# Final Report for Sagarmala (Vol. IV)

Ministry of Shipping, Indian Ports Association

November 2016

- Master Plan for Chennai Port
- Master Plan for Cochin Port
- Master Plan for Kamarajar (Ennore) Port
- Master Plan for Jawaharlal Nehru Port (JNPT)
- Master Plan for Kandla Port
- Master Plan for Kolkata Port (KoPT)

# Final Report for Sagarmala (Vol. IV)

Prepared for

Ministry of Shipping
Government of India

**Ministry of Shipping / Indian Ports Association**

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“In 2015 the Ministry of Shipping instructed McKinsey & Company and AECOM to provide fact-based analysis and insights from best practice around the world into [potential future trends in container shipping, options for infrastructure and potential approaches to financing ports development].

The Ministry will evaluate this advice, along with inputs and advice from a variety of internal and external experts, and determine the most appropriate strategy to give effect to the Cabinet’s decision of 25 March, 2015. McKinsey’s advice, in the form of the following confidential report, was provided in November, 2016.

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*The analyses and conclusions contained in this report are based on various assumptions have been developed with the Ministry of Shipping, which are subject to uncertainty. Nothing contained herein is or shall be relied upon as a promise or a representation. Neither McKinsey nor AECOM are investment advisors, and thus do~~es~~ not provide investment advice. This is not intended to serve as investment advice, and parties should conduct their own due diligence prior to making investment decisions.*

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# Master Plan for Chennai 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 6.1**, 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.

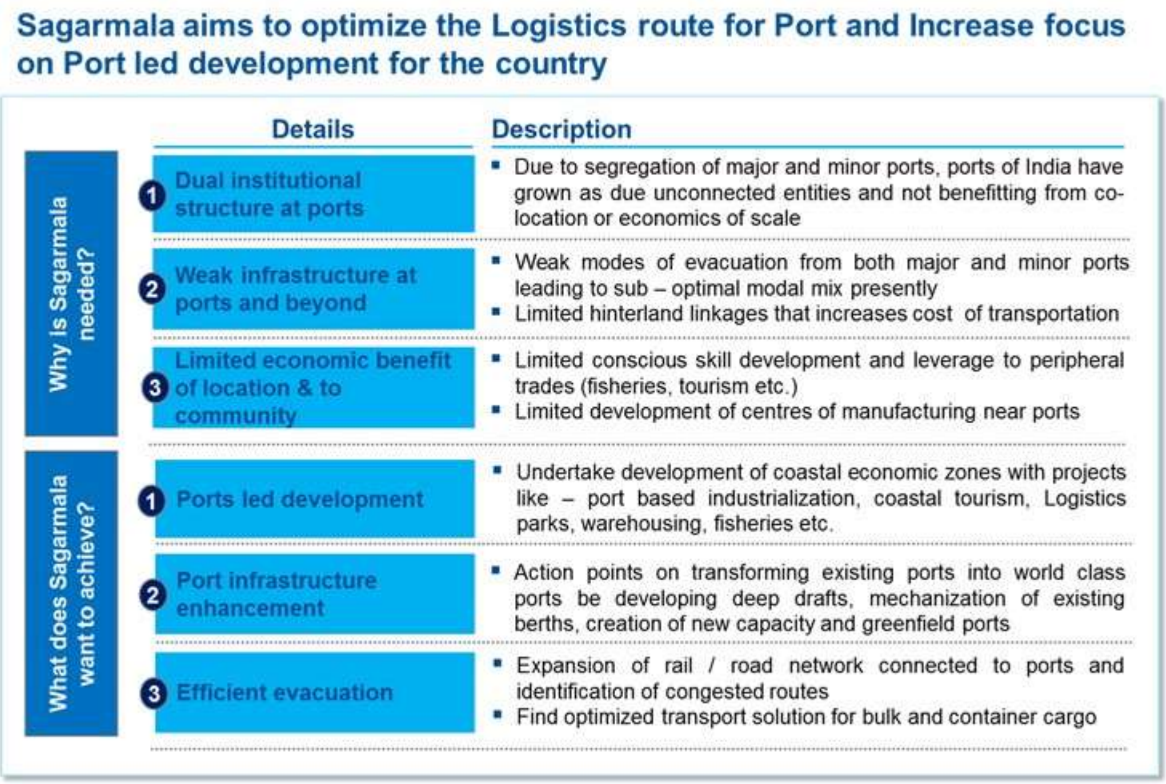



**Figure 6.1 Aim of Sagarmala Development**

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

The team of McKinsey and AECOM distilled learnings the experience in port-led development, the major engagement challenge to develop a set of governing principles for our approach is shown in **Figure 6.2**.

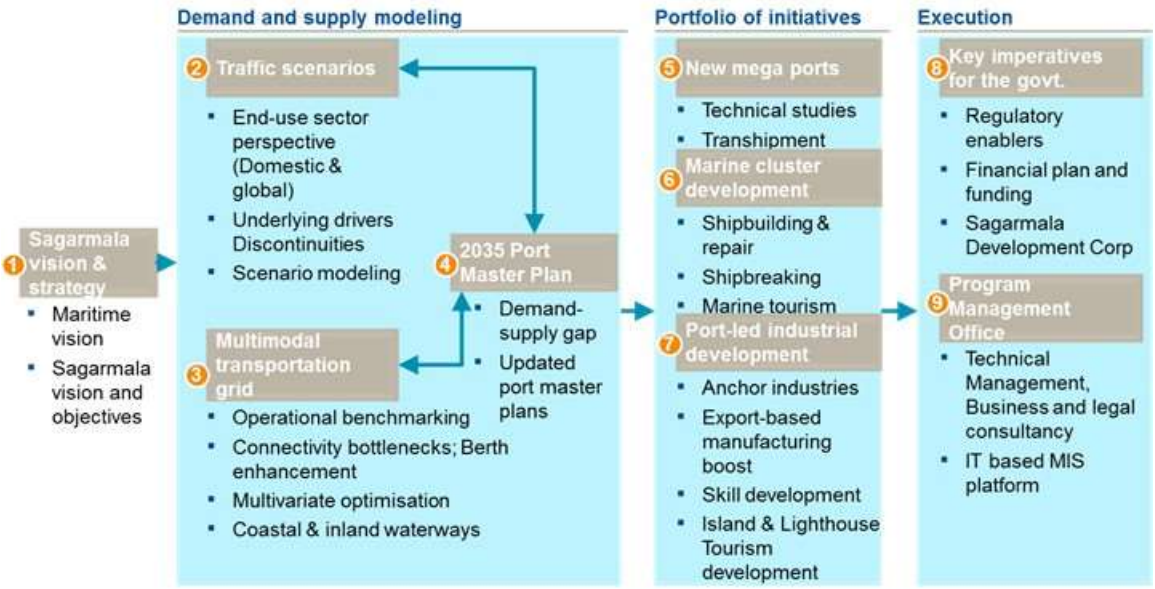



**Figure 6.2 Governing Principles of Our Approach**

As indicated above, the origin-destination of key cargo (accounting for greater than 85% of the total traffic) in Indian ports have been mapped to develop traffic scenarios for a period of next 20 years. The forces and developments that will drive change in the cargo flows are also identified. This would lead to the identification of regions along the coastline where the potential for the expansion of existing port exists. The various activities involved in the port led developments are charted in **Figure 6.3**.

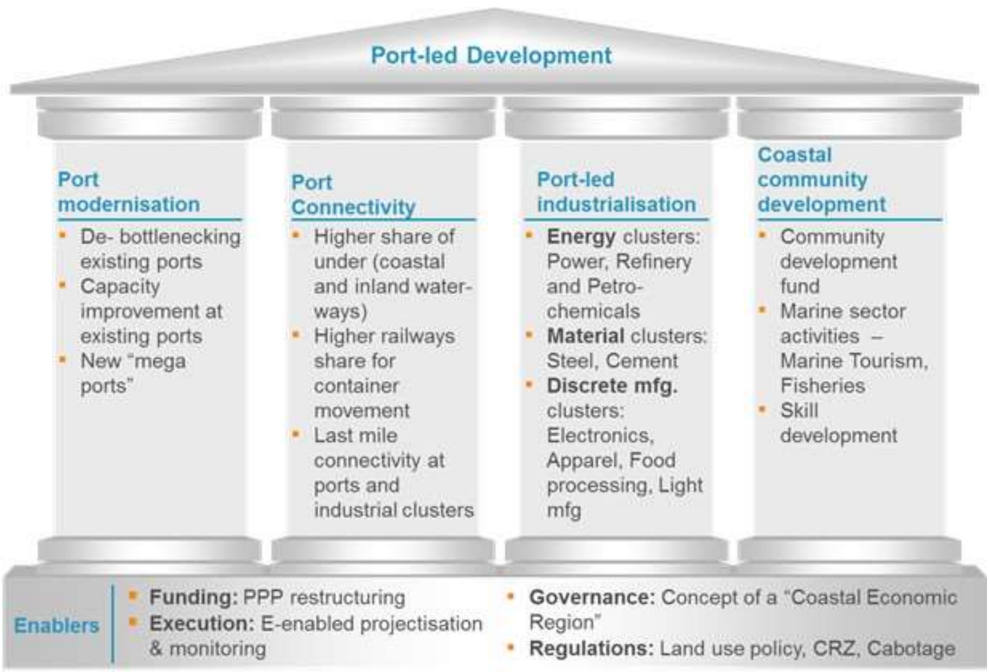



**Figure 6.3 Port Led Developments**

As part of the assignment, we were 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 would 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 Chennai Port as part of SAGARMALA assignment. This report is organised in the following sections:

Section 1 : Introduction
Section 2 : The Port and Site Conditions
Section 3 : Details of Existing Facilities
Section 4 : Performance, Options for Debottlenecking & Capacity Assessment
Section 5 : Details of Ongoing Developments
Section 6 : Traffic Projections
Section 7 : Capacity Augmentation Requirements
Section 8 : Road and Rail – Internal Network and External Connectivity
Section 9 : Scope for Future Capacity Expansion
Section 10 : Shelf of New Projects and Phasing

# 2.0 THE PORT AND SITE CONDITIONS

## 2.1 Chennai Port as at Present

The location of Chennai Port is shown in **Figure 6.4**.


**Figure 6.4 Chennai Port Location**

Chennai Port is the third oldest and about 135 years old port among the twelve major ports of India. It has the strategic advantage of having the entire South India as its hinterland and is emerging as a hub port in East Coast of India. Chennai Port is located at latitude 13°06' N and longitude 80°18' E on the south-east coast of India and in the north-east corner of Tamil Nadu. Port location is on the flat eastern coastal plain. The location advantage enables the port to handle variety of cargo comprising containers, liquid & break bulk cargo.

The port comprises three dock systems viz. Ambedkar Dock, Jawahar Dock and Bharathi Dock. It has in all 24 berths with a total quay length of around 5.5 km. The maximum draft available is 17.4 m at some of these berths. The port is approached through a 7.0 km channel with water depths in the outer channel being 19.2 m and that of the inner channel being 18.6 m. The Port has a total land area of 240 ha.(approx.) and water spread area of 170 ha.

### 2.1.1 Road Connectivity

Popularly known as "Gateway to South India", Chennai is well connected to other major cities through national highways. It is connected to Kolkata through NH 5, to Mumbai through NH 4 and to Kanyakumari through NH 45.

### 2.1.2 Rail Connectivity

Chennai Port is well connected with the national railway network. The Port is linked to Southern Railway network through Chennai Beach Railway Station which connects Chennai Port to Southern parts of Tamil Nadu and through Royapuram Station which connects Southern Railway Trunk line to Kolkata, New Delhi, Bangalore, Coimbatore etc. The Port also has an internal rail network of about 70 km.

## 2.2 Site Conditions

### 2.2.1 Meteorology

The climate in the region has a typical monsoon character. Two monsoons dominate the climate - the SW summer monsoon and the NE winter monsoon. The summer monsoon starts around May and holds on until September. The NE monsoon starts by the latter half of October and lasts until February. The summer monsoon is stronger than the winter monsoon and the months between both monsoons form a transition period of calmer weather. Storms occur particularly in autumn months.

#### 2.2.1.1 ***Winds***

The wind rose indicating the wind climate near Chennai is given in **Figure 6.5**.

The geographical position of the coast makes the region to experience the NE monsoon between October to February and the SW monsoon from May to September. South to southeast wind directions also occur frequently, mainly during the transition period between the two monsoons

The wind conditions that prevail in deep water during the monsoons are summarized below.

- NE monsoon:
  - Wind direction: 49 - 87°, relative to the North.
  - Wind speed: 5.8 - 7.5 M/s
- SW monsoon
  - Wind direction: 153 - 263° relative to the North.
  - Wind speed: 2 - 12 M/s

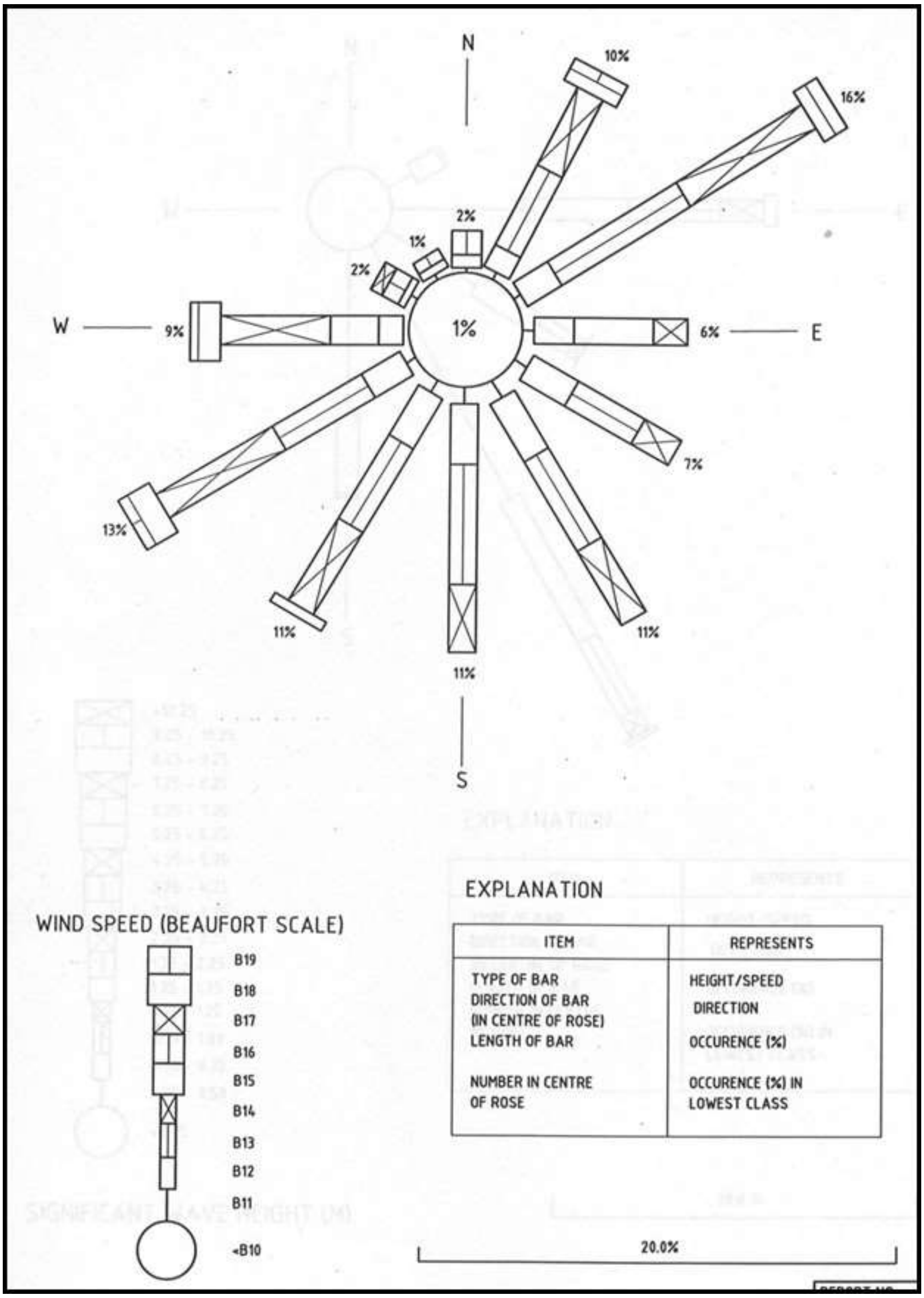



**Figure 6.5 Wind Rose Diagram**

### 2.2.1.2 *Rainfall*

Region gets rainfall during October and November from NE Monsoon. During this time, temperatures are lower and humidity is still high. June to September may receive certain amount of rainfall as well. The pre-monsoon rainfall is almost uniform throughout the district. The coastal regions receive more rainfall than the interior ones. NE and SW monsoons are the major donors, with 54% and 36% contribution each to the total annual rainfall. During normal monsoon, the district receives a rainfall of around 1,200 mm.

#### 2.2.1.3 ***Air Temperature***

The average monthly air temperature varies between 37° C in May and June to about 29° C during December and January. The average minimum temperature varies between 28° C in May and June to 21° C in January and February. The highest recorded temperature is 43° C and the lowest recorded temperature is 15° C.

### 2.2.2 Oceanography

#### 2.2.2.1 ***Tides***

The tides at Chennai are semi-diurnal with a tidal range, relative to the Chart Datum (CD), as follows:

| | | |
|---|---|---|
| – Highest high water level | (HHWL) | + 1.50 m |
| – Mean high water springs | (MHWS) | + 1.10 m |
| – Mean high water neaps | (MHWN) | + 0.80 m |
| – Mean Sea Level | (MSL ) | + 0.54 m |
| – Mean low water neaps | (MLWN) | + 0.40 m |
| – Mean low water springs | (MLWS) | + 0.10 m |
| – Lowest low water | (LLWL) | - 0.10 m |

#### 2.2.2.2 ***Currents***

Chennai Port has observed the following current patterns in their area:

In January the current sets South Westward or Northward at a rate of 1 to 1.5 knots. But it is irregular in February (Northward parallel with the coast 1.5 knots). During March, April and May the current sets Northward from 1 to 3 knots. In June variable but sometimes Southward and weak in July and in August southward or against the wind from 2 to 3 knots at times. In September the current sets South and South-westwards and in October Southerly along the coast. In November and December the current sets South Westerly or Southerly along the coast.

#### 2.2.2.3 ***Waves***

As the near-shore area off Chennai is sheltered from the westerly winds by the mainland, the strong southerly to westerly winds during the southwest monsoon do not cause high waves due to the limited fetch available. Consequently, the wave conditions at Chennai are moderate.

Waves at Chennai approach predominantly from two directions:

- 135° N during March - September, and
- 90° N during November – January.

During the transition period (during February and October), waves approach from 115° N. The wave height is around 2.5 – 3 m with a wave period of 10 s during northeast monsoon and 2 - 2.5 m with a wave period of 6 s during southwest monsoon.

The wave rose diagram for offshore Chennai is shown in **Figure 6.6**.

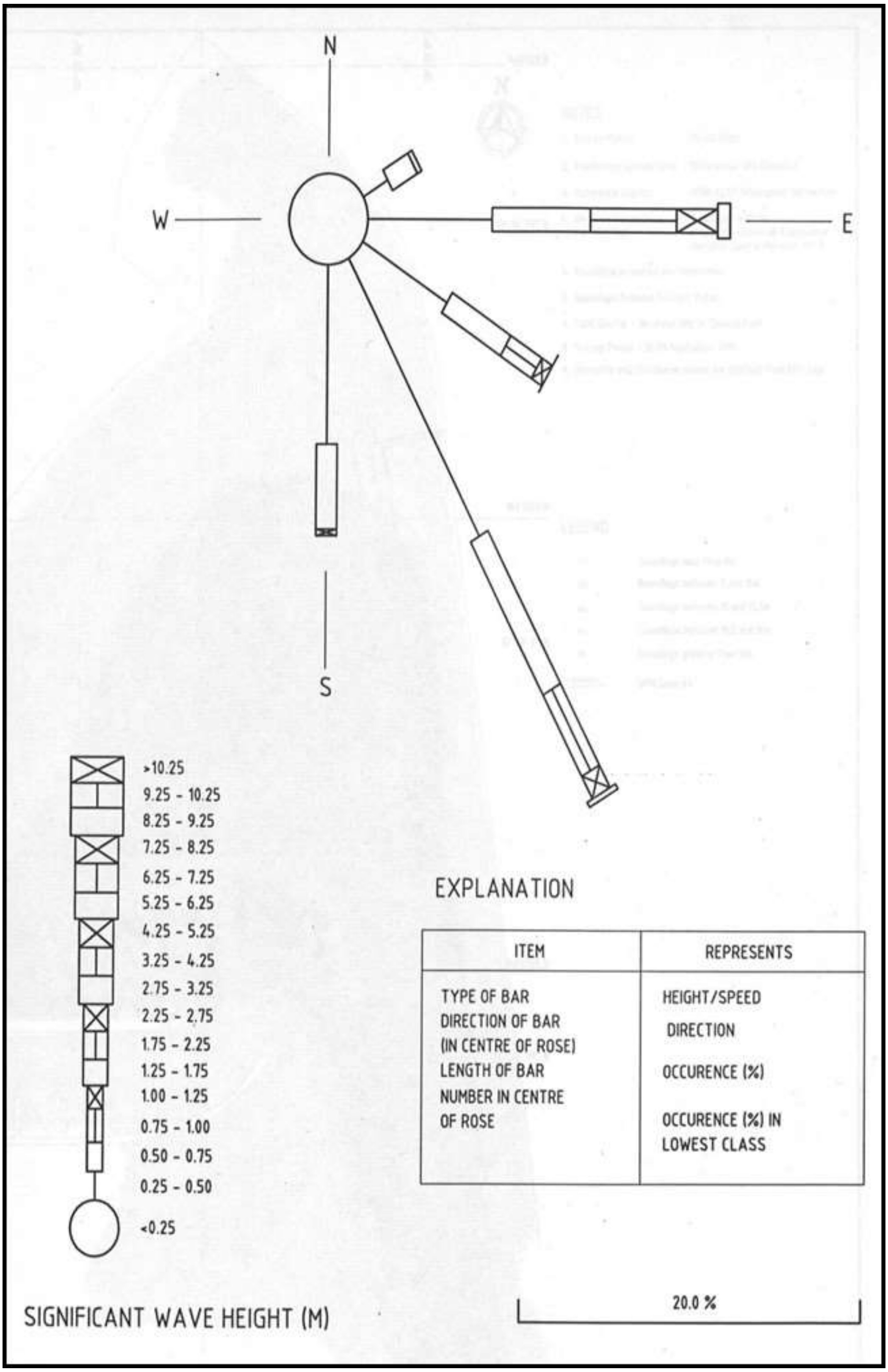



**Figure 6.6** **Wave Rose Diagram**

# 3.0 DETAILS OF EXISTING FACILITIES

## 3.1 General

Chennai Port has three Docks - Bharathi Dock, Ambedkar Dock and Jawahar Dock. The existing Container Terminal is situated in Bharathi Dock. Bharathi Dock contains 7 berths; Ambedkar Dock contains 11 berths and Jawahar Dock contains 6 berths, all totalling to 24 berths. The major commodities handled in the Port are Crude oil & POL products, Containers, Automobiles, Edible oil finished Fertilizers, Fertilizer Raw Materials, and general cargo. The location of these docks is shown in the following **Figure 6.7**.


**Figure 6.7 Location of the Three Docks**

***Entrance Channel***

| | | |
|---|---|---|
| Length of Channel | - | About 7 km |
| Depth of Inner Channel | - | 18.6 m at chart datum |
| Depth of Outer Channel | - | 19.2 m at chart datum |
| Width of Channel | - | The width of channel gradually increases from 244 m to 410 m at the bent portion, then maintains a constant width of 305 m |

***Outer Harbour***

| | | |
|---|---|---|
| Eastern Breakwater | - | 590 m |
| Northern Breakwater | - | 460 m |
| Outer Arm | - | 1,000 m |
| Upper Pitch Revetment | - | 950 m |

The details of these docks along with their berths are brought out hereunder:

## 3.2 Bharathi Dock (BD)

Bharathi Dock is a relatively new addition to the port having been constructed during the late sixties and early seventies. It provides handling facilities for POL, edible oil and containers. The entrance to the Dock is 350 m wide. Particulars of berths at Bharathi Dock have been presented in **Table 6.1**.

**Table 6.1 Details of Bharathi Dock Berths**

| Name | Commodity | Length (m) | Draft (m) |
|---|---|---|---|
| BD - I | POL | 356 | 14.6 |
| BD - II | Edible Oil/ POL | 382 | 16.5 |
| BD - III | POL - Crude | 325 | 16.5 |
| CTB I | Containers | 200 | 13.4 |
| CTB II | Containers | 200 | 13.4 |
| CTB III | Containers | 200 | 13.4 |
| CTB IV | Containers | 285 | 13.4 |

### 3.2.1 POL Berths - BD I and BD III

The POL berths are shown in **Figure 6.8**. BD I (commissioned in 1972) has been designed to handle tankers up to 100,000 DWT while BD III (commissioned in 1986) has been designed for 140,000 DWT tankers. BD I have been provided with 5 × 12" marine loading arms while BD III has been provided with 4 × 16" + 2 × 12" marine loading arms. Both the berths are served by 1 × 30" pipeline for crude oil; 1 × 20" pipeline for white oils and 2 × 14" pipeline for black oils. There are separate service lines for LDO/FO/LO bunkers. The berths are provided with firefighting facilities including tower monitors served by a separate firefighting pump house with requisite pumps and connecting pipelines. Reception facilities, in accordance with MARPOL convention, have been provided for receiving ballast, sludge and slop.


**Figure 6.8 POL Berths - BD I & BD III**

### 3.2.2 Berth BD II

The berth BD II with back up area is shown in **Figure 6.9**. This berth was originally commissioned in 1977 to handle iron ore carriers up to 150,000 DWT. It was designed for receiving, stockpiling, reclaiming, weighing, sampling and ship loading with the facilities consisting of two rotary wagon tipplers, two lines of conveyors, two rail-mounted stackers, two rail-mounted bucket-wheel reclaimers and two rail-mounted ship loaders. Later with the decision to shift iron ore handling to Kamarajar port and also due to the ban on iron ore exports, the iron ore loading and unloading facilities are yet to be dismantled. The berth is presently used for handling edible oil imports.


**Figure 6.9 Berth BD II**

### 3.2.3 Chennai Container Terminal Pvt Ltd. (CCTPL)

Chennai Port was the first port to start container handling operations in 1983. This was later handed over to Chennai Container Terminal Private Limited (CCTPL), a Special Purpose Vehicle, formed by the consortium of M/s P&O Australia Ports Pty. Limited, and three others in 2001 for development, operation and management of the container terminal on a Build, Operate and Transfer (BOT) basis for a period of 30 years. In 2006, DP World, one of the world's largest container terminal operators, acquired P&O Steamship Navigation Company, UK thereby acquiring the 75% stake held by it. In 2008, DP World acquired the balance stake held by other consortium members effectively controlling 100% stake in CCTPL.

The Container Terminal with four berths CTB 1 to 4 has a quay length of 885 m. It can accommodate container vessels up to 6,400 TEU capacity. The total yard area is 21.4 ha and accommodates 3,842 ground slots with a holding capacity of 19,710 TEUs. It has 240 reefer plugs. The yard also houses a Container Freight Station of 6,500 m² area. The terminal is served by 7 Quay cranes and 24 RTG's. Its capacity is 1.6 MTEU per annum.

The berth with back-up yard is shown in **Figure 6.10**.


**Figure 6.10 Chennai Container Terminal (CCTPL)**

## 3.3 Dr. Ambedkar Dock (AD)

Dr. Ambedkar Dock is the oldest original dock more than 125 years old. It has 11 berths, with total quay length of around 2,308 m. The entrance width of the dock is 125 m. The components are North Quay, West Quay, South Quay and East Quay where the second container terminal is located. It also has two finger jetties which are presently used by the Navy and Coast Guard. These berths cater to automobiles, passengers, general cargo fertilisers and containers. Berth particulars and the commodities handled are presented in **Table 6.2**.

**Table 6.2 Berths at Dr. Ambedkar Dock**

| Name | Commodity | Length (m) | Draft (m) |
|---|---|---|---|
| North Quay | GC/Liquid Bulk | 198 | 8.5 |
| West Quay I | GC/Ro-Ro/Other Liquids | 171 | 11 |
| West Quay II | GC/Ro-Ro/Other Liquids | 171 | 12 |
| Centre Quay | GC/Food grains | 171 | 12 |
| West Quay III | GC/Food grains | 171 | 12 |
| West Quay IV | GC/Passenger | 171 | 11 |
| South Quay I | Fertilizer / GC/Dry Bulk | 246 | 9.5 |
| South Quay II | Fertilizer / GC/Dry Bulk/Liquid Bulk | 179 | 9.5 |
| Second Container Berth - I | Containers | 287 | 12 |
| Second Container Berth - II | Containers | 270 | 12 |
| Second Container Berth - III | Containers | 275 | 12 |

### 3.3.1 North Quay and West Quay Berths

The berths with their back up area /sheds are shown in the **Figure 6.11**.


**Figure 6.11 North Quay and West Quay Berths**

The NQ berth is used for handling general cargo and edible oil. WQ 1 & WQ 2 is used to handle car carriers for automobile exports. These berths have a backup area of over 65,500 m$^2$ in two plots. CB and WQ 3 are used for handling general cargo and food grains. They have transit sheds behind. WQ 4 handles general cargo as well as passengers. For this purpose, it is provided with a passenger station with all infrastructures. The entire WQ berths are provided with 2 Jessop Cranes and 2 L&T cranes all of 15 T capacity.

### 3.3.2 South Quay Berths

The berths with their back up area are shown in the **Figure 6.12**.


**Figure 6.12 South Quay Berths**

SQ 1 handles general cargo, dry bulk and fertilisers while SQ 2 handles fertilisers and edible oil/Phosphoric acid. The phosphoric acid tanks of Madras Fertilisers Ltd. and edible oil tanks of IMC are located just behind this berth.

### 3.3.3 Chennai International Container Terminal Pvt. Ltd. (CITPL)

Chennai Port awarded the second container terminal to Chennai International Container Terminal Private Limited (CITPL), a Special Purpose Vehicle, formed by the consortium of M/s Singapore Port Authority and SICAL Logistics Pvt Limited in 2007 for development, operation and management of the container terminal on a Build, Operate and Transfer (BOT) basis for a period of 30 years. It was commissioned in 2009.

The Container Terminal with three berths SCB 1 to 3 has a total quay length of 832 m. The total yard area is 35.8 ha including 7.8 ha of reclaimed area. It accommodates 5,424 ground slots with a holding capacity of 27,120 TEUs. It has 120 reefer plugs. The terminal is served by 10 Quay cranes and 20 RTGs. Its capacity is 1.5 MTEU per annum.

The berth with back-up yard is shown in **Figure 6.13**.


**Figure 6.13 Chennai International Container Terminal (CITPL)**

## 3.4 Jawahar Dock (JD)

Jawahar Dock was created during early sixties. The basin dimension is 655 m × 152 m. The total quay length is around 2 × 650 m with 3 berths each on either side. The entrance width of the dock is narrow and can permit only panamax carriers. The particulars of the berths are presented in **Table 6.3**. Design dredge depth of the dock is - 14.0 m CD.

**Table 6.3 Berths at Jawahar Dock**

| Name | Commodity | Length (m) | Draft (m) |
|---|---|---|---|
| JD I | Fertilizer/Dry Bulk | 218 | 11.5 |
| JD II | Fertilizer/Dry Bulk/ Edible Oil /Other Liquid bulk | 218 | 12.0 |
| JD III | Fertilizer/Dry Bulk | 218 | 12.0 |
| JD IV | Dry Bulk/Edible Oil | 218 | 11.0 |
| JD V | Fertilizer/Dry Bulk | 218 | 12.0 |
| JD VI | Dry Bulk | 218 | 11.0 |

### 3.4.1 JD East Berths (JD II, JD IV & JD VI)

The existing berth structures are of varying type along the length. Initial 518 m from the basin entrance was constructed in 1964 with monoliths. Thereafter, the berth length was increased by another 137 m with a combination of diaphragm wall and piles in 1981. During 2000-07 additional structure supported on piles were constructed for strengthening of apron behind both the berths (mainly to cater to the proposed crane loads). However, two stretches in the apron measuring 97 m and 44 m could not be strengthened due to existing crane locations. These locations need to be strengthened.

The total width available now between the Quay face and the Boundary of CITPL is about 140 m. These berths were used to handle coal, but with the ban on handling coal, the yard area is presently vacant except for an area of 3,000 $m^2$. This area is occupied by tank farm and small building. There are, however space and unused building on the south west and south east direction of the existing yard.

JD II & JD IV is presently used for handling fertilisers and edible oil. Phosphoric tankers are also handled here in view of the tank farms nearby.

### 3.4.2 JD West Berths (JD I, JD III & JD V)

These berths are used for handling general cargo, fertilisers and dry bulk cargo. These berths have transit sheds behind them. JD I is equipped with 1 crane of capacity 10 T and JD III is equipped with 2 cranes of capacity 15 T each.

The berths with their respective back up area are shown in **Figure 6.14**.


**Figure 6.14 Jawahar Dock Berths**

## 3.5 Other Facilities at the Port

The cargo handling equipment's available at the Port are indicated vide **Table 6.4**, as under:

**Table 6.4 Cargo Handling Equipment at the Port**

| S. No. | Equipment | Numbers | Capacity |
|---|---|---|---|
| 1. | Floating Crane | 1 | 150 T |
| 2. | Diesel Electric Locomotive | 10 | 700 HP – 8 Nos.<br>1,400 HP – 2 Nos. |
| 3. | Harbour Mobile Crane | 2 | 100 T |

The cargo storage facilities available at the port are indicated in **Table 6.5**.

**Table 6.5 Cargo Storage Facilities at the Port**

| | |
|---|---|
| Transit Shed / Over Flow shed | 7 no. – 30,693 $m^2$ |
| Warehouse | 5 no. – 30,138 $m^2$ |
| Container Freight Station | 3 no. – 40,644 $m^2$ |
| Open Space | 3,84,611 $m^2$ |
| Container Parking Yard | 2,50,600 $m^2$ |

## 3.6 Bulk Liquid Storage & Linkages

In Chennai port the liquid bulk traffic is almost 25 % of the total traffic. The traffic comprises mainly crude oil for the Manali Refinery of Chennai Petroleum Corporation Ltd., POL product exports, Edible oil/Molasses and chemicals. While crude oil and POL products are handled at BD I & BD III, Molasses/Edible oil are handled at BD II, NQ, WQ 1 , WQ 2, SQ II, JD II & JD IV. Some of the agencies have their own tankage within the port custom bound area while some others are having their tankage outside the port limits. The details of the tankages and linkage are given hereunder.

### 3.6.1 Tankage & Linkage on the Northern Side

On their northern side of the port, near Gate 2 and at Biden Place the following agencies have their tank farms viz.

- Indian Oil Corporation Foreshore Tank farm
- IMC Ltd.
- Kaleesuwari Refinery Pvt. Ltd.
- Integrated Service Point Pvt. Ltd.

Their locations are given in the **Figure 6.15** & **Figure 6.16**.

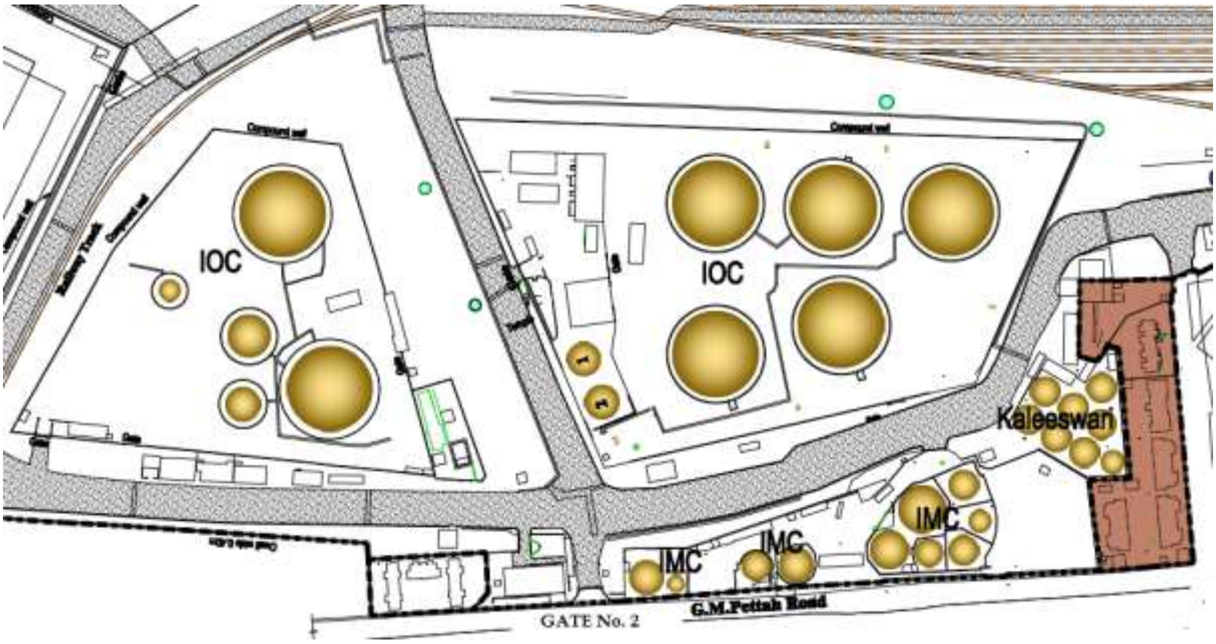



**Figure 6.15 Tank Farms of IOC, IMC & Kaleesuwari – Near Gate No. 2**

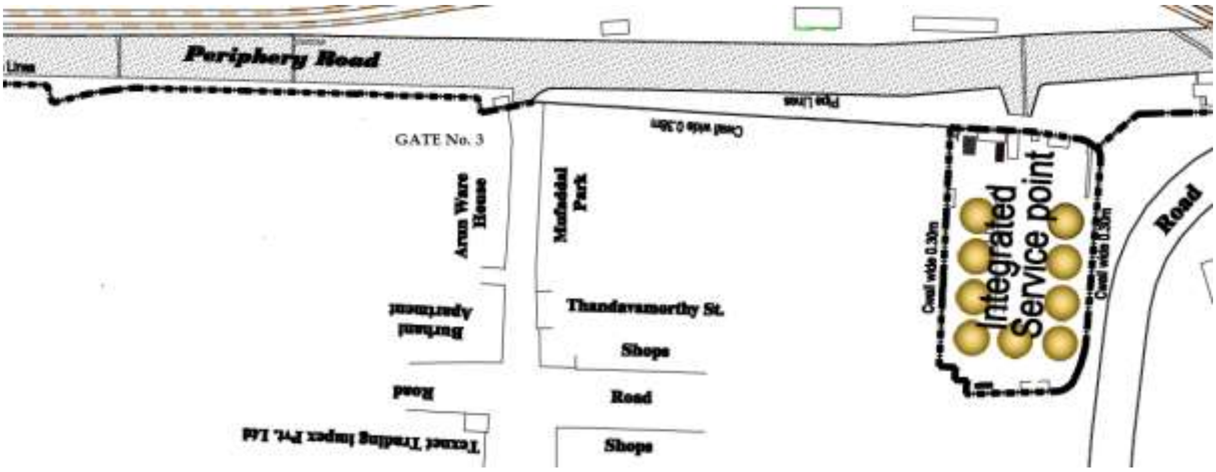



**Figure 6.16 Tank Farm of Integrated Service Point – Near Gate No. 3**

The details of the tankage and the linkage are shown in **Table 6.6**.

**Table 6.6 Cargo Storage Facilities at the Port**

| Details of Tank farm within Port Custom bound Area Northern side near GATE No. 2 | | | | | | |
|---|---|---|---|---|---|---|
| S.No. | Name of Licensee | Product | No. of Tanks | Total Capacity (kL) | Linkage | |
| | | | | | Berth | Pipelines |
| 1 | Indian Oil Corporation Ltd. | POL Products | 10 | 91,054 | BD I | 1 x 20" + 1 x 16" + 3 x 14" |
| | | | | | BD III | 1 x 20" + 2 x 14" |
| 2 | IMC Ltd.. | Molasses | 11 | 33,402 | BD I | 1 x 12" + 1 x 8" |
| | | Edbile Oil | | | BD II | 1 x 12" + 2 x 8" |
| 3 | Kaleesuwari Refinery Pvt Ltd. | Edible Oil | 8 | 23,000 | BD II | 1 x 12" |
| 4 | Integrated Service Point Pvt. Ltd. | Edible Oil | 9 | 18,000 | NQ - WQ 1 | 1 x 14" + 1 x 10" |
| **Outside Custom bound Area** | | | | | | |
| 1 | Chennai Petroleum Corporation Ltd. | Crude Oil | | | BD I | 1 x 30" |
| | | | | | BD III | 1 x 30" |
| 2 | Hindustan Petroleum Corporation Ltd. | LSHS | | | BD III | 1 x 16" |
| | | Bitumen | | | BD II | 1 x 12" |
| 3 | TCL | Chemical | | | BD III | 1 x 8" |
| 4 | Ruchi | Edible Oil | | | BD II | 1 x 12"+ 1 x 8" |
| | | | | | NQ - WQ 2 | 1 x 8" |
| 5 | KTV | Edible Oil | | | BD II | 1 x 10" |

## 3.6.2 Tankage & Linkage on the Southern Side

On their southern side of the port, near SQ II & JD II the following agencies have their tank farms viz.

- IMC Ltd.
- JRE Tank Terminals Pvt. Ltd.
- Kaleesuwari Refinery Pvt. Ltd.
- Madras Fertilisers Ltd.
- Oswal Oils & Vanaspati Industries
- Suraj Agro Infrastructure (India) Pvt. Ltd.
- AVR Storage Tank Terminals Pvt. Ltd.

Their locations are given in the **Figure 6.17** & **Figure 6.18**.

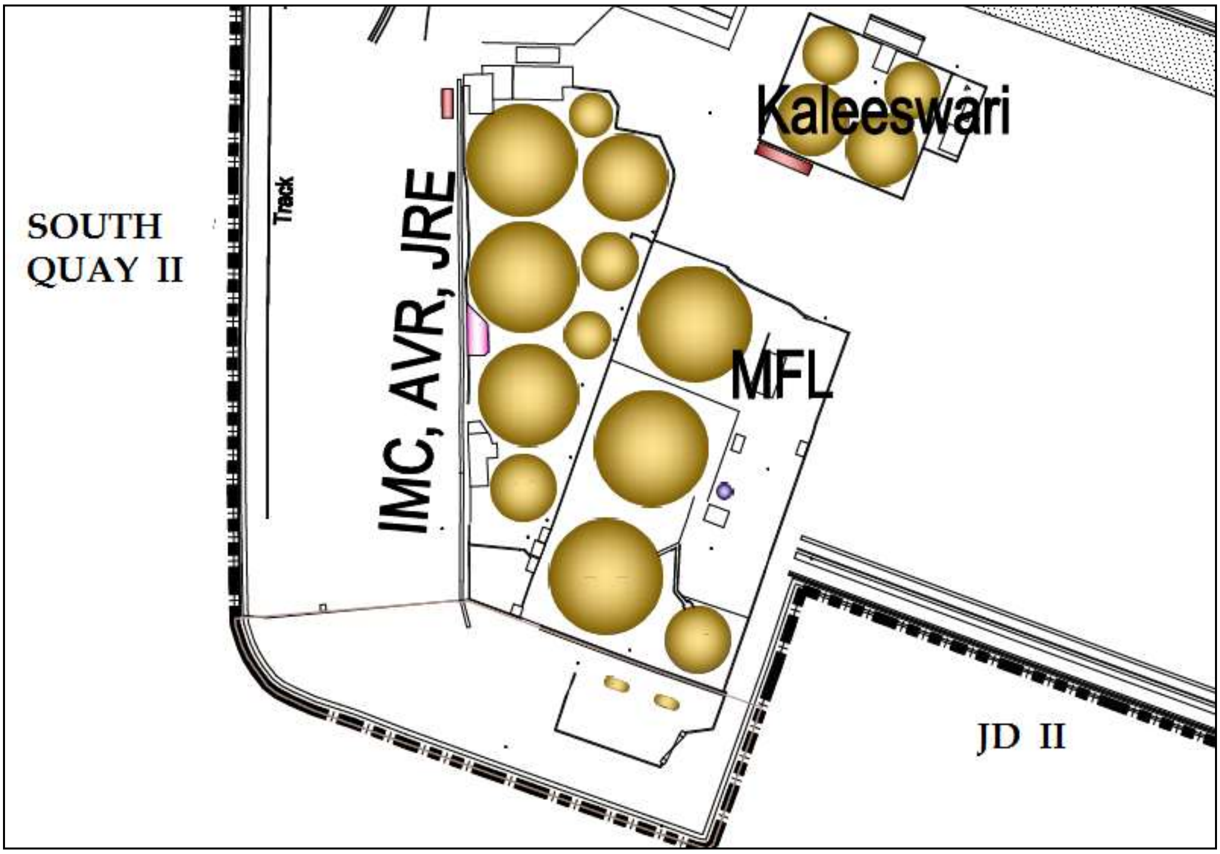



**Figure 6.17 Tank Farms of MFL, IMC, JRE, AVR & KRL Near SQ II & JD II**

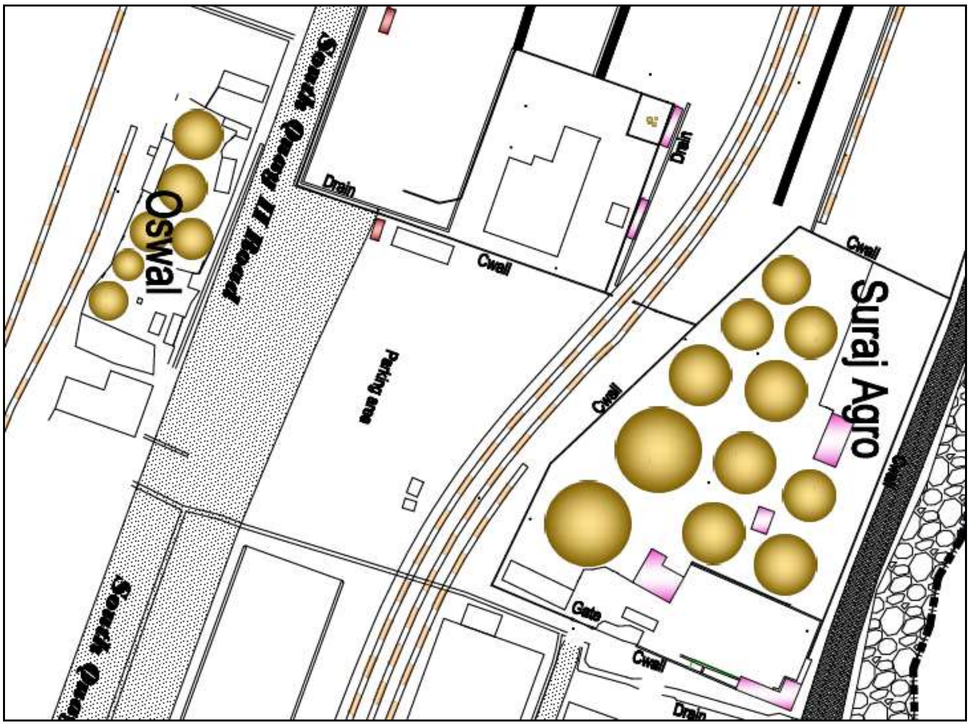



**Figure 6.18 Tank Farms of Suraj Agro & Oswal at JD East**

The details of the tankage and the linkage are given in the following **Table 6.7**.

**Table 6.7 Details of Tank Farms within Port Custom Bound Area Southern Side Near SQ II and JD II**

| S. No. | Name of Licensee | Product | No. of Tanks | Total Capacity (kL) | Linkages | |
|---|---|---|---|---|---|---|
| | | | | | Berth | Pipelines |
| 1 | Madras Fertilisers Ltd. | Phosphoric Acid | 3 | 18,180 | JD IV | 1 x 12" |
| 2 | IMC Ltd. | Molasses | 4 | 11,470 | SQ II - JD II | 1 x 18" + 1 x 10" |
| | | Edbile Oil | | | SQ II | 1 x 6" |
| 3 | AVR Storage Tank Terminals Pvt . Ltd. | Edible Oil | 4 | 12,121 | | |
| 4 | JRE Tank Terminals Pvt. Ltd. | Molasses | 1 | 5,834 | | |
| 5 | Kaleesuwari Refinery Pvt. Ltd. | Edible oil | 4 | 11,796 | SQ II | 1 x 8" |
| 6 | Suraj Agro Infrastructure (I) Pvt. Ltd. | Non Hazardous | 11 | 45,700 | JD II - JD IV | 1 x 18" + 1 x 8" |
| | | Edible Oil | | | SQ II | 1 x 8" |
| 7 | Owal Oils & Vanaspati Industries | Edible Oil | 6 | 9,966 | JD II - JD IV | 2 x 8" |
| | | | | | JD II - JD VI | 1 x 8" |

# 4.0 PERFORMANCE, OPTIONS FOR DEBOTTLENECKING & CAPACITY ASSESSMENT

## 4.1 General

The total cargo handled through the existing facilities, during the past 5 years is presented in the following **Table 6.8**.

**Table 6.8 Cargo Handled during last 5 Years (in MT)**

| S. No. | Commodity | 2014-15 | 2013-14 | 2012-13 | 2011-12 | 2010-11 |
|---|---|---|---|---|---|---|
| **Liquid Bulk** | | | | | | |
| 1. | Crude oil imports | 10.16 | 10.19 | 9.22 | 9.81 | 10.03 |
| 2. | POL – Imports | 0.86 | 1.23 | 2.78 | 2.00 | 1.99 |
| 3. | POL – Exports | 1.42 | 1.46 | 1.38 | 1.47 | 1.97 |
| 4. | Edible oil | 1.07 | 1.03 | 1.06 | 1.12 | 1.08 |
| 5. | Other liquids | 0.31 | 0.24 | 0.23 | 0.17 | 0.14 |
| **Dry Bulk** | | | | | | |
| 6. | Coal | 0 | 0 | 0 | 3.19 | 7.71 |
| 7. | Iron-ore | 0 | 0 | 0 | 0 | 2.31 |
| 8. | Iron & Steel | 1.42 | 1.41 | 1.12 | 1.00 | 0.88 |
| 9. | Food grains | 0.04 | 0.31 | 0.49 | 0.19 | 0.42 |
| 10. | Other Dry bulk | 4.93 | 4.64 | 4.57 | 3.33 | 2.15 |
| | | | | | | |
| 11. | Break Bulk | 2.10 | 1.24 | 1.46 | 1.97 | 1.95 |
| 12. | Containers – TEUs | 1.55 | 1.47 | 1.54 | 1.55 | 1.52 |
| | Containers – T | 29.95 | 28.33 | 29.71 | 30.07 | 29.42 |
| **TOTAL TRAFFIC (MT)** | | **52.26** | **51.11** | **53.40** | **55.70** | **61.46** |

## 4.2 Performance of the Berths

AECOM has carried out a detailed analysis of the performance of the berths during 2014 -15 and the results are furnished in the tables hereunder. The berths are grouped under Liquid bulk handling berths viz. BD I, II & III; Ambedkar Dock berths viz. NQ, and WQ berths; SQ berths; Jawahar Dock West berths; Jawahar Dock East berths and Container Terminals CCTPL & CITPL.

**Table 6.9 Performance of Liquid Berths During 2014 - 2015**

| S. No. | Berth | Occupancy | Cargo | Volume (T) | No. of Ships | Ship Category | Maximum (DWT / T) | Minimum (DWT /T) | Average (DWT /T) |
|---|---|---|---|---|---|---|---|---|---|
| 1. | BD I & BD III | Average 65% | Crude oil | 10,162,563 | 99 | Ship size | 1,64,787 | 73,531 | 1,22,538 |
| | | | | | | Parcel size | 1,47,612 | 24,870 | 1,02,652 |
| | | | POL Products - Import | 727,837 | 52 | Ship size | 74,992 | 4,851 | 32,946 |
| | | | | | | Parcel size | 32,000 | 400 | 9,705 |
| | | | POL Products - Exports | 1,421,378 | 53 | Ship size | 51,763 | 28,810 | 40,395 |
| | | | | | | Parcel size | 38,487 | 400 | 26,322 |
| | | | | **12,311,778** | **204** | | | | |
| 2. | BD II | 61% | POL Products - Import | 592,432 | 85 | Ship size | 51,604 | 4,851 | 27,194 |
| | | | | | | Parcel size | 28,547 | 400 | 5,386 |
| | | | Edible oil | 160,515 | 34 | Ship size | 19,386 | 6,300 | 11,833 |
| | | | | | | Parcel size | 12,000 | 500 | 4,458 |
| | | | Other liquids | 139,894 | 30 | Ship size | 35,435 | 8,884 | 19,543 |
| | | | | | | Parcel size | 9,011 | 193 | 4,663 |
| | | | Steel & Barytes | 5,053 | 2 | Ship size | 58745 | 50292 | 54518 |
| | | | | | | Parcel size | 1976 | 572 | 1263 |
| | | | | **897,894** | **151** | | | | |

**Table 6.10 Performance of North Quay & West Quay Berths During 2014-15**

| S. No. | Berth | Occupancy | Cargo | Volume (T) | No. of Ships | Ship Category | Maximum (DWT / T) | Minimum (DWT /T) | Average (DWT /T) |
|---|---|---|---|---|---|---|---|---|---|
| 1. | NQ, WQ1, WQ2, CQ, WQ3, WQ4 | Varies from 22% to 60% Average 45% | Automobiles | 245,108 | 69 | Ship size | 30,990 | 9,663 | 17,282 |
| | | | | | | Parcel size | 6,675 | 9 | 1,740 |
| | | | General Cargo | 450,739 | 110 | Ship size | 48,139 | 3,500 | 13,671 |
| | | | | | | Parcel size | 25,200 | 4 | 1,507 |
| | | | Iron & steel | 437,889 | 21 | Ship size | 53,496 | 5,604 | 17,983 |
| | | | | | | Parcel size | 30,689 | 33 | 4,561 |
| | | | Edible oil | 348,026 | 30 | Ship size | 44,370 | 6,300 | 14,841 |
| | | | | | | Parcel size | 15,000 | 510 | 5,800 |
| | | | Other liquids | 145,913 | 25 | Ship size | 38,513 | 6,273 | 9,783 |
| | | | | | | Parcel size | 8,957 | 440 | 4,169 |
| | | | | **1,627,675** | **255** | **Parcel size** | | | **6,383** |

**Table 6.11 Performance of South Quay Berths During 2014-15**

| S. No. | Berth | Occupancy | Cargo | Volume (T) | No. of Ships | Ship Category | Maximum (DWT / T) | Minimum (DWT /T) | Average (DWT /T) |
|---|---|---|---|---|---|---|---|---|---|
| 1. | SQ 1 & SQ 2 | Average 57% | Iron & Steel | 300,407 | 19 | Ship size | 49,326 | 6,544 | 23,913 |
| | | | | | | Parcel size | 30,090 | 38 | 3,851 |
| | | | Cut stone | 142,773 | 3 | Ship size | 63301 | 27321 | 49075 |
| | | | | | | Parcel size | 34891 | 21600 | 28555 |
| | | | Fertilisers Raw & Finished | 130,383 | 5 | Ship size | 34,938 | 9,839 | 25,201 |
| | | | | | | Parcel size | 30,414 | 5,900 | 16,298 |
| | | | Edible oil | 61,887 | 15 | Ship size | 19997 | 11321 | 15659 |
| | | | | | | Parcel size | 10698 | 550 | 4126 |
| | | | Barytes | 51,006 | 3 | Ship size | 11606 | 10700 | 11153 |
| | | | | | | Parcel size | 34746 | 1260 | 17002 |
| | | | General Cargo | 201,691 | 67 | Ship size | 50,363 | 2,300 | 13,884 |
| | | | | | | Parcel size | 29,280 | 27 | 2,318 |
| | | | | **888,147** | **112** | | | | **7930** |

**Table 6.12 Performance of Container Terminals During 2014-15**

| S. No. | Berth | Occupancy | Cargo | Volume (T) | No. of Ships | Ship Category | Maximum (DWT / T) | Minimum (DWT /T) | Average (DWT /T) |
|---|---|---|---|---|---|---|---|---|---|
| 1. | CCTPL - CTB 1 to 4 | Average 26% | Containers | 862,595 | 393 | Ship size | 67,686 | 9,944 | 38,008 |
| | | | | | | Parcel size | 2,866 | 2 | 1,061 |
| 2. | CITPL - SCB 1 to 3 | Average 42% | Containers | 719,745 | 369 | Ship size | 62,649 | 1,778 | 22,836 |
| | | | | | | Parcel size | 2,957 | 1 | 856 |
| | | | | **1,582,340** | **762** | | | | |

**Table 6.13 Performance of Jawahar Dock - West Quay Berths During 2014-15**

| S. No. | Berth | Occupancy | Cargo | Volume in T | No. of Ships | Ship Category | Maximum DWT / T | Minimum DWT / T | Average DWT /T |
|---|---|---|---|---|---|---|---|---|---|
| 1. | JD 1 JD 3 JD 5 | Varies from 41% to 63% Average 53% | Limestone | 2,484,274 | 47 | Ship size | 63,351 | 47,286 | 54,454 |
| | | | | | | Parcel size | 54,170 | 10,000 | 40,873 |
| | | | Dolomite & Barytes | 817,469 | 21 | Ship size | 61,344 | 23,524 | 44,795 |
| | | | | | | Parcel size | 54,868 | 2,790 | 34,061 |
| | | | Fertiliser - Raw & Finished | 515,992 | 22 | Ship size | 57,572 | 20,479 | 41,105 |
| | | | | | | Parcel size | 45,000 | 4,399 | 22,434 |
| | | | Iron & steel | 429,818 | 16 | Ship size | 53,208 | 8,241 | 32,546 |
| | | | | | | Parcel size | 37,249 | 34 | 8,955 |
| | | | General Cargo | 319,729 | 29 | Ship size | 61,498 | 7,802 | 26,940 |
| | | | | | | Parcel size | 53,830 | 19 | 8,198 |
| | | | | **4,567,282** | **135** | **Parcel size** | | | **33,832** |

**Table 6.14 Performance of Jawahar Dock - East Quay Berths During 2014-15**

| S. No | Berth | Occupancy | Cargo | Volume (T) | No. of Ships | Ship Category | Maximum DWT / T | Minimum DWT /T | Average DWT /T |
|---|---|---|---|---|---|---|---|---|---|
| 1. | JD 2 JD 4 JD 6 | Varies from 55% to 96% Average 73% | Cement Clinker & Limestone | 393,433 | 18 | Ship size | 56,719 | 6,261 | 24,492 |
| | | | | | | Parcel size | 50,537 | 5,750 | 19,672 |
| | | | Dolomite & Barytes | 363,831 | 9 | Ship size | 58,811 | 26,482 | 47,475 |
| | | | | | | Parcel size | 52,983 | 8,761 | 33,076 |
| | | | Edible oil | 279,925 | 41 | Ship size | 50,844 | 6,337 | 17,305 |
| | | | | | | Parcel size | 12,500 | 300 | 4,117 |
| | | | General Cargo | 863,528 | 32 | Ship size | 58,642 | 5,014 | 34,734 |
| | | | | | | Parcel size | 48,100 | 75 | 24,672 |
| | | | Fertiliser Raw Materials | 19,800 | 1 | Ship size | 35050 | - | - |
| | | | | | | Parcel size | 19800 | - | - |
| | | | CBFS | 2,849 | 1 | Ship size | 2931 | - | - |
| | | | | | | Parcel size | 2849 | - | - |
| | | | | **1,923,366** | **102** | **Parcel size** | | | **18,856** |

The following observations are made from this analysis:

- Almost 80 % of the port traffic is handled at the two oil jetties (crude oil & POL products) and the two container terminals.
- Automobiles are handled at the two WQ berths 1 & 2 which have the requisite back up area for parking the cars units.
- Edible oil is handled at BD II, NQ, SQ 2 and JD 2 berths as the related tank farms are located in two sectors – one near Gate 2 and the other on the east side of JD.
- Fertiliser materials – raw as well as finished are handled at SQ 2 and JD 2 berths.

## 4.3 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 Chennai Port is given in the **Appendix 1**. The key observations are as follows:

### 4.3.1 Observations on CCTPL

Evacuation is a major challenge for Chennai port with large queue lengths of trailers observed from the container terminal gates. It has been found out that the yard productivity is the key constraint on evacuation. It has been observed that the yard throughput (measured as the no. of export TEUs moving in through the terminal gate) is inversely related to berth productivity (measured as the no. of TEUs handled in the berths). When large vessel berths in the terminal, the resources get deployed in the quay side to load/ unload containers from the vessel. This results in shortage of resources on the yard side and hence the number of containers moved from export trailers to yard drops significantly. To cope with this, the terminals proceed to close export gates to stop further inflow of export trailers to the container yard. This phenomenon can be corroborated from the fact that high berth productivity periods coincide with long duration of gate closures. The terminal needs to either boost their RTGC productivity to 15 moves / hr or employ additional RTGCs.

Optimal yard space is critical for maintain yard productivity. Shortage of yard space in this terminal is identified as a driving factor for low yard productivity that leads to congestion in the port. At present, the CCTPL yard has 3,940 ground slots for containers. The analysis carried out shows the optimal number of ground slots required in CCTPL is ~4,400. Adding 460 ground slots with an optimal ground slot density of ~200 would require a yard space of ~22 Ha. Hence 4-5 Ha of additional yard space should be provided to CCTPL for allowing proper yard management. This additional yard space can be provided by utilizing currently unused space near CCTPL terminal. This area would require minimum alterations before it can be handed over to DP World.

Modal shift of cargo from road to rail can help reduce pressure on roads for evacuation and hence ease the congestion issue in and around Chennai port. It will help the port to circumvent all issues with road infrastructure and traffic congestion outside the port boundary. At present, 0.07 M TEU of container cargo gets evacuated through rail. Chennai hinterland has four existing ICDs – Bangalore (Whitefield), Tondiarpet, Arakkonam and Irrungatukottai. Out of the four ICDs, only the Bangalore ICD currently has rake services to Chennai. The logistics cost for moving containers through rail from Bangalore ICD is higher than the cost for moving containers through road by ~Rs. 2,500 per TEU. This is in spite of the fact that the rail freight of Rs. 9,000 is lower than the road freight of Rs. 12,000 in this route. The additional rail yard handling cost, trailer cost for the last mile connectivity and the mark up charged by the liners for ICD bound cargo contribute to the difference in logistics cost. Additional charges are levied on CONCOR for the rake operations by the Chennai port and the railways. All these additional charges add up to ~Rs. 1,300. The port should waive its haulage charge, repositioning charge, port service charge completely on rake operations. This will have result in a loss of revenue for the port but will be critical for retention of container traffic.

The port must develop a common rail yard from where both terminals can move their cargo. Preliminary studies in the port has identified land parcel available near the current marshalling yard as the ideal location for building the common container yard. The yard would have space to handle up to 0.75 MTEU per year and would also have adequate equipment to maintain high productivity levels. The common yard will make running of mixed rakes viable. It will reduce the turnaround time for rakes by ~10 hours. This will allow rake operators to run rakes more frequently and hence increase the maximum rail throughput by 26%. It will also result in higher savings for the rail operator.

### 4.3.2 Observations on Edible Oil Traffic

In recent times, Chennai port has lost part of its edible oil traffic to Krishnapatnam. This is despite the fact that Krishnapatnam is farther from the plant locations than Chennai; hence it has higher logistics cost. But Krishnapatnam has compensated for the higher logistics cost by lowering the port charges on edible oil It has developed a practice of benchmarking its charges to the port charges in Chennai. This allows Krishnapatnam to offer lower prices to customers who can shift their traffic from Chennai to Krishnapatnam. Chennai port should also assign a team to track prices charged by Krishnapatnam and other ports. The pricing of port charges should be revised based on what competitors are charging the customers for the same cargo. In case of Edible oil Chennai port must reduce its port charges by more than Rs. 15 per T to attract additional volumes to the port. The study shows that port charges for Krishnapatnam are ~Rs. 35 per T lower than Chennai. Overall cost of handling edible oil in Chennai is costlier by Rs. 15 per T which translates to ~Rs. 2 lakhs per ship for an average edible oil carrier. Higher cost and evacuation issues in Chennai have made customers move to Krishnapatnam.

Madurai is farther from Chennai port than VOC port. The freight of carrying Edible oil from Madurai to Chennai is estimated to be around Rs. 1300 per T as compared to Madurai to Tuticorin freight of Rs. 700 per T. The higher freights make it infeasible for customers in Madurai cluster to use Chennai port. Running edible oil rakes from Madurai to Chennai can reduce the freight cost by Rs. 900 per T. This will reduce the overall logistics cost of handling edible oil in Chennai port to match that of the VOC port. Railways require a minimum of 6 rakes per month to start the service. This translates to a volume of ~15,000 T per month. Madurai cluster can attract >20,000 T of edible oil volume per month, which would require monthly service of 8-9 rakes. Moving edible oil in rakes will require storage of edible oil in the port till adequate quantity gets aggregated for filling one rake. It will be critical to develop adequate local storage facilities (tankers) in the port. Long-term land leases should be awarded to attract customers to invest in their tank farms in the port.

### 4.3.3 Observations on Fertiliser Traffic

Productivity of fertilizer handling facility in the Chennai port can be improved by mechanization of fertilizer handling facility in the port. Mechanized unloading of fertilizer for ships to conveyor belts can increase productivity by ~40% and match Krishnapatnam's productivity levels. To complement mechanical handling, Chennai port should also create mechanical bagging facility. As Chennai can realistically capture 0.5-0.7 MT of fertilizer cargo, the port should aim to develop a bagging plant of capacity 0.5 MT. Chennai is also well connected by rail network to the hinterland areas and distribution centres. Evacuation of rail can be explored further. The bagging plant must be located at vicinity of the existing rail yard

## 4.4 Measures for Capacity Enhancement

The observations made by BCG are examined and those that are appropriate and are feasible of execution have been considered in the subsequent sections based on the future traffic projections.

# 5.0 DETAILS OF ONGOING DEVELOPMENTS

## 5.1 General

In recent times, in order to meet the growing traffic demands, Chennai Port has initiated action for creating additional terminal facilities. The ongoing projects are

- Development of Coastal Terminal near Northern sheltering arm;
- Construction of a Coastal road with necessary shore protection along the sea shore to the old harbour entrance; and
- Two numbers of Exim Godowns in order to enhance the stacking facility of EXIM cargo (Agri and Food grains).

The locations of these facilities are shown in **Figure 6.19**.


**Figure 6.19 Layout Details of Chennai Port Showing the Ongoing Developments**

The details of these facilities are brought out hereunder:

## 5.2 Development of Coastal Terminal near Northern Sheltering Arm

Taking into account the increasing demand for coastal shipping and the strategic location of Chennai Port on the maritime map of the country, the port has taken up the development of a Coastal Terminal near the northern sheltering arm of Ambedkar Dock. This terminal will be outside the custom bonded area of the port.

The Coastal Terminal will be a wharf structure of 260 m × 16 m to 19.5 m constructed with piled structure. Alongside the wharf structure and the adjacent areas of the turning basin will be dredged to -9.0 m CD to accommodate coastal vessels upto 10,000 DWT and having drafts upto 8.0 m. In addition the top surface of the existing damaged block wall will be retrofitted.

The adjacent reclaimed area of about 30 m width will be hardened as backup area for storing and handling of coastal cargo. An additional stocking area will be developed over the recently reclaimed land area for about 52,000 sqm.

A dedicated road shall be provided to width of 9.0 m from southern end of proposed berth to the upcoming revetment and coastal road along the shore.

This terminal will have a capacity of 1.0 MTPA and is expected to cost about Rs. 80 crores. This terminal is likely to be commissioned by 2017.

The location, layout and details of this coastal terminal are given in the **Figure 6.20**.


Legend:

- (a) - Proposed Coastal Terminal 260m long
- (b) - Existing 11m wide Block wall
- (c) - Existing Reclaimed area to be hardened for coastal cargo (30m wide)
- (d) - Existing Reclaimed area to be hardened for additional area for cargo storage
- (e) - Proposed 4m road widening adjacent to existing 4m mass capping (road) revetment (850m long approx.)
- (f) - Proposed 9m wide road, 175m long

**Figure 6.20 Location, Layout and Details of the Coastal Terminal**

## 5.3 Construction of Coastal Road along the Sea Shore

In order to facilitate the evacuation of coastal cargo outside the custom bonded area, the Port Trust has undertaken the work of formation of a Coastal Road with necessary shore protection on the eastern periphery from INS Adyar to the old Harbour entrance.

From the north tower of old harbour entrance, a concrete road of 850 m length was provided while constructing the rubble mound revetment at east of east quay during 2008 and this road leads to the Outer Protection Arm Breakwater. In the absence of an access road in the portion between M/s Suraj Agro Industries and old harbour entrance, the port does not have access to the Outer Protection Arm breakwater and revetment at East Quay for any immediate rectification or repair works and to carry out further development works. Therefore, the port personnel and vehicles have to pass through the area leased to the 2nd Container Terminal Operator, M/s CITPL with the consent of the Licensee.

Hence, the port planned to provide an exclusive road access east of the 2nd Container Terminal area after carrying out the shore protection in the left out portion of coastal road. Due to instability of the shore area at left out portion of coastal road, it is proposed to provide two lane traffic (8 m width) after adequately strengthening the existing revetment along the eastern side of the M/s CITPL compound from M/s Suraj Agro Industries to Old Harbour Entrance. The core stone and armour layer below the existing revetment shall be the base for forming the road on top. The estimated cost of the project is Rs. 63 cr and the work is in progress. The location and alignment of this coastal road is shown in the **Figure 6.21**.

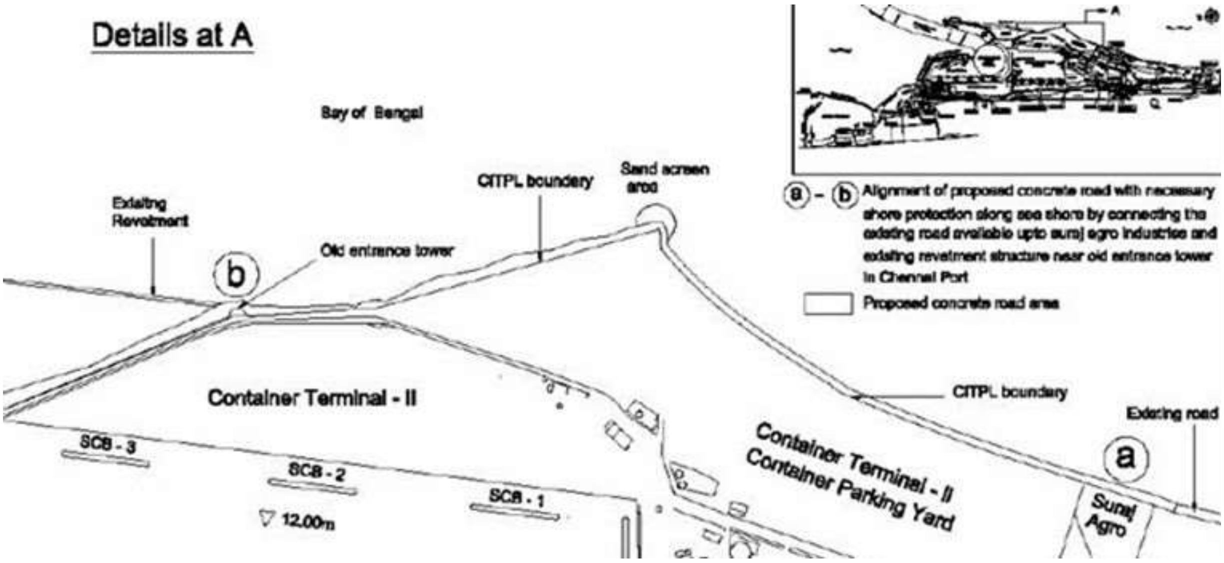



**Figure 6.21 Layout and Alignment of the Coastal Road**

## 5.4 Two Numbers of EXIM Godowns

In order to enhance the stacking facility for EXIM cargo (Agri & Foodgrains) inside the port, it is proposed to construct 2 no. EXIM godown of size 150 m × 30 m with a total area of 9,000 sq.m. The estimated cost of the work is Rs.17.57 crores. The location of the Exim Gowdowns is shown in the **Figure 6.22**.


**Figure 6.22 Location of Two EXIM Godowns**

# 6.0 TRAFFIC PROJECTIONS

## 6.1 General

The port of Chennai is one of the largest major ports in the Southern part of the country. It currently handles more than 50 MTPA of traffic and is situated strategically and well connected both by rail and road to serve the hinterlands of Tamil Nadu, Southern Andhra Pradesh and Southern Karnataka.

The port is also one of the major container ports in the country handling more than 1.5 MTEUs across the two terminals. Along with containers the port also handles large volumes of POL, Limestone, Steel and dolomite.

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 Chennai up to 2035 has be derived as presented in this section.

## 6.2 Major Commodities and their Projections

### 6.2.1 Containers

The port handles roughly 1.55 MTEUs with an export import balanced slightly tilted towards import (~55%). The key hinterlands that the port serves for containers are Chennai and close by SEZs, Bangalore, Southern AP and parts of Southern Tamil Nadu. Large portion of the traffic (~50-60%) is transhipped from the port to other ports in South East Asia like Colombo and Singapore.

Going into the future, with the growth of new ports in the vicinity of Chennai like Krishnapatnam, Katupalli as well as the development of container terminal at Ennore, we expect significant share of volumes to be taken away from Chennai. The port is expected to cater to traffic of roughly 0.9 MTEUs by 2020, 1.2-1.4 MTEUs by 2025 and 2.0-2.4 MTEUs by 2035.

In the case of a new transhipment hub coming up on the Southern tip of the country the potential traffic is expected to further decline owing the fact that most of the South Tamil Nadu containers will go directly to the transhipment hub.

The **Figure 6.23** below show the split of the container traffic from the different hinterlands as well as the projected growth.

COMMODITY TRAFFIC CONTAINER

**Tamil Nadu is the primary hinterland of Chennai port with small traffic from Bangalore and Hyderabad**

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 6.23 Hinterland of Chennai Port**

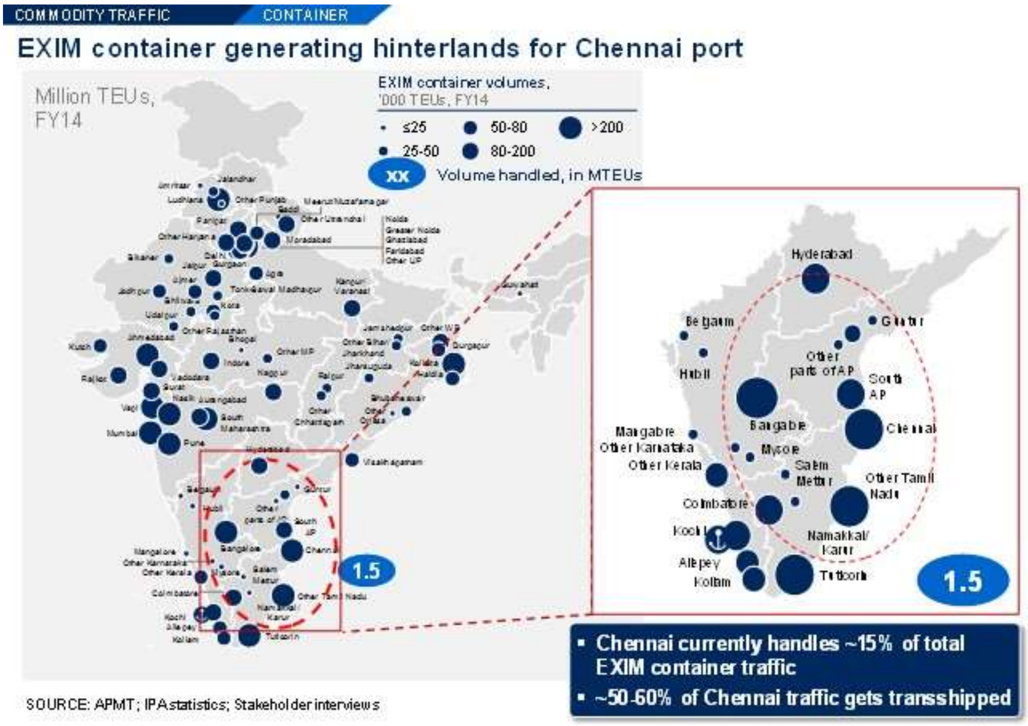



**Figure 6.24 EXIM Container Generating Hinterland**

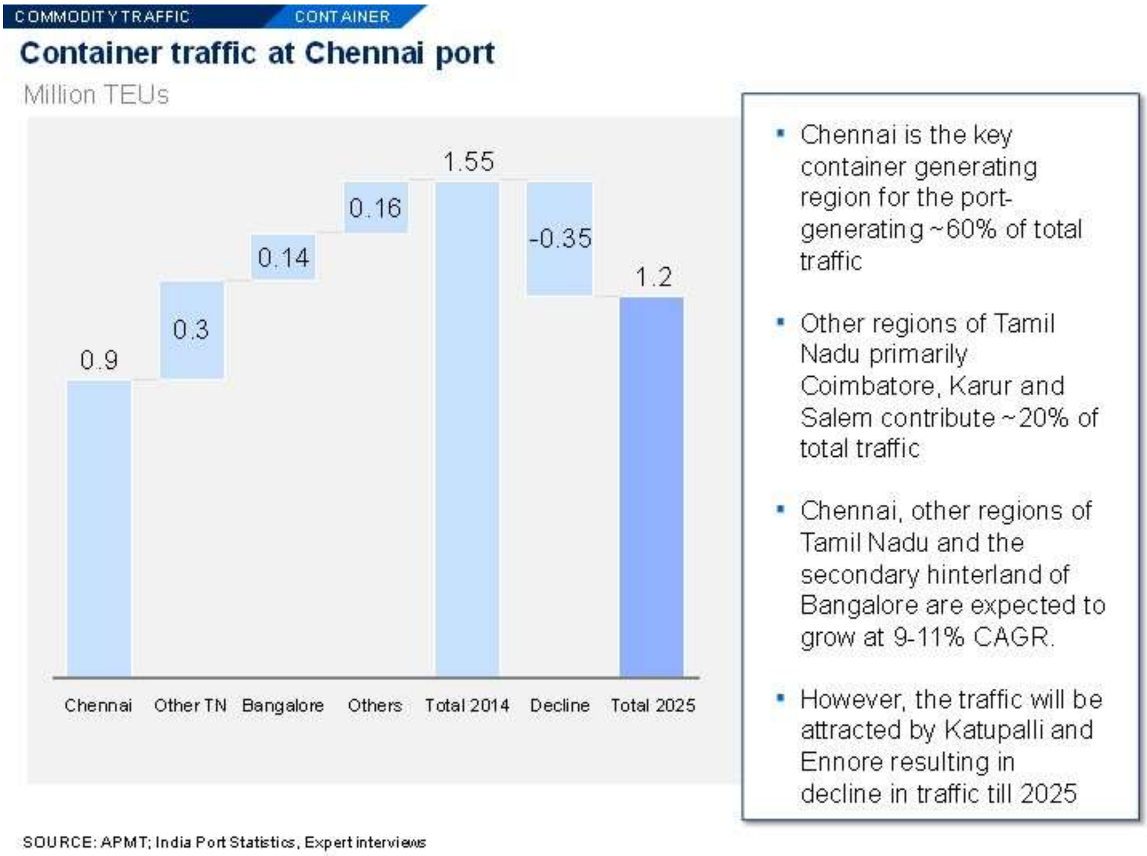



**Figure 6.25 Container Traffic at Chennai Port**

### 6.2.2 POL

The port currently handles 12.7 MTPA of POL; ~10.2 MTPA of this is crude imports for the nearby CPCL Manali refinery. The port also exports roughly 1 MTPA of products from the same refinery and receives roughly 1.5 MTPA of products to cater to the specific demands of the Chennai cluster.

Going into 2025, we expect to see marginal increase of crude import to ~11 MTPA as refinery operates to near capacity because of increased demand from the hinterland. In addition to this, most of the coastal product traffic is expected to decrease in the next few years. This is because the product traffic could move to Ennore port as OMCs have been shifting their terminals there. It is understood from IOC that they are planning to shift incoming POL products at Chennai Port for marketing purposes to Ennore for which they have been given a captive berth. The product export is expected to remain the same in the coming years. Please note that this shift of traffic will have no project implications for Chennai port.

The split of the current POL traffic and the projected future traffic is as shown in **Figure 6.26**.

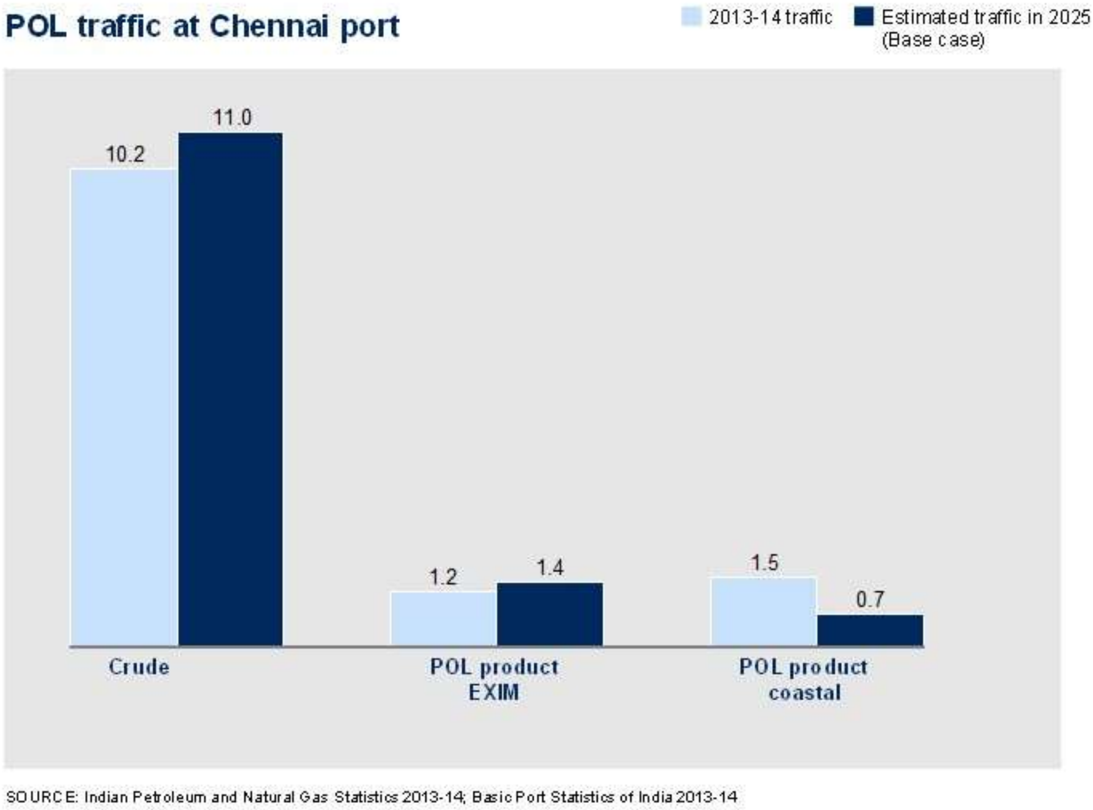



**Figure 6.26 POL Traffic at Chennai Port**

### 6.2.3 Steel

The port current handles ~1.4 MTPA of steel roughly divided 50-50 in terms export and imports. The imports cater to vibrant auto industry in the vicinity of the port.

The overall volume of steel handled at the port is expected to grow to ~2 MTPA by 2020, ~2-3 MTPA by 2025 and ~3-5 MTPA by 2035.

### 6.2.4 Limestone

The port also imports large amounts of limestone to cater to the cement industry in the Chennai area. The current volume of limestone handled by the port is roughly 2.6 MTPA. However, the volume has declined to 2.25 MT during 2015-16 and it is learnt from JSW sources (Major importers of Limestone / Dolomite) that they are contemplating on alternate indigenous resources to replace Limestone / Dolomite. The projected traffic at the port is hence expected to decline in the future.

The overall commodity wise projections for the port are as shown in **Table 6.15**.

**Table 6.15 Traffic Projection**

## Chennai Port - Traffic Projections

Units: MMTPA (except Containers)

xx Base Scenario xx Optimistic Scenario

| Commodity | 2014-15 | 2020 | 2025 | | 2035 | | Remarks |
|---|---|---|---|---|---|---|---|
| | | | Base Scenario | Optimistic Scenario | Base Scenario | Optimistic Scenario | |
| **Liquid Cargo** | | | | | | | |
| POL | 12.7 | 13.3 | 13.1 | 18.8 | 14.3 | 19.2 | ▪ CPCL expansion considered in optimistic case |
| Vegetable Oil | 1.1 | 1.7 | 1.8 | 2.1 | 3.0 | 3.4 | |
| **Dry and Break Bulk Cargo** | | | | | | | |
| Thermal Coal (Loading) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Thermal Coal (Unloading)* | 0.0 | 6.1 | 0.0 | 7.0 | 0.0 | 12.5 | ▪ Traffic projections are contingent on permission to the port by Hon'ble SC to handle coal |
| Coking Coal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Iron Ore | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 | |
| Steel | 1.4 | 1.9 | 2.5 | 2.9 | 3.0 | 5.5 | |
| Limestone | 2.6 | 1.5 | 1.4 | 1.4 | 1.2 | 1.2 | |
| Dolomite | 1.0 | 0.6 | 0.5 | 0.5 | 0.3 | 0.3 | |
| Fertilizers | 0.5 | 0.7 | 0.8 | 0.9 | 1.0 | 1.4 | |
| **Containers and other Cargo** | | | | | | | |
| Containers (Mn TEU) | 1.55 | 0.9 | 1.2 | 1.4 | 2.0 | 2.4 | ▪ Traffic may further reduce by 2025 if Enayam comes up |
| Others | 3.2 | 4.3 | 5.7 | 6.0 | 9.2 | 10.8 | ▪ Highly fragmented |
| Total (MMTPA) | 52.5 | 47.7 | 49.3 | 66.9 | 71 | 101.0 | |

* Traffic potential include non-power thermal coal consumption in the hinterland and part of the thermal coal requirement projected for Mettur plant

Conversion Factor Used for Containers Projections: 1 TEU = 19.3 Tons

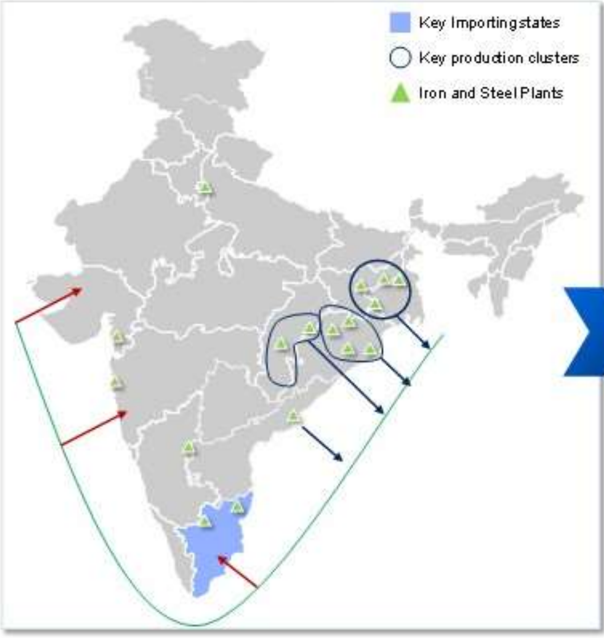
## 6.3 Coastal Shipping Potential

Chennai is strategically positioned to serve the large demand hinterland of Chennai and the adjoining areas through coastal shipping. Steel and cement can be major commodities to Chennai in case coastal shipping revolution takes place in the country. In case a central AP port comes up in the near future roughly 5 MTPA can be imported in the area to support constructions in view of the diminishing reserves of limestone in the state.

- **Steel:** ~1 MTPA of steel can be coastally shipped to Chennai port by 2025 to cater to the demand of the immediate hinterland of Chennai and southern Andhra Pradesh. Odisha will be the key source state for this movement.

COASTAL SHIPPING | IRON AND STEEL

**~1 MTPA of steel can be coastally shipped to Chennai Port by 2025; Odisha being the primary source state**




**Key ODs with coastal shipping potential to Chennai Port**

| Route[1] | Volume, '000 TPA |
|---|---|
| Odisha to Andhra Pradesh | 799 |
| Odisha to Tamil Nadu | 198 |

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

SOURCE: DGCIS data 2013-14

**Figure 6.27 Coastal Shipping Potential to Chennai Port**

- **Cement:** ~2-3 MTPA can be coastally shipped to Chennai port by 2025 contingent on the development of coastal cement cluster facilitated by the proposed central AP port.

COMMODITY TRAFFIC | CEMENT

**~2-3 MTPA can be coastally shipped to Chennai Port from the proposed cement cluster in AP by 2025**

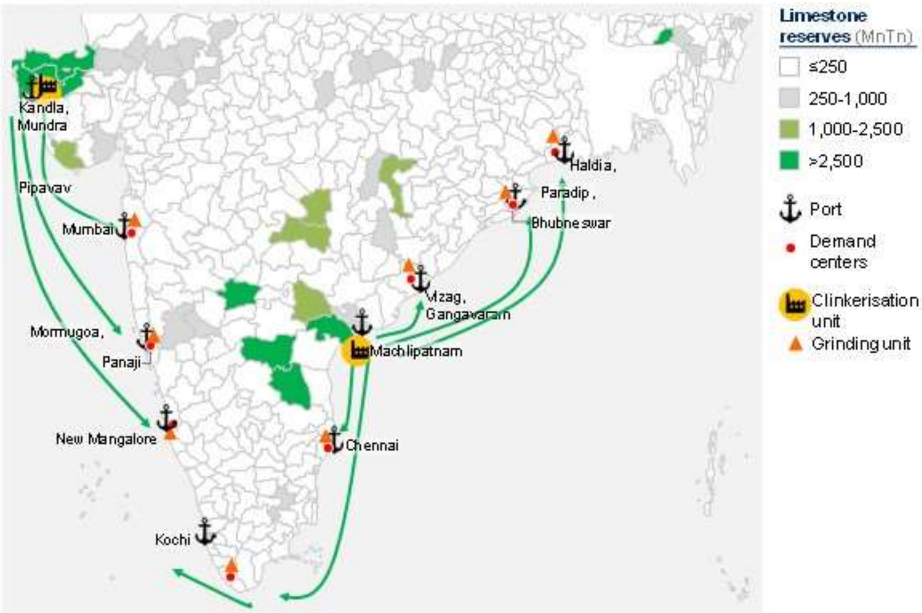



**Figure 6.28 Coastal Shipping of Cement to Chennai Port**

The **Table 6.16** summarizes the potential of coastal movement for key commodities.

**Table 6.16 Chennai Port – New Oppoirtunities Possible via Coastal Shipping**

**Chennai Port – New Opportunities Possible via Coastal Shipping**

Units: MMTPA (except Containers)

| Commodity | 2020 | 2025 | 2035 |
|---|---|---|---|
| Steel (Loading) | 0.05 | 0.07 | 0.13 |
| Steel (Unloading) | 0.86 | 1.15 | 2.06 |
| Cement (Loading) | 0.0 | 0.0 | 0.0 |
| Cement (Unloading) | 0.11 | 2.65 | 2.77 |
| Fertilizer (Loading) | 0.04 | 0.04 | 0.06 |
| Fertilizer (Unloading) | 0.34 | 0.41 | 0.61 |
| Food Grains (Loading) | 0.02 | 0.02 | 0.04 |
| Food Grains (Unloading) | 0.35 | 0.42 | 0.62 |

- 2-3 MMTPA can be shipped from Central AP cement cluster ( If Central AP port comes up)

# 7.0 CAPACITY AUGMENTATION REQUIREMENTS

## 7.1 Existing Port Capacity

Based on the analysis of existing port infrastructure, the current capacity of the port is assessed as given in **Table 6.1**.

**Table 6.1 Existing Port Capacity**

| S. No. | Berth Name | Type of Cargo | Existing Capacity (MTPA) |
|---|---|---|---|
| 1. | NQ | Automobiles, Iron & Steel, Edible oil & Break bulk | 7.00 |
| 2. | WQ 1 | | |
| 3. | WQ 2 | | |
| 4. | CQ | | |
| 5. | WQ 3 | | |
| 6. | WQ 4 | | |
| 7. | SQ 1 | Fertilisers, Iron & Steel, Cut stones & Breakbulk | 3.00 |
| 8. | SQ 2 | | |
| 9. | SCB 1 | Containers | 29.00 (1.5 MTEU) |
| 10. | SCB 2 | | |
| 11. | SCB 3 | | |
| 12. | JD 1 | Dry bulk, Fertilisers, Iron & Steel & Break bulk | 5.00 |
| 13. | JD 3 | | |
| 14. | JD5 | | |
| 15. | JD2 | Dry bulk, Fertilisers, Edible oil & Break bulk | 5.00 |
| 16. | JD4 | | |
| 17. | JD 6 | | |
| 18. | BD 1 | Crude oil & POL Products | 13.00 |
| 19. | BD 3 | | |
| 20. | BD 2 | Edible Oil | 2.00 |
| 21. | CTB 1 | Containers | 29.00 (1.5 MTEU) |
| 22. | CTB 2 | | |
| 23. | CTB 3 | | |
| 24. | CTB 4 | | |
| | | **Total** | **93.00** |

It may be noted that the existing port capacity is based on the current port infrastructure. However the mechanisation of the berths to handle specific cargo shall improve the capacity of that particular berth.

## 7.2 Requirement for Capacity Expansion

Considering the traffic potential and the capacity of existing berths, the need for capacity augmentation has been examined as presented in **Table 1.2**.

**Table 1.2 Capacity Augmentation Required (MTPA)**

| Cargo Handled | Berths Assigned | I/E | Current Capacity (MTPA) | 2020 | | 2025 | | 2035 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Projected Traffic (MTPA) | Capacity Augmentation Required (MTPA) | Projected Traffic (MTPA) | Capacity Augmentation Required (MTPA) | Projected Traffic (MTPA) | Capacity Augmentation Required (MTPA) |
| Crude & POL | BD1, BD 2, BD 3 | I | 15.00 | 13.30 | 0.00 | 13.10 | 0.00 | 14.30 | 0.00 |
| Dry & Breakbulk | NQ, WQ1 to 3,JD1 to 6, OPB | I/E | 17.50 | 16.30 | 0.00 | 12.20 | 0.00 | 17.10 | 0.00 |
| Fertilizers | SQ1 & SQ 2 | I | 2.50 | 0.70 | 0.00 | 0.80 | 0.00 | 1.00 | 0.00 |
| Containers | CTB1 to 4, SCB1 to 3 | I/E | 58.00 | 17.37 | 0.00 | 23.16 | 0.00 | 38.60 | 0.00 |
| **Total** | | I/E | **93.00** | **47.67** | **0.00** | **49.26** | **0.00** | **71.00** | **0.00** |

It could be observed that the port will have surplus capacity at different timelines as compared to the projected traffic. Giving due consideration to the competing ports that operate on either side of Chennai Port viz. Krishnapatnam Port, Kattupalli Port, Kamarajar Port, Karaikal Port and Tuticorin Port, it is felt that the focus of Chennai Port should be to enhance the productivity and efficiency of cargo handling so as to retain the traditional cargo before attempting to attract new cargo volumes.

# 8.0 ROAD AND RAIL - INTERNAL NETWORK AND EXTERNAL CONNECTIVITY

## 8.1 General

For the efficient performance of a port, the effective internal network of road and rail as well as external connectivity to the national highway and trunk railway routes are essential to ensure faster receipt and evacuation of cargo. Accordingly, the existing situation at Chennai Port and their proposals are described in the following sub sections.

## 8.2 Modal Split of Traffic

The cargo handled at the port could be classified under three major heads – dry/break bulk, containers and liquid bulk. While liquid bulk mostly is evacuated through pipelines, the other two are evacuated through road and rail. At Chennai Port, the proportion of traffic handled through these three modes for the past 5 years are presented in the following **Table 1.3**.

**Table 1.3 Modal Split of Traffic Handled (MT)**

| Year | Total Traffic handled | ROAD | | RAIL | | PIPELINE | |
|---|---|---|---|---|---|---|---|
| | | Tonnage | Percentage | Tonnage | Percentage | Tonnage | Percentage |
| 2015 -16 | 50.06 | 33.12 | 66% | 4.85 | 10% | 12.09 | 24% |
| 2014 -15 | 52.54 | 32.75 | 62% | 6.87 | 13% | 12.93 | 25% |
| 2013 -14 | 51.11 | 30.25 | 59% | 6.88 | 13% | 13.98 | 27% |
| 2012 -13 | 53.40 | 32.54 | 61% | 6.18 | 12% | 14.69 | 28% |
| 2011 -12 | 55.71 | 33.46 | 60% | 7.69 | 14% | 14.56 | 26% |

The Port should, accordingly, have proper and sufficient infrastructure for ensuring the smooth and fast movement of trucks by road and rakes by railway lines. The existing internal network or roads and railway lines are examined in the following paras.

## 8.3 Internal Road Network

### 8.3.1 Overview

The Port has in all 10 Gates for entry and exit. Gate no. 1 & 10 are well connected. Gate no. 2, 3, 5 & 7 opens into small arterial roads, while Gate no. 8 is non-functional.  Gate No. 4, 6 & 9 are railway gates which connect to the Southern Railway lines.

The location of the Gates and their connectivity is shown in the following **Figure 1.1**.

**Figure 1.1 Internal Road Connectivity – All Gates and their Connectivity**

The detailed internal road network linking the various gates and the docks inside the port are shown in the **Figure 1.2**, **Figure 1.3** and **Figure 1.4**.


**Figure 1.2 Internal Road Connectivity – from Gate no. 1 to Bharathi Dock**


**Figure 1.3** **Internal Road Connectivity – Dr. Ambedkar Dock and Jawahar Dock**


**Figure 1.4** **Internal Road Connectivity – Marshalling Yard to Gate no. 10**

### 8.3.2 Interconnectivity of CCTPL and CITPL Terminals

Chennai port has two container terminals, viz. Chennai Container Terminal Private Limited (CCTPL) and Chennai International Container Terminal Private Limited (CITPL).

DP World is operating the CCTPL and PSA is operating the CITPL. Both the terminals get the export and import containers through Gate no. 1.

The container trailers moving containers to and from the CFSs located on the northern side take Ennore High Road, Cassimode Fisheries Harbour road and Suryanarayana Road to reach Chennai port through Gate no. 1. From the Surya Narayana Road junction Gate no. 1 is at distance of about 2 km.

Gate no. 1 is an 8 lane gate complex which has 4 import and 4 export gates. The import and export gates are divided into 3 covered roof structure and 1 open gate to allow ODC (over dimension cargo) packages each at either end of the 8 gates complex.

Once the gate-passes are verified, the container trailers move towards their respective terminals. In front of the container scanner complex, separate dedicated single lane roads are made available for CCTPL and CITPL. This dedicated single lane road to CCTPL is around 1.3 km which will take the loaded container trailers directly into the terminal yard from the backside entry. The empty trailers has a dedicated road in front of northern side of the proposed truck and trailer parking area, then the trailers follow the same road till BD II berth, and it has to take the road parallel to the berth BD II to reach CCTPL's back end gate.

The container trailers bound for CITPL have to cross the CCTPL yard boundary area in the single lane road. After crossing the CCTPL out gate area, 4 lane road is available all the way till central workshop 1. On this road, the extreme east side lane is dedicated to CITPL users. From central work shop 1 to the junction at the corner of Timber Pond it is a 3 lane road. Again from this junction to the CITPL entrance gate, 4 lane road is available.

The loaded container trailers come out from the out- gate of CITPL and follow the same incoming route but in the extreme west lane dedicated to the CITPL till CCTPL junction. At this junction CCTPL loaded container trailers join the loaded container trailers from the CITPL. Just beyond the gate no. 4 both the terminal loaded trailers take the peripheral road to reach gate no. 1 to exit from the port.

The empty trailers are allowed to go out from gate 2A at night from 11 p.m. to 4 a.m.

Gate no. 2 is handling oil tankers, tippers and all other cargos.

The layout of road connectivity for both the terminals is shown in **Figure 1.5**.


**Figure 1.5 Internal Road Connectivity of CCTPL and CITPL Terminals**

### 8.3.3 Interconnectivity of Ambedkar and Jawahar Docks

Dr. Ambedkar Dock consists of NQ, WQ1, WQ2, CQ, WQ3, WQ4, SQ1, SQ2, SCB1, SCB2 and SCB3. Jawahar Dock consists of JD1, JD2, JD3, JD4, JD5 and JD6. Both the docks are utilizing the ONB yard for stacking their cargo while the Ro-Ro cargo is parked in the yard parallel to the southern side of the ONB yard which is paved with bitumen.

JD 1, JD 3 and JD 5 are using the western side road of Jawahar Dock and JD2, JD4 and JD6 are using eastern side road. Both are 2 lane roads.

The incoming cargo for Jawahar Dock and Dr. Ambedkar Dock move from gate no. 10 through firefighting road which runs parallel to the compound wall.

Outgoing cargo take the South Spring Haven Road and the Marshalling Yard Road to reach Gate no 10 to exit from the port.

The firefighting road is a 2 lane road but at certain stretches it reduces to a single lane road. The South Spring Haven Road and Marshalling Yard roads are both 4 lane roads. The pink line shown in **Figure 1.6** represents the road circuit.


