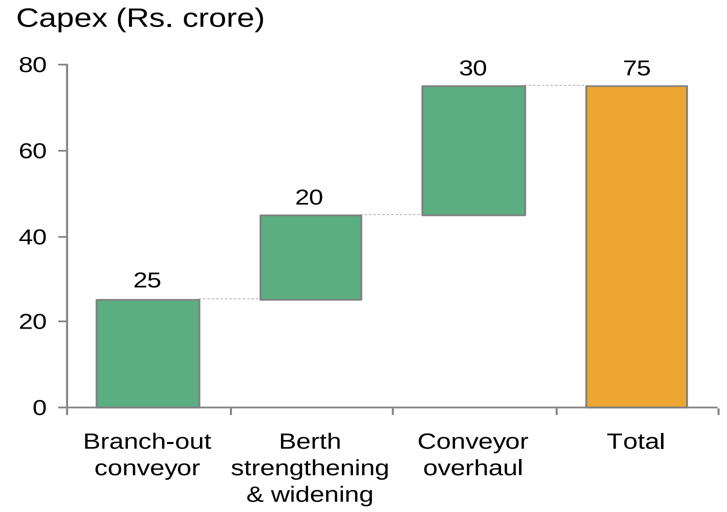


Figure 315: Details of capex required for Phase 2

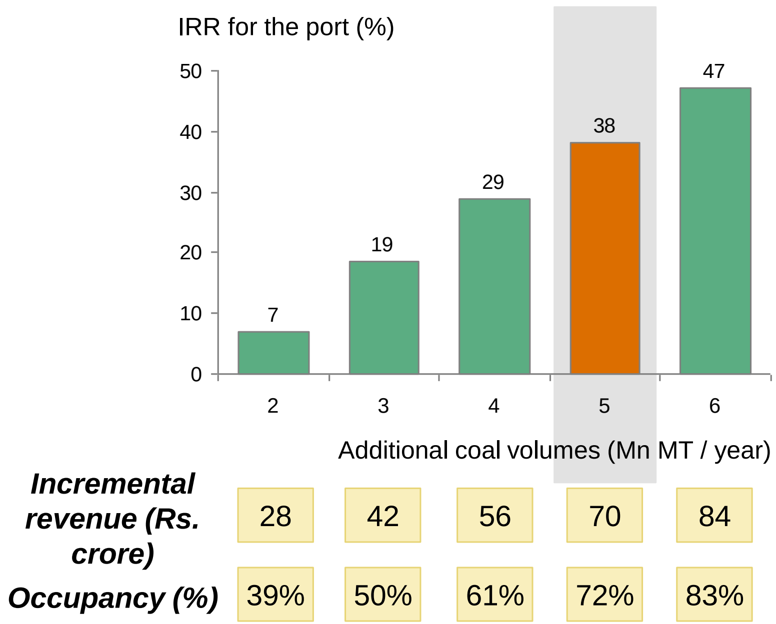


Figure 316: Return on Investment from Phase 2

Phase 3: Port to take over one berth, but refurbish both berths

Port to take over one berth, but refurbish both berths to increase capacity to 25,000 MT per day.

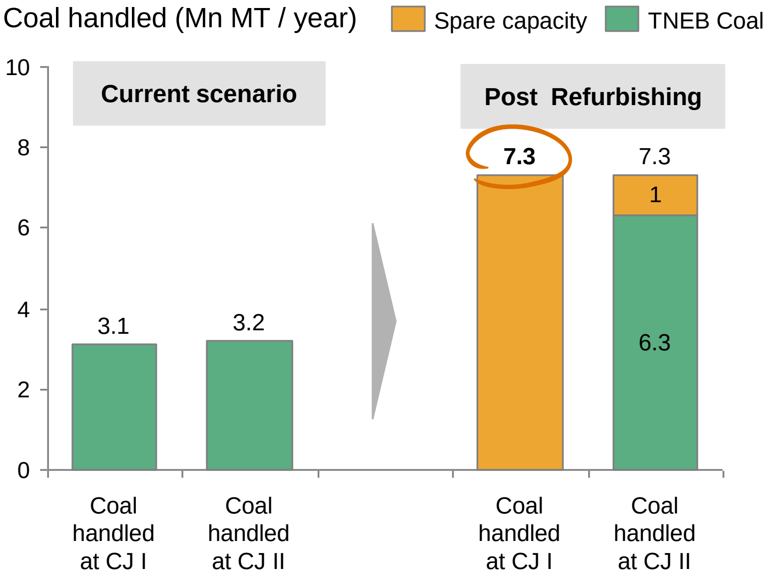


Figure 317: Phase 3 capacity unlocked

Key steps required for Phase 3:

1. Renegotiate contract to take back control of one berth
2. Construct a branch-out conveyor to handle non-TNEB coal evacuation to the port's storage yard
3. Strengthen and widen both berths to accommodate an MHC / shore offloader
4. Invite a private player to setup an MHC / shore offloader on both berths
5. Overhaul the conveyors at CJ I

Benefits to TNEB from Phase 3:

TNEB to accrue logistics cost savings of Rs. 47 crores per year by saving Rs. 75 per MT by chartering gearless vessels.