**Figure 1.6 Road Connectivity of Jawahar Dock and Dr. Ambedkar Dock**

## 8.4 Improvements to the Internal Road Network

### 8.4.1 Widening of Arterial Road & Construction of a ROB

Chennai Port has got a simulation study on congestion issue at Port carried out by IITM and as per the recommendations of the study the congestion issues are mainly attributable to criss cross movement of vehicles of the two container terminals, CCTPL & CITPL, as both terminals are located opposite to each other and the entry and exit with in the Port is same. The container trailers remain outside terminals but inside port for quite a long time as such the by-passes are required for easy movement of containers.

Presently, the road leading from gate no. 1 to CCTL entry gate is being used by both the terminal operators to enter inside the port and thus causing traffic congestion inside the port. Hence to overcome this traffic congestion inside the port, it is proposed to provide a new 4 lane road starting from North West corner of IOCL terminal B boundary. Further, it is proposed to shift the port compound wall between Gate no. 4 & 6 in lieu of upcoming 3rd and 4th railway line by southern railway. A new 8 lane peripheral road is proposed to be laid alongside of the new compound wall to enable the remaining portion as an effective storage area. Also the present project start near Gate no. 1 and ends near Gate no. 6 which will cross over the existing railway line near gate no. 4 and proposed railway line near CISF crime office building. Hence, it is proposed to provide a Road Over Bridge to cross these railway lines. Further details are provided hereunder.

- It is proposed to widen the existing concrete road starting from North West corner of IOCL Foreshore terminal – B (near Gate no.1) and ending up at the container scanning station. The proposed road length is about 284m and width in this stretch will be about 18 m to accommodate 4 lane traffic with central median. Separate chase for power cables and storm water will be provided alongside of the proposed road.

- From container scanning station, it is proposed to provide new four lane road for 1,542 m length and 18 m width alongside of the new eastern side boundary of IOCL Foreshore terminal A' upto the existing loco shed.

- From existing loco shed to CISF crime office building, it is proposed to provide a new 4 lane concrete road of 18 m width in eastern side of the existing peripheral road leaving a gap of 2 m for proposed oil pipe line of IOCL. All the above stretches will have cable chase and storm water drain arrangement.

- From E - FLT service station (near CCTL exit gate ) to gate no. 6, it is proposed to provide 36 m wide eight lane road for 1,104 m length with 1.5 m wide foot path on both the sides with storm water drainage arrangements alongside of the proposed compound wall between E -FLT service station and gate no. 6. It is proposed to provide 13 m space in width alongside of the new compound wall between gate no. 4 & 6 left for proposed railway track connecting northern and southern part of the port. However, as the alignment of the internal railway lines connecting the port to the 3rd & 4th lines of Southern Railway is yet to be finalised, the adequacy of this 13 m wide corridor cannot be confirmed at this stage.

- It is also proposed, a four lane Road Over Bridge of width 18 m (approx.) for existing railway crossing at gate no. 4 and proposed railway crossing near CISF crime office building. The 4 lane ROB consist of 500 m length bridge length portion with 200 m length ramp portion on both ends of Bridge. (Total ROB length is 900 m). Financial Assistance of Rs.100 cr. is expected for the entire scheme from Government in the form of grant in aid.

### 8.4.2 Truck Parking Yard for the Two Container Terminals

At present, the overall incoming traffic at Gate no. 1 is moving towards their respective terminals to unload the loaded containers or to fetch the loaded containers. In this process, the trailers and trucks without proper pass or paper work also move alongwith the trailers and trucks having proper pass and paper work which leads to the confusion and congestion in the roads leading to the terminals. Moreover, trucks and trailers are parked randomly on the side of busy roads and on open lands which obstructs the moving traffic.

The trailers should be discouraged from parking inside the Port area as it leads to idling trailers being parked within the port. With the introduction of RFID, only those vehicles with work proof shall be permitted inside the port. It is suggested to provide parking areas for each terminal separately.

- Suggested Parking Yard for CCTPL Trailers

The proposed location is situated near gate no 1 and adjacent to the compound wall of CFS and container scanner complex. Out of the total 5.8 ha area available in this location, 2 ha has been suggested for locating tank farms for bunkering. In the balance 3.8 ha area, it is possible to park about 750 trailers.

- Suggested Parking Yard for CITPL Trailers

There is not adequate space within custom bound area. However, a small buffer area for 50 – 60 trailers may be created as a common user facility for exigencies.

Facilities like canteen, bathrooms, toilets and rest rooms need to be provided at these parking yards. Check-post shall be established to allow the vehicles out of the proposed parking area only if they possess the complete paper work to fetch or unload the containers from the both the terminals. This, in-turn, will reduce the queuing and congestion in the roads leading to the terminals.


**Figure 1.7 Proposed Truck Parking Area for CCTPL**

## 8.5 External Road Connectivity

Popularly known as “Gateway to South India”, Chennai is well connected to other major cities in the north, west, south and north-east through National Highways. The directly connected Highways are NH 4, NH 5 & NH 45. The road network linking Chennai to other parts of India is shown in **Figure 1.8**.

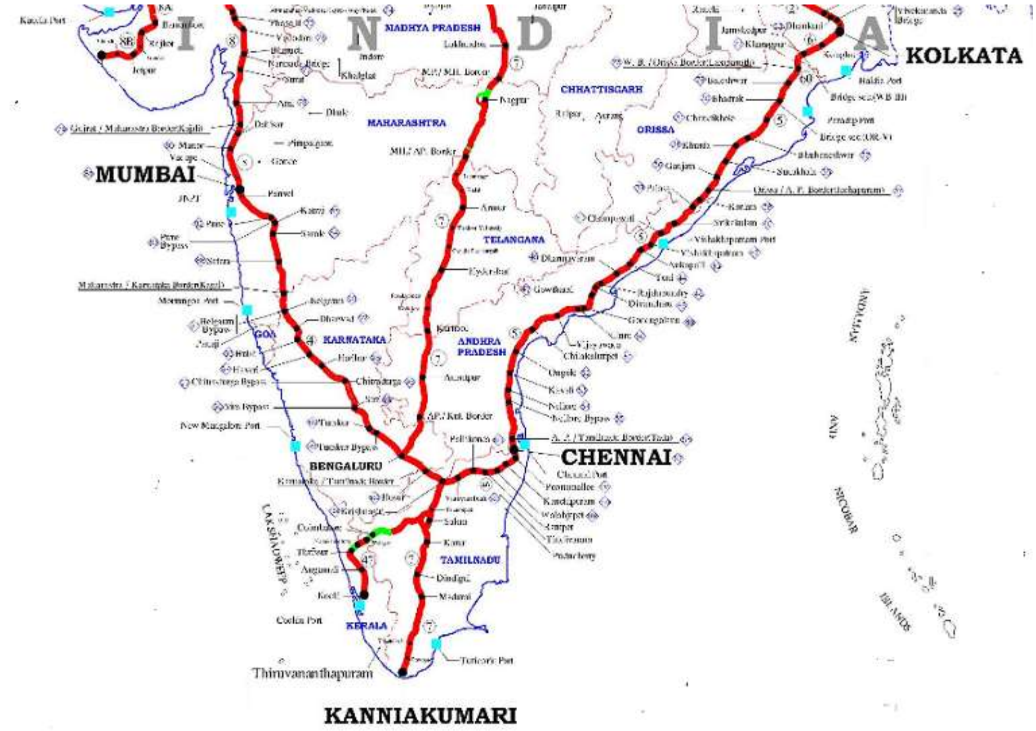



**Figure 1.8 National Highway Network Linking Chennai**

NH 45 from the south is connected with NH 4 & NH 5 through outer and inner ring roads bypassing the city as shown in the **Figure 1.9**.

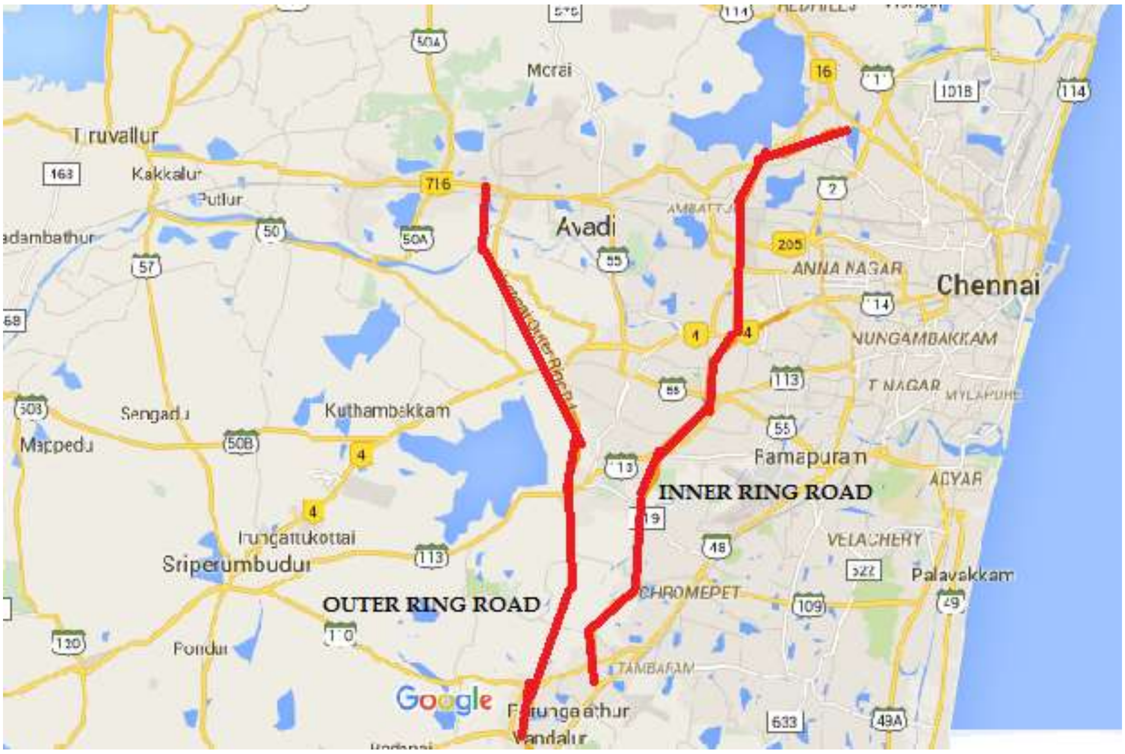



**Figure 1.9 Outer & Inner Ring Roads Bypassing Chennai City**

The stretch of 15 to 20 km from north, west and south to Chennai port from the National Highways are clogged and constrained by traffic restrictions. Heavy port traffic is permitted only during nights. The ring roads circumventing the city have helped but increased the distance and costs against marginal savings in haulage time. Hence there is a need to upgrade the port linkage to these highways to ease cargo movement. Accordingly, two schemes were proposed for evacuating cargo from the port through the north as well as from the south. They are: Chennai Ennore Road Connectivity Project on the northern side and Maduravoyal elevated corridor on the south. These are detailed hereunder.

### 8.5.1 Chennai Ennore Port Road Connectivity Project (formerly EMRIP)

The Chennai Port Road Connectivity Project (formerly EMRIP) was planned to improve the northern connectivity of the Port to the National Highway network by strengthening the connecting roads from the Port. This project is expected by a Special Purpose Vehicle comprising NHAI, ChPT, KPL and GoTN at the current estimated cost of Rs. 600 crores. The project network covers 30.1 km with 6.0 km of Ennore Expressway, 1.6 km of Ennore Expressway (inside Fishing Harbour), 9 km of Thirvottiyur-Ponneri-Panchetty road (TPP) and 5.4 km of Manali Oil Refinery Road (MORR). The project also involved construction of groynes along the seashore for coastal protection. The Equity contribution of ChPT is Rs. 139.80 crores. and debt contribution is Rs.110.68 crores. ChPT has already paid its entire equity amount.

The contract for executing this work was awarded to a joint venture of M/s Coastal and SPL during June 2011, at a contract value of Rs. 253.47 crores. As of date about 90% of the work has been completed and the balance is pending due to non-shifting of Project Affected Families (PAF's) from the alignment of road in two small stretches by GoTN. Both NHAI and ChPT are pursuing with the state government for speedy action in this regard.

### 8.5.2 Maduravoyal Elevated Corridor

This road is envisaged for the smooth movement of the commercial traffic to and from Chennai Port on the southern side. All the traffic will get distributed to the three national highways NH45, NH4 & NH5 from Maduravoyal. It is proposed that this elevated road will follow the banks of river Cooum for the entire length. The project corridor commences at Chennai port (Gate 10) near War Memorial and ends near Maduravoyal Municipal Office, at km 13 at NH4. The total length of this road will be about 17.5 km. The location and alignment of this elevated corridor is shown in **Figure 1.10**.


**Figure 1.10 Location and Alignment of Maduravoyal Elevated Corridor**

The project was included under NHDP VII and is being executed through NHAI. The Project proponents are NHAI, ChPT and GoTN. The present estimated cost is Rs. 1,815 crores with Rs. 1,345 crores towards civil works and Rs. 470 crores towards R&R activities. ChPT and GoTN will be sharing the costs of land acquisition and R&R equally.

Project starts from War Memorial gate of Chennai Port and runs upto Maduravoyal for a length of 19.01 km, which runs along Cooum river bank upto Koyambedu and the balance stretch along NH 4 thereafter. The BOT tender was awarded to M/s Soma Enterprise Ltd., Hyderabad during January 2009, for a concession period of 15 years (including 3 year construction period). After progressing for about 15% the project has landed up in litigation. PWD, GoTN has issued a stoppage notice stating that certain conditions have been violated. On consequent events, NHAI filed a WP in the High Court of Madras against the stop notice by GoTN and as a one of the respondents Chennai Port also filed a counter and additional counter affidavits. After hearing proceedings, the judgment has been delivered by in favour of Chennai Port and NHAI. However, a SLP has been filed by CE, PWD, GoTN in Hon'ble Supreme Court against the judgment delivered by the High Court. The case is still pending.

## 8.6 Internal Railway Network

### 8.6.1 Overview

Chennai Port is served with two rail entry / exit arrangements connecting Indian Railway network - one connecting Chennai Beach Station to the Port Marshalling yard at the southern end through Gate no. 9; and the other connecting Royapuram Station with Bharathi Dock at the northern end through Gate no. 4. Bharathi Dock linkage was mainly for handling iron ore at BD II berth. As of date, the iron ore traffic has been stopped and this Gate no. 4 remains closed. The overall port railway network is shown in the **Figure 1.11**.


**Figure 1.11 Overall Port Railway Network**

### 8.6.2 Port Marshalling Yard

Port Marshalling yard is at the southern end of the port and is connected to the Southern Railway network through Chennai Beach station with a single line. This Marshalling yard distributes the railway traffic to the various docks inside the port. Port Marshalling yard is the feeding yard for the second Container Terminal, Jawahar Dock and CONCOR yards. In addition, this yard also handles loading / unloading of Port's other general cargo handled in Eastern and Western yards. The layout of Port Marshalling yard is such that entry/ exit to all sidings and Chennai Beach are on the Northern end of this yard.

Incoming trains with electric locos are received at the eastern end of the yard and the electric engine is released. Port owned diesel locos shunt the rakes to the various feeder yards like CONCOR yard or CITPL yard or for handling general cargo for placement. After unloading / loading, the rake is brought back to the Central yard by the Port's diesel loco and forms a train. The train is attached with electric loco and dispatched to Chennai beach station through Gate no. 9.

This marshalling yard consists of 4 lines of Eastern yard, 6 lines of Central Yard and one line of Western Yard. The railway network at the Marshalling Yard is shown in **Figure 1.12**.


**Figure 1.12 Railwy Network at the Marshalling Yard**

## 8.6.3 Jawahar Dock, CITPL & CONCOR Linkage

Jawahar Dock East and West are served by railway lines linked to the marshalling yard. Cargo are loaded/unloaded onto and from railway rakes at the dockyard siding.

The second container terminal CITPL has 2 rail sidings in its yard, the containers are loaded on to the rail rakes. From here the loaded rakes are moved to the marshalling yard. DLI is handling JD west line. From here DLI is picking the containers from CITPL or CCTPL and loading into the rakes and moving them to marshalling yard. The CITPL yard has the capacity to handle 10 incoming and 10 outgoing rakes per day.

The first container terminal, CCTPL, does not have railway siding inside its yard. Since the containers in the port are handled by CONCOR, a separate siding for CONCOR has been provided west of Ambedkar Dock. This siding can handle a full rake. CONCOR is the only operator handling rail bound container traffic of CCTPL from its rail terminal and that of CITPL from the yard sidings of CITPL. The total container traffic handled by CONCOR by rail, for the both operators, is about 2 rakes a day, mainly to and from its ICD at Whitefield in Bengaluru. The reason being the limited equipment (2 reach stackers only) provided at the yard. In case additional 2 reach stackers are provided, each rake can be loaded and unloaded in less than 4 hours, which would enable handling 5 rakes per day.

The layout of the railway network linking CITPL, JD EAST, JD WEST and CONCOR Yard is shown in the **Figure 1.13**.


**Figure 1.13 Railway Network Linking CITPL, JD EAST, JD WEST and CONCOR Yard**

### 8.6.4 Bharathi Dock – BD II Berth

Bharathi Dock – BD II is served by rail connectivity through Royapuram Railway station. A railway yard with 5 reception lines, 4 dispatch lines and unloading facilities with tippling arrangements are available, mainly handling iron ore for exports. Since Chennai port is banned from handling iron ore and coal due to environmental issues, this railway yard area and railway lines are kept idle and Gate no. 4 exit / entry lines are non-operational.

The layout of the railway network as existing at BD II yard is shown in the **Figure 1.14**.


**Figure 1.14 Railway Network at BD II Yard at Bharathi Dock**

### 8.6.5 Constraints at the Marshalling Yard

Some of the major constraints in Port Marshalling yard are:

- As per present yard design, only Eastern Yard 2, 3, 4 is meant for reception of rakes and they are fully wired. Each line has a designed length to accommodate only 58 wagons with brake van and power loco. Eastern Yard 1 siding is used for loading/unloading & Centre Yard 1 line is utilized for Southern Railway Loco as escape line and also as a crossover for the movements between Reception and Despatch yard. Centre Yard 2, 3, 4, 5, 6 are despatch lines which are top wired along with Western Yard 1. Even if the despatch yards are fully wired, sufficient track length is not available at the southern end, for loco to escape, due to the existing road leading to Gate No. 10.
- All the feeder sidings and Chennai Beach station which is the gate way for rail movement are on the northern end of the yard with a result, a Z type movement at the Port Marshalling yard is inevitable
- Independent entry and exist arrangements to each of the feeder sidings is not available resulting in criss-cross movements and avoidable detentions.
- Availability of a single line for movement to and from Chennai Beach Railway station which is the only entry / exit point of Chennai Port at present

It is suggested that all the 11 lines could planned to be wired in a period manner depending upon the traffic growth.

### 8.6.6 Laying of 3rd and 4th Line from Royapuram

In order to remove the constraints at the marshalling yard and also to enhance the movement of railway rakes, Southern Railway have come up with a proposal to introduce 3rd and 4th line from Royapuram to Madras Beach Station which will be further extended upto the Port Marshalling Yard. For this purpose they have requested for the release of 1.67 Ha of port land between Royapuram and Madras Beach Station. In exchange they are prepared to hand over equivalent area to the Port. This proposal has been approved both by the MoS and the Ministry of Railways.

Southern railway has requested the port to construct the compound wall as a deposit work and also requested to allow them to carry out the construction of 3rd & 4th tracks. The shifting of existing boundary wall by about 13 m towards the periphery road is going on and the construction work is under progress. After the completion of the work, these new lines will ease the railway operations through the marshalling yard. This proposal is shown in the **Figure 1.15**.

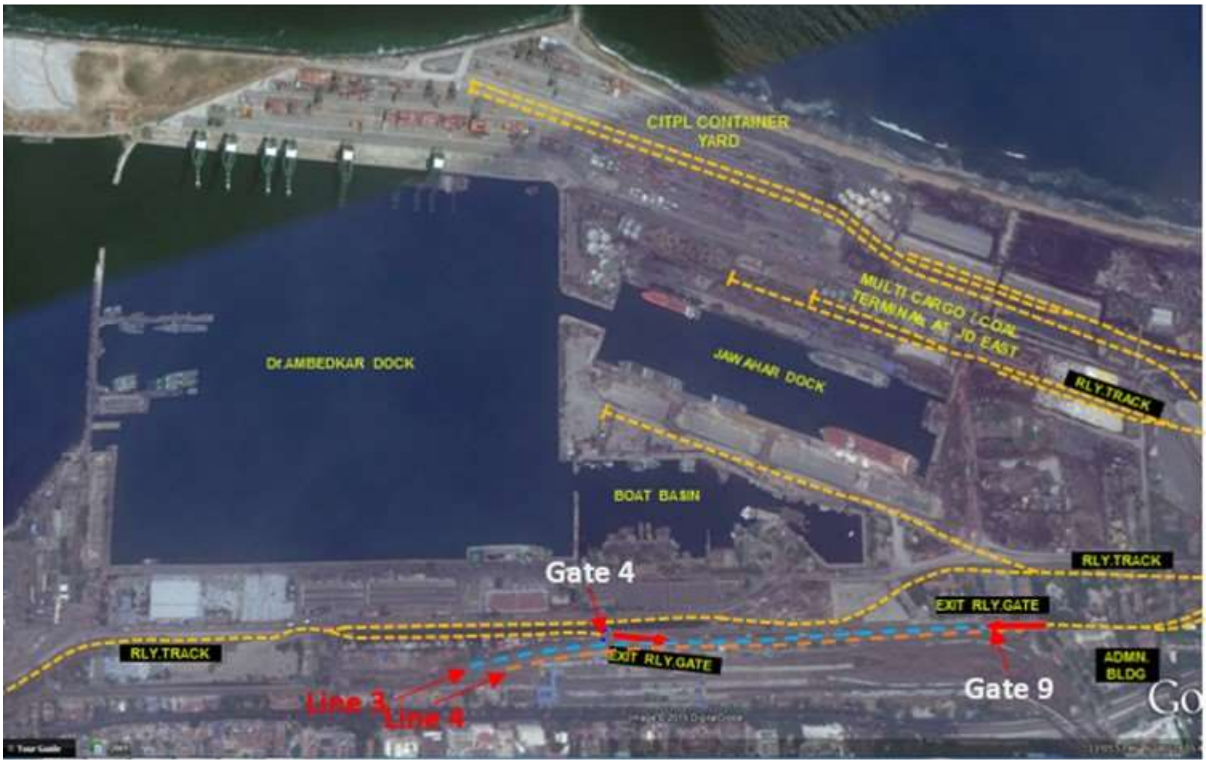



**Figure 1.15 The Proposed 3rd & 4th Line from Royapuram**

It is further suggested that Doubling of track be also taken up at Gate no. 9, so that 3rd and 4th line of southern railway are connected to the ChPT lines for enhanced evacuation of cargo through rail mode.

### 8.6.7 Common Railway Yard for Containers

The port is presently developing a common rail yard in the area west of marshalling yard. The basic purpose of this yard is to aggregate the containers from both the terminals at one location to ensure faster turnaround of rakes. It will also allow handling of DFCC (Dedicated Freight Corridor Corporation) rakes which will be double the length of the current rakes.

This common railway yard is being executed by IPRCL (Indian Port Rail Corporation Ltd.) a SPV formed by Major Ports and RVNL. IPRCL have appointed RITES as the PMC for executing this work. The yard will have two lines on either side of a 700 m × 30 m platform with a main railway line and a reserve line.

The common rail terminal shall have the following components:

- Sidings for receipt/dispatch of DFCC rakes.
- Roads for movement of ITVs in the yard area and rail yard.
- stacking space adjacent to rail yard
- RTGs at the Yard area
- ITVs, other equipment, utilities.

The proposal envisages a full rake loading and avoid cutting of rakes so that the rakes can be released immediately. The concept is to have “Engine on load” which will ease operations. ChPT is at present handling 4 to 7 rakes per day. The proposed common siding is top (partially) wired. Hence, Diesel Loco has to be provided by Southern Railway for placing full rake as direct placement at the common railway yard instead of the rake going to Reception Yard (Eastern Yard) and to be placed in multiple shunts or otherwise the rake has to be pushed from Chennai Beach to Marshalling Yard having Brake Van on the southern side with Southern Railway to enable loading the wagons directly on reception of the rake. With the proposed new platform the number of operations will increase and may be able to handle 10 - 15 rakes per day. The yard would have space to handle up to 0.75 MTEU per year and would also have adequate equipment to maintain high productivity levels. The proposed common yard is as shown in the **Figure 1.16**.


**Figure 1.16 Proposed Common Rail Yard**

The relative locations of the common railway container yard and the two container terminals are shown in the **Figure 1.17**.


**Figure 1.17 Proposed Common Rail Yard wrt Existing Container Terminals**

# 9.0 SCOPE FOR FUTURE CAPACITY EXPANSION

## 9.1 Development of a Bunkering Terminal

### 9.1.1 Bunkering Industry – An Overview

Fuel utilized by shipping companies for fuelling their marine fleet is commonly referred to as bunker fuel. In the bunker industry, there are two primary kinds of fuels currently being used; distillate fuel and residual fuel. Among the two, residual fuel account for around 75% of global bunker consumption. Ships use heavy fuel oil to power their engines, and lighter fuels such as diesel or gas-oil to power the generators that run their lights and other electrical utilities.

The marine fuel grades have been broadly segmented into four major categories: IFO 380, IFO 180, IFO Others, and MDO/MGO. The IFO Others segment includes fuel grades IFO 500, IFO 700, LS 380, and LS 180. With majority of ship engines capable of combusting IFO 380, it is currently the most popular in the bunker market and is the most traded marine fuel oil grade globally. It is easily available at all bunkering destinations in the world, and is more economical when compared to other fuel grades.

The specifications for all types of marine fuel are set out in the International Standard ISO 8217-1996. It is a commercial standard and is not a mandatory one. Subsequently, it was revised in 2005. The latest version was released in June, 2010. Most major suppliers in major ports supply fuels conforming to IS 8217 -2005. If buyer and supplier agree, fuel can be supplied to IS 8217 -2005 or even ISO 8217-1996. There are only very limited people conforming to 2010 version. These cover IFO 40 cst to IFO 380 cst; MGO and MDO.

The requirement for bunker fuel is relatively high in bulk and general cargo vessels. While the major demand from bulk carriers has been recently exhibiting a decreasing trend, the requirement for bunker fuel in the container ships segment is anticipated to grow at a substantial rate in the future.

Selection of the right type fuel is of significant importance to the safety of the ship (substandard fuel can cause severe damage to the ship's engine) and its profitable operation. Bunker fuel costs account for approximately 60% to 70% of the total voyage expenditure for a vessel. Ship operators, while taking fuel, look for the following three important aspects, viz. that the bunkers they buy are of sufficient quality to allow use without any problems; that they can get their bunkers at a good price; and that they buy at the most cost-effective location on their ship's itineraries. This implies that for any bunkering business to thrive, these three aspects are to be satisfied. This also implies that to meet the demand for bunkers there needs to be a corresponding supply source.

With this background, an overview of the region around the Indian sub-continent is made as this is more relevant for this specific study. India lies in between the two significant bunker ports viz. **Singapore and Fujairah** as shown in the **Figure 1.18**. While Singapore is the world's largest bunker port at 45 MTPA of bunker sales, Fujairah is the second with 25 MTPA bunker sales.

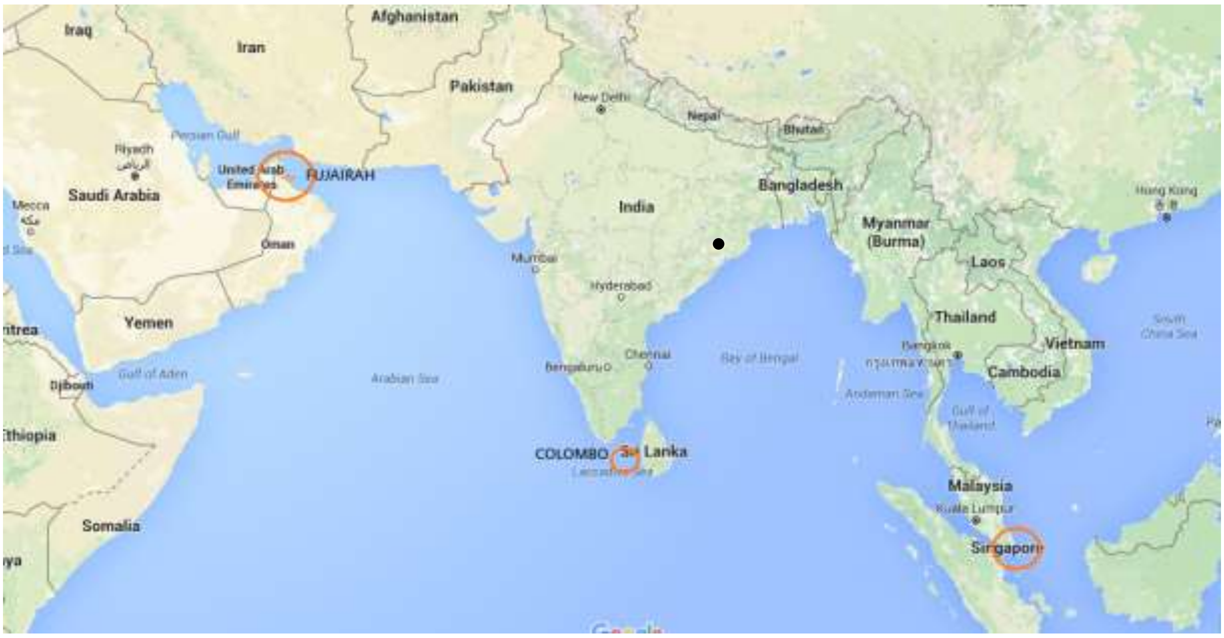



**Figure 1.18 Significant Bunker Ports – Singapore and Fujairah**

### 9.1.1.1 ***Singapore***

Geographically, Singapore enjoys a crucial locational advantage as all the vessels sailing from the West to Southeast pass by it making it an ideal stopping point for bunker calls. As of date, Singapore is the busiest and also the leading bunker port in the world with over 581 MT of cargo traffic and over 45 MT of bunker deliveries in a year, which is around one sixth to one seventh of the total quantity of marine fuel sold annually around the world.

The following **Table 1.4** gives the statistics relating to the types and volumes of bunker supplied at Singapore during the past five years.

**Table 1.4 Singapore Bunker Sales (in '000 T)**

| Year | Total | MGO | MDO | MFO 180 cst | MFO 380 cst | MFO 500 cst | LSMGO | LSFO 180 cst | LSFO 380 cst | LSFO 500 cst | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 43,153.6 | 1,569.6 | 6.6 | 1,641.0 | 34,122.1 | 5,577.7 | N.A. | N.A. | N.A. | N.A. | 236.6 |
| **2012** | 42,685.4 | 1,454.2 | 2.2 | 1,247.0 | 33,685.5 | 6,225.4 | N.A. | N.A. | N.A. | N.A. | 71.1 |
| **2013** | 42,682.2 | 1,182.9 | 2.0 | 950.2 | 32,070.2 | 7,661.5 | 190.9 | 1.8 | 541.1 | 15.0 | 66.5 |
| **2014** | 42,416.8 | 1,023.8 | 1.9 | 747.6 | 31,812.7 | 8,106.0 | 287.4 | 2.0 | 412.6 | 4.9 | 18.0 |
| **2015** | 45,155.5 | 936.2 | 1.5 | 673.4 | 34,106.8 | 8,599.7 | 784.4 | 0.5 | 23.7 | 0.2 | 29.2 |

While there is a steady demand for bunkers, there should be a corresponding steady supply. Singapore is home to an impressive cluster of refineries including Shell, Mobil and Singapore Refining Company. With refining capacity totalling almost 1.4 million barrels per day, Singapore generally has plenty of availability, keeping prices down and making it the cheapest bunker port in Southeast Asia.

There are over 100 bunker suppliers/traders operating from Singapore. There are about 230 bunker tankers with sizes ranging from a minimum 290 T to a maximum 6,500 T serving the bunker trade.

In order to enhance the quality assurance, Singapore Port has put into effect a standard bunkering procedure, setting out a minimum standard of bunker delivery. Bunker receiving ships and bunker tankers are required to follow this procedure. Otherwise, chances of a claim recovery can be difficult in cases of dispute. The Singapore Bunkering Procedure was a world-first when it was introduced in 1992.

The Singapore Standard CP 60 (Code of Practice for bunkering by Bunker barges/ tankers) applies when bunkers are being delivered by bunker tankers to ships and lays down the minimum documentation and equipment requirements and, verification during a bunkering operation. It covers pre-delivery, actual delivery and post-delivery documentation. All bunker suppliers and bunker craft operators are licensed by the Maritime Authority of Singapore (MPA) to comply with the SS CP 60 as a licensing requirement. There is another Standard SS CP 77 (Code of Practice for Bunker Surveying). This sets out the procedures and the documentation and equipment requirements of a bunkering operation between a bunker barge/tanker and a vessel. It covers pre-delivery and post-delivery checks and documentation.

#### 9.1.1.2 ***Fujairah***

Fujairah is the second largest bunkering port in the world next to Singapore with bunker traffic of about 25 MT during 2015.

This bunker market came into prominence as a result of the Iran/Iraq war in the 1980's. Full scale operations started in 1983. The area known as the 'Fujairah bunker market' encompasses the three ports of Khor Fakkan, Kalba and Fujairah itself, all located on the east coast of the UAE

Fujairah's biggest advantage is its location. Fujairah and the neighbouring port of Khor Fakkan are located about 70 nm from the Straits of Hormuz. This strategic location attracts ships traders from the Persian Gulf to anchor here for provisions, bunkers, repair and technical support, spares and stores before proceeding on long voyages.

Fujairah boasts good, open, safe anchorages with ample vessel space. Favourable weather conditions and good strategic location for crew changes and maintenance work at facilities such as Dubai dry docks also attract vessels. So important is bunkering in the region that the anchorages off Fujairah are demarcated for different purposes. There is a particular area called 'Bravo' anchorage used solely for normal bunkering operations.

Fujairah Offshore Anchorage Area (FOAA), located 10 nm offshore, has earned an international reputation establishing Fujairah as one of the largest bunkering and marine logistics hub. There are about 40 bunker suppliers and a fleet of more than 100 independently owned and professionally operated Supply vessels based in the port service the Port and the Anchorage. The average stem size is higher than at other major bunkering ports due to the large number of bigger vessels like VLCCs, tankers and gas carriers bunkering here. The average pumping rate is in the range of 300 to 350 TPH except during winter when it is lower.

At least 95% of bunkers are delivered offshore. Bunker barges vary in size from 40,000 DWT to 2,000 DWT. There is a great flexibility for time and location of bunker delivery. All bunker barges are self-propelled. Bunkering in international waters is beyond control.

There is no bunker fuel indigenously available at Fujairah and Khor Fakkan. Most suppliers import from refineries in Bahrain, Saudi Arabia and Iran – often straight run material. All suppliers in this market have to import product and store it afloat or ashore. This adds to the costs of running a bunker operation in this market, and also demands careful forward planning by the operators if continuity of supplies is to be achieved.

However, the International Petroleum Investment Company (IPIC) refinery with a processing capacity of about 200,000 bpd is expected to be on stream in 2016. This will further boost the bunker sales at Fujairah.

### 9.1.2 Indian Scenario in Bunkering

It is ironical that India, lying in between the two large bunker markets of Singapore and Fujairah, is yet to establish itself as a recognised bunkering destination. It has to be noticed that India is a major supplier of bunker cargoes to Singapore. It has to realise its potential as a major bunker supplier.

Administrative problems coupled with uncompetitive prices compared to direct rivals at Fujairah and Singapore have often been blamed for the relatively slow progress made by the country's bunker sector. In this context, reference is invited to a presentation made by Indian Oil Corporation Ltd. at an international conference in Colombo during September, 2015 on "Indian Bunker Sector Developments". In this they have listed out the negative points restricting the growth of bunker traffic in India. These are presented hereunder:

- India lies in between the two strong bunkering hubs of Singapore & Fujairah
- Different tax structure at different states. Vat is applicable on Bunker supply to FG vessels being deemed export. Exemption / reductions obtained from few States after prolonged follow ups.
- Distributed potential in India leading to multiple expenditure for creating facilities for much smaller volumes as against concentric potential at Singapore & Fujairah
- Desired grades of bunker fuel are not available at all ports
- Port specific restrictions/regulations on bunkering beyond daylight, physical supervision and lengthy documentations
- Barges are not allowed to be used as floating storage of bonded bunker fuel
- Bunkering at OPL (Off Port Limits) is not permitted by ports. At OPL vessels need not come inside the port and save on port charges and time.
- Loading of bonded bunker is allowed against specific vessels with specific approval for which nominations are received.

In another presentation made by Matrix Bharat (a Joint venture between BPCL and Matrix Marine Fuels Pet Ltd., a subsidiary of Mabanaft, a leading oil trading company based at Germany) at Delhi on India Maritime Day in February, 2014, the way forward for bunkering in India has been indicated viz.

- Dedicated Barge loading Jetty at ports
- Barges with higher capacity and better pumping rate.
- Ex pipe bunker delivery facilities at ports
- Proactive steps by port authorities for setting up bunkering facilities and reduced port charges and wharfages.
- Tax concessions and duty draw backs on bonded bunker deliveries
- Simplified customs & excise formalities
- Floating storage for quicker delivery
- Formation of Bunker Association

In recent times, the situation has improved. As an important step, the tax structure has been modified favourably by the states. The applicable taxes in the various states for bunkering are brought out in the following **Table 1.5**.

**Table 1.5 All India Tax Applicability on Bunkers (%)**

| State | Port | Foreign | | Coastal | |
|---|---|---|---|---|---|
| | | IFO | MGO | IFO | MGO |
| West Bengal | Kolkata / Haldia | 1.5 | 17 | 5 | 17 |
| Odisha | Dhamra / Paradip | 5 | 23 | 13.5 | 23 |
| Andhra Pradesh | Visakhaptanam / Gangavaram / Kakinada / Krishnapatnam | 4 | 22.25 | 4 | 22.25 |
| Tamilnadu | Kattupalli / Ennore / Chennai / Karaikal / Tuticorin | 4 | 4 | 5 | 21.43 |
| Kerala | Cochin | 0.5 | 0.51 | 5 | 24.52 |
| Karnataka | New Mangalore / Karwar | 1 | 1 | 14.5 | 16.65 |
| Goa | Mormugao | 1 | 4 | 12.5 | 22 |
| Maharashtra | Mumbai | 0 | 0 | 12.5 | 24 |
| | Jawaharlal Nehru | | | | 21 |
| Gujarat | Kandla / Mundra / Pipavav / Hazira / Dahej | 5 | 24.63 | 5 | 24.63 |

[Courtesy: IOCL presentation on “Indian Bunker Sector Developments”.at Colombo]

**Note:** Andhra Pradesh has reduced the taxes on bunkers to foreign vessels from 14% to 4% effective February, 2016.

As a result, the prices of bunkers at Indian Ports have come down with shrinking differential as compared to Singapore & Fujairah. This is brought out in the following **Table 1.6**, as presented by IOCL in the Colombo Conference.

**Table 1.6 Bunker Prices at Indian Ports**

INDIAN OIL

| | As on 23.09.2015 | Current price in USD | | |
|---|---|---|---|---|
| | Major Ports | IFO180cst | IFO380cst | MGO |
| 1 | Haldia | 276.34 | 239.61 | 528.39 |
| 2 | Paradeep | 294.23 | 0 | 518.49 |
| 3 | Vishakapatnam | 273.55 | 0 | 517.78 |
| 4 | Ennore | 286.21 | 0 | 516.77 |
| 5 | Chennai | | | |
| 6 | Tuticorin | 286.75 | 0 | 524.11 |
| 7 | Cochin | 266.39 | 235.986 | 512.68 |
| 8 | Mangalore | 264.09 | 0 | 509.97 |
| 9 | Mormugao | 267.03 | 0 | 516.84 |
| 10 | JNPT | 263.53 | 0 | 509.81 |
| 11 | Mumbai | 263.53 | 0 | 509.81 |
| 12 | Kandla | 265.12 | 0 | 507.31 |

Exchange rate wef 17.09.15 INR 66.90 per USD

| IFO380cst | As on 23.09.2015 in USD |
|---|---|
| Singapore | 229.5 |
| Colombo | 293.5 |
| Fujairah | 233.5 |

With the improving situation, renowned foreign players are entering the Indian bunkering market. Earlier most of the bunkering was done by the oil PSUs viz. IOCL, HPCL and BPCL.

In 2008 Chemoil Energy Ltd., a Singapore headquartered natural resources company engaged in trading marine fuel, aviation fuel and land - based diesel products, joined hands with Adani for form a JV "Chemoil Adani Pte Ltd." (registered in Singapore) for supplying bunker fuel to vessels in Mundra and other ports. In October, 2015 they sold their entire equity to Adani leaving them the whole ownership. The company was renamed "Adani Bunkering Pte. Ltd.". It imports and sells bunkers IFO 380, IFO 180 & MGO as per specifications of ISO 8217: 2005 (Sulphur Max 3.5%) and supplies are made in compliance with MARPOL Annex VI with competitive prices. They have reserved 90,000 T of tankage at their Mundra terminal exclusively for bunkering. They supply bunkers to Gujarat Ports from Mundra and at other ports supplies are made in association with PSU oil companies. They have a fleet of 2 × 3000 T; 1 × 1350 T; 1 × 500 T; 1 × 450 T; & 1 × 400 T. During 2014-15, they are understood to have supplied 1.2 MT of bunkers.

In the same year 2008, Matrix Marine Fuels Pet Ltd.,(MXB) a subsidiary of Mabanaft, a leading trading company based at Germany, formed a bunkering JV in Singapore with BPCL named "Matrix Bharat Marine Services Pte Ltd.". The JV is engaged in retail bunkering as physical supplier of bunker fuel at Mumbai, JNPT, Kochi, Colombo, Fujairah and Singapore. MXB operates with 11 barges with capacity ranging from 300 T to 1500 T at Mumbai and Kochi. There is no blending of bunker fuel as it is directly sourced from the refineries. While at Mumbai, JNPT and Kochi supplies are from their own source, at other ports supplies are arranged through other physical suppliers/National oil companies.

As at present there are about 50 bunker fuel suppliers/barge operators serving the Indian bunker market.

### 9.1.3 Bunkering at Chennai Port

At Chennai Port bunkering is done by IOCL, HPCL & IMC. The bunker traffic for the past 7 years is presented in the **Table 1.7**.

**Table 1.7 Bunker Traffic at Chennai Port**

| S. No. | Year | Bunker Volume | Total Vessel Calls |
|---|---|---|---|
| 1. | 2008 - 09 | 1,20,258 | 2,078 |
| 2. | 2009 - 10 | 1,74,835 | 2,131 |
| 3. | 2010 - 11 | 1,27,127 | 2,181 |
| 4. | 2011 - 12 | 82,164 | 2,043 |
| 5. | 2012 - 13 | 62,259 | 1,928 |
| 6. | 2013 - 14 | 62,528 | 1,756 |
| 7. | 2014 - 15 | 48,059 | 1,741 |

These volumes include the bunkers supplied to vessels of Navy and Coast Guard.

IOCL has a tankage at the Foreshore Terminal. It has the following storage capacity viz., IFO 180 - 19,020 T; IFO 380 - 16,325 T and MGO - 17,400 T. The supplies are made through barges. They have presently two barges – one for white oil and the other for black oil.

The bunker barges are handled through a small jetty at the root of the northern breakwater of Bharathi Dock and west of BD II. This is closer to the IOCL Foreshore Terminal and connected to it by 2 × 10” lines for FO and 1 × 8” line for HSD. HPCL and IMC have each 1 × 8” line for FO. The layout of the barge jetty is shown in **Figure 1.19** and the satellite picture is shown in **Figure 1.20**.

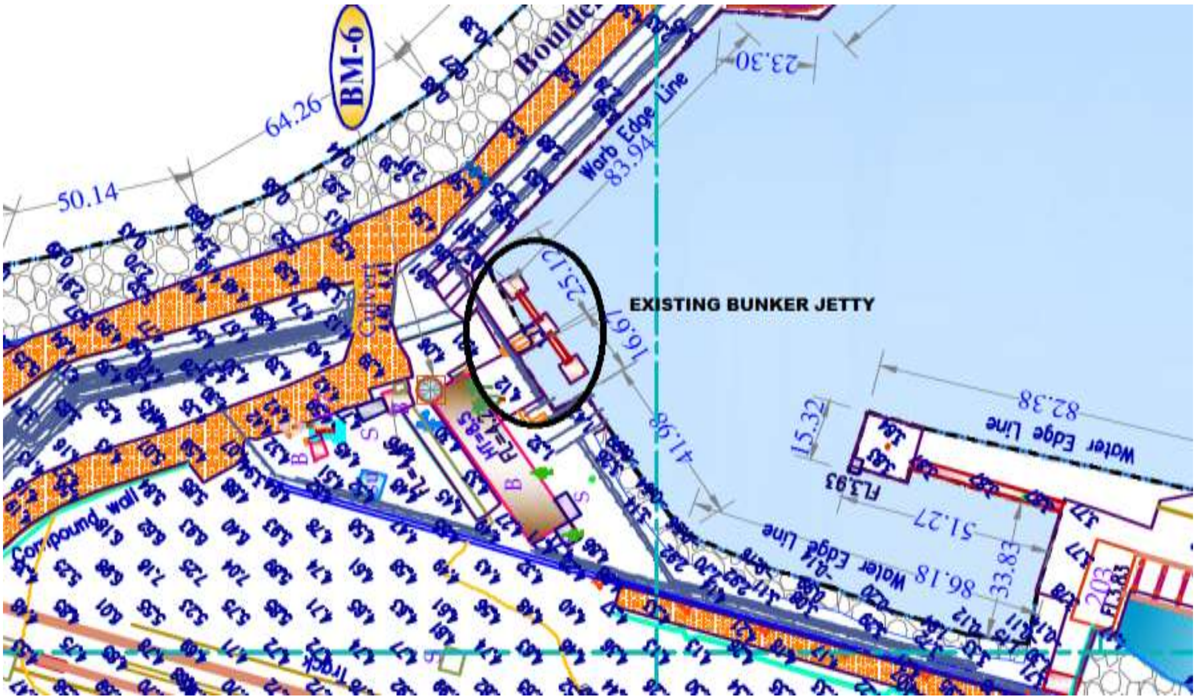



**Figure 1.19 Location and Layout of Existing Bunker Jetty**


**Figure 1.20 Location and Layout of Existing Bunker Jetty**

While IOCL supplies Furnace Oil (FO) and High Flash High Speed Diesel (HFHSD) meeting stringent BIS specifications, it also offers the entire range of SERVO brand marine grade lubricants. It has also started supplying Bonded 380 cst FO bunker fuel from Chennai from May 2009 as per ISO 8217:2005 specifications. The price of this product is internationally competitive. These products are available locally through the refinery at Manali of Chennai Petroleum Corporation Ltd., a unit of IOCL.

Last year Chennai Customs Department allowed OPL (Off Port Limits) bunkering through a public notice outlining the procedures for bunker supply at anchorages/outer anchorages.

Along with this, Chennai Port is trying to set up an exclusive bunker terminal which crucial infrastructure was missing all these years. During March 2013, the Port signed a concession agreement with "Chennai Bunkering Terminal Pvt Ltd." a SPV formed by IMC Ltd. to develop a barge handling jetty under PPP mode. The licensee was expected to construct a jetty of 150 m × 15 m east of BD II with shore connection for handling bunker barges and edible oil vessels. But the licensee did not proceed with the project as planned and hence the Port has cancelled the license.

It is now proposed to develop an exclusive and integrated bunker terminal with berthing facilities and reserved land area for setting up bunker storage tanks.

### 9.1.4 Proposed Bunker Terminal

#### 9.1.4.1 ***Suggested Framework***

It is suggested that the Port can construct the berthing facility on its own instead of passing through the PPP mode. This berthing facility can be used by all the agencies interested in carrying out bunkering business at the Port for berthing their bunker tankers on first-come first- served basis. The Port can also reserve certain land area nearby for interested agencies to set up their storage tanks. The Port can provide ROW for requisite pipelines from the storage tanks to this berth. This will encourage better participation and fair play in the business.

#### 9.1.4.2 ***Traffic Potential***

It can be seen that during 2009 -10, Chennai Port experienced the maximum bunker traffic of about 1.75 lakh T. This was even without the basic infrastructure required. Subsequently, though, the volumes gradually dropped down. Now with the permission for OPL bunkering and with exclusive bunker terminal there is good prospects of the traffic picking up.

Matrix Bharat have indicated the potential for bunkering assuming stem sizes of 800 T for container vessels; 500 T for liquid bulk vessels; 400 T for break bulk and other vessels and 300 T for bulk carriers. The category wise vessel traffic at Chennai Port for the past 5 years is presented in the following **Table 1.8**. Taking the average and applying the stem volumes, the potential is established.

**Table 1.8 Chennai Port Vessel Traffic & Bunker Requirements**

| Vessel Category | 2010 - 11 | 2011 - 12 | 2012 - 13 | 2013 - 14 | 2014 - 15 | Avg | Stem | Bunker Need |
|---|---|---|---|---|---|---|---|---|
| Dry Bulk carriers | 309 | 223 | 183 | 165 | 175 | 211 | 300 | 63,300 |
| Liquid Bulk carriers | 502 | 507 | 460 | 429 | 427 | 465 | 500 | 2,32,500 |
| Break bulk vessels | 500 | 437 | 499 | 430 | 426 | 458 | 400 | 1,83,200 |
| Container vessels | 812 | 789 | 786 | 780 | 762 | 786 | 800 | 6,28,800 |
| Total | 2,123 | 1,956 | 1,928 | 1,804 | 1,790 | 1,920 | | 11,07,800 |

This gives a very optimistic picture of all vessels taking bunkers leading to a total traffic of over 1.0 MTPA. This may not happen. A realistic estimate of certain percentage taking the bunker could be taken – gradually growing from 10% onwards.

On the other hand, IOCL assumes a mean figure of 120 T stem per vessel which gives the possible traffic as 0.23 MTPA. This definitely appear feasible considering the earlier traffic of 1.75 lakh T during 2009-10.

### 9.1.4.3 ***Location of the Terminal***

It is proposed to locate the berthing facilities east of the existing barge jetty and parallel to the pipeline trestle leading to BD I & BD III. An area of about 2 ha can be made available for interested agencies for setting up their bunker tankage on the reclaimed land at the root of the northern breakwater of Bharathi Dock and east of the CFS. The location of the berthing facility and the area for the tank farm are shown in the following **Figure 1.21**.


**Figure 1.21 Locations of the Berthing Facility & Area for Tank Farm**

#### 9.1.4.4 ***Selection of Design Tanker***

From the information about the leading bunker suppliers at Indian Ports, Adani has 6 bunker tankers of sizes ranging from 400 T to 3000 T. Matrix Bharat has 11 bunker tankers of size ranging from 300 T to 1500 T. Most of the others have smaller tankers of size in the range of 300 T to 500 T. The sizes of some of the bunker tankers operating at Singapore are given in the **Table 1.9**.

**Table 1.9 Size of Some of the Bunker Tankers Operating in Singapore**

| S. No. | Name of vessel | DWT | LOA (m) | Beam (m) | Draft (m) |
|---|---|---|---|---|---|
| 1. | Marine Protector | 420 | 30 | 8.0 | 3.2 |
| 2. | Northeast Progress | 620 | 49 | 8.3 | 3.0 |
| 3. | Pacific Honour | 1,502 | 73 | 12.0 | |
| 4. | Foresa | 1,650 | 67 | 13.5 | 4.0 |
| 5. | Marine Priority | 1,783 | 50 | 12.0 | 4.0 |
| 6. | Marine Promise | 2,074 | 50 | 12.0 | 4.0 |
| 7. | Crown Fortune | 2,984 | 78 | 15.0 | 3.9 |
| 8. | Global Duri | 3,123 | 89 | 13.0 | 5.7 |
| 9. | Marine Matrix | 3,865 | 101 | 18.0 | 5.0 |
| 10. | Kitek 9 | 3,911 | 96 | 14.0 | 5.8 |
| 11. | Southern Pec 6 | 4,700 | 100 | 15.0 | 5.5 |
| 12. | Sea Swift | 4,998 | 92 | 15.0 | 5.6 |
| 13. | Pacific Wise | 4,999 | 90 | 16.0 | 5.0 |
| 14. | Sea Frontier | 4,999 | 104 | 15.0 | 4.0 |

The picture of a typical 1,600 T bunker tanker is given in **Figure 1.22**.

**Figure 1.22 A Typical 1,600 T Bunker Tanker**

Considering all these aspects, and also taking into account the fact that bunker traffic at Chennai Port is yet to pick up its full potential, it is suggested that the proposed berthing facility be designed to accommodate bunker tankers up to 5,000 T capacity of size LOA :100 m × Beam :15 m × Draft 5.6 m.

### 9.1.4.5 ***The Berthing Facility***

The location and layout of the berthing facility along with the approach is shown in the **Figure 1.23**.


**Figure 1.23 Location & Layout of the Bunkering Facility with Approach**

The berthing facility will be of an open piled structure with RCC cast–in-situ bored piles. Considering that the bunker tankers will be of a varied size, it is recommended to have a continuous berthing face so that two smaller tankers could be berthed concurrently. The length of the jetty will be 130 m considering the maximum tanker size of 100 m LOA. The structure will be designed to handle tankers of 5,000 DWT. The width of the jetty will be 15 m. The jetty will be provided with 30 T bollards at 15 m intervals and 600 mm super arch rubber fenders, also at 15 m centres. Though the structure will be designed for vessels up to 5.6 m draft, during the initial stages smaller vessels of less than 4 m draft will be operational. Since the available depth at this area is about 5 m no dredging will be required.

The topside facilities on the berthing jetty will just consist of a pipeline manifold with a continuous header with flanges at the centre of the berth and at quarter points so that two smaller tankers side by side and one large tanker could be handled. The transfer will be through rubber hoses only. The incoming pipelines of the various agencies will be linked to this header.

#### 9.1.4.6 ***Approach Trestle***

The berthing jetty will be connected to the shore by an approach trestle of 40 m length. It will have a 5 m wide roadway and a 2.5 m wide pipe rack. This will also be of open piled structure.

#### 9.1.4.7 ***Area for Tank Farm***

It is recommended that an area of about 2 ha. at the reclaimed land at the root of the northern breakwater of Bharathi Dock as shown in **Figure 1.23** be earmarked for location of bunker tank farm by interested agencies. This area could accommodate about 25,000 kL to 30,000 kL tankage with all infrastructures. IOCL have their own tankages at the Foreshore Terminal. This additional area will encourage interested agencies to set up their own tankage and use the berthing facility. This will also facilitate enhancing the bunker traffic at Chennai Port.

## 9.2 Crude Oil Imports

Chennai Port is presently handling the crude oil imports for the Manali Refinery of Chennai Petroleum Corporation Ltd. Chennai Petroleum Corporation Ltd. (CPCL) has a refinery at Manali with a present refining capacity of 11.1 MTPA consequent to the various debottlenecking initiatives as well as addition of Crude Distillation Units 2 and 3. The refinery imported 10.19 MT of crude during 2013-14 and 10.16 MT during 2014-15. The crude imports are handled through berth BD III in Bharathi Dock of Chennai Port. This berth is designed to handle suezmax tankers up to 150,000 DWT with 16.5 m draft. During 2014-15, out of the 10.16 MT handled, about 80% of the quantity was handled through suezmax tankers with an average parcel size of about 138,000 T.

CPCL had a proposal to increase the refining capacity by another 6 MTPA and for this purpose they considered a SBM terminal off Ennore for handling VLCC’s. However, this project has been put on hold for the present.

CPCL is currently laying a new 42" crude oil pipeline from the port to the refinery as the existing 30" pipeline, which was laid during 1969 when the refinery was commissioned, has developed leaks causing safety concerns. CPCL has initiated action the construction work. This pipeline will be laid from the BD III berth in Bharathi Dock of Chennai Port up to the refinery running for a length of about 17 km. The line will be laid along the Ennore Highway and Manali Highway. The relative locations of the refinery, Chennai port crude oil berth and the route of the new 42" pipeline are all shown in the **Figure 1.24**.

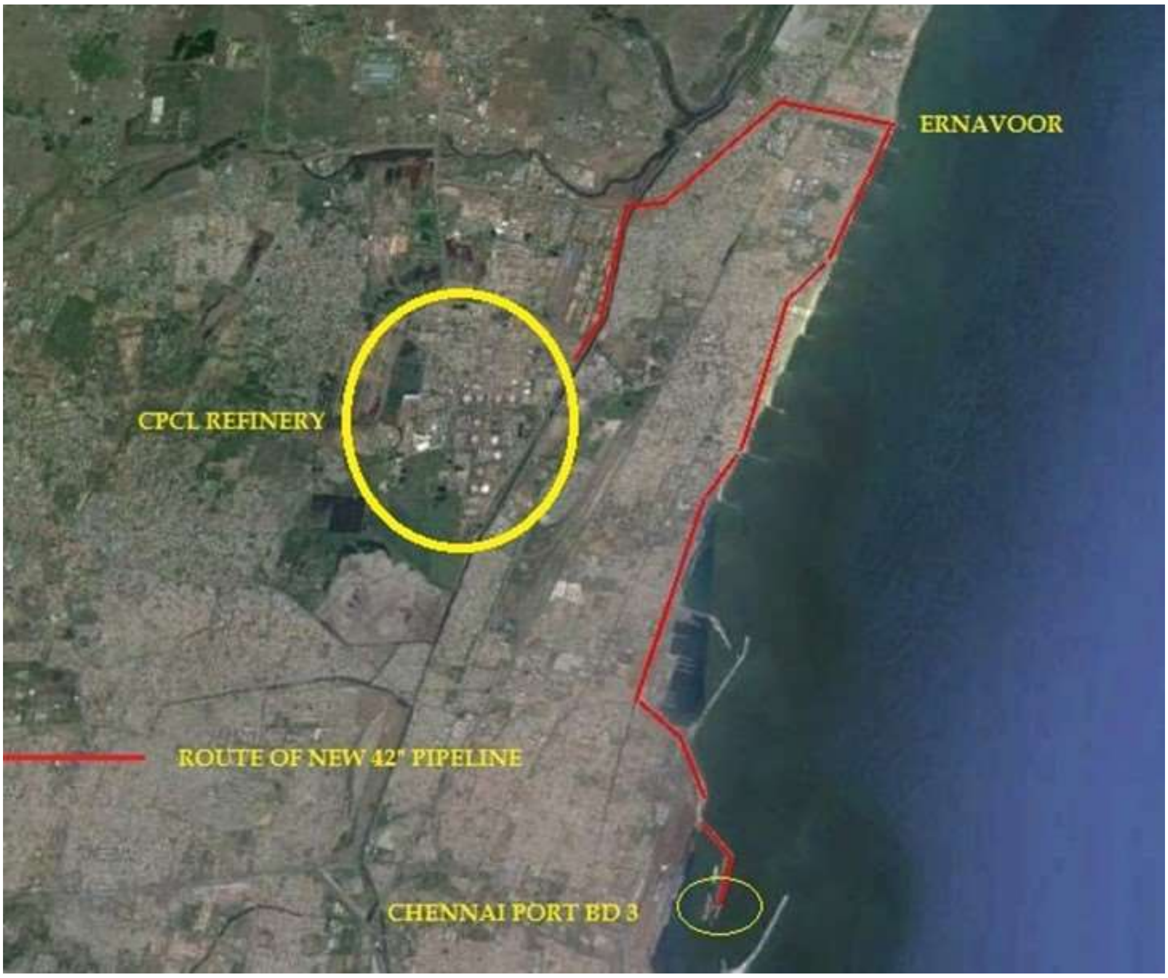



**Figure 1.24 Route of the New 42" Pipeline**

In view of this development, it has been suggested that if a SBM is located south of the earlier location with the feasibility of routing the submarine pipeline in such a way that the landfall point is located near Ernavoor at the junction of Ennore Highway and Manali Highway, this will avoid having a tankfarm at Ennore and laying a 23 km long cross country line within the city limits.

At Ernavoor the submarine pipeline from the SBM could be hooked with new the 42" pipeline leading to the refinery tankage. This SBM will have a double advantage – even with the present traffic, CPCL stand to gain through freight advantage which could be in the range of US $ 3 /T; as and when the refinery capacity expands, this SBM will be able to handle the entire crude imports, which BD III will not be able to handle.

The SBM could be located in water depths of about 32 m and at a distance of about 11 km from the Ernavoor Landfall point. Considering another 8 km from Landfall point to the refinery tankage, the total pumping distance will be about 19 km. However, this falls within the notified Navy Firing Practice Area as marked in the Naval Hydrographic Charts. Chennai Port has already taken this up with the Navy and the Navy is likely to shift their base to the south of the port thus clearing the way for the SBM.

The location of the SBM is shown in the **Figure 1.25**.

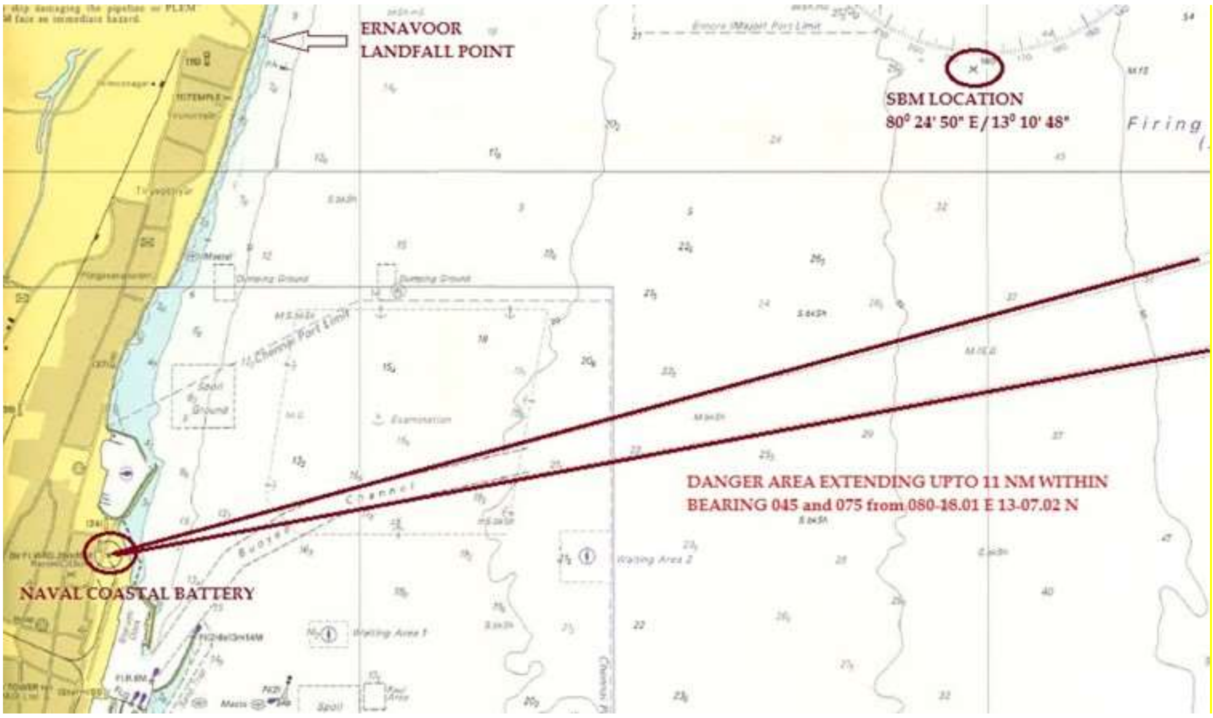



**Figure 1.25 Location of the SBM**

A technical note was prepared and sent to CPCL which was subsequently discussed between the Port and CPCL. It was then decided that a technical committee comprised of CPCL & ChPT will examine the technical and financial aspects and submit a report for further consideration.

This technical committee has since submitted its report. The summary of their report is as follows:

- Capital cost of the project based on budgetary quotes : Rs. 820 cr. (comprising Rs. 587 cr. for SBM system; Rs. 173 cr. for onshore tankage & accessories; Rs. 60 cr. towards other costs viz. contingencies, statutory fees, financing costs)
- Annual Operating & Maintenance costs Rs. 19 cr.
- Of the total crude imports of 10.5 MTPA, 6.7 MTPA (≈ 70%) will be handled through VLCCs
- The total freight savings per annum works out to Rs. 130 cr.
- With these parameters, the project IRR works out to 8.55%
- Hence this project is not viable and cannot be implemented.

It has to be noted that CPCL had a proposal for enhancing its capacity by 6 MTPA more which is presently put on hold. The “Concept Note on POL sector study under Sagarmala” by MoS/IPA also indicates that there will be an additional crude oil demand of about 72 MTPA in the next 10 years and CPCL would be required to enhance its capacity by 2025. At this stage, the existing facilities will not be able to handle the projected traffic and the setting up of the SBM terminal will become a necessity. The increased traffic will increase the freight savings and consequently the project IRR will increase beyond 15% making the project viable. Hence this SBM project is retained to be considered for 2025 timeline.

Meanwhile, CPCL is exploring a possibility of handling partly loaded VLCCs by utilizing the existing liquid berths as short term measure. This may fulfil in realizing the freight savings to CPCL without incurring any capital cost and without establishing the additional crude storage facilities at the Refinery through sharing crude between nearby refineries having SPM facilities.

## 9.3 POL Products

Presently, the imports of POL products for marketing purposes is being gradually shifted to Kamarajar Port as the oil companies are setting up their own marketing terminals at Ennore. Hence Chennai Port will be handling only the exports of surplus products.

With the commissioning of the 42” new crude oil line, the discharge rate of tankers will improve resulting in faster turnaround time. This will result in spare capacity in BD III.

If the refinery capacity is increased, the crude oil imports will be shifted to the SBM and the two oil jetties will be able to handle the increased product exports. Hence no additional facility will be needed.

## 9.4 Edible Oil

The edible oil traffic has been more or less stagnant at 1.0 MTPA. This traffic has been partially taken over by Krishnapatnam. However, by 2025 the traffic is expected to get doubled. It is essential for Chennai Port to streamline the handling of edible oil and provide additional facilities to attract the customers.

There are five customers on the northern side linked to the port, viz. Kaleesuwari Refinery, IMC, ISP, Ruchi and KTV. Their pipelines are linked to BD II, NQ and WQ. As it is unlikely that BD II will be used for either iron ore or coal handling due to environmental issues, the existing berth could be permanently be used for handling of edible oil tankers at one place. Considering the berth length two tankers could be handled simultaneously.

## 9.5 Steel Products & Other Dry Bulk

The traffic in steel products is about 1.4 MTPA. Steel products are presently handled at WQ berths; JD West berths and at SQ 1. The other dry bulk includes primarily limestone imports and dolomite exports. These cargos are presently handled mostly at JD West berths and to a limited extent at JD East berths.

The berths which handle this cargo are presently not fully equipped with requisite equipment to load/discharge the vessels. The available equipment’s are presented in the **Table 1.10**.

**Table 1.10 Ship Shore Cargo Handling Equipment**

| S. No. | Name of the Equipment | Name of the Berth | Operating Capacity |
|---|---|---|---|
| 1. | 2 no. Mobile Harbour Cranes | JD – 1,3 &5<br>WQ 1, 2, 3 & 4<br>Centre Berth & SQ 1 & 2 | 100 T |
| 2. | 4 no. Electric Level Luffing Wharf Cranes of 15 T Capacity of L&T Make | L&T 1 – JD3<br>L&T 2 – JD1<br>L&T 3 – WQ2<br>L&T 4 – WQ1 | 15 T |
| 3. | 15 T Jessop Make Electric Level Luffing Wharf Crane. Crane No J2 and J3 | J2 – WQ3<br>J3 – WQ4 | 15 T |

JD East consists of 655 m length and 123 m wide including the backup area of 15 ha. for the purpose of storage of transit cargo at the terminal. Currently, these berths handle about 5.2 MTPA.

The overall volume of steel handled at the port is expected to grow to 1.9 MTPA by 2020, 2.5 – 2.9 MTPA by 2025 and 3-5.5 MTPA by 2035 and limestone is expected to grow to 1.5 MTPA by 2020, 1.4 MTPA by 2025 and 1.2 MTPA by 2035. To cater to this future traffic, it is suggested for the conversion of JD East into Multi cargo terminal in phased manner. This project shall happen only if the Supreme Court does not allow handling of dusty cargo at the port and as a consequent proposed coal terminal at JD East berth could not be taken up.

The proposed development would involve the following:

- Jetty repair and replacement works with deepening of JD4 and JD 6 berth to 14 m depth below CD
- Procurement of 2 no. Harbour Mobile Cranes (HMC – 100 T capacity with Grab).
- Adequate no. of fork lifts, mobile cranes, pay loaders, Trailers/dumpers to be leased or provided by Stevedore.
- Yard paving, roads, drainage etc.
- Utilities like water, power, lighting, firefighting etc.

The proposed berths would be able to handle 2 to 3 ships simultaneously which could be handled either by ship's gear or by deploying the mobile harbour cranes. As these berths would mainly handle iron and steel products, aluminium ingots, pig iron, fertilizers, sugar etc., the average handling rate between ship to shore transfer shall be around 8,000 TPH. With mechanisation and development of integrated backup space the cargo would be handled more efficiently with faster turnaround of ships. The overall capacity of the berths would improve to about 6.2 MPTA. The overall capital cost of development is estimated as about Rs. 200 crores.

While JD east can cater to handling of proposed traffic for steel and other dry bulk, the possibility of utilising the BD II berth and the backup space for a fully mechanised fertilizer terminal could also be explored in case the fertilizer traffic picks up as a result of improved coastal shipping.

## 9.6 Containers

The container traffic also has been stagnating at about 1.5 MTEU for the past few years. This is only about 50% of the available capacity. The reasons are primarily due to the problems in evacuation of the containers and the competition from nearby ports. BCG has identified the problem and have suggested a couple of remedial measures.

One is to encourage the operator of CCTPL to increase the yard equipment to balance the dockside operations and the yard operations so as to ensure the smooth flow of containers. There is also a need to provide additional yard space for CCTPL. The adjacent iron ore terminal has already been decommissioned and there is no possibility to convert it to the coal terminal due to environmental issues, it is proposed that the possibility of allocating the backup area for this terminal to CCTPL to provide additional stacking space be explored.

The second is to develop a common railway yard to increase the volume of evacuation by rail to ease the road congestion. This yard could be developed in the southern side of the port where sufficient area is available for laying additional railway sidings.

## 9.7 Utilisation of Boat Basin and Timber Pond

### 9.7.1 Existing Details

The Boat basin/Timber pond is a shallow basin located in the southwest end of Ambedkar dock with a combined water spread area of about 60,000 $m^2$ out of which 13,000 $m^2$ constitutes timber pond. The depths in Boat basin vary from 4 m to 8 m which suits the navigational needs of port crafts. The Timber pond is much shallower with depths varying up to 4.0 m below chart datum. However, in the present times it is not of any substantial use. It appears to have been created during the first and second decades of last century.

The Boat basin is primarily used for parking of port crafts and for their afloat repairs. There is a slipway meant for underwater repairs of port crafts like tugs. In addition, there are small slipways meant for repair of small launches in a portion of boat basin called DPC yard as also some ramps for beaching of Catamarans. The Timber pond, an extension of boat basin with water spread having even shallower draft, was meant for handling of timber in the olden days. This activity is however not in vogue for the last over 50 years and was more in use as a shelter for small boats. The layout of boat basin follows a very irregular shape and appears as if it was created and developed based on the instincts and needs from time to time in the first half of last century. The layout is shown in the **Figure 1.26**.

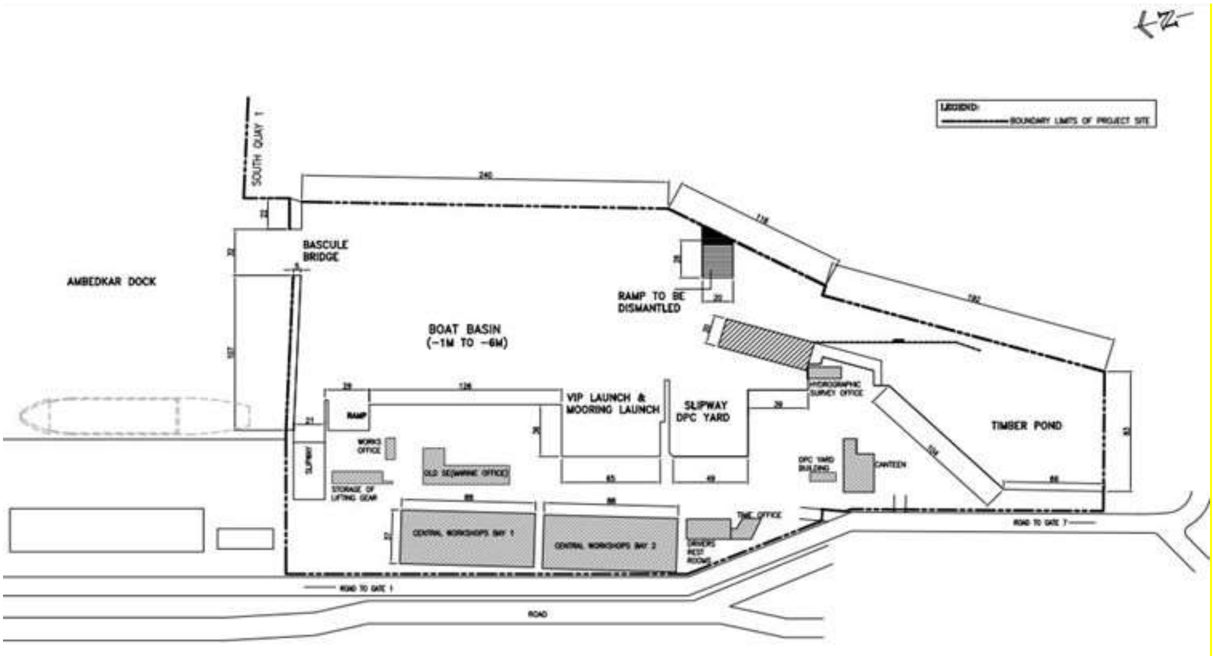



**Figure 1.26 Layout of Boat Basin/Timber Pond**

There are couple of alternative usages of this prime land and waterfront available to the port. These are discussed below.

### 9.7.2 Option 1 – Ship Repair Facilities

Chennai port has already got a feasibility report prepared by a consultant for developing ship repair/building facilities at Boat basin/timber pond. Based on the feasibility study, considering the length of the waterfront and the size of the basin area, Ship Repair facility could be developed not only to provide the required service to the shipping industry but also to maximize the Port revenue.

The advantage of the proposed project is the ready-made availability of basic infrastructure like water area, land area, a small slipway, the covered workshop facilities, access road, which could attract a future entrepreneur who can utilise these for start-up phase till the main facilities are built.

Based on the corresponding ship repair numbers and the ship calls to the ports on east coast, the ship repair traffic forecast have been arrived. Based on the above it is estimated that proposed dry docking facilities at Chennai port could share about 25% to 30% of the traffic.

In addition, it may be noted that the Indian vessels are the major sources of revenue for the Colombo dockyard. The main reasons for which the Indian vessels travel to Colombo is congestion at Indian docks as well as prompt repairs available at Colombo free of pre-berthing delays. Approximate number of vessels in the total ship-repair traffic at Colombo was 90, 80, 90, 110 and 80 in the years 2008, 2009, 2010, 2011 and 2012 respectively. It could be well assumed that the proposed dry docking facility could attract about 25% of the traffic diverted to Colombo by way of offering competitive facilities at faster turnaround time at competing rates.

Various alternatives with graving dock options and ship lift options were studied by the consultant, and it could be observed that graving dock option, though could handle larger ship size, and does not offer adequate dry dock days to meet the projected throughput of ship repair and ship building. The ship lift alternative offers the best solution to provide adequate dry and wet berths for ship repair as well as ship building activities duly optimising the limited available backup area. In this alternative, the side transfer arrangement has been proposed instead of longitudinal transfer. This allows for providing total 5 dry berths and also additional area for locating workshop facilities.

The proposed ship repair facilities with Shiplift system are shown in the **Figure 1.27**.

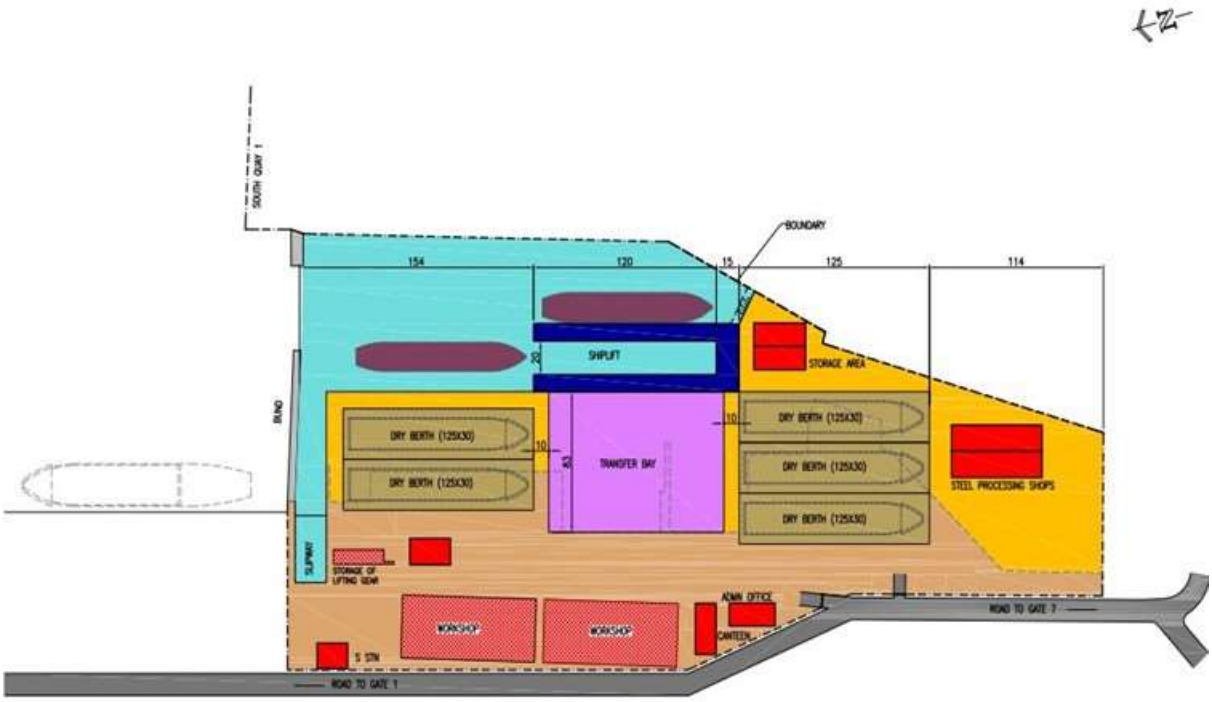



**Figure 1.27 Proposed Layout of Boat Basin/Timber Pond – Shiplift**

However, this proposal by port did not get a favourable response by the industry due to involvement of very high capital cost and gloom in the ship building industry.

### 9.7.3 Option 2 – Development of Marina

Considering the location, available water area and nearness to the main city, the Boat Basin and Timber Pond is an ideal location for an urban marina; probably one of the most ideal locations on the whole east coast. Only few issues as below would need to be addressed:

1. The port is not a clean environment and yachtsmen do not like having their yachts covered in grime. However, a properly managed marina will have mechanisms in place to minimise this negative aspect.
2. This area is inside the port security zone. This situation is unacceptable for a marina which, by definition, implies leisure use and visits by family and friends. The obvious solution is to move the ISPS line such that the west side of the Boat Basin and Timber Pond and their onshore areas are no longer subject to this regime. There would be no need to affect the land on the east side of the Basin & Pond because yachtsmen would not need to access that side.
3. Boats would still have to pass through the port's ISPS waters when moving to and from the marina but this should not be a problem because it is a situation that occurs in hundreds of ports worldwide, and anyway such boats will be under visual and radar observation throughout by the port control tower.

To develop this into an international class marina and waterfront, the land on west side has to be suitably planned for:

- Modern yacht club
- Boating-related commercial retail premises (e.g. chandlers, sea school, boat sales, cafe).
- A boatyard for servicing the yachts.
- Hotels / Restaurants
- Adequate car parking in support of the foregoing
- Extensive landscaping so as to create a pleasant environment.


**Figure 1.28 Proposed Layout of Marina at Timber Pond / Boat Basin**

## 9.8 Development of Outer Harbour for Navy

There is a requirement from India Navy to get additional berthing and repair facilities for their vessels. It is proposed that an outer harbour to the Chennai port could be developed, which shall provide about 1600 m of quay length and about 100 Ha of reclamation area towards the eastern side of approach channel for use by Indian Navy. The indicative layout plan of the outer harbour is shown in **Figure 1.29**.

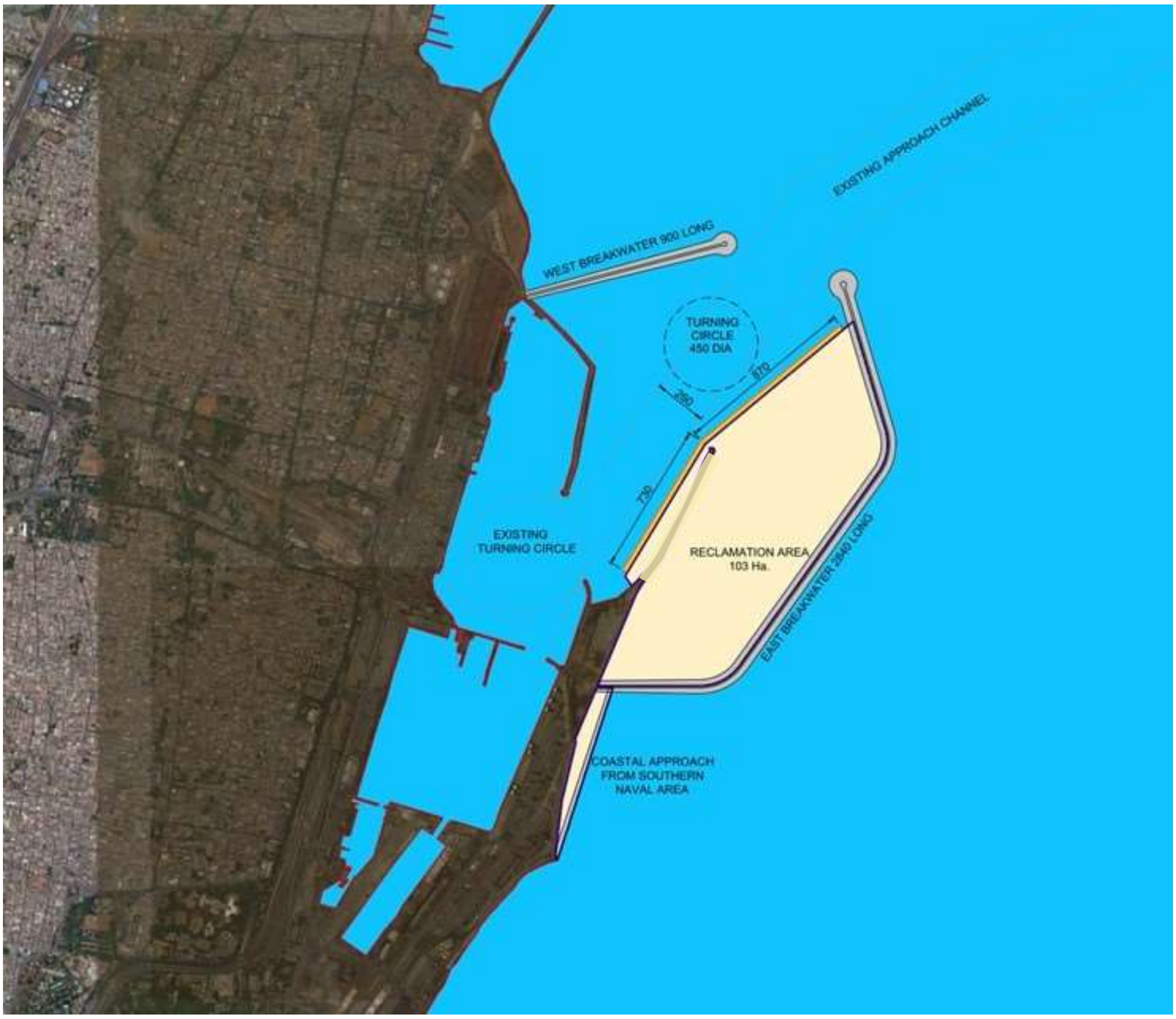



**Figure 1.29 Indicative Layout of Proposed Outer Harbour and Navy Facilities**

The lee side of the proposed western breakwater could be used for developing berths for liquid or other cargo subject to demand. The overall layout can be further refined once the explicit requirements from Navy are known.

# 10.0 SHELF OF NEW PROJECTS AND PHASING

As part of the Chennai 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.

## 10.1 Ongoing Projects

The details of the projects which have already been awarded and development is ongoing are given below in **Table 1.11**.

**Table 1.11 Ongoing Projects**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (INR in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Development of Common Rail yard inside the port | - | 19 | Port's Funds |

## 10.2 Projects to be completed by Year 2020

The details of the projects which are envisaged to be completed by year 2020 are given in **Table 1.12**.

**Table 1.12 Projects to be Completed by Year 2020**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (INR in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Development of Bunker Berth at Bharathi Dock | 1.0 | 44 | Port's funds |
| 2. | Development of Dry Dock at Timber Pond/Boat basin<br>or<br>Development of Marina | - | 500 | PPP |
| 3. | Upgradation of JD East Berths and Paving of the Backup Area | 1.0 | 90 | Port's funds |
| 4. | Development of Coastal Terminal | 1.1 | 80 | Port's funds |

## 10.3 Projects to be completed by Year 2025

The details of the projects which are envisaged to be completed by year 2025 are given in **Table 1.13**.

**Table 1.13 Projects to be Completed by Year 2025**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (INR in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Conversion of JD East into Multi cargo Berth | 1.0 | 110 | PPP |
| 2. | Development of BD II back- up area for Additional Container Storage or Developing BDII berth and backup space as fully mechanised Fertilizer terminal | 2.0 | 100 | PPP |
| 3. | SBM Terminal at Chennai | 10.0 | 600 | PPP |

# Appendix 1 - **BCG Benchmarking Study for Chennai Port Trust**

# Master Plan for Cochin Port

Prepared for

## Ministry of Shipping / Indian Ports Association

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| | | | | |
| | | | | |

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# 1.0 Introduction

## 1.1 BACKGROUND

The Sagarmala initiative is one of the most important 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 the 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 a larger economic diverse.

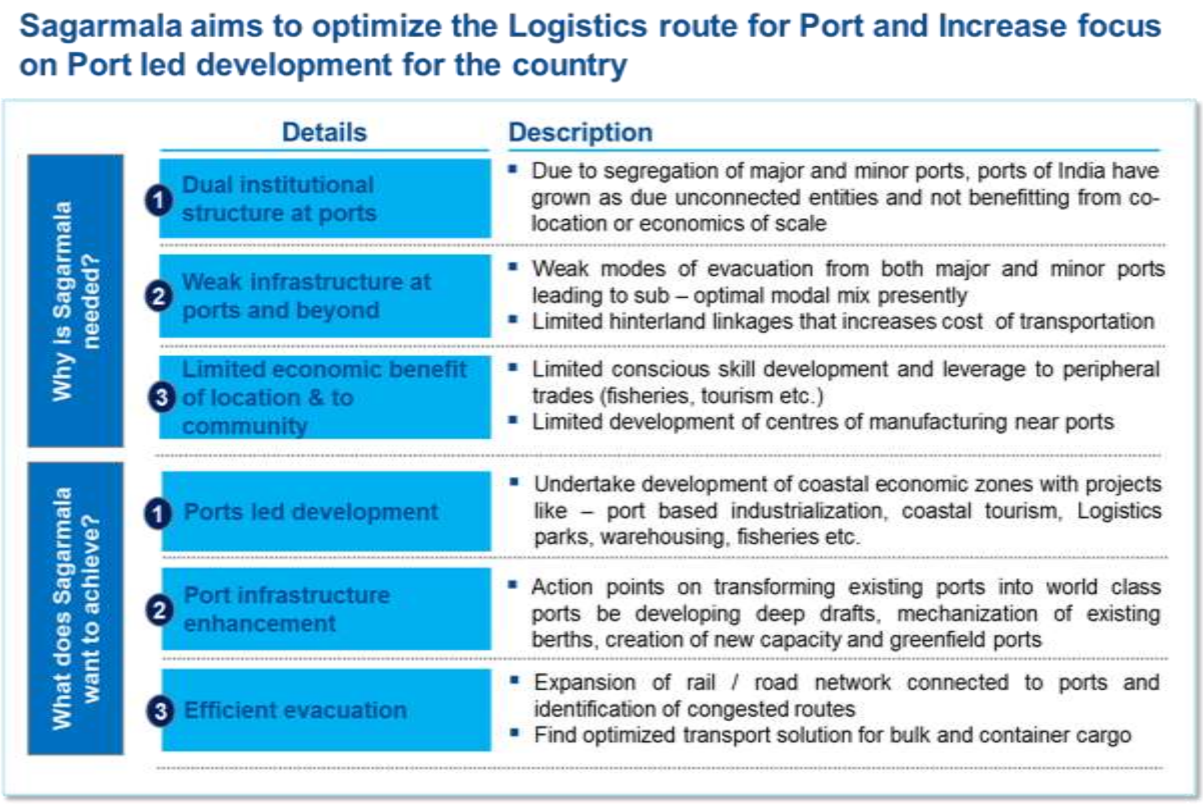



**Figure 1.1 Aim of Sagarmala Development**

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**.

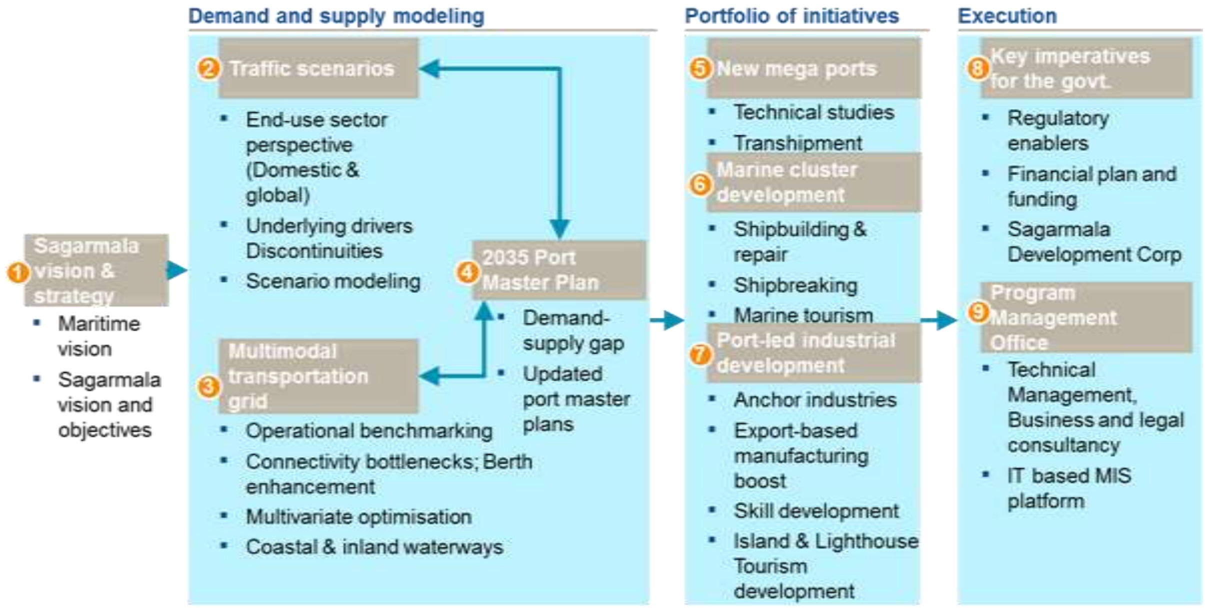



**Figure 1.2 Governing Principles of Our Approach**

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**.

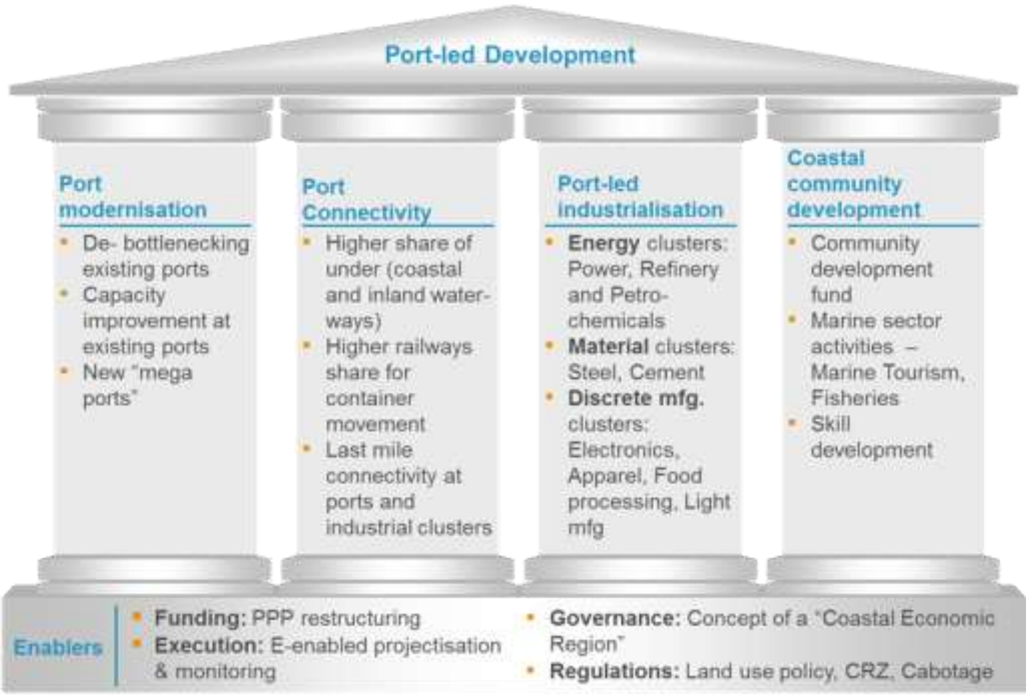



**Figure 1.3 Port Led Developments**

## 1.3 PRESENT SUBMISSION

The present submission is the Master Plan for Cochin Port. This report is organised in the following sections:

| | |
|---|---|
| Section 1 | : Introduction |
| Section 2 | : The Port and Site Conditions |
| Section 3 | : Details of Existing Facilities |
| Section 4 | : Performance, Options for Debottlenecking & Capacity Assessment |
| Section 5 | : Details of Ongoing/ Planned Developments |
| Section 6 | : Traffic Projections |
| Section 7 | : Capacity Augmentation Requirements |
| Section 8 | : Scope for Future Capacity Expansion |
| Section 9 | : Shelf of New Projects and Phasing |

# 2.0 The Port and Site Conditions

## 2.1 COCHIN PORT AS AT PRESENT

Cochin Port is one of the 12 major ports in India and is located on the south-west coast of India, in the state of Kerala at 9°58‘N and 76°14‘E (**Figure 2.1**). The Port of Cochin is an all-weather natural Harbour. The location of the port offers calm and placid channels for ships throughout the year, even during the Monsoon season.


**Figure 2.1** **Location of Cochin Port**

### 2.1.1 Road Connectivity

Cochin is connected to other states through the following national highway network.

- NH 17 – Cochin to Panvel takes off from Edapally at Cochin.
- NH-47 – Salem to Kanyakumari Passes through Cochin.
- NH 49 – Cochin to Madurai/ Dhanushkodi, takes off from NH 47 from Kudanoor at Cochin.
- NH 47 A – National highway link connecting Willingdon Island and NH 47 at Kudanoor.

All-important destinations in India whether on the North, West or East could be accessed through any one of these Four National Highways as shown in **Figure 2.2**.


**Figure 2.2 Road Connectivity to Cochin**

### 2.1.2 Rail Connectivity

Port facilities located on Willingdon Island are served by a 8 km long section of broad gauge which branches off at Ernakulum from the main line to Shoranur - Trivandrum. While, International Container Transhipment Terminal (ICTT) on Vallarpadam Island is connected to Edapally, a suburb in Cochin City through an 8.86 km long rail corridor. The ICTT Vallarpadam railway link also has longest rail bridge in India, i.e., 4.62 km. This rail link is very crucial for the operations of ICTT as is exclusively used for container traffic to and from the terminal as shown in **Figure 2.3**.

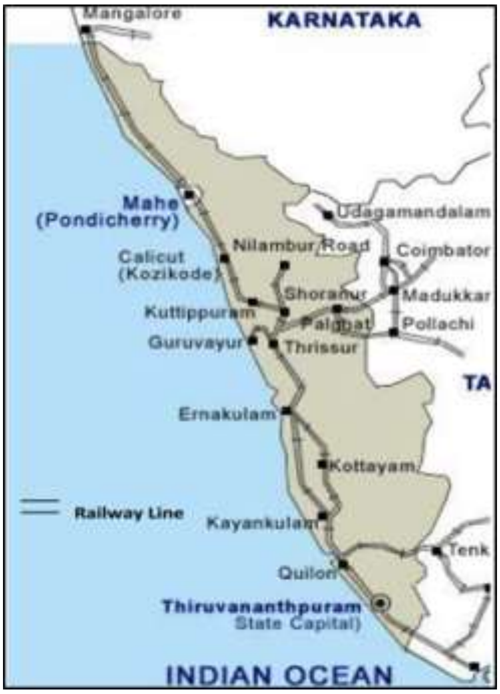



**Figure 2.3 Rail Connectivity to Cochin**

### 2.1.3 Inland Waterways

Cochin is accessible through a series of interconnecting waterways, canals and lagoons which allow movement of barges and crafts between Alleppey and Quilon in the south and Porur in the north. The main linkages are provided by the West Coast Canal, the Udyogamandal Canal and the Champakkara Canal. Of these, the west coast canal is the most significant in terms of potential capacity.

## 2.2 SITE CONDITIONS

### 2.2.1 Meteorology

The climate at Cochin is governed by the monsoons. In the months June-September, the south-west monsoon occurs, followed by the north-east monsoon during the months of October, November and December. The months of January and February marked as winter period, while March to May is usually the hot weather period.

#### 2.2.1.1 Winds

The wind speed and wind direction is determined by the season and by the daily temperature differences between land and sea. The predominant wind direction during the monsoon period i.e., from June to September is west to south-west and the effect of land breeze is not dominant during this period.

During the non-monsoon periods, the predominant wind direction is from north-east during the morning and west during the evening, which shows influence of land breeze. The Wind Rose diagram at Cochin Port is presented in **Figure 2.4**.

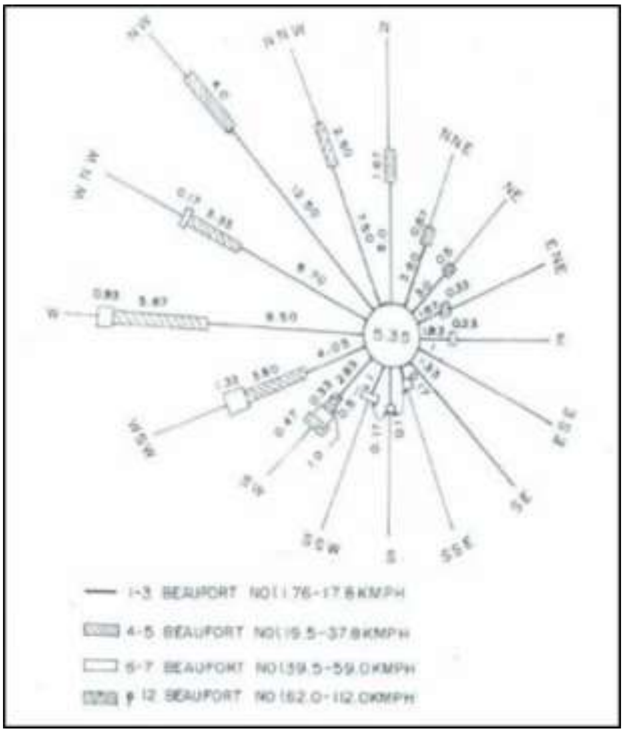



**Figure 2.4 Wind Rose Diagram**

The month-wise predominant and extreme wind directions, as per the long term meteorological data collected by the Indian Meteorological Department over the past 40 to 50 years period, are presented in **Table 2.1**. The maximum wind velocity given is the highest ever in that particular month considered over a period of 40/50 years' observations.

The maximum wind speed observed was of the order of 112 KMPH from WSW direction.

**Table 2.1 Wind Data at Cochin Port**

| Month | Observed Wind Maximum Velocity | | % time speed Exceeded 20 KMPH | Predominant Direction |
|---|---|---|---|---|
| | KMPH | Direction | | |
| January | 58 | SSE | 10 | W |
| February | 53 | N | 20 | W |
| March | 80 | SSW | 26 | W |
| April | 88 | SSW | 23 | W |
| May | 112 | WSW | 23 | W |
| June | 86 | WNW | 13 | W |
| July | 93 | SW | 13 | NW |
| August | 93 | NNW | 16 | NW |
| September | 77 | WNW | 15 | NW |
| October | 67 | NNW | 6 | W |
| November | 69 | WNW | 5 | W |
| December | 64 | SSE | 3 | W |

## 2.2.1.2 Rainfall

The maximum rainfall usually occurs during the monsoon period i.e., from June to September. The annual rainfall in the region varies between 2500 to 3500 mm. The maximum rainfall recorded over a 24 hour period was 240 mm. The average monthly distribution of the rainfall is presented in the **Table 2.2**.

**Table 2.2 Average Monthly Distribution of Rainfall on Willingdon Island**

| Month | Rainfall (mm) | |
|---|---|---|
| | Maximum | Minimum |
| January | 85 | 0 |
| February | 11 | 0 |
| March | 64 | 6 |
| April | 201 | 35 |
| May | 553 | 39 |
| June | 702 | 387 |
| July | 1063 | 514 |
| August | 536 | 104 |
| September | 513 | 199 |
| October | 503 | 199 |
| November | 305 | 75 |
| December | 276 | 1 |

#### 2.2.1.3 Air Temperature

Annual temperatures range between 23° and 31° C (73° and 88° F) with the record high being 36.5° C (97.7° F), and record low of 16.3° C (61.3° F).

#### 2.2.1.4 Visibility

Generally, the visibility at the port location is very good, except a few days during monsoon and winter season.

### 2.2.2 Oceanography

#### 2.2.2.1 Tides

Cochin experiences semi diurnal tides with marked by daily inequality. The tides enter harbour basin through Cochin Gut and propagates southwards and northwards to the extremities of the basin and the tidal prism is estimated to be 100 million cum. About 75% of the tidal prism moves to south and balance to north. The tidal levels as per Naval Hydrographic chart No. 2004 are as follows.

- Mean Highest High Water Level (MHWL) + 1.20 m
- Mean Lowest High Water Level (MLHWL) + 0.80 m
- Mean Sea Level (MSL) + 0.60 m
- Mean Highest Low Water Level (MHLWL) + 0.60 m

- Mean lower Low Water Level (MLLW) + 0.30 m

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

#### 2.2.2.2 Currents

The currents along the coast of Cochin consist of tide, wave and wind induced components. As per observations the maximum current velocities at the Cochin Gut during the non-monsoon periods is of the order of 3 knots, which could increase to as high as 5.5 knots during the monsoon periods. Inside the harbour the current velocities are low, of the order of 0.5 knots only.

#### 2.2.2.3 Waves

The wave climate is governed by the South West monsoon with prevailing wave directions from north-west to south-west. Deep water (15 m) wave observations in the past indicate the significant wave heights of 4 m, 2 m and 1 m at the water depths of 10 m, 5 m and 2 m respectively, the predominant wave direction being west.

Wave action inside the harbour is insignificant because of narrow entrance between Cochin Gut and Fort Cochin and the configuration of the land.

Generally calm conditions prevail throughout the year except during the times of extreme wind action.

#### 2.2.2.4 Salinity

The salinity of the harbour waters varies with the season due to the influx of fresh water from the rivers. During the monsoon, the salinity can be almost negligible, whereas during the dry season the water can become as saline as the outer sea. The sea-water analysis is given below:

- pH value : 6.7
- Chlorides : 14350 ppm at 5.10 m depth; 14310 ppm at 30.68 m depth
- Sulphates : 1974 ppm at 5.10 m depth; 1981 ppm at 30.68 m depth
- Suspended sediments : 0.2 mg/litre to 12.4 mg/litre

#### 2.2.2.5 Mud banks

Mud banks are unique geological phenomenon confined to the Kerala coast. The mud banks are not stationary and have a tendency to move in the coastal region. These are formed during the southwest monsoon and the sea water has concentration of suspended mud at the surface up to 1200 mg/l and at the bottom up to 1500 mg/l. The important constituent of the mud banks are silt, clay and very little sand. To the immediate north of Cochin, mud bank is reported at Narakkal and to the south at Manasseri / Chellanam. It is reported that the mud bank at Narakkal plays an important role is silting of the Cochin Harbour Channel.

#### 2.2.2.6 Siltation

Littoral drift takes place during both the monsoons as a result of which the channel experiences siltation. This gets compounded when material from the mud banks finds its way to the entrance channel during the flood tides. The sediments getting deposited in the Cochin port and immediate offshore are cohesive sediments and are essentially composed of fine clays.

Bar formation at the entry of the port is a natural phenomenon and takes place during the south west monsoon season. Hence, annual maintenance dredging needs to be resorted to in order to keep the necessary depths and widths in the navigational channel.

#### 2.2.2.7 Bathymetry

The seabed slopes gently in the offshore region and is about 1 in 500/600. A sequential overlay analysis of the various isobath maps generated over the past few decades shows progressive changes of the contour pattern with time. A seaward movement of the contours up to over 1 km has been noted. A significant consequence of this is the accretion of a vast stretch of land on the western side of Vypeen which has come up gradually during the last few decades.

# 3.0 Details of Existing Facilities

## 3.1 GENERAL

The port has many facilities for cargo handling which include wharfs at Mattancherry and Ernakulam, Container Terminal at Vallarpadam, LNG Terminal at Puthuvypeen and Single Point Mooring (SPM) at an offshore location and a cruise terminal (**Table 3.1**).

**Table 3.1 Berthwise Details**

| S. No. | Name of Berth | Length (m) | Draft (m) | Max Size of Ship (DWT) | Commodities Handled |
|---|---|---|---|---|---|
| 1. | Single Point Mooring | | 22.5 | 3,00,000 | Crude |
| 2. | COT | 250 | 12.5 | 1,15,000 | Crude / POL |
| 3. | NTB | 213 | 9.1 | 30,000 | POL |
| 4. | STB | 170 | 9.1 | 20,000 | POL |
| 5. | Ernakulam Wharf (Q5-Q6) | 250 | 10.0 | 20,000 | Dry Cargo / CBFS |
| 6. | Ernakulam Wharf (Q7) | 250 | 10.5 | 60,000 | Dry Cargo |
| 7. | Ernakulam Wharf (Q8-Q9) | 250 | 11.0 | 60,000 | Dry Cargo |
| 8. | Fertilizer Berth ( Q10) | 207 | 10.7 | 60,000 | Fertilizers/Phos./Acid |
| 9. | SCB | 170 | 9.1 | 15,000 | Liquid Bulk |
| 10. | NCB | 410 | 9.1 | 35,000 | Dry /Liquid Bulk |
| 11. | BTP | | 10.0 | 35,000 | Dry /Liquid Bulk |
| 12. | Mattancherry Wharf (Q1-Q3) | 180 | 9.1 | 16,000 | Dry Bulk |
| 13. | Mattancherry Wharf (Q4) | 180 | 9.1 | 65,000 | Dry /Liquid Bulk |
| 14. | ICTT Vallarpadam (V2-V3) | 335 | 14.5 | 1,10,000 | Containers |
| 15. | LNG Puthuvypeen | 320 | 12.5 | 1,20,000 | LNG |

## 3.2 NAVIGATION CHANNEL

The main inward shipping channel divides the port into Ernakulam and Mattancherry channels. The Ernakulum Channel is 4.90 Km long, with the width varying from 250 to 500 m and has a draft of 12.5 m up to the Oil Terminal and Q8 / Q9 and a draft of 9.14 m up to the wharves and the north and south tanker berths. The 1024 m long Ernakulam Wharf has six alongside berths, five for general cargo and a fertilizer berth. Besides there are three oil berths in the Ernakulum channel. The Mattancherry channel is 4.08 km long, with the width varying from 180 to 250 m and a draft of 9.14 m except at Boat Train Pier where the draft is 10.0 m. On the Mattancherry Channel there are four alongside berths, for general cargo, one Boat Train Pier and two jetties for miscellaneous cargo.

The National waterway 3 passes through the inner harbour. Other regional waterways and ferry service routes are also passing through inner harbour.

## 3.3 BERTHING FACILITIES

### 3.3.1 Berths at Ernakulam and Mattancherry

The 1,024 m long Ernakulam Wharf has six alongside berths, five for general cargo and a fertilizer berth. Besides these, there are three oil berths in the Ernakulum channel. The Mattancherry Wharf consists of four alongside berths, for general cargo, one Boat Train Pier and two jetties for miscellaneous cargo. The locations of the berths are shown in the following **Figure 3.1** and details are given in **Table 3.1** above.


**Figure 3.1 Existing Facilities**

### 3.3.2 ICTT Vallarpadam (V2-V3)

The International Container Transhipment Terminal (ICTT) at Vallarpadam SEZ has been developed as a container transhipment terminal (**Figure 3.2**). It can handle container ships of 8000+ TEU capacities having draft of 14.5 m. The project has been executed on BOT basis by M/s. India Gateway Terminal Pvt. Ltd, a subsidiary of M/s Dubai Port World (DPW). The first phase of the ICTT consisting of a 600 m berth was commissioned on Feb. 2011. The details of the ICTT Terminal – Phase 1 and Final Phase are shown in **Table 3.2**.

This terminal is planned to have a berth length of 1,800 m to handle about 3 million TEUs of container traffic in the ultimate stage.

**Figure 3.2 Existing and Planned Facilities - ICTT (V2-V3)**

**Table 3.2 ICTT Parameters**

| Terminal Parameters | Current Configuration | Final Configuration |
|---|---|---|
| Capacity | 1 million TEU's | 4 million TEU's |
| Quay Length | 600 m | 1800 m |
| Terminal Size | 40 ha. | 115 ha. |
| Depth Alongside | 16 m (MSL) | 16 m (MSL) |
| Max Draft | 14.5 m (13.5 m) | 14.5 m (13.5 m) |
| Max LOA | 350 m | 350 m |
| Container Yard | 2,800 TEU's ground Slot | 15,000 TEU's ground Slot |
| Rail Tracks | 2 | 2 |
| Reefer Points | 450 Points (415 V, 3 Phase AC) | 450 Points (415 V, 3 Phase AC) |
| Super Post Panamax | 4 | 18 |
| Rubber Tyred Gantry cranes | 15 | 54 |

The infrastructure of this Container terminal is planned to be developed in three phases as below.

- In the first phase the terminal has built a container berth of 600 m Quay length with a draft of more than 15 m, and the terminal is designed and equipped to handle 1 million TEU containers annually. This phase became fully functional in Feb 2011. The traffic of Phase 1 was originally envisaged to happen in 2012 itself.

- In the second phase the capacity is designed to be enhanced to 3 million TEUs. This was originally envisaged to happen by 2014.

- In the third phase the terminal may handle up to 4 million TEUs.

### 3.3.3 Kochi LNG Terminal (Petronet LNG Limited)

The Kochi LNG Terminal Jetty and trestle is situated in the western reaches of the port area and is designed to receive LNG Tankers ranging from 65,000 to 2,16,000 $m^3$ (Q-Flex LNG tankers) with provisions for expansion up to 260,000 $m^3$ (Q-Max LNG tankers). The location and details are presented in **Figure 3.3** and **Table 3.3**.

**Figure 3.3 Kochi LNG Terminal**

**Table 3.3 LNG Berth Parameters**

| Vessel/Berth Criteria | Berth Limitations |
|---|---|
| Maximum Vessel length overall | 320 m |
| Maximum Allowable Draft alongside | 12.5 m |
| Maximum Beam | 50.0 m |
| Maximum Vessel displacement on Arrival | 1,50,500 T |
| Maximum Cubic Capacity (LNG) | 2,16,000 $m^3$ |
| Jetty Alignment | 063° - 243° |

### 3.3.4 Single Point Mooring for Crude Oil Import

Kochi Refineries Ltd. (BPCL – KRL) has set up a Single Point Mooring System (SPM), at a water depth of 30 m, about 19 km from the coastline at Puthuvypeen, as captive reception for the import of Crude oil. The Single Point Mooring of M/s BPCL (KR) is located in position Latitude 09° 59' 49.93" N; Longitude 076° 02' 30.73" E within the limits of Cochin Port.

The facility is capable of receiving Very large Crude Carriers (VLCCs) of 3, 00,000 DWT. The SPM is connected by a 48 inch submarine pipeline of 19.5 km to tank storage facilities at Puthuvypeen comprising of 4 tanks of 80,000 KL each. The total area of the facility is 70 ha, which provides room for two more storage tanks of 80,000 Kl capacity. The facility became fully operational in December, 2007.

Vessels calling for discharge at the SPM are to anchor 2.5 miles south of the S.P.M, where a port pilot will board the tanker.

### 3.3.5 International Cruise Terminal

Cochin Port has an International Cruise Terminal as shown in **Figure 3.4** . The facilities include an air-conditioned Passenger Lounge, Customs and Immigration Counters, Luggage Counter, Public Address system, Drinking Water and Modern Toilets. The air-conditioned Passenger Facilitation Centre, named “Samudrika”, has an area of 1,500 sqm and a 4,500 sqm. Convention Centre, named “Sagara”, alongside the Cruise Jetty at NCB.  The Seaport Immigration Check Post is equipped with APIS to enable speedy clearance of passengers.  Around 40 cruise vessels call at Cochin every year.

The facility is also used during the non-cruise season for hosting conventions and exhibitions.


**Figure 3.4 Kochi International Cruise Terminal**

## 3.4 STORAGE FACILITIES

The Cochin port has sufficient storage area to support its operations. There are 11 sheds and 7 warehouses (**Figure 3.5**) for cargo storage covering a cumulative area of 65,000 $m^2$ (**Table 3.4**).

**Figure 3.5 Storage Sheds at Mattancherry and Ernakulam Wharf**

**Table 3.4 Details of Cargo Storage Facilities**

| **Covered Area (Transit Sheds and Overflow sheds)** | | |
|---|---|---|
| **Location** | **Total Sheds** | **Area (Sqm)** |
| Mattancherry Wharf | 6 | 19,160 |
| Ernakulam Wharf | 4 | 13,200 |
| Container Freight Station | 1 | 10,000 |
| **Grand Total** | **11** | **42,360** |
| **Covered Area (Warehouses)** | | |
| **Location** | **Total Sheds** | **Area (Sqm)** |
| Mattancherry Wharf | 4 | 11,800 |
| Ernakulam Wharf | 1 | 2,980 |
| Cement Godown | 1 | 1,000 |
| BTP | 1 | 6,000 |
| **Grand Total** | **7** | **21,780** |

# 4.0 Performance, Options for Debottlenecking & Capacity Assessment

## 4.1 GENERAL

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

**Table 4.1 Cargo Handled During Last 5 Years (in 000 T)**

| Commodity | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|---|---|---|---|---|---|
| **Liquid Bulk** | | | | | |
| ■ Crude Oil | 8,863 | 10,027 | 10,186 | 10,228 | 10,746 |
| ■ POL | 3,318 | 3,983 | 3,709 | 4,093 | 3,271 |
| ■ LNG | - | - | - | 115 | 395 |
| ■ Liquid Ammonia | 38 | 23 | 21 | 68 | 163 |
| ■ Sulphuric Acid | - | 9 | 8 | 35 | 10 |
| ■ Phosphoric Acid | 154 | 100 | 143 | 154 | 82 |
| ■ Benzene | 45 | 31 | 6 | 18 | 18 |
| ■ Methanol | 56 | 58 | 112 | 77 | 80 |
| ■ Others | 8 | 8 | 14 | 44 | 51 |
| **Total** | **12,482** | **14,239** | **14,199** | **14,832** | **14,816** |
| **Dry Bulk** | | | | | |
| ■ MOP | 76 | 59 | 22 | 36 | 68 |
| ■ Urea | - | 56 | - | - | - |
| ■ Sulphur | 194 | 171 | 148 | 148 | 173 |
| ■ Rock Phosphate | 158 | 145 | 183 | 123 | 204 |
| ■ Cement | 259 | 350 | 311 | 604 | 703 |

| Commodity | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|---|---|---|---|---|---|
| ■ Coal | 40 | 34 | 28 | - | 98 |
| ■ Riversand | - | - | - | 32 | 163 |
| ■ Shredded Scrap | 27 | 27 | 29 | 27 | - |
| ■ Zinc Concentrate | 77 | 49 | 82 | 33 | 11 |
| ■ Others | 69 | 136 | 112 | 89 | 67 |
| **Total** | **900** | **1,027** | **915** | **1,092** | **1,487** |
| **Break Bulk** | | | | | |
| ■ Defence Cargo | 2 | 1 | 2 | 1 | 1 |
| ■ Machinery | - | - | - | - | 11 |
| ■ Iron & Steel | - | 43 | 14 | 6 | 16 |
| ■ Timber logs | 61 | 64 | 95 | 156 | 11 |
| ■ Project cargo | 2 | 2 | 1 | 2 | 1 |
| ■ Others | 7 | - | 12 | 13 | 6 |
| **Total** | **72** | **110** | **124** | **178** | **46** |
| **Containers** | | | | | |
| ■ TEUs | 3,12,189 | 3,37,053 | 3,34,925 | 3,46,204 | 3,66,377 |
| ■ Weight | 4,419 | 4,715 | 4,607 | 4,785 | 5,246 |
| **Grand Total** | **17,873** | **20,091** | **19,845** | **20,887** | **21,595** |

## 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 Cochin Port is given in the **Appendix 1**. The key observations are also discussed in the following paragraphs.

According to them, high dredging costs, management overheads and pension expenses are the factors driving pressure on profits. Dredging costs and Management overheads comprise ~60% of total operating income. Additionally, the Port has a retirement benefits liability to the labour base on account of pension and employee benefits payable.

Almost 90% cargo is handled by six private dedicated terminals. However, there is low berth utilization across these terminals, which is one of the key sources of financial pressure.

The report indicates that the ICTT has only achieved 10% of the target set for trans-shipment in last three years due to its geographic location, lack of cost competitiveness w.r.t Colombo, small parcel size etc. Thus it was suggested to increase the parcel size whereby attracting cargo from a wide hinterland, to deal with inland transport challenges via road and rail and cost in-competitiveness to reach Cochin. In addition, certain policies need to be drafted in the interest of port and people, so that the port can attract cargoes from its natural hinterland.

Currently ~1.7 MT of rice and wheat are transported into Kerala for storage and public distribution in Kerala by FCI through rail from North India and Andhra Pradesh. Rail transport from North India to Cochin is currently more economical than a multi-modal option involving transport by rail from Punjab/Haryana to Kandla followed by coastal movement to Cochin Port. Higher cost on the coastal route is primarily on account of high labour handling and bagging costs at Cochin Port. To deal with this, it is suggested for mechanization of food grains in dry bulk and containerization of food grains in bags as relevant.

The study identified that Kerala imports of ~0.5 MTPA, via Ports of Tuticorin and Mangalore due to cost advantage. In order to attract this cargo, Cochin port must provide tariff incentives; improve productivity by mechanisation and provision of bagging facility.

POL is the largest cargo by volume handled at Cochin Port. With the planned expansion of BPCL refinery from 10 MTPA to 16 MTPA, the current occupancy of SPM of 43% will reach to about 69%, close to acceptable norms. However, given the increase in exports of POL products (5.9 MTPA), berths occupancy of NTB and SCB will reach about 88%. To cater to increased demand, it is required to improve performance of POL handling at these berths by reducing time taken for sampling and testing, which may be done by putting a lab within the premises of port area; decreasing time taken for Export documentation may be achieved by adopting e-system; decreasing the time taken by vessel during the shifting of vessel from one berth to other to handle different commodities and re-deployment of marine loading arm to reduce idle time on account of shifting vessels.

## 4.3 CAPACITY ASSESSMENT 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 stackyard, number of users, grades, capacity of evacuation system etc.

### 4.3.2 Capacity of Berths

The capacity of existing berths is calculated 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 ports to minimise the pre-berthing detention are given in **Table 4.2.**

**Table 4.2 Recommended Berth Occupancy**

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

The available berths and the cargo handled at each of the berths during last year are presented in **Table 4.3**

**Table 4.3 Berth Occupancy**

| S. No. | Berth Name | Cargo Handled | Total Cargo Handled (T) | No. of Ships | Avg. Parcel Size (T) | Standard Time at Berth (Days) | Current Handling Rate (TPD) | Berth Occupancy |
|---|---|---|---|---|---|---|---|---|
| 1. | BTP | Dry/Liquid Bulk | 4,92,089 | 43 | 11,444 | 74.4 | 6,612 | 23% |
| 2. | COT | Crude/ POL Products | 16,09,849 | 92 | 17,498 | 152.6 | 10,548 | 46% |
| 3. | LNG | LNG | 2,61,521 | 4 | 65,380 | 10.3 | 25,438 | 3% |
| 4. | NTB | POL Products | 14,39,864 | 143 | 10,069 | 209.0 | 6,888 | 63% |
| 5. | Q1 | Breakbulk | 2,32,716 | 18 | 12,929 | 105.4 | 2,208 | 32% |
| 6. | Q10 | Breakbulk | 4,69,498 | 25 | 18,780 | 126.4 | 3,715 | 38% |
| 7. | Q2 | Breakbulk | 54,696 | 5 | 10,939 | 20.9 | 2,611 | 6% |
| 8. | Q3 | Containers | 8,775 | 22 | 585 | 0.4 | 20,714 | 0% |
| 9. | Q4 | POL | 2,27,172 | 58 | 3,917 | 47.7 | 4,761 | 14% |
| 10. | Q5 | Breakbulk | 62,004 | 7 | 8,858 | 11.4 | 5,453 | 3% |
| 11. | Q6 | Breakbulk | 22,212 | 1 | 22,212 | 6.8 | 3,252 | 2% |
| 12. | Q7 | Breakbulk | 89,476 | 23 | 3,890 | 29.8 | 3,007 | 9% |
| 13. | Q8 | Breakbulk | 3,61,879 | 24 | 15,078 | 115.2 | 3,142 | 35% |
| 14. | Q9 | Breakbulk | 14,779 | 10 | 1,478 | 19.6 | 755 | 6% |
| 15. | SCB | Liquid cargo | 1,79,985 | 27 | 6,666 | 28.2 | 6,379 | 9% |
| 16. | SPM | Oil | 1,05,49,031 | 97 | 1,08,753 | 157.1 | 67,146 | 48% |
| 17. | STB | POL Products | 32,590 | 5 | 6,518 | 5.8 | 5,624 | 2% |
| 18. | V2 | Containers | 30,14,985 | 268 | 11,250 | 256.8 | 11,740 | >50% |
| 19. | V3 | Containers | 24,67,736 | 257 | 9,602 | 314.0 | 7,859 | >50% |

# 5.0 Details of Ongoing/Planned Developments

## 5.1 GENERAL

Cochin Port Trust has taken slew of developmental projects which are in various stages of implementation. The locations of these projects are shown below in **Figure 5.1**. Some of them are discussed in this section.

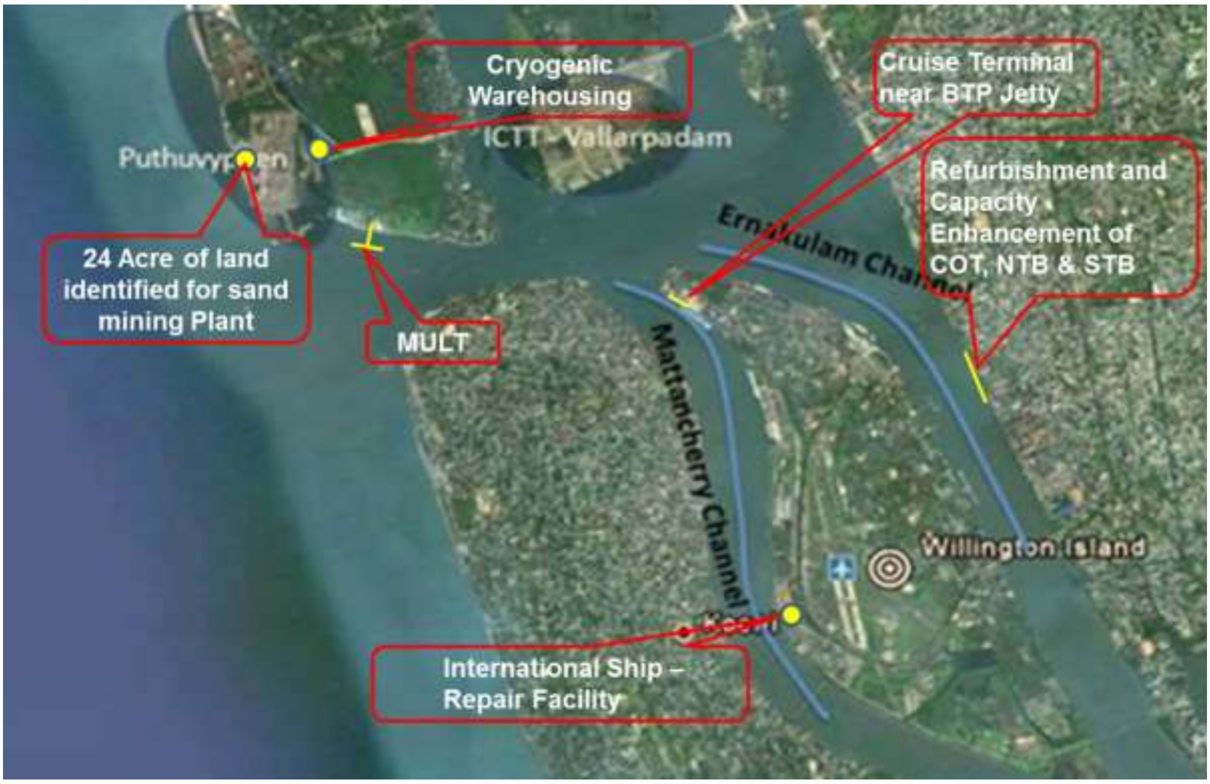



**Figure 5.1 Location of Ongoing Developments**

## 5.2 DEVELOPMENT OF AN INTERNATIONAL SHIP REPAIR FACILITY

The Port has awarded development of an international ship repair facility to Cochin Shipyard Limited (CSL) with an estimated investment of Rs. 970 crores. The facility is being developed on 41 acres of land on the western side of Willingdon Island along the Mattancherry channel. The facility will have a dry dock (66m × 12.5 m × 4m), slipway and a Shiplift with transfer system for 6 vessels. The Shiplift system would be approx. 120m long, with a 30 m wide lifting platform, with capacity to handle light ship weights up to 6,000 T, LOA 130 m and beam 25 m. The facility will enable ships visiting Cochin Port to undergo both floating as well as docking repairs.

## 5.3 MULTI USER LIQUID TERMINAL (MULT)

LPG is currently imported at NMPT by IOCL and transported by road to Kerala for local consumption. This poses a safety hazard as LPG is highly combustible and numerous accidents have taken place during transportation via road. Accordingly, there is heavy pressure to move LPG off roads to avoid accidents.

Several options were explored for handling LPG with the existing port infrastructure; however, the combustible nature of the commodity poses a severe challenge in using of existing infrastructure. Existing POL berths COT and NTB are close to Ernakulam where handling of LPG is a safety concern. The existing LNG terminal set up by Petronet for LNG is under-utilized, however, the terminal has not granted permission to IOCL to handle LPG due to safety concerns.

Hence, a new facility would be required to handle LPG at Cochin Port. Cochin Port Trust and Indian Oil Corporation Limited are jointly developing 4.52 MTPA Oil cum LPG Jetty at Puthuvypeen as shown in **Figure 5.2** below. When complete, it can berth vessels with LOA up to 230 m, 13 m draft and 80,000 DWT. The berth will be captive to IOCL for 161 days a year and available to the Port for the remaining period of 204 days a year.

The jetty, when functional, will give access to 100 acres of tank farms in the Puthuvypeen Port based SEZ. 21 acres of this SEZ has already been allotted to BPCL and HPCL.

The jetty will also serve as an international Bunkering Terminal for supplying bunkers to vessels calling at the port as well as at the anchorage. The Commerce Ministry has sanctioned INR 15 crore as assistance under ASIDE for a barge jetty adjacent to the MULT Jetty for bunkering, which can handle barges with capacity ranging from 500 to 2,500 DWT.

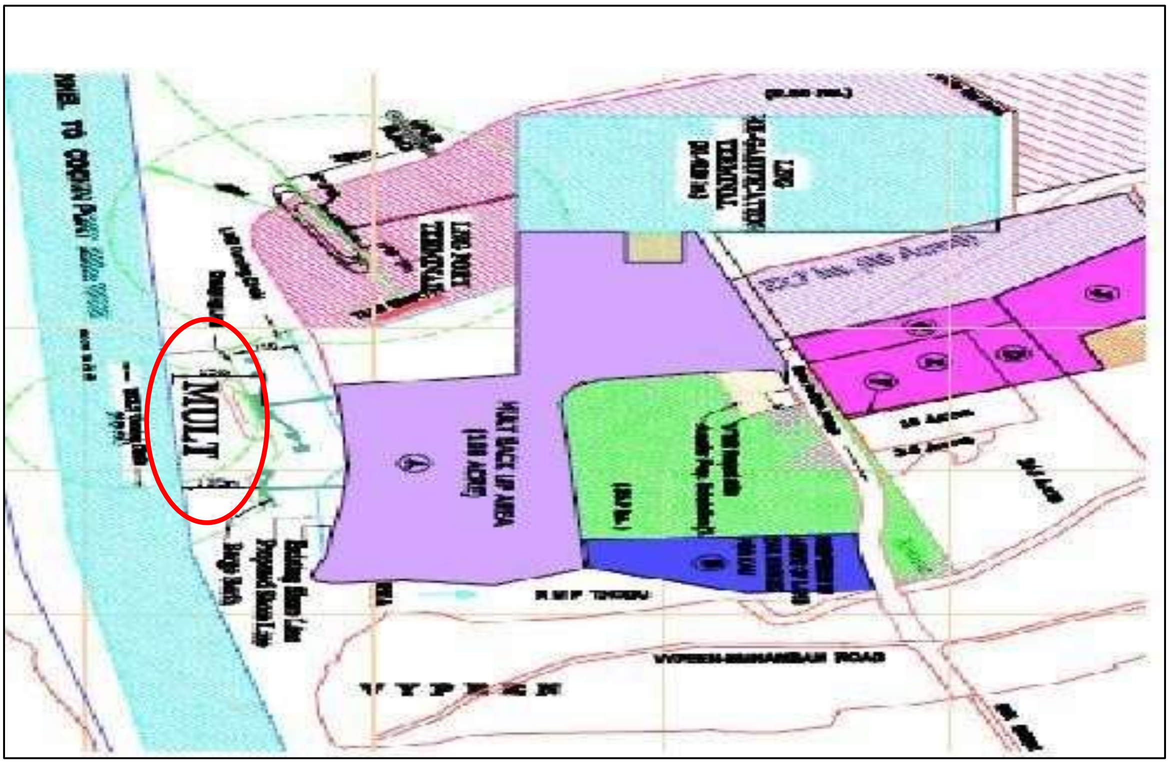



**Figure 5.2 Location of Multi User Liquid Terminal**

## 5.4 DEVELOPMENT OF CRUISE TERMINAL CUM EXHIBITION /CONVENTION HALL NEAR BTP JETTY

Cochin figures prominently in the cruise itinerary of all the major cruise lines like Carnival Cruise Lines, Royal Caribbean International and their sister affiliates. As a leading cruise destination of India, every year Cochin hosts on an average 35-45 cruise call and depending on the ship size between 500 to 3,000 international guests per call.

Buoyed by this consistent increase in the cruise tourist arrivals, Cochin Port has created a dedicated facilitation centre to cater to discerning cruise tourists. This full-fledged modern cruise terminal facility called – Samudrika - built adjacent to the all-weather BTP berth caters to the cruise ships calling at Cochin Port.

Cochin Port is also now developing a dedicated Cruise Terminal by extending the BTP/ NCB berth with the financial assistance provided by the Ministry of Tourism for INR 22.43 crores as shown in **Figure 5.3**.

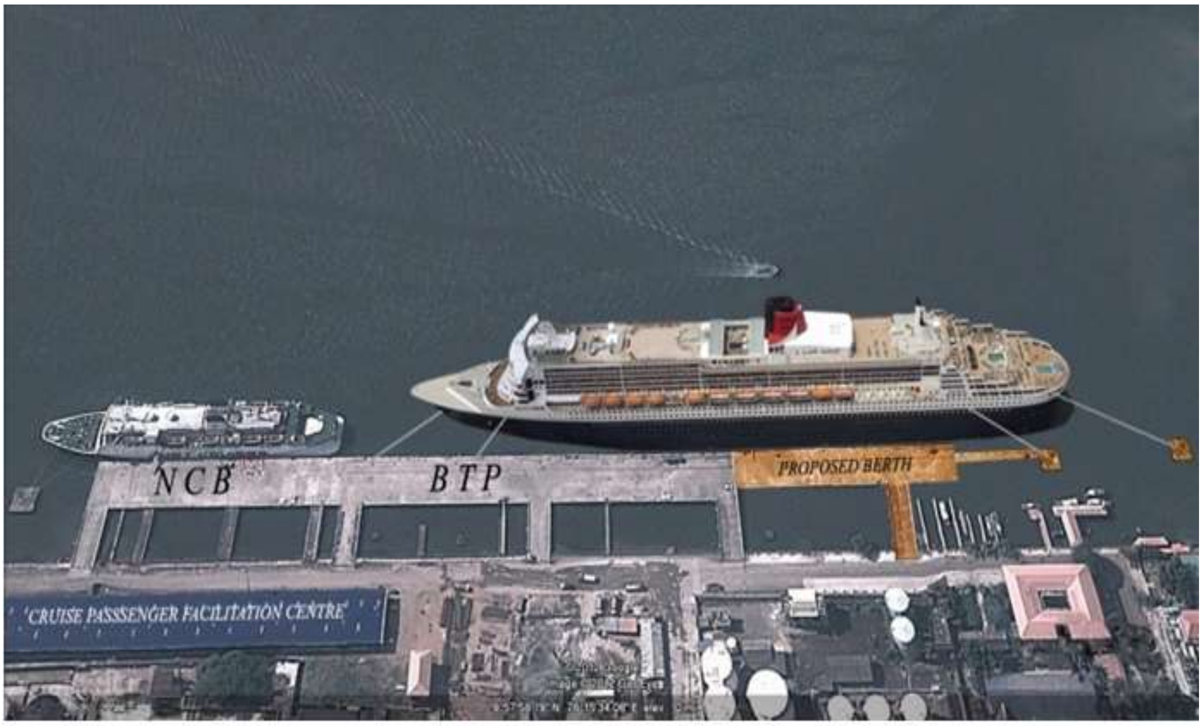



**Figure 5.3 Location of Proposed Cruise Berth**

## 5.5 REFURBISHMENT AND CAPACITY ENHANCEMENT OF COT, NTB & STB

Cochin Port has awarded this project for INR 22.45 crores. Ministry of Shipping has sanctioned INR 14.9625 crores under assistance to Coastal Shipping Berth. The balance is being funded by BPCL. The work will be completed by September, 2016. Apart from this, the port is taking up refurbishment of STB for BPCL for handling plant fuel by laying heat traced pipelines.

## 5.6 BITUMEN COMPLEX

The Port is negotiating with HPCL for developing a bitumen handling facility in the site adjacent to Q4 terminal. This will serve the requirements of Kerala when Kochi Refinery stops production of bitumen.

## 5.7 STUDY FOR IMPLEMENTING NAUTICAL DEPTH CONCEPT IN COCHIN PORT

Many ports around the world have a problem with silt, liquid mud, deposited in the channel. Liquid silt has the characteristic of prohibiting navigation if it reaches a certain density. However, in most ports, silt with a density of 1,250 kg/l (1.2 $T/m^3$) and more is not navigable. The depth at which this density is found is called the Nautical Depth.

It is important to note that the sediment prevailing in Cochin channels is very fine comprising about 40% clay. The mean sediment diameter generally varies from 0.002 mm to 0.006 mm and has low density. Thus it may be relevant to study characteristic of the sediment and utilize the concept of nautical depth to reduce the maintenance dredging expenditure.

Cochin Port Trust engaged an agency for carrying out detailed study on Siltation at the Port Channels and Basins for facilitating implementation of Nautical Depth concept in the Port. The main objective of the study is to recommend parameters for implementation of nautical depth concept, so that actual depth of dredging required to be reduced.

## 5.8 DECONGESTING VALLARPADAM

Cochin Port has taken up the conversion of second GIDA Bridge as an ROB and the construction of a flyover in front of the exit gate of the ICTT on the LHS of the NH - 47C on Vallarpadam to decongest the area at a cost of INR 60 crores (**Figure 5.4**). The work is expected to be completed by September, 2016. Apart from this, the port is developing a truck parking terminal on Vallarpadam in association with HPCL.

**Figure 5.4 Construction of ROB to Ease Congestion**

## 5.9 CEMENT HUB

Cochin Port is fast emerging as a cement hub with Ambuja Cements Limited, Ultratech Cements Limited, and Zuari Cements Limited all having Cement handling terminals. Penna Cements Limited has started construction of their facility and is expected to commission it by April, 2017, while Malabar Cements Limited is in a preliminary stage.

## 5.10 GRAIN TERMINAL

Kerala's consumption of rice is near about 39 lakh T/year whereas it produces only 5 lakh T/year. Considering that Kerala imports 34 lakh T of rice per annum from other states (17 lakh T by FCI and 17 lakh T by private parties) apart from 3 lakh T of wheat and pulses, the Port is trying to catalyse investments in BOT mode for a mechanised grain terminal.

## 5.11 CARGO PARK

The port is trying to develop 1 million sqft. of warehousing space to attract traffic. The Port has earmarked 45 acres of land for the purpose.

## 5.12 SAND MINING PROJECT IN COCHIN PORT

Cochin Port Trust has been exploring methods of reducing the net expenditure on maintenance dredging. One of the possibilities in this regard is to utilise the material obtained from maintenance dredging. It is estimated that around 4 million cubic metres of sand per year is being dredged from the area around Vypeen. This area extends about 5 km into the shipping channel from the Vypeen Gut.


**Figure 5.5 Sand Mining Location**

The Port has secured Environmental Clearance to use the dredged spoils for beach nourishment.

It is now proposed to use this sand for construction purposes after segregating and subjecting it to washing. This will be done on a PPP (DBFOT) basis. Around 24 acres of land is available to the west of the LNG terminal in Puthuvypeen for locating the necessary plant and machinery.


**Figure 5.6 Location of Availaible Land - West of LNG Terminal**

When the LNG terminal runs at 5 MTPA, it will produce 2.4 MLD of de-mineralized water. This could be procured for washing operations on mutually acceptable terms from the Petronet LNG Ltd.

The Port proposes to call a tender-cum-auction for a sand mining operation to be located on this land; the period of the concession will be for 10 years. The Port will undertake the dredging and deliver the sand to this area by means of pipelines.

The bidding parameter will be the premium that the bidders offer to the Port over and above the rate charged by the Port as fixed by the Port from time to time for the dredged sand.

## 5.13 CRYOGENIC WAREHOUSING

Cryogenic warehousing proposed is basically for perishable products like vegetables, meat, fish as also for pharma products.

The business of an LNG terminal consists of importing, storing and regasification of LNG. The process involves handling of LNG at –160° C. As a synergy many LNG terminals world over are establishing cryogenic warehouses for multiple products – perishable and other valuable products adjacent to LNG Terminals. In the process it recovers "waste cold" from LNG Terminals. The facilities will be in line with the requirements for cold storage by significantly raising the temperature from -160 ° C to -70 ° to +10° thus meeting the cooling demand of a refrigerated food warehouse and recovering the waste heat.

An area of 10 acres in Puthuvypeen next to the LNG terminal has been earmarked for setting up cryogenic warehousing using the cold energy available from the regasification process that can be used for creation of a zero $CO_2$ emission cold-chain hub.


**Figure 5.7 Location of Cryogenic Warehouse**

The Ministry of Shipping and the Ministry of Agriculture are spearheading a project to set up cold chain hubs at Ports with LNG terminals like such as Cochin Port, so that they could be developed as Perishable Handling Centres and Perishable Port Gateways.

The support from Government of India for this venture is as under:

- Fast-track Customs and phyto-sanitary clearances.
- Access to low interest fund of INR 5,000 crores from WIF from the National Centre for Cold Chain Development under the Ministry of Agriculture.
- Access to National Clean Energy Fund.
- Credit linked subsidy at 35% (upto 50%) for cold chain infrastructure.
- Investment linked 150% tax deduction.
- Automatic route clearance for 100% FDI with ECB route open.
- Service Tax exemption for warehousing or transporting of agriculture produce.

There is therefore an opportunity to utilize the earmarked area on PPP (DBFOT) basis to build and operate cold chain facilities after tying up with PLL for the cold energy.

## 5.14 TEA PARK

Around 15 million Kg of tea gets transacted in a year at Willingdon Island in Cochin Port. However, most of the existing tea processing operations are undertaken in a traditional manner with considerable scope for improvement.

Cochin Port Trust would like to take up the development of a Tea Park with world-class infrastructure on the lines of the Dubai Tea Trading Centre to increase the quantity of tea transacted to 25 million Kg a year on PPP (DBFOT) basis.

10 acres of land on Willingdon Island has been earmarked for the same. The Tea Park would have the following operations:

1. Auction centre
2. Warehousing of teas and packing materials required for tea packaging.
3. Temperature controlled warehouses.
4. Offices for tea companies, who are users of Cochin Port.
5. Factory facility for tea companies for value added production.
6. Common blending and bulk packing facilities for tea.
7. Offices for shipping companies to bring production and export under one roof.

There is scope for funding such a development under ASIDE operated by the Department of Commerce, Government of India even for projects structured in the PPP format.

## 5.15 RO-RO FACILITY FOR TRANSPORTING CAR & CARGO BEARING TRUCKS

Kerala is a great market for cars. The congestion on the roads is now opening up an opportunity for operating coastal Ro-Ro services for transporting cars.

Mundra to Cochin is a 5 day voyage while Cochin to Ennore is a 7 day voyage. Original Equipment Manufacturer's) OEMs like Maruti, GM, Ford, Tata, and Honda could be potential clients on the Mundra to Cochin to Ennore run while Hyundai, Nissan, Toyota, Ford, Renault could be the clients on the Ennore to Cochin to Mundra run.

Cochin Port offers good storage yards and concessional Port charges for committed, regular Ro-Ro runs.

# 6.0 Traffic Projections

## 6.1 GENERAL

Cochin is located on the south-western coast of India and serves the southern hinterland of the country primarily Kerala. Cochin currently handles ~21.4 MTPA of cargo out of which liquid cargo- POL, LNG and LPG forms the major chunk at 14 MTPA while the other commodities including containers, fertilizers, coking coal, etc. form a small share of the total traffic.

Going into the future we expect to see the total traffic handled at this port to go upto 41-43 MTPA by 2025 and 52-60 MTPA by 2035 driven primarily by the expansion of the BPCL refinery, LNG and LPG imports and growth in container volumes.

## 6.2 MAJOR COMMODITIES AND THEIR PROJECTIONS

### 6.2.1 POL

POL crude and product constitute the biggest portion of traffic handled at the port. Cochin handles approximately 10 MTPA of crude for the BPCL refinery out of which approximately 8 MTPA is imported and the remaining is coastal shipping of domestic crude production e.g. Bombay High to Kochi. POL products coastal and EXIM traffic form the remaining share.

Going forward, crude oil import is expected to rise from ~10 MTPA to ~15.5 MTPA considering expansion plans for BPCL refinery. BPCL currently has an installed capacity of 10 MTPA and is expected to expand to 16 MTPA by 2025. Kochi LNG regasification terminal is expected to operate at capacity in the next 5 years adding ~5 MTPA in the total traffic. LPG imports are expected to rise to ~1 MTPA by 2025 with government's focus on distribution of LPG connections to rural households. The split of the current POL traffic and the projected traffic for 2025 is shown in **Figure 6.1**.

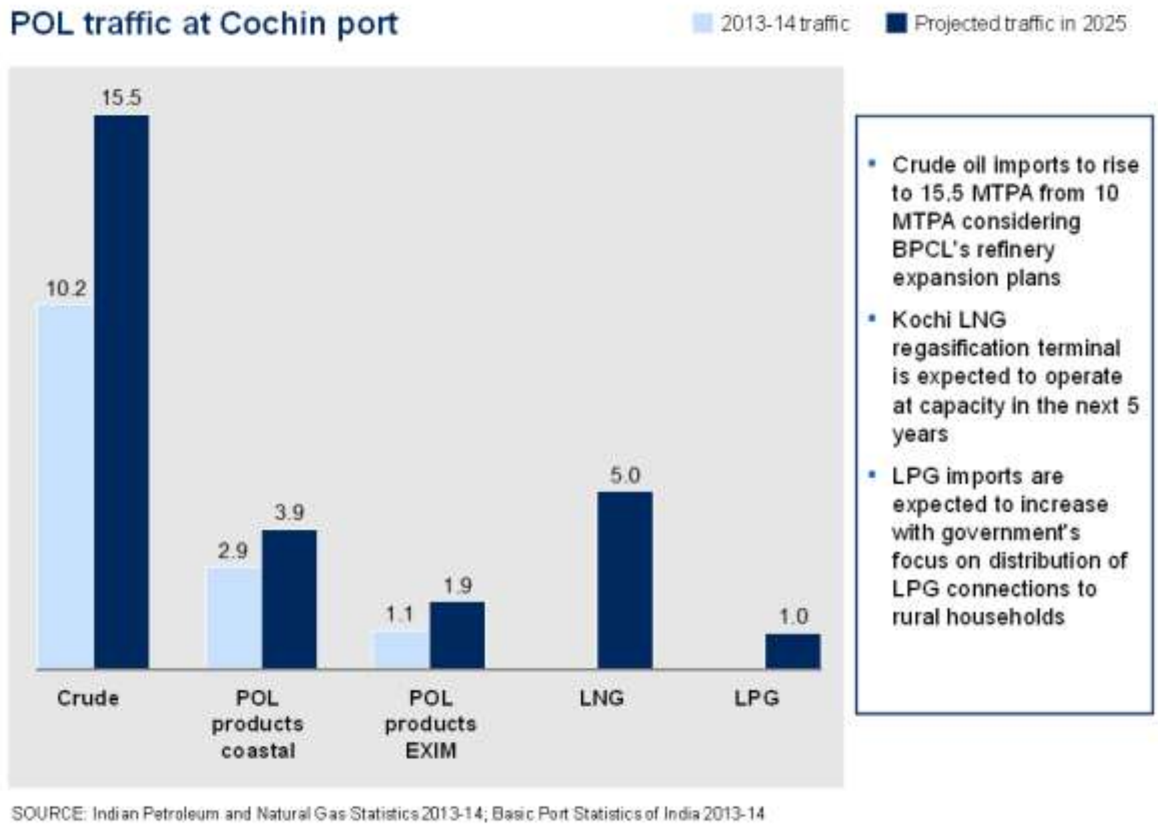



**Figure 6.1 POL Traffic at Cochin Port**

### 6.2.2 Containers

The port currently handles 0.35 MTEUs of containers serving the primary hinterland of Kerala. Kochi, Allepey and Kollam contribute ~85% to this traffic (**Figure 6.2**).

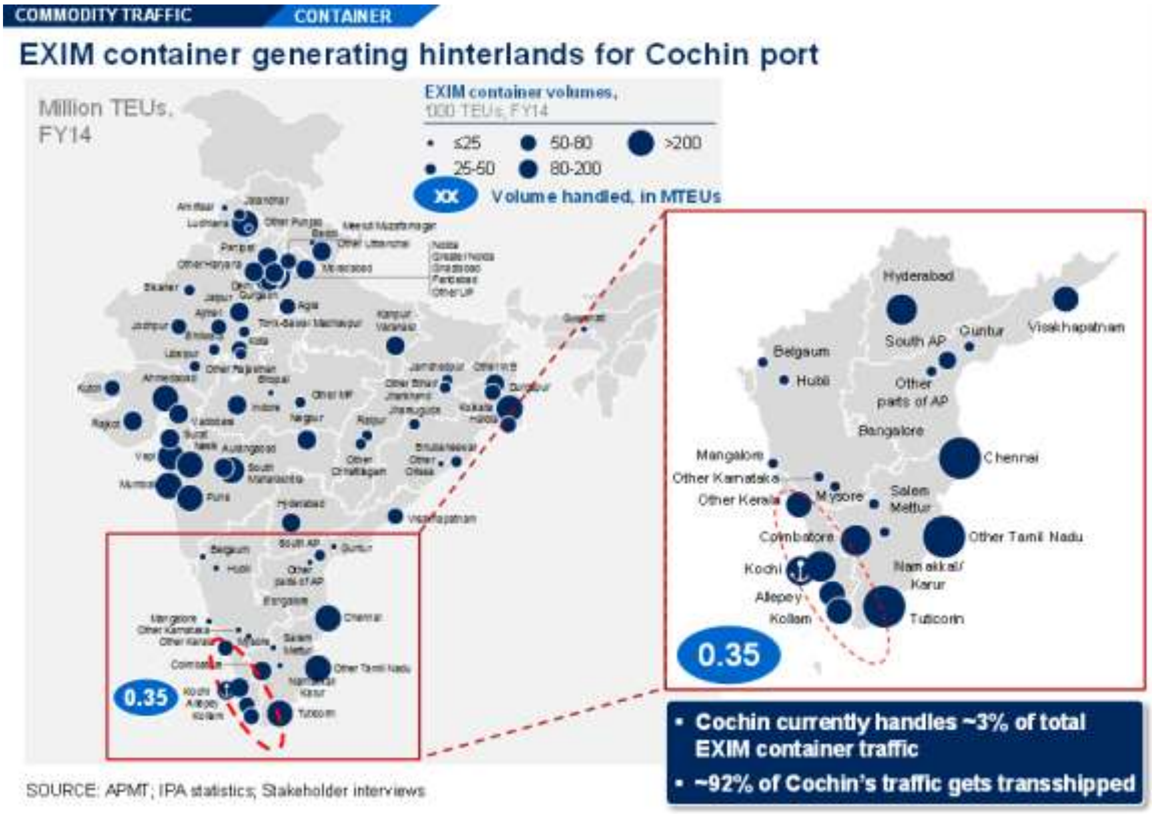



**Figure 6.2 EXIM Container Generating Hinterlands for Cochin Port**

**Table 6.1 Hinterland to Port Mapping for Containers**

COMMODITY TRAFFIC — CONTAINER

**Kerala is the only hinterland for container traffic at Cochin port**

Primary hinterland of port

| EXIM container volumes, '000 TEUs, FY14 | JNPT | Mundra | Chennai | Pipavav | Tuticorin | Haldia | Cochin | Visakha-patnam | Mangalore |
|---|---|---|---|---|---|---|---|---|---|
| NCR+Punjab | 938 | 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 | 189 | 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

Kochi's GDP is expected to grow at a CAGR of 11-13% while other hinterlands are expected to grow at 7-9%. Combined with the manufacturing coefficient of the state and the estimated increase in containerization, the total container traffic at the port is expected to increase to 0.7 TEUs by 2025 and 1.2 MTEUs by 2035 in the base case scenario.

The actual traffic attracted by the port would depend on a number of factors like last-mile connectivity, operational efficiency, pricing, customer preference, etc. Port has been giving a significant thrust on building a positive image and changing customer preference. In the optimistic scenario, considering an increased share of traffic from Tamil Nadu hinterlands including Coimbatore, Salem, Namakkal, etc., it is projected that the container traffic can reach ~1.1 Mn TEUs by 2025 and ~2.3 Mn TEUs by 2035.

However, this traffic might reduce only to traffic from Kochi's hinterland by 2025 if Enayam and/or Vizhinjam come up since most of the other cargo would preferably go to the gateway port. The base case projected traffic for Cochin port for 2025 is as shown below (**Figure 6.3**).

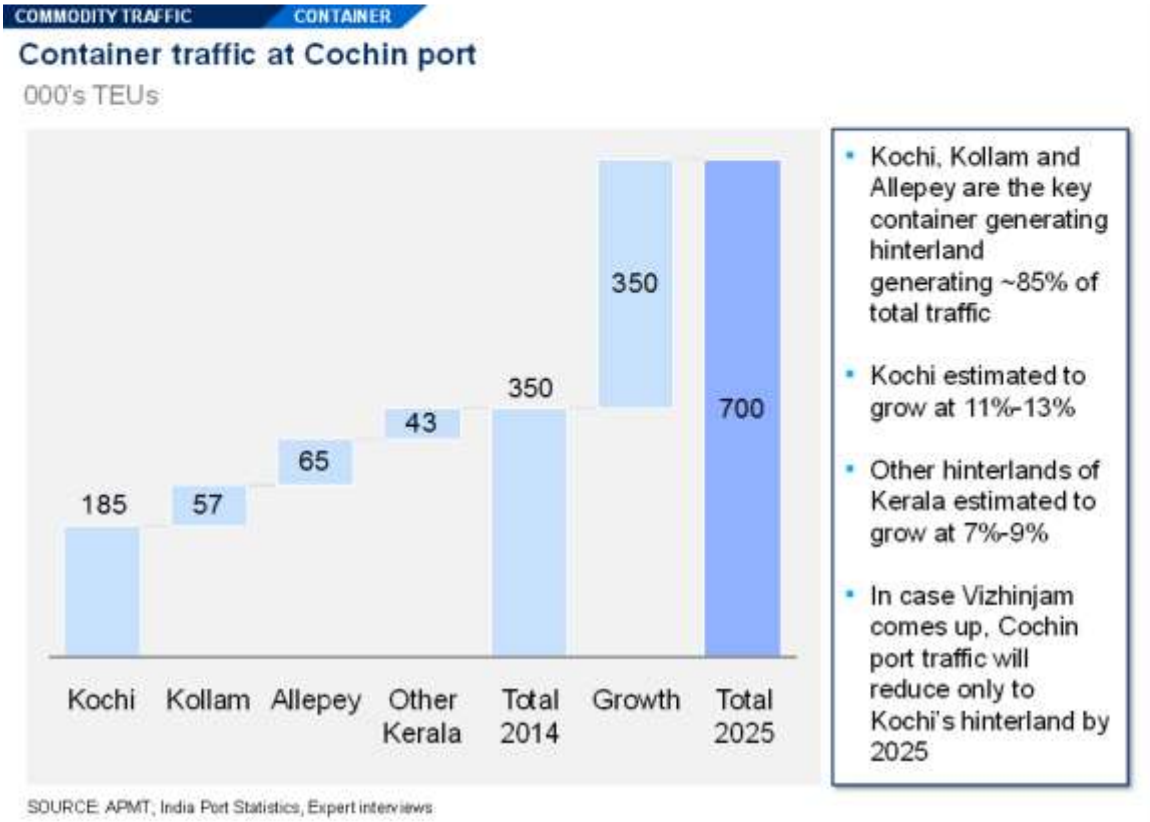
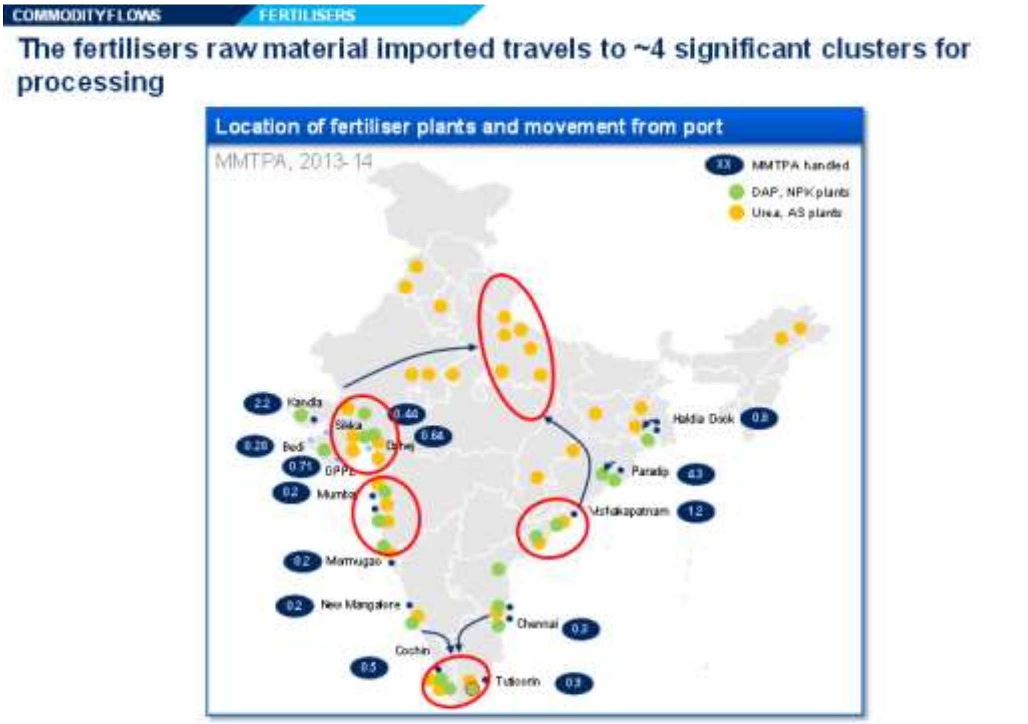



**Figure 6.3 Container Traffic at Cochin Port**

### 6.2.3 Fertilizers

Current traffic of ~0.45 MTPA of fertilizers at Cochin port is dominated by imports of fertilizer raw material including rock phosphate, MOP, etc. The finished fertilizer forms a very small share of ~ 0.04 MTPA in the traffic. The volume of imports of fertilizer raw materials and finished products is estimated to grow to ~0.7 MTPA by 2020, 0.8-0.9 MTPA by 2025 and 1.3-1.4 MTPA by 2035. FACT-Kochi is the biggest consumer of the fertilizer raw material imports at Cochin port. The location of fertilizer plants and movement from ports is as shown in **Figure 6.4**.




SOURCE: Ministry of fertilisers

**Figure 6.4 Location of Fertilizer Plants**

The overall commodity wise projections for the port are shown in **Table 6.2**.

**Table 6.2 Traffic Forecast for Cochin Port**

## Cochin Port – Traffic Projections

Units: MMTPA (except Containers)

xx Base Scenario | xx Optimistic Scenario

| Commodity | 2014-15 | 2020 | 2025 | | 2035 | | Remarks |
|---|---|---|---|---|---|---|---|
| **Liquid Cargo** | | | | | | | |
| POL | 14.0 | 24.1[1] | 27.3 | 27.7 | 30.1 | 34.1 | ▪ Increase in crude imports driven by BPCL Kochi refinery expansion and LNG imports |
| **Dry and Break Bulk Cargo** | | | | | | | |
| Thermal Coal (Loading) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Thermal Coal (Unloading) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Coking Coal | 0.10 | 0.13 | 0.2 | 0.2 | 0.3 | 0.4 | |
| Iron Ore | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | |
| Fertilizers | 0.45 | 0.66 | 0.8 | 0.9 | 1.3 | 1.4 | |
| **Containers and other Cargo** | | | | | | | |
| Containers (MnTEU) | 0.35 | 0.55 | 0.70 | 1.05 | 1.16 | 2.3 | ▪ Optimistic scenarios refer to increased share of container traffic from Coimbatore, Salem, Namakkal, etc. Development of Vizhinjam/ Enayam would reduce the traffic significantly |
| Others | 1.8 | 2.5 | 2.8 | 3.2 | 3.8 | 4.2 | ▪ Highly fragmented |
| **Total (MMTPA)** | **21.4** | **35.3** | **41.1** | **47** | **52.1** | **73** | |

1 Assuming LNG re-gasification terminal is operational at 60% capacity

Conversion Factor Used for Containers Projections: 1 TEU = 14.3 Tons

## 6.3 COASTAL SHIPPING POTENTIAL

For the hinterland of Kerala and western Tamil Nadu, Kochi can facilitate the movement of coastal shipped cargo from other states. Cement and food grains can be major commodities unloaded at Cochin port in case coastal shipping revolution takes place in the country.

**Cement:** Cochin port can be the destination port for coastally shipped cement from Andhra Pradesh. ~3-4 MTPA cement can be coastally shipped to Cochin port by 2025. ~50% of this will be destined for serving the demand of western Tamil Nadu and remaining for Kerala hinterland. Additional ~2.5 MTPA cement can be coastally shipped to Cochin by 2025 contingent on the development of coastal cement cluster in AP and the movement of the same facilitated by the proposed Central AP port (**Figure 6.5** & **Figure 6.6**).

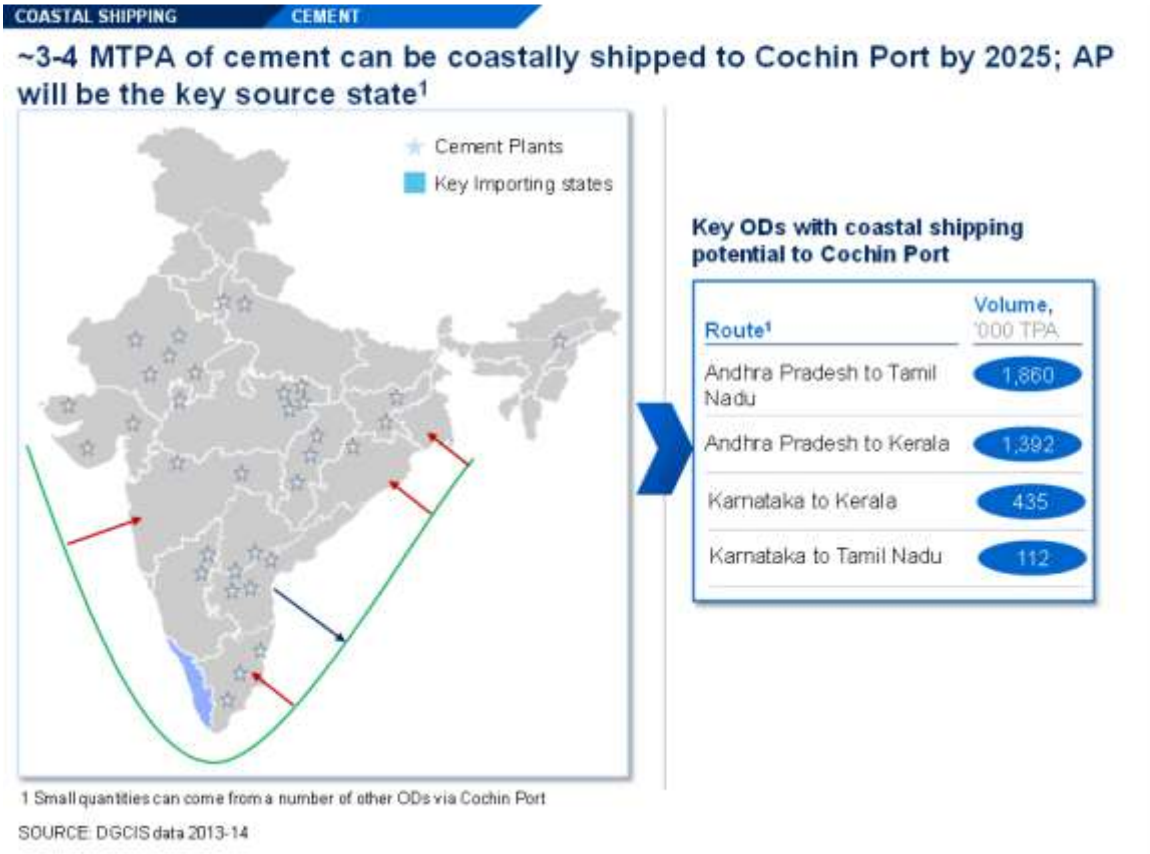



**Figure 6.5 Coastal Shipping Potential of Cement to Cochin Port by 2025 from AP**

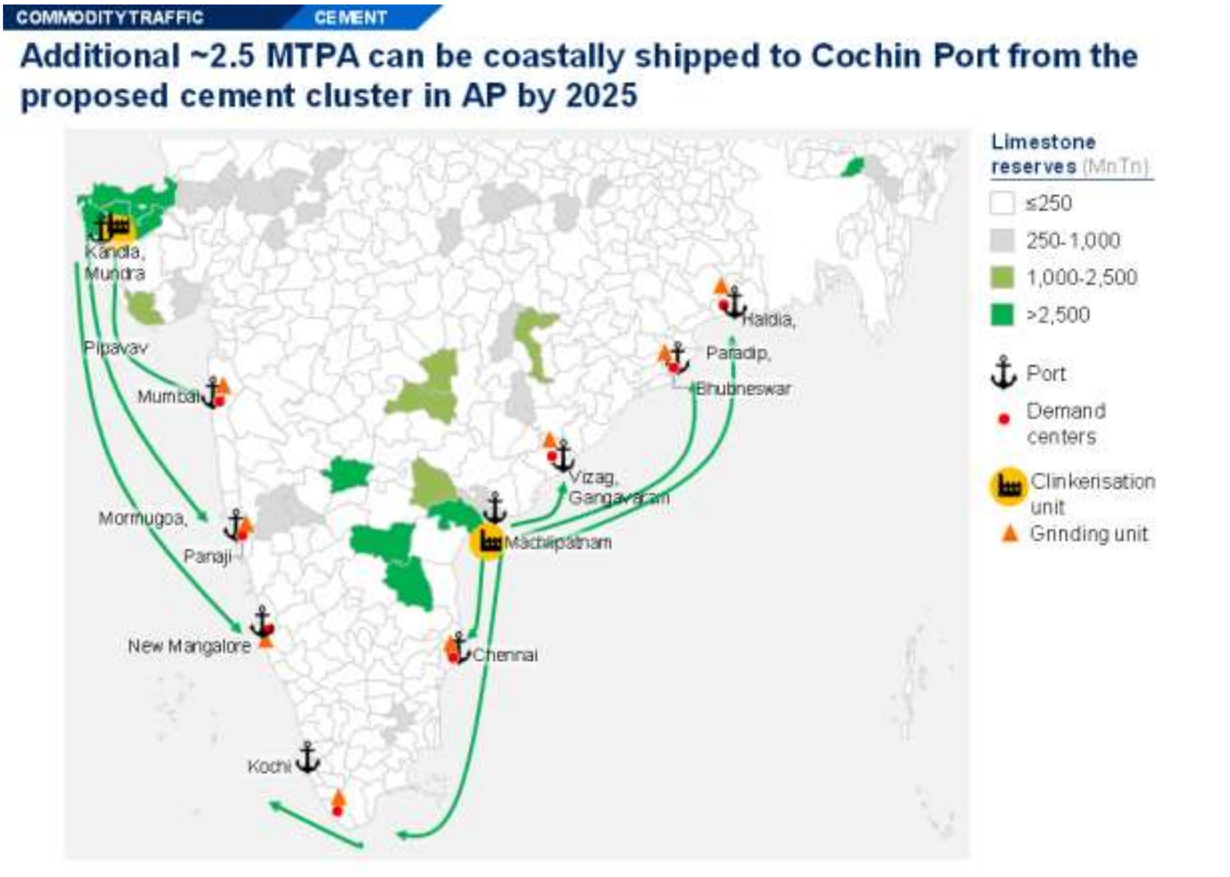
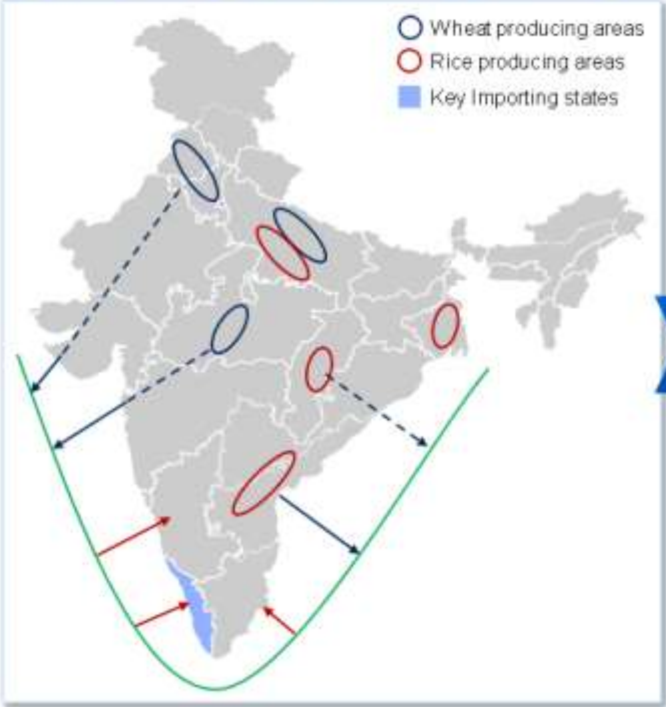



**Figure 6.6 Coastal Shipping Potential of Cement to Cochin Port by 2025**

- Food Grains: There is a potential for coastal shipping of ~1.6 MTPA of food grains to Cochin port by 2020 which is expected to grow to ~2 MTPA by 2025 and ~3 MTPA by 2035. This would serve the demand from hinterland of Kerala and western Tamil Nadu. This traffic will mostly come from states of Punjab (Wheat) and Andhra Pradesh (Rice). The increase of coastal traffic of food grains is contingent on the development of food grains handling facility at the exporting terminals in Kakinada and Kandla. For the same, mechanization projects have been suggested under Sagarmala to enable the coastal movement (Figure 6.7).

COASTAL SHIPPING | FOODGRAINS

**~2 MTPA of food grains can be coastally shipped to Cochin Port by 2025; Punjab being the key source of wheat and AP for rice**




**Key ODs with coastal shipping potential to Cochin Port**

| Route[1] | Volume, '000 TPA |
|---|---|
| Punjab to Kerala | 503 |
| Punjab to Tamil Nadu | 141 |
| Madhya Pradesh to Tamil Nadu | 251 |
| Haryana to Kerala | 169 |
| Haryana to Tamil Nadu | 128 |
| Andhra Pradesh to Kerala | 242 |

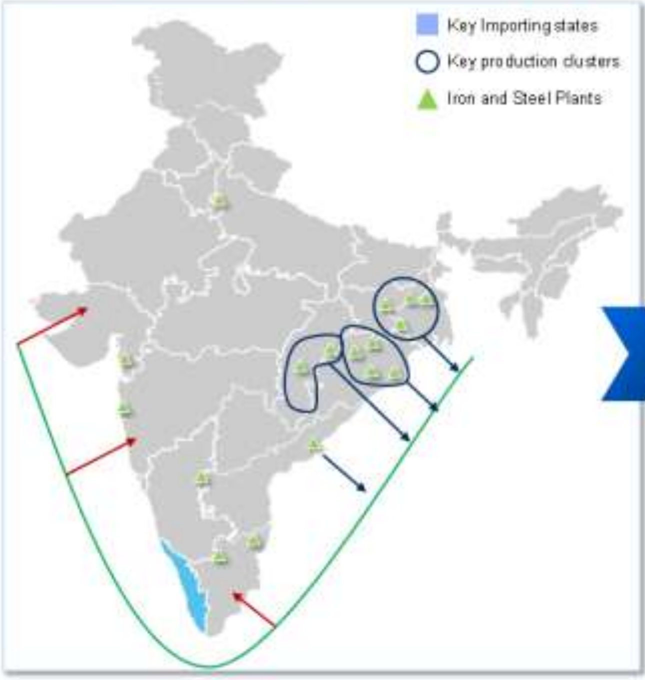
1 Small quantities can come from a number of other ODs via Cochin Port

**Figure 6.7 Coastal Shipping Potential of Food Grains to Cochin Port**

- **Steel:** Cochin can also facilitate ~0.6 MTPA of coastal movement of steel by 2025 most of which will serve the demand of western Tamil Nadu. This traffic is expected to increase to ~1.15 MTPA by 2035. Andhra Pradesh and Odisha will be the primary source states for this movement. Multiple steel plants on the eastern coast- Vizag (Through Vizag port), Rourkela (Through Paradip port), Jamshedpur (Through Kolkata port), Meramandali (Through Paradip port), etc. have the potential to move traffic to coastal route **(Figure 6.8).**

COASTAL SHIPPING IRON AND STEEL

**~0.6 MTPA of steel can be coastally shipped to Cochin Port by 2025; Andhra Pradesh and Odisha being the primary source state**




**Key ODs with coastal shipping potential to Cochin Port**

| Route[1] | Volume, '000 TPA |
|---|---|
| Andhra Pradesh to Tamil Nadu | 233 |
| Andhra Pradesh to Kerala | 66 |
| Odisha to Tamil Nadu | 198 |
| Jharkhand to Kerala | 55 |
| Jharkhand to Tamil Nadu | 76 |

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

SOURCE: DGCIS data 2013-14

**Figure 6.8 Coastal Shipping Potential of Steel to Cochin Port**

- **Fertilizers:** There is a potential for coastal movement of fertilizers from Cochin of ~0.24 MTPA by 2020. Coastal districts of Andhra Pradesh and West Bengal will be the primary consumers of the same. This traffic can increase to ~0.30 MTPA by 2025 and ~0.44 MTPA by 2035.

The table below summarizes the potential of coastal movement for key commodities.

**Table 6.3 New Opportunities Possible via Coastal Shipping**

## Cochin Port – New Opportunities Possible via Coastal Shipping

Units: MTPA (except Containers)

| Commodity | 2020 | 2025 | 2035 |
|---|---|---|---|
| Steel (Loading) | 0.06 | 0.08 | 0.15 |
| Steel (Unloading) | 0.48 | 0.64 | 1.15 |
| Cement (Loading) | 0.01 | 0.01 | 0.02 |
| Cement (Unloading) | 2.85 | 6.32 | 9.34 |
| Fertilizer (Loading) | 0.24 | 0.30 | 0.44 |
| Fertilizer (Unloading) | 0.04 | 0.05 | 0.08 |
| Food Grains (Loading) | - | - | - |
| Food Grains (Unloading) | 1.64 | 2.00 | 2.96 |

- 2.5 MMTPA can be shipped from Central AP cement cluster ( If Central AP port comes up)

# 7.0 Capacity Augmentation Requirments

## 7.1 EXISTING PORT CAPACITY

Based on the analysis of existing port infrastructure, the current capacity of the port is assessed as given in **Table 7.1**.

**Table 7.1 Existing Port Capacity**

| S. No. | Berth Name | Cargo Handled | Total Cargo Handled (T) | No. of Ships | Avg. Parcel Size (T) | Standard Time at Berth (Days) | Current Handling Rate (TPD) | Berth Occupancy (%) | Capacity (MTPA) |
|---|---|---|---|---|---|---|---|---|---|
| 1. | BTP | Dry/Liquid Bulk | 4,92,089 | 43 | 11,444 | 74.4 | 6,612 | 23% | 1.53 |
| 2. | COT | Crude/ POL Products | 16,09,849 | 92 | 17,498 | 152.6 | 10,548 | 46% | 2.44 |
| 3. | LNG | LNG | 2,61,521 | 4 | 65,380 | 10.3 | 25,438 | 3% | 5.88 |
| 4. | NTB | POL Products | 14,39,864 | 143 | 10,069 | 209.0 | 6,888 | 63% | 1.59 |
| 5. | Q1 | Breakbulk | 2,32,716 | 18 | 12,929 | 105.4 | 2,208 | 32% | 0.51 |
| 6. | Q10 | Breakbulk | 4,69,498 | 25 | 18,780 | 126.4 | 3,715 | 38% | 0.86 |
| 7. | Q2 | Breakbulk | 54,696 | 5 | 10,939 | 20.9 | 2,611 | 6% | 0.60 |
| 8. | Q3 | Containers | 8,775 | 22 | 585 | 0.4 | 20,714 | 0% | 4.78 |
| 9 | Q4 | POL | 2,27,172 | 58 | 3,917 | 47.7 | 4,761 | 14% | 1.10 |
| 10. | Q5 | Breakbulk | 62,004 | 7 | 8,858 | 11.4 | 5,453 | 3% | 1.26 |
| 11. | Q6 | Breakbulk | 22,212 | 1 | 22,212 | 6.8 | 3,252 | 2% | 0.75 |
| 12. | Q7 | Breakbulk | 89,476 | 23 | 3,890 | 29.8 | 3,007 | 9% | 0.69 |
| 13 | Q8 | Breakbulk | 3,61,879 | 24 | 15,078 | 115.2 | 3,142 | 35% | 0.73 |
| 14. | Q9 | Breakbulk | 14,779 | 10 | 1,478 | 19.6 | 755 | 6% | 0.17 |
| 15. | SCB | Liquid cargo | 1,79,985 | 27 | 6,666 | 28.2 | 6,379 | 9% | 1.47 |
| 16. | SPM | Oil | 1,05,49,031 | 97 | 1,08,753 | 157.1 | 67,146 | 48% | 15.51 |
| 17. | STB | POL Products | 32,590 | 5 | 6,518 | 5.8 | 5,624 | 2% | 1.30 |
| 18. | V2 | Containers | 30,14,985 | 268 | 11,250 | 256.8 | 11,740 | >50% | 7.50 |
| 19. | V3 | Containers | 24,67,736 | 257 | 9,602 | 314.0 | 7,859 | >50% | 7.50 |
| **Total** | | | | | | | | | **55.30** |

It may be noted that the existing port capacity is based on the current port infrastructure. However the mechanisation of the berths to handle specific cargo shall improve the capacity of that particular berth.

## 7.2 REQUIREMENT FOR CAPACITY EXPANSION

Considering the traffic potential and the capacity of existing berths, the requirement of capacity augmentation have been worked out. These are indicated **Table 7.2**.

**Table 7.2 Capacity Augmentation Required (MTPA)**

| Cargo Handled | Berths Assigned | I/E | Current Capacity (MTPA) | 2020 | | 2025 | | 2035 | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Projected Traffic (MTPA) | Capacity Augmentation Required over current (MTPA) | Projected Traffic (MTPA) | Capacity Augmentation Required over current (MTPA) | Projected Traffic (MTPA) | Capacity Augmentation Required over current (MTPA) |
| Crude & POL | Q4,COT,NTB,STB,SPM, BTP,NCB,SCB | I | 24.94 | 18.10 | 0.00 | 21.30 | 0.00 | 24.10 | 0.00 |
| LNG | LNG | I | 5.00 | 5.00 | 0.00 | 5.00 | 0.00 | 5.00 | 0.00 |
| LPG | MULT | I | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Dry & Breakbulk | Q1-Q3,Q5-Q10,UTL | I | 10.36 | 3.29 | 0.00 | 3.80 | 0.00 | 5.40 | 0.00 |
| Containers | V2, V3 | I/E | 15.00 | 7.87 | 0.00 | 10.01 | 0.00 | 17.40 | 2.40 |
| **Total** | | I/E | **55.30** | **35.26** | **1.00** | **41.11** | **1.00** | **52.90** | **3.40** |

It could be observed that while there is no specific need for creation of the additional berths to cater to projected traffic, several initiatives in terms of mechanisation of the specific cargo and redevelopment of existing berths needs to be taken.

# 8.0 Scope For Future Capacity Expansion

## 8.1 GENERAL

Presently, the cargo profile of Cochin port traffic is dominated by Crude and POL followed by Containers, Cement and Fertilizers in that order. The rest of cargoes beyond these are highly fragmented and their individual volumes are too small.

The OD studies as part of the assignment though continue to uphold the order of importance of these cargoes over the master plan horizon in terms of volumes, it also projects opportunities that can be expected in respect of certain other cargoes that are not handled hitherto in any significant quantity like import of food grains, steel and a quantum jump in cement and fertilizers through coastal shipping opportunities. The import of crude palm oil which now stands banned may be revived if there is policy shift by the Government.

Keeping the above cargoes in view, the cargo augmentation proposals outlined below are envisaged on the basis of the following guidelines:

- That the existing berthing infrastructure which has a low occupancy need to be put to optimal use by handling the cargo over the master plan horizon to the possible extent.
- All present and future handling systems shall ensure clean and environmental friendly methods and shall be in line with ecology of inland waterways, the naval base in the wellington island and the habitation in and around the place.
- Diversion of cargo from other mode of transportation now in vogue viz., Rail and Road shall be considered.
- The traditions and practices in Kerala in general and Cochin port in particular more specifically the labour force not being inclined to handling by manual labour methods unlike those in other ports need to be kept in view apart from high labour costs.

The proposals therefore envisage the highest level of mechanisation and automation which may be different from other ports.

## 8.2 CARGO AUGMENTATION PROJECTS

### 8.2.1 Container Cargo

#### 8.2.1.1 General

International Container Transhipment terminal (ICTT) at Vallarpadam terminal, with its strategic location close to international sea route was envisioned to bring back India’s international container cargo that is being transhipped through the port of Colombo and Dubai. With this vision it became the first container terminal in the country to operate in a special economic zone.

However, the terminal has actually handled 0.37 MTEUs in 2014-15, which is far below the figure of 0.55 MTEUs that it needs to handle to just breakeven.

This is in spite of the fact that about two years ago, the Government granted the ICTT a cabotage exemption, which permits foreign lines to operate feeder service between Vallarpadam and any other port in India. It was thought that this would attract mother vessels bringing containers from other ports but that did not happen and the ICTT continues to handle very little transhipment cargo. Though ICTT does match the tariff of Colombo to some extent, the facilities that Colombo has established and more particularly the number of liner services that call has no comparison.

#### 8.2.1.2 Issues Identified with the Terminal

During the course of this Master Plan study some of the issues relating to the lower container throughput at ICTT have been identified as mentioned below:

- The terminal has no freedom to have its own tariff as it is regulated by TAMP thus lacking a level playing field.
- Initial disputes between Customs and SEZ authorities over jurisdictional control with customs insisting on examining transshipment containers which does not happen anywhere as they are already cleared by customs at load port.
- There is only one liner which brings deep draft large mother vessels. DP World despite being a global port operator with business association with several shipping lines could not bring any major lines.
- The perceived and actual labour problems that plague the region.
- Development of Vizhinjam and Colachel ports as transshipment hubs, which if happen may reduce the container traffic significantly.
- Other Indian ports competing for the same traffic.

Apart from the above the following is also noted with regard to the equipment provided at the terminal:

1. For two berths of total 600 m length only 4 RMQCs and 2 Mobile harbour Cranes have been provided.
2. RMQCs and mobile harbour cranes in tandem are not ideally suited for ship handling due to basic difference on how they place containers on the ITVs. Unlike RMQC the ITVs lane is beyond the footprints of the mobile harbour crane. This is also a reason that the two mobile harbour cranes are hardly being used.
3. At the Transhipment ports and also ports having direct calls, it is a usual practice to deploy 4 to 5 cranes on the mainline vessels for faster turnaround. In the present case two cranes per vessels can be deployed (assuming the other berth is also occupied).
4. It is further observed that the present 15 RTGS are just sufficient for the present fleet of Quay cranes. The equipment in the terminal may need matching augmentation of equipment in all the areas.

The points are just to indicate that there could be a negative perception of the users about the adequacy of the terminal facilities. The decision to deploy additional equipment has to be best left to the PPP operator.

### 8.2.1.3 Suggested Measures

Based on the traffic projections, the terminal does not need any additional berthing facilities till 2025 and thereafter also there is provision for the present operator to create additional berths.

Apart from that, the operator has to assess whether an additional berth of say 150 m length (extension of existing berths to west) could be provided specifically for the feeder vessels where the existing two mobile harbour cranes could be deployed. Alternatively, the operator may provide additional RMQC for increasing the berth productivity that can reduce the turnaround time of ships.

The terminal operator has to merely augment the onshore facilities in the terminal to the appropriate level and the port has to maintain the promised depths of 15.5 m below CD which is contractual obligation on the part of the port, thus enabling main line vessels of requisite draft call at ICTT.

In order to avoid congestion on roads and to ensure that the container trailers entering the terminal does not block the road margins, it is proposed that a holding yard be created for which adequate land area belonging to FACT is already identified. Before the traffic reaches a level of 0.5 MTEUs, it is proposed that the terminal operator may develop such facility with systems to regulate movement of container trailers before they enter the main terminal. The holding yard will serve this purpose of regulating the inward movements before they enter Vallarpadam.

## 8.2.2 Setting of Edible Oil Terminal

### 8.2.2.1 General

Till 2007, Cochin Port was handling palm oil imports. The volume ranged from 0.1 to 0.15 MTPA. However, during October, 2007, the Union Commerce Ministry imposed a ban on Palm oil imports based on request from the State Government which felt that the interest of the coconut farmers in the state would be better served if palm oil import through Cochin port is stopped. This has resulted in the increased spending of about INR100 crores extra for palm oil imported through the neighbouring port of New Mangalore while port facilities at Cochin are lying severely underutilised. This should be brought to the notice of the State Government as well as the Central Government and impressed upon to lift the ban.

### 8.2.2.2 Market Overview

India has a large consumption of edible oil in consonance with the population. India's local production of edible oil (mustard oil; soya bean oil; groundnut oil; sunflower oil & palm oil) is just short of 10 MTPA while the consumption is more than double this. During 2014-15, the domestic production was 9.74 MT and the imports were about 12 MT. The break up details as well as the source countries is given in the tables hereunder.

During 2013-14, Kolkata/Haldia ports handled about 2.1 MT of edible oil; Chennai port handled about 1.0 MT; Mumbai/JNPT ports handled about 1.2 MT; Kandla port handled about 2.5 MT and the balance by other ports.

#### 8.2.2.3 Cochin Port and Palm Oil Imports

The Board of Trustees of Cochin Port had been trying to impress upon the State Government on the futility of the ban. The issue had been taken up in the past as it was apparent that the ban was not serving the purpose for which it came into effect.

In reality the Palm oil imports that take place through the port of New Mangalore get moved through road mostly after refining and packing for open market. This thrives as there is no ban on such movement or trade. The net result is that the cost of Palm oil in Kerala costlier by about INR 2.50 per kg than it would cost of imported through Cochin. At this rate for an estimated 0.4 MT being received through New Mangalore for the Kerala Market there is an additional cost of INR100 crores per annum. This has an impact on the State economy. This additional cost is on account of road transport.

#### 8.2.2.4 Policy Change Required – Flagging the Issue

This fact viz. that the people of Kerala are spending around INR 100 crores extra for palm oil imported through the neighbouring port of New Mangalore while port facilities at Cochin are laying severely underutilised should be brought to the notice of the State Government as well as the Central Government. Both the Governments should be impressed upon to lift the ban.

While there is nothing novel about handling crude Palm oil through Cochin port as such, the proposal now envisages flagging the issue. The proposal seeks a modal shift by permitting imports of Palm oil through Cochin port rather than its transportation into the state of Kerala from the Port of New Mangalore by road which is now taking place with an additional cost. The proposal also envisages creation of well-defined facilities for import of Crude Palm oil through the Port and for making use of existing berth and other port infrastructure and more particularly the land area.

#### 8.2.2.5 Advantages of Channelizing Imports through Cochin

The import of crude palm oil through the port of Cochin has the following advantages.

- Import of Crude Palm oil can be affected through the existing berthing infrastructure with no additional investment to port authority.
- Importers who have earlier created storage tanks for Palm oil but have subsequently modified them for other purposes may make use of them more effectively. They may get encouraged to put up further facilities for storage, refineries to convert raw Palm oil into ready to use refined Palmolein oil and packaging units in the vicinity of port. They may consider putting up Palm oil refineries in the port lands which means their leasing of port lands on long term basis, as it would be a port related activity.
- This may generate income to the port authority from land which is otherwise lying idle. For this purpose, the port may consider long term lease (of say 30 years).
- It may generate local employment and encourage local skills and entrepreneurship.
- Most importantly, there will be savings on account of reduction in road freight and may help decongest highways from Mangalore to Kerala, albeit in a small way.

- Import of Edible oils in bulk does not create any labour issues as involvement of manual labour is negligible.

### 8.2.2.6 Development of Handling Facilities in the Port for Palm Oil Imports

In the eventuality of the proposal materialising, it is proposed that a berth/group of berths be identified for berthing of edible oil vessels. It is noted that the BTP and NCB berth is eminently suitable for this purpose on account of the following.

1. The berth has a length of about 425 m. The maximum DWT of Palm oil vessels is in the region of 45,000 DWT with an LOA of 183 m. As such two edible oil vessels can be handled simultaneously at this berth. The draft will be limited to 10.15 m.
2. This is a captive berth for cruise vessels which will have priority. But it is not expected to pose any serious limitation as cruise calls are about 40 or so in a year and their stay is limited to day light hours during these days. Also they call up during season which is confined to Nov to April. In any case cruise vessels have a firm time table and planning around them will be easy for other vessels.
3. Being a cruise berth, edible oil handling will not in any way cause problem in maintaining clean environment in berth and the berth can be vacated at a short notice and in a matter of a few hours.

### 8.2.2.7 Infrastructure Proposed - Pipelines

Edible oil requires only a shore pipe line for their conveyance from wharf side to their storage tanks. The size of pipe line required would depend on the rate of discharge aimed at and the length of pipe line.

In India edible oil imports over a period have consolidated around a few edible oil importers who have their own port based tankages. In addition there are two or three service providers who serve importers by way of putting up storage facilities and hire them to importers. Such infrastructure includes edible oil tanks, pipe lines from berths to tankage, lorry loading facilities for evacuation in addition to safety; security etc., as the edible oil by each importer comes is small parcels, a pipe line size of 200 mm dia. or so would be normally adequate. In almost all government owned Indian ports where edible oil is handled individual importers puts up their exclusive pipe lines and in many cases where same or similar edible oil is handled from the same berth, they end up having multiple pipe lines corresponding to each importer.

It is proposed to rationalise this by proposing only two pipe lines from BTP Berth to enable handling two vessels simultaneously as the berth has adequate length for the purpose.

Based on the geography of BTP berth vis- a- vis existing and potential storage tank farms, it is expected that the length of pipe lines will be in the region of s less than a km. For a vessel parcel size of 10,000 T an average pumping rate of about 150 TPH is achieved with an 8” dia pipe lines while handling crude palm oil.

It is proposed that two no. 12”dia pipe lines be laid from BTP Berth to a point nearest to the land area where the prospective edible oil tank farms will be located. The two pipe lines will serve the two edible oil vessels that can be berthed and handled simultaneously in BTP Berth area.

It is relevant to note that edible oil from a single berth is handled through a single pipe line in some of the private ports. For example in the port of Krishnapatnam, crude Palm oil is discharged through a single 16”dia pipe line over a length of about 6.5 km to various private tankage and edible oil refineries and a high handling rate of 600 TPH is achieved. The port authority itself does this and charges for the service. This enables avoidance of multiple pipe lines.

#### 8.2.2.8 Operation of Pipe Lines and Pigging

It is further proposed that the pipelines may be piggable with a pig launching station on the berth end and the pig receiving station on the other end.

Normally after completion of discharge of crude palm oil of one user, the line contents will be evacuated by suck back arrangement from the tank farm side of the respective user installation. Normally they may handle crude palm oil and the same pipe lines can be used for multiple users one and after another in each of the berths. In case the same pipe line is to be used for others like refined palm oil or any other oil, the line can be cleared by launching a PIG which process is very uncomplicated, inexpensive and widely used.

#### 8.2.2.9 Way Forward

The proposal elaborated herein is meant for flagging the issue to be taken up by port with the State Government and Central Government. The expenditure involved in implementation is close to Nil. The edible oil importers can share the cost of pipe line among themselves which is a onetime capital expenditure for them.

At the estimated potential of o.4 MTPA, the port may get revenue of over INR 4 Crores (@ INR 109.20/T) on cargo related charges alone. This is in addition to revenue on account of vessel related charges and estate rentals.

The proposal would involve a political decision on the part of Governments as it would involve public opinion as well.

### 8.2.3 Mechanised Fertilizer Loading Facility

As per the above possibilities for loading of fertilizers range from 0.24 MT in 2020 increasing to 0.3 MT by 2025. Assuming that the fertilizer to be exported will be in bulk and it will be brought to the port in bulk, it is proposed that the same may be handled berth no Q7 and through a flat storage arrangement.

The fertilizer will be brought from the factory in bulk and unloaded in a shed adjoining the present berth and when the vessel arrives the cargo shall be fed by special loaders into hoppers which in turn feed on to a conveyor inside the shed and that is led through an elevated conveyor into a fertilizer loader for loading into the ship seamlessly. The entire arrangement will be semi-mechanized with the following steps in the process.

Receipt of fertilizer bulk through Tipper Lorries → Unloading in flat storage shed by tippers → stacking by front end loaders → Reclaiming by Front end loaders for ship loading → feeding into ground level hoppers → Shed conveyor and dock conveyors → Fertilizer loader.

A typical fertilizer loader that can be deployed will alone cost about 20 Crores. But the loading facility for handling the projected small quantity of 0.2 to 0.3 MTPA will be very unviable. It is therefore recommended that the fertilizers in bulk be handled by ship's gear and its grabs loading into ship's holds.

### 8.2.4 Mechanised Food Grain Handling Facility

#### 8.2.4.1 General

The state of Kerala is predominantly consumes rice and the consumption of food grains is about 3.5 MT of which only about 0.4 to 0.5 MT is produced in the state. The state predominantly imports rice from the state of Andhra Pradesh. The movement of rice presently takes place by rail and only a small portion is by sea and that too for the last two or three years as can be found from **Table 8.1** below.

**Table 8.1 Details of Food Grain Movement by FCI from Other Regions/States into Kerala**

| S. No. | Year | Rice (T) | | | Wheat (T) | | |
|---|---|---|---|---|---|---|---|
| | | By Road | By Rail | By Sea | By Road | By Rail | By Sea |
| 1. | 2012-13 | 0 | 9,68,348 | 0 | 0 | 5,46,253 | 0 |
| 2. | 2013-14 | 0 | 11,61,043 | 0 | 0 | 3,90,145 | 0 |
| 3. | 2014-15 | 0 | 11,08,231 | 1,09,075 | 0 | 3,39,463 | 0 |
| 4. | 2015-16 (Anticipated) | 0 | 10,50,000 | 60,000 | 0 | 4,20,000 | 0 |
| 5. | 2016-17 (Projections) | 0 | 10,50,000 | 60,000 | 0 | 4,20,000 | 0 |
| 6. | 2017- 18 (Projections) | 0 | 10,50,000 | 60,000 | 0 | 4,20,000 | 0 |

The supply of rice to the state government's public distribution system is channelled through Food Corporation of India which procures and transports the same from one region to the other. The table above indicates the amount of rice and wheat that is moved by FCI and it is found that the movement of rice is predominantly from Andhra Pradesh to Kerala and all by rail. The origin is predominantly from east Godavari, west Godavari and Krishna districts of present Andhra Pradesh and Nalgonda district of Present Telangana state. The rice is transported by rail in bags and with loading taking place in various sidings of FCI godowns in that the origin state, transported to Kerala and unloaded at similar FCI godown sidings in Kerala.

In addition various private agencies from Andhra Pradesh and more specifically by rice millers of Andhra Pradesh who get permissions to move to other states after supply of government levy rice to that state government, transport rice for open market consumption of Kerala. On detailed interactions with FCI and other informed agencies it is found that movement by sea in large volumes from Andhra Pradesh to Kerala many not be feasible in near future in view of subsidised railway tariff and as the port of Kakinada is not close enough to a number of paddy producing centres in that state and as it involves multiple handling and ultimate costing is not favourable. In view of this the volume of rice movement through sea from Andhra Pradesh will remain low.

As regards wheat the requirement is mostly by flour mills which are supplied by FCI and by private trade. During the current year it is seen that about 3 shipments of wheat was imported from abroad of which a large quantity is stored still in port's covered storage sheds. Never the less the government of India has plans to promote model shift in logistics of food grain movement and it is identified that the port of Kandla will the exporting port where mechanized bulk loading facilities will be put up both for foreign and coastal shipment of wheat and Cochin is identified as a potential port for unloading.

In order to handle the projected food grain traffic in bulk it is proposed that a bulk food grain unloading terminal be planned in berth in Q6 in Ernakulam wharf. The unloading terminal may be developed for 0.5 MT.

#### 8.2.4.2 Receipt through Coastal Shipments and Unloading

The wheat received through coastal vessels in bulk is unloaded by deploying a gantry screw type unloader which lifts the grains from the ship's hatches and through a horizontal conveyor discharges into a closed type shore conveyor on the rear of the berth

#### 8.2.4.3 Types of Storage

There are broadly two types of bulk storage of food grains viz., Flat storage and Silos. The former can be resorted to when land and labour is cheap whereas the later viz., Silo storage is the preferred option when full scale mechanization is required with least manual intervention.

**Flat Storage Facility**

In a mechanized flat storage shed the unloaded grain received from the dock conveyor will be conveyed to a roof top conveyor from which the grain is dropped through a mobile tripper to spread evenly on the shed for the designed height (**Figure 8.1**).

**Figure 8.1 Flat Storage Shed**

For the purpose of evacuation the grain from the flat storage is reclaimed by front end loaders and through bagging hoppers is directed to bagging and stitching machines and the bags are then loaded into Lorries through a bag conveyor.

**Silo Storage**

In this the unloaded food grains brought by the dock conveyor is fed to a ground level hopper and is lifted through an elevator in to Silos for vertical storage. The silos may be of either fabricated steel or constructed of masonry Concrete.

The silos can be in multiple units to accommodate different types of grains simultaneously (**Figure 8.2**).

**Figure 8.2 Steel Silos for Food Grains**

**Recommended Type of Transit Storage**

AECOM proposes transit storage for the imported food grains shall be of steel silos for the following reasons:

1. Being a vertical storage arrangement, will occupy least space and the silos can be located either closer to the berth or away depending upon the layout and architecture
2. The food grains will be fully protected from outside atmosphere.
3. The evacuation of food grains is from the bottom of the silos and with directing it to automatic bagging and stitching of bags and loading into lorries in an automatic system in a seamless manner.

**Capacity and Number of Silos**

It is proposed to have 2 silos each with a holding capacity of 10,000 T. This will enable adequate capacity to unload the largest parcel size of vessel proposed viz., 15,000 T and yet have a buffer capacity.

Each silo of this size will be typically of about 30 m dia. and about 25 m height which will be within the mandatory height restriction to be adhered to in Cochin's Wellington Island.

### 8.2.4.4 Evacuation of Food grains

The grain in the transit storage in Silos will be evacuated from the bottom of silos through a closed conveying system onto an automatic bagging machine and the same after weighing to the required capacity of each bag of typically 50 Kg will be automatically stitched and the stitched bags will be roll through a conveyor into the lorry loading machine. This machine will be programmable in terms of no of bags to be loaded into a particular lorry in terms of no of rows, and the number of layers that will be loaded height wise. Once the details like the capacity of lorry the size of loading body etc. are programmed, the machine will automatically formulate the same and load the required numbers like 10 no. bags in one go.

**Figure 8.3 Typical Food Grain Ship Unloader**

### 8.2.4.5 Capacity of Grain Unloading Terminal

A fully mechanized and automated terminal for unloading food grains in Cochin is initially planned with a capacity of 1,000 TPH to achieve average rate of unloading of food grains from the ship to about 15,000 TPD. This will enable handling food grains of 0.5 MTPA in a single berth with berth occupancy of about 20%.

### 8.2.4.6 Conclusion and Way Forward

The facility proposed is meant for Wheat, Maize and Soya bean in bulk and not for rice. The grain terminal is proposed to be installed in berth Q6 in Ernakulam wharf. The indicative Capital cost for developing the mechanised grain terminal is about INR 85 crores.

### 8.2.5 Dedicated Berth for Handling Steel

Significant volume of steel products is projected at Cochin port by way of coastal shipping. It is therefore that the existing berths Q8 and Q9 in the Ernakulum wharf be earmarked for handling of the steel, heavy cargoes, timber etc., and unloading will be means of two mobile harbour cranes. The existing Italguru make 40 T capacity Mobile crane which now has a low demand will have significant utilization for unloading of such heavy cargo. Also the large open area behind berth 8 and 9 will make it eminently suitable for the transit storage.

### 8.2.6 Cement Handling Facilities

#### 8.2.6.1 General

Kerala as a state, has a booming building construction industry and together with other uses like CC roads consuming about 10.5 MTPA. Of this, only about one MT is produced by the only cement factory located in Kerala viz., Malabar Cements. This is mainly on account of the state not having deposits of Limestone.

#### 8.2.6.2 Cement Handling – Status as of Now

The port of Cochin has already started developing a cement importing hub by enabling a shift in logistics of transport of cement in bags from the cement factories from the bordering states of Tamil Nadu and Karnataka which themselves though are surplus their quantum is not large. The states of Gujarat and Andhra Pradesh which have surplus are exporting to other deficient states. Of them Gujarat is strategically positioned for movement of cement in bulk with its port based cement factories and the port of Cochin is equally strategically located to receive it.

However, the marketing efforts coupled with automatic systems available in recent times are slowly but steadily pushing its volumes through the port.

**Figure 8.4 Zuari Automated Cement Plant at Ernakulam Wharf (Q5)**

M/s. Ambuja was the first to establish a cement terminal in Cochin port by way of importing cement through coastal vessels. This company has installed the facility in the backup area of Q1 berth in Mattancherry wharf by taking over the transit shed of this berth in 2001 on 30 year lease. They have installed a flat storage facility and automatic bagging plant with a bag conveyor delivering the bagged cement to load into Lorries where they are manually staked for despatch.

The terminal works in a shift of 8 hours between 8AM and 4PM and has an agreement to handle a minimum guaranteed throughput of 0.3 MTPA. During 2014-15 a quantity of 0.265 MT was handled through 27 vessels with an average parcel size of about 12,000 T.

Though the company has contracted for a guaranteed minimum throughput of 0.3 MTPA it has handled slightly lesser quantity during the year. It is seen that the berth occupancy of Ambuja's cement vessels was a little less than 30% and the backup facilities work for one shift only. It is seen that the type of facilities installed by M/s. Ambuja are somewhat of old in terms of technology in terms of stacking, evacuation of stored cement by means of front end loaders into bagging bins, bag stitching, loading through a bag conveyor into lorries requiring manual stacking . With this type of facility this terminal has maximum capacity of about no more than 0.7 to 0.8 MTPA even if it works round the clock. However if the terminal operator puts up silo storage and a fully automatic evacuation system it is possible to upgrade the capacity of this berth to 1.5 MTPA.

M/s. Ultratech has installed their cement terminal in the backup area close to BTP berth with four silos each of 6,000 T capacities totalling to 24,000 T. The packing and evacuation facility is fully automatic with very little manual intervention and the installation is able to handle 0.4 MT with berth occupancy of 17%. It is seen that this company has brought in cement in chartered cement vessels of about 20,000 DWT with an LOA of about 145 to 150 m, a beam of about 25 m and a designed full load draft of about 9.4m. However the average parcel size of vessels was about 15,000 T as can be seen from the **Table 8.2**.