Return on Investment from Phase 3:

1. Port to incur a capex of Rs. 95 crores (as explained in the Figure below)
2. Port to earn an attractive IRR of 44% on its investment

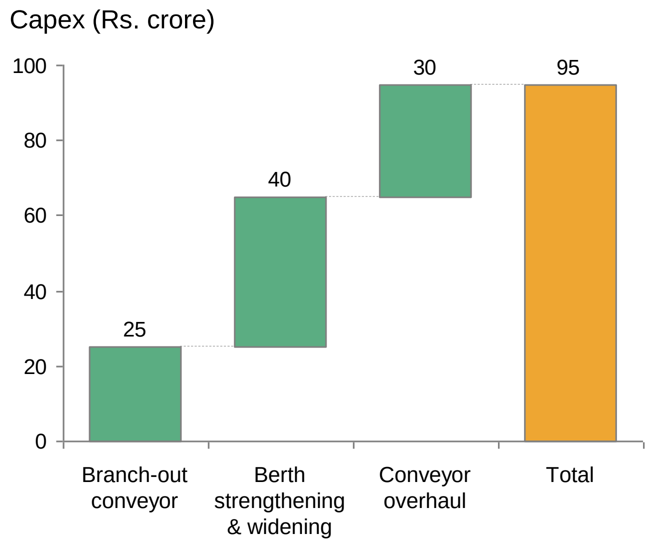


Figure 318: Capex requirements for Phase 3

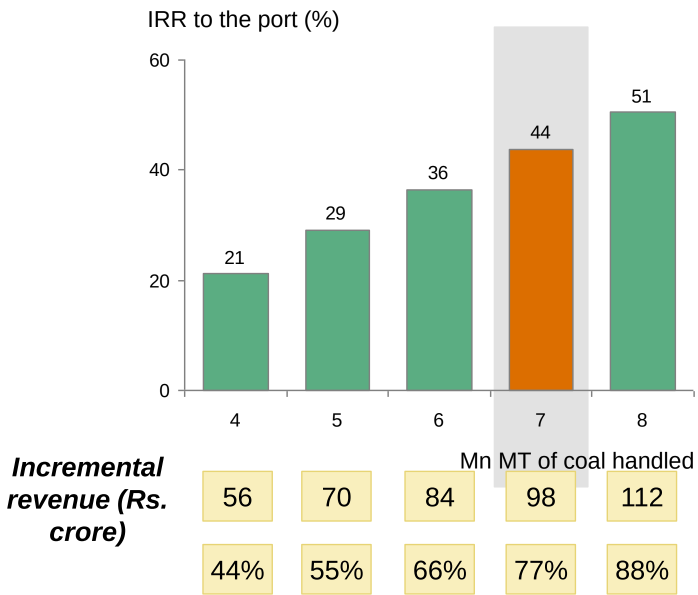


Figure 319: Return on investment for Phase 3

10.2.2.2 Initiative: VOC 2.2 Use of berth VIII for copper concentrate vessels

Initiative Overview

Berth VIII (DBGT), envisioned to be a container berth, currently has low occupancy of ~55%. Absence of quay cranes limits the increase in occupancy till 2016 after arrival of cranes. Shortage of deep draft berths can be addressed by use of berth VIII for dry bulk vessels in the short term. Clean cargo like copper concentrate can easily be handled with the use of hoppers without disruption of container traffic.

Key Findings

Low occupancy on berth VIII due to delay in arrival of DBGT's quay cranes is resulting in sub-optimal utilization of deep draft berths and, hence, berth VIII can be used to manage the shortage of deep draft berths in the short term.

The proximity of berth VIII to berth IX (the only deep draft dry bulk berth) make it an attractive proposition for handling of clean cargo that does not require dumping on the ground. Hence, berth VIII can be used to ease the bottleneck at berth IX for the short-term.

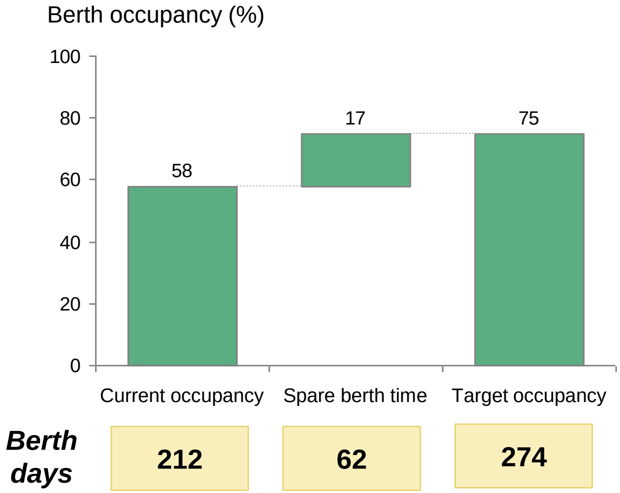


Figure 320: Berth occupancy at berth VIII

Clean commodities to prevent dust accumulation on berth and equipment

- Commodities handled through hoppers can be handled on berth VIII as there is no dumping on the berth
- Copper concentrate, sugar, etc., can be discharged through hoppers

Berth planning required in order to accommodate bulk vessels along with existing container service schedule

- Coordination between the port and DBGT required to intimate DBGT about expected vessels up to 2 weeks in advance
- All copper concentrate volume is imported by a single player—Sterlite Copper—and can provide better visibility over schedule

Recommendations

Negotiate short-term agreement for use of berth VIII based on pre-agreed parameters

- Permissible cargo, i.e., copper concentrate (proposed)
- Customers identified
- Tariff and revenue share
- Operating norms
- Productivity norms