From the studies it is found that the combined effect of higher vessel parcel size, the silo storage with a capacity of 24,000 T, the fully automatic evacuation system as installed by Ultratech, the terminal can handle 1.5 MTPA. In other words a cement berth backed by a fully automated terminal working round the clock has a capacity 1.5 to 1.75 MTPA.

**Table 8.2 Cement Handling During FY15 - A Review**

| S. No. | Importer | Berth | No of Vessels | Quantity Handled (T) | Max. Parcel Size (T) | Min. Parcel Size (T) | Average Parcel Size (T) |
|---|---|---|---|---|---|---|---|
| 1. | Ultratech | BTP | 27 | 4,10,210 | 20,522 | 9,000 | 15,193 |
| 2. | Ambuja | Q1/Q2 | 22 | 2,65,359 | 16,453 | 6,740 | 12,062 |
| 3. | MBK | Q5 | 1 | 6,134 | 6,134 | 6,134 | 6,134 |

More recently during 2015 a third cement terminal of the port was installed by M/s. Zuvari in berth no Q5 in Ernakulam wharf. Their backup facilities consist of a 2 Silos each of 8,000 T capacity and a fully automatic evacuation system of bagging and lorry loading as also bulk lorry loading facility. This cement terminal operator has also contracted for a guaranteed minimum throughput of 0.3 MTPA. The study has revealed that if the capacity has to be scaled up a third silo of 8,000 T has to be put up.

It is understood that in addition to these three cement terminals two more viz., M/s. Pennar cements and M/s Malabar cements will put up similar facilities in berths Q5 and Q6 respectively with their backup facilities in the backup area of the respective berths.

As can be seen that of the total demand of the state for import of 10.5 MT after accounting of state's production of 1 MT, the imports through the port of cochin accounts for just less than 10%. The traffic projections indicate that there exists opportunities increase them manifold.

#### 8.2.6.3 Planning of Facilities for Cement Handling

A cement terminal with a berth for unloading cement vessels of about 20,000 DWT with an average parcel size of 15,000 T with a berth occupancy of about 60%, backed by a silo storage of about of 24,000 T and a fully automatic bagging, automatic loading of bags into lorries and bulk cement loading into lorries and working round the clock has a minimum capacity of about 1.5 MTPA.

Apart from berths BTP, Q1 and Q5 through which cement is imported by Ultratech, Ambuja and Zuvari respectively, the berths Q2 and Q3 may be planned as berths for import of cement over the master plan period. This in the course of time will involve complete reconstruction of berths Q1 to Q3 as already proposed and up gradation of facilities by terminal operators which will depend on their market.

In this connection it is relevant to note that each terminal need not exactly be tied to particular berth and in case the terminal has a capacity of less than 1.5 MTPA, more than one cement handling terminal can operate from one berth and the storage, bagging and evacuation terminal need not exactly be in the transit area of the berth and can be far away about 100 m or more. In this way more than one operator can import through the same berth without hindering each other.

The above proposal envisages development of Mattancherry wharf as a cement import hub over a period.

### 8.2.7 Crude, POL, LNG & LPG Handling Facilities

The port is presently handling about 10.746 MT of crude through single SPM and about 3.271 MT of POL products through a number of jetties. The LNG terminal though operational has handled just 4 shipments totalling to about 2.6 Lakh T with occupancy of less than 3%.

The BPCL's Cochin refinery has an installed capacity of 10 MTPA and is currently expanding to about 16 MTPA. This is expected to be operational in the current year itself i.e. 2016. However, the requirement of full capacity of refinery is likely to build up over the years. Expansion of BPCL along with increase in imports of LNG and LPG in the future will lead to POL traffic of roughly 25 MTPA by 2020, 30-32 MTPA by 2025 and 34-45 MTPA by 2035.

In 2025, out of ~30 MTPA, LNG and LPG import is expected to contribute 5 MTPA and 2 MTPA respectively. Kochi LNG regasification terminal is expected to operate at capacity in the next 5 years while LPG imports will be driven by government's focus on distribution of LPG connections to rural households. Crude and POL products are estimated to be ~16 MTPA and ~7 MTPA respectively The total traffic of 7 MTPA of POL products include ~3 MTPA of coastal shipping potential from Cochin to Southern Tamil Nadu.

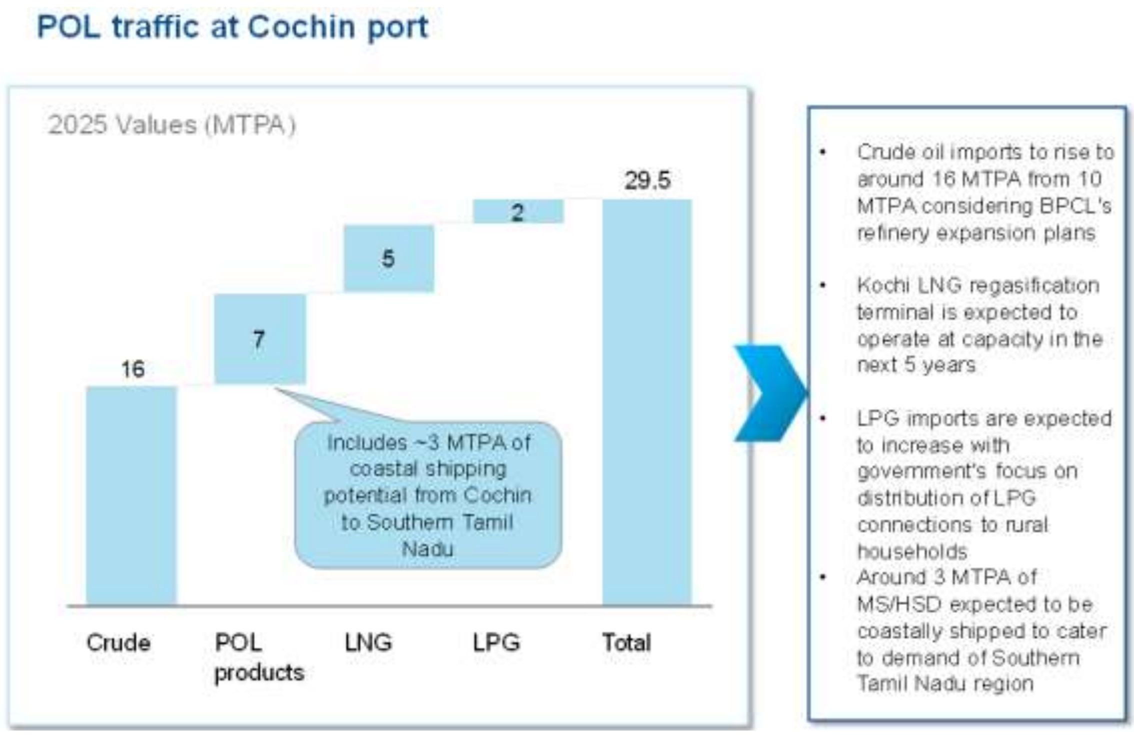



**Figure 8.5 POL Traffic at Cochin Port**

### 8.2.7.1 Crude

The projected crude of 15 to 16 MTPA will be handled by the SPM which quantity roughly corresponds to the capacity of a single SPM.

### 8.2.7.2 LNG

Similarly the LNG of 5 MTPA will be handled by the LNG jetty and the LNG terminal which is ready for use. Though the LNG facility is ready for use since a long time the holdup has been the pipe line is not laid simultaneously. Presently the laying of pipe line the state of Kerala both on north and south side out of a total length of 520 km about 360 km is progressing with ROW having been obtained. The Kerala state portion of work is expected to be completed by 2016. Though the portion of pipe line laying for Karnataka and Tamil Nadu portion of this LNG pipe line has made no progress so far this is also expected to be completed by 2017 end. By that time the port's LNG terminal is expected to come to full utilisation and no other infrastructure in the port would be required.

### 8.2.7.3 POL Products

The POL products being handled in Cochin port broadly consists of HSD, MS, SK, FO and Naptha and are predominantly being handled in COT and NTB. They are also being handled in STB, Q4 and BTP. The berth SCB while mostly handles Liquid ammonia, also handles a small quantity of FO. The total quantity of POL products handled is about 3.2 MTPA.

**Table 8.3** **POL Products Handled During 2014-15**

| S. No. | Berth | Quantity (T) | Vessels | Exports (T) | Imports (T) | Max. Parcel Size (T) | Average Parcel Size (T) | Berth Occupancy (POL/ Chemicals) | Type of POL Products and Chemicals Handled |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BTP | 63,674 | 14 | NIL | 63,674 | 9589 | 4548 | 8% | LSHS, FO, HSD |
| 2 | COT | 14,08,845 | 88 | 10,38,852 | 3,69,993 | 40,859 | 16,009 | 46% | HSD, MS, SK, FO, NAPTHA |
| 3 | NTB | 14,39,863 | 142 | 8,63,557 | 5,76,306 | 25,200 | 9,996 | 63% | HSD,MS,SK,FO, NAPTHA |
| 4 | SCB | 1,79,984 | 27 | NIL | 1,79,984 | 7,875 | 6,666 | 9% | Liquid Ammonia and FO Vessels |
| 5 | STB | 32,590 | 5 | NIL | 32,590 | 15,200 | 6518 | 2% | Four FO and one HSD Vessels |
| 6 | Q4 | 2,27,171 | 58 | NIL | 2,27,171 | 11,600 | 2,917 | 14% | FO, HSD, MS & Chemicals (Methanol, EDC, Acetone) |
| | **Total** | **33,52,127** | **334** | **19,02,409** | **14,49,718** | | | | |

As regards to capacity for POL handling, while the capacity of COT is 2.5 MTPA, the capacity of NTB, SCB and STB is about 1.5 MTPA. Of them NTB is already handling to its near full capacity. The COT has a spare capacity of about 1 MTPA.

### 8.2.7.4 LPG

In addition the port has already entered into an agreement with IOC for setting up a Multiuser Liquid Terminal (MULT) for handling LPG and POL products and more particularly products for bunkering. Its capacity is estimated as 4 MTPA consisting of 2 MTPA of LPG and 2 MTPA of POL products. Once the MULT is developed the port will have adequate capacity to handle the projected POL products as also the projected LPG. In this connection it is pertinent to note that of the present import of refined products totalling to about 1 MTPA, some of it will get reduced once the expanded refinery goes into operation in stages.

## 8.3 RECONSTRUCTION OF MATTANCHERRY WHARF

The Mattancherry wharf consisting of four berths Q1, Q2, Q3 and Q4 was originally constructed in 1930s with steel sheet pile earth retaining structure for a length of 457.6 m and concrete/rubble masonry monolith on either side for a total length of 221.5 m. Subsequently a 10.7 m frontage with RCC decking supported on screwcrete piles was constructed in 1950s. The present Mattancherry wharf has a total length of about 661 m. Of this a portion of the wharf (Q4 and part of Q3) covering a length of 251m has been reconstructed in 2005.The remaining length of wharf with old structures is 410 m consisting of Q1, Q2 and part of Q3.

The berths Q1 to Q3 were originally used for handling of general cargo and the quay structure was designed for a dredged depth of -9.75 m CD in front. The wharf frontage of Q1 to Q3 is 10.7 m wide and consists of 2 crane rails at a spacing of 5.5 m. The original earth retaining steel sheet pile quay has been very badly corroded and is beyond economical repairs. Due to this reason the wharf has become not fit for safe berthing of vessels. The berth apron has developed huge settlements to the extent that cargo handling equipment cannot operate in the areas.

Since the berth Q1 is a captive berth for the cement terminal of M/s. Ambuja Cements, a length of about 53 m in the middle of Q1 was recently reconstructed and fitted with new cellular fenders. At the back of the berth Q1, there is a shed (which was originally a transit shed) housing the cement terminal of Ambuja cements.

The Q1 to Q3 berths has a backup area of nearly 7.5 Ha. There are facilities like transit sheds and ware houses.

It is therefore imperative that the berths Q1 to Q3 need reconstruction for length of about 410 m as shown in the image below as marked in red.

**Figure 8.6 Proposed Reconstruction of Mattancherry Wharf Q1 to Q3**

The reconstruction may be done in line with the following overall guidelines.

- The new berth may be constructed so as to be in alignment with berth Q4 which has an offset of about 20 m from the berthing face of Q1 to Q3.
- Whenever such reconstruction is taken up it shall be done without detriment to the berthing and operations of cement vessels belonging to M/s. Ambuja cements whose vessels need either Q1 or Q2 so that they can lay their pipeline and flexible hoses as and when required.

Therefore the construction of Q1 and Q2 shall be done only after another.

- The reconstruction of Q1 to Q3 may be designed to handle fully loaded handysize vessels up to an LOA of 180 m and a maximum depth of 11 m, which approximately corresponds to vessels of 35,000 DWT capacities. This proposal envisions handling of ships by the new berthing structure for the next 50 to 75 years. The limitation in the LOA of the vessels is on account of the limitation of width in the Mattancherry Channel and the turning circle.

As of now it is understood that the CoPT has already firmed up plans to hand over berths Q2 and Q3 to the naval authorities for berthing of naval craft for the next five years or so or till the completion construction of navy's berths. However subsequent to that these berths should be reconstructed so that they could be utilised for import/export of moderate parcels of bulk and break bulk cargoes like food grains, cement, edible oil etc.

## 8.4 OUTER HARBOUR TO COCHIN PORT

Although the traffic projections for Cochin port do not justify development of the outer harbour, however the proposed development could be considered due to the following reasons:

1. The breakwaters built as part of the development would trap the littoral movement and also help in reducing the sedimentation in the entrance channel and harbour basin.
2. There is a requirement from Navy for having higher draft berths, which could be provided in the lee of one of the breakwaters.
3. It would be possible to create large area by way of reclamation that could be used for setting up of petroleum refinery or thermal power plant. This is however subject to approval from MoEF, which prohibits such development in CRZ.

Considering the above aspects four alternative layouts have been developed which are more or less similar to what have been earlier prepared by the port as shown in **Figure 8.7**.

**Alternative 1** – This layout provides for building of one north breakwater (2,000 m long ) and one south breakwater (3,250 m long ) at the port entrance upto 4 m contour so as to block the alongshore sediment movement. This would help in reducing the sedimentation in the channel and hence lower maintenance dredging.

**Alternative 2** – In this layout the north breakwater is kept same as that in case of alternative 1 but the much larger south breakwater of length 6,500 m has been proposed to provide berthing facilities for navy vessels and the backup area. This would however leave most of the quay length of Navy exposed to the waves from W and NW directions, resulting in unfavourable berthing conditions for some part of the year, which are unlikely to be acceptable to Navy.

**Alternative 3** – This layout is developed basically to cover the shortfall of layout 2 and involves longer north breakwater (4900 m length) to provide full protection to the navy berths.

**Alternative 4** – This layout is similar to alternative 3 except that the root of north breakwater is shifted towards north to provide space for reclamation to create vast land area that could be utilised for setting up of an industry like petroleum refinery or thermal power plant. To handle the raw material/product requirements of the refinery additional berthing facilities could be built on the face of reclaimed area. This main issue in this option is while it is permissible to use the reclaimed land for port related works like storage and operations; the MoEF guidelines prohibit its use for setting up any industries, housing, commercial use etc.

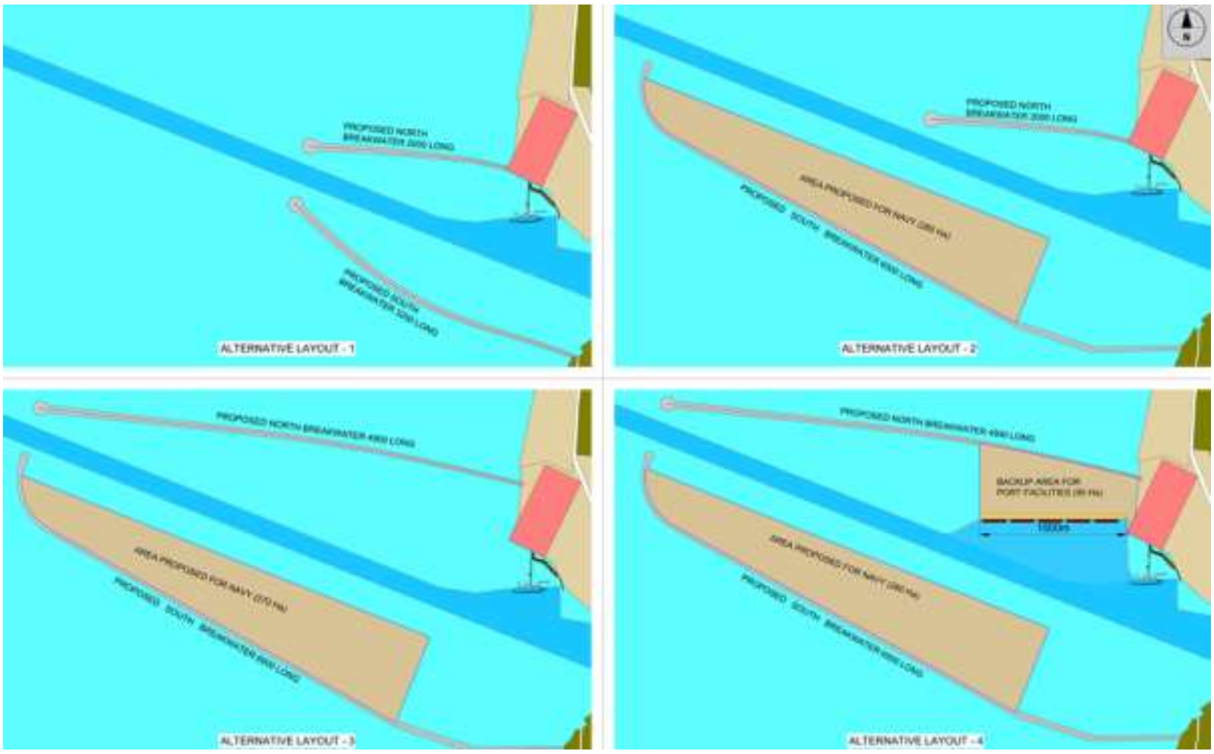



**Figure 8.7 Cochin Outer Harbour - Alternatives**

While proceeding ahead with the development following factors also need consideration:

1. The soil conditions comprise of Soft silty clay for a depth of 20 m from bed level. This means that it cannot support the load of breakwater and thus would resulting in excessive settlements, endangering failure of structure. This may need either very flat slope of the breakwater or ground improvement along the breakwater before dumping the rock. In either case the structure would be very expensive particularly due to the large length.
2. Similar to above the proposed reclamation would need borrowed fill as the dredged material is not suitable for reclamation. Further considering the weak underlying strata ground improvement would need to be carried out resulting in high cost of reclamation.

The investment to create the basic infrastructure of two breakwaters and reclamation is expected to cost over INR 6,500 crores and the total land area obtained from reclamation would be about 3,250 acres i.e. the land would cost about INR 2.0 crores per acre. The immediate apparent benefit seems to be the reduction in the dredging cost by 40% i.e. about INR 60 crores per year. As it is not possible to establish a power plant or petroleum refinery on the reclaimed land as per MoEF guidelines any investment by port on the proposed outer harbour development does not seem to be financially viable.

## 8.5 SMART CITY

### 8.5.1 Vision of Ministry of Shipping (MoS)

The vision of MoS is that each major port will construct one smart city – a “Smart Port City”. These cities will be built as per international standards and have wide roads, green energy, advanced townships and greenery. These will have e-governance links, international standard facilities, special economic zones, ship breaking and ship building centres besides allied things.

Port water will be recycled. Port wastes will be turned into bio gas. Vehicles will run on bio fuel. Solar energy and wind power will be generated at ports. These cities will be pollution-free and very green smart cities. Besides, these smart cities would house schools, commercial complexes and other amenities.

This vision is aiming for a sort of port city continuity. It starts with the needs of the city, albeit in a “systemic” way: the port city must be liveable whilst maintaining its port industry competitive. This means satisfying the logistics requirements of the port as well as the social needs of citizens; if one is to achieve the enhancement of both.

### 8.5.2 Developing Willingdon Island as a Smart Port City

In line with Government of India’s vision of developing smart cities the port also can contribute in their own limited way by developing smart port cities. Since Cochin has been selected as one of the smart cities to be developed in the very first phase, it will be appropriate for the port of Cochin to take up similar development that can get integrated with such smart city development. Fortunately Cochin port has a land bank that can be developed in such lines it is considered appropriate to propose some concepts as part of master plan proposals.

### 8.5.3 SWOT Analysis

While developing such proposals it is considered relevant to analyse the Strength, Weakness, Opportunity and Threat (SWOT) that underlie such proposals in the case of Cochin Port.

#### 8.5.3.1 SWOT – Background and Approach

The SWOT is a common analytical technique for integrated evaluation of an area in order to provide a systematic basis for decision-making in planning, marketing and branding. SWOT refers to strengths, weaknesses, opportunities and threats. It focuses on major issues likely to influence development and does not attempt to list all minor points.

#### 8.5.3.2 Analysis Summary

From the analysis the most significant strengths/opportunities and the threats/weaknesses are summarised. This summary assists in the identification of development framework and the related factors that are significant in identifying potential development agenda and other key supporting amenities.

### 8.5.3.3 Strengths/Opportunities

**Accessibility**

- Proximity to Ernakulam and Fort Kochi; lies in the centre of Ernakulam and Fort Kochi;
- Major port of the region and has strong economic ties with the surrounding area;
- Major Arterial roads passing through the Willington Island connecting Fort Kochi and Ernakulam mainland;
- Destination for a limited number of cruise ships that halt at Willingdon Island for a period of 12 to 16 hrs in a particular season.

**Significant Assets**

- Gateway to the Fort Kochi area which has significant built heritage attracting tourists from around the globe and surrounding region of Ernakulam mainland;
- Presence of significant flora and fauna attracting visitors for bird watching;
- Relocation of container operations from Willingdon Island to Vallarpadam has freed up considerable amount of land that can be used for non-port related activities;
- This land measures 206.53 acres at the south end of Willingdon Island and is fragmented in nature (125 acres near Maritime university, 57.55 acres at south end of island, 4.5 acres between Mattancherry bridge and Thoppumpady, 19.48 acres on western side of tank farms);
- The net area available for development after considering CRZ regulations and flying cone restrictions is about 186 acres or 76 hectares;
- Existing railway line infrastructure; not in use and offers potential for development as a pedestrian walkway dispersed with informal commercial (i.e. food kiosks, food on wheels);
- Efforts in place for developing a promenade; needs high quality facilities and detail planning.

**Significant Built Assets**

- Existence of a few heritage buildings (Bristow School) on Willingdon Island and the neighbouring Fort Kochi offering opportunities to explore the heritage resources of Willingdon Island and surrounds.
- Mattancherry Bridge proposed to be converted into a heritage bridge.
- Key hotels that operate from the islands are Taj Malabar, Trident, Casino and ATS Willingdon Island.
- Opportunities for incubator development and expansion for start-ups which can directly tie back to the start-up mission of the GoI.
- Further the residency education establishments and opportunities for expansion including association with tourism; potential for rental affordable housing.

**Markets and Marketing**

- Opportunities for traditional Kerala Ayurveda centre/spa to be set-up at Willingdon island in order to increase time spent by tourists on the island and hence increasing tourism spend.
- A possible destination for conventions and MICE tourism.
- Youth visiting Kerala through Cruises; youth of the region and their entertainment requirements.
- Opportunities to consolidate existing markets through raising standards and upgrade facilities and services to attract higher spending market sectors.

**Kochi Development Plan and Surrounding Development in Mainland**

- The DP envisages Kochi to be a Global City focussing on a diversified economy by promoting port related activity, industries, IT, tourism, healthcare & trade.
- Focuses on shifting new commercial sub-centres to hinterlands thereby creating opportunities for developing the new parcels in Willingdon Island for commercial purposes.

### 8.5.3.4 Weaknesses/Threats

- The earlier product mix, for which tenders were floated, looked into development of a Free Trade and Warehousing Zone (FTWZ) which did not see any responses (120 acres); need for recalibrating the product mix;
- Limited land area which has further built restrictions due to the CRZ regulations and flying cone restrictions; G+1 floor buildings allowed;
- The port trust can give the land on a maximum lease period of 30 years; commercial development would need flexibility in lease tenure to reach break-even;
- Limited range of recreational activities and tourism product;
- No ‘flagship’ developments for Willingdon Island;
- Threats to adjacent natural and cultural heritage sites due to lack of management plans;
- Lack of ground tour operators;
- Little tourism information, presentation/interpretation;
- Lack of market research data;
- Increased competition from other commercial developments in the Region;
- Lack of security of investment.

### 8.5.3.5 The Need for a Development Framework for Willingdon Island

The overall objectives for a strategic development framework are as follows:

- Develop prospects of economic development and improve the living standard of the population;
- To diversify the economic base by introducing strategic project related to tourism as well as businesses and creating employment opportunities for local people and investors;
- Conserve the natural characteristics of Willingdon Island;
- Develop a liveable environment;
- Focus on efficiency of land utilization.

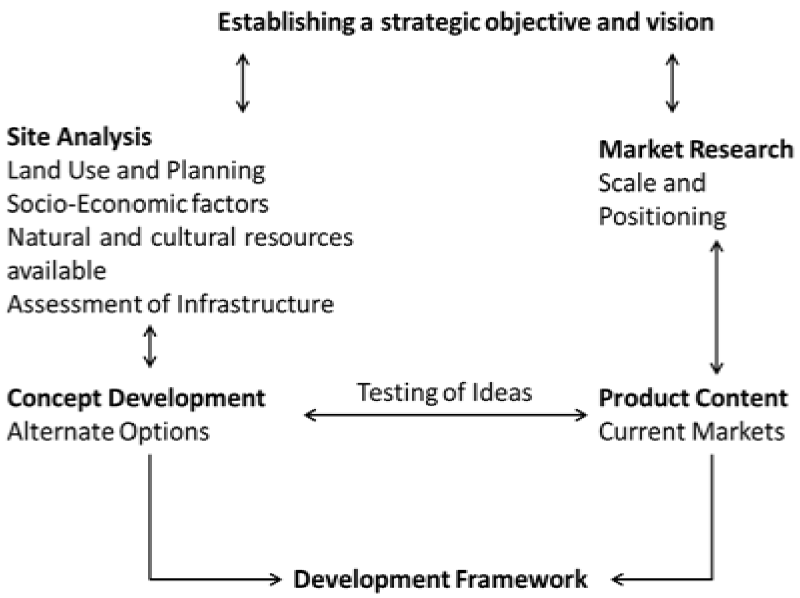
In consultation with the Port Trust, the possibilities for developing a smart port city were explored. It was concluded that in order to develop a smart port city the land development opportunities will need to have a robust development program which is informed by a market analysis. The market analysis would confirm the penetration of commercial development in the region vis-e-vis the absorption capacity of commercial development on the island.

The existing program for the development of the available land parcels as identified by the Port Trust includes the following:

- Hospitality use for around 57 acre site;
- Business District on a 23 acre site;
- Commercial development on a 4.5 acre site; and
- Free Trade Warehousing Zone (FTWZ) for around 102 acre site.

Based on the inputs from the port trust it is established that the programme for development of a FTWZ on a 102 acre site did not receive a positive response from the market and potential investors. This development provides an opportunity for recalibrating the development program and accordingly a development framework will have to be established for the same.

In order to establish a development framework the following steps needs to be followed:




The following are the logical steps to be followed for starting the process:

- On-boarding of a consultant
- Detailed site analysis
- Program development – Initially based on ideas
- Market assessment to test the ideas
- Detail concept master plan based on market assessment and programme validation
- Guidelines for the development
- Financial and revenue model based on the program

### 8.5.3.6 Initial Ideas for Development of Land Parcels

*(Ideas are subject to validation through a market study)*

Market segments that could be explored:

- MICE (Meetings, Incentives, Conferences and Exhibitions) across all sectors.
- Youth markets related to art, music, and festivals. The island could also offer to construct a performing arts centre akin to Sydney Opera House which could be used for promoting traditional dance forms such as Kathakali, martial arts (Kalaripayattu) and Carnatic music providing significant revenue to the Port Trust. This effort could be dove-tailed with the existing initiatives of Kerala Kathakali Centre and Cochin Cultural Centre.
- Creating visitor attractions such as exploring the Ayurveda Centre located at Willingdon Island. Willingdon Island could promote an Ayurveda eco-system.
- Activities related to water sports could also be explored and could be themed as 'Willingdon Waters'.
- Willingdon Island being a separate entity also has very strong linkages to the Fort Kochi (Heritage) and the Ernakulam main land. This provides ample opportunity to create rope-ways to and from the Willingdon Island offering unique views of the place to the visitors.
- Marketing the Indira Priyadarshini Park as a nature asset, and creating similar destinations to the south of the island in order to promote nature tourism.
- Since there is limited vehicular traffic on the island, this could be a perfect opportunity for promoting bicycling tours linking various destinations or just identifying biking circuits for tourists with various amenities provided along the circuit.
- The smallest parcel (4.5 acres) could be developed as a commercial destination with retailing opportunities for businesses.
- Since Willingdon Island has a fisheries technology institute, it could also be developed as the gastronomy destination associated with sea food.
- The Port Trust is also keen on developing residential housing schemes on the released land. This could be possible if the lease period of land could be relaxed and rental housing be promoted at Willington Island.
- A small scale boat making workshops could be created in defunct warehouses in order to retain tourists further promoting local employment.
- Further promoting small scale spice markets on the island which are unique to Kerala.
- Promoting the formation of a 'Central Business District' on the large land parcels following the suggestions made in the master plan for Willingdon Island. This will require a study of the absorption capacity of the region for more commercial, retail and office space.

- As a short term measure, the possibility of renting out the large number of vacant port quarters to general public.
- In order to have affordable rapid transport for general public, Indian Railways may be approached to run local trains between Ernakulam and Cochin Harbour Terminus as part of metro rail system

# 9.0 Shelf of New Projects and Phasing

As part of the Cochin 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.

## 9.1 ONGOING PROJECTS

The details of the projects which have already been awarded and development is ongoing are given below in **Table 9.1**

**Table 9.1 Ongoing Projects**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (INR in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Development of an International Ship Repair Facility | - | 970 | PPP |
| 2. | Multi User Liquid Terminal (MULT) | 4.10 | 230 | PPP |
| 3. | Development of Cruise Terminal cum Exhibition /Convention Hall near Boat Train Pier Jetty | - | - | Port's Funds |
| 4. | Refurbishment and Capacity Enhancement of COT, NTB & STB | - | 22.45 | Port's Funds |
| 5. | Decongesting Vallarpadam | - | 60 | PPP |
| 6. | Malabar Cement Terminal | 1 | 160 | PPP |

## 9.2 PROJECTS TO BE COMPLETED BY YEAR 2020

The details of the projects which are envisaged to be completed by year 2020 are given in **Table 9.2**

**Table 9.2 Projects to be Completed by Year 2020**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (INR in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Setting up of fertilizer bagging facility at Cochin | - | 155 | PPP |
| 2. | Setting up of food grain import terminal at Cochin | 1 | 120 | PPP |
| 3. | Setting of Edible Oil Terminal at Cochin | - | 10 | Port fund |
| 4. | Cryogenic Warehousing | - | - | PPP |
| 5. | Sand Mining | - | - | PPP |

## 9.3 PROJECTS TO BE COMPLETED BY YEAR 2025

The details of the projects which are envisaged to be completed by year 2025 are given in **Table 9.3.**

**Table 9.3 Projects to be Completed by Year 2025**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (In Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Development of Cochin Outer Harbour | - | >6,500 | PPP |

# Appendix 1 - **BCG Benchmarking Study for Cochin Port**

# Master Plan for Kamarajar (Ennore) Port

Prepared for

Ministry of Shipping / Indian Ports Association

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# Quality Information

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| | | | | |
|---|---|---|---|---|
| C. | Master Plan for Kamarajar (Ennore) Port - Final | Marshal Praveen 16.07.2016 | Ritu Paliwal 17.07.2016 | Sanjeev Gupta 19.07.2016 |
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# 1.0 INTRODUCTION

## 1.1 Background

The Sagarmala initiative is one of the most important 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 the 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 a larger economy.

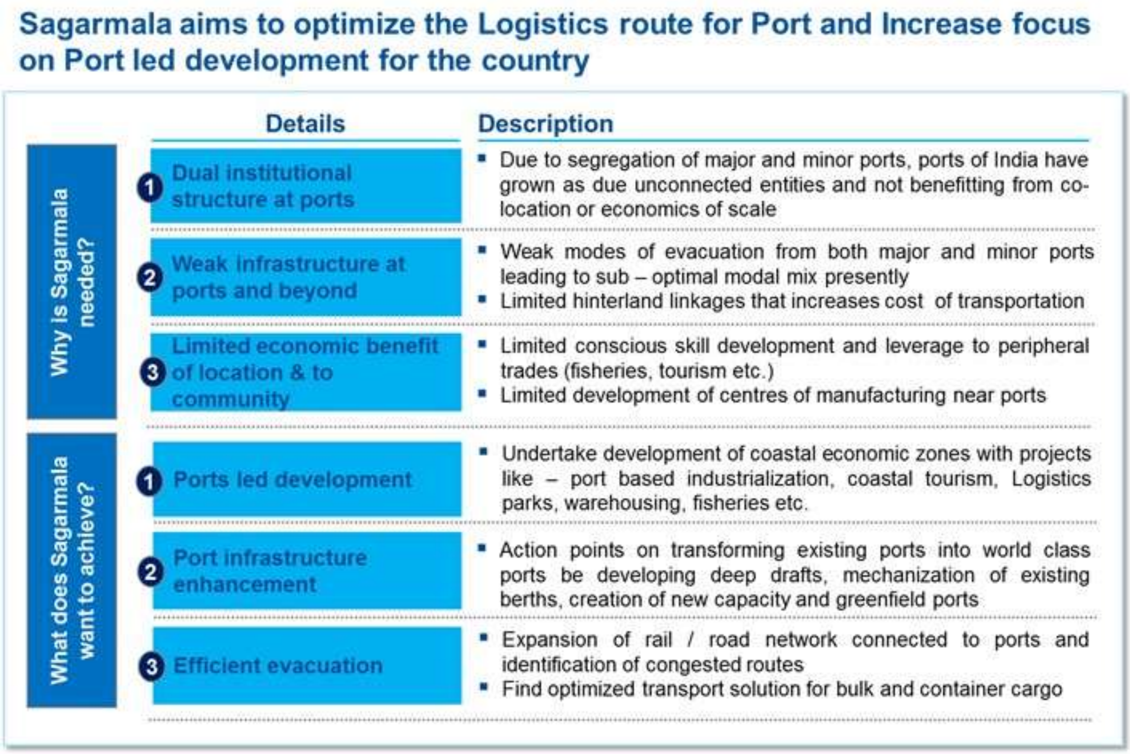



**Figure 1.1 Aim of Sagarmala Development**

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

The team of McKinsey and AECOM distilled learnings from experience in port-led development, the major engagement challenge to develop a set of governing principles of approach is shown in **Figure 1.2** below.

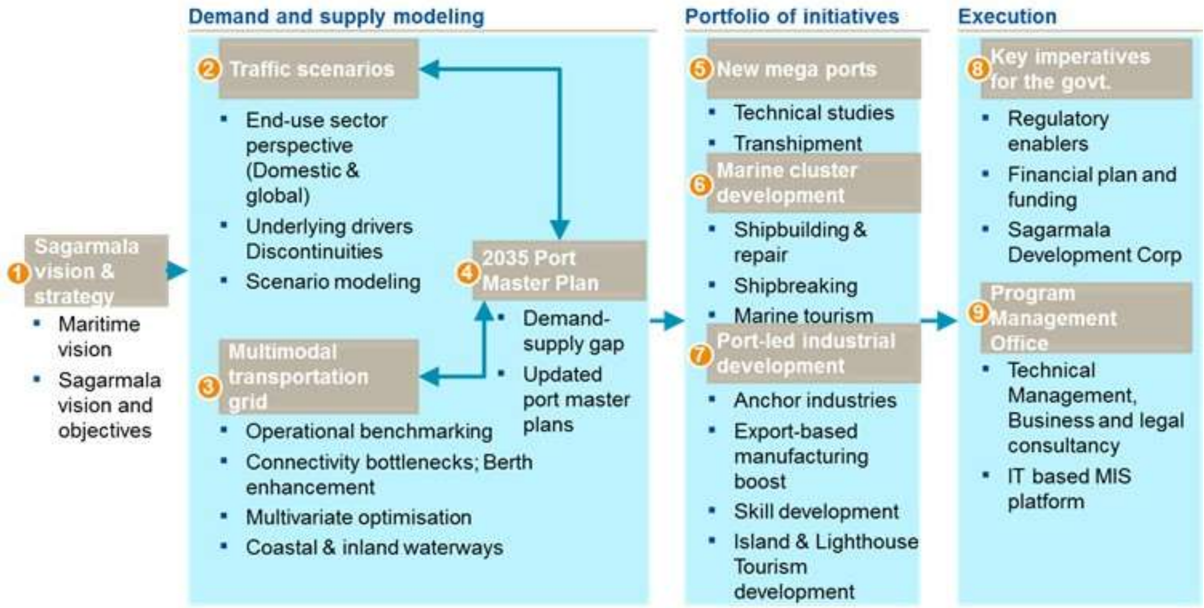



**Figure 1.2 Governing Principles of Approach**

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**.

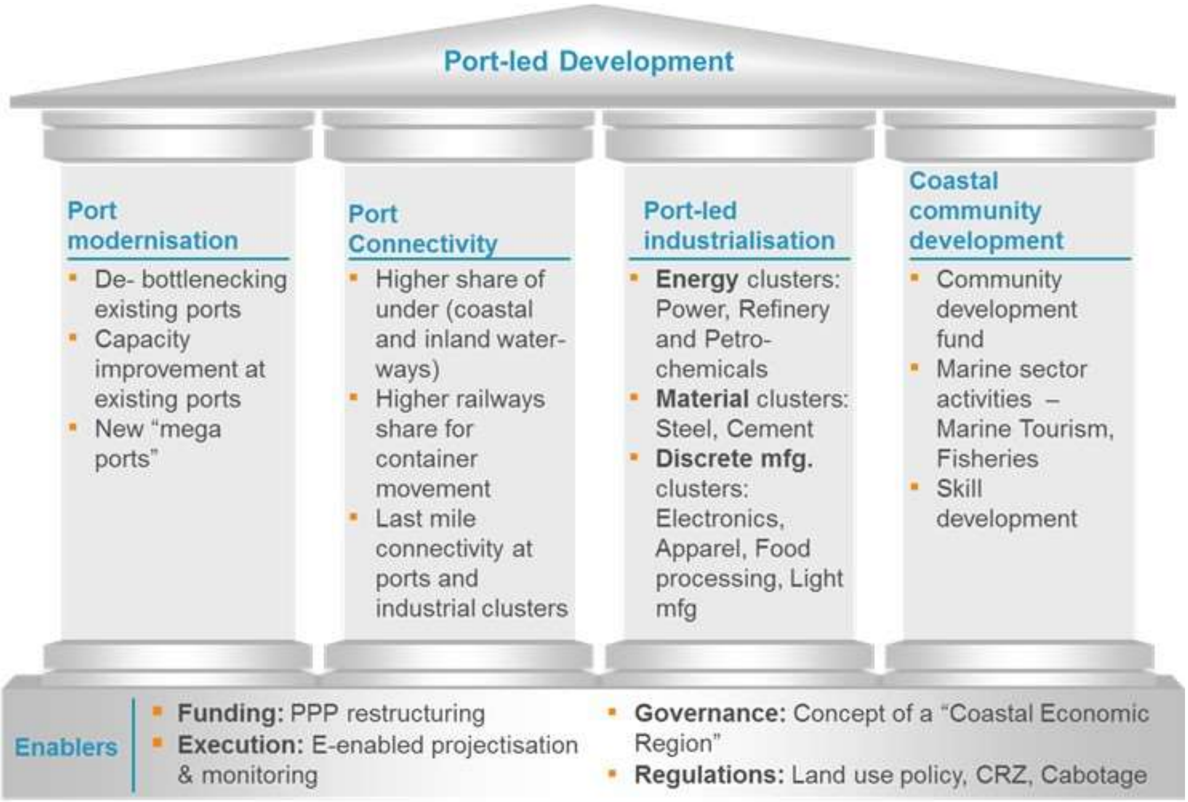



**Figure 1.3 Port Led Developments**

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 Kamarajar Port (Ennore) as part of Sagarmala assignment. This report is organised in the following sections:

| | |
|---|---|
| Section 1 | : Introduction |
| Section 2 | : The Port and Site Conditions |
| Section 3 | : Details of Existing Facilities |
| Section 4 | : Performance, Options for Debottlenecking & Capacity Assessment |
| Section 5 | : Details of Ongoing Developments |
| Section 6 | : Traffic Projections |
| Section 7 | : Capacity Augmentation Proposals |
| Section 8 | : Port Internal Network, External Connectivity and Infrastructure |
| Section 9 | : Scope for Future Expansion |
| Section 10 | : Shelf of New Projects and Phasing |

# 2.0 THE PORT AND SITE CONDITIONS

## 2.1 Kamarajar Port as at Present

The Govt. of India declared Kamarajar Port as the 12th Major Port in March, 1999. It was incorporated as a corporate entity, Kamarajar Port Limited (KPL), under the Indian Companies Act of 1956 on 11th October, 1999.

KPL is operating the Port as a landlord port limiting its functions to overall planning for development, conservancy of the port, regulatory aspects, environment monitoring, dredging the berth areas, port basin and approach channel, installation of navigational aids/fire-fighting facilities, road and rail connectivity. The development and operation of individual cargo terminals are entrusted to private operators.

Kamarajar Port is located on the east coast at Latitude 13° 15' 30" N and Longitude 80° 21' 00" E as shown in **Figure 2.1**.

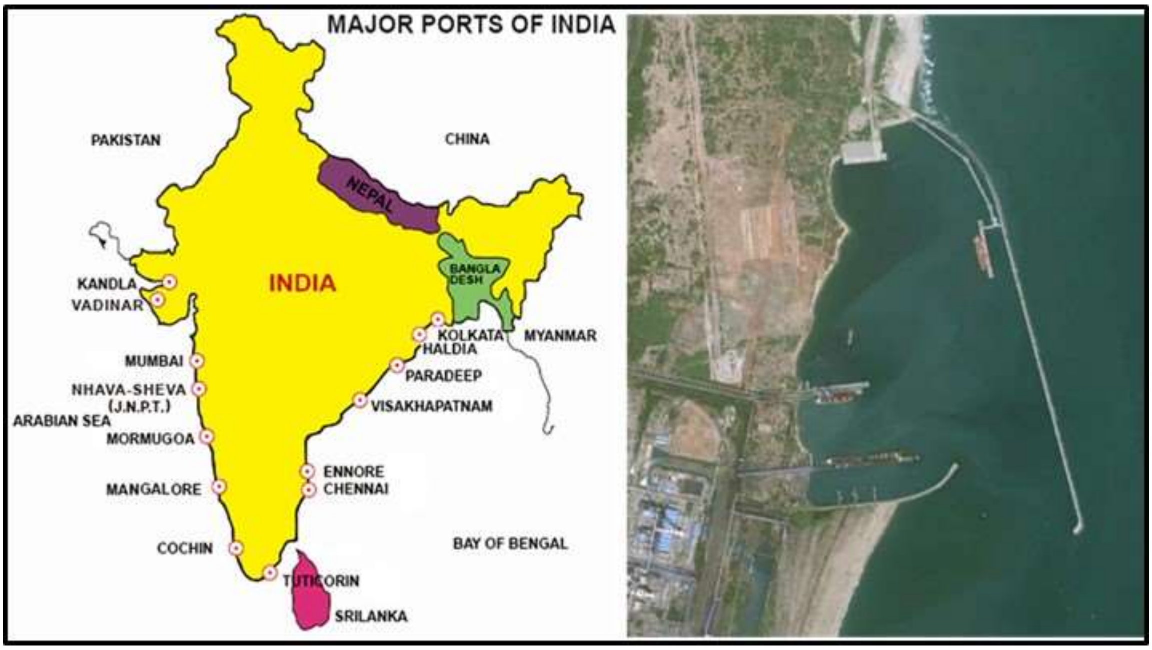



**Figure 2.1 Location of Kamarajar Port**

The Port presently consists of a harbour basin protected by two breakwaters – 3,080 m long on the north/east side and 1,070 m on the south side. An approach channel 3,775 m long; 250 m wide and 19/20 deep (CD) leads to a turning basin of 600 m diameter and 18.5 m deep (CD). For safe navigation in and out of the Port, KPL has a signal tower and navigations aids in the form of two transit light towers, six channel buoys and one fairway buoy. It has also set up an 11 kV sub-station. The navigation of ships in and out of the port and handling them inside the port have been offloaded to an agency on contract basis. The marine crafts include 3 × 40 T bollard pull tugs; 2 pilot launches and 3 mooring launches.

### 2.1.1 Road Connectivity

The following are the three important National Highways emerging from Chennai/ Ennore, these are:

- NH 5 connecting Chennai and Kolkata and passing through major cities such as Vijayawada, Visakhapatnam and Cuttack.
- NH 4 linking Chennai and Mumbai passing through Bangalore and Pune
- NH 45 linking Chennai and Madurai and connecting the southern parts of Tamil Nadu.

All-important destinations in India whether on the North, West or East could be accessed through any one of these three National Highways

### 2.1.2 Rail Connectivity

Presently, Kamarajar Port is connected by rail to the mainline at Attipattu and Attipattu Pudunagar Stations located in the Chennai – Gudur section of the Southern Railway on the Chennai – Delhi/Kolkata route. The southern connectivity takes off from Attipattu Pudunagar Railway Station. The northern connectivity takes off from Attipattu Railway Station. These two lines merge at the Apex Point and run as a single line to the NCTPS Yard. One line branches off from the NCTPS line to Ennore Port premises.

KPL developed the railway facilities connecting the stackyards of the coal and iron ore terminal to the existing NCTPS Railway line.

## 2.2 Site Conditions

### 2.2.1 Meteorology

The climate in the region has a typical monsoon character. Two monsoons dominate the climate - the southwestern summer monsoon and the north-eastern winter monsoon. The summer monsoon starts around the beginning of June and holds on until September. The northeast monsoon starts by the latter half of October and lasts until December. The summer monsoon is stronger than the winter monsoon and the months between both monsoons form a transition period of calmer weather. Storms occur particularly in autumn months.

#### *2.2.1.1 Winds*

The wind rose indicating the wind climate near Ennore is given in **Figure 2.2**. The diagram shows that the largest frequencies of occurrence are from northeast and southwest directions. This corresponds with the monsoon seasons and is in accordance with more general data for the western part of the Bay of Bengal. South to southeast wind directions also occur frequently, mainly during the transition period between the two monsoons.

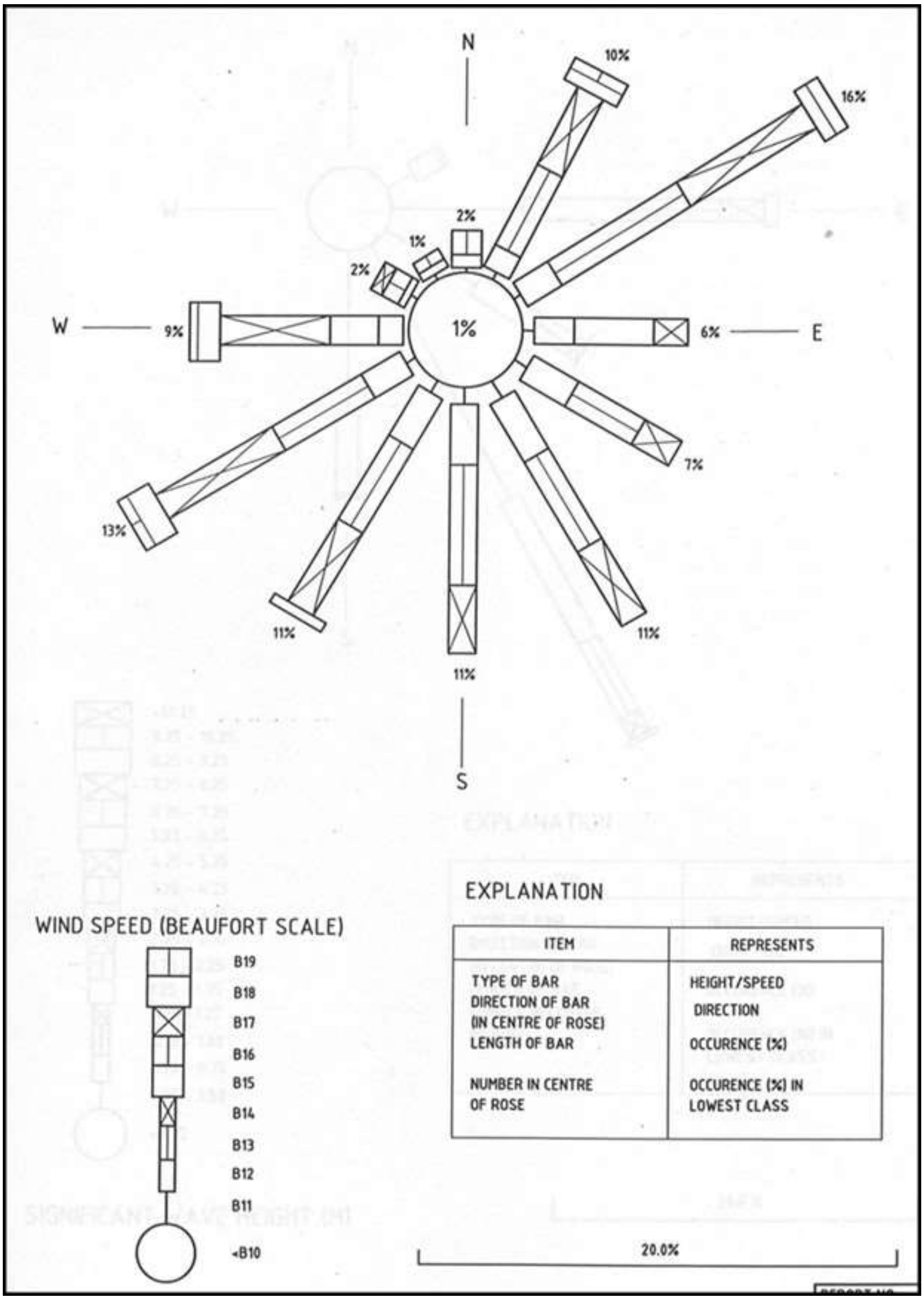



**Figure 2.2 Wind Rose Diagram – Kamarajar Port**

### *2.2.1.2 Rainfall*

More than 60% of the annual rainfall takes place during the northeast monsoon (October to December). The average monthly rainfall in the period 1972 –1983 varied from 1 mm in March/April to 416 mm in November. The total annual rainfall shows considerable variation over the years, from 1,525 mm in 1975 to 550 mm in 1982.

#### 2.2.1.3 Temperature

The average monthly air temperature varies between 37° C in May and June to about 29° C during December and January. The average minimum temperature varies between 28° C in May and June to 21° C in January and February. The highest recorded temperature is 43° C and the lowest recorded temperature is 15° C.

### 2.2.2 Oceanography

#### 2.2.2.1 Tides

The tides at Ennore are semi-diurnal in nature with a tidal range, relative to the Chart Datum (CD), as follows:

| | | |
|---|---|---|
| – *Highest high water level* | *(HHWL)* | *+ 1.50 m* |
| – *Mean high water springs* | *(MHWS)* | *+ 1.10 m* |
| – *Mean high water neaps* | *(MHWN)* | *+ 0.80 m* |
| – *Mean Sea Level* | *(MSL )* | *+ 0.65 m* |
| – *Mean low water neaps* | *(MLWN)* | *+ 0.40 m* |
| – *Mean low water springs* | *(MLWS)* | *+ 0.10 m* |
| – *Lowest low water level* | *(LLWL)* | *- 0.10 m* |

#### 2.2.2.2 Currents

During the NE monsoon, the current is directed southwards while during the SW monsoon the current is directed northwards. The currents in the coastal zone are approximately 0.15 to 0.20 m/s. NIOT has measured currents at four locations off Ennore Port during March 2002. At two locations with water depths of 15 m and 10 m, measurements were taken at 1 m depth intervals. It was noted that the maximum current velocity was 0.35 m/s at the surface and 0.25 m/s near to the seabed.

Current data were also collected by NIOT from the NDBP buoy. It has been noted that the maximum current recorded during March to July, 1999 was around 0.40 m/s and for a few days it reached up to 0.60 m/s. The predominant current direction was towards NNE.

#### 2.2.2.3 Waves

As the near-shore area off Ennore is sheltered from the westerly winds by the mainland, the strong southerly to westerly winds during the SW monsoon do not cause high waves due to the limited fetch available. Consequently, the wave conditions at Ennore are moderate.

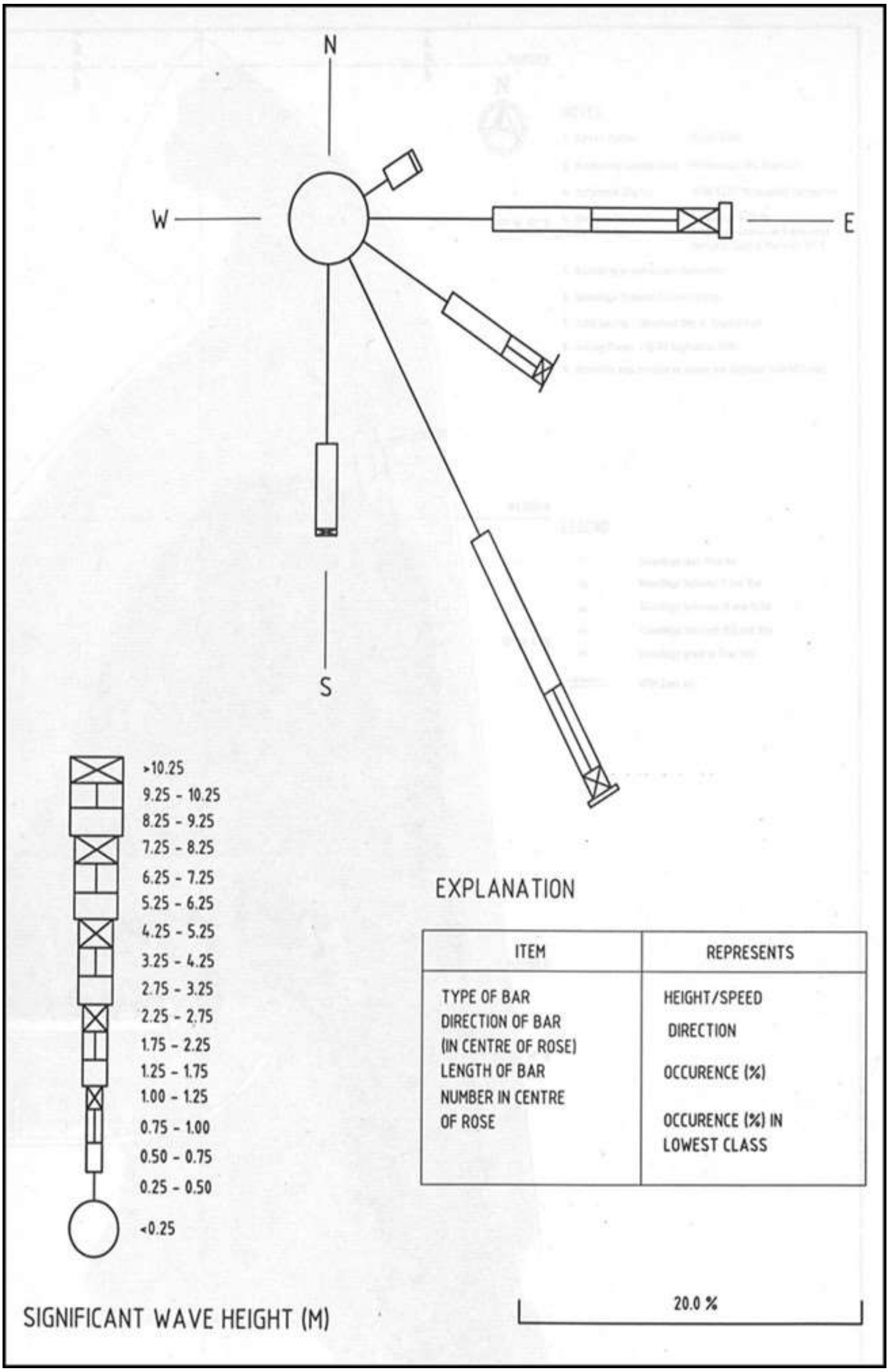
Waves at Ennore, approach predominantly from two directions - 135° N during March - September and 90° N during November – January. During the transition period (February and October), waves approach from 115° N.

The wave rose diagram for offshore waves are shown in **Figure 2.3**.

NIOT deployed a wave rider buoy off Chennai Port at a water depth of 16 m. The buoy could measure waves and currents only for a part of 1998, during which no cyclones crossed the coast. After interpolating for the missing data and making corrections based on visual observations, the wave climate for 1998 was generated. The monthly mean values of wave parameters estimated from the above data are given in the following **Table 2.1**.

**Table 2.1 Monthly Mean Wave Parameters**

| Month | Significant Wave Height (m) | Significant Wave Period (s) | Wave Direction from True North |
|---|---|---|---|
| January | 0.90 | 8.10 | 090° |
| February | 1.10 | 8.20 | 115° |
| March | 0.90 | 8.30 | 135° |
| April | 1.30 | 9.50 | 135° |
| May | 1.60 | 10.80 | 135° |
| June | 1.50 | 11.10 | 135° |
| July | 1.00 | 10.40 | 135° |
| August | 1.10 | 11.00 | 135° |
| September | 1.20 | 11.00 | 135° |
| October | 1.10 | 9.80 | 115° |
| November | 1.00 | 8.60 | 90° |
| December | 1.40 | 8.40 | 90° |
| Note : 90° – waves approach from E<br>115° – waves approach from ESE<br>135° – waves approach from SE | | | |




| ITEM | REPRESENTS |
|---|---|
| TYPE OF BAR | HEIGHT/SPEED |
| DIRECTION OF BAR (IN CENTRE OF ROSE) | DIRECTION |
| LENGTH OF BAR | OCCURENCE (%) |
| NUMBER IN CENTRE OF ROSE | OCCURENCE (%) IN LOWEST CLASS |

**Figure 2.3 Wave Rose Diagram – Kamarajar Port**

# 3.0 DETAILS OF EXISTING FACILITIES

## 3.1 General

Kamarajar Port at present has five operating berths while the sixth berth developed for exporting iron ore has been lying idle since the date of commissioning due to ban on iron ore exports. There are two coal berths for handling coal exclusively for Tamil Nadu Electricity Board (TNEB); one coal berth for multi-users (non-TNEB); one multi-user liquid terminal and one berth for export of automobiles. The locations of these berths along with their back-up areas are shown in the **Figure 3.1**.


**Figure 3.1 Existing Facilities of Ennore Port**

## 3.2 TNEB Coal Berths

Coal berths 1 & 2 are operated by the port and are exclusively for TNEB (TANGEDCO) to handle thermal coal brought from Paradip by coastal transport for its thermal power plants at north Chennai, Ennore and Mettur. Unloaded Coal is directly moved through the conveyor system to the stackyard located in the adjoining North Chennai Thermal Power Station (NCTPS) from where a part of it is moved further to Mettur and Ennore through railway connectivity.

These berths are located north of the southern breakwater and are in the form of a continuous finger jetty. Each berth is 280 m long and 26 m wide with a dredge depth of 15.0 m. The berths have been designed to accommodate bulk carriers up to 85,000 DWT.

NTECL, JV of TNEB erected 2 no. of shore based gantry grab unloaders at CB-2.

Coal Berth 1 (CB-1) is equipped with gantry grab unloaders, each of 2,000 TPH rated capacity. There are two conveyors each of 4,000 TPH running along the entire length of the finger jetty covering the two berths. Coal Berth 2 (CB-2) does not have any shore based unloader and the coal is discharged through ship's own gears. It is equipped with six mobile hoppers on the deck set over the conveyor. In addition there is one large mobile hopper installed for receiving coal through a self - discharging vessel. This hopper is positioned in the middle of the two berths.

## 3.3 Common User Coal Terminal 1

The License to develop a Common User Coal Terminal was awarded to M/s. Chettinad International Coal Terminal Private Limited (CITPL) in 2006 for a thirty-year concession period. The terminal operations commenced in 2010-11. The cargo handled are Steam coal, Thermal coal, Coking coal, Metallurgical coke and Petroleum coke. This terminal is understood to serve about 30 different users.

The berth is in the form of a finger jetty with the berthing face located at a distance of 400 m from the northern face of the TNEB coal berths. The berth is 347.5 m long and 30 m wide. It has been designed for handling Capesize carriers up to 1,50,000 DWT to suit -18.0 m CD dredge depth. The berth is equipped with two rail mounted grab unloaders, each of 1,750 TPH rated capacity. The approach is 145 m long and 8.0 m wide and connects the existing road to the coal berth.

The stackyard area is located at about 2.5 km west of the berth. The total plot area is around 52.0 Ha. The stock pile area is 1,670 m × 105 m with two rows of piles on either side. Each pile is 45 m wide and 10m high with a capacity of 65,000 T each, giving a total capacity of the yard as 7,80,000 T. The stackyard is served by two rail-mounted Stacker cum Reclaimer units each of 3,500 TPH of capacity for stacking and 2,000 TPH capacity for reclaiming. The berth, the yard and the loading stations are all interconnected through a system of conveyors. The receiving conveyors have a rated capacity of 3,500 TPH for coal and 1,400 TPH for coke. The despatch conveyors have a rated capacity of 2,000 TPH.

An in-motion wagon loading station has been suitably installed for loading one full rake of 59 wagons (3,500 T) in about 1 hr 40 min. A steel surge silo of 1,300 T capacity fed through the reclaiming system serves the system. There is an in-motion weigh bridge 50 m south of the silo with an interface with the wagon loading system. Two more parallel tracks have been added to reduce the turn round time of wagons. At present 35 % of traffic moves through rail.

Two truck loading stations along with 1 standby station with pitless weigh-scales are provided for evacuation through trucks. A surge silo of 500 T capacity is provided with swing spouts dust loading spouts. The operations are manually controlled and at present 65% of traffic moves through road.

## 3.4 Multi-User Marine Liquid Terminal 1

The license to develop a Multi-User Marine Liquid Terminal 1 (MLT 1) was awarded to M/s. Ennore Tank Terminals Private Ltd. (ETTPL) in 2004 for a 30 year concession period. The terminal was commissioned in January, 2009. It handles POL, LPG, and chemicals.

The jetty is located at about 1,330 m from the root of the northern breakwater on the western side. The berthing face is at a distance of 160 m from the northern breakwater. The berth is an integrated structure with a continuous deck of 360 m length and 20.75 m width. The structure has been designed to handle fully loaded tankers up to 1,50,000 DWT. Presently, the jetty has a water depth of 15 m sufficient to handle tankers up to 13.50 m loaded draft. The jetty is connected to the shore by a 1.3 km long and 12 m wide approach trestle.

The ship-shore transfer of products is handled through marine unloading arms and flexible hoses. These are one 2 × 12" arms for refrigerated LPG; 1×12" arm for black oil and 1 × 10" arm for white oils. The hoses are of 8" diameter for chemicals. Pipeline manifolds have been provided at the centre as well as quarter point on the northern side. For transfer of products from berth to tank farm, a set of nine pipelines has been laid. These are 2 × 24" dia. (mild steel); 2 × 18" (insulated}; 2 × 12" dia. (mild steel); 2 × 10" and 1 × 8" (stainless steel). All these pipelines are piggable. Required pig launchers and receivers have been provided. There is sufficient space available at the approach trestle as well on the quay supports for laying additional pipelines as and when required. The berth has been provided with Fire Protection System designed as per Oil Industry Safety Directorate (OISD) Standard 156.

The tank farm is located in a 33 acre port-leased plot at about 3.7 km from the berth. It is located within the port security area with an exclusive access from the public road through the west gate. There are seven enclosures for different group of products. There are 63 tanks with a total storage capacity of about 247,990 KL. These can store class A/B/C petroleum products, petrochemicals, vegetable oils, biofuels, acids and safe class liquids. There are stainless steel tanks and internally coated tanks for handling specialised products. All the enclosures have their own truck loading bays with loading gantries with facilities for top or bottom loading. Each enclosure has 5 × 2 truck loading bays except Enclosure 1 which has 3 × 2 loading bays. Each chemical has dedicated pumps and pipeline for delivery to the trucks. There are two 60 T weigh bridges. The entire terminal is having an integrated firefighting system consistent with the requirements of OISD Standard 117.

## 3.5 General Cargo Berth 1 / Automobile Terminal

Kamarajar Port entered into an agreement with M/s. Nissan Motor India Pvt Ltd., M/s Ford India Pvt Ltd., & M/s. Toyota Kirloskar Motor India Pvt Ltd., to export cars. In order to provide required terminal link facilities within the port, Port has constructed the berth as well as a car parking yard on its own with internal resources.

The length of the berth is 250 m and width is 27.5 m. There is an extension of 28 m on the eastern side to retain the earth slope. The berth was designed to handle the largest car carrier with 8,000 car units capacity, of 230 m overall length and 32 m beam. It has a backup yard of 250 m × 100 m for transit parking of cars. The regular car parking yard has been provided initially in a 14.4 Ha plot located about 1.5 km from the berth, opposite to the tank farm of MLT-1, which can accommodate about 10,000 car units.

Subsequently, developed additional parking area of 5.5 Ha plot located adjacent to the existing car parking yard which can accommodate additional 4,000 car units.

## 3.6 Common User Coal Terminal 2

The License to develop Iron Ore Terminal was awarded to M/s SICAL Iron Ore Terminals Ltd. (SIOTL) in 2006 for a thirty-year concession period on (BOT) basis. The terminal was completed during 2010-11. However, due to ban on export of iron ore, the terminal was never put into use. All these years the terminal could not be put into alternate use because of the exclusivity clause in the agreement with the other terminal. Since this period is over now, KPL has taken action to convert this into a common user coal/iron ore import terminal (Non TANGEDCO) capacity on Design, Build, Finance, Operate and Transfer (DBFOT) basis. The modifications/additions to the existing system to meet this dual requirement will be decided by the licensee based on the market demands.

The iron ore berth is located in an East-West direction parallel to the existing TNEB coal berths. This is in the form of a finger jetty with berthing face on the northern side. The berthing face of this finger jetty is located at a distance of 465 m from the northern face of the TNEB coal berths. The berth is of 347.5 m long and 30 m wide with a return berth of 50 m. It has been designed to accommodate a cape size vessel of 1,50,000 DWT.

The terminal has been provided with cargo handling facilities like tippler, conveyor system, stacker cum reclaimer, loader etc. The stackyard is of nearly 1,700 m long to provide space for 8 no. of stock piles of trapezoidal shape each with a length of 145 m and width of 40 m on either side of the Stacker/Reclaimer tracks.

# 4.0 PERFORMANCE, OPTIONS FOR DEBOTTLENECKING & CAPACITY ASSESSMENT

## 4.1 General

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

**Table 4.1 Cargo Handled During Last 5 Years**

(In MT/automobiles in numbers)

| S. No. | Berth | Commodity | 2014-15 | 2013-14 | 2012-13 | 2011-12 | 2010-11 |
|---|---|---|---|---|---|---|---|
| 1. | Coal Berth 1 | TNEB Coal | 11.01 | 9.76 | 8.02 | 7.88 | 5.94 |
| 2. | Coal Berth 2 | TNEB Coal | 4.06 | 4.33 | 1.81 | 1.77 | 2.92 |
| 3. | Common User Coal Berth | Coal | 9.224 | 8.37 | 5.10 | 3.43 | 0.55 |
| 4. | MLT 1 | Liquid | 3.32 | 2.43 | 1.22 | 0.6 | 0.59 |
| 5. | GCB | Automobiles | 2,15,071 | 2,01,981 | 1,45,053 | 1,03,667 | 54,264 |

CICTL – Chettinad International Coal Terminal Ltd. the licensee for common user coal terminal
** It has to be noted that while Coal berth 1 is equipped with ship unloaders, Coal berth 2 depends on ships' own gears to unload the coal but shall soon be equipped with ship unloaders.

## 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 Kamarajar Port is given in **Appendix-1**. Their study has covered CB 1, CB 2 and CICTL berths only. The key observations are as follows:

According to BCG, the coal berths at KPL are all operating at productivity much lower than their rated capacity. Coal berth 1 whose unloaders have a rated capacity of 4,000 TPH are operating at 34% and CICTL whose unloaders have a rated capacity of 3,500 TPH are operating at 37%. The best rate is 60% of rated capacity for unloading operations.

According to them, the performance norms at CICTL are not strictly followed.

The stipulated norms are

- 40,000 DWT vessels - 30,000 TPD
- 77,000 DWT vessels - 50,000 TPD
- 150,000 DWT vessels - 60,000 TPD

According to their observations, on an average about 38% of the total time spent by the vessels at the berth is non-working time. This has to be brought down.

In order to improve the overall productivity, they have suggested the setting up of a port governance system. For this purpose they have proposed a new data template. According to them, there is also a need to set up a team within KPL to take charge of audit of operations of terminals and identifying areas for further operational improvements within each terminal.

They have also suggested that the Marketing/Business development team at the port need to be activated to drive relations with end customers for the port. All the marketing activities of port terminals need to be integrated with the port BD team to derive the best results.

## 4.3 Performance of Coal Handling Berths

The performance of coal handling berths during 2014-15 is examined in **Table 4.2**.

**Table 4.2 Performance of Coal Handling Berths During 2014-15**

| S. No. | Description | CB 1 & CB 2 | CICTL |
|---|---|---|---|
| 1. | Total volume handled | 1,51,33,515 | 92,19,197 |
| 2. | Total number of ships | 252 | 161 |
| 3. | Share of ships <60,000 dwt | 52% | 49% |
| 4. | Average ship size | 48,500 | 56,000 |
| 5. | Share of ships >60,000 dwt | 48% | 51% |
| 6. | Average ship size | 74,600 | 76,000 |
| 7. | Average productivity TPD - ships <60,000 DWT | 33,310 | 31,380 |
| 8. | Average productivity TPD - ships>60,000 dwt | 40,340 | 30,395 |

Since the TNEB second berth CB 2 was being equipped with ship unloaders, its performance was affected. However, since the same vessels chartered by TNEB / NTECL call at either of these berths the operation of these two berths has been combined for the analysis.

As indicated earlier, the capacity of the berth depends on the productivity, fleet mix and the allowable berth occupancy.

BCG, in their study report, have indicated the shortcomings in the productivity and suggested measures to improve. Assuming at least 25% improvement in the overall productivity, the average handling rate for the two categories of ship sizes could reach up to 40,000 TPD for ships < 60,000 DWT and 50,000 TPD for ships >60,000 DWT.(In this category the maximum ship size at KPL has been 87,000 DWT)

As regards fleet mix, TNEB, presently charters all size of ships from handysize to capesize (84,000 DWT). They can be advised to increase the ship size uniformly to panamax size to increase the capacity of the berths. On the other hand, CICTL serves multiple customers big and small and the fleet mix is not under their control. It is seen from BCG report that there are at least 25 customers each having a traffic volume of only 0.1 MTPA. Accordingly their ship size is likely to be small. Hence it is likely that the present fleet mix will remain.

During 2014-15, CB 1 had 97% berth occupancy with an average pre-berthing detention of 2.3 days/ship while CICTL had 84% berth occupancy with an average pre-berthing detention of 1.9 days/ship. As an international practice, it is customary to consider 350 operational days in a year and 65% berth occupancy. Even though with limited number of berths, there will still be pre-berthing detention; it may not be very high.

Based on the foregoing, the assessed capacities of coal berths will be as shown in **Table 4.3**.

**Table 4.3 Existing Capacity of Existing Coal Berths**

| S. No. | Particulars | Unit | Coal Carriers | |
|---|---|---|---|---|
| | | | DWT < 60,000 | DWT > 60,000 |
| 1. | Cargo Handled | MTPA | 4.50 | 4.50 |
| 2. | Average Parcel size | T | 48,500 | 74,600 |
| 3. | No. of Ship Calls per Annum | No. | 93 | 60 |
| 4. | Average Handling Rate | TPD | 40,000 | 50,000 |
| 5. | Time Required at Port Per Ship | | | |
| a. | Cargo Handling Time | Days | 1.21 | 1.49 |
| b. | Berthing / Deberthing & Miscellaneous Time | Days | 0.17 | 0.17 |
| | Total Time per Ship | Days | 1.38 | 1.66 |
| 6. | Total Berth Days Required | Days | 128 | 100 |
| | Total Berth Days Required | Days | 229 | |
| 7. | Berth Days Available per Berth | Days | 350 | |
| 8. | Berth Occupancy | % | 65.3% | |
| 9. | **Capacity of Berths** | **65%** | **8.96** | |

The assessed capacity could be rounded off to 9 MTPA. If the entire volume is brought in Panamax vessels only, the capacity will be about 10 MTPA.

Considering the possible fleet mix, the same capacity could be assumed for all the coal berths including the iron ore berth, which is being converted into a common user coal berth.

## 4.4 Performance of Liquid Bulk Handling Berth

The performance of the multi-user liquid terminal during 2014-15 is examined in detail in the **Table 4.4**. This terminal handles primarily POL, LPG and chemicals including CBFS.

The POL products are mainly MS, ATF, SKO and HSD for marketing purposes handled for IOCL, BPCL, HPCL, Reliance, Essar and Shell. Except for HPCL all the requirements of other agencies pass through the tankage terminal of ETTPL, the operator of the berth. HPCL have their own tank farm about 12 km from the berth and they take their products directly to their terminal. BPCL is also setting up their tank farm next to that of HPCL and they will also take the products directly to their terminal. IOCL is also planning to set up tank farms away from the port.

LPG is received for IPPL who have their tankage about 12 km from the berth. The product is pumped directly to their tanks.

All the chemicals are handled through the ETTPL tank farm which is about 4 km from the berth.

**Table 4.4 Performance of Liquid Handling Berth (2014-15)**

| S. No. | Description | POL | LPG | Chemicals |
|---|---|---|---|---|
| 1. | Total volume discharged | 1,893,997 | 1,294,053 | 129,092 |
| 2. | No. of ships | 133 | 56 | 54 |
| 3. | Average parcel size | 14,241 | 23,108 | 2,391 |
| 4. | Total working time in days | 188.2 | 82.25 | 38.3 |
| 5. | Average pumping rate in TPH | 410 | 645 | 120.0 |
| 6. | Average productivity TPD | **10,007** | **15,733** | **3,515** |
| **OVERALL AVERAGE PRODUCTIVTY - 10,719 TPD** | | | | |

From the table, it can be seen that the average pumping rate is only 410 TPH. This is mainly because the bulk of the volume is handled for HPCL whose terminal is 12 km away. As regards LPG, here again the pumping distance is about 12 km. Moreover, it takes about 6 hours for pre-cooling the arms at low pumping rate before the full discharge rate is achieved. Chemicals are received in small parcels and are discharged through flexible hoses.

Adopting the current average productivity of about 13,500 TPD taking weighted average according to commodities handled, the capacity of the berth could be limited to 350×0.65×13,500 ≈ 3.0 MTPA.

## 4.5 Performance of General Cargo/Automobile Berth

The performance of the general cargo/ automobile berth during 2014-15 is given in **Table 4.5**. This berth primarily caters to the export of Renault-Nissan car units as also those of Ford and Ashok Leyland.

- Total volume handled - 2,15,071 units
- Number of ships - 123
- Average parcel size - 21,000 T
- Total working time in days - 75.5
- Average productivity - 2,850 units/day

Based on these key parameters, the capacity is assessed as follows:

**Table 4.5 Existing Capacity of Multipurpose Berth**

| S. No. | Particulars | Unit | Car Berth |
|---|---|---|---|
| 1. | Cargo Handled | Units | 5,00,000 |
| 2. | Average Parcel size | units | 21,000 |
| 3. | No. of Ship Calls per Annum | No. | 24 |
| 4. | Average Handling Rate | Units per day | 2,850 |
| 5. | Time Required at Port Per Ship | | |
| a. | Handling Time | Days | 7.37 |
| b. | Berthing / De-berthing & Miscellaneous Time | Days | 0.17 |
| | Total Time per Ship | Days | 7.54 |
| 6. | Total Berth Days Required | Days | 179 |
| | Total Berth Days Required | Days | 179 |
| 7. | Berth Days Available per Berth | Days | 350 |
| 8. | Berth Occupancy | % | 51% |
| 9. | **Capacity of Berth** | **65%** | **6,33,753** |

The assessed capacity could be rounded off to 6, 00,000 units per annum or equivalent to about 1.0 MTPA.

## 4.6 Summary of Debottlenecked Port Capacity

Summing up the earlier conclusions, the capacity of the existing berths and the port after debottlenecking would be as shown in **Table 4.6**.

**Table 4.6 Capacity After Debottlenecking**

| Berths | Capacities (MTPA) |
|---|---|
| **Coal Handling berths CB 01; CB 02 (2× 8 MTPA); CICTL (8 MTPA) & SIOT (12 MTPA)** | 36.0 |
| **Liquid Handling berth MLT 1** | 3.0 |
| **General cargo/ Automobile berth** | 1.0 |
| **Total** | **40.0** |

# 5.0 DETAILS OF ONGOING DEVELOPMENTS

## 5.1 General

In recent times, in order to meet the growing traffic demands, Kamarajar Port has initiated action for creating additional terminal facilities. Two more coal berths for TNEB, one container terminal, one LNG terminal and one multi-cargo terminal are under construction. While the two TNEB berths are developed by KPL on its own, the container terminal and multi-cargo terminal are licensed to private agencies on DBFOT basis. The LNG terminal is being set up by IOCL on nomination basis. The locations of these berths along with their back-up areas are shown in the **Figure 5.1**.


**Figure 5.1 Location of Ongoing Developments**

The details of these berths are brought out hereunder:

## 5.2 Additional TNEB Coal Berths – CB 3 & CB 4

With the setting up of Vallur Thermal Power Station (VTPS) near Kamarajar Port, expansion of NCTPS, Ennore Power Station, Mettur Power Station and also with a proposal for a new Power Station at Kattupalli, there is growing demand for coal handling facilities at KPL for TNEB coal. Accordingly, KPL has taken action for construction of two more berths CB 3 & CB 4 on its own through internal funding. The port will provide the berth structure and all the topside facilities such as gantry type grab unloaders and conveyor system will be erected and operated by TNEB.

These berths are located within a dock basin created at the foreshore in between the berthing faces of CB 1/CB 2 (at south side) and CICTL (at north side). The basin will be 329.5 m wide and 342.0 m long and with dredged depth of 20 m below CD. The berths have been designed to accommodate capesize bulk carriers up to 180,000 DWT.

***<u>Coal Berth CB 3</u>***

The construction was awarded to M/s. ITD Cementation India Ltd. The construction work started during July, 2015 and is expected to be completed and commissioned by July, 2017, the berth is 354 m long and 34.8 m wide. The berth structure is made up of a 1,400 mm thick diaphragm wall founded at -30 m; 3 rows of 1,300 mm dia. and the front row of 1,600 mm dia. bored cast-in-situ piles, all founded at -40 m. The berth is provided with cell dock fenders with frontal frames and 150 T bollards, spaced at 20 m centres.  The space between the existing conveyors of CB 1/2 and CB 3 will be hardened for 360 m × 10 m.

In addition, an earth retaining structure on the western side for a length of 207.3 m and 22 m wide is also being constructed. The structure is made up of a 1200 mm thick diaphragm wall founded at -30 m; 3 rows of 1,200 mm dia. bored cast-in-situ piles, all founded at -40 m. This structure is provided with 60 T bollards and v type fenders spaced at 20 m centres.

The berth will be equipped with two gantry grab unloaders, each of 2,000 TPH rated capacity. There will be a conveyor of 4,000 TPH capacity running along the entire length of the berth leading directly to NCTPS stackyard.

***<u>Coal Berth CB 4</u>***

The construction was awarded to M/s. AFCONS Infrastructure Ltd. The construction work started during August 2015 and is expected to be completed and commissioned by August 2017. The berth is 342 m long and 27.5 m wide. The berth structure is made up of a 1400 mm thick diaphragm wall founded at -30 m; 3 rows of 1300 mm dia. and the front row of 1600 mm dia. bored cast-in-situ piles, all founded at -40 m. The berth is provided with cell dock fenders with frontal frames and 150 T bollards, spaced at 20 m centres.

In addition, an earth retaining structure on the western side for a length of 184.6 m and 22 m wide is also being constructed. The structure is made up of a 1,200 mm thick diaphragm wall founded at (-) 30 m; 3 rows of 1,200 mm dia. bored cast-in-situ piles, all founded at -40 m. This structure is provided with 60 T bollards and V type fenders spaced at 20 m centres.

The berth will be equipped with two gantry grab unloaders; each of 2,000 TPH rated capacity. There will be a conveyor of 4,000 TPH capacity running along the entire length of the berth leading directly to NCTPS stackyard as well as to the stackyard of Kattupalli Power Station.

## 5.3 Container Terminal Phase 1 (Stage I & II)

The License to develop a Container Terminal was awarded to Adani Ports & SEZ Ltd. on DBFOT basis, who formed a SPV named M/s. Adani Ennore Container Terminal Private Limited for this purpose. The concession agreement for a thirty-year concession period was signed during May, 2014. This will be developed in two phases. The first phase of terminal construction started in October 2014 and should be completed and commissioned by January 2017. However, the licensee is planning to commission the terminal by mid-2016

The berth will be constructed on land and later the water front will be dredged. The berth will be 400 m long during the first phase and extended by 330 m during the second phase. It has been designed for handling post-panamax container vessels up to 14,000 TEU to suit -16.0 m CD dredge depth. The sub-structure consists of 1100 mm thick diaphragm wall in the front, a 1200 mm dia. bored cast-in-situ concrete pile in the middle and a 1100mm x 3000mm panel pile on the landside. The centre distance between these three units is 15m + 15 m. The 30 m gauge crane rails are supported by the diaphragm wall on the sea side and the panel pile on the land side.

The berth will be equipped with four rail mounted quay cranes each with 62 m outreach during the first phase and three more such cranes will be added during the second phase.

During the first phase, the back-up area is 400 m × 500 m accommodating the container parking areas, service roads, buildings, gate complex, utilities, weigh bridge and other service facilities. The container parking area will have 3590 TEU ground slots. This will be served by 12 no. eRTGs, one reach stacker and 24 ITVs. During the first phase Stage I, the terminal capacity will be 0.8 million TEUs.

During the first phase Stage II, the back-up area will be 330 m × 500 m. The container parking area will have 3,615 TEU ground slots. This will be served by 9 no. eRTGs, one reach stacker and 18 ITVs. During the first phase Stage II the terminal capacity will be 0.6 million TEUs.

Initially, the containers will be evacuated by road only. KPL is taking action for extending the railway lines to serve both the container terminal as well as the multi-cargo terminal. Once these railway facilities are commissioned, containers will move by rail also.

## 5.4 Multi-Cargo Terminal

The License to develop a Multi-cargo Terminal was awarded to a consortium of M/s. Chettinad Builders Pvt. Ltd. & South India Corporation Pvt. Ltd. on DBFOT basis, who formed a SPV named M/s. Chettinad International Bulk Terminal Private Limited for this purpose. The concession agreement for a thirty-year concession period was signed during March, 2014. Award of concession was granted during February, 2015. The terminal construction started in July, 2015 and should be completed and commissioned by July 2017. The terminal is expected to handle fertilisers – both finished and raw material, sugar, food grains, bulk cement, general cargo, dry bulk other than coal and project cargo. The capacity of the terminal is expected to be about 2 MTPA in the initial stages.

The terminal will have a 270 m long berth with 500 m deep back-up area. The berth sub-structure will consist of a diaphragm wall on the sea side, a central row of bored cast-in-situ piles and a rear row of panel piles of the same thickness as the diaphragm wall. The deck will be made up of transverse beams, precast and in-situ deck slabs.

The terminal will be served by two Harbour Mobile Cranes with two mobile hoppers, 12 dumpers, 3 front-end loaders, 5 trailers, 2 heavy duty and 4 normal fork lift trucks. The back-up area will have suitable transit sheds, service buildings, work shop, gate complex, Weigh Bridge etc. During initial stages the receipt and evacuation of cargo will be by road only. KPL is taking action for extending the railway lines to serve the multi-cargo terminal. Once these railway facilities are commissioned, cargo will be moved by rail also.

## 5.5 LNG Terminal

Indian Oil Corporation Limited (IOCL) had identified Ennore as a possible location for setting up its LNG Terminal with regasification facilities. KPL obtained "in principle" approval of the Government in July 2005, for IOCL to set up this LNG terminal. During May, 2013, Ministry conveyed the approval of the Government for leasing of land measuring 52 ha. to the Joint Venture led by IOCL for a period of 30 years for setting up of LNG Storage and Re-gasification Terminal of 5 MTPA capacity at the project cost of Rs. 5151 cr. Subsequently, KPL signed the Concession Agreement with the SPV company of Indian Oil LNG Private Limited (IOLPL) during 2015 for setting up of the LNG Terminal.

The LNG berth will be located near the root of the north breakwater. The centre to centre distance between the LNG berth and the next liquid bulk berth may be about 450 m the berthing face of the jetty will be located 235 m from the centre line of the breakwater. The minimum water depth at the berth will be 15 m below Chart Datum. This jetty will be designed to accommodate LNG tankers of 160,000 DWT with 290 m overall length and 48 m beam. This will be an open piled jetty with isolated dolphins basic layout of 4 berthing dolphins and 6 mooring dolphins.

The regasification plant will have 2 cryogenic storage tanks each of 180,000 $m^3$ capacity and regasification facilities.

IOLPL awarded the two packages i.e., Regasification terminal and Tankage Construction and mobilization work is in progress. The other package i.e. berth construction also awarded recently. The terminal is likely to be commissioned by 2018.

## 5.6 Captive Jetty for IOCL

KPL has granted Indian Oil Corporation (IOC) in principle approval to set up a captive jetty to handle imported Petroleum, Oil and Lubricants (POL) & LPG cargo. This facility would be of 360 m in length and shall have a design capacity of 3 MTPA. KPL has signed the MOU with IOCL on 30th November, 2015.. The terminal would become operational by early 2019.

## 5.7 Second Automobile Terminal/ Ro-Ro Jetty

The berth will be located adjacent to the existing automobile berth at its western end. The berth will be located within the proposed dock basin as shown in the Master Plan of the port. For serving the existing terminal, KPL has already developed an area of about 35 acres for parking the car units and another area of about 14.5 acres is under development. The combined parking area can accommodate about 10,000 car units and that should be sufficient to serve the second terminal also. The second terminal will have a transit parking area just behind the berth with an area of 250 m × 250 m.

The berth will be designed to accommodate the largest car carrier of 8,000 units capacity. This will have the following dimensions: 30,400 DWT; LOA 228 m; beam 32 m and a loaded draft of 11.3 m. The berth will be330 m long and 33.25 m wide.

KPL selected the Contractor i.e., M/s. L&T Geostructure LLP, Chennai for construction of RORO cum General Cargo Berth-II during March 2016.

## 5.8 Capital Dredging Phase III

In order to provide a water depth of -16 m CD for the proposed Container Terminal Phase 1 and Multi Cargo Berth and -18 m CD for the proposed Coal Berth 3 and 4, Phase 3 of the capital dredging is being taken up by the port.


**Figure 5.2 Phase 3 Capital Dredging**

KPL has issued the Letter of Award to M/s. International Seaport Dredging Ltd., Chennai during July, 2015. The work is expected to be completed by early March, 2017.

## 5.9 Capital Dredging Phase IV

Deepening the basin and channel to cater to capsize vessels is like a lifeline for the port in the absence of which there is every probability of losing its competitive position over neighbouring ports particularly in case of Coal and Container Cargo. While the increasing demand for import steam coal, the importers will prepare deployment of deep draft vessel to gain economics of scale. Considering the demand Port has initiated to deepen the basin and channel to cater to capsize vessels.

IPA has prepared the Feasibility Report, the channel length to be increased to 7,680 m from the existing length of 5,200 m. The existing channel has 270 m width at straight portion and 300 m at bend portion. The deepening may be done in the existing width only. The scopes of the proposed dredging works are given below:

Proposed depths in the basin and channel:

(i) Outer approach channel from -20 m CD to -23 m CD and extension of the channel from -20 m contour to – 23 m contour

(ii) Inner channel from -19 m CD to -22 m CD

(iii) The basin area will be dredged to -21 m CD.

KPL selected the Contractor i.e., M/s. International Seaport Dredging Pvt. Ltd., Chennai during March 2016.

# 6.0 TRAFFIC PROJECTIONS

## 6.1 General

Kamarajar is a major port in Tamil Nadu handling ~30 MTPA of cargo. Thermal coal forms the major share in the port traffic contributing ~80% to the total traffic. POL, coking coal and automobiles form the majority of the remaining share. Going into the future we expect to see the total traffic at the port to go up to ~70 MTPA by 2020 and 85-95 MTPA by 2025.

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 Kamarajar up to 2035 has be derived as presented in this chapter.

## 6.2 Major Commodities and their Projections

### 6.2.1 Thermal Coal

Ennore facilitates movement of thermal coal to TNEB-Ennore, North Chennai and Mettur Power Stations. The total coal requirement for all these power plants having an installed capacity of ~5200 MW is ~26 – 67 MTPA.

The capacities of these power stations are as follows:

- Ennore TPS 450 MW
- Mettur TPS 1440 MW
- North Chennai TPS 1830 MW
- Vallur TPS 1500 MW

In addition, TNEB is taking action for the following power plants, viz.

- ETPS expansion 660 MW
- NCTPS Stage III 800 MW
- Kattupalli TPS 1600 MW

These plants are expected to be commissioned before 2020. The total coal requirement for these power plants is about 13 MTPA. Accordingly the total thermal coal imports are likely to be 40 MTPA by 2020.

The split of the thermal coal traffic amongst the different power plants is as shown **Figure 6.1**.

## Thermal coal volumes

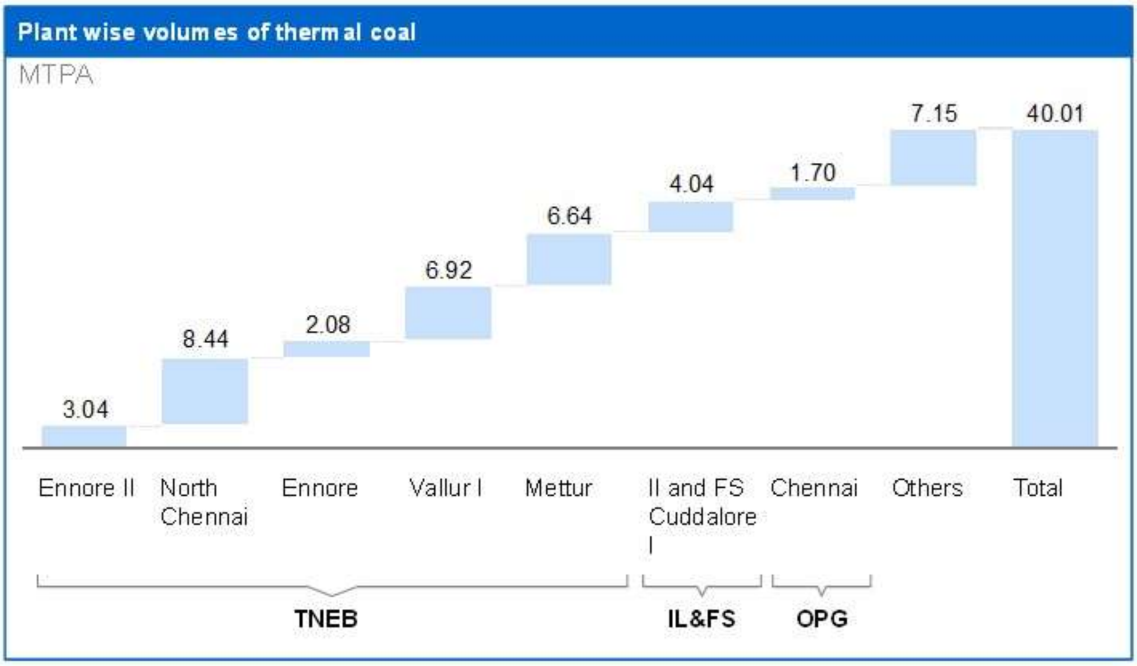



**Figure 6.1 Plant Wise Volume of Thermal Coal**

Earlier, Karnataka Power Corporation Ltd. (KPCL) for their Raichur Power Plant, (1.0 MTPA ) and Andhra Pradesh Electricity Board (APGENCO) for its power plant at Muddanur (1.0 MTPA) were importing thermal coal through Chennai Port. Subsequently, they shifted to Krishnapatnam. It is possible to get these back to Ennore.

### 6.2.2 POL

Current ~3 MTPA of POL handled at the Ennore port comprise of 1.80 MTPA of POL products (Coastal and EXIM) and 1.30 MTPA of LPG. It is understood from IOC that they are planning to shift incoming POL products at Chennai Port for marketing purposes to Ennore for which they have been given a captive berth. This volume will be about 2.0 MT. In addition they propose to handle about 0.7 MT of lubricants. They have also a proposal to bring in excess POL from Paradip for marketing purposes which will be moved through existing pipelines to Bangalore & Tiruchi/Madurai/Sankari. The volumes are not yet firmed up but could be over 1 MT. They have provisionally informed the port that their volume could be 3.5 MTPA.

BPC has acquired land near Ennore Port for shifting their existing marketing terminals from Chennai. They have already started getting POL products at Ennore in small quantities through MLT 1. Once their new terminal is fully commissioned, their volume could reach 1.0 MT.

Hence by 2020, the total POL traffic could reach 7.8 MT without taking into account the incremental imports by Shell/Reliance/Essar for marketing purposes and also the normal growth. For example LPG traffic grew from 0.6 MT in 2012-13 to 1.0 MT in 2023-14 and to 1.3 MT in 2014-15.

IOC has also initiated action for construction and commissioning of a LNG terminal at Ennore. Its capacity will be 5 MTPA. This terminal is likely to be commissioned by 2018.

The split of the current POL traffic and the projected volumes for 2025 is as shown in **Figure 6.2**.

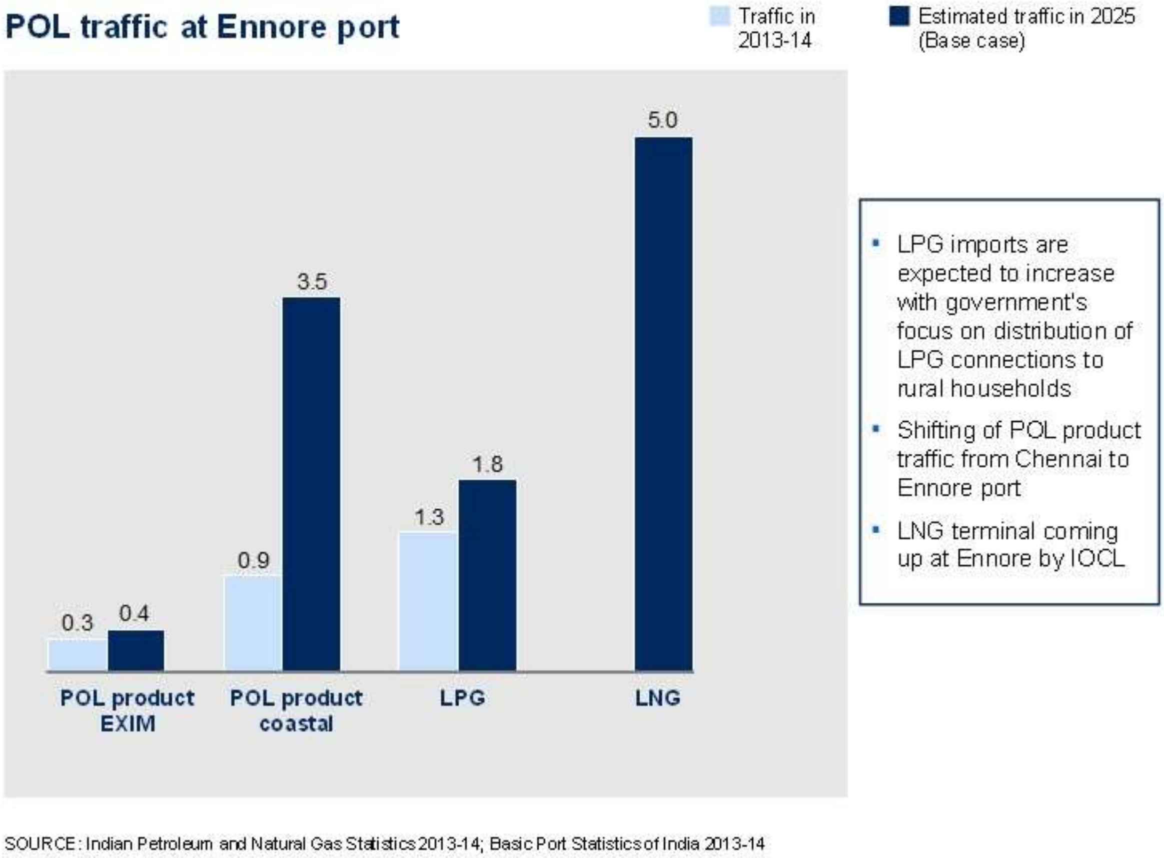



**Figure 6.2 POL Traffic – Ennore Port**

### 6.2.3 Containers

Adani Ennore Container Terminal Private Ltd. (AECTPL), in the 1st Phase will construct a 400 m long berth with a capacity to handle 0.8 MTEU. In the 2nd Phase another 330 m long extension of the berth will be carried out with a capacity to handle another 0.6 MTEU. Even though the first phase is scheduled for commissioning by early 2017, they are planning to commission it during mid 2016 with the confidence of getting the required traffic. Development of container handling facility at Ennore would divert part of the traffic going to Chennai. It is estimated that Ennore would be able to attract 0.8 MTEU by 2020, 1.1-1.3 MTEU by 2025 and 1.8-2.2 MTEUs by 2035. However, it is to be noted that the exact potential to attract container traffic depends on a number of factors including tariff, operational efficiency, last mile connectivity, etc.

## 6.2.4 Other Localized Commodities (Automobiles)

Currently 2.15 lakh car units have been handled. (≈ 0.22 MT). According to a report prepared by JICA, the likely exports from Chennai & Ennore by 2020 will be around 1.5 Million car units. Accordingly, they have recommended additional berths at Kamarajar Port. Based on the present situation, Chennai Port may not be able to add any more Ro-Ro berths for want of parking space and also due to restrictions in the timing of cars arriving into the port. Taking a conservative look at the growth of the industry, it may be reasonably assumed that KPL will be required to handle at least 900,000 car units by 2025.

**Table 6.1** summaries the traffic potential for key commodities for Kamarajar port.

**Table 6.1 Traffic Projection – Kamarajar (Ennore) Port**

**Ennore Port - Traffic Projections**

Units: MMTPA (except Containers)

xx Base Scenario | xx Optimistic Scenario

| Commodity | 2014-15 | 2020 | 2025 (Base) | 2025 (Optimistic) | 2035 (Base) | 2035 (Optimistic) | Remarks |
|---|---|---|---|---|---|---|---|
| **Liquid Cargo*** | | | | | | | |
| POL product (EXIM and coastal) | | 6.3 | 6.6 | 7.0 | 8.1 | 8.8 | ▪ Shifting of POL product traffic from Chennai |
| LPG | | 1.5 | 1.8 | 2.0 | 2.5 | 2.8 | |
| LNG | | 3.0 | 5.0 | 5.0 | 5.0 | 5.0 | ▪ 5 MTPA LNG terminal by IOCL |
| Total POL (including LPG and LNG) | 3.2 | 10.8 | 13.4 | 14.0 | 15.6 | 16.6 | |
| **Dry and Break Bulk Cargo** | | | | | | | |
| Thermal Coal (Loading) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Thermal Coal (Unloading) | 24.0 | 40.2 | 46.5 | 51.4 | 77.0 | 92.0 | ▪ Coastal increase; could also capture traffic from Cuddalore and Katupalli |
| Coking Coal | 0.3 | 0.5 | 0.6 | 0.7 | 1.1 | 1.3 | |
| Iron Ore | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Fertilizers | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| **Containers and other Cargo** | | | | | | | |
| Containers (MnTEU) | 0.0 | 0.8 | 1.1 | 1.3 | 1.8 | 2.1 | |
| Others | 2.7 | 4.2 | 5.6 | 5.9 | 9.2 | 10.5 | ▪ Vehicle Exports and Other commodities |
| **Total (MMTPA)** | **30.2** | **71.1** | **87.3** | **97.1** | **137.6** | **160.1** | |

Conversion Factor Used for Containers Projections: 1 TEU = 19.3 Tons
* For 2013-14, POL, LPG and LNG traffic split: POL (EXIM and coastal)- 1.3 MTPA, LPG-1.3 MTPA

## 6.2.5 Additional Traffic Potential from Proposed Coastal Clusters

Apart from the above mentioned traffic, there is additional opportunity of handling ~14-15 MTPA of coking coal by 2025 if the proposed 20 MTPA coastal steel cluster comes up at Ennore.

# 7.0 CAPACITY AUGMENTATION PROPOSALS

## 7.1 Port Capacity After On-Going Developments

The capacity of the existing berths and the new berths after on-going developments are shown in **Table 7.1**.

**Table 7.1 Capacity of Existing/ Ongoing Berths**

| Berths | Capacity (MTPA) |
|---|---|
| **Coal Handling berths CB 1; CB 2 (2 × 8 MTPA); CB 3 & CB 4 (2 × 9 MTPA)** | 34.0 |
| **Coal Handling berths CICTL (8 MTPA) & SIOTL (12 MTPA)** | 20.0 |
| **Liquid Handling berth MLT 1** | 3.0 |
| **General cargo/ Automobile berth (600,000 units)** | 1.0 |
| **Multi-cargo berth** | 2.0 |
| **Container berths Phases 1 & 2** | 27.02* |
| **Captive jetty – IOCL** | 3.0 |
| **LNG Terminal – IOCL** | 5.0 |
| **Second Automobile Terminal/ Ro-Ro Terminal** | 1.0 |
| **TOTAL** | **96.02** |

Note: *1 TEU ~ 19.3 MTPA

## 7.2 Requirement for Capacity Expansion

Referring to **Table 6.1** and **Table 7.1**, even though prima facie it appears that the overall capacity is slightly more than the overall traffic, there is shortfall on facilities for handling specific cargo as seen in **Table 7.2**.

**Table 7.2 Requirement of Capacity Addition Over Master Plan Horizon (MTPA)**

| Cargo Handled | Current Capacity and planned (MTPA) | 2020 | | 2025 | | 2035 | |
|---|---|---|---|---|---|---|---|
| | | Projected Traffic (MTPA) | Capacity Augmentation required over current (MTPA) | Projected Traffic (MTPA) | Capacity Augmentation required over current (MTPA) | Projected Traffic (MTPA) | Capacity Augmentation required over current (MTPA) |
| Coal | 54.0 | 40.7 | 0.0 | 47.1 | 0.0 | 78.1 | 24.1 |
| Crude/ POL | 11.0 | 10.8 | 0.0 | 13.4 | 2.4 | 15.5 | 4.5 |
| Container | 27.0 | 15.4 | 0.0 | 21.2 | 0.0 | 34.7 | 7.7 |
| Other | 4.0 | 4.2 | 0.2 | 5.6 | 1.6 | 9.2 | 5.2 |
| **Total** | **96.0** | **71.1** | **0.2** | **87.3** | **4.0** | **137.5** | **41.5** |

As regards all types of coal, the total available capacity is 54 MTPA as against the projected traffic of 47 MTPA in 2025 leaving a surplus capacity of 8 MTPA. However, over a period of master plan horizon there would be a requirement to build additional 2 to 3 coal berths.

With reference to liquid bulk, the capacity is far short of the traffic. While the projected traffic is 10.8 MTPA in 2020 and current capacity will be able to service this cargo. However, capacity augmentation of about 2.4 MTPA and 4.5 is required for years 2025 and 2035 respectively. The cargo numbers for 2025 and 2035 account for LNG traffic for IOCL, which may be catered with the planned captive jetty and LNG terminal for IOCL.

Similarly, for automobiles, there is a shortfall in capacity for 300,000 units, which may be met through Ro-Ro terminal being undertaken at the port.

Considering projected cargo and planned facilities, it is required to provide for an additional liquid terminal at Kamarajar port as detailed in further section.

# 7.3 Second Multi-User Liquid Terminal (MLT 2)

## 7.3.1 Background

The license for the construction, operation and maintenance of the Multi-user Liquid Terminal (MLT 1) was awarded by EPL to a consortium of Indian Molasses Company Ltd., and Larsen & Toubro through a global bidding process. A Special Purpose Vehicle named "Ennore Tank Terminals Pvt. Ltd" was incorporated for implementing the MLT Project on 30 years' Build, Operate and Transfer (BOT) License. The License was awarded during October, 2004 and the construction started during June, 2006. The complete terminal was commissioned by January, 2009.

The liquid bulk traffic handled at the Multi-user Liquid Terminal 1 during the past five years is presented in **Table 7.3**.

**Table 7.3 Liquid Bulk Traffic Handled at the MLT 1 During the Past Five Years**

| S. No. | Product Handled | 2010 - 11 | 2011 - 12 | 2012 - 13 | 2013 - 14 | 2014 - 15 |
|---|---|---|---|---|---|---|
| 1. | Pol Products | 5,11,422 | 5,04,349 | 5,22,981 | 12,76,431 | 18,88,478 |
| 2. | Chemicals | 77,518 | 94,356 | 92,739 | 89,326 | 1,34,612 |
| 3. | Liquefied Petroleum Gas (LPG) | 0 | 0 | 6,03,533 | 10,65,247 | 12,94,053 |
| | **Total volume handled** | **5,88,940** | **5,98,705** | **12,19,253** | **24,31,004** | **33,17,143** |
| | No. of Ship arrival during year | 87 | 92 | 121 | 175 | 243 |
| | Berth Occupancy | 19% | 22% | 38% | 65% | 85% |

It could be seen that the traffic, especially in POL products and LPG are growing in a past pace for the past 3 years. This sudden spurt is consequent to the market situation which is explained in the next section.

## 7.3.2 Market Overview

### *7.3.2.1 Petroleum Products*

The three oil majors, viz. IOC, BPC & HPC are having their marketing terminals for POL products at Chennai and these terminals are located amidst the thickly populated Tondiarpet / Korukkupet areas in North Chennai. The location of these three terminals is shown in **Figure 7.1**.

**Figure 7.1 IOC, HPC & BPC Terminals in Crowded Tondiarpet – Korukkuppet Area of Chennai**

Though these terminals were in operation for many decades, the devastating fire at IOC terminal at Jaipur during October, 2009 rang a danger bell and the occasional oil leaks in the old pipelines were seen as potential danger signals. Soon after, these oil companies were instructed to shift their terminal operations to Ennore. The Chief Controller of Explosives of Petroleum & Explosives Safety Organisations issued directives to the terminals for moving out of Tondiarpet / Korukkupet area. Accordingly, the oil companies initiated action towards identifying a suitable land near Ennore Port and creating a new terminal. The first to move was HPC who commissioned its full-fledged terminal at Ennore during the later part of 2013. Reliance Industries Ltd. has already established their terminal at Ennore earlier. Now both IOC and BPC are in the process of shifting their operations to Ennore.

The HPC terminal at Ennore is shown in **Figure 7.2**.

**Figure 7.2 HPC Terminal at Ennore**

The new facility is located on 108 acres land belonging to the Salt Department on North Chennai Thermal Power Station Road at Ennore. The terminal has 20 above ground tanks with total capacity of 140,000 KL for storage and despatch of products of 4 × 10,000 KL (MS); 6 × 10,000 KL (HSD); 4 × 5,000 KL (SKO) and 4 × 10,000 KL Aviation Turbine Fuel. Three pipelines each spanning seven km have been laid from Ennore Port to HPCL terminal. It includes 20 inches for High Speed Diesel (HSD), 16 inches for motor spirit (MS) and super kerosene oil (SKO).

The terminal has facilities such as tankages, tank truck loading facility, tank wagon loading and receipt facility along with product receipt facilities from the Ennore Port and CPCL. The tank farm and tank truck loading operations are fully automated. This terminal is to supply diesel, MS, HSD and SKO to eight districts – Chennai, Thiruvallur, Cuddalore, Kancheepuram, Vellore, Tiruvannamalai, Puducherry and Villupuram. Progressively, this would reduce the company's dependence on Chennai Petroleum Corporation Ltd's Manali refinery as products for the new terminal would be shipped to Ennore from refineries of HPCL. It is expected that their total volume will be about 1.0 MTPA.

Bharat Petroleum Corporation Ltd (BPCL) is also fast tracking plans for establishing a terminal in Ennore, an installation that will be a bigger, better alternative to its Tondiarpet facility BPCL applied for 110 acres in Ennore in salt pan lands. The terminal, with latest facilities for improved handling and safety, in Ennore would be having a storage capacity of 1,55,000 kl. The company estimates that it would need two years, from the date of receiving all approvals, to commission the new terminal. With the new terminal in a relatively larger area at Ennore, they would like to expand their marketing activities. It is understood that their volumes will also be around 1.0 MTPA.

Indian Oil Corporation Ltd. has already acquired land at Ennore for setting up their marketing terminal. It is understood from IOC that they are planning to shift incoming POL products at Chennai Port for marketing purposes to Ennore. This volume will be about 2.0 MT. In addition, they propose to handle about 0.7 MT of lubricants. They have also a proposal to bring in excess POL from Paradip for marketing purposes which will be moved through existing pipelines to Bangalore & Tiruchi/ Madurai/ Sankari. The volumes are not yet firmed up but could be over 1 MT. They have provisionally informed the port that their volume could be 3.5 MTPA.

The POL imports of other players such as RIL, Essar etc. is likely to be around 0.5 to 0.6 MTPA.

The relative locations of Kamarajar Port and the installations of these oil companies are shown in **Figure 7.3**.


**Figure 7.3 Relative Locations of Ennore Port and the Installations of Various Oil Companies.**

#### 7.3.2.2 Liquefied Petroleum Gas (LPG)

The demand for LPG in Tamil Nadu is more than the supply. In order to bridge the gap between demand and supply, IOCL was moving LPG by road from New Mangalore Port to Chennai traversing a distance of about 850 km as there was no LPG handling facilities at Chennai Port. IOC is already operating a bottling plant at Attipattu, near Ennore Port with LPG inputs from the refinery.

Indian Oil Petronas Private Limited, a JV of IOC and Petronas of Malaysia, has set up a LPG Bulk Plant at Ennore terminal adjoining IOC bottling plant. The terminal has 2×15,000 T refrigerated tanks connected to the port through 2×18” diameter pipelines. This terminal was commissioned during 2012. The LPG traffic is picking up fast in that during the start-up year, it was 0.60 MT which jumped to 1.07 MT the next year, 2013-14 and last year it was 1.29 MT. It is likely to grow further and could reach up to 1.5 MT.

#### 7.3.2.3 Chemicals

It could be observed from the past statistics that the chemical traffic has not been significant. The average traffic is less than even 100,000 T. It is not expected to have a spectacular increase in the forthcoming years.

Taking into consideration all these aspects, the total POL traffic could reach 7.6 MTPA or say 8.0 MTPA by 2020.

It has to be noted that out of the projected 8.0 MTPA, 3.5 MTPA of IOCL products, 1.0 MTPA each of HPCL & BPCL products and 1.5 MTPA of IPPL LPG will all move through pipelines directly to their respective tankages outside the port. The balance 1 MTPA will need storage and evacuation facilities inside the port.

### 7.3.3 Performance of MLT 1 and its Optimum Capacity

A look at the traffic for the past 5 years indicates that the berth occupancy increases along with the increase in traffic. The acceptable berth occupancy is 65% which will have least pre-berthing detention. During 2013-14, the terminal handled 2.43 MT with the acceptable berth occupancy level of 65%. However, during 2014-15 the traffic increased to 3.3 MT and the berth occupancy also increased to 85%. This has resulted in a cumulative pre-berthing detention of more than 800 ship days. It has been reported that each LPG tankers had to wait for a period ranging from 6 to 10 days. All the users have been affected because of this situation.

The performance of the Multi-User Liquid Terminal 1 during 2014-15 is examined in detail in **Table 7.4.** This terminal handles primarily POL, LPG and chemicals including CBFS.

**Table 7.4 Performance of the Multi-User Liquid Terminal 1 During 2014-15**

| Commodity | No. of Tankers | Total Volume | Berth Days | Productivity TPD | Parameter | Max. | Min. | Avg. |
|---|---|---|---|---|---|---|---|---|
| POL | 131 | 1.89 | 198 | 9,545 | DWT | 1,15,418 | 10,313 | 42,623 |
| | | | | | LOA | 249 | 125 | 177 |
| | | | | | Parcel Size | 47,927 | 2,336 | 14,416 |
| LPG | 56 | 1.29 | 87 | 14,828 | DWT | 64,220 | 25,926 | 51,380 |
| | | | | | LOA | 230 | 167 | 221 |
| | | | | | Parcel Size | 33,579 | 8,428 | 23,108 |
| Chemicals | 56 | 0.14 | 42 | 3,333 | DWT | 44,401 | 3,799 | 16,244 |
| | | | | | LOA | 183 | 96 | 133 |
| | | | | | Parcel Size | 9,210 | 720 | 2,404 |

As regards the agencies using the terminal and the mode of evacuation, the following details are available for 2014-15;

- POL-HPCL 0.798 MT
- BPCL 0.685 MT
- 5 others 0.411 MT
- LPG-IPPL 1.290 MT
- Chemicals 0.140 MT

Out of the total traffic of 3.3 MT, the POL of HPCL & LPG of IPPL (totalling 2.088 MT) moved through pipelines directly to their respective tank farms outside. The balance 1.212 MT passed through the tankage of ETTPL.

The POL products are mainly MS, ATF, SKO and HSD for marketing purposes handled for IOCL, BPCL, HPCL, Reliance, Essar and Shell. Except for HPCL all the requirements of other agencies pass through the tankage terminal of ETTPL, the operator of the berth. HPCL have their own tank farm about 12 km from the berth and they take their products directly to their terminal. BPCL is also setting up their tank farm next to that of HPCL and they will also take the products directly to their terminal. IOCL is also planning to set up their own tank farm away from the port and its products also will be directly pumped to their terminal.

LPG is received for IPPL who have their tankage about 12 km from the berth. The product is pumped directly to their tanks.

All the chemicals are handled through the ETTPL tank farm which is about 4 km from the berth.

From the table, it can be seen that the overall average productivity is only 10,000 TPD. This is mainly because the bulk of the volume is handled for HPCL whose terminal is 12 km away. As regards LPG, here again the pumping distance is about 12 km. Moreover for LPG, it takes about 6 hours for pre-cooling the arms at low pumping rate before the full discharge rate is achieved. Chemicals are received in small parcels and are discharged through flexible hoses.

In view of the above, any dramatic improvement in the discharge rate cannot be expected. Adopting the current average productivity of about 10,000 TPD, the capacity of the berth could be ≈2.5 MTPA.

### 7.3.4 Need for MLT 2

The projected traffic by 2020 has been arrived at as 8.0 MTPA and the assessed optimum capacity of MLT 1 is 2.5 MTPA. This leaves a gap of 5.5 MTPA. KPL has signed a MOU with IOC for a captive berth. IOC has indicated that they propose to handle about 3.5 MTPA at their captive berth. Based on the analysis of MLT 1 it is felt that IOC will be able to handle only up to 3.0 MTPA at their berth. This could be possible by bringing in larger parcel sizes. Since IOC intends to move their products further off the city through their existing pipelines connecting Bangalore, Madurai, Trichirapalli, it is possible to bring in larger parcels. This still leaves a gap of 2.5 MTPA which establishes the immediate need for MLT 2.

### 7.3.5 Project Details

#### ***7.3.5.1 Siting of the Berth & Tankage***

The berth will be located adjacent to the existing MLT 1 berth and south of it as shown in the Master Plan of the port. The associated tank farm will be located in a 33 acre plot north of the tank farm area of MLT 1 and this will be about 4.3 km from the jetty.

The berthing face will be located at about 150 m from the centre line of the breakwater and will be in line with the berthing face of MLT 1. The tentative location is marked in the **Figure 7.4**.

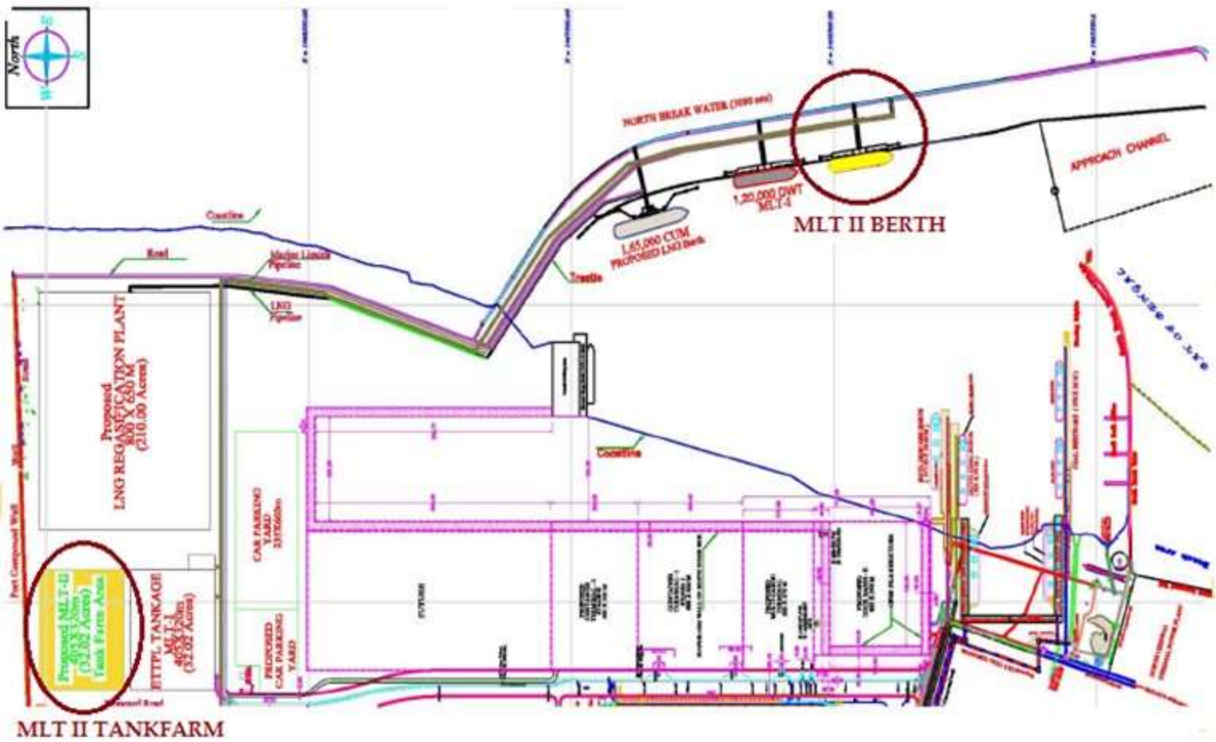



**Figure 7.4 Tentative Location MLT 2 Berth and Tank Farm**

### *7.3.5.2 Design Tanker Size*

An analysis on the sizes of tankers – range of their DWT; range of LOA and the range of their parcel sizes – were carried out at MLT 1 for the past 3 years to get an idea. The details are furnished in the **Table 7.5**

**Table 7.5 Analysis on Sizes of Tankers**

| Commodity | Year | Parameter | Maximum | Minimum | Average |
|---|---|---|---|---|---|
| POL | 2014 - 15 | DWT | 1,15,418 | 10,313 | 42,623 |
| | | LOA | 249 | 125 | 177 |
| | | Parcel Size | 47,927 | 2,336 | 14,416 |
| | 2013 - 14 | DWT | 1,11,405 | 7,682 | 45,443 |
| | | LOA | 247 | 118 | 181 |
| | | Parcel Size | 45,081 | 1,023 | 14,672 |
| | 2012 - 13 | DWT | 1,07,505 | 9,210 | 44,064 |
| | | LOA | 254 | 110 | 178 |
| | | Parcel Size | 41,186 | 973 | 10,459 |
| LPG | 2014 - 15 | DWT | 64,220 | 25,926 | 51,380 |
| | | LOA | 230 | 167 | 221 |
| | | Parcel Size | 33,579 | 8,428 | 23,108 |
| | 2013 - 14 | DWT | 77,523 | 9,469 | 49,557 |
| | | LOA | 266 | 126 | 215 |
| | | Parcel Size | 34,707 | 3,301 | 23,158 |
| | 2012 - 13 | DWT | 59,421 | 13,663 | 48,158 |
| | | LOA | 230 | 138 | 218 |
| | | Parcel Size | 31,802 | 6,000 | 22,353 |

It could be seen that the maximum DWT was 115,418 and the maximum LOA was 266 m while the minimum DWT was 7682 and the LOA was 110 m.

The proposed jetty, being located in the deep basin which will be dredged to -18.0 m CD, it is suggested that this berth be designed to handle Suezmax tankers up to 150,000 DWT. Since the growth of the chemical traffic is not likely to be so much as to spill over the capacity of MLT 1, the small chemical tankers have not been considered.

The parameters of design Suezmax tankers are LOA 275 m, beam 48 m and loaded draft 16.5 m.

#### 7.3.5.3 Jetty Structure

The berth will be of conventional type with a service platform, four berthing dolphins and four mooring dolphins. The berthing dolphins will be provided with rubber fenders and bollards while the mooring dolphins will be provided with quick release hooks. The service platform will be served by an approach trestle linked to the pipeline trestle of IOC captive berth which will be designed to accommodate the pipelines of MLT 2 also.

Normally the berthing dolphins will be spaced between 0.25 to 0.40 times LOA of the tanker to be berthed. Considering the wide variation of LOA between the largest design vessel and the smallest possible tanker i.e. 150,000 DWT with 275 m LOA and 9,000 DWT with 110 m LOA, it is proposed to integrate the two pairs of berthing dolphins and the service platform into a single platform of 100 m length. The mooring dolphins will be split into two groups – one pair on either side for larger tankers and a single one on either side to take care of the smaller tankers.

#### 7.3.5.4 Integrated Service Platform & Berthing Dolphins

The integrated service platform cum berthing structure will be of size 100 m × 20 m. The deck level will be kept at + 5.0 m CD. The sub-structure will be of 1200 mm bored cast-in-situ RCC piles and capping beams and slab. This will be provided with dock fenders with frontal frames to absorb the berthing energy from the various sizes of tankers. These fenders will be provided at 20 m intervals. Bollards will also be placed at 15 m centres to take the spring lines. In addition, the platform will accommodate the pipelines manifolds with headers, marine unloading arms, firefighting tower monitors, fire hydrants and jumbo curtain nozzles.

#### 7.3.5.5 Mooring Dolphins

It is proposed to have three pairs of mooring dolphins. The outermost pair of mooring dolphins will be at 165 m on either side of the centreline and 50 m behind the berthing face. The first pair of inner mooring dolphins will be at 120 m on either side of the centreline and 50 m behind the berthing face. The second pair of inner dolphins will be at 70 m on either side of the centreline and 30 m behind the berthing face. This pair of dolphins will be mainly used by smaller tankers. These dolphins will be of size 12 m × 14 m with the sub structure made up of steel tubular piles. This has been done considering the mooring loads, site conditions and the available soil data. The deck level will be kept at + 5.0 m. Each of the dolphins will be provided with a triple hook quick release hook assembly with capstans. All the mooring dolphins and service platform will be interconnected with walkways.

A general layout of the integrated service platform and mooring dolphins is shown **Figure 7.5**.

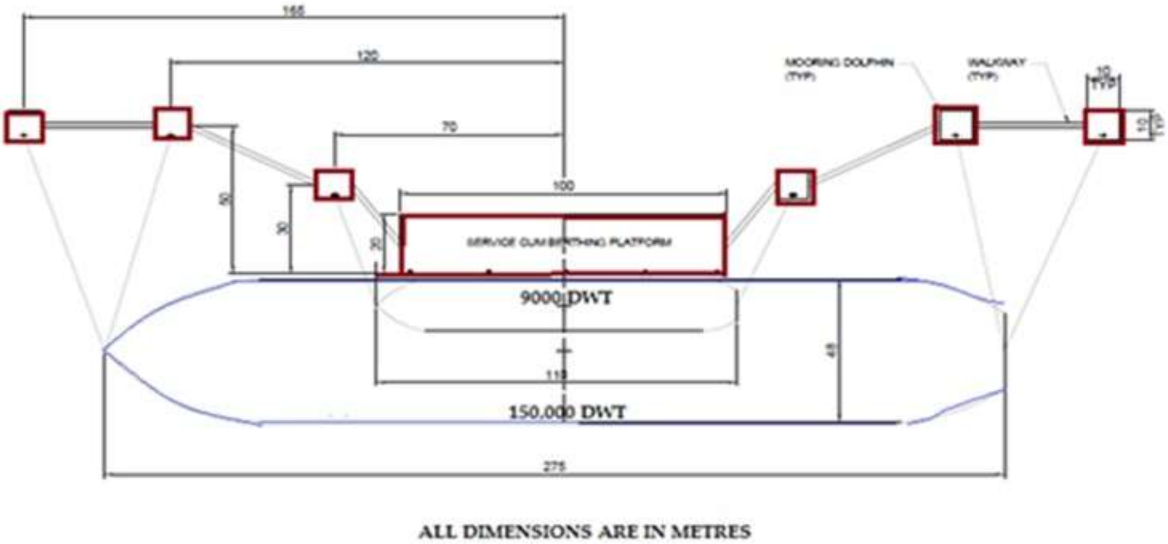



**Figure 7.5 General Layout of the Integrated Service Platform and Mooring Dolphins**

The approach trestle will be of 12 m total width comprising 6.5 m of carriageway and 4.5 m of pipe rack. It may be noted that the proposed location of the IOCL captive jetty will be further south of MLT 2 jetty. The relative locations of all the three jetties are shown in **Figure 7.6**.


**Figure 7.6 Relative Locations of All the Three Jetties**

It is understood from KPL that it has been agreed with IOCL that their approach trestle will be designed to accommodate the pipelines of MLT 2 also. It has been provisionally agreed with IOCL that their approach trestle will be independent of the existing approach trestle of MLT 1. Since there is no sufficient space in between the toe of the breakwater and the trestle of MLT 1, it has been decided to take the new approach trestle west of MLT 1 trestle as shown in the picture. The pipeline has to cross the existing trestle leading to MLT 1 jetty as also it has to cross the LNG pipelines. The location of the trestle further beyond MLT 1 is being discussed with IOC LNG group. Since the DPR of IOC captive jetty is under preparation, this alignment of the approach trestle will be decided in due course. The total length of the approach trestle up to the shoreline will be about 1.80 km from MLT 2.

### 7.3.6 Jetty Topside Facilities

#### ***7.3.6.1 Marine Unloading Arms***

The service platform will be provided with two marine unloading arms of 12" dia. for handling POL products (white oil and black oil). These shall be designed and constructed according to OCIMF standards. The capacity of each arm shall be 2000 $m^3$/hr at an operating pressure of 10 kg/$m^2$.

#### ***7.3.6.2 Pipelines***

The following pipelines will be provided. These will be connected to the unloading arms through pipeline manifolds. The total length of the pipelines up to the tank farm will be about 1.8 km on trestle and about 2.5 km on land.

- 1×24" white oil line going up to the tank farms outside the port
- 1×24" black oil line going up to the tank farms outside the port.
- 1×12" white oil line leading to the tank farm inside the port
- 1×12" black oil line leading to the tank farm inside the port
- 1×6" slop oil collection line leading to the tank farm inside the port
- 1×8" freshwater line

### 7.3.7 Fire Fighting System

The berth will be provided with fire-fighting system comprising tower monitors, jumbo curtain nozzles and hydrants as per OISD 156. The firefighting system shall be based on seawater which is available immediately adjacent to the berth. The facilities shall comprise two separate systems – tower monitors & water curtains, hydrants and ground monitors. Accordingly two separate sets of pumps shall be provided one for each system.

The tower monitors shall be mounted on steel towers, 18 m high. They will have a horizontal range of 100 m for water and 50 m for foam. The monitors shall be auto operated from the control room located on the pump house building. Local operating station shall also be provided at the berth. The monitors can operate either with foam or with water as required. The capacity of each monitor shall be 6000 lpm.

Four water curtain nozzles shall be provided at the jetty for protection of critical equipment from heat radiation - two for the protection of towers and two for the protection of unloading arms. Curtains of capacity 1500 lpm and with a range of 12 m radius shall be provided. Water is delivered to the curtains at a pressure of 7 to 8 kg/$cm^2$. The angle of spray is approximately 170°. A curtain is created by high-pressure water passing through a circular nozzle, having fine holes/notches along half its periphery.

Two double-headed hydrants shall be located on the unloading platform. The double headed hydrants, at 1.4 m height are two valve units connected to the main hydrant ring. Near each hydrant, there shall be an FRP box containing two 15m long rubber lined hoses and one triple purpose nozzle. This nozzle can provide water in the form of a jet or spray. It can also provide foam compound supply. Each hydrant can discharge 2 × 36 cum/hr water at 7 kg/$cm^2$ pressure.

Two additional water/ foam monitors shall also be located on the Platform. They will be installed on three metre high structures. The capacity of each monitor will be 2400 lpm.

The fire water pressure system shall be designed for a minimum residual pressure of 7 kg/cm$^2$ at the hydraulically remotest point of application in the terminal. Centrifugal type fire water pumps shall be provided to meet the design fire water flow rate and head. These will have flooded suction and capable of discharging 150% of its rated discharge at a minimum of 65% of the rated head. It is proposed to have one electrically driven pump with a stand by diesel engine driven pump set for tower monitors and hydrant system separately. Also jockey pumps of adequate capacity to maintain minimum pressure 7 kg/cm$^2$ in fire water distribution network will be provided.

The Fire water pump house will be located at least 100 m away from the jetty.

### 7.3.8 Tank Farm

As indicated earlier about the evacuation of the projected traffic, only 1 MTPA of products will pass through the terminal tankage while the balance 7 MTPA will move through pipelines outside the port to the respective terminals. It has also been indicated that during 2014-15, the existing MLT 1 had handled 1.2 MT through its terminal. Considering all these, it may be concluded that there may not be any need for tankage for MLT 2.

However, it has to be noted that MLT 2 will be developed as a competing facility under PPP mode with freedom to handle any type of liquid cargo depending upon its capacity to attract new customers. With this contingency, it may necessary to have at least a minimum tankage to serve the customers who are interested. For this purpose only it has been proposed to lay 2 ×12” pipelines from the jetty to the tank farm one each for while oil and black oil.

It is proposed that, initially, 5 × 5000 kl tanks (25,000 kl total capacity) can be provided which will be able to handle about 0.3 MTPA of products. These will be supported by 3 bays of TLF for evacuation by road. Further addition of tanks and pipelines shall be provided later based on market demand.

The tank farm will have all other infrastructure and service facilities required for the effective functioning of a tank farm. It will have an administrative office building with a control room; weigh bridge; TLF sheds; Security house and gate complex; interconnecting pipelines; transformers for power supply; slop tank; effluent treatment plant; DG set etc.

The tank farm will be located north of the existing MLT 1 tank farm as shown in **Figure 7.7**.


**Figure 7.7 MLT 1 Tank Farm**

The tank farm will be laid out according to OISD 118. The terminal firefighting facilities shall be designed as per OISD-117

## 7.3.9 Project Cost

### *7.3.9.1 Capital Cost*

Block cost estimates have been prepared for the scope of the project as detailed in earlier section. The estimated capital cost of the project works out to Rs. 393 crores.

### *7.3.9.2 Operational & Maintenance Costs*

The operational & maintenance costs have been worked out grouping the project components as civil and mechanical. These costs are derived as percentage of capital costs, the percentage based on industrial practice. The annual operation and maintenance costs work out to about Rs. 10.6 cr.

# 8.0 PORT INTERNAL NETWORK, EXTERNAL CONNECTIVITY AND INFRASTRUCTURE

## 8.1 General

For the efficient performance of a port, the effective internal network of road and rail as well as external connectivity to the national highway and trunk railway routes are essential to ensure faster receipt and evacuation of cargo. Accordingly, the existing situation at KPL and their proposals are described in the following sub sections. The internal road and rail network is presented in the **Figure 8.1**.


**Figure 8.1 Internal Rail Road Network of Kamarajar Port**

# 8.2 Internal Network

## 8.2.1 Road Network

### *8.2.1.1 Existing Port Access Road (VOC Road)*

From the existing coal berth a road, developed during port construction, links the coal berth to the Port Access Road though the Port Main Gate. The Port Access Road joins the NCTPS road which in turn joins the TPP road. This is being widened to four lanes and will continue to be the main link for the next few years.

### *8.2.1.2 Additional Internal Roads*

#### *8.2.1.2.1 Road Along the Compound Wall (Security Road)*

There is a security road along the compound wall inside the Port premises with total length of about 5 km.

#### *8.2.1.2.2 Principal Road (East-West) South of the Liquid Storage from the Compound Wall*

This principal port road runs for a length of 1.6 km inside the Port area and the road is extended outside beyond the port premises.

#### *8.2.1.2.3 Connectivity Road for POL/Chemical Tankage and LNG Regasification Plant*

The road branches off from the principal road to provide access to MLT and LNG tank area.

#### *8.2.1.2.4 Road Along the Shore East of Liquid Storage Area up to Root of North Breakwater*

The road along the shore to the root of the north breakwater for a length of about 1.8 km has been formed with black topping for access to the General Cargo Berth and North Breakwater.

#### *8.2.1.2.5 North-South Road*

This is a proposed road connecting the proposed container terminal and multi cargo terminal to the western and northern gates of the port. The contract for construction of two lane concrete road with paved shoulders on either side has been awarded and is expected to be completed in the mid of 2016. This would be about 2.6 km long.

### *8.2.1.3 External Roads in Immediate Vicinity*

#### *8.2.1.3.1 Kattupalli Road*

Kattupalli road that has a length of about 3.8 km has developed for evacuation of liquid cargo and car carriers with two lane bitumen road. Till the completion of Northern Port Access Road, the present Kattupalli road is being widened for handling the projected volume of traffic.

##### 8.2.1.3.2 *Access Road to Iron Ore / Coal Stackyard*

The existing BOT Operator of CICTPL under the CSR activity developed a two lane concrete road from the Stackyard to the Port Access Road. The trucks carrying the coal from the stackyard are being evacuated through this road.

##### 8.2.1.3.3 *Road Connecting NCTPS Road to Iron Ore / Coal Stackyards*

The road provides connectivity to coal and iron ore yards and recently KPL developed as a concrete road. The road stretch between NCTPS road and northern end of the coal yard is about 6 km long. This road crosses the existing railway track for which RUB has been planned and construction work is in progress.

## 8.2.2 Rail Network

### 8.2.2.1 *Holding Yards I & II*

Presently Kamarajar Port is connected by rail to the mainline at Attipattu and Attipattu Pudunagar Stations located in the Chennai – Gudur section of the Southern Railway on the Chennai – Delhi/Kolkata route. The southern connectivity takes off from Attipattu Pudunagar Railway Station. The northern connectivity takes off from Attipattu Railway Station. These two lines merge at the Apex Point and run as a single line to the NCTPS Yard.

The siding was developed and is being used by TNEB for dispatch of thermal coal by rail from NCTPS to their power plants located at Mettur and Ennore. KPL developed the railway facilities connecting the stackyards of the coal and iron ore terminals to the existing NCTPS railway line. Subsequently, KPL has developed two more R&D lines on the Northern side of the existing NCTPS Yard.

### 8.2.2.2 *Railway Layout and Operations at the Coal and Iron Ore Yards*

The planning and rail operations are being executed by the respective BOT operators.

### 8.2.2.3 *Connectivity to the Container & Multi Cargo Terminals*

An independent railway line is proposed for the ongoing container terminal and multi cargo terminal. These lines take off from the one line branch of NCTPS line to KPL premises. The DPR has been approved by Railways in December 2014 and the work has been entrusted to RITES for construction on deposit basis. KPL signed the MOU with RITES 14.02.2015. Subsequently, RITES prepared the tenders for different packages such as embankment formation, procuring rails and sleepers, laying of railway track, OHE, etc. The contracts for the works of embankment formation and construction of culverts and the supply of pre-stressed concrete sleepers, slack gauge sleepers and turnout sleepers, etc., have been awarded. Construction work is in progress and the work is expected to be completed by end of 2016

## 8.3 External Connectivity

### 8.3.1 General

The external road and rail connectivity to the National Highways and the railway trunk routes are shown in the **Figure 8.2** hereunder.

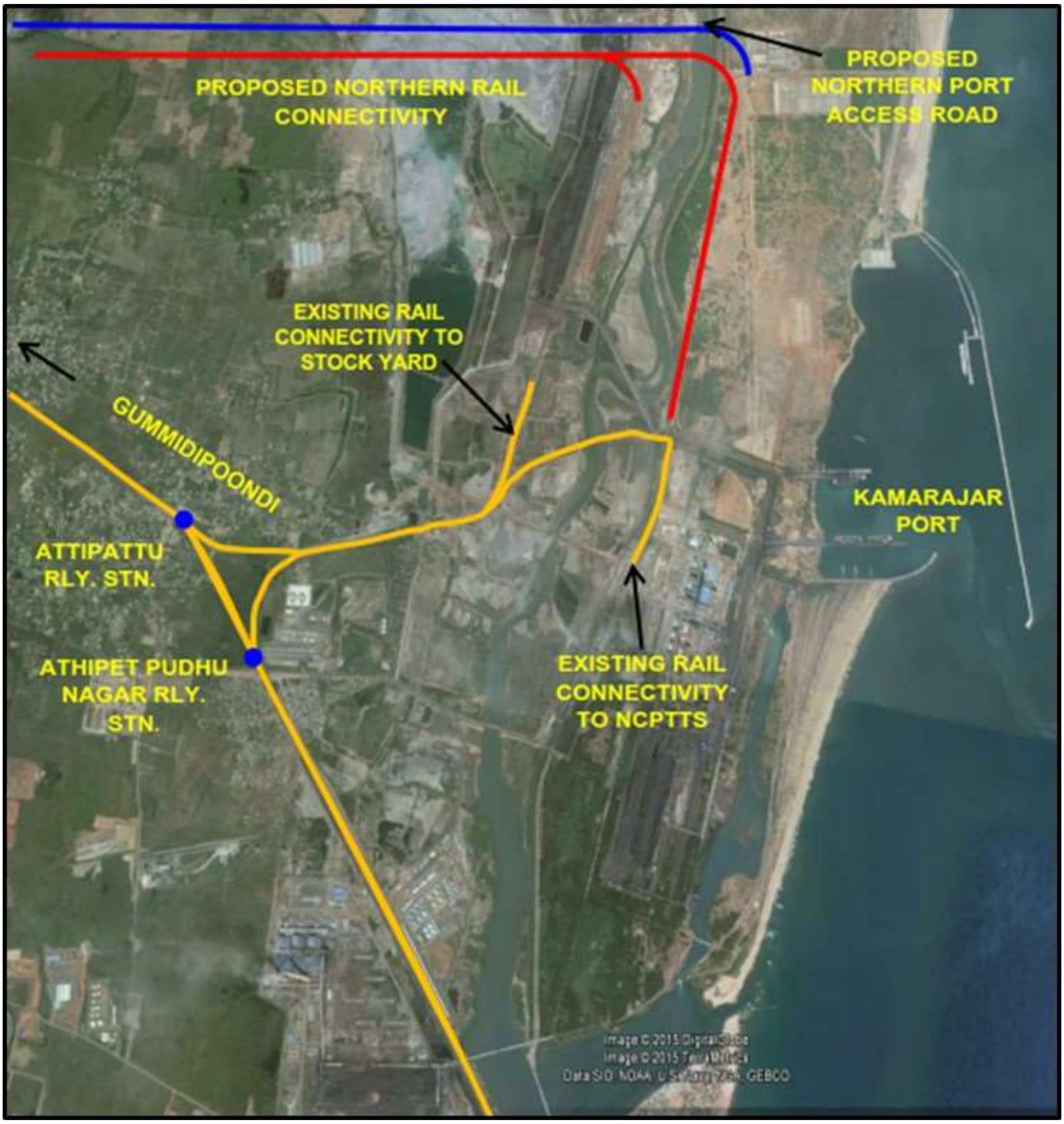



**Figure 8.2 External Rail and Road Connectivity to Kamarajar Port**

### 8.3.2 Upgrading the Southern Port Access Road

Present road connectivity of Kamarajar Port to the three National Highways (NH5, NH4 & NH45) is through the **Port Access Road, the NCTPS approach road**, Tiruvottiyur – Ponneri – Panchetty (TPP) Road, the Inner Ring Road (IRR) and the Chennai bypass.

Considering the increasing road traffic movement of import / export of cargoes, KPL has envisaged interest for widening of the existing two lane road starting from Vallur Junction (TPP road) to Kamarajar Port Main entrance to four lane road. The proposal comprising the 4.8 km length of North Chennai Thermal Power Station (NCTPS) road belongs to Tamil Nadu Generation and Distribution Corporation Ltd (TANGEDCO) and the 2.3 km length of port access road which belongs to Kamarajar Port.

KPL appointed Tamil Nadu Road Development Corporation Ltd. (TNRDC) as a consultant for preparation of Detailed Feasibility Report (DFR) and implementing the said project. The consultant submitted the DFR and the proposal in 2 stages.

- Stage 1 – Widening and strengthening the existing 2 lane road to 4 lane road from Vallur Junction to KPL Main Gate to a length of 7.1 km at the block estimate of Rs. 160 cr.
- Stage 2 – Construction of dedicated 2 lane exit road from Port Main Gate to the NCTPS road with a length of about 1 km at the block estimate of Rs. 30 cr.

Initially, it is planned to develop the Stage 1 proposal i.e., widening and strengthening the existing 2 lane road to 4 lane road from Vallur Junction to KPL Main Gate at an investment cost of Rs.160 cr. and Stage 2 will be taken up subsequently.

The funding mechanism for Stage 1 will be done through IEBR which is subject to discussion and finalization with L&T Shipbuilding and L&T Kattupalli Ports either by collecting the user fee for the trucks or sharing the expenses.

The proposal for developing the Southern connectivity of the Port from Vallur Junction at TPP road to KPL Main Gate – Widening and strengthening the existing 2 lane road to 4 lane road (Stage 1) at the block cost estimate of Rs.160 cr. by funding through Internal and External Budgetary Resources (IEBR) is awaiting the Board approval.

### 8.3.3 Proposed Northern Port Access Road

The Government of India conveyed in-principle approval for inclusion of New 4 lane road to provide direct connectivity to Kamarajar Port from NH-5 under NHDP Phase-VII in 2004. A new 4 lane road is proposed from Kamarajar Port to Thatchur on NH-5 with a length of 21.148 Km and a link to TPP Road with a length of 4.35 km for providing seamless evacuation of cargo from Kamarajar Port.

As per the original proposal, this road is an exclusive access controlled road linking Kamarajar Port to NH-5. Accordingly, the Feasibility Report was prepared by NHAI at a total cost of Rs. 271 cr. As on date, the Government of Tamil Nadu has taken over the project from NHAI during January 2012. Now state Government has finalized the alignment of road and DPR is in the approval stage from State Ministry. This is one of the components of Chennai Peripheral road alignment which is now in the planning stage of State Government. TNRDC is the implementing Agency for the Northern Port Access road.

Alignment has been finalized and the project has been approved by State Government. NPAR to be developed in two stages.

- Stage 1 – Spur Road starts from Port to TPP Road near Minjur
- Stage 2 – Starts from the Spur Road to Thatchur on NH-5

Now Govt. of Tamil Nadu issued the G.O. for acquisition of land and allots the provisional amount for land acquisition. TNRDC is the implementing Agency for the Northern Port Access road.

### 8.3.4 Proposed Northern Rail Connectivity

KPL initiated action for development of Northern Rail Link connecting north of Minjur to KPL which is parallel to the proposed Northern Port Access Road. The DFR has been prepared and approval was obtained from Southern Railways during September, 2013. KPL appointed a Consultant for the preparation of DPR and obtaining approval from the Railways. The consultant has submitted the draft DPR and is in the process of preparing the final DPR after incorporating the comments of KPL and detailed engineering study. To firm up the alignment, Additional Chief Secretary, Industries Department held a meeting with the stakeholder during April, 2015. KPL forwarded the alignment drawings to TIDCO & L&T for their comments and their comments were received during July, 2015. KPL propose to convene a joint meeting with the stakeholders i.e., TNRDC, TIDCO and L&T Kattupalli Port. The tentative project cost is Rs.244.438 crores. The DPR has been submitted to Railways on 24.11.2015 for approval. Totally 160.46 acres of land is required for the Rail Connectivity. KPL is pursuing with the State Government for acquiring of land from the Private Owners and also give ROW permission for Govt. land for construction of the proposed NRL. The project is identified as one of the critical projects for Ponneri node under Chennai Bangalore Industrial Corridor (CBIC).

## 8.4 Proposed Infrastructure Projects

### 8.4.1 Container Truck Parking Yard & Yard for Parking Car, Trucks and Road Tankers

KPL is initiating action for setting up a container truck parking yard outside the port which will be custom bound. Container trailers will be parked here, inspected and cleared by the Custom authorities. There will be a six lane road connecting this yard with the container terminal inside which will be exclusive for the container trailers only with restricted entry. There will be a ROB to cross the railway line. This yard will be provided with necessary office accommodation for the terminal operator as well as the Custom authorities. The yard will also have rest rooms and canteen for the trailer operators.

Adjacent to this yard, there will be another yard open for trucks carrying car units for export as also road tankers waiting to receive POL products and chemicals. This yard will ease the present congestion on the road leading to the port gates. A consultant has been appointed to prepare the detailed project report.

### 8.4.2 Development of Free Trade and Warehousing Zone

Keeping in view, the envisaged growth objective of KPL, the port proposes to undertake the development of FTWZ offering State-of-the-Art logistics infrastructure through the following:

- Warehousing and forwarding facilities
- Free trade zones/export processing areas
- State of the art communications infrastructure
- Transport facilities
- Support facilities for Social / Commercial / Institutional
- Any other facilities as required for making it as the State-of-the Art FTWZ.

KPL has appointed a consultant to prepare a Master Plan. The Consultant carried out the Topography survey of the proposed FTWZ during February, 2015 and collected the relevant data. They Consultant submitted the draft Master Plan during June,.2015 and KPL has given in-principle approval During the Board Meeting held during August, 2015, the Consultant made a presentation and the Board directed the Consultant to suggest measures to reduce the capital cost. Further, the Board suggested to have the development through Private Sector Investment and thus a concession or Joint Venture based development can be considered by KPL.

The Consultant submitted the various Investment Models. KPL Board has approved the Consultant's proposal for developing the FTWZ on DBFOT basis by March 2016. KPL is in the process of appointing Transaction Advisor for bidding process of the project.

# 9.0 SCOPE FOR FUTURE EXPANSION

## 9.1 Development Possible within the Existing Harbour

Even after creating the new facilities, the existing harbour basin will be able to accommodate 7 more berths as shown in the marked zones 1, 2 & 3 in the Layout presented in **Figure 9.1**.

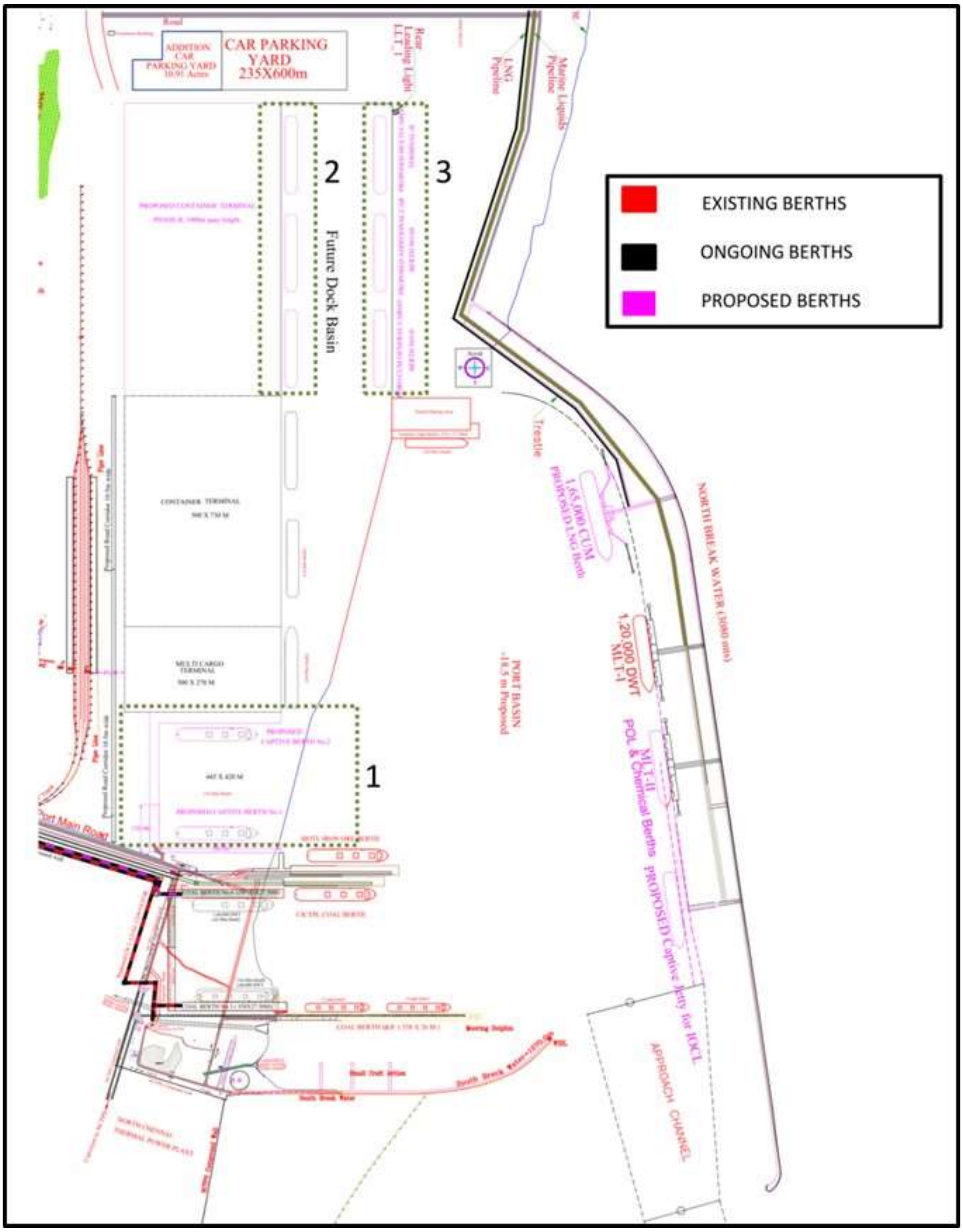



**Figure 9.1 Development within the Existing Harbour**

In zone 1, the port has made provisions for creating a dock basin of 400 m × 445 m to accommodate two berths capable of handling Cape size bulk carriers. These are proposed to be set apart for captive users. These berths could have a combined capacity of 18 MTPA.

In zone 2, the port has plans to develop a second container terminal with 1000 m of quay length. If this terminal materialises, this can handle about 2 MTEU equivalents to 38.6 MTPA.

In zone 3, two more berths for handling general and break bulk cargo could be developed. The combined capacity of these two berths could be about 3 MTPA. KPL has initiated action for developing one more Marine Liquid Terminal (MLT 2) on DBFOT basis with a capacity of 3 MTPA on the Lee side of the breakwater.

Thus the existing harbour basin would be able to handle an additional 62.6 MTPA (apart from 96 MTPA as indicated in **Table 7.1**) and the gross capacity will be about 158.6 MTPA.

The growth of traffic with regard to the type of cargo that needs to be handled will decide the development of these berths according to the need. This trend will be known once all the ongoing schemes are completed and commissioned.

The expansion plan of the existing harbour with related back-up area is shown in the **Figure 9.2**.

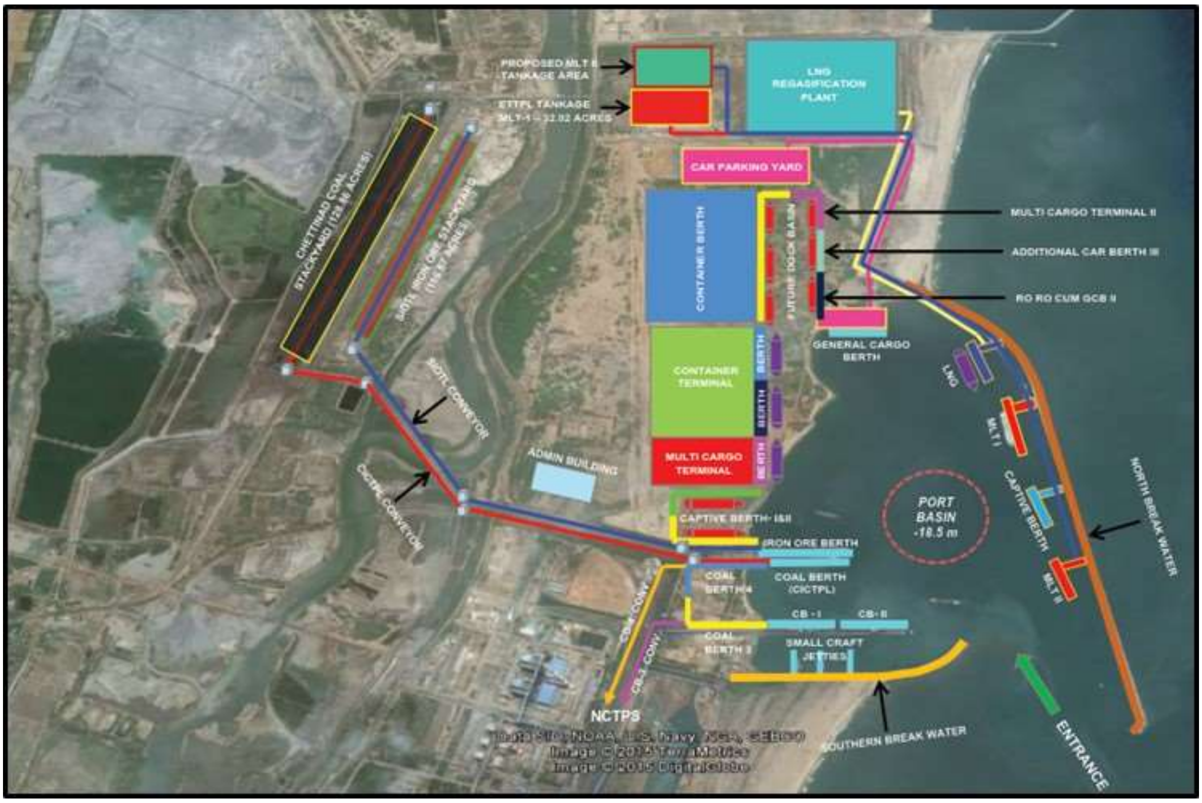



**Figure 9.2** Expansion Plan of the Existing Harbour with Related Back-Up Area


AECOM

# 9.2 Development Potential Outside Harbour

## 9.2.1 General

Kamarajar port has the ownership of the coastline between the north breakwater of the port and south breakwater of the Kattupalli port. The area behind the coastline is also available with the port. This area could be used for in case any expansion potential is needed beyond what could be developed within inner harbour.

## 9.2.2 Alternative Layouts

With a view to assess the development potential of the outer harbour various alternative layouts were developed as mentioned below:

### ***9.2.2.1 Alternative Layout 1***

This layout has been developed so as to provide facilities for ship repair and ship building as part of the Kamarajar Port. Though a shipyard already exists at Kattupalli, these facilities could be part of a ship building cluster that could be built in this area. This layout is shown in **Figure 9.3**.

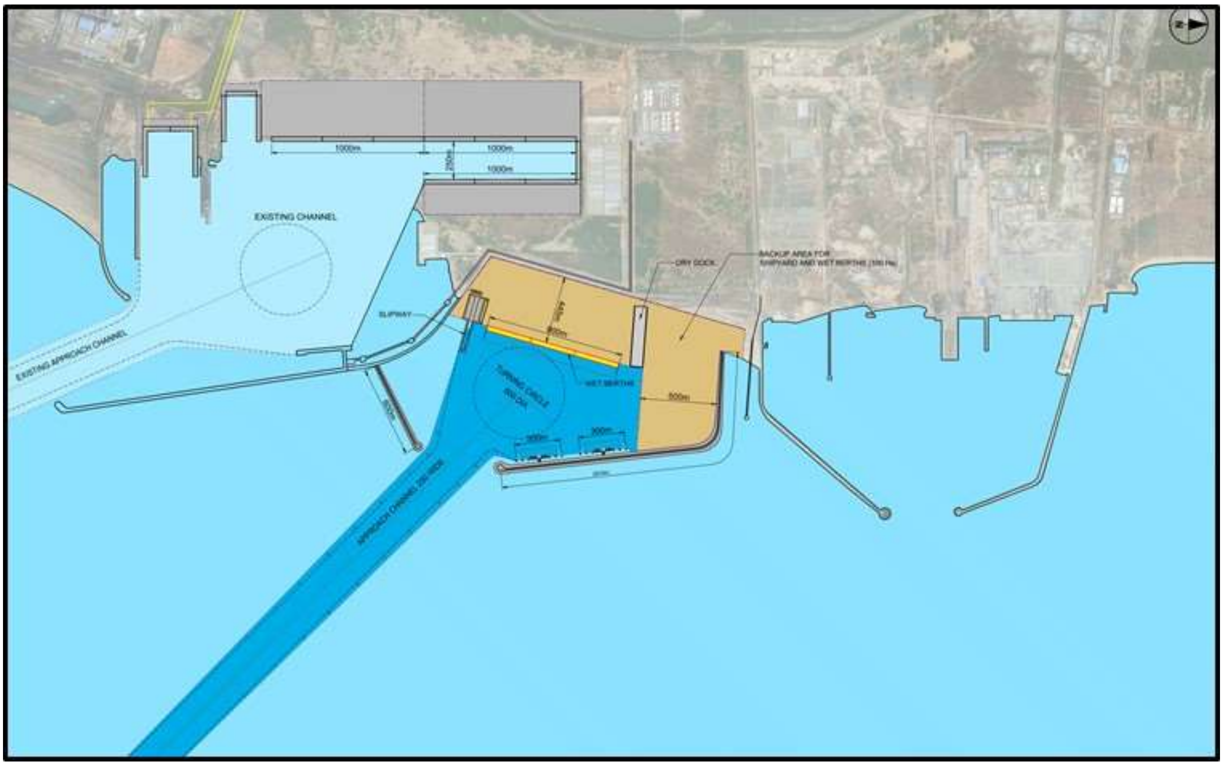



**Figure 9.3 Potential Outer Harbour Development - Alternative Layout 1**

#### 9.2.2.2 *Alternative Layout 2*

This layout has been developed to provide additional cargo handling facilities in a new harbour located outside the existing one. The layout has been prepared such that part of the approach channel to the existing port shall be utilised for the outer harbour also. This layout is shown in **Figure 9.4**.

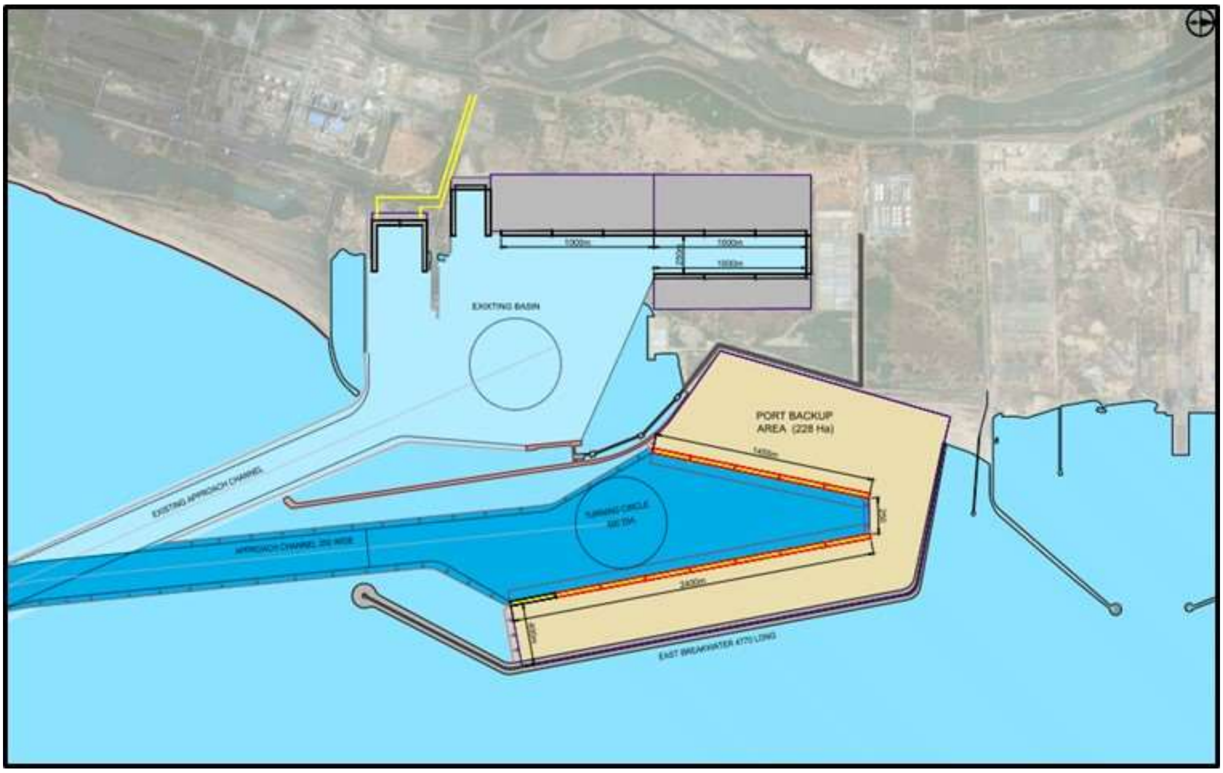



**Figure 9.4 Potential Outer Harbour Development - Alternative Layout 2**

As could be seen from **Figure 9.4**, it would be possible to provide a quay length of about 2.8 km for handling breakbulk and bulk cargo. An area of 230 ha shall also be created by way of reclamation for storage of cargo and port operations. The breakwater of length 4.75 km shall need to be provided.

### 9.2.3 Suitable Layout of Outer Harbour

It is established that the space within inner harbour is adequate to provide the required berths for the master plan horizon of year 2035 and even beyond. Therefore the requirement of outer harbour from cargo handling point of view would come much later.

The growth of traffic with regard to the type of cargo that needs to be handled will decide the development of these berths according to the need. This trend will be known once all the ongoing schemes are completed and commissioned.

## 9.3 Land Use Plan

At present, Kamarajar Port Limited has a land area admeasuring 2771.50 acres, where 1392.2 acre is inside port (Zone A) and 1379.30 acres is outside port (Zone B).

Under Zone A the port has facilities like storage for terminals, administrative buildings, guest house, CISF barracks, car parking, road, sub-station, and plantation, which occupy a total of 786.81 acres of land. Land in the Zone B is majorly utilized for Railway siding, access road, conveyor, staff quarter, coal and Iron stack yard, totalling to 594.5 Acres.

At present a total of 605.390 acres of land is available in Zone A and 785.39 acres in Zone B is available.

In 2015, the port has entrusted a study to Ravi associates to prepare a future land use plan. The new land use plan has been prepared to accommodate all future expansions, i.e., 2 TNEB coal berths, Container terminals, LNG terminal and multi-cargo terminals. The new land use has also left about 414 acres of land as Green belt and avenue trees, which is about 30% of total land inside the port.

Zone B, that is outside port limit is planned along a creek. It is proposed to develop several activities including FTWZ, cargo storage, office buildings, parking, truck terminals etc.  A CRZ map of the area has been prepared by IRS, Anna University, which classified this either as CRZ 1B or CRZ III.

The Coastal Zone Regulation, 2011 suggests that no activity except storage of non-hazardous cargo, such as edible oil, fertilizers and food grain is allowed in CRZ 1B (area between LTL and HTL). CRZ III is defined from HTL to about 100 m or width of the creek (whichever is less) is categorized as ‘No Development Zone’ and storage of some of the petroleum products/ liquefied natural gas petroleum can only be taken up in this zone.

It may be noted if a suitable distance (i.e., 100 m) is be left along the creek all the facilities may be developed without requiring CRZ as CRZ along creek is defined only from HTL to about 100 m or width of the creek (whichever is less). However, the natural path of the creek shall not be hindered and all the mangroves or its associated species in this zone shall be protected in this zone.

Based on the analyses above a new land use plan has been proposed for Kamarajar Port (**Figure 9.5**). New land use plan demarcates entire area on the eastern and western side of the creek (under CRZ 1B and marked as ‘6’) for development of warehouse, where clean cargo could be stored. However, in case there is demand in future for using this land parcel for storage of dirty cargo like coal, this entire area would need to be notified as port land for which KPT will need to take necessary action for approvals. In addition this land may also be utilised to develop required Green Belt.  Beyond this region about 100 m buffer is kept designated as CRZ III (marked as ‘5’), may be used for liquid cargo storage.

In the proposed Land Use map, Zone 2 and 3 are designated for FTWZ and logistic park, while Zone 4 is for Truck Parking yard.

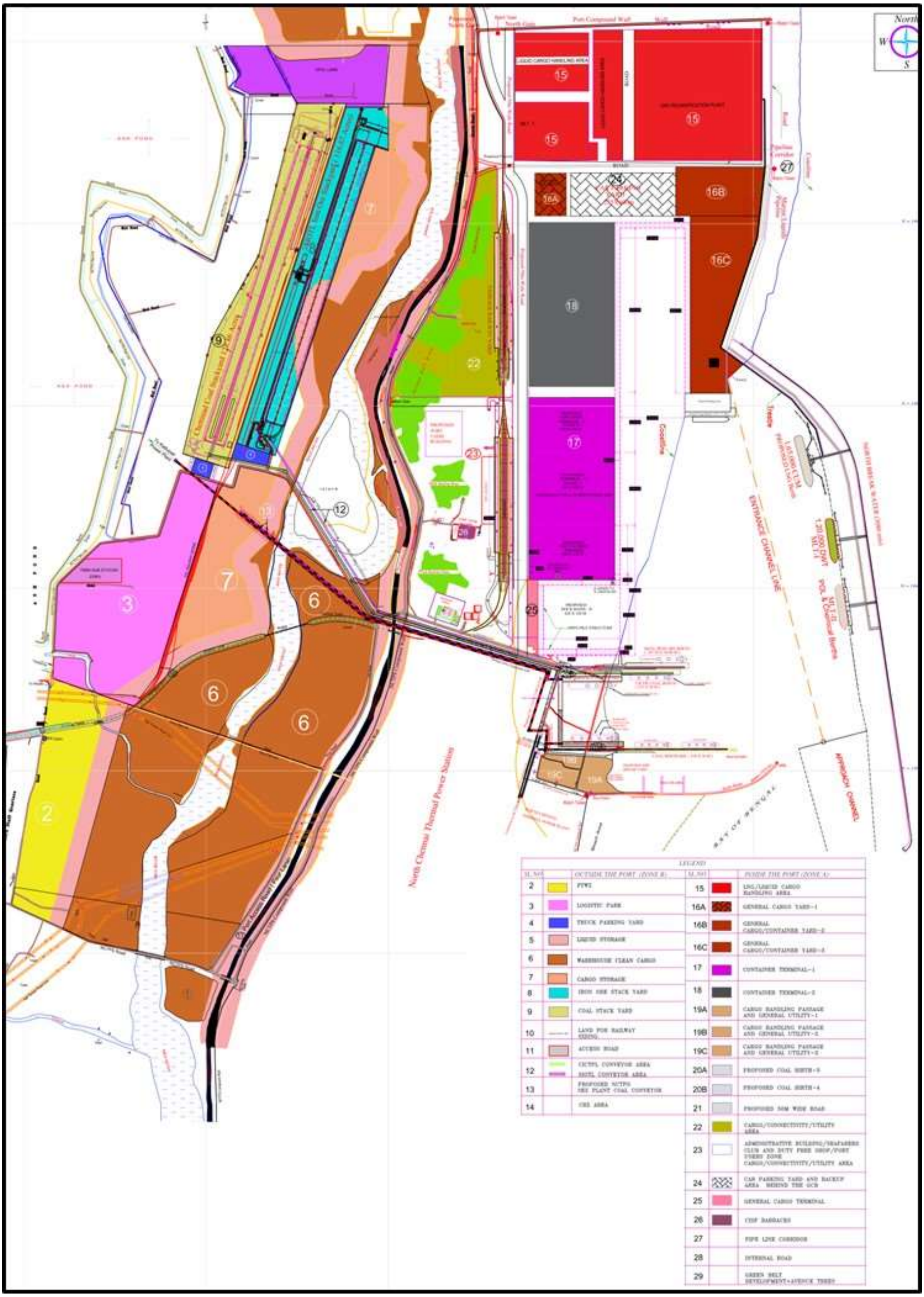



**Figure 9.5 Proposed Land Use Plan**

# 10.0 SHELF OF NEW PROJECTS AND PHASING

It has been established in the earlier sections that the Port will have a surplus capacity of about 8 MTPA for handling coal and that two new liquid bulk terminals and an automobile berth have to be established to meet the projected traffic up to 2020.

As part of the Kamarajar 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 is observed that facilities that are possible within the existing harbour are adequate even for the projected throughput for year 2035. However, the growth of traffic with regard to the type of cargo that needs to be handled will decide the development of these berths according to the need. A higher traffic growth may also require advancement of Greater Kamarajar port development. However the trend will be known once all the ongoing schemes are completed and commissioned.

Therefore 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.

## 10.1 Ongoing Projects

The details of the projects which have already been awarded and development is ongoing are given in **Table 10.1**. The port layout after completion of ongoing projects shall be as shown in **Figure 10.1** .

**Table 10.1 Ongoing Projects**

| Projects | Capacity Addition (MTPA) | Investment Required (INR in Cr) | Mode of Implementation |
|---|---|---|---|
| **Development of LNG Terminal** | 5.0 | 5,151 | PPP |
| **TNEB Coal Berth CB 3** | 9.0 | 250 | Port's funds |
| **TNEB Coal Berth CB 4** | 9.0 | 250 | Port's funds |
| **Multi Cargo Terminal** | 2.0 | 151 | PPP |
| **Construction of Container Terminal Phase 1 Stage 1** | 15.4 | 800 | PPP |
| **Development of Ro-Ro Terminal** | 1.0 | 150 | Port's funds |
| **Capital Dredging Phase III** | - | 300 | Port's funds |
| **Capital Dredging Phase IV** | - | 300 | Port's funds |


**Figure 10.1 Projects Awarded / On Going**

## 10.2 Projects to be Completed by Year 2020

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

**Table 10.2 Projects to be Completed by Year 2020**

| Projects | Capacity Addition (MTPA) | Investment Required (INR in Cr) | Mode of Implementation |
|---|---|---|---|
| **IOC-POL Captive Jetty** | 3.0 | 465 | PPP |
| **Multi-User Liquid Terminal 2 (MLT 2)** | 3.0 | 393 | PPP |
| **Construction of Container Terminal Phase 1 Stage 2** | 11.62 | 470 | PPP |
| **Modification of Existing Iron Ore Terminal to handle coal (SIOTL)** | 6 | 220 | PPP |
| **Capital Dredging Phase-V for providing water depth of -16 m CD for the proposed Ro-Ro cum GCB 2, LNG, MLT 2 and IOCL Captive Jetty berths** | - | 250 | Port's funds |
| **Development of Northern Port Access Road (4.35 Km)** | - | 271 | State Govt./ Stakeholders |
| **Development of Northern Rail Connectivity** | - | 244 | Port's funds / IPRCL |

| Projects | Capacity Addition (MTPA) | Investment Required (INR in Cr) | Mode of Implementation |
|---|---|---|---|
| **Upgrading The Southern Port Access Road** | - | 200 | Port's funds |
| **FTWZ** | - | 850 | PPP |

The port layout after completion of projects mentioned above shall be as shown in **Figure 10.2**


**Figure 10.2 Port Layout with All Facilities Up to 2020**

## 10.3 Projects to be Completed by Year 2035

The details of the projects which are envisaged to be completed by year 2035 are given in **Table 10.3**.

**Table 10.3 Projects to be Completed by Year 2035**

| Projects | Capacity Addition (MTPA) | Investment Required (INR in Cr) | Mode of Implementation |
|---|---|---|---|
| **Container Terminal Phase II** | 38.6 | 2,000 | PPP |
| **Coal Berths / Bulk Terminal (2 × 9 MTPA)** | 18 | 700 | PPP |
| **Ro-Ro and General Cargo Berth** | 1 | 350 | Port's funds |
| **2nd Multi Cargo Terminal** | 2 | 200 | PPP |

The port layout after completion of projects mentioned above shall be as shown in **Figure 10.3**.


**Figure 10.3 Port Master Plan with All Facilities Up to 2035**

# Appendix 1 - **BCG Benchmarking Study for Kamarajar (Ennore) Port**

# Master Plan for Jawaharlal Nehru Port (JNPT)

Prepared for

Ministry of Shipping/ Indian Ports Association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August 2016

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| C. | Master Plan for Jawaharlal Nehru Port (JNPT) – Final | NK/HM<br>16.07.2016 | ASM<br>17.07.2016 | SG<br>20.07.2016 |
| B. | Master Plan for Jawaharlal Nehru Port (JNPT) – Draft Final | NK/HM<br>10.05.2016 | ASM<br>10.05.2016 | SG<br>14.05.2016 |
| A. | Master Plan for Jawaharlal Nehru Port (JNPT) – Draft | RR/HM<br>30.12.2015 | ASM<br>30.12.2015 | SG<br>31.12.2015 |
| **Revision** | **Description** | **Prepared by/ date** | **Reviewed by/ date** | **Approved by/ date** |

**Document Revision Register**

| Issue no. | Date of issue | Section | Revision Details | Revision By Name & Position |
|---|---|---|---|---|
| 1. | 14.05.2016 | | Incorporating comments on draft Master Plan report | Himanshu Mahajan<br>Engineer |
| 2. | 20.07.2016 | | Incorporating comments on draft Final Master Plan report | Himanshu Mahajan<br>Engineer |
| 3. | 25.08.2016 | | Incorporating comments on Final Master Plan report | Himanshu Mahajan<br>Engineer |

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# 1.0 INTRODUCTION

## 1.1 Background

The Sagarmala initiative is one of the most important 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 the 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 a larger economy.

**Sagarmala aims to optimize the Logistics route for Port and Increase focus on Port led development for the country**

| | Details | Description |
|---|---|---|
| Why is Sagarmala needed? | 1 Dual institutional structure at ports | ▪ Due to segregation of major and minor ports, ports of India have grown as due unconnected entities and not benefitting from co-location or economics of scale |
| | 2 Weak infrastructure at ports and beyond | ▪ Weak modes of evacuation from both major and minor ports leading to sub – optimal modal mix presently<br>▪ Limited hinterland linkages that increases cost of transportation |
| | 3 Limited economic benefit of location & to community | ▪ Limited conscious skill development and leverage to peripheral trades (fisheries, tourism etc.)<br>▪ Limited development of centres of manufacturing near ports |
| What does Sagarmala want to achieve? | 1 Ports led development | ▪ Undertake development of coastal economic zones with projects like – port based industrialization, coastal tourism, Logistics parks, warehousing, fisheries etc. |
| | 2 Port infrastructure enhancement | ▪ Action points on transforming existing ports into world class ports be developing deep drafts, mechanization of existing berths, creation of new capacity and greenfield ports |
| | 3 Efficient evacuation | ▪ Expansion of rail / road network connected to ports and identification of congested routes<br>▪ Find optimized transport solution for bulk and container cargo |

**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

The team of McKinsey and AECOM distilled learnings from the experience in port-led development, the major engagement challenge to develop a set of governing principles of approach is shown in **Figure 1.2** below.

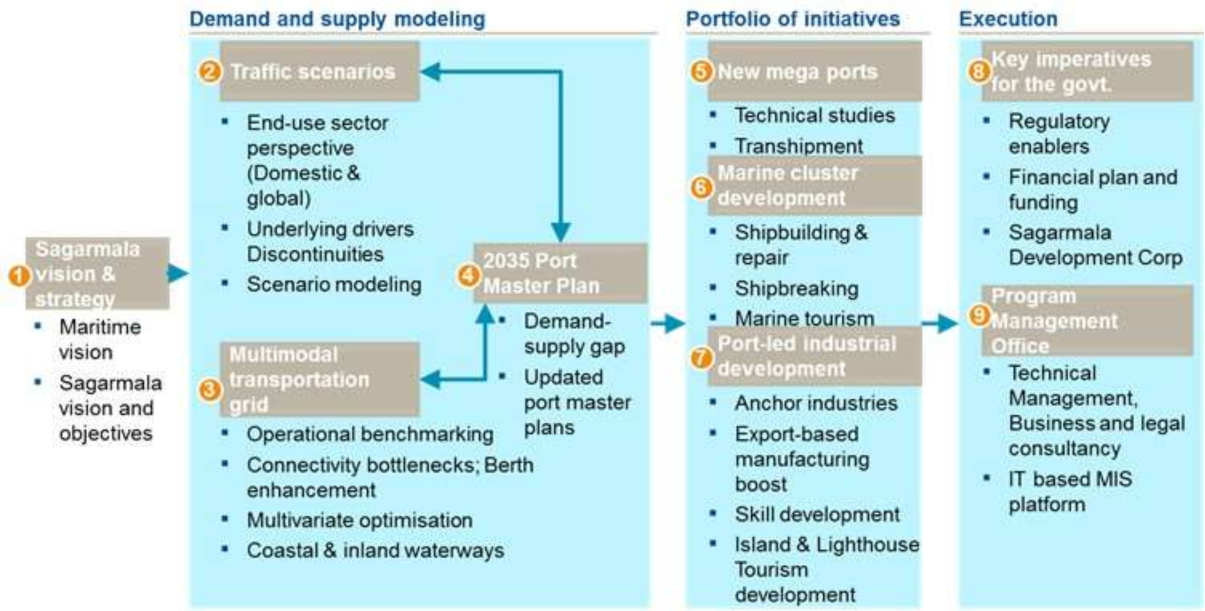



**Figure 1.2 Governing Principles of Approach**

As indicated above, the origin-destination of key cargo (accounting for greater than 85% of the total traffic) in Indian ports have been 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.

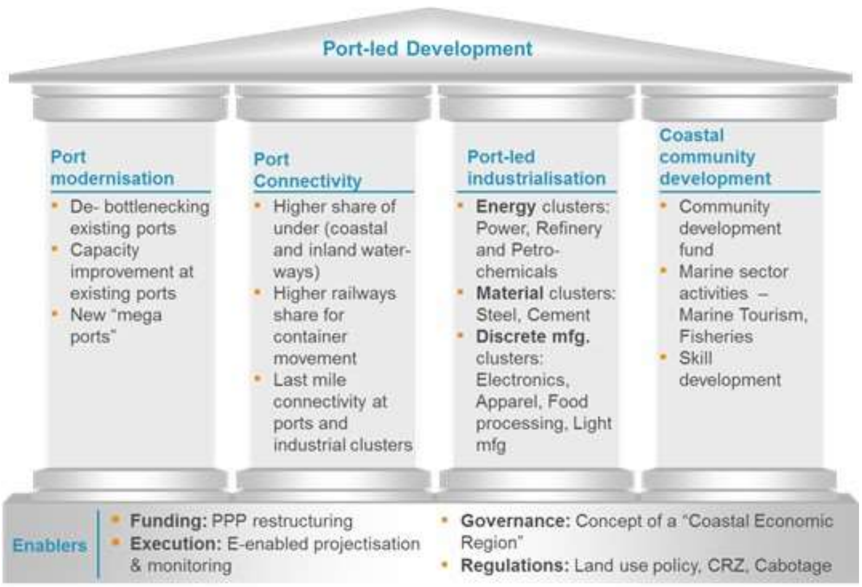



**Figure 1.3 Port Led Developments**

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 Jawaharlal Nehru Port as part of SAGARMALA assignment. This report is organised in the following sections:

Section 1 : Introduction
Section 2 : The Port and Site Conditions
Section 3 : Details of Existing Facilities
Section 4 : Performance, Options for Debottlenecking & Capacity Assessment
Section 5 : Details of Ongoing Developments
Section 6 : Traffic Projections
Section 7 : Operational Improvements and Capacity Augmentation of Existing Facilities
Section 8 : Scope for Future Capacity Expansion
Section 9 : Shelf of New Projects and Phasing

# 2.0 THE PORT AND SITE CONDITIONS

## 2.1 Port Location

The location plan and a satellite image of the Jawaharlal Nehru Port is shown in **Figure 2.1** below.


**Figure 2.1 Location Plan of JNPT**

Jawaharlal Nehru Port was commissioned for commercial operations in the year 1989. Jawaharlal Nehru Port is run by the Jawaharlal Nehru Port Trust (JNPT), an autonomous corporation wholly owned by the Government of India under the Ministry of Shipping. The port was created to relieve pressure on Mumbai Port. It is located at the eastern end of Mumbai on the Sheva Island and is situated at latitude 18° 56' 43" N and longitude 72° 56' 24" E. JNPT accounts for more than half of total container volumes handled at India's 12 public ports and around 40% of the nation's overall containerized ocean trade.

## 2.2 Rail and Road Connectivity

### 2.2.1 Road Connectivity

The major road linkages connecting JNPT with hinterland road network are NH4B, NH4, NH17, NH 3 & 8 and a State Highway 54. The major road linkage connecting JNPT to its hinterland is as below:

**National Highway 4B** – This road connects JNPT with Mumbai and other important cities of Maharashtra and Gujarat. The road mainly serves the heavy traffic of containerized vehicles to and fro JNPT. It has a length of 26.43 km and branches at km 108/800 of NH4.

**National Highway 4 (4 lanes) -** The port is connected through National Highway number 4 through NH 4B. The linkage to NH 4 provides connectivity to Pune and southern states of India.

**National Highway 17 -** The state Highway number 66 links port to National Highway number 17 (2 lanes) which provide connectivity to Goa.

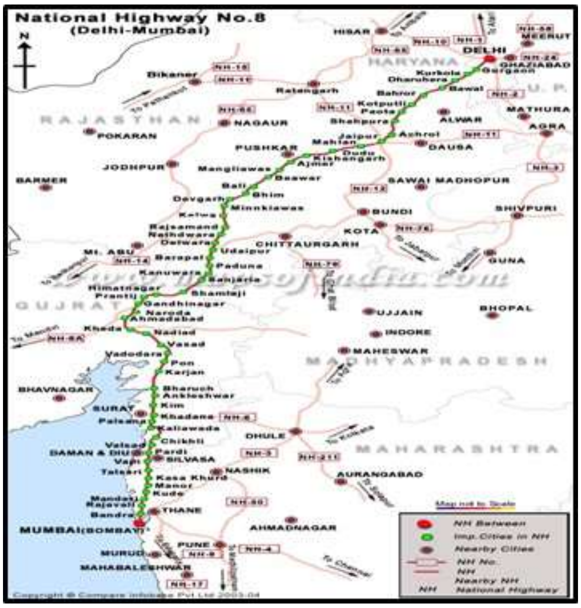
**National Highway 3 and 8 -** National Highway Number 4 (2 lanes with portion of highway being 4 lane) links port to NH 3 and NH 8 (2 lanes with portion of highway being 4 lane) which provides connectivity to Nashik and Ahmedabad region

**State Highway 54** - This state Highway stretch connects Uran to Panvel. It runs more or less parallel to NH 4B. SH54 meets NH 4B at km 6/000 on Uran side and km 21/000 on Panvel side A number of container yards are located abutting SH54 and majority of traffic on this road is due to the JNPT.

***Aamra Marg:*** It begins at km 125/800 of Sion Panvel highway (SH42) and passes through Belapur, Nerul and Ulwa and ends at km 13/900 of SH54. The road is an important link between northern and southern parts of Navi Mumbai and JNPT.

All-important destinations in India whether on the North, West or East could be accessed through any one of these three National Highways.

**Figure 2.2** to **Figure 2.4** is provided to detail road connectivity around the JNPT.

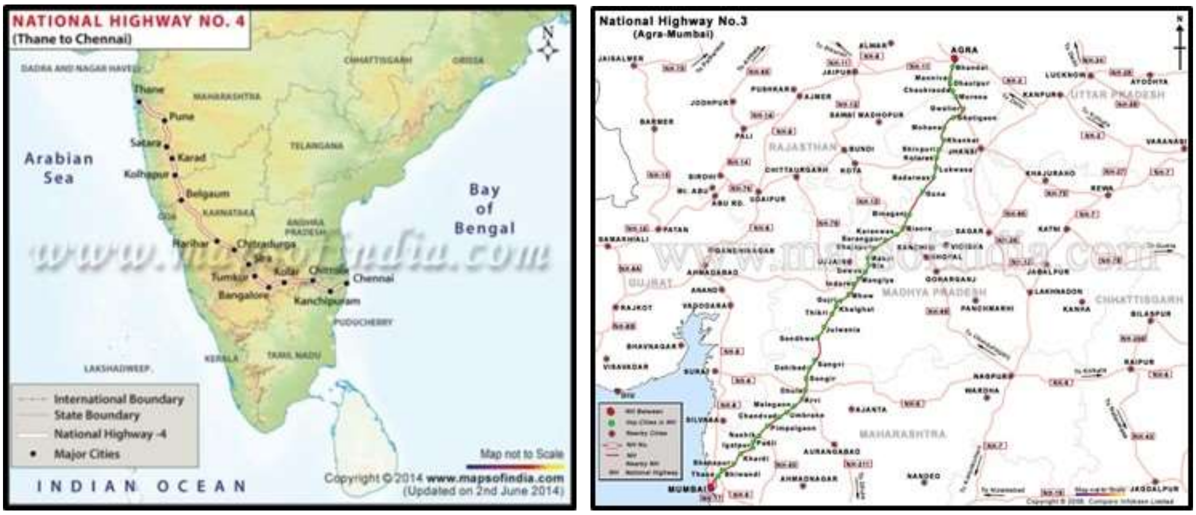



**Figure 2.2** **Map Showing in Clockwise Direction NH-17 (Panvel-Kochi) , NH-8 (Mumbai-Delhi), NH-3 (Mumbai-Agra) and NH-4 (Thane-Chennai) Serving JNPT Hinterland**

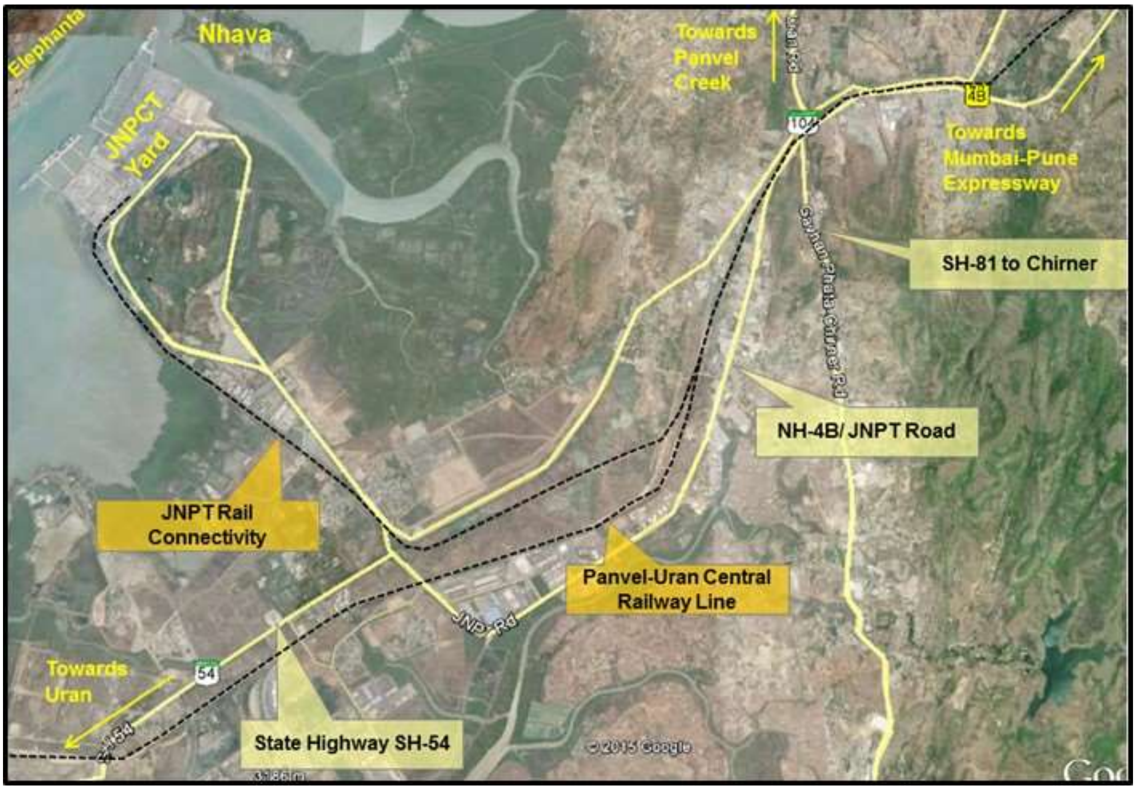



**Figure 2.3 Existing JNPT Road and Rail Connectivity**

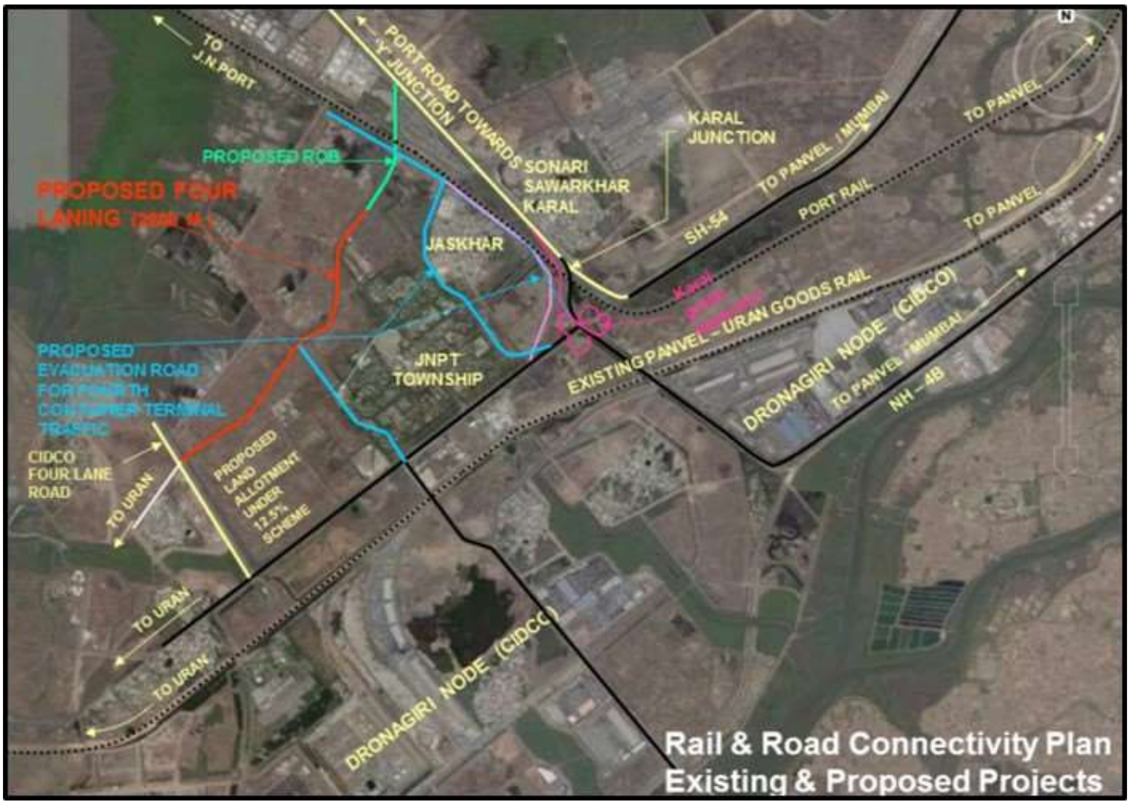



**Figure 2.4 Road Connectivity at JNPT**

### 2.2.2 Rail Connectivity

JNPT is linked with the Indian Railways through a lead line connecting the port with it serving station Jasai. Jasai is located on the Panvel – Uran branch line section of Mumbai division, Central Railway at a distance of 9 km from the port. The rail system at the port, which is operated and maintained by the Indian Railways, has 8 full length railway lines serving the three existing container terminals. Besides these, there is 4 line intermediate holding yard between Jasai and the port. The Jasai station yard deals with all traffic between JNPT and the Indian Oil Tank farm Ltd. The 4 line intermediate holding yard between Jasai and the port also serves to hold back and regulate traffic in the event of congestion at JNPT or at Jasai yard.

- Northern Corridor from JNPT up to Ludhiana via Diva, Vasai road, Vadodara, Ratlam, Kota, Bayana, Mathura junction, Tughlaqabad and Delhi.
- North Western Corridor from JNPT to Rewari via Vadodra-Ahmedabad, Sabarmati Palanpur, Marwar Jn. Jodhpur, Jaipur

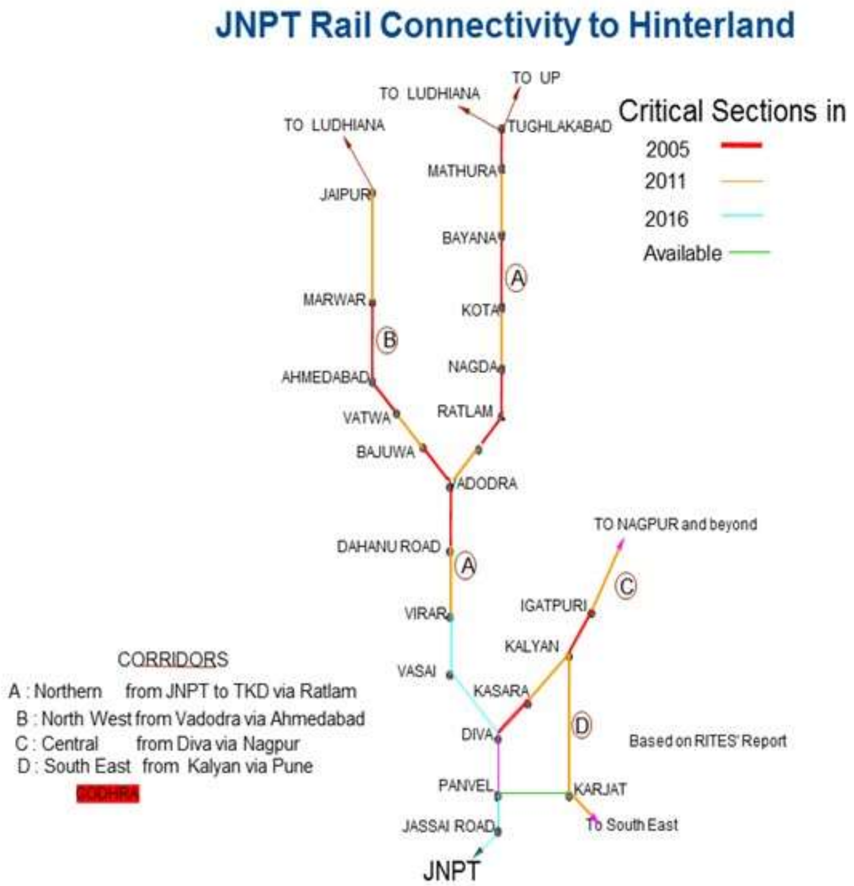



**Figure 2.5 Rail Connectivity to JNPT Hinterland**

## 2.3 Site Conditions

### 2.3.1 Meteorology

#### *2.3.1.1 General*

The region experiences a tropical monsoon climate with regular seasonal rains and has four distinct seasons as follows:

- Monsoon season (June to September) -This is the main rainy season with the highest number of rainy days. The main features of this season are very high humidity, low clouds and several spells of moderate to heavy rains.
- Post-monsoon season (October to November) - The frequency of severe cyclonic storms is the highest during this season.
- Winter season (December to February) - The main features of this season are fine weather and occasional morning mist or fog.
- Summer season (March to May) - This season is also referred to as the "pre-monsoon" season. During this season the sea level atmospheric pressure and wind systems gradually get disrupted prior to the setting-in of the south west monsoon. A rise in air temperature with incidence of thunderstorms and cyclonic storms during the latter part of the season are the main features.

#### *2.3.1.2 Winds*

The prevalent direction of wind is from the North West to SW direction during May to September months and that from North East to South West during October to March. The direction of occurrence of wind during various months is shown in **Table 2.1**.

**Table 2.1 Occurrence of Wind - Percentage Number of Days**

| MONTH | | WIND | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PERCENTAGE NUMBER OF DAYS WIND FROM | | | | | | | | |
| | | **N** | **NE** | **E** | **SE** | **S** | **SW** | **W** | **NW** | **CALM** |
| January | I | 5 | 15 | 22 | 2 | 0 | 0 | 0 | 1 | 55 |
| | II | 18 | 1 | 0 | 0 | 0 | 0 | 12 | 69 | 0 |
| February | I | 8 | 15 | 17 | 3 | 0 | 0 | 0 | 2 | 55 |
| | II | 15 | 0 | 0 | 0 | 0 | 0 | 12 | 73 | 0 |
| March | I | 11 | 16 | 11 | 4 | 2 | 0 | 0 | 5 | 51 |
| | II | 11 | 0 | 0 | 0 | 0 | 2 | 18 | 69 | 0 |
| April | I | 9 | 10 | 7 | 7 | 8 | 4 | 3 | 10 | 42 |
| | II | 6 | 6 | 0 | 0 | 0 | 4 | 31 | 59 | 0 |
| May | I | 6 | 3 | 3 | 3 | 7 | 14 | 21 | 15 | 28 |
| | II | 2 | 0 | 0 | 0 | 8 | 32 | 48 | 11 | 1 |
| June | I | 1 | 1 | 3 | 9 | 14 | 22 | 28 | 8 | 14 |
| | II | 0 | 0 | 0 | 0 | 8 | 32 | 48 | 11 | 1 |
| July | I | 1 | 0 | 1 | 3 | 5 | 28 | 45 | 7 | 10 |
| | II | 1 | 0 | 0 | 0 | 2 | 30 | 54 | 10 | 3 |
| August | I | 1 | 1 | 1 | 2 | 3 | 22 | 49 | 8 | 13 |
| | II | 1 | 0 | 0 | 0 | 1 | 19 | 59 | 16 | 4 |
| September | I | 2 | 5 | 8 | 6 | 5 | 8 | 14 | 7 | 45 |
| | II | 4 | 1 | 0 | 0 | 1 | 13 | 38 | 40 | 3 |
| October | I | 2 | 15 | 22 | 6 | 2 | 1 | 0 | 1 | 51 |
| | II | 13 | 2 | 1 | 1 | 1 | 5 | 19 | 56 | 2 |
| November | I | 1 | 22 | 34 | 4 | 1 | 0 | 0 | 0 | 38 |
| | II | 16 | 3 | 1 | 0 | 1 | 1 | 11 | 65 | 2 |
| December | I | 1 | 18 | 35 | 2 | 0 | 0 | 0 | 1 | 43 |
| | II | 16 | 2 | 0 | 0 | 0 | 0 | 11 | 70 | 1 |
| **Annual Total or Mean** | I | 4 | 10 | 14 | 4 | 4 | 8 | 13 | 5 | 37 |
| | II | 9 | 1 | 0 | 0 | 1 | 10 | 30 | 48 | 1 |
| **Numbers of year** | I | 30 | | | | | | | | |
| | II | | | | | | | | | |

*[Source: IMD]*

### 2.3.1.3 Cyclone

The cyclones generally occur in the period of May/June or October/November. The last serve cyclonic storm was experienced in 1982 at the port location. Occasionally, sudden high winds also occur during the fine weather period from north east.

### 2.3.1.4 Rainfall

The Southwest monsoon season (June-September) accounts for about 94% of the total annual rainfall in the region, which averages around 1800 mm. The onset of monsoon is generally around June, when the rainfall increases from 1% of the average annual rainfall in May to about 25% in June. On an average, there are 73 days in a year, with a rainfall of 2.5 mm or more. Out of these, about 67 days occur during the monsoon season with about 22 days in the month of July – the month of the year with the maximum rainfall (34% of the average annual rainfall).

The month-wise distribution of the average rainfall, the number of rainy days (with a precipitation of 2.5mm or more) and the heaviest rainfall recorded in 24 hours for each month of the year is provided in **Table 2.2**.

**Table 2.2 JNPT Rainfall Data**

| Month | Average Rainfall (mm) | Average No. of Rainy Days | Heaviest Rainfall Recorded in 24 hours (mm) |
|---|---|---|---|
| January | 4.1 | 0.3 | 49.3 |
| February | 2.0 | 0.1 | 41.7 |
| March | 1.5 | 0.1 | 34.3 |
| April | 1.5 | 0.1 | 37.3 |
| May | 18.3 | 0.8 | 126.2 |
| June | 464.8 | 14.2 | 408.2 |
| July | 613.4 | 22.2 | 304.8 |
| August | 328.9 | 18.2 | 287.0 |
| September | 286.0 | 12.6 | 548.1 |
| October | 64.5 | 3.0 | 148.6 |
| November | 17.5 | 0.8 | 122.7 |
| December | 2.3 | 0.3 | 24.4 |
| **Total** | **1804.8** | **72.7** | **-** |

*[Source: IMD]*

### 2.3.1.5 *Temperature*

The mean of the maximum temperature recorded is 33.3° C in the month of May while the mean Minimum is 19.4° C recorded in the month of January. Mean daily highest maximum and minimum temperature is 40.6° C and 11.7° C respectively.

The maximum and minimum mean daily air temperatures for each month along with the extremes are as follows in **Table 2.3**.

**Table 2.3 Temperature Data of JNPT Area**

| Month | Maximum Mean Daily (°C) | Minimum Mean Daily (°C) | Highest Maximum Recorded (°C) | Lowest Minimum Recorded (°C) |
|---|---|---|---|---|
| January | 29.1 | 19.4 | 35.6 | 11.7 |
| February | 29.5 | 20.3 | 38.3 | 11.7 |
| March | 31.0 | 22.7 | 39.7 | 16.7 |
| April | 32.3 | 25.1 | 40.6 | 20.0 |
| May | 33.3 | 26.9 | 36.2 | 22.8 |
| June | 31.9 | 26.3 | 37.2 | 21.1 |
| July | 29.8 | 25.1 | 35.6 | 21.7 |
| August | 29.5 | 24.8 | 32.4 | 21.7 |
| September | 30.1 | 24.7 | 35.0 | 20.0 |
| October | 31.9 | 24.6 | 36.6 | 20.6 |
| November | 32.3 | 22.8 | 36.2 | 17.8 |
| December | 30.9 | 20.8 | 35.7 | 12.8 |

[Source: IMD]

### 2.3.1.6 *Relative Humidity*

The relative humidity is moderate to high throughout the year with the mornings being more humid than the afternoons. The mean relative humidity for each month of the year measured at 0830 hrs and 1730 hrs is provided in **Table 2.4**.

**Table 2.4 JNPT Area Humidity Data**

| Month | Mean Relative Humidity (%) | |
|---|---|---|
| | 0830 Hr. | 1730 Hr. |
| January | 71 | 63 |
| February | 72 | 62 |
| March | 72 | 63 |
| April | 73 | 66 |
| May | 73 | 68 |

| Month | Mean Relative Humidity (%) | |
|---|---|---|
| | 0830 Hr. | 1730 Hr. |
| June | 80 | 78 |
| July | 85 | 85 |
| August | 85 | 84 |
| September | 85 | 80 |
| October | 80 | 74 |
| November | 73 | 67 |
| December | 70 | 64 |

[Source: IMD]

#### 2.3.1.7 Visibility

From November to March smog hangs over the land around Mumbai. This happens only for short periods, most often shortly after sunrise but occasionally in the evening. The visibility in the port area is generally good throughout the year, except for a few days during the winter season and during periods of heavy rain. The number of days on which visibility is poor being negligible.

### 2.3.2 Oceanography

#### 2.3.2.1 Tides

The tides in the region are semi-diurnal characterised by two high and two low waters in a period of 24 hours and 25 minutes. Duration of each tidal cycle is between 5 to 7 hours (theoretically 6 hours and 12 minutes).

The tidal levels are based on extensive data collected by the port over many years and are well established. Tidal levels are recorded at three locations in the region viz. at Apollo Bandar (Lat. 18° 55'N; Long. 72° 50'E), at Mora (Lat. 18° 55'N; Long 72° 56'E) and at Trombay (Lat. 19° 02'N; Long 72° 57'E).

From the recorded data, it is seen that the highest tidal range (both spring and neap) occur at Trombay. At Apollo Bandar the spring tidal range is greater and the neap tidal range is lesser than that at Mora. The tidal range, relative to the Chart Datum (CD), for JNPT is as follows:

| | | |
|---|---|---|
| Highest High Water Recorded | (HHW) | +5.38 m |
| Mean High Water Springs | (MHWS) | +4.42 m |
| Mean High Water Neaps | (MHWN) | +3.30 m |
| Mean Sea Level | (MSL) | +2.51 m |
| Mean Low Water Neaps | (MLWN) | +1.86 m |
| Mean Low Water Springs | (MLWS) | +0.76 m |
| Lowest Low Water Recorded | | - 0.44 m |

Statistical studies indicate that:

- All high tides exceed +2.70 m.
- About 5% of all high tides would be less than +3.20 m.
- About 5% of lower high tides (LHW) would be less than +2.85 m.

#### *2.3.2.2 Currents*

The currents in the Harbour waters are essentially caused by the tides and are not influenced to any extent by monsoon etc. The currents in the Mumbai estuary are of the order of 0.75 m/s to 1.5 m/s (1.5 to 3 knots). The current in the creeks are also affected by the freshets which results in not only increasing the strength of ebb current but also limiting the propagation of the tide upstream.

#### *2.3.2.3 Waves*

The National Institute of Oceanography (NIO) have complied and published wave data for the entire coastline of India in the form of a 'Wave Atlas' The monthly wave rose diagrams published in the 'Wave Atlas' for the area from latitude 15° N to 25° N and longitude 70° to 75° E shows that during monsoon period the predominant wave directions are from Southwest to West. During this period, waves of 4-5 m height normally occur; however, waves up to 8.0 m and period of 14 sec. have also been reported at offshore locations. October and November are transition months during which the predominant wave direction changes between North and Northeast. During December and January the waves mainly occur from North to Northeast and from February to May, waves predominantly come from the North West quadrant.

### 2.3.3 Geotechnical Data

The typical soil characteristics at the JN Port are silty clay or marine clay overlaying basalt rock. However, the thickness of silty/marine clay varies at different locations. While at the Nhava Creek area in shallow waters the silty clay with thickness varying from 2 m to 7 m, the same is the Uran mudflat area is much higher at about 15 to 20 m.

# 3.0 DETAILS OF EXISTING FACILITIES

## 3.1 General

The port has four container terminals:

- JNPCT operated by the JNPT port with a quay length of 680 m;
- NSICT operated on BOT basis by DP World with a quay length of 600 m and
- GTICT operated on BOT basis by a consortium of Maersk and CONCOR with a quay length of 712 m.
- NSIGT operated on BOT basis by DP World with a quay length of 330 m

Liquid bulk jetty built and operated on BOT basis by BPCL on the southern side of GTICT. It is a twin berthing jetty with a 390 m berthing face on one side and 310 m berthing face at the rear. It can handle 85,000 DWT tankers at the front side and 30,000 DWT tankers at the rear. The locations of these berths along with their back-up areas are shown in the following **Figure 3.1** and **Table 3.1** provides details of various berths. The information in this section has been obtained from JNPT.


**Figure 3.1 JNPT Existing Facilities**

**Table 3.1 JNPT Terminal Wise Details**

| Terminal | Operator/ Terminal | Number of Berths | Length (m) | Design Dredged Level (m) |
|---|---|---|---|---|
| JNP Container Terminal | JNPT | 3 | 680 | 16.5 |
| NSICT | DP World | 2 | 600 | 16.5 |
| NSIGT – 330 m | DP World | 1 | 330 | 16.5 |
| GTIPL | APM | 3 | 712 | 16.5 |
| Shallow Water Berth | JNPT | 2 | 445 | 10 |
| JNPT Liquid Terminal | BPCL | 2 | 390 + 310 | 16.5 Outer Berth<br>12.5 Inner Berth |

## 3.2 Nhava Sheva International Container Terminal (NSICT)

JN Port entered into a license agreement in July 1997 with M/s. Nhava Sheva International Container Terminal (NSICT) a consortium led by M/s. P & O Ports, Australia, for construction, operation and management of a new 2-berth container terminal on BOT basis for period of 30 years. The NSICT berths were commissioned in April 1999. The NSICT berths comprise of 600 m quay length; 25.84 ha. of reclaimed backup area for container yard and requisite container handling equipment along with other related facilities (**Figure 3.2**). The present capacity of the terminal is currently assessed as 1.2 MTEUs per annum.

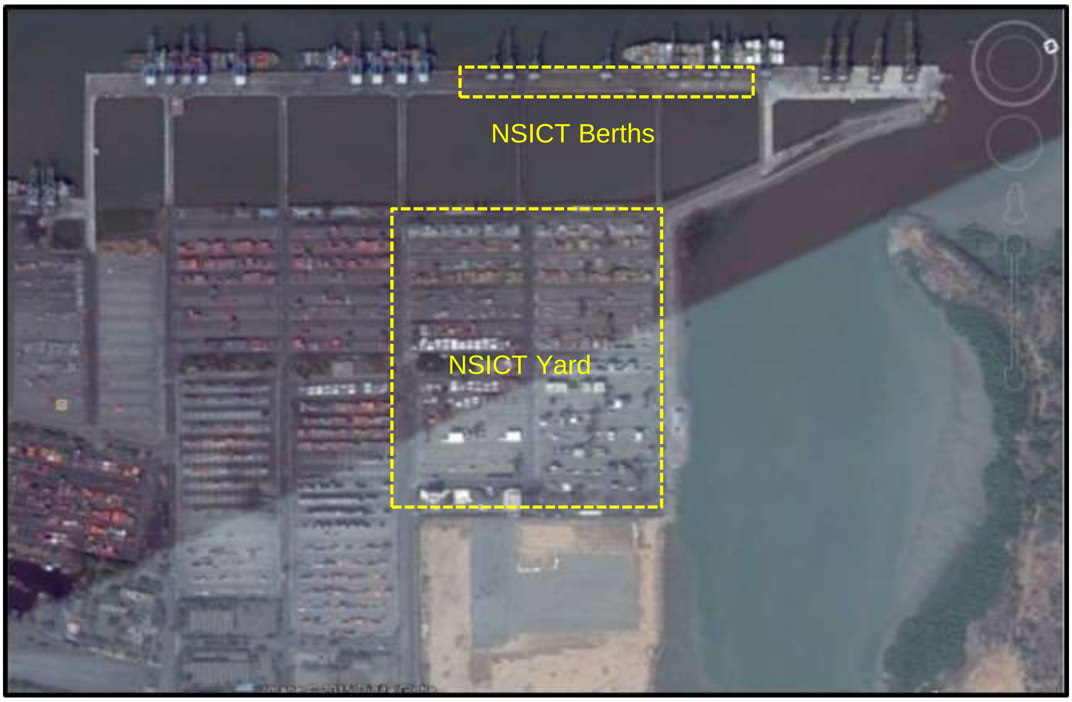



**Figure 3.2 Plan View of NSICT Yard and Berth**

**Table 3.2 NSICT Terminal Details**

| Terminal | NSICT |
|---|---|
| Quay Length (m) | 600 |
| Maximum draft of vessel at Port (m) | 14 (Tidal) |
| Design capacity<br>• Million TEUs/ Year<br>• MT/Year | <br>1.2<br>15 |
| Reefer Points (No.) | 772 |
| RMQCs (No.) | 8 |
| RTGCs (No.) | 29 |
| RMGCs (No.) | 3 |
| Yard Area (In Hectares) | 25.84 |
| Max. Permissible LOA of the Vessel (m) | 340 |

## 3.3 Jawaharlal Nehru Port Container Terminal (JNPCT)

JNPCT is JNPT's own Container Terminal. JNPCT has 3 berths with a total quay length of 680 m and is capable to handle vessels up to 14 m draft. The capacity of JNPCT terminal is about 1.25 M TEUs with a backup yard of approx. 61 ha. (including shallow berth area). The existing JNPCTs facilities are shown in the **Figure 3.3**.


**Figure 3.3 Existing JNPCT Facilities**

Recently, modernisation of container terminal were undertaken by adding three new post Panamax size Rail Mounted Quay Crane (RMQCs) at main berth totalling 9 RMQCs supported by 18 RTGCs and 5 RMGCs.

The details of JNPCT is shown as below in **Table 3.3**.

**Table 3.3 JNPCT Terminal Details**

| Terminal | JNPCT |
|---|---|
| Quay Length (m) | 680 |
| Maximum draft of vessel at Port (m) | 14 (Tidal) |
| Capacity (in million TEUs) | 1.25 |
| Reefer Plugs (No.) | 320 |
| RMQCs (No.) | 9 |
| RTGCs (No.) | 18 |
| RMGCs (No.) | 5 |
| Tractor Trailers | 130 |
| Backup Area – (ha.) | 61.49 (Including Shallow Berth area) |
| Reach Stackers | 8 (Hired) |
| Railway Siding Tracks for ICD | 4 |
| Maximum Permissible LOA of The Vessel | 340 m |

## 3.4 Shallow Draft Berth

Shallow Draft Berth was commissioned on 1st September 2002, has a total length of 445 m. Vessels up to 183 m LOA and up to 10 m draft is being handled at this berth (**Figure 3.4**). Container vessels, cement, general cargo and liquid cargo vessels are being handled with a capacity of about 0.15 Million TEU's Container and 0.9 MTPA other cargo totalling to 2.77 MTPA.

The details of Shallow berth are shown as below in **Table 3.4**.


**Figure 3.4 JNPCT Shallow Berth and Yard**

**Table 3.4 Shallow Berth Details**

| Terminal | Shallow Draft Terminal |
|---|---|
| Quay Length (m) | 445 |
| Maximum draft (m) | 10 |
| Design capacity<br>• Million TEUs Year<br>• MT/Year | <br>0.15<br>2.77 |
| Max. Permissible LOA of the Vessel | 183 m |
| RMQCs (No.) | 3 |

## 3.5 Gateway Terminal India Private Limited (GTIPL) Terminal

Gateway Terminals India Private Limited (GTIPL) is a joint venture between APM Terminals and the Container Corporation of India Ltd (CONCOR) and it operates the third container terminal at Jawaharlal Nehru Port on a build, operate and transfer (BOT) basis for a period of 30 years. It commenced partial operations in March 2006 and became fully operational from October 2006. **Figure 3.5** and **Figure 3.6** show GTI berths at its yard. The Quay length of the GTI berth is 712 m and is capable to handle vessels up to 14 m draft (**Table 3.5**).


**Figure 3.5 Plan View of GTI Berths**


**Figure 3.6 GTI Container Yard**

**Table 3.5 GTI Terminal Details**

| Terminal | GTI |
|---|---|
| Quay Length (m) | 712 |
| Maximum draft of vessel at Port (m) | 14 (Tidal) |
| Design capacity<br>• Million TEUs Year<br>• MT/Year | <br>1.8<br>22.5 |
| Reefer Points (No.) | 880 |
| RMQCs (No.) | 10 |
| RTGCs (No.) | 40 |
| RMGCs (No.) | 3 |
| Yard Area (ha.) | 47.24 |
| Maximum Permissible LOA of the Vessel (m) | 340 |
| Empty Handlers (No.) | 2 |

# 3.6 Liquid Terminal

A license on BOT basis was awarded to M/s. Bharat Petroleum Corporation Limited and M/s. Indian Oil Corporation Limited in August 1999 for construction of a twin-berth liquid cargo jetty. The twin-berth liquid cargo jetty has been functional since 2002. The liquid terminal is shown in **Figure 3.7**.


**Figure 3.7 JNPT Liquid Terminal**

The berth has twin loading/ unloading facilities which can accommodate a vessel of 120,000 DWT and 50,000 DWT on sea side and shore side respectively. The capacity of the terminal is about 6 MTPA. The jetty is provided with six 12' diameter marine loading and unloading arms and two loading arms with 16" diameter. **Table 3.6** provides details of the liquid terminal.

There are ten dedicated customers utilising the marine liquid terminal as shown in **Figure 3.7** and **Figure 3.8**.

**Table 3.6 Liquid Terminal Details**

| Terminals | Liquid Cargo Terminal |
|---|---|
| Quay Length (m) | 390-Sea<br>310-Shore |
| Berth Width (m) | 40.5 |
| Maximum draft (m) | 14-Outer (Tidal)<br>10-Inner (Tidal) |
| Design capacity (MTPA) | 6.5 |
| Loading Arms (No.) | 10 |
| Storage Area Outside Port | 142 Tanks<br>Capacity: (710,619MT) |
| Max. Permissible LOA of The Vessel | 330 m Outer Berth<br>185 m Inner Berth<br>305 m for twin Vessels |

**Table 3.7 JNPT Liquid Terminal Customer and Product Details**

| S. No | Customer | Distance to Tankage | Products |
|---|---|---|---|
| 1. | BPCL | 6.35 km / 15 km (LPG) | FO (Bunker); LPG |
| 2. | Deepak Fertiliser Corporation | 4.75 km | Ammonia; Phosphoric Acid; Phenol |
| 3. | Ganesh Benzo Plast | 4.75 km | Chemicals; Edible oil; Molasses |
| 4. | Indian Molasses Company | 5.00 km | Chemicals; Edible oil;; POL |
| 5. | IOCL | 6.35 km | POL |
| 6. | Indian Oil tanking Ltd. | 13.00 km | POL |
| 7. | ONGC | 15.00 km | Crude oil |
| 8. | Reliance Industries Ltd. | 5.50 km | POL; Chemicals |
| 9. | Shell | 4.75 km | Chemicals |
| 10. | Suraj Agro Products | 4.75 km | Edible oil |

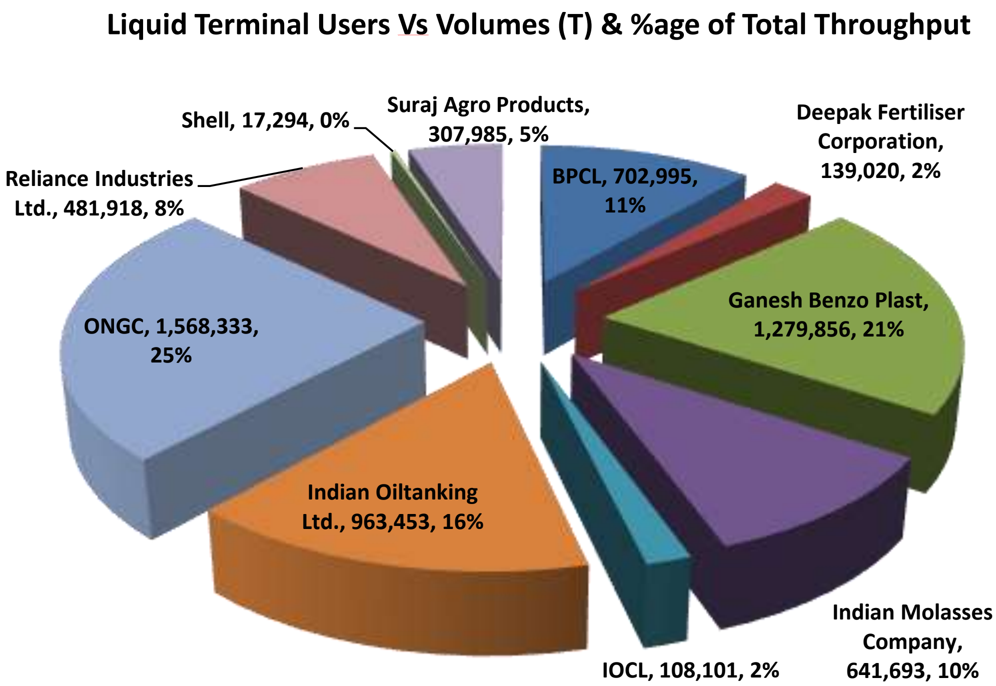



**Figure 3.8 JNPT Liquid Traffic Split Customer Wise**

# 3.7 JNPT Approach Channel

This approach channel is a Common Harbour channel for JNPT and Mumbai Port. The characteristic of the approach channel is as below:

- Channel Length of 33.54 km
- Designed Channel depth (below CD)
  - 13.1 m in JNP channel &
  - 14.2 m in outer harbour channel.
- Channel Width
  - 370 m at straight reach;
  - 460 m at the berths.
- Turning Circle/ Anchorage of 600 m diameter

The existing JNPT channel is dredged to handle 14 m draft container ship with tide advantage. **Figure 3.9** shows the layout of the existing JNPT approach channel.

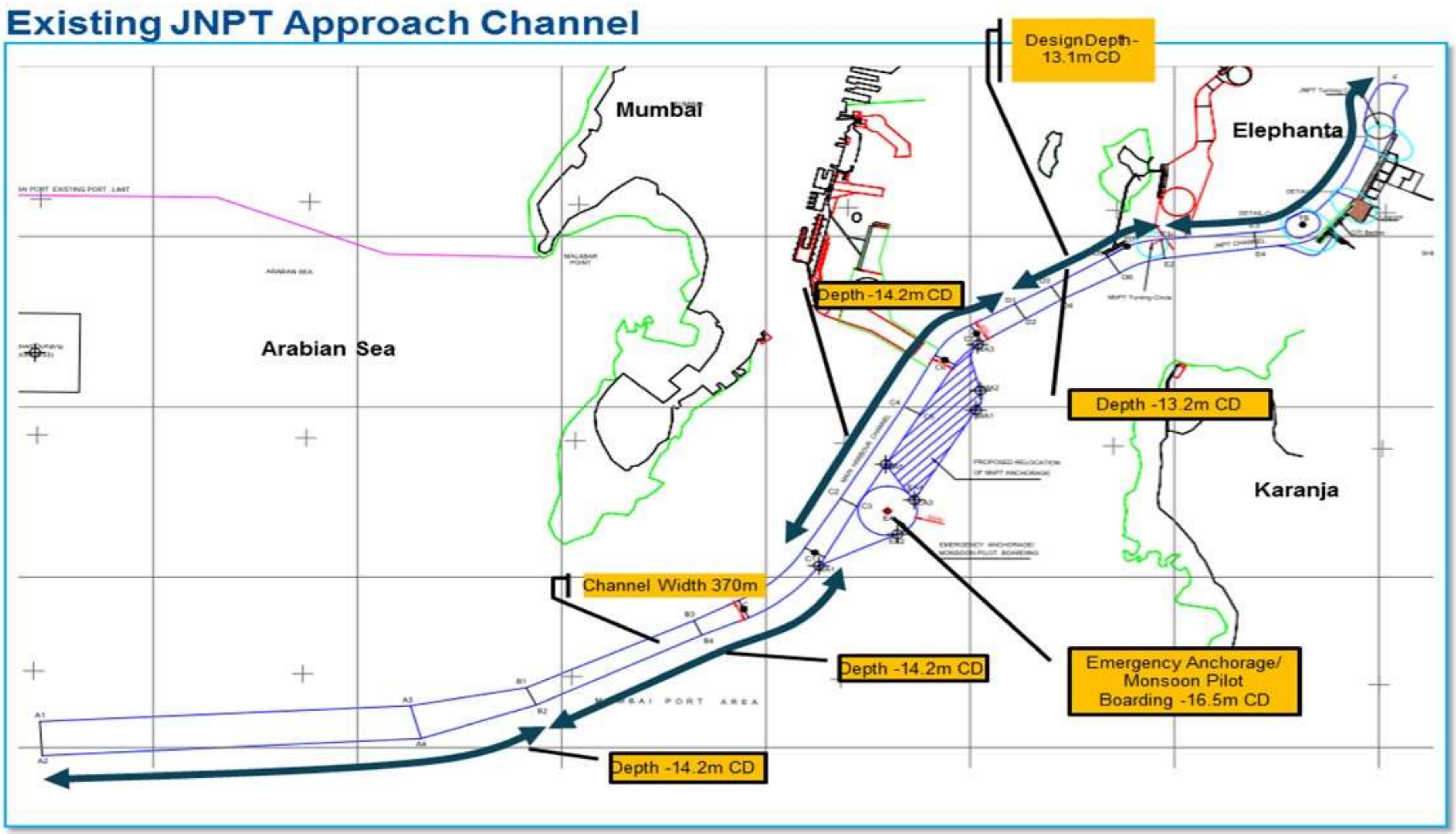



**Figure 3.9 Existing JNPT Approach Channel**

# 4.0 PERFORMANCE, OPTIONS FOR DEBOTTLENECKING & CAPACITY ASSESSMENT

## 4.1 General

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

**Table 4.1 Cargo Handled During Past 5 Years.**

| Commodity | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|---|---|---|---|---|---|
| POL+ Crude + Product | 5.0 | 4.9 | 4.1 | 4.4 | 5.9 |
| **Containers** | | | | | |
| Tonnage (MTPA) | 56.4 | 58.2 | 57.9 | 55.2 | 57.6* |
| MTEUs | 4.2 | 4.3 | 4.2 | 4.1 | 4.5 |
| Others | 2.8 | 2.6 | 2.5 | 2.7 | 0.9 |
| **Grand Total (MTPA)** | **64.3** | **65.7** | **64.5** | **62.3** | **64.4** |

*Conversion factor for container projections in 2014-15: 1 TEU =12.8 T

## 4.2 BCG Benchmarking Study Inputs for Master Plan

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 extract of report of BCG pertaining to Jawaharlal Nehru Port is given in the **Appendix-1**. The key observations are as follows:

### 4.2.1 Key Points of BCG Benchmarking Study

#### *4.2.1.1 JNPT Container Terminal*

- JNPT's container volume growth has been stagnated and it's loosing container traffic share to other ports in Gujarat (Mundra and Pipavav).
- JNPT's own container terminal JNPCT is lagging behind in Quay Crane productivity when it comes to its Indian terminal peers.
- As per the survey conducted by BCG with various stake holders in the port industry, JNPT's productivity, berth availability and road connectivity lags when compared to Gujarat's container terminals.
- Dual cycling, Efficient yard planning, Twin lifts Quay cranes, Quay crane operator skills and productivity enhancement through monetary incentives these are some of major points for improvement that are highlighted by the BCG study.

#### 4.2.1.2 JNPCT Container Yard

- Current JNPCT yard storage utilization lowest among the Indian peers.
- Benchmarking shows significant gaps between JNPCT and GTI on RTGC equipment levels, utilization and productivity. High RTGC productivity gap likely driven by low utilization rather than equipment or operator skill. As a result, productivity gap between berth and yard exists today and will grow with increasing crane productivity.
- Separation of import and export yards limits opportunities for RTGC pooling and drives longer TT travel distances. Connecting IM/EX yard for RTGC sharing can increase average IM yard RTGCs and improve equipment utilization.
- BCG's yard performance diagnosis suggests improving the yard layout to facilitate RTGC sharing and reduce TT travel.

#### 4.2.1.3 JNPCT Gate Complex

- JNPCT gate throughput is lower than average among its Indian peers and need improvement.
- JNPCT gate utilization is much lower than GTI due to longer processing time at JNPCT Gate required for CISF seal number verification.
- OCR-based gate automation can further enhance gate processing speed/accuracy and achieve manpower saving.
- Longer lead time at JNPCT for import out-gate due to EIR generation at the gate.

#### 4.2.1.4 JNPT Rail Yard

- JNPT rail performance has declined over the past years. Rail throughput has been declining despite the overall volume growth and increasing rail turnaround time especially for JNPCT and NSICT.
- About 95% of rakes are mixed contributing to significant delay in rail turnaround time.
- Improved rail handling required given the future capacity expansion and dedicated freight corridor (DFC) project.
- BCG study considered two options to improve the rail handling for JNPT Option 1- Multi-modal logistics park (MMLP) outside port to dispatch dedicated trains for all JNPT terminals and Option 2-Common rail yard within the port for three terminals & separate station for the terminals with Single operator for ICD container handling and shared yard for ICD import & export buffer.
- Based on infrastructure availability, handling cost, turnaround time and space utilization, BCG suggested Common rail yard as preferred option.

## 4.3 Capacity Assessment 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, possible handling rates, time required for peripheral activities, capacity of stackyard, number of users, grades, capacity of evacuation system etc.

### 4.3.2 Capacity of Berths

#### *4.3.2.1 General*

The capacity of existing berths is calculated assuming the 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 4.2**.

**Table 4.2 Recommended Berth Occupency**

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

The available berths and the cargo handled at each of the terminal during last year are presented in **Table 4.3**.

**Table 4.3 Container Cargo Handled at JNPT During 2013-2015 (in TEUs)**

| Container Traffic | 2013-14 | | | 2014-15 | | |
|---|---|---|---|---|---|---|
| | JNPCT | NSICT | GTIPL | JNPCT | NSICT | GTIPL |
| **Import** | 6,31,219 | 4,46,102 | 9,87,658 | 6,43,849 | 5,27,763 | 10,86,464 |
| **Export** | 6,31,384 | 5,20,816 | 8,78,133 | 6,15,413 | 6,20,885 | 9,14,625 |
| **Transhipment** | 50,112 | 2,540 | 13,737 | 34,740 | 11,571 | 11,385 |
| **Total of Terminal** | 13,12,715 | 9,69,458 | 18,79,528 | 12,94,002 | 11,60,219 | 20,12,474 |
| **JN Port Total** | **41,61,701** | | | **44,66,695** | | |

[Source: JNPT Website]

#### *4.3.2.2 JNPT Container Terminal Capacity*

Based on the above considerations of berth occupancy, capacity of different container terminals have been calculated as shown in **Table 4.4**.

The berth capacity for container terminals has been estimated based on rated equipment capacity, berth occupancy of 70% which is an acceptable internal standard, 20 hours/day operations time, 350 days of total operational days, and TEU ratio of 1.3.

The capacity estimated is the optimum capacity of the terminal based of efficient levels of operations. For GTI Terminal throughput being handled in port exceeds the estimated capacity because of higher berth occupancy (in same cases as high as 90%) which has a potential to cause high pre-berthing waiting time for ships.

**Table 4.4 Capacity Estimation for JNPT Container Terminals**

| S. No. | Particulars | JNPCT | GTICT | NSICT | NSIGT (330 m) | Shallow Berth (445 m) |
|---|---|---|---|---|---|---|
| 1. | Berth Occupancy Proposed | 70% | 70% | 70% | 70% | 70% |
| **2.** | **Annual Throughput Estimated (TEUs per annum)** | **12,22,386** | **16,38,666** | **12,04,926** | **6,84,180** | **1,88,125** |
| 3. | Container Quay Length(m) | 680 | 712 | 600 | 330 | 250 |
| 4. | Container Throughput per meter berth | 1,798 | 2,301 | 2,008 | 2,073 | 753 |
| 5.. | Total Quay Canes Provided | 9 | 10 | 8 | 4 | 3 |

# 5.0 DETAILS OF ONGOING DEVELOPMENTS

## 5.1 General

The principal traffic in JN Port as of now comprises of containers and liquid bulk. With the fast growing industrial development in the hinterland, it is the intention of the port to develop facilities for handling dry bulk, break bulk, project cargo, and automobiles for export etc. Port has taken up several steps to augment the facilities in order to meet the increasing traffic. The locations of these ongoing developments are shown in the **Figure 5.1** and details are provided in subsequent section.

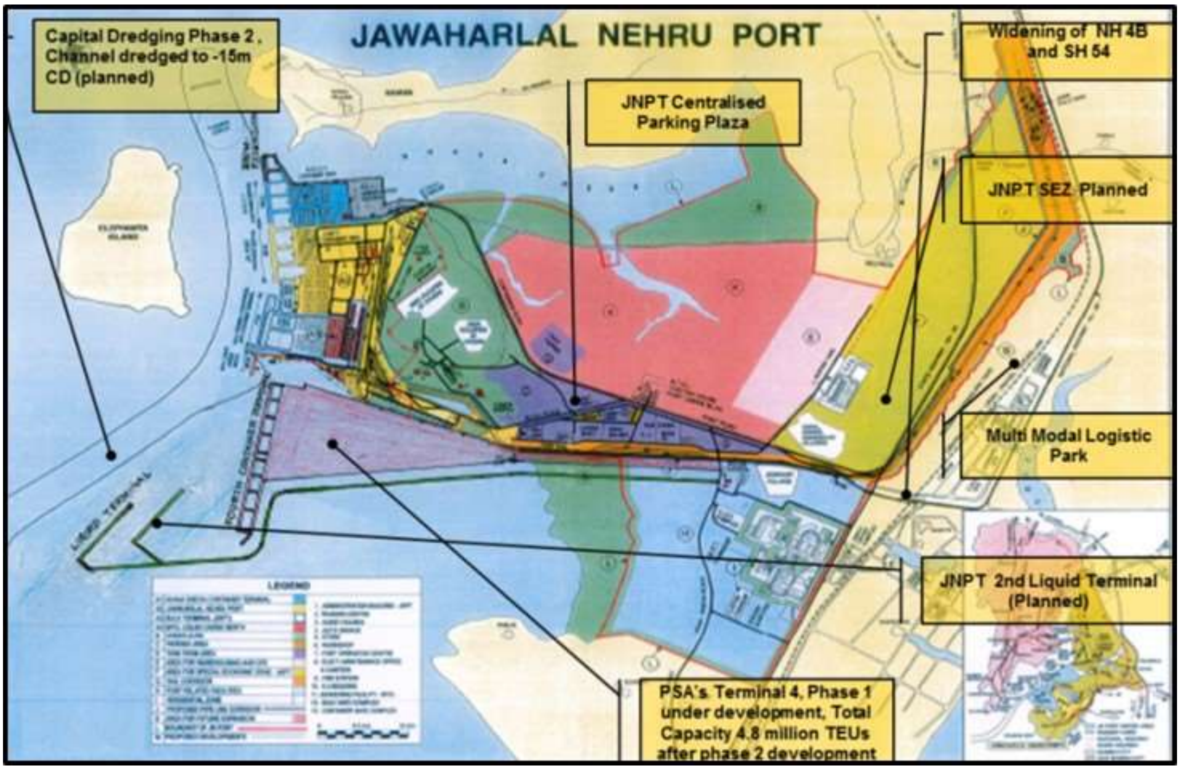



**Figure 5.1 Location of Ongoing Developments**

## 5.2 Deepening and Widening of Main Harbour Channel and JN Port Channel

The total length of the existing channel is 18.11 nautical miles (33.54 km) and it comprises five sectors named the 'Outer Sector', 'Karanja Sector', 'Uran Sector', 'S. Elephanta Sector' and the 'Elephanta Deep Sector'. The Channel is shared by the Mumbai Port Trust and the JNPT. The Channel commences at the existing west port limit of MbPT and extends up to the anchorage area north of JNPT.

Currently, the JN Port can handle container ships with draft limited to 14 m but with the need to accommodate deeper-draught Post-Panamax ships, the channel has to be deepened and extended westwards. The rocks levels in some pockets of the navigational area are at the surface or very close to the surface level. Therefore deepening of the channel and Navigational areas would involve significant quantity of rock dredging. JNPT has already prepared a detailed project report for deepening of the channel and it suggests that the dredging be carried out to handle 15 m container ships at the port. A higher draft may not be justified as the currently operating container berths are designed for a vessel draft limited to 15 m only.

## 5.3 NSIGT-DPW's 330 m Stand-alone Container Terminal

This project involves construction of a 330 m container berth, approach bridges, extension of guide bund, reclamation of 27 ha. area for container yard and installation of container handling equipment (**Figure 5.2** and **Figure 5.3**). The berth is already built and container yard development is in progress. The concession Agreement signed with Nhava Sheva (India) Gateway Terminal Pvt. Ltd., an SPV of DP World, on 19th June 2013.


**Figure 5.2 NSIGT-DPW's 330 m Container Berth, Approach Bund and Trestle**


**Figure 5.3 NSIGT-DPW's 330 m Berth Container Yard Under Dvelopment**

## 5.4 Construction of Additional Liquid Cargo Terminal

JNPT has envisaged additional 2nd liquid terminal. Feasibility studies and DPR has been completed and RFQ was invited but did not attract any bidder. Proposed JNPT 2nd Liquid Terminal Plan as shown in **Figure 5.4**.

It is understood that the currently proposed development plan is very expensive and does not commensurate with the incremental traffic. The project needs to be restructured to ensure a favourable response from the bidders.

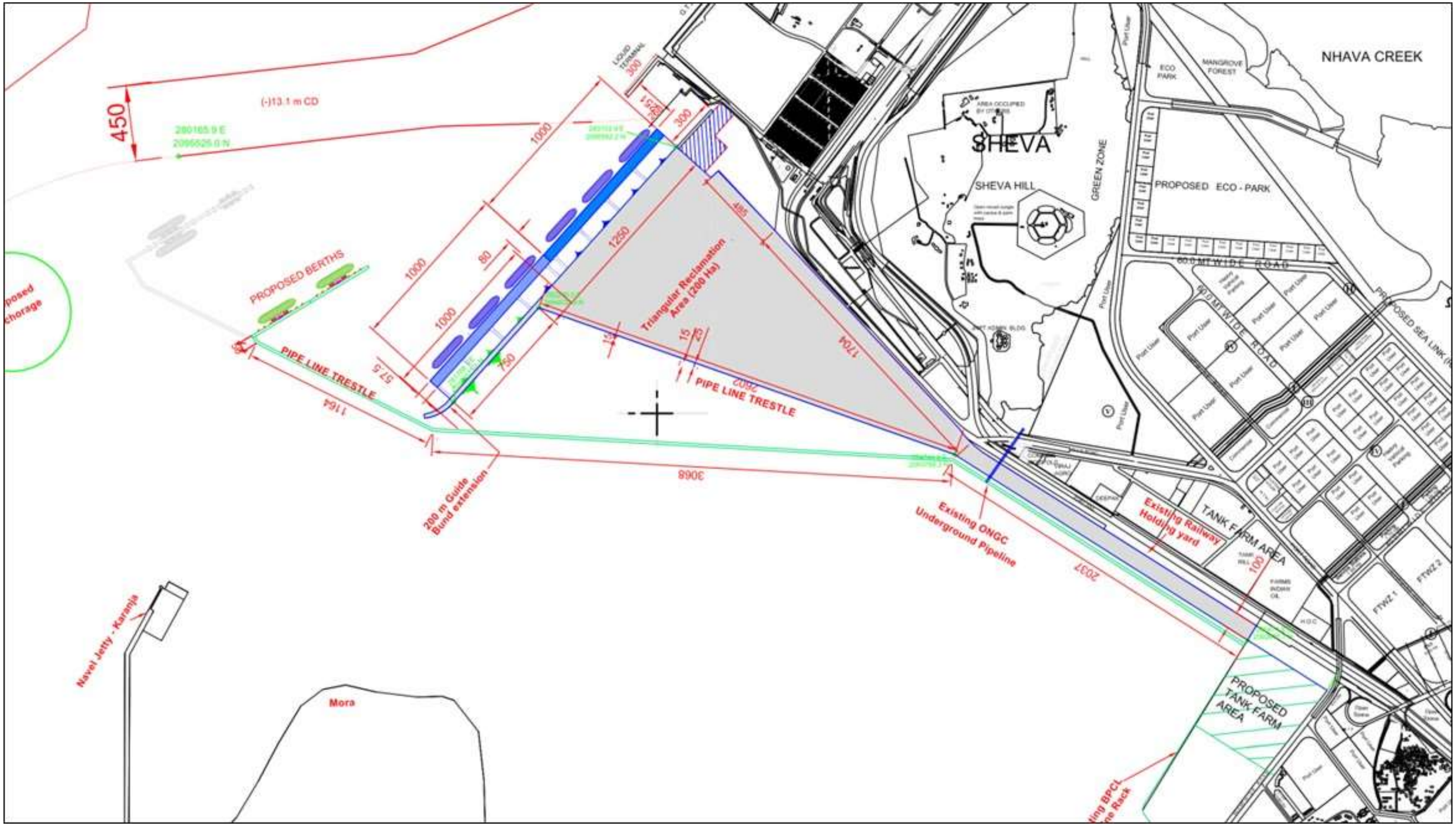



**Figure 5.4 Proposed JNPT 2nd Liquid Terminal Plan**

## 5.5 Widening of Highway Linkages to 6/8 Lanning

In order to take care of the congestion of roads, a new project has been proposed to widen 43.9 km length of NH-4B, SH-54 and Aamra Marg linkages to 6/8 lanes along with 2 lane Service Roads at an estimated cost of INR 3,220 crores, by Mumbai-JNPT Port Road Company Ltd, an SPV formed by JNPT, NHAI and CIDCO (**Figure 5.5)**.

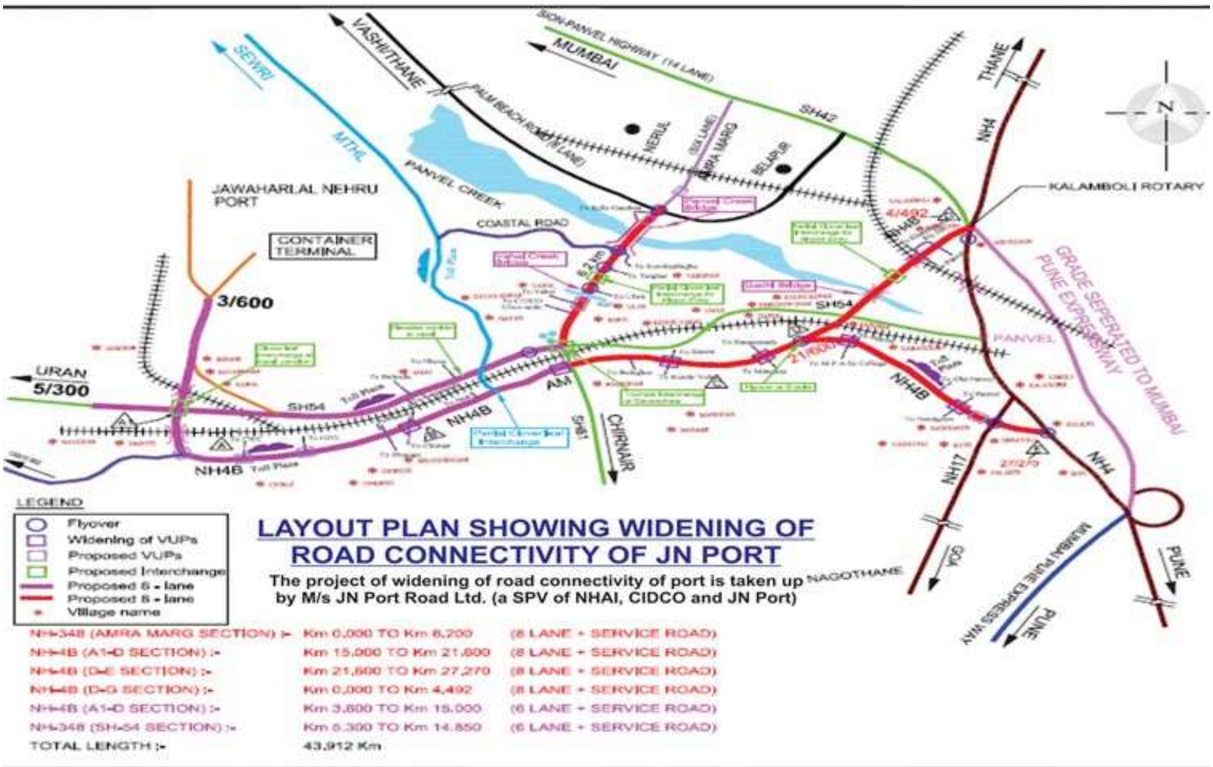



**Figure 5.5 Proposed JNPT Road Connectivity Widening**

## 5.6 Rail Connectivity Project

The Ministry of Railways has planned for Western Dedicated Freight Corridor or Western DFC to connect JN Port with the Northern hinterland, being taken up by the Dedicated Freight Corridor Corporation of India Ltd. This corridor will cover a distance of 1483 km and would be electrified with double line operation.

**Figure 5.6** shows Western DFCC alignment.

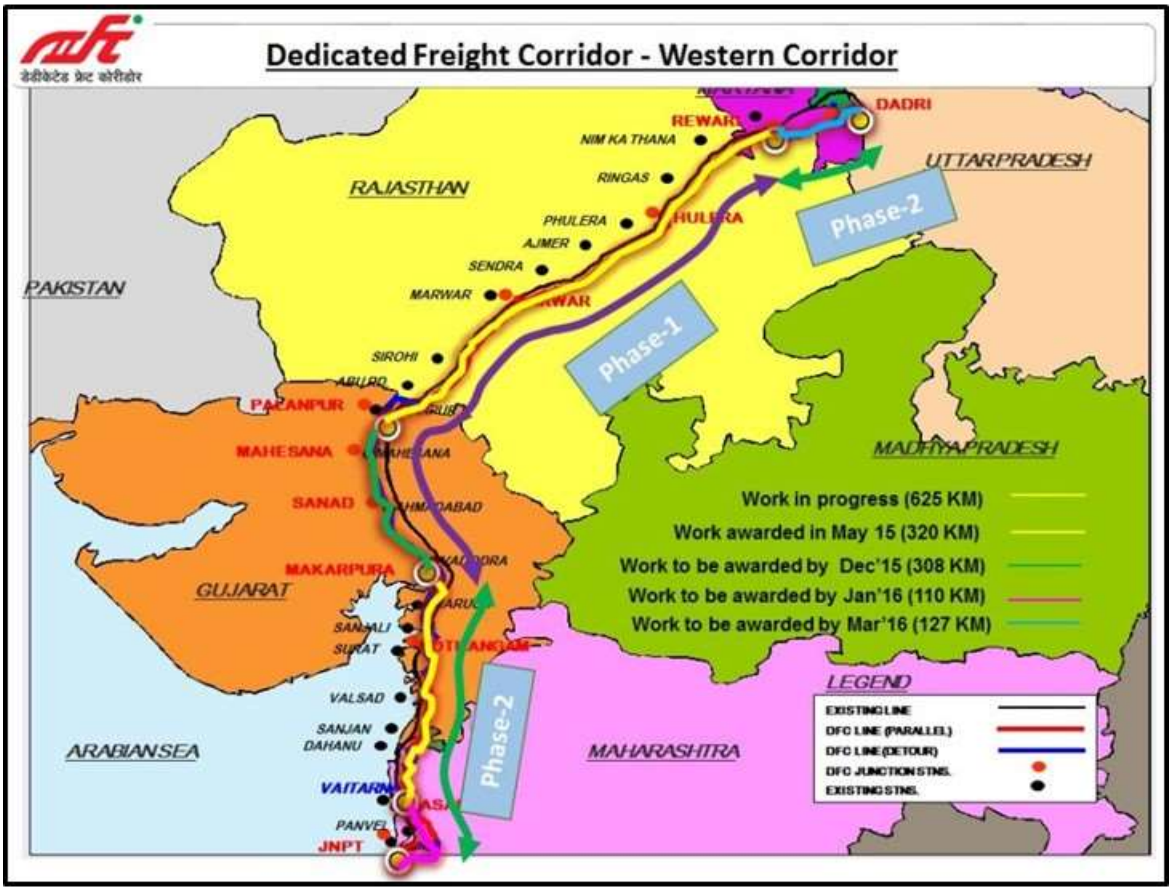



**Figure 5.6 Western DFCC Alignment**

## 5.7 Multi-Modal Logistic Park and Dry Port

JN Port had identified about 100 ha. of land near the Jasai Rail Yard (near the Port area) for developing as multi-modal logistic park and dry port (Refer **Figure 5.1)**. The logistic park was planned to have a covered warehousing, open storage, paved stacking areas, circulating areas, truck parking, repair facilities for containers, trailers/trucks and handling equipment. However, the same project has now been cancelled and instead it has been decided to develop a common rail yard inside port.

## 5.8 Centralized Parking Plaza

A centralised parking has also been foreseen for a 2000 TTs. A total of 45 ha area will be developed for this purpose in phases, where Phase 1 will cover 22 ha. The work has been awarded and is contemplated to complete soon. The proposed facility includes Dormitories for truck drivers, Auto Repairs Zone and Customs set-up for examining EXIM consignments. Refer **Figure 5.1** for location of proposed central parking plaza.

## 5.9 Development of PSA's 4th Container Terminal on DBFOT Basis

The Concession Agreement for the 4th container terminal was signed on May 6, 2014 with M/s. Bharat Mumbai Container Terminals Pvt. Ltd., an SPV of Port of Singapore Authority (PSA). The project details are given below:

- Berth Length: 2 km, Capacity: 4.8 million TEUs (60 MT).
- Area for back-up facilities: 200 ha.
- Commissioning of Phase 1: (1 km Berth) of this project having 2.4 million TEUs (30 MT) capacity will be completed by November 2017.
- The Phase 2 (1 km Berth) of the project with additional 2.4 million TEUs (30 MT) capacity will be completed by November, 2022.

## 5.10 Port Based Multi Product SEZ

It is proposed to develop port based multi-product SEZ at JNPT. The same shall be developed by an SPC (Special Purpose Company), a wholly owned subsidiary of JNPT under the engineering, procurement & construction (EPC) mode. An overall investment of about Rs. 4,000 crores is envisaged out of which JNPT will invest about Rs. 468 crores in developing infrastructure facilities at the SEZ.

# 6.0 TRAFFIC PROJECTIONS

## 6.1 General

JNPT handles containers, liquid cargo including POL, vegetable oil and chemicals and cement in dry and break bulk cargo. Out of these commodities, containers constitute ~90% of the cargo. JNPT currently has Maharashtra as its primary hinterland for containers with other hinterlands including Gujarat, NCR, Punjab, Rajasthan and UP which it shares with Gujarat ports- Mundra and Pipavav.

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 Kandla Port upto 2035 is presented in **Table 6.2**.

## 6.2 Major Commodities and their Projections

### 6.2.1 Containers

Assessment of traffic has been done based on analysis of past traffic at JNPT, interviews with Port authorities, Maharashtra Maritime Board and Maharashtra Industrial Development Corporation (MIDC) as well as several stakeholders in the shipping and user industries.

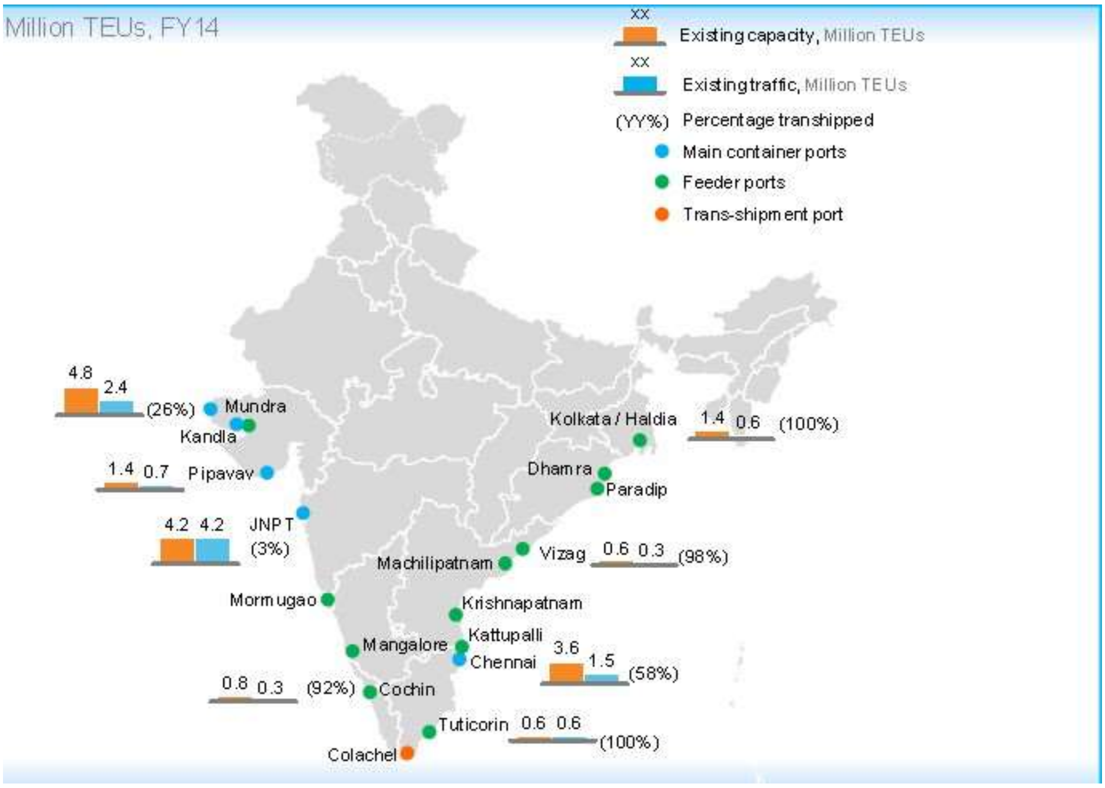



**Figure 6.1 Port wise EXIM Container Movement in India**

West coast container ports handled ~7.6 Mn TEUs out of the 10.7 Mn TEUs handled in India in FY14. In the same year, JNPT operated at ~100% capacity utilization handling 4.2 Mn TEUs.

The key hinterland of JNPT includes Maharashtra, NCR, Punjab, Uttar Pradesh, Uttaranchal, Rajasthan and Gujarat. Except for Maharashtra, which is almost solely served by JNPT, above hinterland is also served by the Gujarat Ports – mainly Mundra and Pipavav. Maharashtra (Mumbai, Pune, Nashik, Aurangabad and Nagpur) is the primary hinterland for JNPT generating ~45% of the total traffic (**Table 6.1**).

**Table 6.1 Hinterland to Port Mapping**

COMMODITY TRAFFIC CONTAINER

Maharashtra is the primary hinterland of JNPT followed by NCR, Punjab and Gujarat

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 | 468 | 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 | 89 | 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

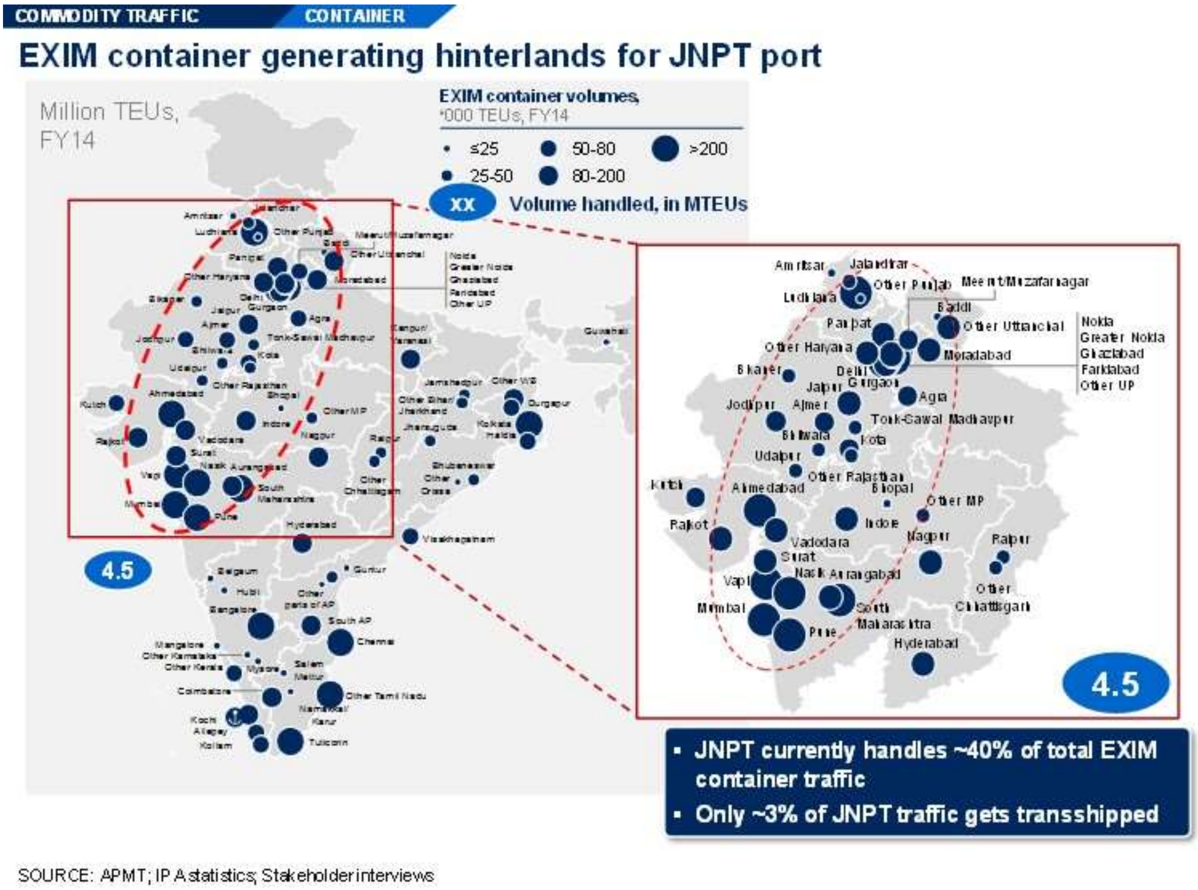



**Figure 6.2 EXIM Container Generating Hiterland for JN Port**

Container traffic from the North and North-western parts of India (including NCR, Uttar Pradesh, Haryana, Punjab and Rajasthan) has shifted to Mundra and Pipavav over the recent years. This trend is expected to continue going forward mainly because of the shorter distance by road and rail from this hinterland to Gujarat ports as compared to JNPT (e.g., avg. rail distance of NCR from/to Mundra and Pipavav is ~350 and 250 km lesser than JNPT).

A part of the reason for the shift is due to increasing congestion at JNPT. While the completion of the 4th container terminal and other expansions will ease this situation, the rail distance advantage of Gujarat Ports will still make them more competitive for North and North-western parts of India.

JNPT handled 4.2 Mn TEUs in FY14. Traffic projections for JNPT have been done considering

- Historical growth in container traffic at JNPT and other ports
- Historical trends in level of containerization in India
- Forecast for manufacturing GDP of different districts including increase in demand and manufacturing from initiatives like Delhi-Mumbai Industrial Corridor (DMIC), Visakhapatnam-Chennai Industrial Corridor (VCIC), Chennai-Bangalore Industrial Corridor (CBIC), Mumbai-Bangalore Economic Corridor (MBEC), "Make in India" campaign
- Proposed Dedicated Freight Corridor from Dadri till JNPT

Based on above, container traffic at JNPT is expected to be ~9-10 Mn TEUs by FY25 which will be about the same as the planned capacity at the port.

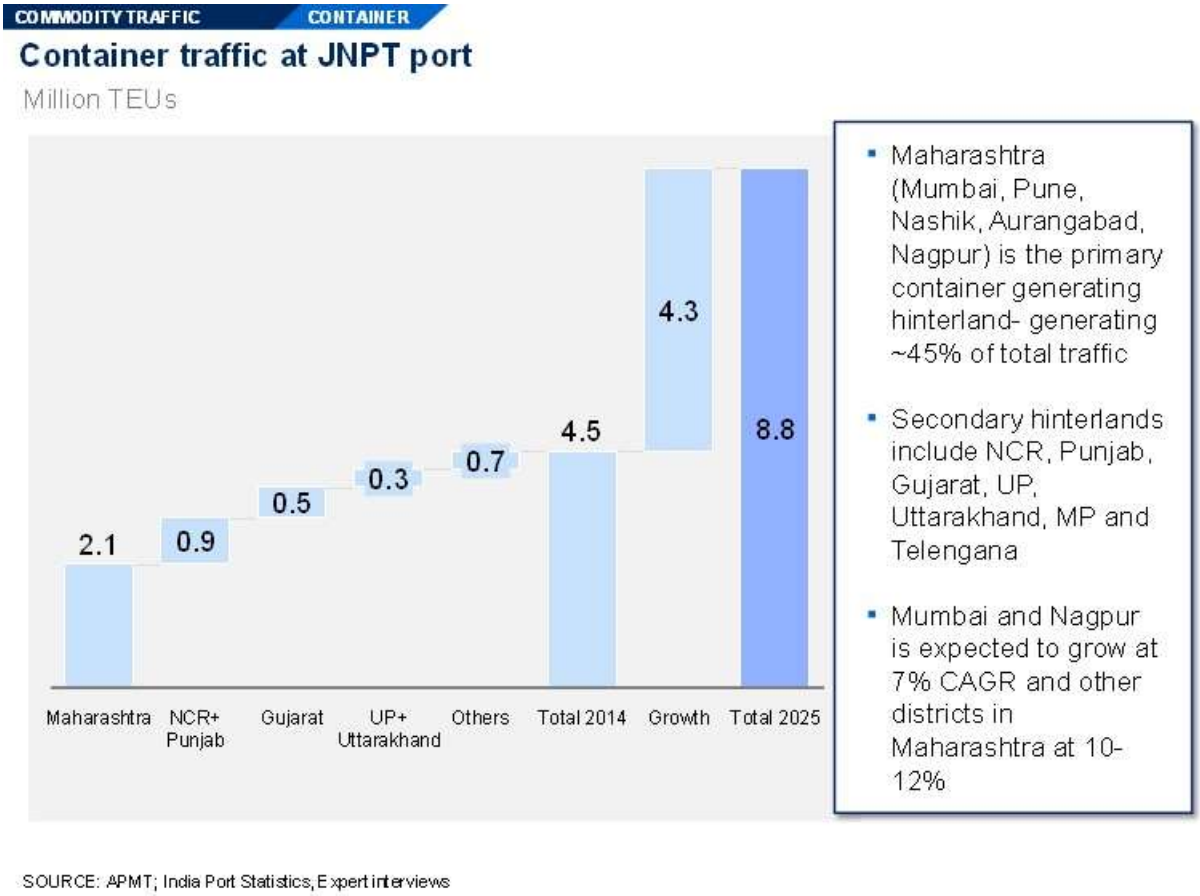



**Figure 6.3 Container Traffic at JN Port**

A summary of traffic projections for all commodities at JN Port is given in **Table 6.2**.

**Table 6.2 Traffic Projections for all Comodities at JN Port**

Units: MMTPA (except Containers)

**JNPT - Traffic Projections**

xx Base Scenario xx Optimistic Scenario

| Commodity | 2014-15 | 2020 | 2025 | | 2035 | | Remarks |
|---|---|---|---|---|---|---|---|
| | | | Base | Optimistic | Base | Optimistic | |
| **Liquid Cargo** | | | | | | | |
| POL | 4.1 | 5.5 | 7.0 | 8.1 | 9.1 | 10.3 | |
| Vegetable Oil | 1.0 | 1.3 | 1.7 | 1.8 | 2.9 | 3.3 | |
| Chemicals | 0.8 | 1.1 | 1.4 | 1.5 | 2.4 | 2.7 | |
| **Dry and Break Bulk Cargo** | | | | | | | |
| Thermal Coal (Loading) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Thermal Coal (Unloading) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Coking Coal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Iron Ore | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Cement | 0.7 | 0.9 | 1.2 | 1.3 | 2.0 | 2.3 | |
| Fertilizers | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| **Containers and other Cargo** | | | | | | | |
| Containers (Mn TEU) | 4.5 | 6.8 | 8.8 | 10.2 | 14.6 | 18.3 | |
| Others | 0.2 | 0.3 | 0.4 | 0.4 | 0.6 | 0.7 | |
| **Total (MMTPA)** | **64.4** | **96.1** | **124.5** | **143.9** | **203.9** | **253.5** | |

Conversion Factor Used for Containers Projections: 1 TEU = 12.8 Tons

## 6.3 Coastal Shipping Potential

Apart from the above mentioned traffic, there is additional opportunity of coastal shipping of cement that can be potentially tapped. There is a potential to coastally ship ~5 MTPA of cement from Andhra Pradesh to Maharashtra via JN Port by 2025. This is contingent on the development of central AP port which will serve as the origin port for this movement (**Figure 6.4**).

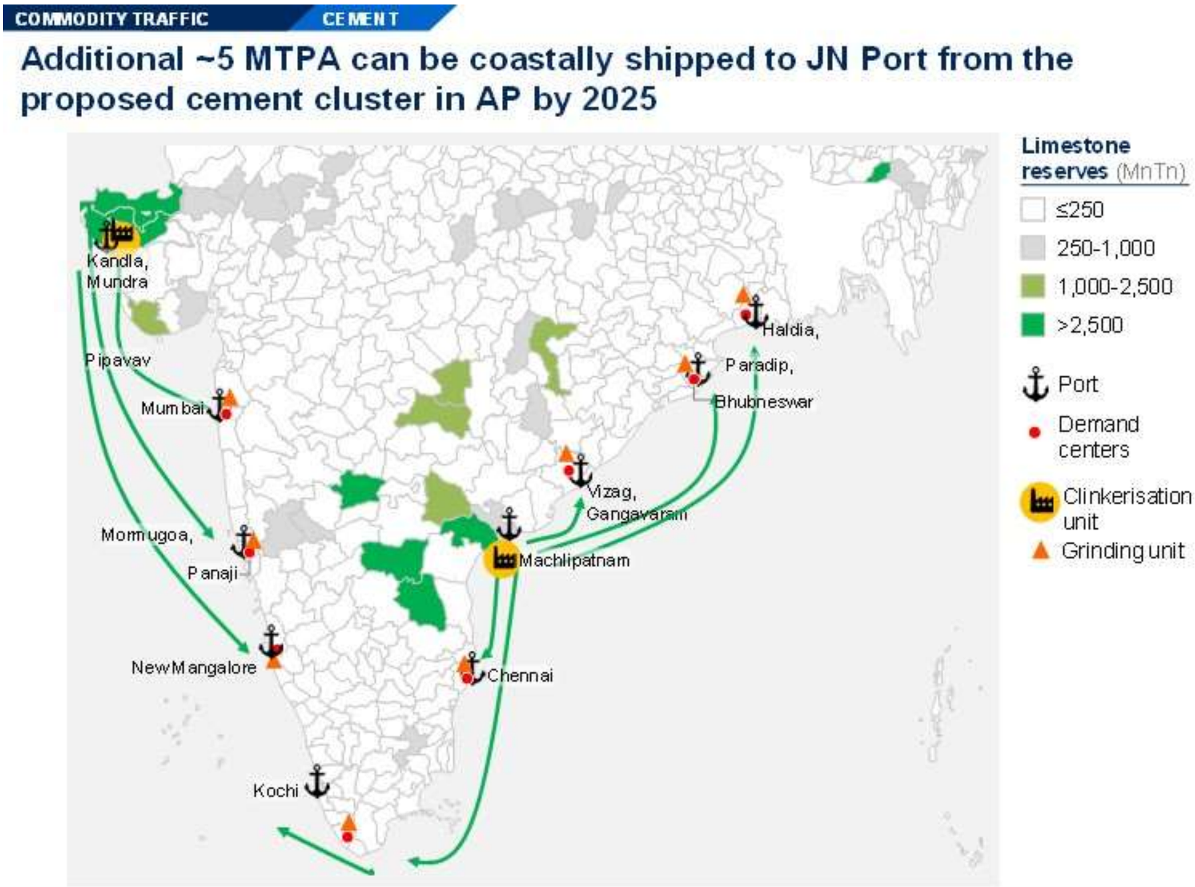



**Figure 6.4 Coastal Shipping Potential of Cement**

# 7.0 OPERATIONAL IMPROVEMENTS AND CAPACITY AUGMENTATION OF EXISTING FACILITIES

## 7.1 Introduction

As per the traffic projections significant cargo throughput is expected at JN Port, particularly in containers. While port has already taken action to increase the cargo handling capacity, it also needs that the current facilities operate efficiently and there should not be operational bottlenecks which would result in users drifting away from the port. The present section deals with these issues and possible remedial measures.

## 7.2 Operational Improvements

### 7.2.1 Entry Exit Gates and Approach Road Congestion

As could be seen from the **Figure 7.1** below that at the entry exist gates of NSICT and JNPCT there has been a huge congestion in front of the entry & exit traffic of both these gates which results in delays and is also an operational hazard particularly inside the gates. This is mainly due to the operational reasons in the gate processing system. At some instances, it has been observed that due to very high incoming traffic exit lanes are narrowed down to barely 2 lanes in front of the exit gates.


**Figure 7.1 Entry and Exit Gates of NSICT and JNPCT**

The situation is likely to worsen once the standalone 330 m long container terminal (NSIGT) becomes operational as their entry-exit gates are planned to be constructed further towards north of the existing NSICT Exit Gate. It would create three sets of interacting traffic at the Y junction. Presently, JNPT has undertaken a project of widening the road from Y-Junction to the Terminal Gates by adding another 30 m width for the new terminal.

The following two options are proposed to streamline the entry exist of the vehicles to these terminals.

**Option 1** : Restructuring of the entry and exit gates of the three terminals so that all the entry gates are shifted towards south and all the exit gates are shifted towards north. This option is presented in **Figure 7.2**. This option shall create most logical traffic movement for 3 terminals at gate. However, it will require the terminal operators to exchange their present gates. This may be a difficult arrangment for operators as it is observed that the existing facilities and gate process are not exactly same between JNPCT & NSICT.

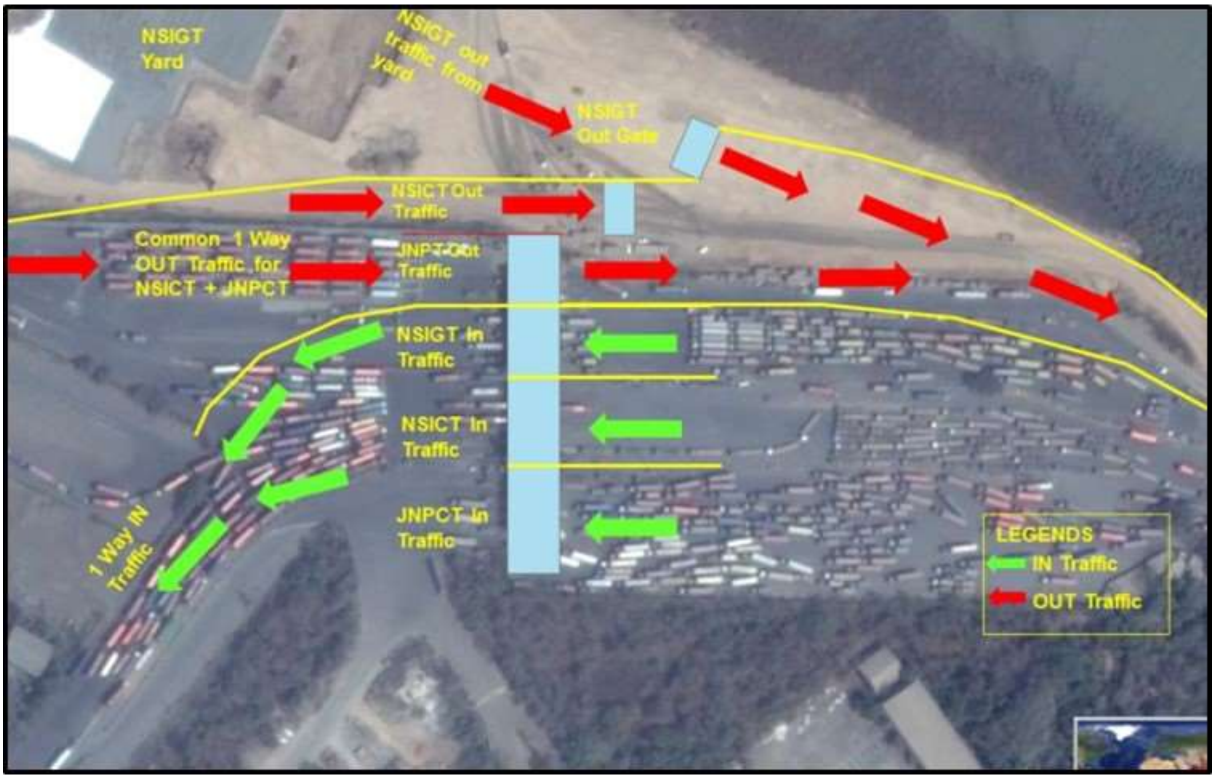



**Figure 7.2** **Proposed JNPT Entry-Exit Gate Restructuring**

**Option 2 :** A segregator flyover on the approach road to the gates shall separate the approaching traffic from Y junction to the three terminals in separate lanes divided by permanent medians on the way. This is presented in **Figure 7.3**. Road from the flyover till the gates shall be 3 separate parallel roads each having it's own space for 2 way traffic movement.

**Figure 7.3 Flyover Segregating Entry & Exit Traffic to & from Port**

**Table 7.1 Comparative Analysis of Option 1 and Option 2 to Resolve Entry-Exit Road Criss Crossing**

| Parameters | Option 1 | Option 2 |
|---|---|---|
| | **Gate Restructuring** | **Segregator Flyover** |
| **Capital Investment** | Low | High |
| **Ease of Implementation** | Moderate. Will need other terminal operators consensus | Moderate. Careful traffic planning and controlling needs to be done during construction. |
| **Effects on Existing Operations** | Will also solve intersecting traffic situations within the yard. This will facilitate traffic movement to Common ICD from all the terminals, JNPCT's Gate can be modernised while implementing the gate restructuring | Will not change existing situation within the yard |
| **Long Term Flexibility in Planning** | Since less civil infrastructure is to be created, less land is used which can provide flexibility in development | Construction of flyover will occupy existing road. Will not offer any flexibility in future |

In view of the difficulties for gate exchange due to different infrastructure available in different gates and their management system implemented, it is decided to go for the segregator flyover option.

### 7.2.2 Traffic Flow Improvement at Y-Junction

The major problem at the Y-Junction is the interfacing of the traffic to-n-from the South & Central Gates (mainly catering to GTI Terminal) and North Gates (catering to JNPCT, NSICT & upcoming NSIGT) at the same grade. This crossing exists without any traffic control. At the very intersection there is a fuel pump located. This also adds to the traffic chaos.

To solve these issues the following measures are proposed:

a. The Fuel Pump at the crossing has to be relocated. Presently, JNPT is in the process of developing the empty land at Y-junction behind this Fuel Pump as a parking space for the incoming traffic. The fuel pump may be relocated within this developed land, somewhere inside so that the traffic leading to/coming out of the pump may not hinder the traffic flow of the main roads.
b. Of all the traffic movement possible at the Y-junction which creates the traffic interface, it is seen that the major interface is between the outbound traffic from South & Central Gate and inbound traffic to North Gate. To avoid this intersection, a flyover for the outbound traffic from South & Central Gates is proposed.

The alternatives 1 and 2 for the flyover are shown in **Figure 7.4** and **Figure 7.5** respectively.

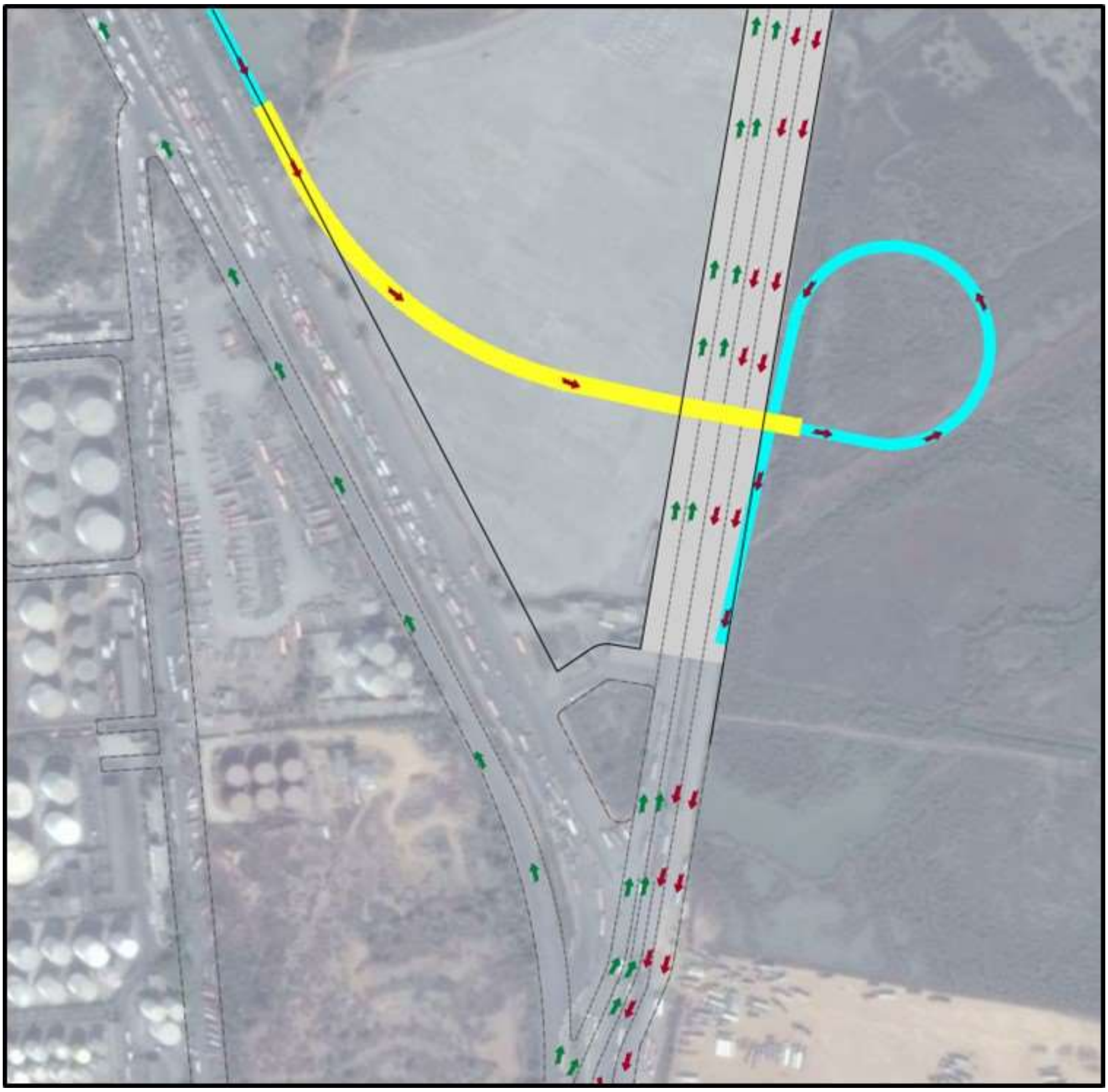


**Figure 7.4 Alternative 1 - Proposed Flyover at Y Junction to Streamline Traffic**

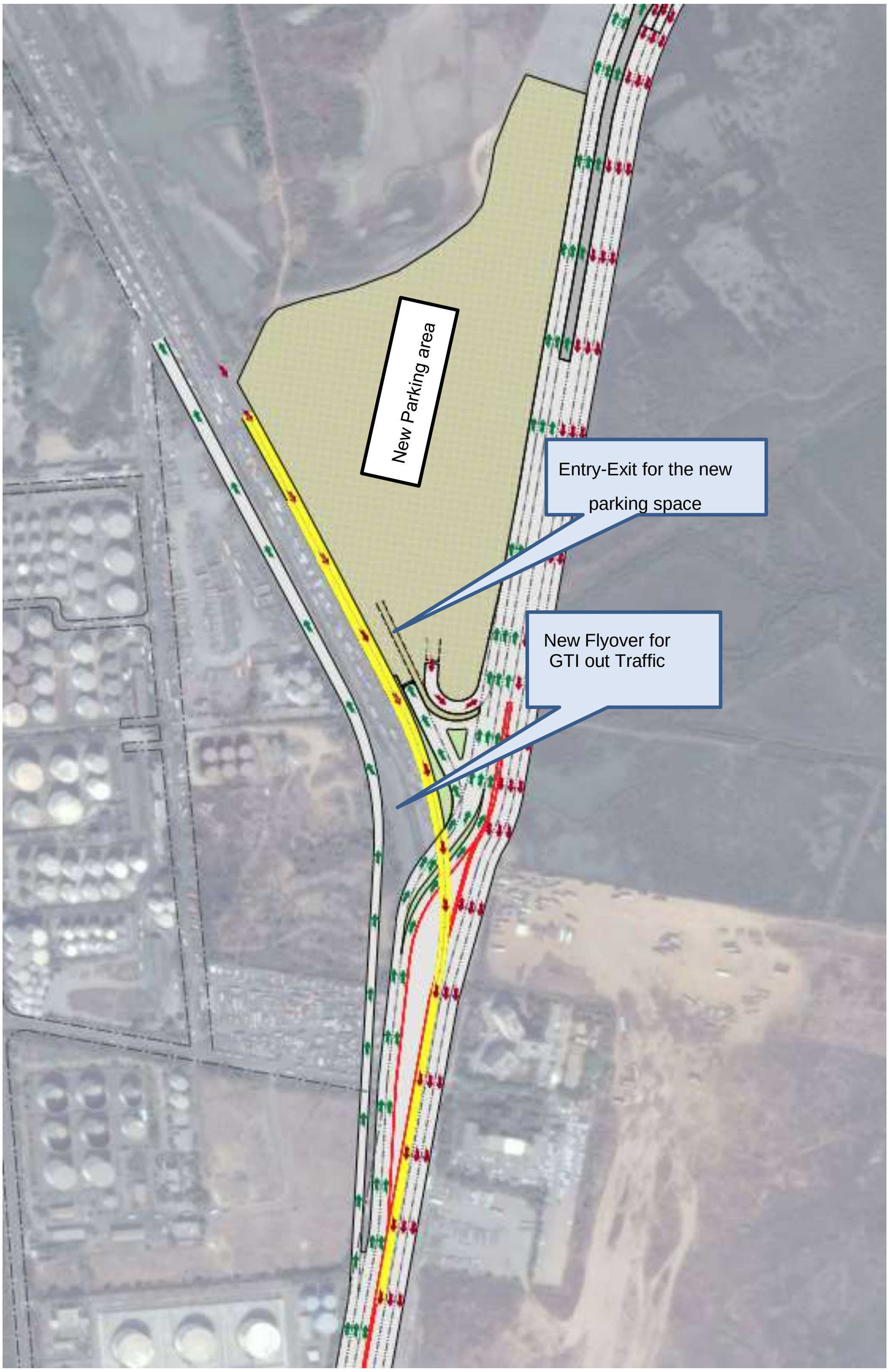



**Figure 7.5 Alternative 2 - Proposed Flyover at Y Junction to Streamline Traffic**

**Table 7.2 Comparative Analysis of Alternative 1 and Alternative 2 of Flyover at Y-Junction**

| Parameters | Alternative 1 | Alternative 2 |
|---|---|---|
| | **Flyover with loop over Inter-tidal zone** | **Skewed Flyover aligned to existing road** |
| Environmental Effect | Loop over inter-tidal zone would require separate environmental clearance. | The proposed flyover shall be on the existing road space. Diverted roads shall take up existing parking spaces/developed lands. Hence, special environmental clearance may not be required. |
| Effect on the parking space planned | It is possible to plan the entry-exit in the way to serve all 4 terminals (GTI, JNPCT, NSICT & NSIGT) | Exit towards GTI Terminal is restricted |
| Traffic Movement from North Gate to Central Gate | Possible to have an escape lane remaining at the grade level for very minor traffic from North Gate to Central & South Gate | This traffic have to go back all the way to Karal junction to avail the proposed clover loop flyover to take U turn and come back to go towards central & south gate. |
| Future Scalability | Since the actual flyover shall be away from the junction and the total obligatory spans shall be all across the parking area planned, the road below can be easily diverted/widened in future | The flyover shall restrict the road space towards median of the outgoing traffic. Any future widening has to be done on the other side (towards Customs Building) only. Similarly the obligatory spans shall be across the road space planned below. Future widening of inward traffic lane towards north gate may not be possible. |

Details of the flyover, including preferred option, shall have to be worked out in the detailed design phase.

### 7.2.3 Entry-Exit Flyover to GTI Terminal

The common rail yard will handle to about 9 DFCC trains per day on an average. To avoid rail crossing at grade level a flyover is proposed which will start after the GTI entry gate till GTI yard. As shown in **Figure 7.6**. This would also affect the central gate as the same is coming within the approach of the flyover. The gate shall require to be shifted further towards the Y-junction.


**Figure 7.6 Proposed Flyovers for GTI Entry/Exit Traffic Over DFCC Rail Tracks**

## 7.2.4 JNPT Yard Restructuring

The existing yard area of JN Port is discontinuous as shown in **Figure 7.7**. It is proposed that JNPCT's import-export yards are made continuous, which will lead to better RTG utilisation and provide better operational arrangement.

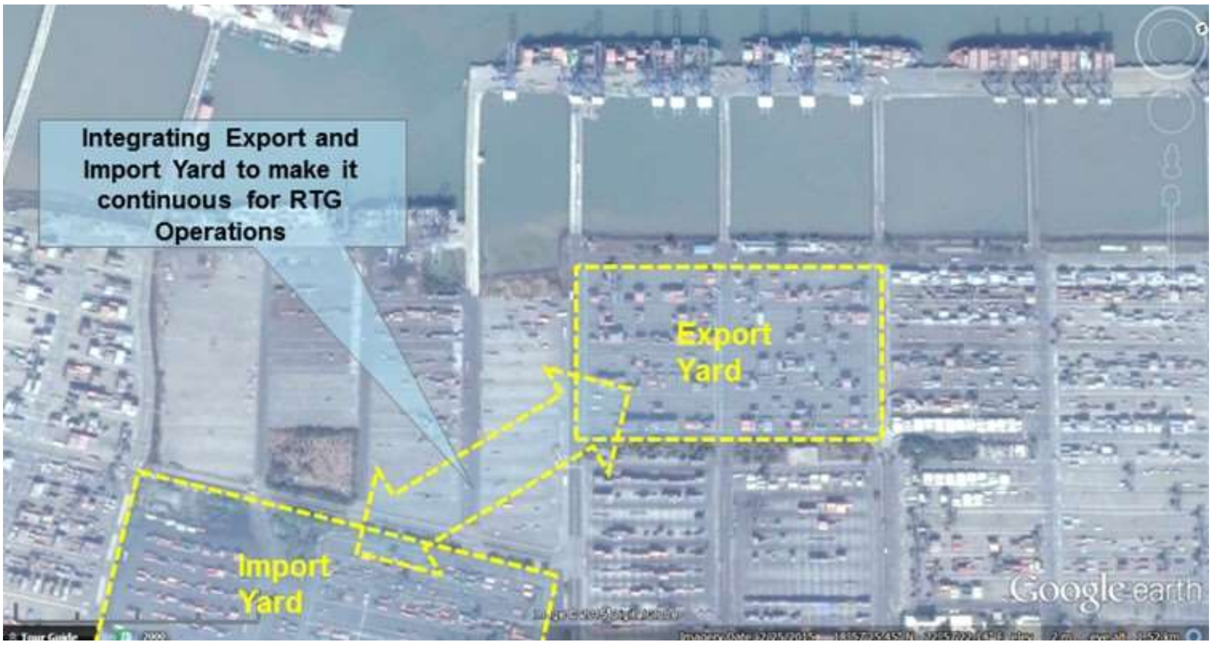



**Figure 7.7 JNPCT's Existing Import-Export Yards**


**Figure 7.8 JNPT Yard Restructuring**

The restructuring of the yard would allow optimum utilization of space and equipment and also free up space to develop roads of adequate width for proper circulation of traffic of all terminals to common rail yard.

Based on the current throughput to be handled at the JNPCT, it is assessed that only about 6,500 ground slots are adequate. However, provision of total 9,186 grounds slots is made to cater the increase in traffic in future. With proper arrangement for effective handling by RTGs lesser area would be needed to provide the required ground slots.  This releases lot of space that could be utilised for the widening of internal roads and allow space for movement of vehicles between other terminals and common rail yard.

### 7.2.5 Common Rail Yard

#### *7.2.5.1 Purpose*

It is proposed to provide a common rail yard for the existing four container terminals at JNPT namely GTI, NSICT, NSIGT and Port's own JNPCT terminal. The 4th container terminal under construction shall have its own independent ICD yard.

The basic purpose of this yard is to:

- Aggregate the containers from different terminals at one location to ensure faster turnaround time of rakes.
- To allow handling of DFCC rakes which are double the length of current rakes

The location and layout of the existing yards and the proposed new yard is shown in **Figure 7.7**.

The common rail terminal shall have the following components:

1. In rail yard there shall be sidings for receipt/dispatch of DFCC rakes, assumed to be of 1400 m length.
2. Roads for movement of ITVs in the yard area and rail yard
3. Stacking space adjacent to rail yard
4. RTGs at the Yards area
5. RMGCs at rail yard
6. Terminal Buildings in the spare area in JNPT outside the rail yard
7. ITVs, other equipment, utilities

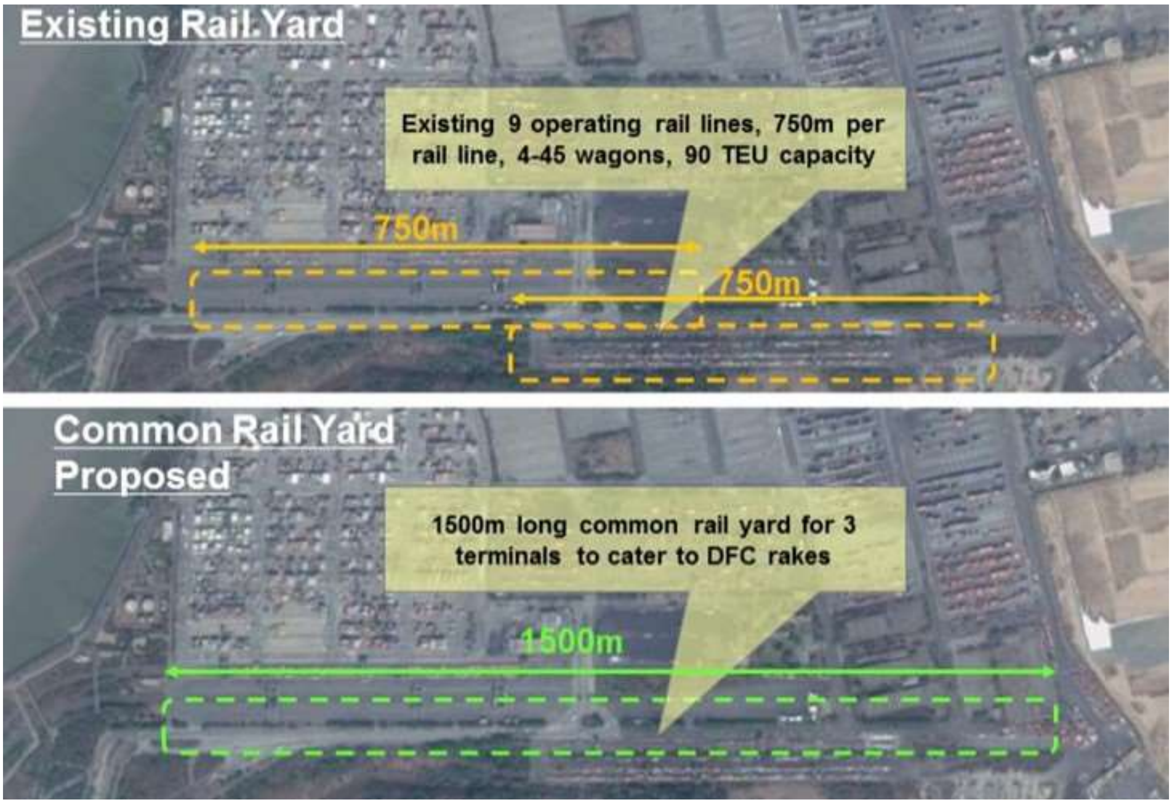



**Figure 7.9 Existing and Proposed JNPT Rail Yard Plan**

#### *7.2.5.2 Facility Requirements*

For arriving at the facility requirements at the rail terminal following assumptions have been made:

- The capacity of the existing terminals is taken as about 5.00 MTEUs per annum
- Maximum 5 high container stacking is assumed
- Dwell time of containers in the yard is taken as 2 days
- Total time for loading and unloading of each DFCC rake is limited to 8 hours

The facility requirements for the common rail terminal are worked out in **Table 7.3**.

**Table 7.3 Facility Requirement for Common Rail Terminal**

| S. No. | Description | Proportion to be moved by Rail | | |
|---|---|---|---|---|
| | | 20% | 30% | 40% |
| 1. | Total Ground Slots at the Common Rail Yard | 1,553 | 2,330 | 3,107 |
| 2. | Number of Rail Sidings Required | 3 | 5 | 7 |
| 3. | Number of RTGs Required | 16 | 24 | 32 |
| 4. | Total number of RMGCs Required | 9 | 13 | 18 |
| 5. | Total Number of ITVs Required | 71 | 105 | 143 |

It may be noted that the ground slot requirements for the common yard could be reduced by lowering the dwell time meaning the containers are transferred from this yard to the respective yards immediately on receipt or vice versa the containers are brought to this common yard just before their despatch by rakes.

### *7.2.5.3 Location and Layout*

The common rail yard shall be located south of the existing road outside the JNPT's terminal. The overall yard length is kept as 1500 m and width as 250 m. This would enable handling of DFCC Compliant rakes at this yard. There shall be changeover points at the mid-length of the track to handle two non-DFCC compliant rakes at the same time.

The stacking areas are proposed adjacent to rail sidings with Nested RMGCs and RTGs. The storage area in this yard shall be utilised for aggregation and separation of ICD traffic. In the proposed arrangement about 2,856 Ground Slots are available for stacking. The overall layout of common rail yard is shown in **Figure 7.10**.

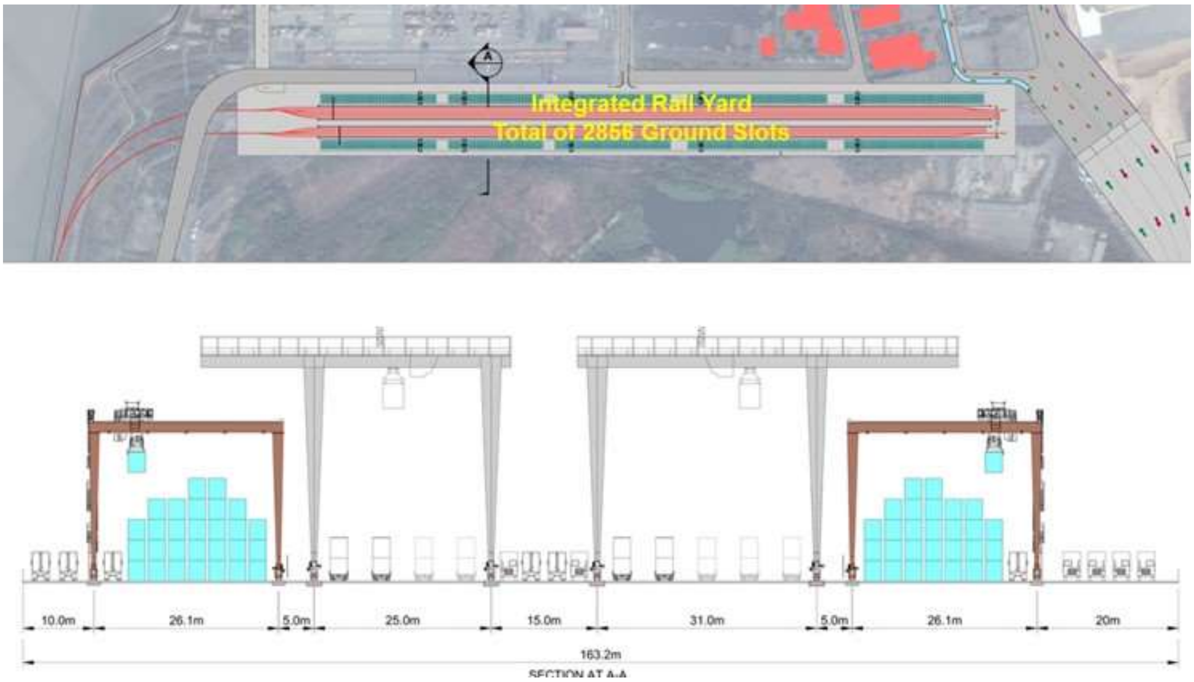



**Figure 7.10 Concept Plan of Integrated Common Rail Yard**

### 7.2.6 Traffic Circulation Plan at the Container Terminals

Major changes in the existing layout for the smooth flow of traffic at the container terminal are envisaged as below:

- A flyover is proposed for entry of external TTs to JNPCT yard to reduce criss-crossing observed at various locations.
- New 20 m wide road is proposed for movement of ITVs from terminal to Common rail yard simultaneously facilitating the inter terminal movement between GTI terminal to NSIGT/ NSICT terminal
- Existing Road as shown in the **Figure 7.11** has been widened to minimum 60m width.


**Figure 7.11 Major Changes in the Existing Layout for the Smooth Flow of Traffic at the Container Terminal**

#### 7.2.6.1 Movement of ITVs and External TTs from NSICT

The movement of ITVs from the NSICT terminal to common rail yard shall follow the designated path as shown in the **Figure 7.12**. There shall be a separate entry and exit for the movement of external TTS and ITVs in order to avoid criss-crossing.

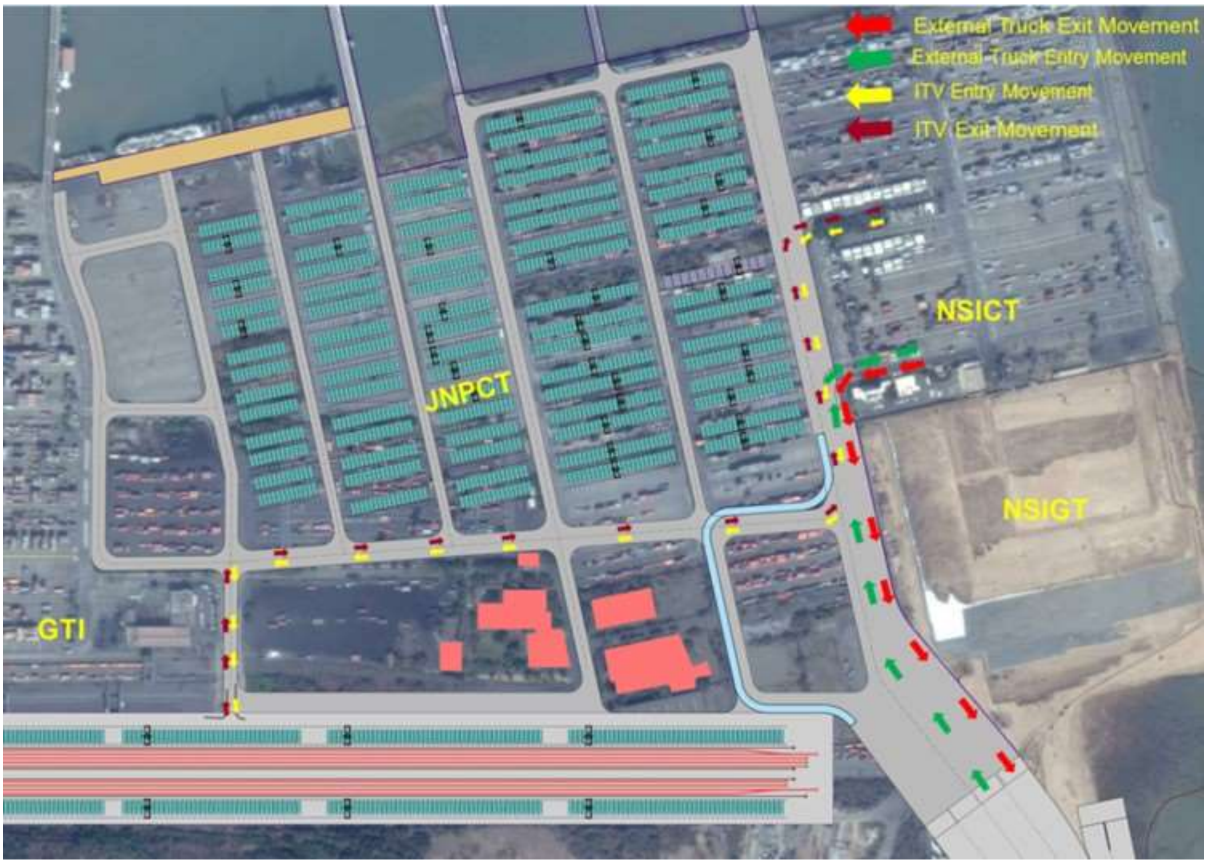



**Figure 7.12 Traffic Circulation Plan for NSICT Terminal**

#### 7.2.6.2 Movement of ITVs and External TTs from NSIGT

The movement of ITVs from the NSIGT terminal to common rail yard shall follow the same path as designated for the NSICT terminal to common railyard however the ITVs shall pass through NSICT terminal as shown in the **Figure 7.13**. The external TTs shall also follow the designated path.

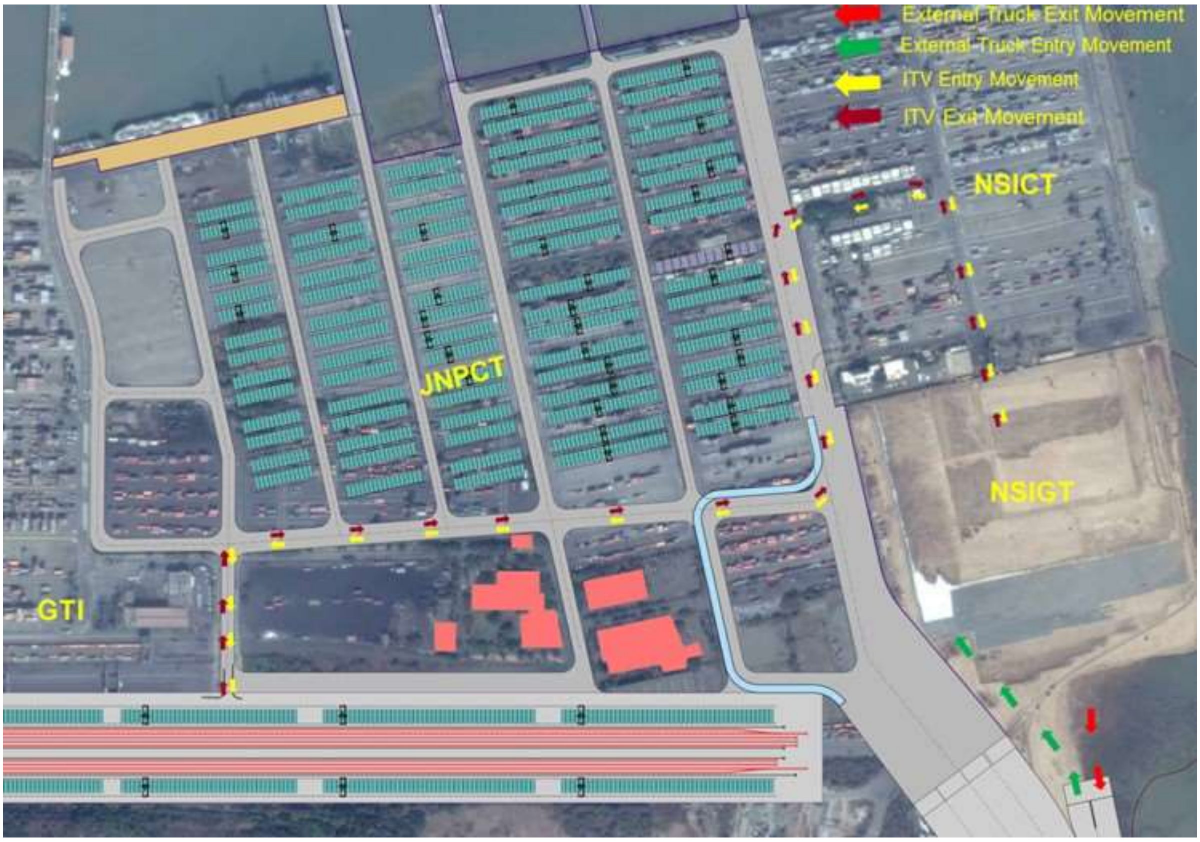



**Figure 7.13 Traffic Circulation Plan for NSIGT Terminal**

#### *7.2.6.3 Movement of ITVs and External TTs from JNPCT*

The movement of the ITVs from the JNPCT terminal to common rail yard shall be as per the designated path shown in the **Figure 7.14**. However for the entry of external TTs to JNPCT a flyover is proposed. This flyover allows the external trucks to enter JNPCT terminal without any criss-crossing while the exit will remain from the bottom of the proposed flyover.


**Figure 7.14 Traffic Circulation Plan for JNPCT**

### *7.2.6.4 Movement of ITVs and External TTs from GTICT*

GTICT has a separate entry and exit and shall use the flyover proposed for the to and fro movement of the external TTs. For the movement of the ITVs from GTI terminal to common rail yard the designated path shall be as shown in the **Figure 7.15**.


**Figure 7.15 Traffic Circulation Plan for GTI**

### *7.2.6.5 Movement of ITVs in the Common Rail Yard*

One way circulation movement is proposed for the ITVs in the common rail yard as shown in the **Figure 7.16**.

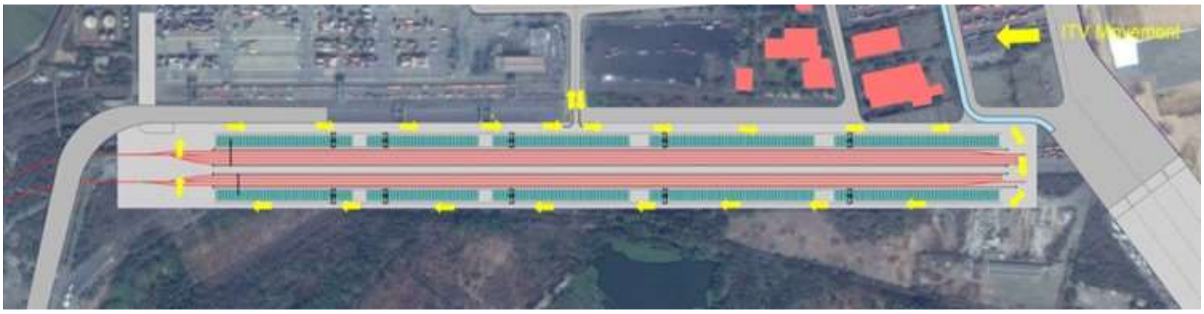



**Figure 7.16 Traffic Circulation Plan for the Common Rail Yard**

# 7.3 Capacity Augmentation

## 7.3.1 Liquid Cargo Handling Facility

### *7.3.1.1 Constraints*

The existing liquid terminal faces the following constraints:

- Berth occupancy is very high at over 80% and as a result average waiting time for a vessel is around 5-6 days. Waiting period attributed due to port is 2-3 days and due to other factors in 3-5 days.
- When LPG vessel is berthed on the front side and during that time Crude/POL vessel cannot be handled at the other side but chemicals and edible oil tankers can be handled.
- Edible oil cargo volumes are showing increasing trend but due to their low parcel size and lower pumping rates they occupy the berth for significant time.

While JN Port has plans to build the second liquid terminal, it is likely to take time before it gets commissioned. It is therefore required to assess the possible schemes by way of which the waiting time of the liquid ships could be reduced and berth capacity increased.

### *7.3.1.2 Analysis of Data*

The analysis of liquid terminal data is presented in **Table 7.4**.

**Table 7.4 Analysis of JNPT's Liquid Terminal Cargo Handling**

| Ship Type vs. Calls Estimated | | | Cargo Transfer Rate (T / Hr) | Average Parcel Size (T) | Total Cargo (April14-March15) |
|---|---|---|---|---|---|
| 1. | Crude Oil | 22 | 2,167 | 54,912 | 12,08,063 |
| 2. | LPG | 52 | 321 | 11,591 | 6,02,706 |
| 3. | POL | 46 | 536 | 24,585 | 11,30,903 |
| 4. | Edible Oil | 113 | 341 | 11,285 | 12,75,202 |
| 5. | Chemicals | 121 | 260 | 5,394 | 6,52,620 |
| **Total Ship Calls** | | **354** | | **Total Cargo** | **48,69,495** |

*(Liquid Terminal Raw data Source JNPT)*

In order to arrive at the possible solutions the berth capacity has been assessed for the following 5 scenarios:

1. Base case scenario where berth handles all cargo
2. Berth to handle only LPG, Crude and POL
3. Berth to handle only crude and POL
4. A new berth for handling smaller tankers of Chemical and Edible oil
5. Existing berth to be augmented with an additional berth

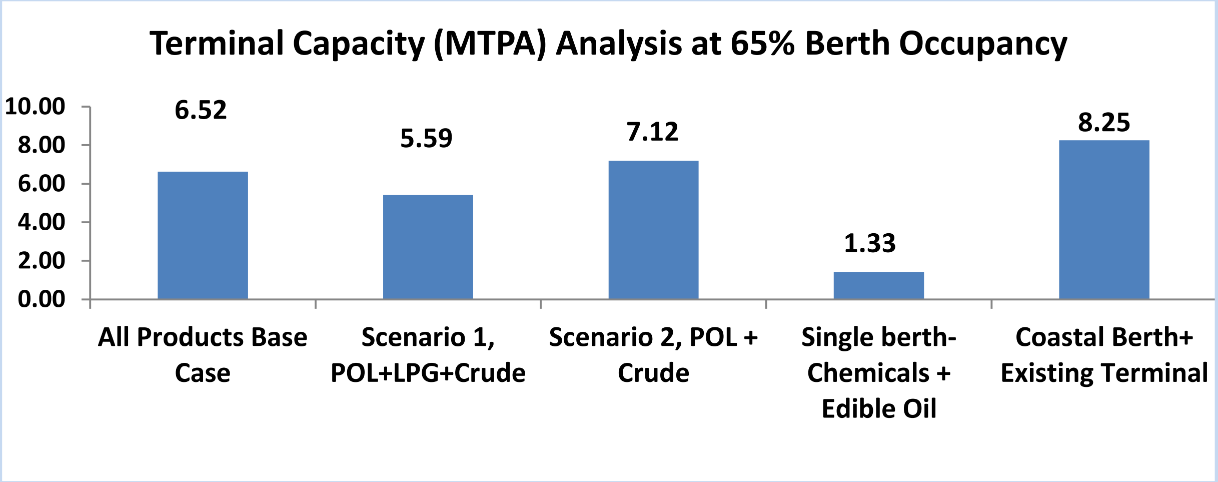



**Figure 7.17 JNPT Liquid Terminal Options Capacity Analysis**

The capacity for all the scenarios considered has been worked out and shown in **Figure 7.17**. It could be seen that in case an additional berth for small tankers could be made available, the total liquid handling capacity would go up to **8.25 MTPA** at optimal berth occupancy.

#### ***7.3.1.3 Possible Options to Expand Handling Facilities for Liquid Cargo***

Following possible options have been considered:

- Extension of the Existing Liquid Jetty
- Utilisation of Coastal berth (under planning stage) for small tankers

These options are presented in **Figure 7.18** to **Figure 7.20**.

The extension of existing jetty would require consultation with PSA but it can offer most optimal solution by way of which significant additional liquid handling capacity would be available.

Utilisation of the coastal berth also would enhance the total capacity to **8.25 MTPA** and the only investment needed would be for laying the pipeline and providing marine hoses at berth and their connection to the existing pipelines passing nearby at a distance of about 300 m only.

#### 7.3.1.4 Extension of Existing Liquid Terminal - Alternative 1

Existing liquid jetty can be extended by 300 m to create one side berthing facility for two small tankers as shown in **Figure 7.18**.

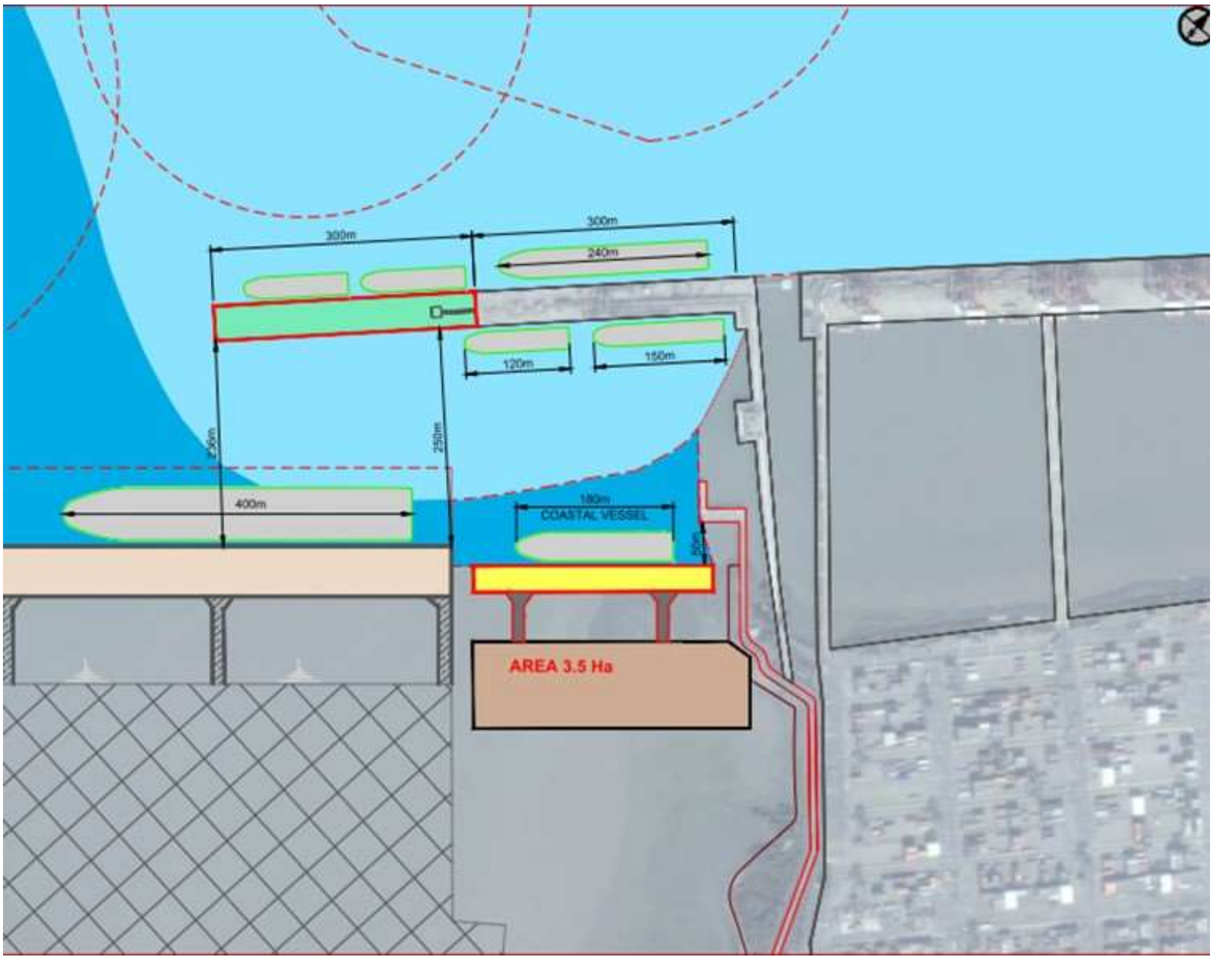



**Figure 7.18 JNPT Liquid Terminal with 300 m Extension**

#### *7.3.1.5 Extension of Existing Liquid Terminal and /or Coastal Berth - Alternative 2*

Existing liquid jetty can be extended by 150 m and one mooring dolphin to accommodate one small tanker on the additional berthing facility as shown in **Figure 7.19**.

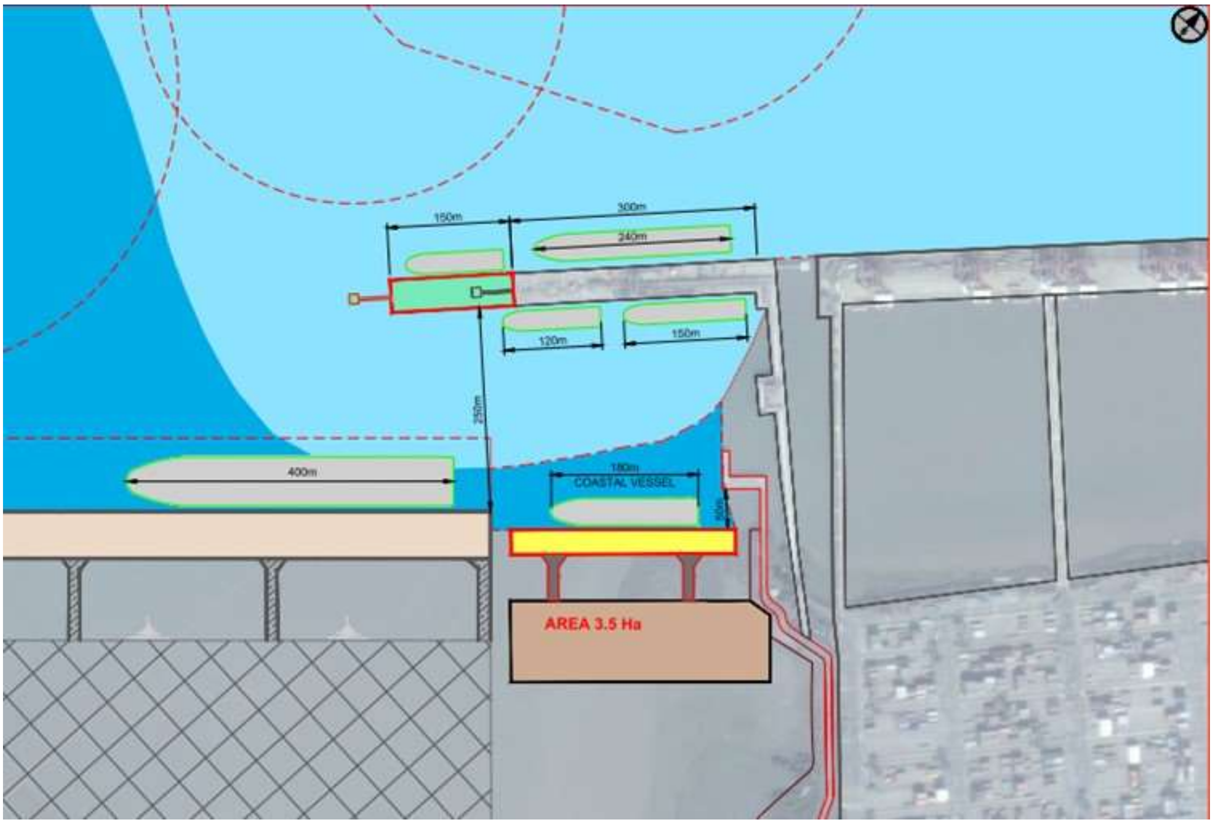



**Figure 7.19 JNPT Liquid Terminal with 150 m Extension and Mooring Dolphin**

### 7.3.1.6 Existing Liquid Terminal and /or Coastal Berth - Alternative 3

Existing liquid terminal facility can continue as it is with 300 m quay length added as a coastal terminal along the reclaimed land as shown in **Figure 7.20**. As per the capacity calculation standalone coastal berth for Edible oil and Chemicals will be able to handle about 1.3 MTPA cargoes.

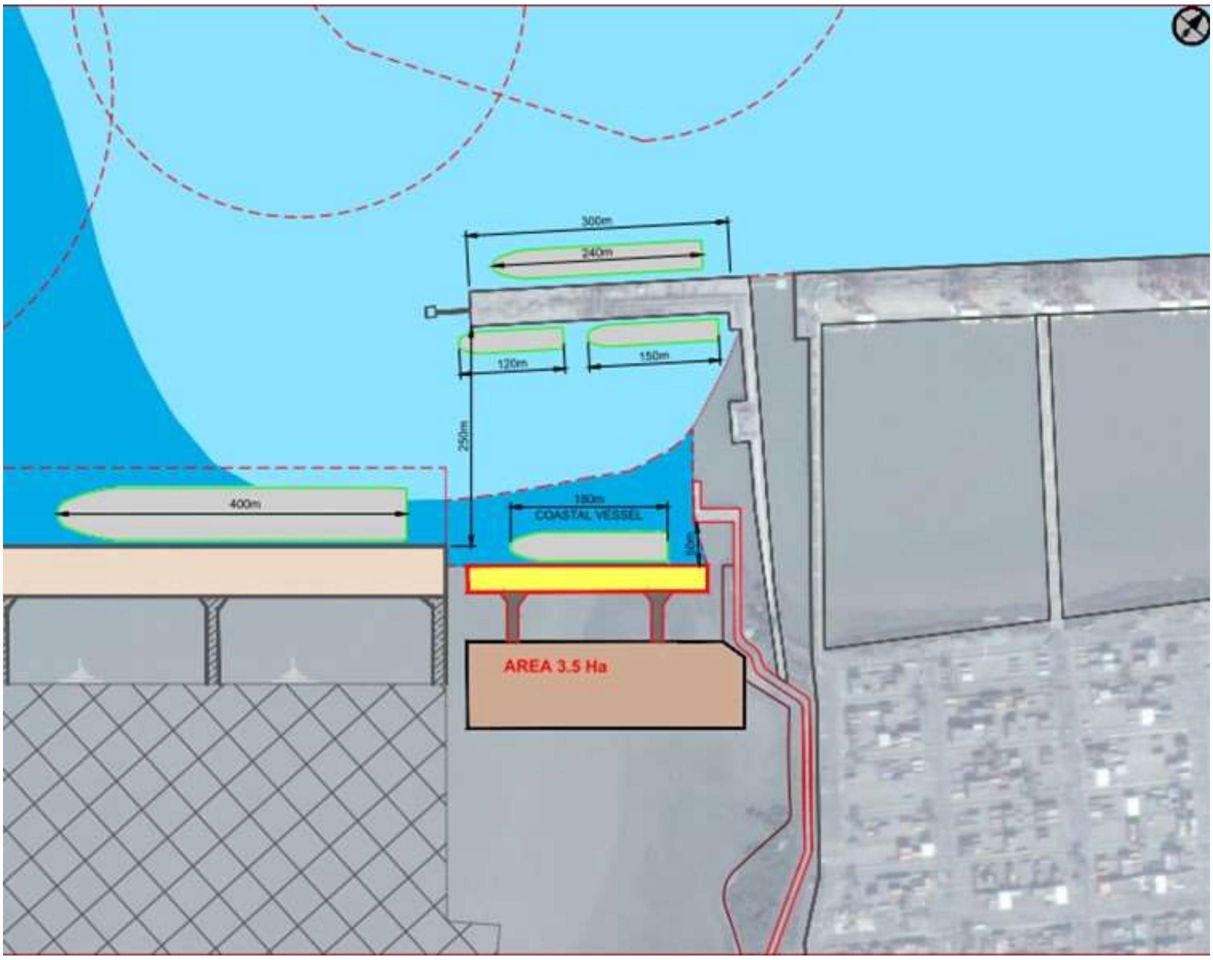



**Figure 7.20 JNPT Liquid Terminal with Coastal Berths along the Reclaimed Land**

### 7.3.1.7 JNPT Liquid Terminal Capacity Augmentation Conclusion

It may be observed from that above that Alternative 1 provides the most optimum solution, as the berth will be able to handle two small tankers. However, the clear gap of about 235 m between the 4th container terminal and the berth extension needs to be critically evaluated from the navigation point of view. Same is the case with Alternative 2. It is therefore suggested that ship manoeuvring studies be carried out to confirm the suitable scheme.

However, Alternative 3 can be independently taken up and this itself has a potential to augment the overall terminal capacity by about 1.3 MTPA.

It is also understood that port received requests from M/s. Monopoly Innovations Pvt Ltd., M/s Emami and M/s. Sumeru Bio-diesel for allotment of land for the subject purpose. They have informed that the expected throughput of these units will be about 2 to 3 MTPA. In view of the significant traffic it is suggested that shall water berth be also used along with the proposed coastal berth for handling of the edible oil and biodiesel. It would however be required that the pipelines from the coastal berth and shallow water berths are connected to the existing pipelines on the approach to BPCL jetty, for which user consent will be required. Common user manifolds will be needed at the connection point near jetty and near refineries (proposed to be located behind PUB/Custom office).

### 7.3.2 North Anchorage

JNPT should have an inner anchorage so sailing time can be saved thus increasing overall occupancy and throughput. Anchorage area at the north of JNPT can be used for this purpose. Two sets of Steel Mooring Buoys with Quick Release Hooks and Triple Anchor System of mooring shall be procured, which could be placed on the north western edge of the JNPT anchorage off Nhava Island. This would enable lighterage operations for transferring cargo to Mumbai port and also provide space for waiting of the ships.


**Figure 7.21 JNPT North Anchorage Location**

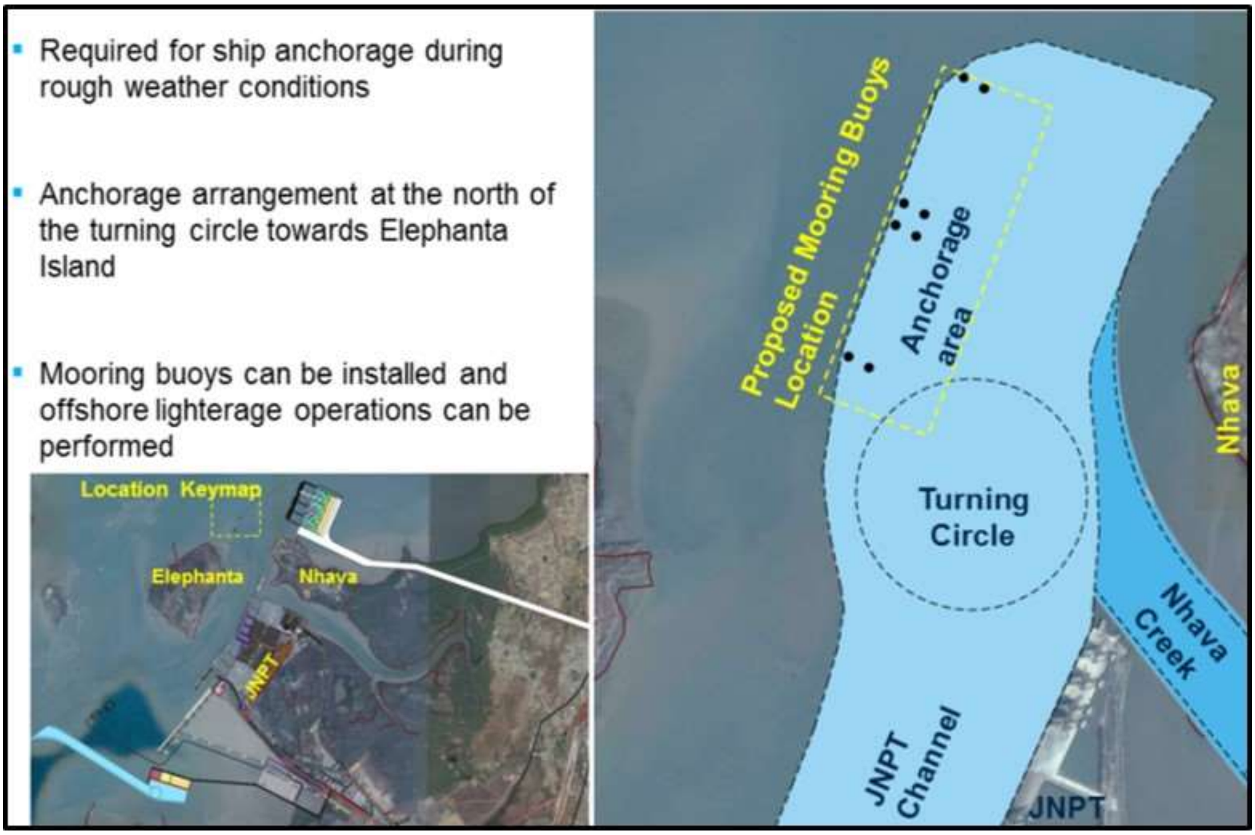



**Figure 7.22 JNPT North Anchorage proposed Mooring Buoys**

# 8.0 SCOPE FOR FUTURE CAPACITY EXPANSION

## 8.1 Possible Locations for Capacity Expansion

In order to create more capacity, various sites within JNPT port limits have been studied. The section presented below summarises various project which can be taken up for capacity addition. **Figure 8.1** below shows the different sites considered for new projects.

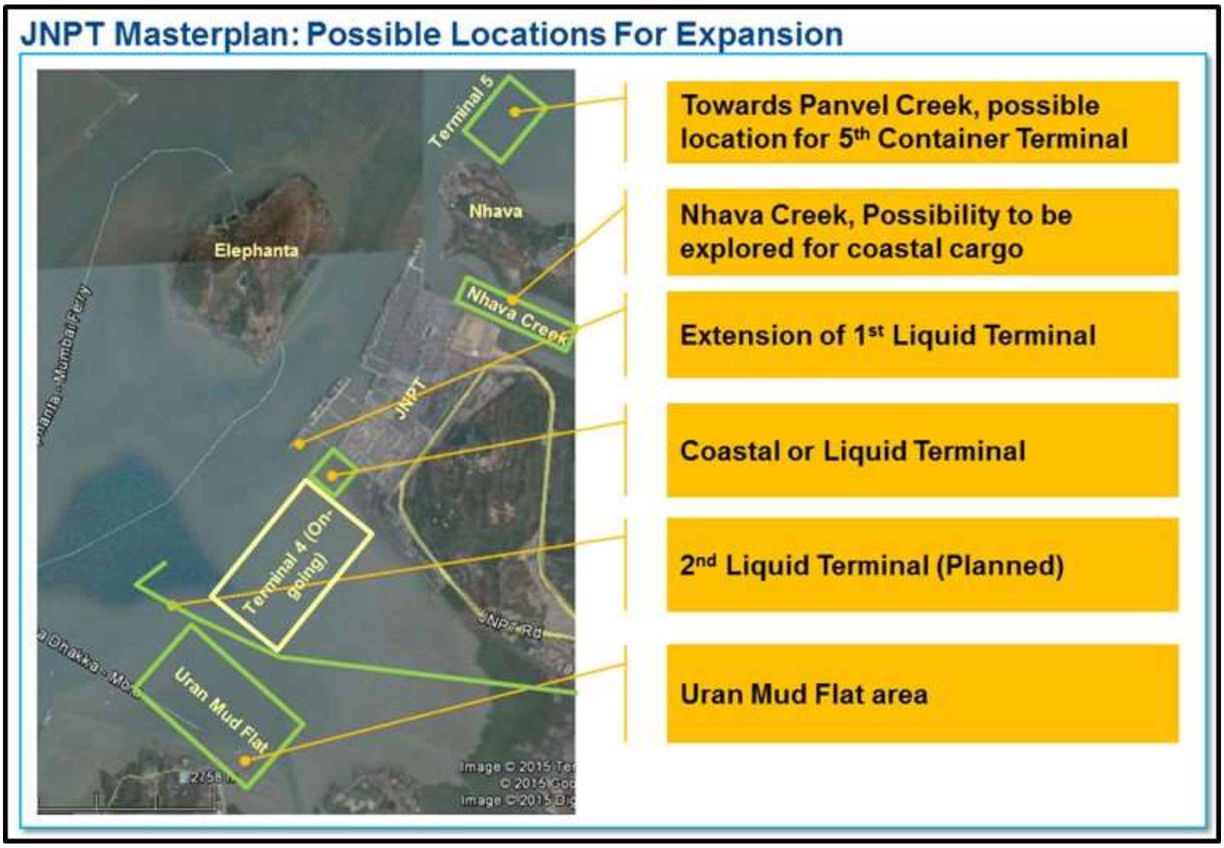



**Figure 8.1 Possible Location for Expansion within JNPT Limits**

## 8.2 5th Container Terminal at Panvel Creek

### 8.2.1 Site Data, Constraints & Opportunities

**Figure 8.2** below shows the opportunities and constraint map of the 5th Terminal location.

5th terminal will have to be a separate terminal just like JNPT's 4th container terminal. Proposed Trans Harbour Sea Link alignment is just north of the proposed site. 5th terminal will have to be developed entirely on the reclaimed land and approach corridor will be needed for rail and road connectivity.

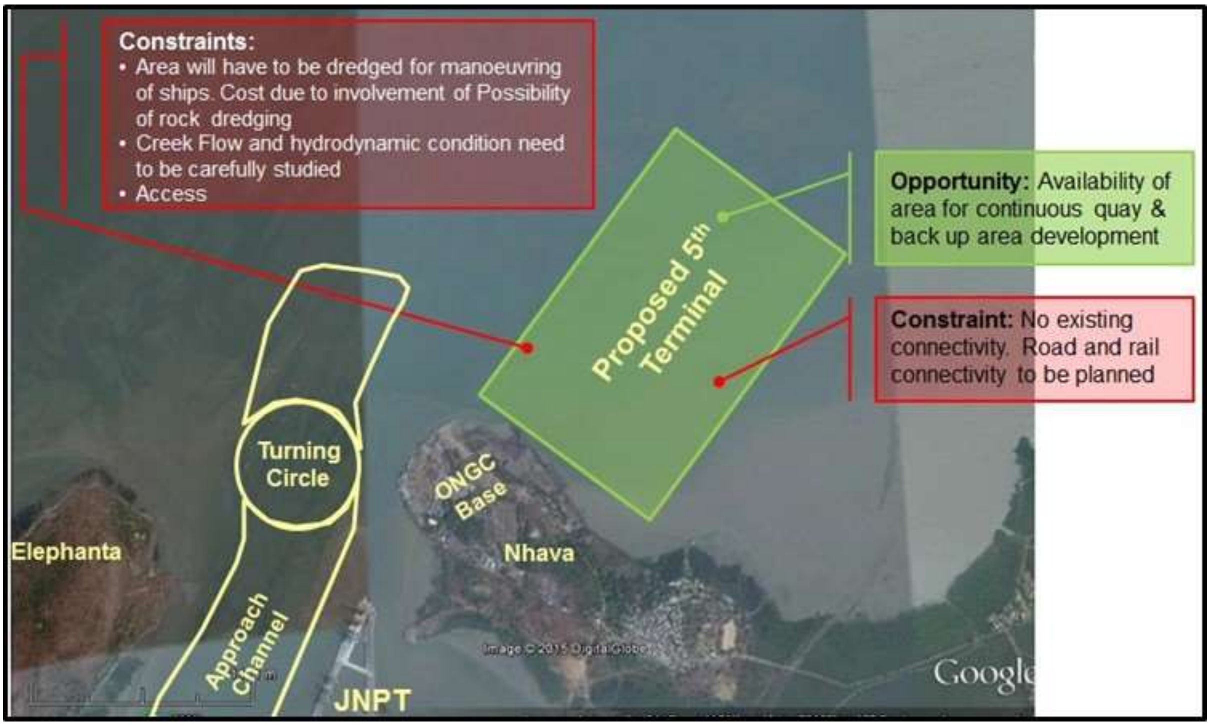



**Figure 8.2 Opportunities and Constraint map of 5th Terminal Location Near Nhava**

### 8.2.2 Salient Features & Layout of the Proposed 5th Container Terminal

- Proposed Terminal is at the North of Nhava Island in Panvel Creek
- Phase 1 facilities proposed: 1000 m long Container berth, with yard and other facilities on reclaimed land, connected to main land using approach trestle.
- 85 ha. area for Container Yard and backup area, 40 ha. area for approach corridor.
- Possible capacity addition of **2 million TEUs**

Conceptual plan of the 5th container terminal is shown in the **Figure 8.3**.

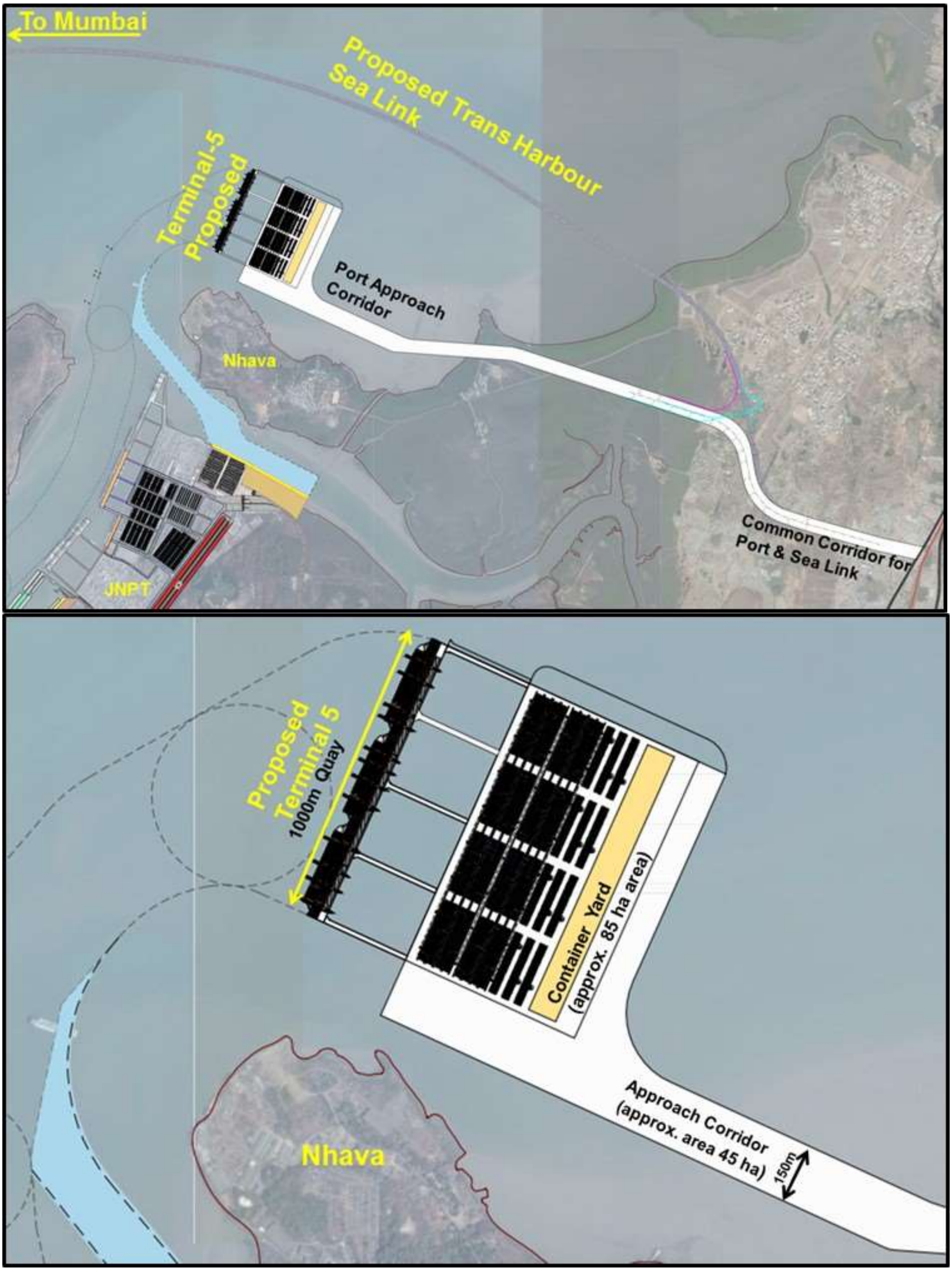



**Figure 8.3 Proposed 5th Container Terminal and its Location Plan**

The hydrodynamic conditions due to the proposed development need to be critically studied from sedimentation point of view

# 8.3 Terminals in Nhava Creek

## 8.3.1 Site Data, Constraints & Opportunities

Nhava Creek as shown in **Figure 8.4**, is the relatively small tidal Creek which separates Nhava Island from Sheva and flows out and meets the waters of Mumbai Harbour at the eastern edge of "Elephanta Dweep". Thus, the island of Nhava is on its north bank and Sheva on its south bank. The last (downstream) 5 or 6 km of this creek fall within the port limits of JN Port. The entrance has a restricted width of about 90 m due to the construction of the guide bund north of Sheva Island. Immediately inside the entrance the creek width is about 600 m and narrows down to about 500 m, 1 km upstream of the creek.

- POL/Edible Oil & Costal Cargo Terminal Proposed
- Road connectivity possible along the existing port road
- 16.4 ha. of storage area through reclamation.


**Figure 8.4 Opportunities and Constraint Map of Nhava Creek**

There are many constraints for the proposed development as clearly mentioned in **Figure 8.4**. These have to be mitigated during the detailed design phase.

### 8.3.2 Salient Features & Layout of Nhava Creek Terminal

- Nhava creek terminal will need reclamation over the existing mangroves area in Nhava Creek.
- Approach corridor can be developed along the existing JNPT approach corridor.
- Nhava creek terminal will be developed to handle small draft coastal cargo, liquid cargo (edible oil/chemicals) and Car carriers.
- Maximum possible ship size will have to be restricted as per the Nhava creek opening and dredged depth.
- 1000 m quay length can be developed for handling various cargo handled using small parcels.

Conceptual plan of Nhava creek terminal is shown in the **Figure 8.5**.


**Figure 8.5 Location of Proposed Berths at Nhava Creek**

# 8.4 Developments at Uran Mud Flat

## 8.4.1 Site Data, Constraints & Opportunities

Uran mud flat site is south of JNPT Terminal 4. Similar to JNPT Terminal 4, a coastal terminal can be developed on reclaimed land. The constraint could be the flow pattern that would be affected by the reclamation which can be studied using mathematical or physical modelling studies. The tidal flow pattern may cause siltation in the dredged basin. **Figure 8.6** below shows the opportunities and constraint map of Uran mud flat area.

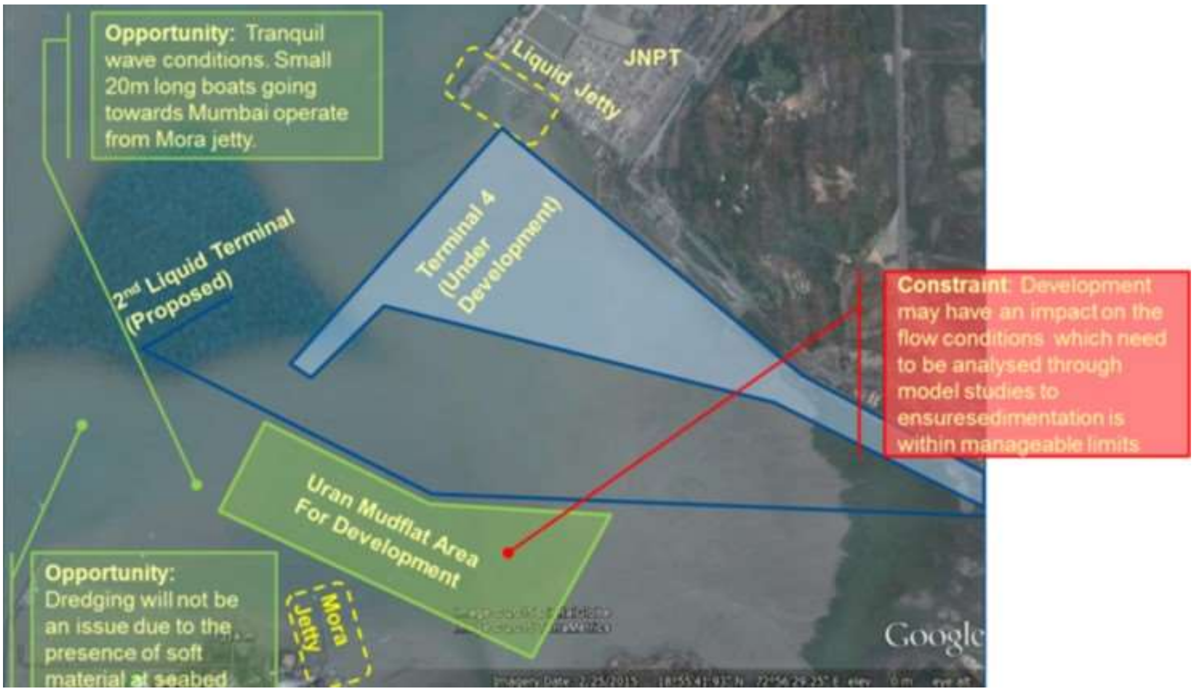



**Figure 8.6 Oppotunities and Contraint Map of Uran Mudflat Area**

There are many constraints for the proposed development as clearly mentioned in **Figure 8.6**. These have to be mitigated during the detailed design phase.

## 8.4.2 General Layout

While developing the options at Uran Mudflat, it has also been borne in mind that the independent terminal for a single commodity may not be viable financially due to likely high cost of maintenance dredging and therefore the emphasis is to provide multiple facilities, including that for liquid cargo, for which offshore berths have been planned currently.

**Figure 8.7** shows various possible alternatives that could be possible at Uran Mudflats. These options would however need to be studied in model studies to arrive at the most optimal solution that can make the development in Uran Mudflats financially viable, without having an adverse impact on the existing facilities.

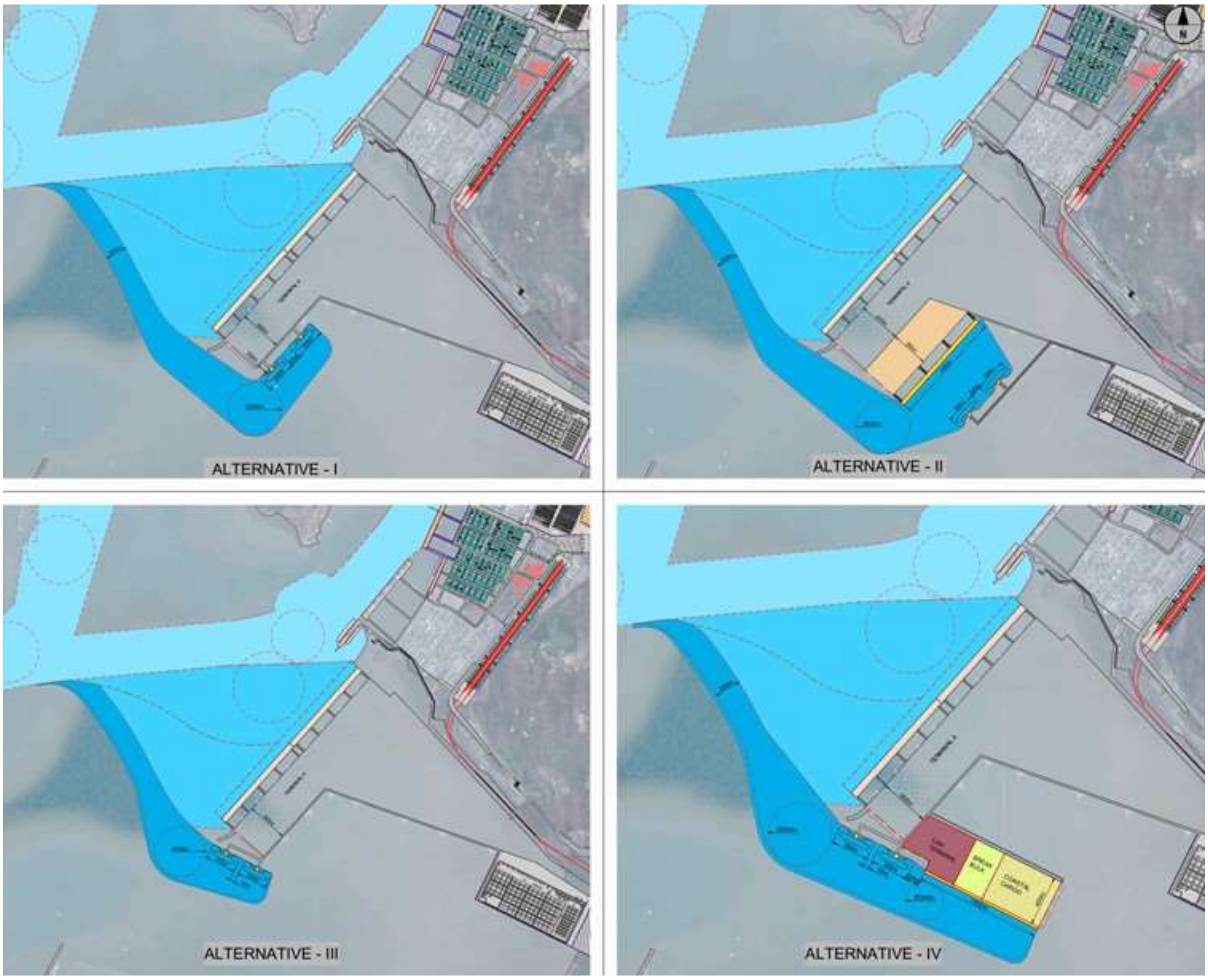



**Figure 8.7 Indicative Alternative Options for Development at Uran Mudflats**

# 9.0 SHELF OF NEW PROJECTS AND PHASING

As part of the JNPT 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. Many of these projects are subject to outcome of detailed techno economic studies, which shall be conducted as part of the project development.

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.

## 9.1 Ongoing Projects

The details of the projects which have already been awarded and development is ongoing are given below in **Table 9.1**.

**Table 9.1 Ongoing Projects**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | JNPT Container Terminal T4 - Phase 1 | 30.0 | 4,719 | PPP |

## 9.2 Projects to be completed by Year 2020

The details of the projects which are envisaged to be completed by year 2020 are given below in **Table 9.2**.

**Table 9.2 Projects to be Completed by Year 2020**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Restructuring of JNPT Yard for Optimal Yard Utilization | 3.0 | 200 | Port's funds |
| 2. | Flyover at Y Junction for Decongestion of Traffic Flow | - | 200 | Port's funds |
| 3. | Integrated Common Rail Yard | 3.0 | 200 | PPP |
| 4. | North Anchorage | - | 50 | Port's funds |
| 5. | Flyover for GTI Entry/Exit Over the Rail Tracks to Common Rail Yard | - | 70 | Port's funds |
| 6. | Deepening and widening of JNPT and Mumbai Channel Phase 2 | 24.0 | 2,029 | Port's funds |
| 7. | Utilization of Coastal Berth for Liquid Cargo | 2.5 | 20 | Port's funds |
| 8. | Additional liquid bulk terminal - Phase 1 | 3.8 | 570 | PPP |
| 9. | Construction of central Truck Parking Terminal | - | 200 | Port's funds |
| 10. | Evacuation road for standalone Container Terminal (330 m extension to DPW terminal) | - | 54 | Port's Funds |
| 11. | SEZ Phase EPC Contract for Infrastructure Development | - | 468 | Port's funds |

The port layout after completion of  projects mentioned above shall be as shown in **Figure 9.1**.


**Figure 9.1 Layout Plan 2020**

## 9.3 Projects to be completed by Year 2025

The details of the projects which are envisaged to be completed by year 2025 are given below in **Table 9.3**.

**Table 9.3 Projects to be Completed by Year 2025**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | JNPT Container Terminal T4 - Phase 2 | 30.0 | 3,196 | PPP |

The port layout after completion of mentioned above shall be as shown in **Figure 9.2**.


**Figure 9.2 Layout Plan 2025**

# 9.4 Projects to be completed by Year 2035

The details of the projects which are envisaged to be completed by year 2035 are given below in **Table 9.4**.

**Table 9.4 Projects to be completed by Year 2035**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (In Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | JNPT Multipurpose Cargo Terminal in Uran Mud flats | 6.0 | 1,000 | PPP |
| 2. | Terminals in Nhava Creek | 6.0 | 600 | PPP |
| 3. | Additional Liquid Bulk Terminal - Phase 2 | 3.8 | 385 | PPP |
| 4. | JNPT 5$^{th}$ Container Terminal | 30.0 | 5,500 | PPP |

The port layout after completion of mentioned above shall be as shown in **Figure 9.3**.


**Figure 9.3 Layout Plan 2035**

# Appendix 1 - **BCG Benchmarking Study for Jawaharlal Nehru Port (JNPT)**

# Master Plan for Kandla Port

Prepared for

## Ministry of Shipping / Indian Ports Association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| 2. | 20.07.2016 | | Incorporating Comments from Port | Amit Magadum<br>Associate |
| | | | | |
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# 1.0 Introduction

## 1.1 Background

The Sagarmala initiative is one of the most important 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 the 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 a larger economy.

**Sagarmala aims to optimize the Logistics route for Port and Increase focus on Port led development for the country**

| | | Details | Description |
|---|---|---|---|
| Why is Sagarmala needed? | 1 | Dual institutional structure at ports | ▪ Due to segregation of major and minor ports, ports of India have grown as due unconnected entities and not benefitting from co-location or economics of scale |
| | 2 | Weak infrastructure at ports and beyond | ▪ Weak modes of evacuation from both major and minor ports leading to sub – optimal modal mix presently<br>▪ Limited hinterland linkages that increases cost of transportation |
| | 3 | Limited economic benefit of location & to community | ▪ Limited conscious skill development and leverage to peripheral trades (fisheries, tourism etc.)<br>▪ Limited development of centres of manufacturing near ports |
| What does Sagarmala want to achieve? | 1 | Ports led development | ▪ Undertake development of coastal economic zones with projects like – port based industrialization, coastal tourism, Logistics parks, warehousing, fisheries etc. |
| | 2 | Port infrastructure enhancement | ▪ Action points on transforming existing ports into world class ports be developing deep drafts, mechanization of existing berths, creation of new capacity and greenfield ports |
| | 3 | Efficient evacuation | ▪ Expansion of rail / road network connected to ports and identification of congested routes<br>▪ Find optimized transport solution for bulk and container cargo |

**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

The team of McKinsey and AECOM distilled learnings from 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** below.

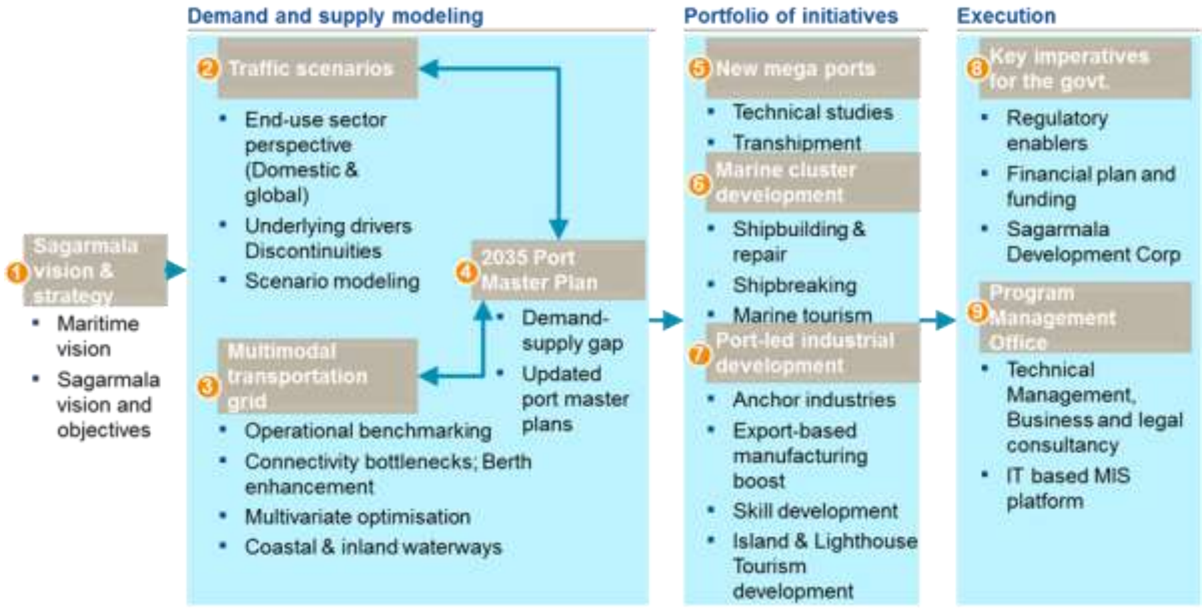



**Figure 1.2 Governing Principles of our Approach**

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

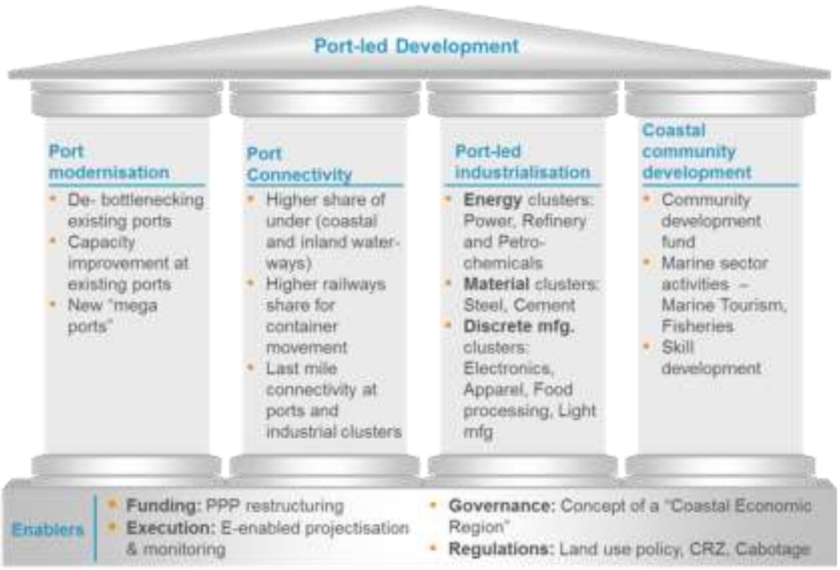



**Figure 1.3 Port Led Developments**

As part of the assignment, we are 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 would 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 on Master Plan for Kandla Port as part of SAGARMALA assignment. This report is organised in the following sections:

| | |
|---|---|
| Section 1 | : Introduction |
| Section 2 | : The Port and Site Conditions |
| Section 3 | : Details of Existing Facilities |
| Section 4 | : Performance, Options for debottlenecking & Capacity Assessment |
| Section 5 | : Details of Ongoing Developments |
| Section 6 | : Traffic Projections |
| Section 7 | : Capacity Augmentation Proposals |
| Section 8 | : Port External Connectivity and Infrastructure |
| Section 9 | : Scope for Future Capacity Expansion |
| Section 10 | : Shelf of New Projects and Phasing |

# 2.0 The Port and Site Conditions

## 2.1 Kandla Port

Port of Kandla governed by Kandla Port Trust is located at the west coast of India, is one of the 12 major ports of India and the only Major Port in the state of Gujarat. It was declared as a Major Port on April 8, 1955.

Kandla Port is a natural harbour situated in Kandla Creek and is 90 km from the mouth of Gulf of Kutch. Geographically, the port is spread in three locations viz., Kandla, Vadinar and Tuna Tekra. These site locations are as shown in the **Figure 2.1**.

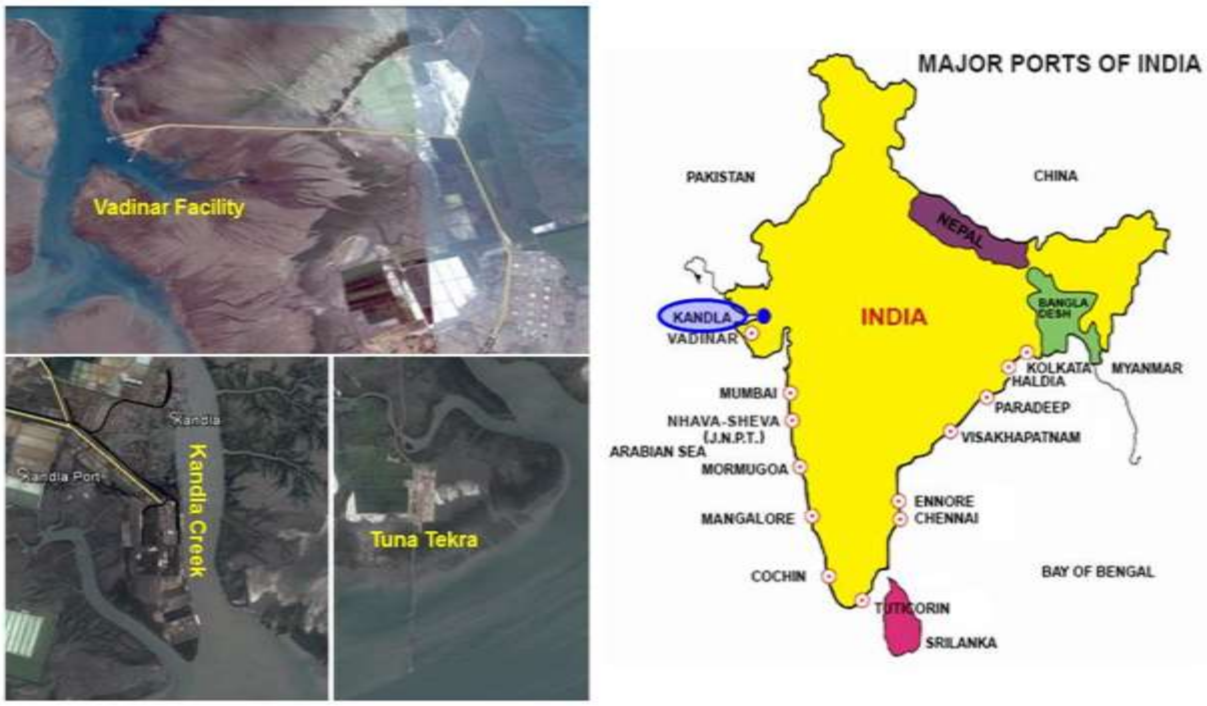



**Figure 2.1 Geographic Location of Kandla Port**

## 2.2 Rail and Road Connectivity

### 2.2.1 Background

Access to the port will play a key role in linking the port expansion to the rest of its supply chain. Ensuring that surface transport links to the port expansion are adequate will be crucial in ensuring the efficiency of the overall supply chain. Kandla Port needs to have an efficient “whole of chain” system to maximise the port’s attractiveness to shippers and thus its competitiveness.

Whilst the mode split of cargo to and from the port will be determined to a large extent by the types of products hauled, and hence the detailed road and rail requirements, there are a number of general issues which need to be considered concerning road and rail access.

It is clear that road and rail infrastructure in the port is already in place which could be utilised to serve the port expansion, although some additional facility will be required to customise the connections to the various terminal areas and to upgrade the internal transport infrastructure generally to provide the level of service required.

With regard to the external connectivity, the Port is well connected by the network of rail and road. It caters to the trade requirements and provides gateway port for export and import of traffic of one of the most highly productive granary and industrial belt of the country stretching across the hinterland states of northern Indian states of Jammu & Kashmir, Delhi, Punjab, Himachal Pradesh, Haryana, Rajasthan, Gujarat and parts of Madhya Pradesh, Uttaranchal and Uttar Pradesh.

### 2.2.2 Road Connectivity

Kandla Port is connected with National Highways NH 8A connecting Ahmedabad and Mundra/ Mandvi through Gandhidham. The four lane NH 8A extends right up to the port’s main gate. The port is also connected through NH 141. The port also has fully developed road network, both in and around the Port area to facilitate faster movement of cargo. The road network within the port area is as below:

- Inside Cargo jetty area 30 km
- Outside Cargo Jetty area 31 km

### 2.2.3 Rail Connectivity

Broad gauge (BG) tracks directly connect the Port at Kandla with the principal cities of Mumbai, Ahmadabad, Surat, Baroda, etc., and also Delhi, Punjab and Haryana through the route Ahmadabad – Ratlam – Kota – Mathura to Delhi. The second route is via Palanpur – Ajmer to Delhi. The nearest railway station is Gandhidham railway station is 24.3 km.

The port has railway connectivity inside the cargo jetty area up to CJ 10 and is being extended till CJ 16.

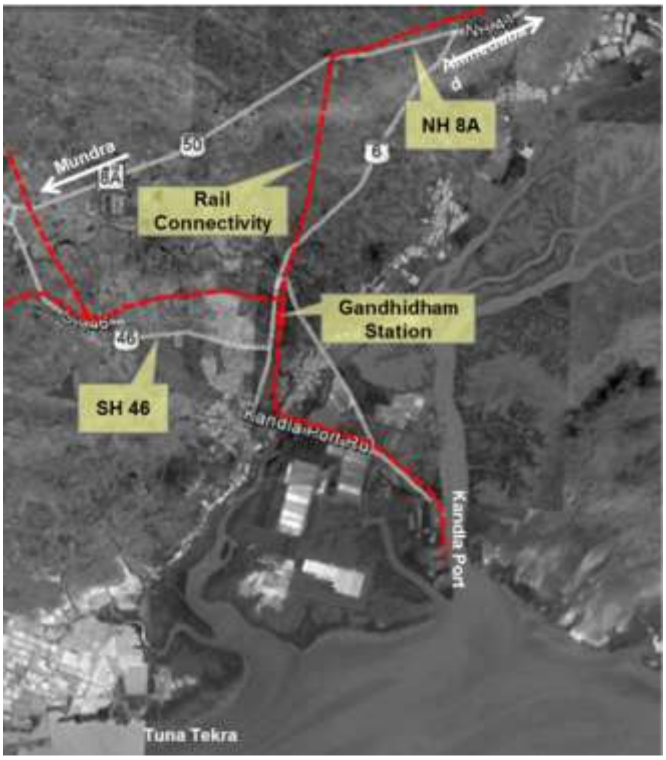



**Figure 2.2 External Rail and Road Connectivity to Kandla**

# 2.3 Site Conditions

## 2.3.1 Meteorology

The climate at Kandla is governed by the monsoons. In the months June-September, the south-west monsoon occurs. The later period is often indicated as the post-monsoon period.

### *2.3.1.1 Winds*

Non cyclonic maximum winds (30-40kmph) occur during May-August. Wind speeds are relatively less during North East Monsoon. However, wind speeds up to 180 KMPH have been observed during cyclonic storms.

### *2.3.1.2 Rainfall*

Rainfall at Kandla is low. Annual average rainfall is about 322 mm per annum with the total number of rainy days of 17 per year, about 90% of which is received during the south-west monsoon season, i.e., between June and September with a maximum of 153 mm in July. April and May are dry months with average rainfall below 0.6 mm per month.

### *2.3.1.3 Temperature*

The mean daily maximum temperature is 34°C and with 40°C the highest occurring in May. Mean daily minimum temperature is 20°C and with 12°C the lowest occurring in January.

#### ***2.3.1.4 Visibility***

Throughout the year visibility is good as the region has zero fog days. However, during rains and squalls, the visibility deteriorates.

#### ***2.3.1.5 Relative Humidity***

Relative humidity is generally high and rises to about 80% during the monsoons in the month of August.

### 2.3.2 Oceanography

#### ***2.3.2.1 Tides***

The tides at Kandla are semi-diurnal with tidal levels, relative to the Chart Datum (CD), as follows:

| | Kandla Creek | Tuna Tekra |
|---|---|---|
| Mean High Water Spring (MHWS) | +6.6m | + 5.8 m |
| Mean High Water Neap (MHWN) | +5.7m | + 4.6 m |
| Mean Sea Level (MSL) | +3.8m | + 3.4 m |
| Mean Low Water Neap (MLWN) | +1.8m | + 2.1 m |
| Mean Low Water Spring (MLWS) | +0.8m | + 1.0 m |

#### ***2.3.2.2 Cyclone***

In general the west coast of India is less prone to cyclonic storms compared to the east coast. It is observed from the cyclonic tracks in the Arabian Sea that only 6 storms endangering the Kandla coast have occurred till date with maximum speed recorded was 100 kmph. However, in 1998 a severe cyclone hit the Kandla Port with a wind speed of 150 kmph resulting in high tidal waves of 10.5m causing extensive damage to port installations.

### 2.3.3 Geotechnical Data

Based on the geotechnical information, the Kandla port area substrata comprises of silty clay up to 10m depth below seabed followed by followed by hard silty clay up to 26 m and beyond which is dense sand.

### 2.3.4 Topography

Topography at the port site is flat. Kandla Port has developed the area at Kandla creek by raising the area which was marshy land to the current level. To the west of Kandla creek is Khori creek with salt pans where salt activities are being carried out. To the east of the creek is completely marshy land, which is underwater most of the time and are only exposed during lowest tidal conditions.

# 3.0 DETAILS OF EXISTING FACILITIES

## 3.1 General

Kandla is a natural, all weather harbour, fully protected from waves during the monsoon period which has grown to become one of the most economical major ports in India. It has an advantage of locating port facilities.

Kandla port is a natural tidal harbour and is connected to deep water by a dredged channel. The locations of the berths are shown in the following **Figure 3.1**.

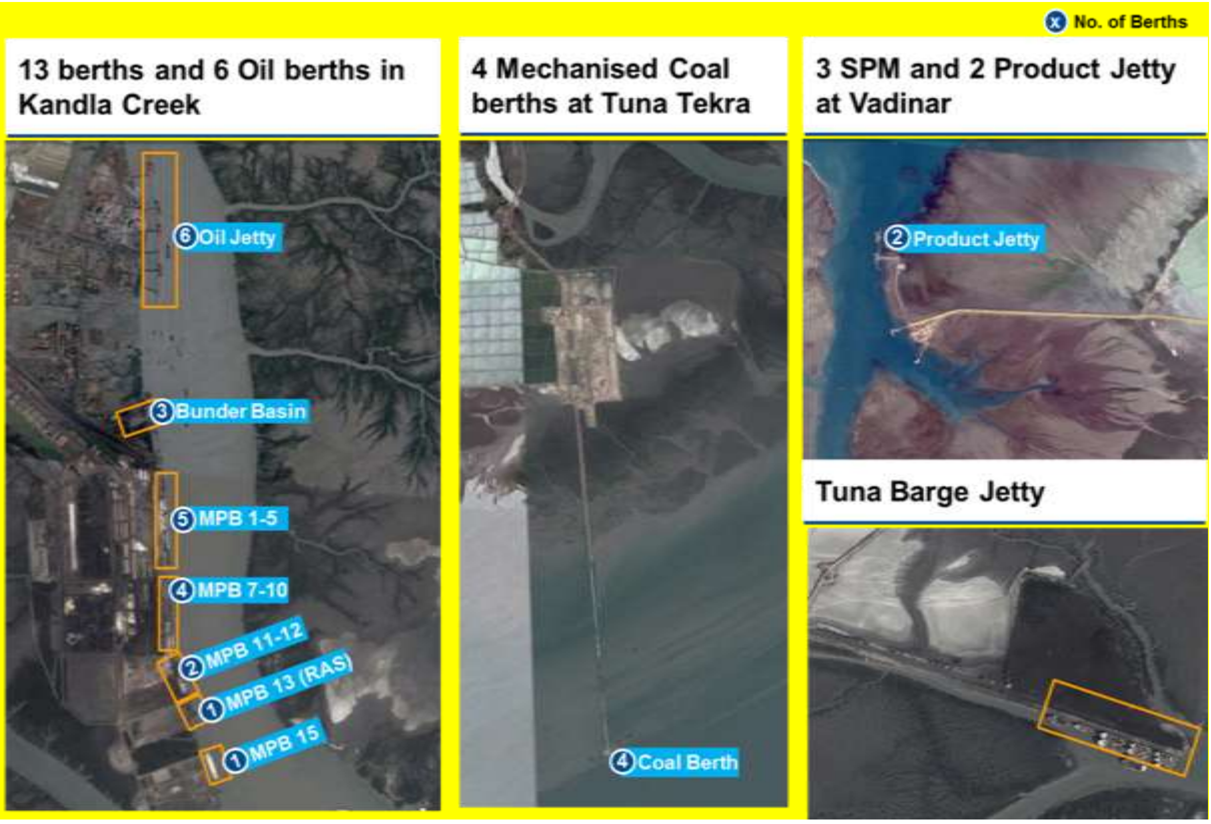



**Figure 3.1 Existing Facilities**

Kandla Port presently handles commodities POL, liquid and dry cargo. The port handles substantial quantities of POL through SBMs, oil and product jetties and pipelines which accounts to ~64% of the total traffic. The total area available with the port is 2,22,591 acres and is located on the west bank of Kandla creek at the eastern end of Gulf of Kutch. Of the total port area, an area of 2,20,416 acres accounts to the submerged land and only 10% i.e. 22,042 acres of this land is usable, as the other 90% is tidal affected area.

## 3.2 Details of Existing Berths

### 3.2.1 Overall Berthing Facilities

Kandla port currently has its operating facilities at Kandla creek, Tuna Tekra and Vadinar (**Figure 2.1**).

6 Oil jetties, 14 multipurpose berths, barge handling at bunder basin are located in Kandla creek, 4 berths for deep draft bulk terminal at Tuna Tekra while 3 SPM and 2 product jetties are located at Vadinar. **Table 3.1** provides details of all the berths at Kandla Port.

**Table 3.1 Berth wise Details**

| Berth Name (No. of berths) | Length (m) | Draft (m) | Present Capacity (MTPA) | Design Vessel size (DWT) | Cargo Handled |
|---|---|---|---|---|---|
| **Kandla Creek** | | | | | |
| • CJ-1 | 182.87 | 9.8 | 1.50 | 45,000 | Multipurpose, dry bulk |
| • CJ-2 | 182.87 | 9.8 | 1.50 | 45,000 | Multipurpose, dry bulk |
| • CJ-3 | 182.87 | 9.8 | 1.50 | 45,000 | Multipurpose, dry bulk |
| • CJ-4 | 182.87 | 9.8 | 1.50 | 45,000 | Multipurpose, dry bulk |
| • CJ-5 | 205.73 | 9.1 | 1.50 | 35,000 | Multipurpose, dry bulk |
| • CJ-6 | 205.73 | 9.1 | 1.50 | 35,000 | Multipurpose, dry bulk |
| • CJ-7 | 238.64 | 12 | 2.25 | 55,000 | Multipurpose, dry bulk |
| • CJ-8 | 213.04 | 12 | 2.25 | 55,000 | Multipurpose, dry bulk |
| • CJ-9 | 182.87 | 12 | 2.25 | 55,000 | Multipurpose, dry bulk |
| • CJ-10 | 205.72 | 12 | 2.25 | 55,000 | Multipurpose, dry bulk |
| • CJ-11 | 281.00 | 12.5 | 3.60 | 65,000 | Multipurpose, dry bulk |
| • CJ-12 | 264.00 | 12.5 | 3.60 | 65,000 | Multipurpose, dry bulk |
| • CJ-13 | 300.00 | 13.0 | 1.50 | 75,000 | Multipurpose, dry bulk |
| • CJ-15 | 300.00 | 13.0 | 1.50 | 75,000 | Multipurpose, dry bulk |
| • OJ-1 | 213.40 | 10.40 | 2.00 | 40,000 | POL products, Veg. Oil and Others Liquids |
| • OJ-2 | 183.00 | 9.00 | 2.00 | 52,000 | POL products, Veg. Oil and Others Liquids |
| • OJ-3 | 213.40 | 9.80 | 2.00 | 40,000 | POL products, Veg. Oil and Others Liquids |
| • OJ-4 | 216.00 | 10.70 | 2.00 | 56,000 | POL products, Veg. Oil and Others Liquids |
| • OJ-5 | 216.00 | 10.70 | 2.00 | 45,000 | Phos/Ammonia |
| • OJ-6 | 216.00 | 10.10 | 2.00 | 45,000 | POL Products |
| **Tuna Tekra** | | | | | |
| • Tuna Tekra (4) | 600.00 | 16.2 | 14.11 | 120,000 | Dry bulk |
| **Vadinar** | | | | | |

| Berth Name (No. of berths) | Length (m) | Draft (m) | Present Capacity (MTPA) | Design Vessel size (DWT) | Cargo Handled |
|---|---|---|---|---|---|
| • SBM – 1 | - | 30 | 11.25 | upto 300,000 | Crude |
| • SBM – 2 | - | 30 | 11.25 | upto 300,000 | Crude |
| • SBM – 3 | - | 30 | 19.95 | upto 300,000 | Crude |
| • Product Jetty – 1 | - | 14 | 7.25 | upto 100,000 | POL products |
| • Product Jetty – 2 | - | 14 | 7.25 | upto 100,000 | POL products |
| **Barge Jetties** | | | | | |
| • Bunder Basin | 152 | | 1.5 | 2200 DWT | Multipurpose, dry bulk |
| • Tuna Jetty | 240 | | 1.2 | 2200 DWT | Multipurpose, dry bulk |

### 3.2.2 Berthing Facility at Kandla Creek

#### 3.2.2.1 *Cargo Jetty (CJ) 1-12, 13 and 15*

The Port has total of twelve multipurpose cargo berths, of which first six viz., CJ 1 to 6 can cater to vessels of up to a draft 9.8 m only. The contiguous length of berth 1 – 6 is 1143 m. Currently, CJ 6 is not operational due to maintenance.

CJ 7 – 10 are used as 3 long berths to cater panamax size vessels with a total length of 840m have a draft of 12 m.

CJ 13 and 15 which are constructed very recently in PPP mode and have a draft of 13 m and each berth is 300m long. These berths can handle vessels of any size up to 13m vessel draft.

#### 3.2.2.2 *Oil Jetties 1-6*

Currently, Kandla port has 6 oil jetties handling variety of products ranging from LPG, POL, Chemicals, edible oil etc. The drafts at these berths vary from 9 m to 10.7 m and handle tankers up to 56,000 DWT.

#### 3.2.2.3 *Bunder Basin*

The Bunder Basin is situated to the north of Cargo Jetty area facing Kandla Creek connected by internal road to cargo jetty area. The basin area is also is called as Bunder Area for barges/ stream handling for unloading ships from Outer Tuna Buoy (OTB).

The basin is of size 85 m × 152 m with a total wharf length of 242 m. Of this about 200m has already been constructed and around 40m construction is pending.

### 3.2.3 Tuna Tekra Bulk Terminal

Kandla Port Trust awarded the concession for the development of deep draft bulk terminal at Tuna Tekra to M/s Adani Kandla Bulk Terminals Ltd., who has developed a T shaped jetty of 600 m × 60 m with berthing facilities to import / export all type of dry bulk cargoes like coal, fertilizer and its raw material, salt, wheat, iron ore etc. The designed capacity of this terminal is assessed at 14.1 MTPA.

This terminal with its T shaped jetty can handle two vessels of 100,000 DWT and a draft of 15 m on its front side and two vessel of 75,000 DWT with a draft of 14 m on its rear side. Being an offshore jetty located at -9.4 m CD, it is connected to the shore by an 18 m wide approach trestle consisting of 10 m wide road for two lane road traffic and an 8 m wide conveyor corridor. The jetty has a dredged level of -16.2 m CD on its front side. Further, KPT has given permission to deepen the access channel and on the front side of one berth to accommodate the vessels up to 210,000 DWT.

The present handling facilities include 4 Harbour Mobile cranes of 100 T capacity (of Leibherr 400 model) with the two berths on the front side equipped with two cranes each. Also a belt conveyor system to convey unloaded bulk material from the two berths to stackyard is provided. At the stackyard presently a fixed type stacker discharging coal at a fixed point is in operation. The mechanised stackyard is being developed and as of now the stacking and reclaiming of coal in the stackyard is currently done through conventional means of front end loaders and dumpers.

The Tuna Tekra facilities of Adani's, is operational since Feb. 2015. It is seen that as of now mechanization is for import of bulk cargoes. For export of bulk cargoes only harbour mobile cranes are available for shore to ship loading, that too on the front side of the jetty.

### 3.2.4 Tuna Bunder

Tuna Bunder is situated in Tuna creek on the west of Kandla creek and north of Tuna Tekra. A wharf of 240 m × 10 m along with the backup land of 5 ha for storage and operation is available. Barge jetty at Tuna has been developed to support the transloading operations at the anchorage. This facility has the provision for additional waterfront of 260 m along with the additional backup land of 16 ha for expansion. KPT has proposed to award the facility for barge handling on PPP basis.

The current water depths in the berthing area are about 2 m above CD. However, at many places in the 7.0 km long approach channel the bed levels are 3.5 m above CD. Therefore significant amount of capital dredging would be required to enable barges to travel to the jetty location under all tidal conditions.

### 3.2.5 Offshore Mooring Facility

Kandla Port Trust has 1 deep draft offshore mooring and 4 inner harbour mooring facilities for carrying out mid-stream cargo handling by carrying out lighterage of cargo from mother vessel to barges.

### 3.2.6 Offshore Oil Terminal at Vadinar

The Kandla Port Trust had commissioned the Offshore Oil Terminal facilities at Vadinar in the year 1978, jointly with Indian Oil Corporation, by providing Single Buoy Mooring (SBM) system. Two SBM's each of 11.25 MTPA capacity of IOC and 1 SBM of 20 MTPA capacity of Essar Oil Ltd. along with two product jetties of 7.25 MTPA capacities each are in operation.

## 3.3 Cargo Handling System

The port is equipped with a range of cargo handling equipment to handle different types of cargo passing through the port. There are nine number of high capacity Electrical Level Luffing cranes working on the present cargo berths. The mobile cargo handling equipment includes cranes, forklift trucks, trailers etc. Details of the cranes presently, held by the port are given as below:

- ELL wharf cranes at cargo jetty
  - 2 of 12 T
  - 4 of 16 T with a rated capacity of 400 TPH
  - 6 of 25 T with a rated capacity of 600 TPH
- ELL at Bunder area
  - 1 of 6 T
- Mobile harbour cranes
  - 2 of 63 T
- 9 forklifts

It is important to mention that beside these, other private equipment are permitted time to time, wherever necessary.

## 3.4 Storage Facilities

Kandla Port offers excellent and vast cargo storage facilities for storage of import and export cargoes.

The Port has developed storage capacity for dry cargo inside the custom bounded area for storage of import and export cargo.

The tank farms at Kandla for liquid bulk cargo (chemicals, edible oils, POL products, acids, etc.) storage have a total combined capacity of nearly 23.75 Lakh kilo-litres. The tank farms are connected to the oil jetties through a number of pipelines facilitating easy and faster handling of liquid cargo ships. All tank farms are situated behind the port jetties.

In addition to the open stack yard, there are 35 warehouses within the dry cargo jetty area as presented in **Table 3.2**.

.

**Table 3.2 Details of the Storage Facilities**

| Description of Storage Area | No. / Area | Area ($m^2$) | Capacity |
|---|---|---|---|
| Warehouses | 35 | 2,03,000 | 6,47,000 T |
| Open Storage | | 16,63,000 | 36,00,000 T |
| Liquid Storage | PSU – 79 | | 9,73,000 KL |
| | Private – 581 | | 14,01,000 KL |

## 3.5 Port Railways

Kandla Port Trust has its own railway system. The port has a total track length of 150 km and an effective length of 117 km. Currently, the port is handling 9 rakes each side totalling to 18 rakes per day. The rail line has the capacity of 18 rakes/day/line. KPT has excellent rail handling facilities at its premises.

The existing internal rail network of Kandla Port is as shown in **Figure 3.2**.


**Figure 3.2 Internal Rail Network of Kandla Port**

## 3.6 Pilotage and Towage Facilities

The pilotage is compulsory for all vessels having capacity of more than 200 MT Gross Tonnage. The port has wide number of tugs, mooring and pilot launches as detailed below.

- 9 harbour tugs of various sizes – 50 T and 35 T bollard pull
- 3 high speed pilot launches
- Two harbour tugs of 7.5 T bollard pull
- 6 mooring launches and 4 service launch
- 1 heave up barge for maintenance of navigational aids
- 2 Pilot & Oil-cum-debris recovery vessel – 1 at Kandla and 1 at Vadinar

The port has 120 m berth with twin side berthing facility port craft and two floating jetties for port launches. Another 220 m berth is under construction for port crafts as depicted in **Figure 3.3**.

**Figure 3.3 Port Craft Berths**

## 3.7 Navigational Facilities at Port

Kandla creek has depth, stable banks, and is well sheltered from south-west monsoon and is navigable in all weather. The presence of shoals in the approach channel and frequent geo-morphological changes taking place at the creek entrance requires regular dredging in the port for maintaining the depth of 9 m below the chart datum. The width of the channel is 200 m. The total length of the Kandla Port approach Channel is around 23 km.

The navigating channel of Kandla has a depth of 9 to 9.5 m. Taking a tidal advantage of 4 m above CD Kandla can cater to vessels with a draft of 12 to 12.5 m at its maximum. The maximum permissible draft in the Kandla Navigational Channel is 12.5 m, which includes the rise of tide. This draft may not be available on all days of the month depending on the height of tide for a particular day.

The maintenance dredging at Kandla port to maintain the depth in the channel is 12 million cum per year.

## 3.8 Repairing Facility

The port has steel floating dry dock for repair and maintenance of port crafts and barges and can accommodate vessels of following parameters:

| Parameter | Max. Dimension |
|---|---|
| LOA (m) | 100 |
| Beam (m) | 17.5 |
| Draft (m) | 4.5 |
| Lift Displacement (T) | 2500 |

## 3.9 Port Capacity

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 stackyard, number of users, grades, capacity of evacuation system etc.

The design capacity of various berths as per the data received from Kandla port is as indicated in the **Figure 3.4** below.

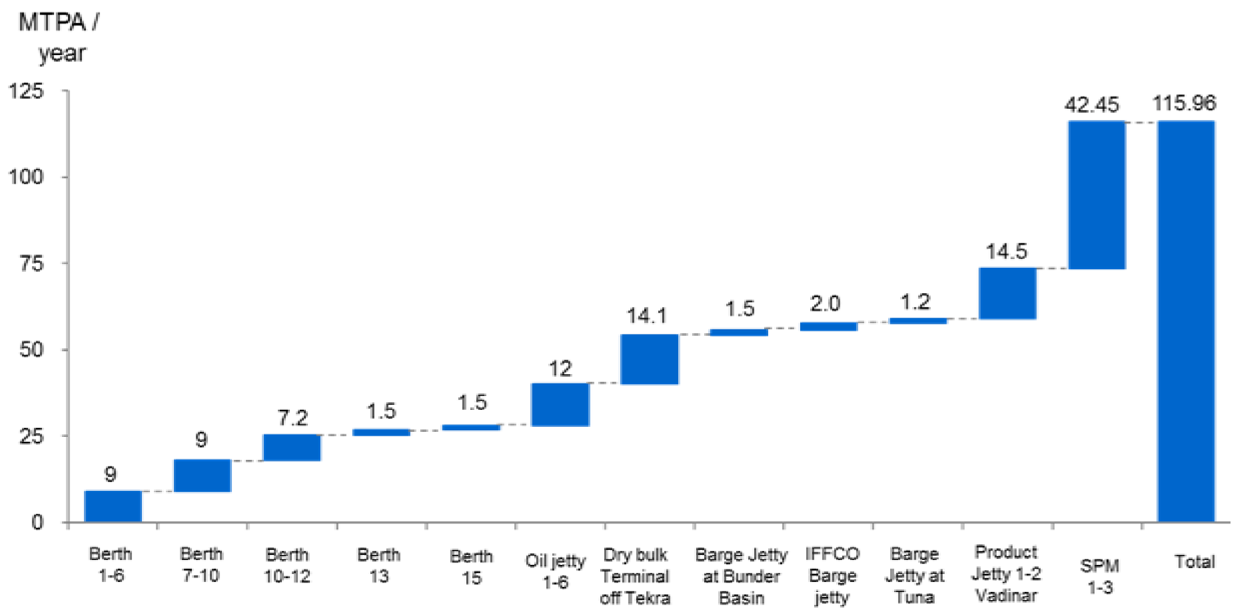



**Figure 3.4 Design Capacity of Various Berths at Kandla Port**

## 3.10 Port Performance

The cargo throughput of Kandla port including Vadinar in FY 15 is 92.4 MTPA, 6.20% more than that of the previous year (KPT data). Of the aggregate traffic of 582 MTPA handled in the preceding fiscal by all the major ports combined, the port accounted for about 15.7%, and is the number one major port in India in terms of traffic handled.

The Kandla port handles liquid bulk as its major cargo which accounts for 64% of the total traffic. **Figure 3.5** shows the share of each cargo handled at the port in FY 15.

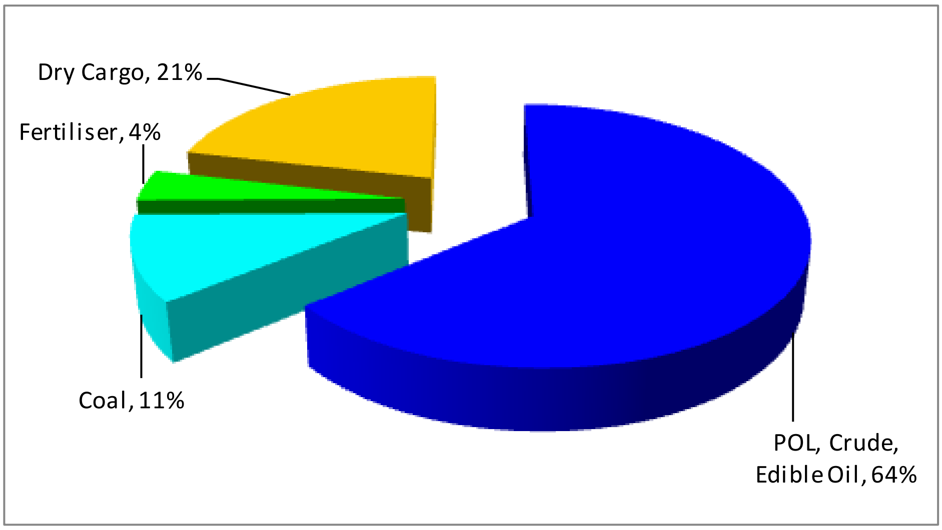



**Figure 3.5 Cargo Traffic Share at Kandla Port**

Presently, Kandla port handles dry cargo at its 14 general cargo berths and through barges at Bunder Basin and Tuna, and 6 oil jetties to handle liquid bulk viz., chemicals, POL and edible oils. Both these facilities have a combined capacity of 42.9 MTPA, which includes dry handling design capacity of 30.4 MTPA and liquid cargo handling design capacity of 12.0 MTPA. Against this capacity, a total of ~39 MTPA was handled at Kandla Port resulting in berth occupancy exceeding 80%+ at general cargo berths in FY 14.

The berth occupancy as indicated by the port in presented in **Figure 3.6** and **Figure 3.7**.

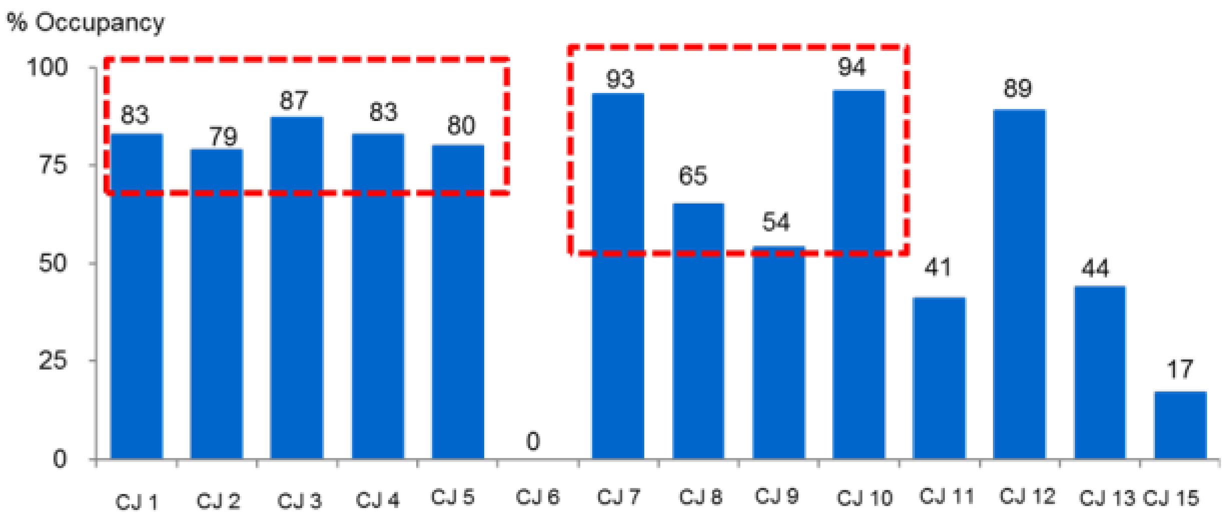
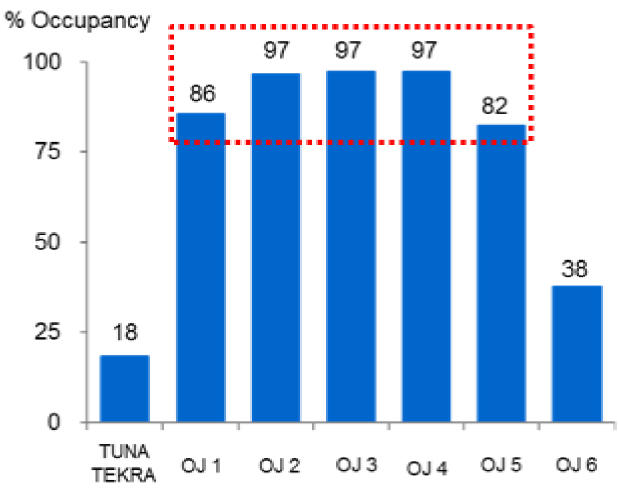



**Figure 3.6** **Berth Occupancy Details of Dry Cargo Berths**

It may be noted from the above figure that CJ 1 to 5 are highly utilised resulting in increased BO and bunching of ships. Berth 7 to 10 are used as 3 long berths. CJ 15 is the IMC berth developed on PPP basis is highly under utilised.



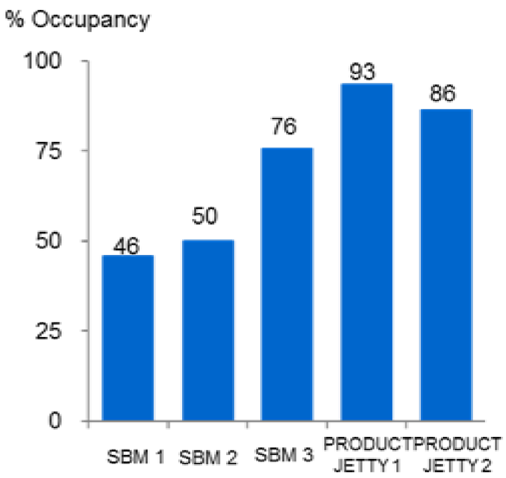




**Figure 3.7** **Berth Occupancy Details of Tuna Tekra, Oil Jetties and Vadinar Terminal**

The assessment of port facilities based on the data received from the port is discussed in the next section.

# 4.0 PERFORMANCE, OPTIONS FOR DEBOTTLENECKING & CAPACITY ASSESSMENT

## 4.1 General

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

**Table 4.1 Cargo Handled during last 5 years (MTPA)**

| Commodity | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|---|---|---|---|---|---|
| **Liquid** | | | | | |
| • POL+ Crude + Product | 48.43 | 46.94 | 54.36 | 53.14 | 60.40 |
| • Iron Ore | 0.63 | 0.99 | 1.01 | 0.59 | 1.20 |
| **Fertilizer** | | | | | |
| • Finished | 5.81 | 5.30 | 3.68 | 2.64 | 4.50 |
| **Coal** | | | | | |
| • Thermal | 3.08 | 4.06 | 4.06 | 6.08 | 9.70 |
| • Coking | 0.41 | 0.16 | 0.37 | 0.27 | 0.20 |
| **Containers** | | | | | |
| • Tonnage | 2.59 | 2.79 | 1.94 | 0.45 | 0.00 |
| • M TEUs | 0.16 | 0.168 | 0.118 | 0.03 | 0 |
| **Others** | 20.94 | 22.26 | 28.21 | 23.83 | 16.40 |
| **Grand Total** | **81.88** | **82.50** | **93.62** | **87.00** | **92.40** |

## 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 Kandla Port is given in the **Annexure 1**. The key observations of the study are as follows:

- Kandla port has an operating surplus of approximately 22%, despite cargo handling operations making losses (except for Vadinar).
- Mundra has grown at much faster rate with volumes growing at 22% compared to a meagre 4% at Kandla.
- The berth occupancy is very high at few berths (Dry bulk and liquid), and low at few berths (Berth 6, RAS berth and Tuna Tekra). High berth occupancy results in pre berthing delay at Dry and liquid berth and ineligibility of RAS berth and Tuna Tekra to handle vessels having draft less than 13.0 m results in making the costs more expensive to bring cargo to these berths.

### 4.2.1 Key Recommendations

As per BCG Report productivity at Kandla Port may be improved by following measures:

- Optimization of Grabs
- Improving crane capacity
- Tug fuel cost reduction
- Navigation aids for improving night navigation
- Automated rake loading fertilizer plant
- Instituting berth productivity norms for dry cargo
- Instituting hot seat changes
- Instituting berth productivity norms for liquid bulk

#### 4.2.1.1 *Optimization of Grabs*

Identify optimal grab size basis commodities handled, and use those for crane operations can boost handling of traffic at Kandla port. Utilization of optimal grab size will result in increase of volume per lift by ~50% and crane productivity by ~25%.

#### 4.2.1.2 *Improving crane capacity*

Currently, 3 no. of 25 T ELL cranes are used across berth CJ7 to CJ12, however CJ6, 9, 10 have stronger load bearing capacity, thus, these berths can handle more productive cranes as well as more number of cranes.

The existing 63 T Italgru HMCs, are not used at its most optimal performance. The cranes are not placed at most optimal distance from the vessel and the grab size that these cranes use is not as per the lifting capacity of the cranes or as per the density of the commodity being loaded/unloaded, which can be optimized.

#### 4.2.1.3 *Tug Fuel Cost Reduction*

10-15 % reduction in fuel consumption is possible through smart usage and maintenance:

- Limit usage of own tugs: Use only for shifting vessels between berths since the fuel consumption for shifting will be lesser than sailing and berthing. (20% of overall movements)
- Explore O&M contracts/ improve current AMC with performance guarantee: Guaranteed availability, guaranteed maximum fuel consumption per hour, guaranteed maintenance of pull capacity.
- Install flow meters and GPS trackers on all tugs and explore periodic retrofits to own tugs every 4-5 years to upgrade performance like higher efficiency nozzles, etc.

Reduction in fuel consumption from ~160LPH for hired tugs to ~140LPH and from ~150LPH for owned tugs to ~100LPH.

#### 4.2.1.4 *Navigation aids for improving night navigation*

Currently, only 20% of movements are undertaken at night due to restrictions on night navigation. This causes pre berthing delays and non-working time at berth because if a ship is unable to sail out at night (high tide), it has to wait ~6-8 hours for next movement.

Navigation aids can be used to make night navigation easier and safer thereby increasing the percentage of movements at night. It is proposed to adopt a tablet based navigation system that pilots can plug into the AIS of the ships. This will reduce dependence of buoys for night navigation and will improve safety as well as number of night movements. This initiative will result in improvement of berth occupancy by increasing the % of movements at night.

#### 4.2.1.5 *Automated rake loading fertilizer plant*

Currently, fertilizer bags are transported outside the KPT gate and loaded manually into the rakes. This takes ~18 hr where as competition turn around a rake in ~6 hr. improving the rake turnaround time can result in increased rake allocation. This is particularly important for fertilizers where the customers would want to ship out their cargo mostly immediately.

Coordination with rail ministry to convert the private siding within KPT into public siding and the design and set up a fertilizer bag loading plant next to the fertilizer bagging plants on PPP basis.

#### 4.2.1.6 *Instituting Berth Productivity Norms for Dry Cargo*

Berth productivity norms for cargo berths needs to be upgraded for better productivity. This initiative will increase productivity by ~20% creating capacity of 0.5-1 million tonnes.

#### 4.2.1.7 *Instituting hot seat changes*

Currently, the shift change time takes between 30 min to 1 hour per shift per day. However, this can be resolved by instituting hot seat shift change.

Implementation of hot seat changes by finalizing the plan with unions to add 30 minutes to each shift or give one hour overtime will reduce idle time by ~2.5 hrs per day.

#### 4.2.1.8 *Instituting berth productivity norms for liquid bulk*

Currently, the productivity of liquid berths at KPT (220 TPH) is lower than benchmarks (Mundra – 300-350TPH) as well as the best demonstrated performance at KPT. This has been mapped to the incentive structure so that it does not create pressure for the customers to empty vessels at maximum possible rate. This can be addressed through stringent berth productivity norms.

## 4.3 Capacity Assessment of Existing Facilities

### 4.3.1 General

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 4.2**.

**Table 4.2 Recommended Berth Occupancy**

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

The various performance indicators at the berth are analysed and presented in the sections below.

#### ***4.3.1.1 Oil Jetties 1-6***

Currently the port is handling POL, chemicals and edible oils at Oil jetties. The proportion of handling of these cargoes is as shown in **Figure 4.1**.

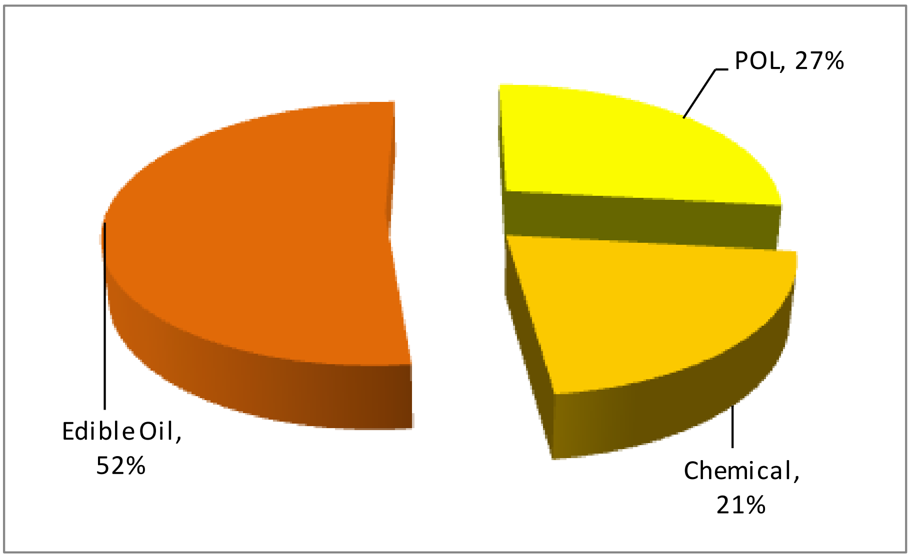



**Figure 4.1 Proportion of Liquid Cargo Handling at Oil Jetties**

It may be noted that the designated capacity may not be considered correct figure for analysing the demand supply gap for the augmentation and new port facility to be developed. There are some practical operational factors as mentioned in the following are responsible this:

- Time loss due to
  - Berthing, deberthing, custom checks, custom boarding, cargo sampling, etc.
  - Tidal restriction which may not allow ships to sail out even if the handling operations are over, keeping them waiting for next high tide.
- Low productivity due to small ship sizes, and thus lower pumping rates, of various liquid cargo categories

Analysis of the data for the existing oil jetties (**Table 4.3**) was carried out to assess the proportion of traffic of various oil commodities, the corresponding average parcel sizes and the pumping rates. On this basis, typical calculations have been carried out to assess the capacity of one liquid berth.

**Table 4.3 Berth Capacity Assessment for Oil Jetties**

| S. No. | Particulars | Unit | Oil Jetties within Creek | | |
|---|---|---|---|---|---|
| | | | POL | Chemicals | Edible Oil |
| 1. | Traffic | MTPA | 0.27 | 0.21 | 0.52 |
| 2. | Average Parcel size | T | 25,000 | 5,000 | 12,500 |
| 3. | No. of Ship Calls per Annum | No. | 11 | 42 | 42 |
| 4. | Handling Rate | TPD | 13,000 | 5,000 | 5,000 |
| 5. | Time Required at Port Per Ship | | | | |
| a. | Handling Time | Days | 1.92 | 1.00 | 2.50 |
| b. | Berthing / Deberthing & Miscellaneous Time | Days | 0.25 | 0.25 | 0.25 |
| | Total Time per Ship | Days | 2.17 | 1.25 | 2.75 |
| 6. | Berth Days Required | Days | 23 | 53 | 114 |
| | Total Berth days | Days | 190 | | |
| 7. | Berth Days Available per Berth | Days | 350 | | |
| 8. | Berth Occupancy | % | | | |
| | Number of Berths | | | | |
| | 1 | | 54% | | |
| 9. | **Capacity of Berths** | **70%** | **1.29** | | |

It may be noted that at 70% berth occupancy, the overall berth capacity for 6 oil jetties works out to 7.7 MTPA.

#### 4.3.1.2 Dry Cargo Berths

Berths 1 to 12, 13 and 15 handle cargo using ELL cranes /MHCr as well as ship gears combined with loaders and dumpers for evacuation. These 14 berths handle variety of cargoes of different characteristics and brought in ships in different parcel sizes.

The capacity of the berth handling multiple commodities is governed by the type of cargo handled, average parcel sizes and the possible handling rate that could be achieved for that particular cargo. Berth capacity calculations of a typical multipurpose terminal are shown in **Table 4.4** below:

**Table 4.4 Berth Capacity of a Typical Multipurpose Berth**

| S. No. | Particulars | Unit | ELL* | | Ship's Gear | |
|---|---|---|---|---|---|---|
| | | | Bulk | Break bulk | Bulk | Break bulk |
| 1. | Traffic | MTPA | 4.00 | 4.00 | 4.00 | 4.00 |
| 2. | Average Parcel size | T | 37,000 | 14,000 | 37,000 | 14,000 |
| 3. | No. of Ship Calls per Annum | No. | 108 | 286 | 108 | 286 |
| 4. | Handling Rate | TPD | 15,000** | 6,000 | 12,000 | 3,000 |
| 5. | Time Required at Port Per Ship | | | | | |
| a. | Handling Time | Days | 1.85 | 1.75 | 3.08 | 2.33 |
| b. | Berthing / Deberthing & Miscellaneous Time | Days | 0.25 | 0.25 | 0.25 | 0.25 |
| | Total Time per Ship | Days | 2.10 | 2.00 | 3.33 | 2.58 |
| 6. | Total Berth Days Required | Days | 227 | 571 | 360 | 738 |
| 7. | Berth Days Available per Berth | Days | 350 | 350 | 350 | 350 |
| 8. | Berth Occupancy | % | | | | |
| | Number of Berths | | | | | |
| | 1 | | 65% | 163% | 103% | 211% |
| | 2 | | 32% | 82% | 51% | 105% |
| 9. | **Capacity of Berths** | **70%** | **4.32** | **1.72** | **2.72** | **1.33** |

* Using MHCr cranes the corresponding handling rates could increase by about 30%.
** The value would reduce with reduction in vessel size and for export bulk cargo (where the handling rate is lower than import cargo)

As could be observed from above that capacity of multipurpose berth is affected significantly by the type of cargo handled at the berth and the equipment for ship handling. As the mix of cargo are being handled in all the multipurpose berths with higher proportion of bulk, the average capacity of each berth of all the 10 available multipurpose berths for the purpose of planning could be considered as about 1.75 MTPA.

# 5.0 DETAILS OF ONGOING DEVELOPMENTS

## 5.1 General

Kandla Port Trust has taken slew of mega developmental projects which are in various stages of implementation. The locations of these projects are shown below in **Figure 5.1** and **Figure 5.2** below. Some of them are listed below:


**Figure 5.1 Ongoing Developments -1**

### 5.1.1 Development of Oil Jetties and Bunkering Facility

Currently, there are 6 oil jetties handling liquid cargo at Old Kandla Port. In order to ease pressure on the existing liquid cargos berths / avoid the waiting of the vessels for the existing oil terminals and to cater additional liquid cargo, KPT has taken a slew of measures that include development of 7th Oil jetty at Kandla Port to handle general oil cargo.

Further, KPT has also signed concession agreement with Kandla Oil Terminal Private Limited for “Development of Oil Jetty to Handle Liquid and Ship Bunkering Terminal at Old Kandla on BOT Basis”. The proposed facility will be able to cater vessels of higher DWT. Commissioning of the proposed facilities shall augment the liquid cargo handling capacity of Kandla Port by 2 MTPA and 3.39 MTPA respectively.

### 5.1.2 Barge Berths at Bunder Basin

It is proposed to further upgrade the Bunder Basin area for barge handling. The jetty at Bunder Basin shall be used for unloading/loading of cargo from barges used to lighten/load the ships at Outer Tuna Buoy (OTB).

### 5.1.3 Mechanisation of Berth 5 to Handle Agri Products

KPT is planning to modernize the existing CJ 5 to facilitate exporters and traders for export of agricultural commodities especially cereals like wheat, rice, pulses and ground nuts etc.

### 5.1.4 Development of 14th and 16th Multipurpose Berth

KPT has taken various measures that include development of 14th and 16th dry cargo berths to handle multipurpose dry cargo other than liquid bulk and containers with a throughput of 2 MTPA and 1.57 MTPA respectively on BOT basis.

The License for development of CJ 14 was awarded to M/s. Grain Bulk Handlers on 20.10.12. Concession agreement signed with M/s Royal Maritime Handlers Pvt. Ltd. on 14.03.13. M/s. RMHPL could not fulfill the condition Precedents and accordingly, KPT terminated the existing concession agreement. Fresh RFP was issued in Dec. 2015 for the development of this berth on BOT basis.

### 5.1.5 Development of Container Terminal facility at Berth 11 & 12

KPT has awarded the concession for development, operation, management of Berth 11 & 12 for container handling to United Liner Agencies (ULA) on revenue share basis.

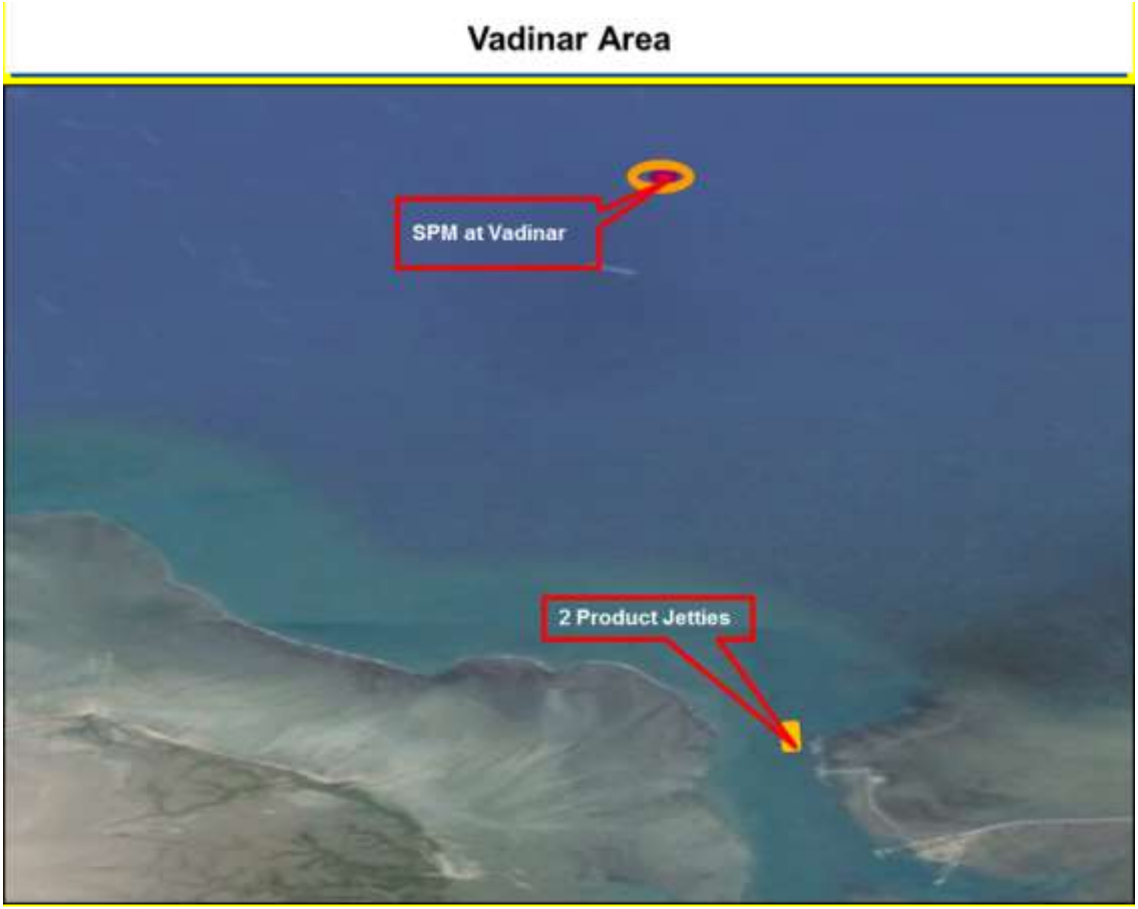



**Figure 5.2 Ongoing Developments – 2**

### 5.1.6 Development of Product Jetty at Vadinar

Vadinar Liquid Terminal Limited (VLTL) has been awarded the concession to develop Marine Liquid Terminal facilities at OOT, Vadinar on captive use basis. As part of the concession VLTL, is installing an SPM and developing 2 product jetty at Vadinar with a capacity of 24.5 MTPA for liquid product exports through its refineries.

# 5.2 Industrial Park

Kandla Port Trust intends to develop a Port based Industrial Park (in an area of 292 acres) to the east of railway line and north of KK road near village Kharirohar as shown in the **Figure 5.3** below. The units and industries operating inside the Industrial Park shall be procuring, producing and promoting industrial development while supporting the theme of **Make in India**.

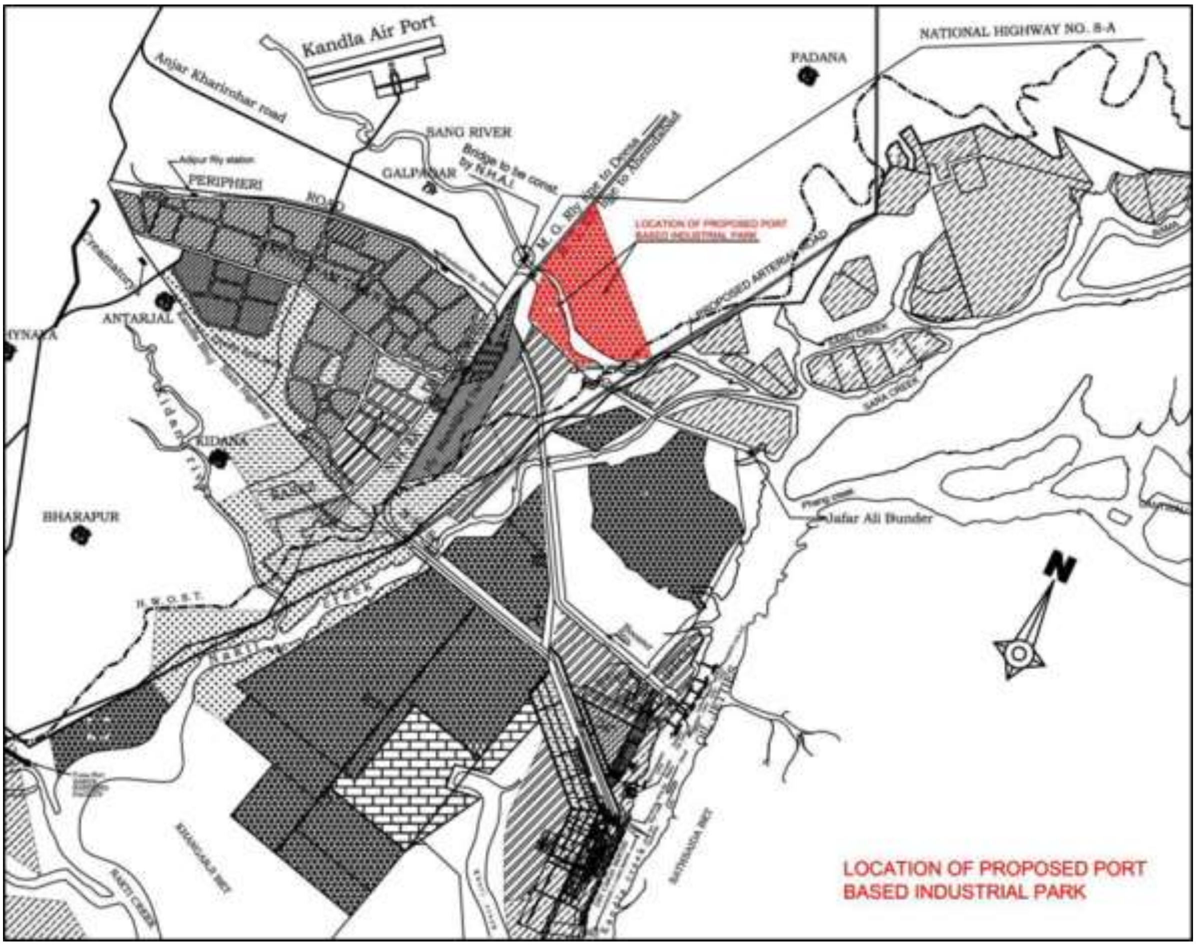



**Figure 5.3 Location of Proposed Port based Industrial Park**

The project shall be developed on PPP basis where KPT as the Developer of the Industrial Park shall provide the following:

- Get the land area developed with basic infrastructure like roads, water supply, electricity, drainage etc.
- Allocate the developed land on as is where is basis as per the requirement of entrepreneurs / Industrialist at applicable rates.

# 6.0 TRAFFIC PROJECTIONS

## 6.1 General

This section covers the traffic projections for the port of Kandla. In terms of volumes, Kandla is the largest major port in the country handling more than 90 MTPA of cargo (including the Kandla creek and Vadinar). Kandla is strategically located in the interior part of the northern coast of Gujarat placed perfectly to serve the North and Western hinterlands of the country like Rajasthan, Delhi-NCR, Punjab and Haryana.

Currently, the port handles large volumes of POL including ~54 MTPA at Vadinar. Other major commodities include thermal coal, fertilizers, food grains, salt and timber logs.

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 Mumbai up to 2035 has be derived as presented in this chapter.

## 6.2 Major Commodities and their Projections

### 6.2.1 POL

POL crude and product constitute the biggest portion of traffic handled including both Vadinar and Kandla creek. Kandla handles roughly 2 MTPA of POL while majority of the traffic is at Vadinar. At Vadinar ~40 MTPA of crude is imported for the close by refineries and then after processing roughly 15 MTPA of products are exported including coastal and EXIM. The key refineries served by the crude from Vadinar are IOCL Mathura, Koyali, Panipat, Essar Vadinar and BPCL Bina.

Going into the future due to expansion of these refineries will lead to traffic of roughly 60 MTPA by 2020, 74-76 MTPA by 2025 and 84-92 MTPA by 2035. Crude oil imports are expected to rise to ~51 MTPA considering refinery expansions. LPG imports are expected to increase with government's focus on distribution of LPG connections to rural households. By 2025, there is a potential to coastally ship ~ 5 MTPA of POL products from Kandla to Maharashtra as shown in **Figure 6.1**.


Figure 6.1 **Potential of Coastal Shipping from Kandla to Maharashtra**

The split of the current POL traffic and the estimated traffic in 2025 is shown in **Figure 6.2**.

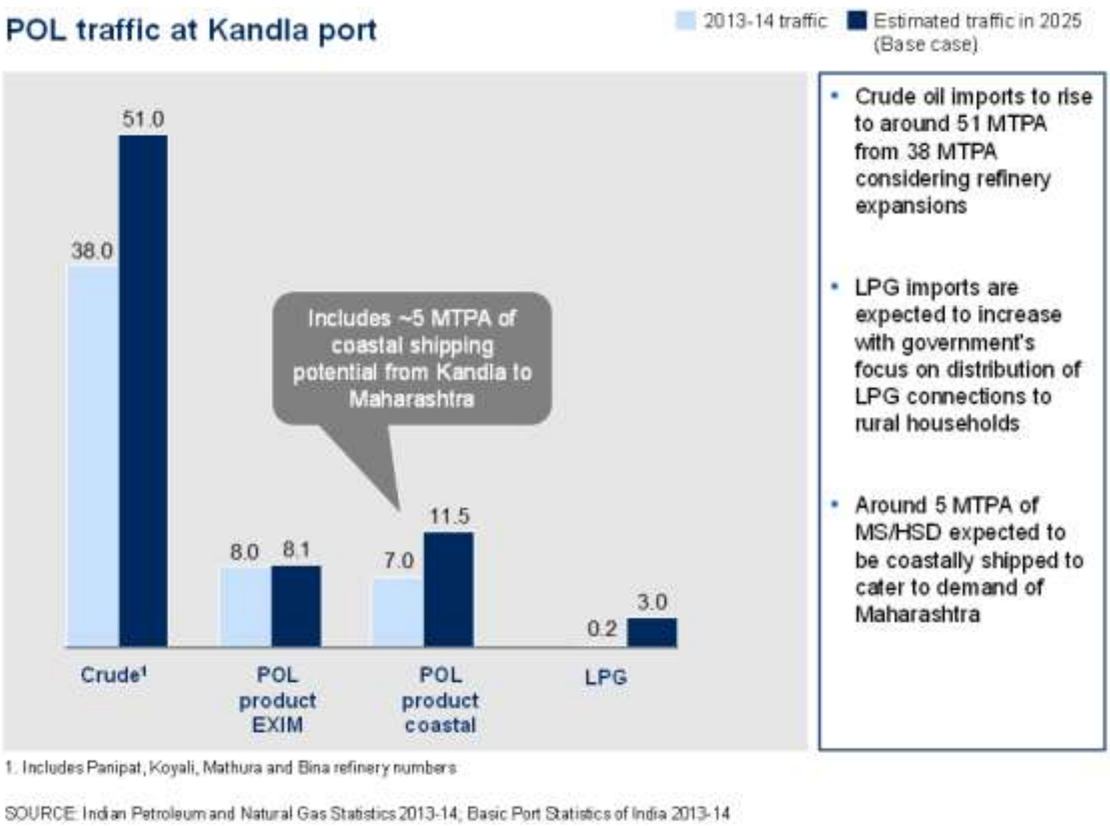



**Figure 6.2 POL Traffic at Kandla Port**

## 6.2.2 Thermal Coal

Currently the port imports 9.7 MTPA of thermal coal primarily for the consumption of non-power plants (>50% of the overall imports). This number is expected to grow at a healthy rate of 10-15% given the port already having developed a mega coal terminal at Tuna Tekra and further plans of expansion through a mega bulk terminal outside the creek. We project that going into 2020 the volumes handled by Kandla will be roughly around 18 MTPA, 23-25 MTPA by 2025 and 38-46 MTPA by 2035.

## 6.2.3 Fertilisers

The port primarily imports fertilizers to serve the Punjab, Haryana and UP hinterlands in the country as shown below. The port imported 4.5 MTPA of fertilizers in FY 15 out of which 0.66 MTPA was rock phosphate (used as a raw material for fertilizer plants), 2.71 is urea (finished fertilizer which is primarily government controlled) and 1.14 MTPA is DAP(finished fertilizers). Going into the future given the proposal of mechanization of 1/2 berths for the import of urea and availability of neem coating facilities with the port we expect the port to handle rough 6.1 MTPA of fertilizers by 2020, ~8 MTPA by 2025 and 11-13 MTPA by 2035.

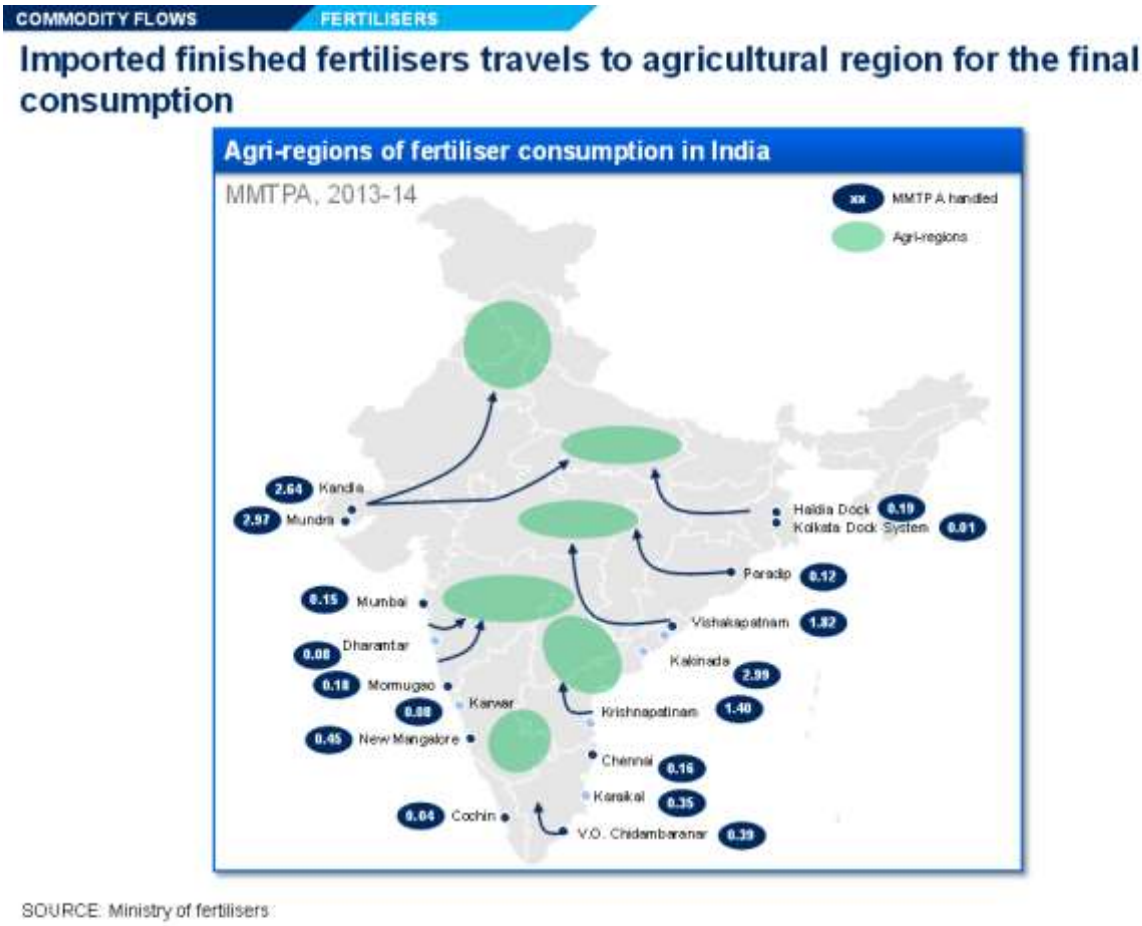



**Figure 6.3 Fertiliser Consumptions Centres in India**

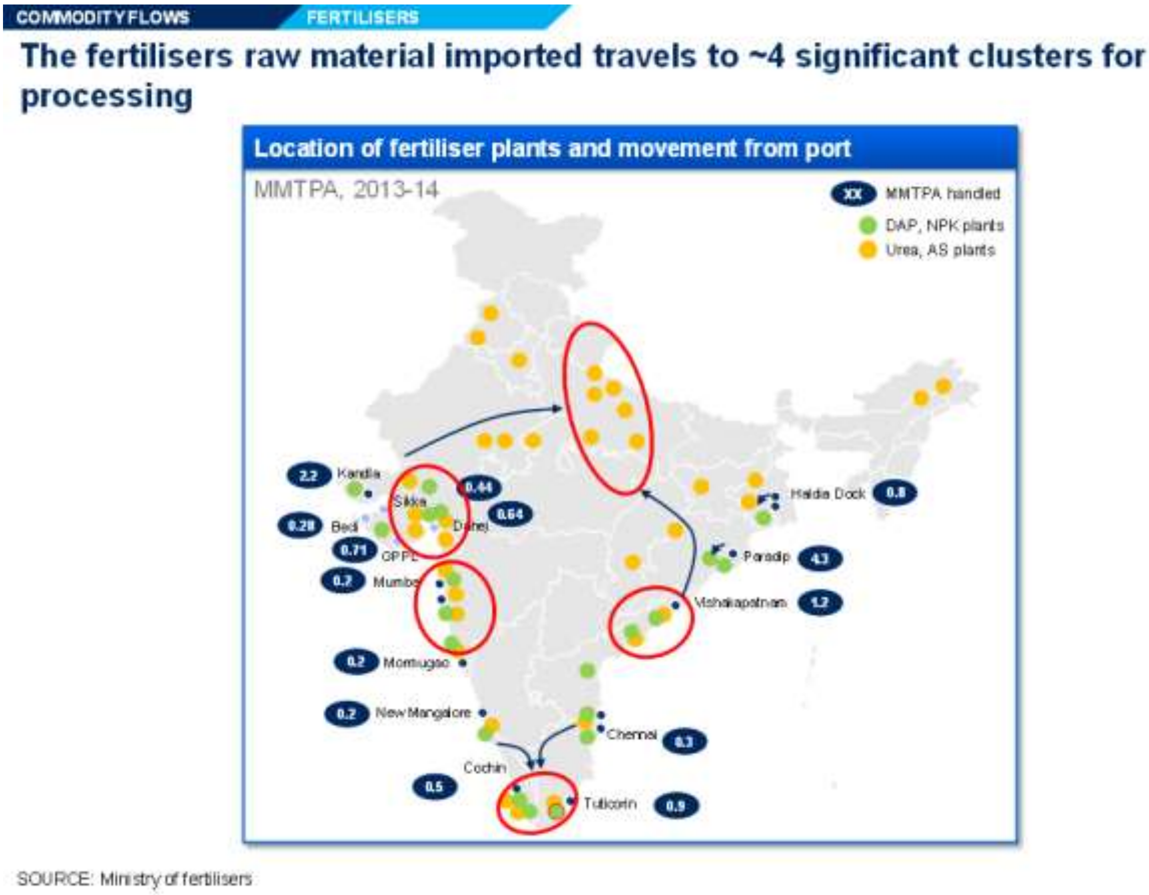



**Figure 6.4 Fertiliser Plants and movement of Fertiliser Raw Material from Port**

## 6.2.4 Food grains

Kandla is ideally placed to serve the northern hinterlands to export the key food grains. Primarily wheat and rice are exported from the port of Kandla; these grains are primarily grown in the north and central areas of the country (Punjab, Haryana and MP). In the past few years the exports have steadily declined from roughly 4 MTPA in FY 13 to 2.2 MTPA in FY 15. We expect these volumes to remain stagnant due to pulses and rice moving towards containerization.

## 6.2.5 Containers

Of the 2.5 MTEU produced in North Western region (NCR+ Punjab) ~50% of the same (1.3 MTEU) are handled by Mundra port at the moment due to an advantage of – turnaround time, call of mother line ships and strong connectivity. Kandla port has an approximate 60 km advantage over Mundra for container cargo coming from NCR + Punjab, thus in case of Kandla port being able to establish a container terminal with world class efficiency benchmarks (turnaround time, container clearance etc.) it could attract a sizeable market share from the Mundra port. The traffic projections of container handling are based on the premise of Kandla port being able to provide efficiency and have a strong port to hinterland connectivity.

### 6.2.6 Other Localized Commodities

Commodities like Salt and Sugar are produced in the nearby hinterlands of the port which are still one of major drivers of port volumes in the country. Roughly 3 MTPA of salt is exported from Kandla which will grow to roughly 5 MTPA by 2025 and 8-9 MTPA by 2035. Also 1.5 MTPA of sugar traffic is expected to grow to roughly 2.5-3 MTPA by 2025. The overall commodity wise projections for the port are shown below.

**Table 6.1 Traffic Forecast for Kandla Port**

Units: MMTPA (except Containers)

**Kandla 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 | 55.6 | 59.0 | 73.7 | 76.3 | 84.0 | 91.6 | ▪ Mainly Crude imports driven by IOCL expansion (Koyali, Panipat & Mathura) |
| Vegetable Oil | 3.6 | 4.8 | 6.5 | 6.8 | 10.7 | 12.2 | |
| Mixed chemical | 1.2 | 1.6 | 2.2 | 2.3 | 3.6 | 4.1 | |
| **Dry and Break Bulk Cargo** | | | | | | | |
| Thermal Coal (Loading) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Thermal Coal (Unloading) | 9.7 | 18.2 | 23.0 | 25.5 | 38.2 | 45.6 | |
| Coking Coal | 0.2 | 0.3 | 0.5 | 0.5 | 0.8 | 1.0 | |
| Iron Ore | 1.2 | 1.3 | 1.8 | 1.9 | 3.1 | 3.6 | ▪ Mostly imports |
| Steel | 1.1 | 1.6 | 2.1 | 2.3 | 3.8 | 4.4 | |
| Food grains | 2.3 | 2.3 | 2.5 | 2.5 | 3 | 3 | |
| Fertilizers | 4.5 | 6.1 | 7.7 | 8.1 | 11.6 | 12.9 | |
| Salt | 2.8 | 3.7 | 4.9 | 5.1 | 8.1 | 9.2 | |
| Sugar | 1.5 | 2.0 | 2.6 | 2.7 | 4.3 | 4.9 | |
| Timber log | 2.8 | 3.8 | 5.0 | 5.3 | 8.4 | 9.5 | |
| Gypsum | 0.4 | 0.5 | 0.7 | 0.7 | 1.1 | 1.3 | |
| **Containers and other Cargo** | | | | | | | |
| Containers (Mn TEU) | 0.00 | 0.1-0.6 | 0.2-0.6 | 1.2 | 0.6 | 3.0 | ▪ Base case relates to operation of existing container terminal, Optimistic case-operation of Tuna Tekra terminal |
| Others | 5.5 | 6.3 | 8.4 | 8.9 | 14.1 | 15.9 | ▪ Highly fragmented |
| **Total (MMTPA)** | **92.4** | **120.5** | **150.6** | **167** | **204** | **264** | |

Conversion Factor Used for Containers Projections: 1 TEU = 15 Tons

## 6.3 Coastal Shipping Potential

Kandla is strategically positioned to serve large areas in the hinterland of the country through coastal shipping. Coal, food grains and fertilizers can be major commodities to/from Kandla in case coastal shipping revolution takes place in the country.

- **Thermal coal:** There is a potential to coastally ship thermal coal from MCL to the plants of GSECL Gandhinagar, Reliance Power Thane and HPGCL Hisar. Ports of Paradip/Dharma will be the origin ports for this cargo and Kandla can act as a receiving port. The overall potential for coastal traffic has been identified to be ~6.3 MTPA by 2020 and ~12 MTPA by 2025. However, Kandla would have to complete with Alewadi, Navlakhi and Ahmedabad Terminal for this traffic.

COMMODITY TRAFFIC COAL

**~6.3 MTPA Coal can be coastally moved to Kandla Port via coastal shipping by 2020; GSECL and Reliance Power will be the key customers**


**Key plants with coastal shipping potential**

| Plant | Location | Volume Potential to shift to coastal (in MTPA) |
|---|---|---|
| GSECL | Gandhinagar | ~4.0 |
| Reliance Power | Thane | ~2.3 |

1 Considering linkage rationalization from Pakri Barwadih to Talcher does not happen

**Figure 6.5 Key Plants with Coastal Shipping Potential**

■ **Fertilizers:** ~1.3 MTPA of fertilizers can be coastally shipped to demand states of Maharashtra and Karnataka via Kandla port by 2025.

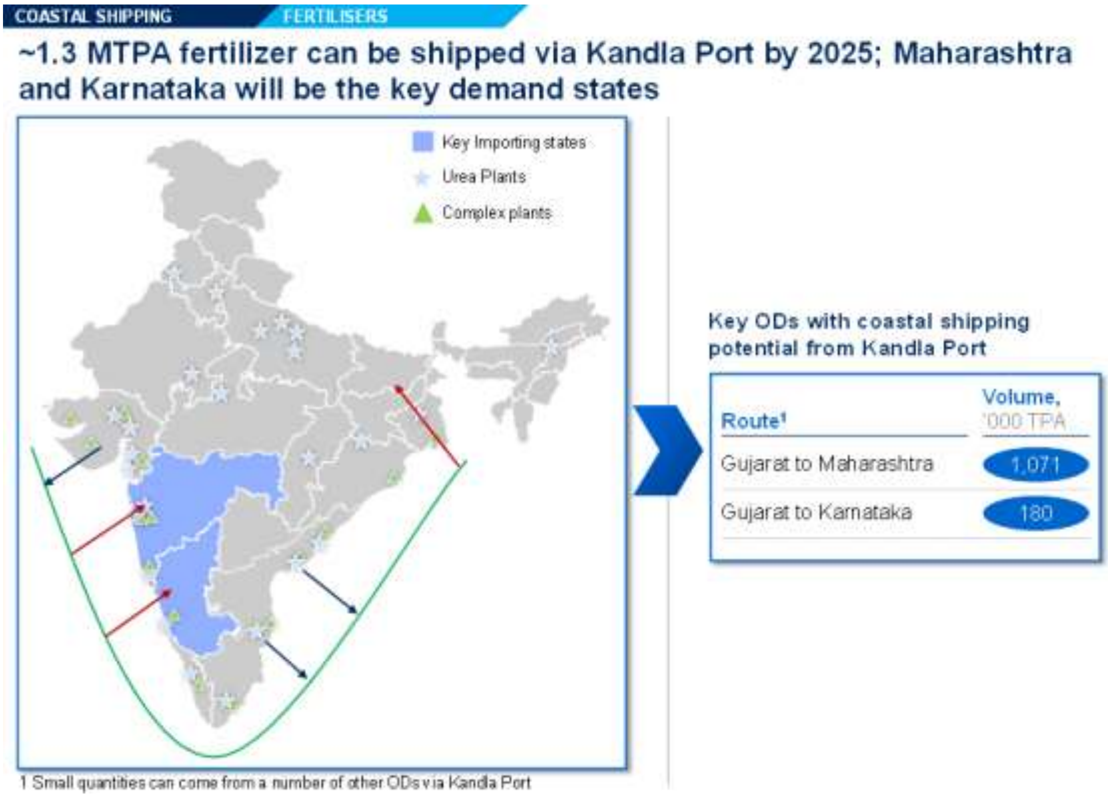



**Figure 6.6 Key ODs with Coastal Shipping Potential**

The table below summarizes the potential of coastal movement for key commodities.

**Table 6.2 New Opportunities Via Coastal Shipping**

**Kandla Port – New Opportunities Possible via Coastal Shipping**

Units: MMTPA (except Containers)

| Commodity | 2020 | 2025 | 2035 |
|---|---|---|---|
| Thermal Coal (Unloading) | 6.36 | 11.93 | 11.93 |
| Steel (Loading) | - | - | - |
| Steel (Unloading) | 0.44 | 0.59 | 1.05 |
| Cement (Loading) | 0.08 | 0.11 | 0.20 |
| Cement (Unloading) | 0.00 | 0.00 | 0.00 |
| Fertilizer (Loading) | 1.07 | 1.30 | 1.93 |
| Fertilizer (Unloading) | 0.01 | 0.02 | 0.02 |

- Additional Coastal shipping Potential if GSECL Gandhinagar, Reliance Power Thane adopt coastal shipping. Kandla would have to compete with Alewadi, Navlakhi and Ahmedabad Terminal

# 7.0 CAPACITY AUGMENTATION PROPOSALS

## 7.1 Current Port Capacity

The capacity of the existing berths has been worked out as presented in **Table 7.1** below:

**Table 7.1 Existing and Proposed Capacity of Berths**

| Location of Cargo Handling | Cargo Handled | I/E | Current Capacity (MTPA) |
|---|---|---|---|
| Liquid Bulk | | | 69.0 |
| • Oil Jetty 1-6 | POL | I/E | 12.0 |
| • Product Jetty 1-2 at Vadinar | POL | E | 14.5 |
| • SPM 1-3 | Crude | I | 42.5 |
| | | | |
| Break Bulk | | | 30.0 |
| • Berths 1,2,3,4,5,6,7-10 | Breakbulk | I/E | 18.0 |
| • Berths13,14,15,16 | Breakbulk | I/E | 8.0 |
| • Break bulk Terminal off Tekra | Breakbulk | I/E | 4.0 |
| Containers | | | 5.0 |
| • Berths 11,12 | Containers | E | 5.0 |
| Fertilizer | | | 1.5 |
| • IFFCO Barge Jetty | Fertiliser | I/E | 1.5 |
| Coal | | | 16.3 |
| • Barge Jetty at Bunder Basin | Coal | I/E | 1.5 |
| • Dry bulk Terminal off Tekra | Coal | I/E | 14.1 |
| **Total** | | | **121.1** |

## 7.2 Requirement for Capacity Expansion

Even though prima facie it appears that the overall capacity is slightly more than the overall traffic, there is shortfall on facilities for handling specific cargo. While comparing the existing capacities for the Kandla port with the traffic projections as shown in **Table 7.2**, it could be seen that in 2020 there would be a shortfall of capacity for dry cargo.

**Table 7.2 Requirement of Capacity Addition Over Master Plan Horizon**

| Commodity | Current Capacity | 2020 | | 2025 | | 2035 | |
|---|---|---|---|---|---|---|---|
| | | Forecast Traffic (MTPA) | Capacity Augmentation over current (MTPA) | Forecast Traffic (MTPA) | Capacity Augmentation over current (MTPA) | Forecast Traffic (MTPA) | Capacity Augmentation over current (MTPA) |
| **Liquid Bulk*** | **69** | 65.4 | 0.0 | 82.4 | 13.4 | 98.3 | 29.3 |
| **Break Bulk** | **30** | 21.5 | 0.0 | 28.0 | 0.0 | 45.9 | 15.9 |
| **Containers** | **5** | 9.0 | 4.0 | 9.0 | 4.0 | 9.0 | 4.0 |
| **Fertilisers** | **1.5** | 6.1 | 4.6 | 7.7 | 6.2 | 11.6 | 10.1 |
| **Coal** | **15.6** | 18.5 | 2.9 | 23.5 | 7.9 | 39.0 | 23.4 |
| **Total** | **121.1** | **120.5** | **11.5** | **150.6** | **31.5** | **204** | **82.7** |

* mainly crude imports at Vadinar

It is therefore necessary that action be initiated immediately for the capacity augmentation for handling fertiliser so that the projected throughput for year 2020 and beyond could be handled at port efficiently. This can be taken up by mechanising existing multipurpose berths within the creek.

AECOM has identified the following projects which could be initiated in different phases of development to enhance the port capacity:

- Mechanized Fertiliser Import Terminal at Berth 6
- Mechanized Food grains Export Terminal at Berth 2
- Mechanization of Barge Handling at Bunder Basin
- Development of Ro-Ro Terminal at Berth 1

The details of these projects are discussed in sections below.

## 7.3 Mechanised Fertiliser Import Terminal at Berth 6

### 7.3.1 Background

India has serious raw material constraints in producing fertilizers required for the country. While India is somewhat self-supporting in Urea production, it is perpetually dependent on import of phosphoric fertilizers to a large extent and 100% dependent on import for Potash. Additionally, the country also imports Urea to bridge the gap between indigenous production and actual requirement which varies year to year.

Kandla port's geographical position makes it unique to handle such imports required for the large agrarian economy of north and north-west part of country which actually produces all most all the wheat required for the country.

While Kandla already handles fertilizers to a substantial extent, off-late Mundra port located very close to Kandla has developed capabilities to handle fertilizer imports with better facilities by way of semi mechanization of bulk imports, bagging and evacuation.

### 7.3.2 Opportunities

During 2014-15 Kandla port has imported 3.66 MT of Fertilizers all in bulk as detailed below:

**Table 7.3 Fertilizers Imports handled during 2014-15**

| Commodity | Quantity (T) | No of Vessels | Max Vessel DWT (T) | Min Vessel DWT (T) | Max Parcel size (T) | Min Parcel Size (T) | Average Parcel Size (T) |
|---|---|---|---|---|---|---|---|
| **Fertilizers (Alone without FRM - Dry and Ammonium Sulphate** | 3,657,686 | 96 | 82,153 | 22,019 | 66,000 | 6,750 | 38,100 |

In order to meet the requirements of southern part of the country which are routed through Kandla port through rail, there is a huge potential of coastal movement and decongest the fertiliser movement through railway.

### 7.3.3 Need for Mechanisation

The traffic potential of fertilizer imports both raw and finished through Kandla has already been assessed. Based on the traffic forecast, Kandla which is currently handling 4.5 MTPA has a potential to attract traffic of over 12 MTPA by 2035. Therefore there is a need to develop mechanized fertilizer handling facilities to ensure cleaner and faster operations with reduce manual intervention to benefit the trade.

The mechanised system for handling fertilizers comprises of the following main components:

1. Unloaders at Berth
2. Connected conveyor system
3. Transit storage of Bulk material in a covered shed

4. Equipment for reclaiming the material at bulk shed and transfer to bagging shed
5. Bagging shed with Bagging and Stitching Machines
6. Covered platform for storing the bags and loading onto wagons

### 7.3.4 Details of the Facility

A fully mechanized Fertilizer import terminal can be installed on a dedicated berth. The material unloaded at berth would need to be conveyed to a bulk shed for storage. From the bulk shed the material shall be reclaimed and conveyed to a bagging shed, where bagging and stitching machines shall be installed. The bagged material shall be stored at a platform provided at ground level of the bagging shed, from where it shall be loaded to the rail lines provided along either side of the shed.

The proposed system aims at speedy operation with minimum manual intervention apart from ensuring clean environment at the port as well as for the operating personnel.

### 7.3.5 Suitable Berth for Fertilizer Handling

As CJ 1 to 6 have draft to cater the design ship size (handymax vessels) for fertiliser, it is suggested that CJ 6 be utilised for mechanisation of fertilizer terminal. The overall layout of the terminal considering CJ 6 as a suitable one is presented in **Figure 7.1**.

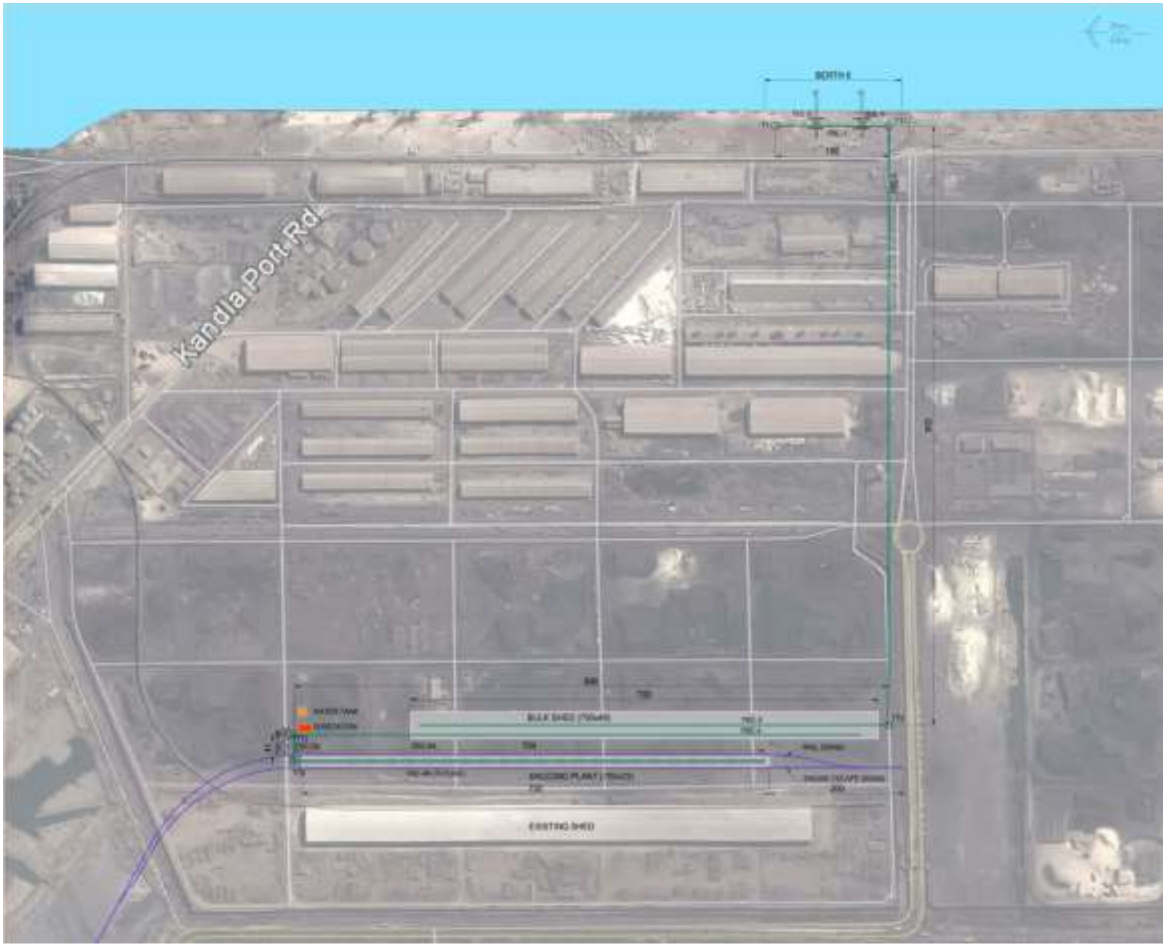



**Figure 7.1** Layout of Mechanised Fertiliser Terminal

### 7.3.6 Storage Area for Bulk Fertilizer

The material received from berth in bulk shall be stacked in a covered storage shed through an elevated tripper conveyor. It is proposed to provide a total storage capacity of 125,000 T at the bulk shed of 45 m width and 700 m length.

### 7.3.7 Bagging and Evacuation Requirements

The bulk material stored in the bulk shed will need to be transferred to the bagging shed for bagging and stitching. For this purpose it is proposed to deploy a portal type scraper reclaimer at the bulk shed. This equipment shall reclaim the material from the relevant stockpile and transfer it to the connected conveyor system. From conveyor the material shall be taken to the top of the bagging shed, where a series of hoppers shall be provided along its length. The material shall be dropped to the main hopper one by one using the plough feeders.

There shall be an intermediate floor in the bagging shed for the bagging and stitching of the fertilizers from where the bags shall be transferred to the platform level through chute. A total of 22 bagging machine shall be provided in the shed along its length i.e. each covering 2 wagons. The bagging machines are proposed to be semiautomatic type with design capacity of 700 bags per hour each. With this system it would take about 4 hours to bag the material for loading to one rake.

### 7.3.8 Capacity of Various Components of Mechanised Handling System

The effectiveness of a fertilizer import terminal lies as much in efficient evacuation as ship unloading. An efficient layout with relative positions of transit storage, bagging area and wagon loading platforms decides the efficacy of the whole system.

1. It is proposed to deploy two grab type unloaders with integrated hoppers. Each grab unloader shall have design unloading capacity of 1,000 TPH. This would provide an average unloading rate of 25,000 tonnes per day through a ship. The connected conveyor system including the tripper at shed shall also have design capacity of 2,000 TPH. With the proposed mechanised system at the berth, the possible annual capacity of the berth works out to 4.55 MTPA.
2. The bulk shed has been planned to provide a storage capacity of 125,000 T and thus this can also support the berth capacity of 4.55 MTPA assuming the dwell time of 10 days.
3. 22 semi-automatic bagging machines shall be provided each with a design capacity of 700 bags per hour and thus shall provide annual bagging capacity of 2.7 MTPA.
4. To match the design capacity of bagging in the bagging shed it is proposed to have the design capacity of scraper-reclaimer as well as reclaiming conveyor as 700 TPH.
5. It is assessed that initially one number of loading siding shall be provided along with an engine escape line, which shall be on the other side of the shed. Considering the turnaround time of each rake to be around 5 hours (from exchange yard), the annual capacity of one rake loading siding works out to 2.7 MTPA, which also matches with the bagging capacity of the system. Once the facility is expanded, one more siding shall be provided so that loading of rakes could be carried out simultaneously on either side of the shed.

6. During the later stages of development one more set of 22 semiautomatic bagging machines along with an additional rail loading line shall be provide the improve the capacity of the system from 2.7 MTPA to 4.55 MTPA.

### 7.3.9 Cost Estimates

The capital cost for mechanised fertiliser handling works out to INR 235 cr. The annual operation and maintenance costs of the facilities work out to INR 30 cr.

The implementation of the mechanised terminal development is likely to take about 24 months from the date of start of construction.

## 7.4 Mechanized Food Grain Export Terminal at Berth 2

### 7.4.1 Background

India is surplus in production of food grains and more particularly Rice, Wheat and Maize. This affords an opportunity for exports which has been taking place for many years now mostly through the ports of Mundra through containers and Kandla as bulk on the west coast. The countries that import Indian food grains include Gulf countries, Iran, Afghanistan, African countries for which Kandla's location is most favourable.

The only way that Kandla can be back into reckoning is by offering speedy and efficient systems to export which is possible by installing latest mechanization for transit storage and ship loading facilities.

In addition to the export of food grains to other countries, India has a huge potential to ship food grains in the domestic market through the coastal route, food grains like wheat and rice are primarily grown in the northern (Punjab and Haryana) and central (Madhya Pradesh and Chhattisgarh) parts of the country. There is a huge requirement of these food grains in the southern parts of the country, currently all the movement takes place through rail. If an efficient methodology is put in place to handle the food grains at ports like Kandla a potential saving ranging INR 600-1000 can be realised per ton of food grains transported on these routes as shown in **Figure 7.2**.

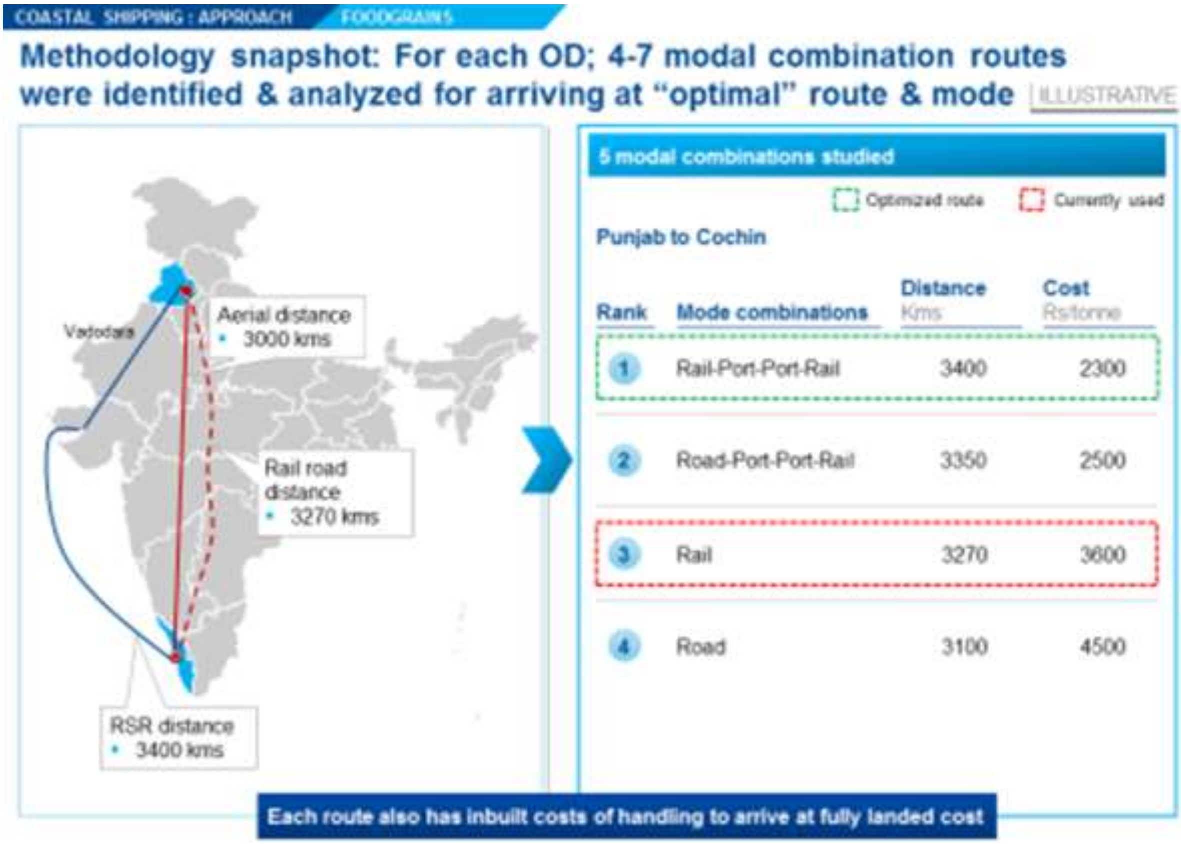



**Figure 7.2 Modality Analysis of Cargo Shipment**

## 7.4.2 Opportunities

During 2014-15 Kandla port has exported 2.28 MT of food grains both in break bulk and dry bulk as detailed below:

**Table 7.4 Food Grains Handled During 2014-15**

| Commodity Type | Quantity (T) | No. of Vessels | Max. Vessel (DWT) | Min. Vessel (DWT) | Max. Parcel size (T) | Min. Parcel Size (T) | Average Parcel Size (T) |
|---|---|---|---|---|---|---|---|
| Food Grains Dry Bulk | 19,46,205 | 62 | 73,127 | 9,650 | 52,192 | 8,805 | 31,390 |
| Food Grains Break Bulk | 3,39,801 | 25 | 38,888 | 6,568 | 32,602 | 2,750 | 13,592 |

It is seen that all the food grains as above are for foreign exports. Additionally, the port has exported another 1.75 MT of Agri-products (in the form of Oil cakes) all in dry bulk.

Based on traffic flows on railways in the current system, the overall potential of coastal movement of food grains in the system is 8-10 MTPA (**Figure 7.3**) and out of this the North Gujarat ports have a potential to export nearly 4 MTPA, in addition if a strong south Gujarat port doesn't come up in the near future, nearly 70% of the potential of the South Gujarat ports can be taken up by the North Gujarat ports (**Figure 7.4**).

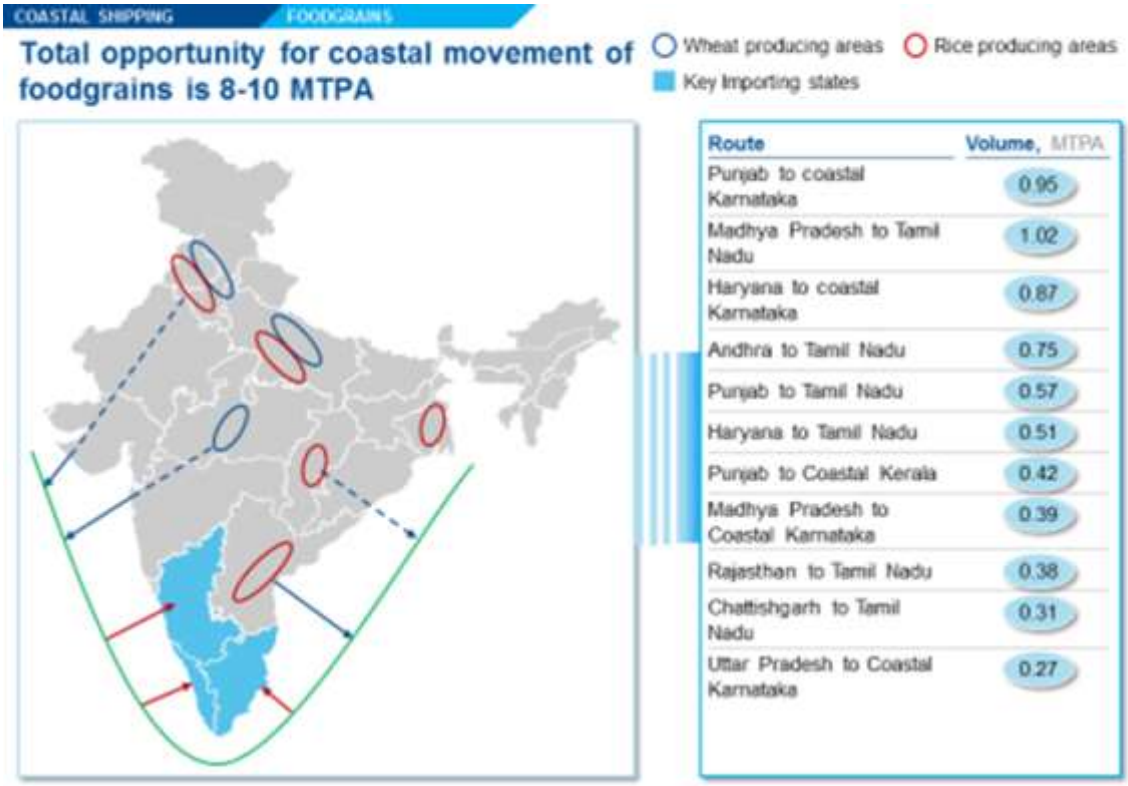



**Figure 7.3 Opportunity for Coastal Movement of Foodgrains**

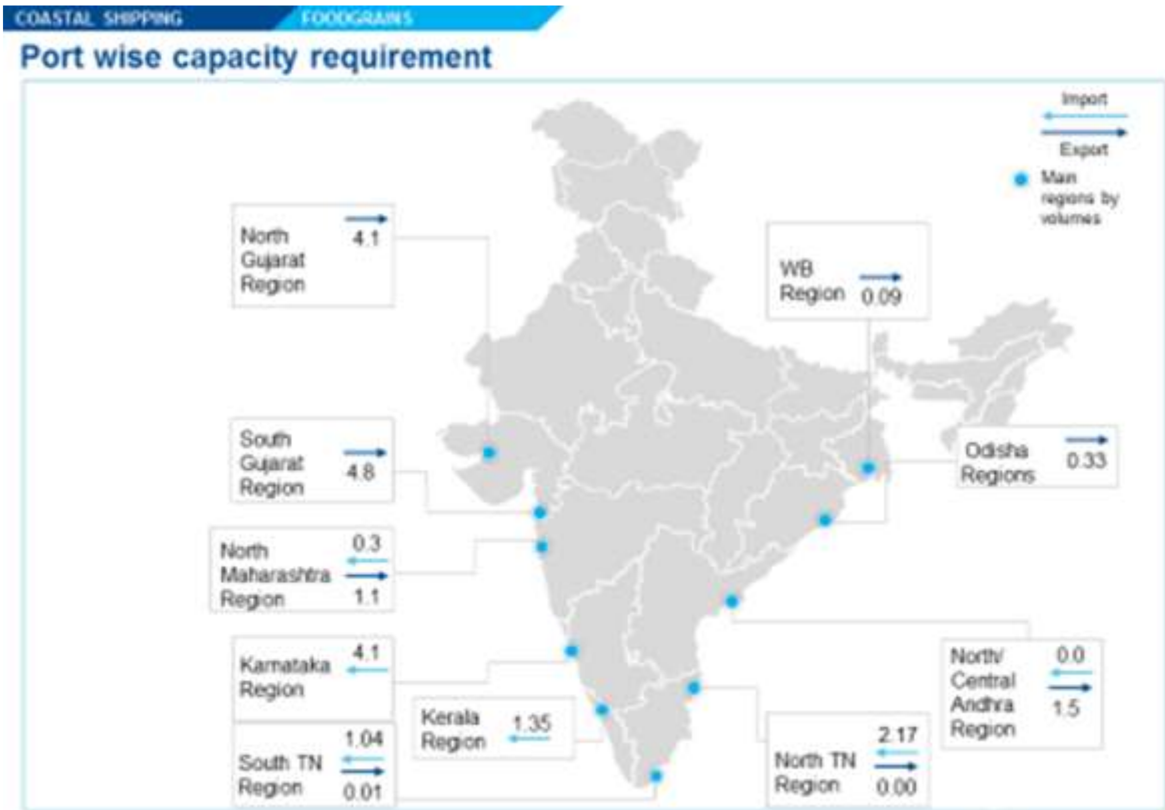



**Figure 7.4 Portwise Capacity Requirements**

### 7.4.3 Need for Mechanisation

The potential for export of Food grains through Kandla port has been assessed as about 2.5 MTPA in year 2025 and that 3 MTPA in year 2035. The mechanisation of the food grain export facilities would ensure speedy and clean operations, which might enable attracting more traffic.

### 7.4.4 Berth Suitability

Currently, food grains are being handled between CJ 1 to 12 based on the availability. However, considering the cargo complexion being handled at Kandla, it is necessary to identify the suitable dedicated berth to handle food grains. Studies were carried out to assess the suitability of mechanising CJ 5/ CJ 2. Based on the discussions and feedback from the port, it was decided to mechanise CJ 2 instead of CJ 5.

The overall layout of the terminal considering the CJ 2 being a suitable one is presented in **Figure 7.5**. CJ 2 is most suitable because it is already a clean cargo berth which can be directly accessed by a full rake length warehouse (warehouse 34) through a straight conveyor system. Further details of the rationale are given as below:

- Parcel size and draft related issues – CJ 2 and 3 handled the maximum number of food grain ships in the current system also, the berth has enough draft to handle all the current and the future projected ships for food grains.
- Clean cargo handling possibility on CJ 2 – CJ 1-4 are clean cargo berths where commodities like coal and fertilizers are not handled, hence CJ 2 will also be far away from all other polluting commodities which are handled on CJ 8-10. This will ensure that the customers are assured of clean handling of food grains in Kandla.
- Direct conveyor access to full rake length warehouses – CJ 2 can be connected to full rake length warehouse with a straight conveyor system without need any turning stations in the system, saving much needed space and capital expenditure. The only small modification that needs to be undertaken is the removal of warehouse by 30 m length in order for the conveyor to be able to pass through
- Berth Strength – Even though slight old, this berth has the same load strength (3.3 T/m2) as the other CJ 1 to 9

### 7.4.5 Facility Requirement

Based on the above, the assessment of capacity for the proposed facility has been carried out as indicated in **Table 7.5**.

**Table 7.5 Capacity Assessment Details for Mechanised Handling of Food grains**

| S. No. | Particulars | Unit | |
|---|---|---|---|
| 1. | Traffic for period | MTPA | 3.10 |
| 2. | Average Parcel size | T | 10,000 |
| 3. | No. of Ship Calls per Annum | No. | 310 |
| 4. | Handling Rate | TPD | 20,000 |
| 5. | Time Required at Port Per Ship | | |
| a. | Handling Time | Days | 0.50 |
| b. | Berthing / Deberthing & Miscellaneous Time | Days | 0.25 |
| | Total Time per Ship | Days | 0.75 |
| 6. | Total Berth Days Required | Days | 233 |
| | | | |
| 7. | Berth Days Available per Berth | Days | 350 |
| | | | |
| 8. | Berth Occupancy | % | |
| | Number of Berths | | |
| | 1 | | 66% |
| | 2 | | 33% |
| 9. | **Number of Berths Required** | | **1** |
| 10. | **Berth Capacity (@70% occupancy)** | **MTPA** | **3.26** |

### 7.4.6 Terminal Details

It is proposed that initially a fully mechanized and integrated food grain export terminal be installed in a dedicated CJ 2 (**Figure 7.5**). It will be mainly for export of Wheat, Maize and Soya bean. As all these cargoes are compatible with each other, a single system can be used for handling them one after the other albeit thorough pneumatic cleaning. It will not be possible to handle rice (in the form of break bulk) through this terminal.

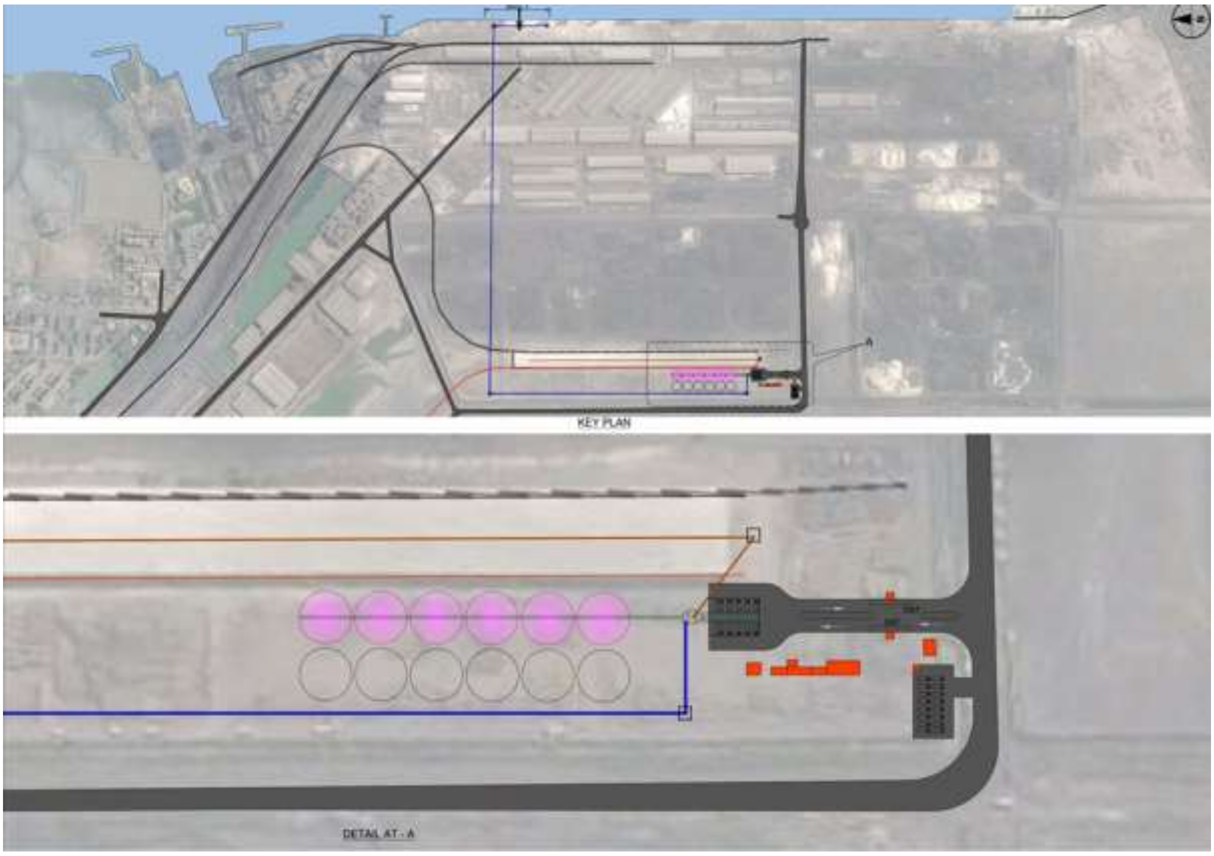



**Figure 7.5 Terminal Layout for Mechncaised Food grain Handling Facility**

### 7.4.6.1 *Receipt of Food Grains from Hinterland*

The food grains typically received in bags through a full rake of covered wagons. Each rake of covered wagons consists of 40 wagons of BCNA type each having a payload of about 56 T with a rake length of about 600 m. The rake will be positioned alongside the rake unloading cum bag storage shed. The shed will have unloading platforms on either side along its length. The bags will be unloaded from the wagons manually onto the unloading platform and carried in pallets by forklift trucks into the shed.

In this connection, it is pertinent to note that the port already has a shed with raised service platform capable of accommodating a full rake. This shed has railway siding with raised platform on one side. In order to simultaneously unload 2 rakes another similar railway line can be laid on the other side of the shed. This will enable the existing facility to be used effectively. The rail line is proposed to be connected from the new rail line alignment which is passing along the port boundary wall as part of internal rail connectivity augmentation

### 7.4.6.2 *Conversion from Bags to Bulk*

The bags thus received in the rail wagon unloading shed will be taken into grain hoppers where they are debagged manually and fed into the ground hopper. This process of debagging may take place either immediately or after some lapse of time, depending upon the shipping schedule and availability of space in the final storage facility. From the bottom of this ground hopper the grain passes through a conveying system and undergoes a process of cleaning for removal of dust and other foreign materials so that only clean grain fit for export will be conveyed into the storage facility before shipment.

#### 7.4.6.3 ***Transit Storage***

The transit storage for export of food grains shall be of steel silos which being a vertical storage arrangement, will occupy least space and the food grains are fully protected from outside atmosphere.

It is proposed to have 6 silos each with a holding capacity of 12,500 T.  This will enable adequate capacity to load the largest parcel size of vessel which was about 52,192 T during 2014-15.

Each silo of this size will be typically of about 32 m dia. and about 16 m height.

#### 7.4.6.4 ***Grain Loading***

The grain in the transit storage in silos will be evacuated from the bottom of silos through a closed conveying system onto a dockside conveyor running parallel to the berth which in turn will transfer the same to the grain loader specially designed for the purpose.

A fully mechanized and automated terminal for loading food grains in Kandla will typically have a capacity of about 1,500 TPH. It is pertinent to note that the food grains being a seasonal cargo about 75% of the annual capacity has to be handled in about 6 to 7 months with the balance handled in remaining months with a month set apart for intensive annual maintenance.

The rate of loading of food grains into the ship will be about 20,000 TPD with a single loader of this capacity. This will enable handling food grains of 2.5 MTPA in a single berth with berth occupancy of about 65%.

### 7.4.7 Cost Estimates

The capital cost for mechanised food grain handling works out to INR 155 cr. The annual operation and maintenance costs of the facilities work out to INR 14 cr.

The implementation of the mechanised terminal development is likely to take about 24 months from the date of start of construction.

# 7.5 Mechanisation of Barge Berths at Bunder Basin

## 7.5.1 Requirement of Mechanisation

The jetty at Bunder Basin is planned for unloading/loading of cargo from barges used to lighten/load the ships at Outer Tuna Buoy (OTB). It is proposed to further upgrade the Bunder Basin area for barge handling through mechanisation for quick turnaround of barges. This would have the following benefits:

- Reduction in the number of barges needed to support the transloading operations
- Reduction in the number of dumpers needed to transfer the material from basin berths to the rail sidings.
- Cleaner operations
- Increase in the berth capacity

The proposed arrangement of mechanisation of the barge berths at bunder basin is as shown in **Figure 7.6**.

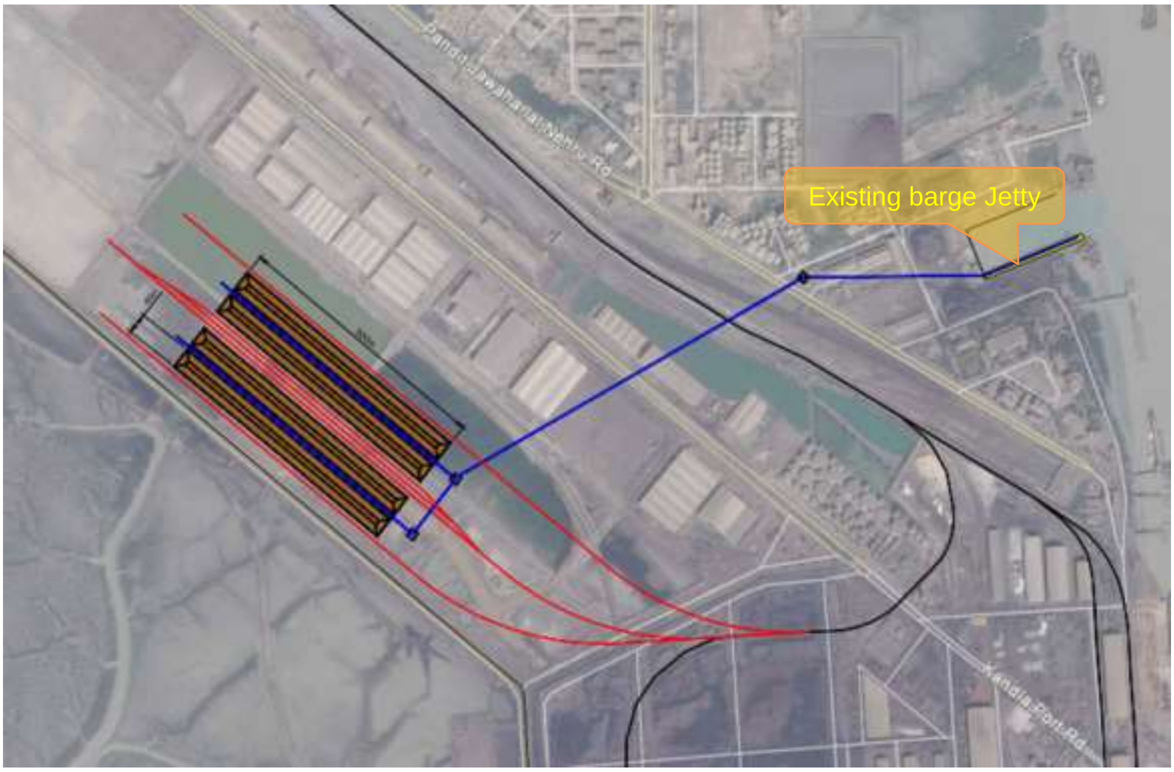



**Figure 7.6 Mechanised Handling of Barge Berths at Bunder Basin**

The mechanisation could be undertaken in phases with initial phase being the discharge of material into the yard to a conical stockpile from where it would be spread to the yard using dumper and front end loaders. Subsequently with increase in throughput trippers could be provided.

### 7.5.2 Salient Features of Mechanisation of Barge Berths

The mechanised system for barge handling comprises of the following main components:

1. Barge unloaders with associated movable hopper
2. Connected conveyor system to the stackyard where the material is stacked using elevated tripper
3. Transit storage area
4. Taking off additional spur rail lines to the proposed stackyard

**Figure 7.7 Typical Barge Unloading Equipment**

### 7.5.3 Issues to be Addressed

However, this proposal is subject to the following issues which would need to be addressed at the implementation stage:

- Continuing of the transloading operations at the anchorage vis a vis direct berthing at the bulk jetty at Tuna Tekra.
- Availablity of land porposed for storage of coal before loading to wagons
- An aggregator who would handle substantial quantity of coal, instead of many small traders bring in small quantities as at present
- Improvement in charter rates of ships requiring faster turnaround time, which would support mechanisation for faster turnaround time of barges as well.

In view of the above it is suggested that the proposed development be taken up during later phases of development.

# 7.6 Development of Ro-Ro Terminal

It is proposed to develop a Ro-Ro facility at Berth 1 for which a ~20,000 sqm of land has been identified by the port (Error! Reference source not found.Error! Reference source not found.). Also leading car nufactures i.e. Ford and Maruti have also shown interest in the project. Initially the facilities would be develop to handle 50,000 to 1,00,000 cars per annum which shall ultimately increase to 2.5 to 3.0 lacs per annum.

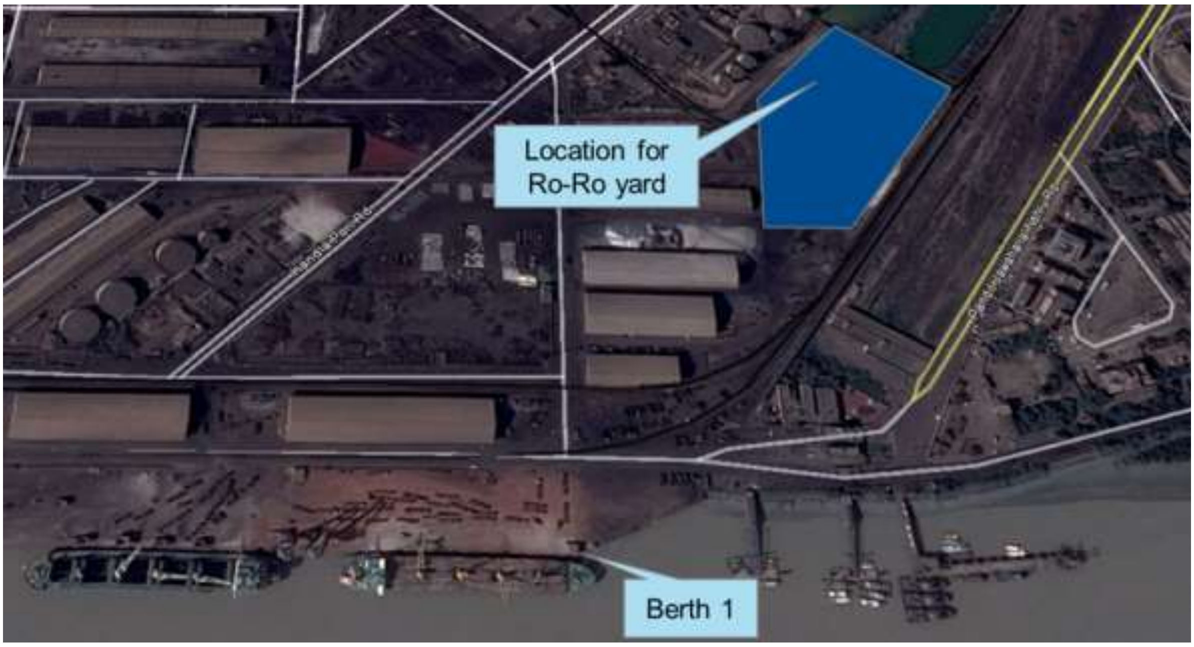



**Figure 7.8 Location for Ro-Ro Facility**

As the operations of Ro/Ro terminals varies depending on the types of Ro/Ro ships, i.e. ships for vehicles only, vehicles and cargo, or vehicles and passenger. The dimensions of required facilities for vehicles carriers including yards should be determined in consideration of the purpose of the terminal (e.g. for exporting only, exporting & importing, tranship, etc.), the size of targeted calling ships, calling frequency and calling order in the service loop.

Accordingly capacity for car handling is assessed at ~1,53,000 car units per annum.

Initially the yard is sufficient to cater ~150,000 units cars however there is a need to identify additional land area / multi-level car parking in order to cater 2.5 to 3 lacs car units as projected by the port. Additionally, the port has to ensure to provide clean berth for loading.

# 8.0 PORT EXTERNAL CONNECTIVITY AND INFRASTRUCTURE

## 8.1 External Rail Connectivity

The evacuation of cargo through the port is predominantly by road. However, some portion of cargo is handled by rails as well. Currently, the port handles 9 rakes per day. In view of the ongoing expansions and also enhance the rail capacity western railway has already taken the steps of doubling the rail lines at various stretches.

The Kandla to Gandhidham which is a double line has the capacity of 18 rakes/day/line. The stretch between Gandhidham and Samakhiyali which is a double line has been upgrade by providing an Intermediate block signalling station by which the capacity of this stretch is 58 rakes/ day (24 rakes each way). Further developments are depicted in the **Figure 8.1** below.

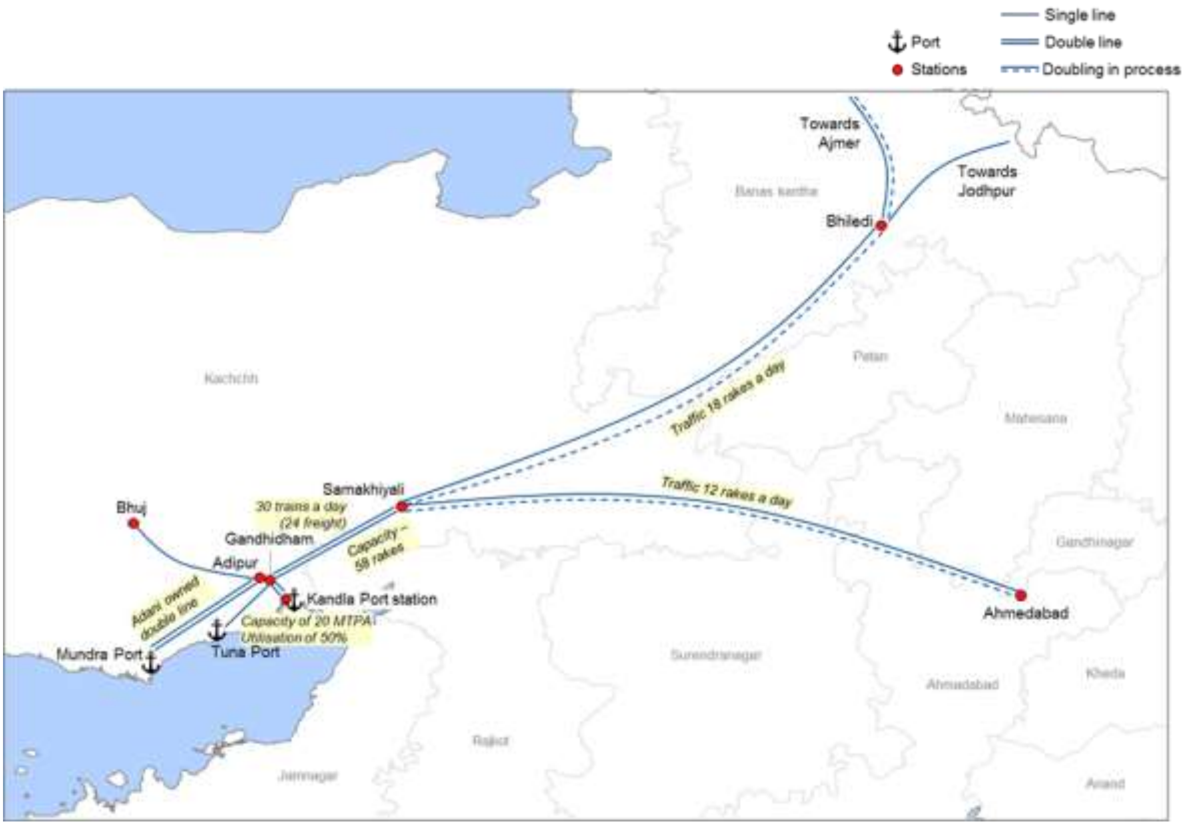



**Figure 8.1 Current Rail Connectivity and Ongoing Improvements**

# 8.2 Internal Rail Network

## 8.2.1 General

A multimodal system, which uses the most efficient modes of transport from origin to destination, is a prerequisite for the smooth functioning of any port. With the growth of cargo in the ports, the Government has laid emphasis on capacity expansion and improvement in infrastructure of the ports for handling these growing volumes of cargo. Unless matched with connectivity infrastructure, the increased cargo would result in congestion and undermine the competitiveness of Indian industry and also affect the economy at large.

Unlike international ports like Singapore and Rotterdam, the shortage of storage space in the major ports in India had further compounded the problem of speedy evacuation of cargo from port premises.

In the major ports, liquid cargoes directly move to the storage tanks of the users, bulk cargo move to the stackyards within the ports and from there to the users' points. Containers are initially stored in container yards within the port or moved to Container Freight Stations (CFS) and from there to the users' points. In a few cases, containers directly moved from the ship-shore interfaces to the user areas.

## 8.2.2 Internal Rail Connectivity

In view of the significance of port connectivity for efficient evacuation of cargo from the ports and its impact on international trade, a Special Purpose Vehicle (SPV) – The Indian Port Rail Corporation (IPRC) is incorporated under the Companies Act 2013, under the administrative control of the Ministry of Shipping, Government of India in order to execute the last mile connectivity rail connectivity and internal rail projects of the Major Ports more effectively and efficiently.

The SPV has already taken up the task of preparing the DPR for providing rail connectivity to CJ 13, 14, 15 & 16 from take-off point to west end of berth apart from modernization and upgradation of existing rail network within cargo jetty area.

The internal rail network for the proposed expansion of port is as shown in the **Figure 8.2**.

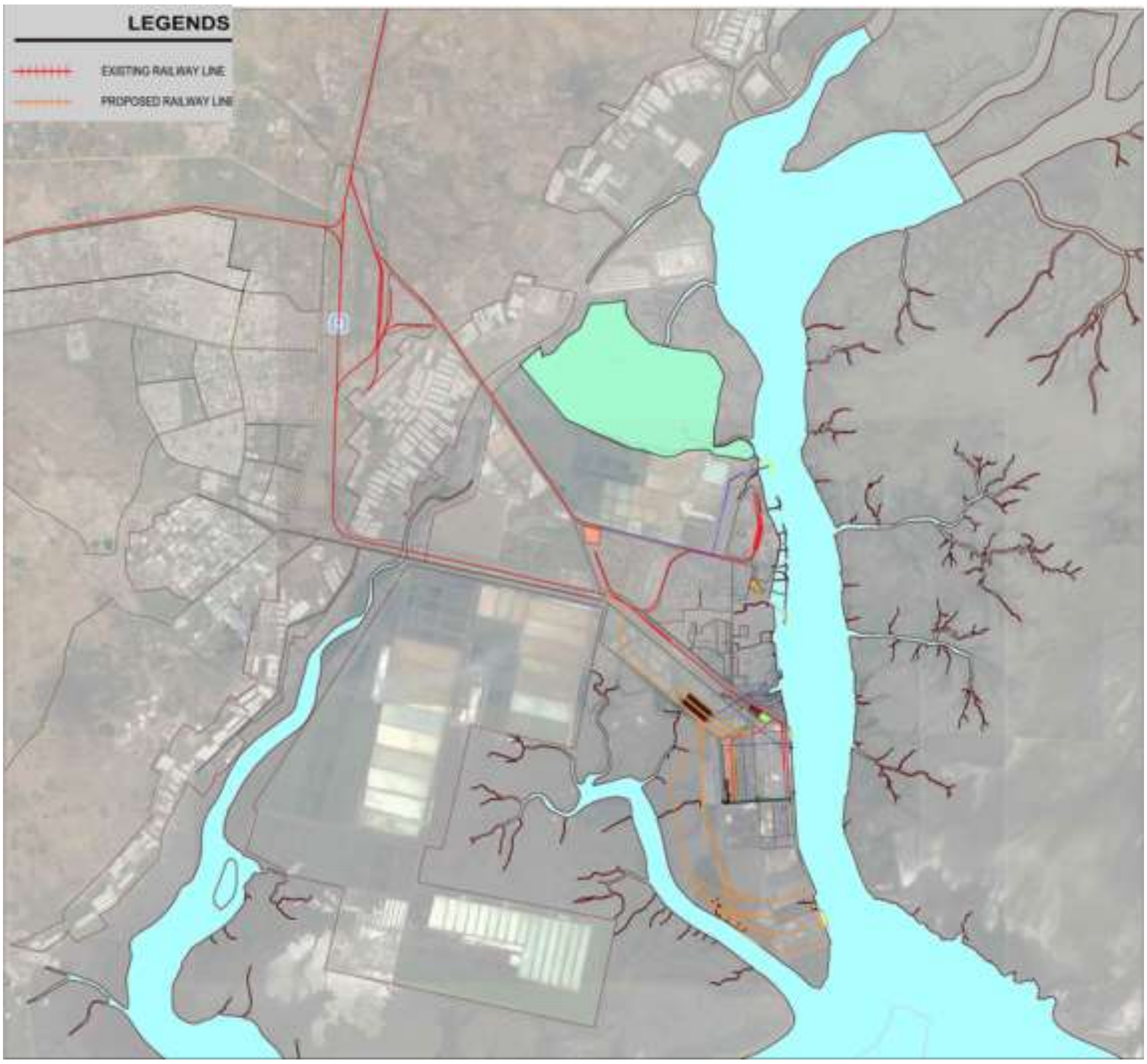



**Figure 8.2 Proposed Internal Rail Network**

# 9.0 SCOPE FOR FUTURE CAPACITY EXPANSION

## 9.1 Tuna Tekra Bulk Terminal

Kandla has been serving as a gateway port for North and Northwest part of India since 1955, handling all types of cargoes despite severe competition from its new neighbour port of Mundra. Among the basket of cargoes handled in Kandla, bulk Coal is emerging as an important cargo over the years to meet the increasing energy needs of the country.

During last year viz., 2014-15 the total quantity of coal imports through Kandla is close to 10 Million tons. Although Kandla port is able to stand on its own strengths in import of this quantity of coal, the neighbouring Mundra west basin port has built impressive infrastructure to handle coal. This is in terms of berths that handle large cape size vessels drawing deep drafts and matching mechanized handling facilities for unloading, stacking, reclaiming and evacuating bulk coal.

Though the composition coal imports consist of Thermal Coal, Coking coal and Pet coke, the proportion of Coking coal and Pet coke is very small. Since the port has no mechanized bulk handling facilities for import of coal, all of it is being handled in multi-purpose berths.

If Kandla has to remain relevant and further face competition from Mundra in the long run, it has to build equal if not better facilities than Mundra and also match with other world class ports. This proposal visualizes future traffic of coal which is expected to grow considerably.

### 9.1.1 Traffic Handled

Kandla Port has handled coal imports to the tune of nearly 10 MTPA during 2014-15. This consists of Thermal coal, Coking coal and Pet Coke. However, proportion of Coking coal and Pet coke is very small.

**Table 9.1 Coal Imports through Kandla in 2014-15**

| S. No | Cargo | No. of Vessels | Quantity Imported (T) |
|---|---|---|---|
| 1. | Coal | 149 | 9,762,218 |
| 2. | Coking Coal | 3 | 153,868 |
| 3. | Pet Coke | 1 | 50,408 |
| | **Total** | **153** | **9,966,494** |

In this connection it is noted that almost all the thermal coal imports are from Indonesia, Australia and South Africa. The Coking coal and Pet coke is entirely from Australia. This aspect has relevance as these countries have capabilities to load large cape size vessels and the shipping economics demand that both load port and discharge port should have matching facilities to derive the full advantage of ocean freight.

### 9.1.2 Present Facilities

#### ***9.1.2.1 Present Import Handling Facilities in Kandla***

As Kandla has no mechanized coal handling facilities, all coal imports are handled through the multi-purpose berths. The coal is unloaded by shore electric level luffing cranes. Often times Harbour Mobile Cranes are also deployed. These cranes discharge the unloaded coal on to dumper lorries through a shore hopper as can be found in the following pictures.


**Figure 9.1 Coal unloading Facility through Multipurpose Berths**

**Figure 9.2 Loading of trucks through Hoppers**

The dumper lorries then transport the coal to the stacking areas spread over various locations inside the port. The coal thus conveyed is high stacked by front end loaders. The stacked coal is evacuated by front end loaders and dumpers on to railway siding and loaded into wagons. All these operations in effect result in multiple handling which involving time and cost. The large number of coal carrying dumpers crisscrossing the area naturally results in undesirable air pollution.

These and others naturally bring to the fore the need for a mechanized coal unloading, conveying, stacking and evacuating system that also ensures clean environment

#### 9.1.2.2 Berthing Infrastructure & Permanent Limitations

The Port has total of twelve multipurpose cargo berths, of which first six viz., CJ 1 to 6 can cater to vessels of up to a draft of 9.8 m only. Further these berths have already attained their designed life of 50 years.

CJ 7 to 10 are comparatively of later construction and have a draft of 12 m, whereas berths 11 and 12 have a draft of 12.5 m. Berths 13 and 15 which are constructed very recently in PPP mode and have a draft of 13 m.

All the port owned cargo berths in Kandla are multi-purpose berths with a high berth occupancy rate of 80% and above which is not a desirable proposition.

A dissection of coal traffic during last year viz., 2014-15 is presented in the following two tables.

**Table 9.2 Coal Vessels 2014-15 - DWT, Draft & Parcel Size**

| S. No | Cargo | No. of Vessels | Total Quantity (T) | Max. DWT | Average DWT | Max. LOA (m) | Max Draft (m) | Max Parcel Size (DWT) | Average Parcel size (DWT) |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Coal | 149 | 97,62,218 | 1,80,171 | 78,492 | 295 | 17.9 | 1,64,999 | 65,518 |
| 2. | Coking Coal | 3 | 1,53,868 | 81,393 | 74,710 | 225 | 14.4 | 72,793 | 51,289 |
| 3. | Pet Coke | 1 | 50,408 | 61,403 | 61,403 | 200 | 12 | 50,408 | 50,408 |
| | | **153** | **99,66,494** | | | | | | |

**Table 9.3 DWT Range Distribution of Coal Vessels - 2014-15**

| DWT Range | | No. of Vessels | Max draft | Total Quantity (T) | % age Quantity | Max Parcel Size | Average Parcel Size |
|---|---|---|---|---|---|---|---|
| From | To | | | | | | |
| 35,000 | 65,000 | 82 | 13.7 | 3,800,717 | 38% | 69,761 | 46,310 |
| 65,000 | 80,000 | 28 | 14.62 | 1,762,265 | 18% | 77,003 | 62,938 |
| 80,000 | 120,000 | 25 | 15 | 1,834,745 | 18% | 112,800 | 73,389 |
| 120,000 | and above | 18 | 17.6 | 2,568,767 | 26% | 164,999 | 142,709 |
| **Total** | | **153** | | **99,66,494** | **100%** | | |

Of the total 153 vessels handled in 2014 -15 the number of vessels with a draft of 11.5 m and above is found to be 128 vessels with a total quantity of 9,066,658 T. Since the maximum draft is available in CJ 7 to 10 which is 12 m, it is taken that only vessels which draw a draft of 11.5 m (with a UKC of 0.5 m) can only be berthed. Otherwise they need to be lighteraged at the anchorage till they attain acceptable draft. It means 84% of coal vessels which carried a quantity of 91% of cargo could not be berthed on arrival due to draft limitations at Kandla port.

Further the maximum draft for all the vessels in DWT ranges as presented above have a draft of 13.7 and more, thus limiting them from berthing due to draft limitation. Also the berth structures are not designed to berth vessels beyond Panamax size, if they are laden more than Panamax loads.

This in effect takes away Kandla's ability to compete with neighbouring Mundra leave alone foreign ports.

#### 9.1.2.3 Competing Facilities in Mundra

Adani's Mundra west port basin claims to have an infrastructure to handle coal imports to the tune of 60 MTPA. It is already handling coal imports to the tune of 50 MTPA consisting of 38 Million tons for captive use of Tata and Adani power plants and 12 Million tons for other users.

#### 9.1.2.4 Limitations Imposed by Channel

The navigating channel of Kandla has a depth of 9 to 9.5 m. Taking a tidal advantage of 4 m above MSL Kandla can cater to vessels with a draft of 12 to 12.5 m at its maximum. This means that Kandla cannot cater to cape size vessels and even fully loaded panamax vessels.

### 9.1.3 Alternative Location for large Coal Vessels

Having realised that the port has to equip itself to handle cape sized coal vessels the port has looked for locations beyond Kandla creek and decided on Tuna Creek in 2010 itself. The port has got a TEFR prepared for developing a dry bulk terminal on BOT basis by IIT Madras who zeroed upon a location at Latitude 22° 53' 18" N and Longitude 70° 06' 20" E nearer to Tekra.

### 9.1.4 Bulk Cargo Terminal of M/s. Adani Kandla Bulk Terminals Ltd.

In line with the above, M/s. Adani Kandla Bulk Terminals Ltd. has developed a T shaped jetty of 600 m × 60 m with berthing facilities to import / export all type of dry bulk cargoes like coal, fertilizer and its raw material, salt, wheat, iron ore etc. The designed capacity of this terminal is fixed at 14.1 MMTPA.

**Figure 9.3 Tuna Tekra Bulk Terminal**

### 9.1.5 Need for New Bulk Coal Import terminal at Tuna Tekra

It is now established that if Kandla Port has to further grow in its bulk handling capabilities and face competition of Mundra port, it has to create facilities to handle cape size vessels. It is already noted that Coal imports is an attractive enough cargo with 10 MTPA to create deep draft berthing facilities and for mechanization of bulk coal imports which can be done only at Tuna Tekra and not in Kandla.

There could be apprehension on the traffic potential of another bulk import terminal, as M/s. Adani Kandla Bulk terminals Ltd. Has commissioned its facilities in Feb. 2015 with a capacity of 14.1 MTPA which it is yet to be realised.

In an optimistic scenario of country's increasing energy needs, it will justify such approach for additional facilities for Coal imports.

### 9.1.6 Proposal for a Bulk Import terminal in Tuna Tekra

#### *9.1.6.1 General*

The above details prima facie establishes the need for a modern Bulk Import terminal with deep drafts, primarily for coal. This proposal also envisages handling breakbulk.

Such bulk import terminal capable of handling cape size vessels can only be created in Tuna Tekra as the existing Kandla berths and channel impose certain permanent limitations.

### 9.1.6.2 Design Vessel Size

- Cape-size vessel of 100,000 DWT range with an LOA of 255 m, a beam of 39 m and a full load draft of 15.3 m for Import of coal in bulk. This berth will be located on the front side of the jetty structure.
- Panamax vessel of 65,000 DWT to 80,000 DWT range with an LOA of 240m, a beam of 32.2m and a full load draft of 14.5m. This berth will be located on the back side of the jetty structure.

### 9.1.6.3 Location of Proposed Bulk terminal in Tuna Tekra

Similar to existing Tuna Tekra Bulk handling facilities, it is possible to develop additional bulk terminal with deep drafts. It is proposed that the bulk import terminal will located to the east of the existing Adani terminal and will be located in -9.4 m CD contour in same alignment to the existing facility.

### 9.1.6.4 Capacity of the Proposed Terminal

It is envisaged that the proposed Bulk Import terminal will have a capacity of 21.2 MTPA consisting of 17 MTPA of coal Imports, 4.2 MPTA of coastal export of breakbulk imports. It will consist of four berths with two berths for coal imports, and two for breakbulk.

### 9.1.6.5 Phased development of proposed terminal

It is proposed that the terminal may be developed in two stages with first phase development of one coal import berth and one multipurpose berth in an L shaped jetty. In the second phase the other side of L in the alignment of earlier Jetty will be extended to add two more berths thus making it a T shaped terminal. This would be similar to the existing Adani Bulk terminal in Tuna Tekra. The two phases of the proposals are depicted in **Figure 9.4** and **Figure 9.5** below.

**Figure 9.4 Proposed Bulk Terminal in Tuna Tekra – Phase 1**


**Figure 9.5 Proposed Bulk Terminal in Tuna Tekra – Phase 2**

#### 9.1.6.6 *Jetty structure*

In Phase 1 the berth is proposed to be of 350 m length and a width of 60 m and a draft of 16 m on the front side and 15 m on the rear side. The berth will be a RCC Cast-in-situ piled structure.

It will be suitable to berth 2 ships with one berth for cape size vessel on the front side and one Panamax vessel on the rear side.

During Phase II the berth structure will be extended length wise towards the free end by another 250 m so that two cape size vessels can be berthed on the front side and two panamax vessels can be berthed on the rear side.

#### 9.1.6.7 *Approach Trestle*

Since the jetty head will be located at -9.4 m contour it will be connected to the land area by an approach trestle of about 2 km length and trestle will be an RCC piled structure. In the tidal zone up to land area a rubble bund connecting the RCC trestle and land area will be constructed.

#### 9.1.6.8 *Navigating Channel for the proposed berths*

The vessel navigation to the proposed bulk terminal will be through the existing Adani navigating channel leading to Adani Bulk berth. Adani is carrying out dredging in their channel for its length of 5.2 m in Tuna creek from the present -16 to -18m.

It is proposed that for navigation to proposed bulk terminal, Adani’s channel can be used and beyond that, further dredging has to be carried out till be berth and in the berth pocket.

### 9.1.7 Mechanization of Coal Imports

#### 9.1.7.1 *Phase 1*

In Phase 1 all coal will be imported from the berth in the front side of jetty structure by installing Gantry grab Unloaders and conveyed through Belt conveyors to the stack yard where it is stacked in an open stack yard through Mobile Rail mounted Stackers. For evacuation of coal, Reclaimer, evacuating conveyors and Rapid wagon loading system will be installed.

Similarly on the rear side of the berth, breakbulk cargo would be handled through mobile harbour cranes for ship to shore transfer and transferred to the storage yard through trucks.

#### 9.1.7.2 *Phase 2*

In Phase 2, the second berth on the front side of jetty will handle coal imports through cape size vessels. It will be equipped similar to first coal berth with Gantry grab Unloaders and conveyed through Belt conveyors to the stack yard where it will be stacked in an open stack yard through Mobile Rail mounted Stackers.

### 9.1.8 Auxiliary Infrastructure

The following auxiliary infrastructure required for the bulk terminal will be planned.

a. Electrical Power supply and Distribution System
b. Firefighting system
c. Water Supply system
d. Dust Suppression System
e. Illumination
f. Drainage
g. Service Roads
h. Storage sheds for Fertilizers
i. Shed for Bagging and Stitching Plants with loading platforms and sidings
j. Railway yard

### 9.1.9 Phasing of the Terminal Facilities

As already indicated, the Tuna Tekra bulk terminal as proposed above will be developed in two phases. In the first phase a coal import berth, a multipurpose berth with approach trestle, bund, coal stack yard, coal evacuation system and railway system for evacuation shall be developed.

In the second stage, the second coal import berth, and multipurpose berth will be developed.

### 9.1.10 Cost Estimates

The capital cost estimates have been prepared for the Phase 1 development of the project. The capital cost of Phase 1 development works out to INR 1050 Crores. The annual operation and maintenance costs of the Phase 1 facilities work out to INR 120 Crores. These costs are indicative and based on the preliminary assessment of the available data and the proposed facilities for Phase 1 development.

The implementation of the Bulk Terminal development is likely to take about 30 months from start of construction.

## 9.2 Tuna Container Terminal

Siting the growth of Mundra which has seen exponential growth in container handling, KPT is also moving towards planning of dedicated container handling terminal to capture the market. It is envisaged that container traffic would increase in coming years.

During 2014-15 Kandla port handled traffic of ~90+ million tonnes of cargo. The port has not been able to cater the container traffic, which has seen a continuous decline in the past 5 years. The port handled container traffic at berth 11 and 12 which had full-fledged container handling facilities. However, the Kandla port having its own limitations in terms of ship size, draft availability etc., majority of this share has been taken away by the neighbouring Mundra port which has world class facilities and infrastructure to handle Containers.

In order to be competitive, there is a need to develop container handling facilities and this container terminal should have the capability to handle current generation container vessels with a fast turnaround time. Given the limitation on capacity front in Kandla creek, development of new deep draft container terminal at Tuna Tekra has been explored.

### 9.2.1 Current Facilities

Currently, the port is has container terminal facilities at berth 11 and 12 with a combined handling capacity of 0.6 MTPA. The terminal was developed on PPP basis. The berth has 2 RMQC for loading/ unloading of containers with the yard facilities. However, this terminal has limitations of draft which can cater ships of 11m draft.

### 9.2.2 Location of Terminal Development

Adani has developed a deep draft bulk terminal at Tuna Tekra. The basic purpose of the proposed terminal is to utilise the common approach channel of the existing terminal to avoid any additional maintenance dredging.

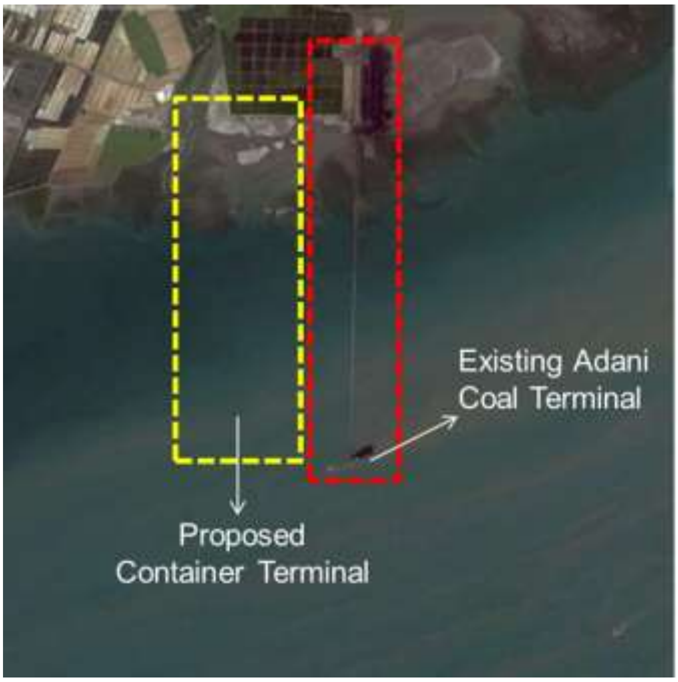



**Figure 9.6 Terminal Location**

### 9.2.3 Need for Deep Draft Container Terminal

In order to cater the main line vessels of bigger parcel size and deeper draft, there is a potential for development of deep draft container terminal at Tuna Tekra which otherwise cannot be handled at berths within creek.

### 9.2.4 Proposed Container Terminal at Tuna Tekra

The above details establish the need for a modern container terminal with deep drafts.

#### 9.2.4.1 Design Vessel Size

Container ships are classified into six broad categories viz. Feeder, Feeder Max, Handy, Sub-Panamax, Panamax and Post-Panamax. The principal dimensions of the ships considered for the preparation of the layouts and design of marine structures for the proposed Vadhavan port are presented in **Table 9.4** below:

**Table 9.4 Parameters of Ship Sizes**

| Commodity | Design Ship Sizes (TEUs) | Maximum Parcel Size (TEUs) | Overall Length (m) | Beam (m) | Loaded Draft (m) |
|---|---|---|---|---|---|
| Containers | 1,000 | 500 | 160 | 22 | 10.0 |
| | 9,000 | 2,500 | 350 | 45 | 15.0 |

However, considering the tidal window the terminal can also be utilised to cater 14,500 TEU vessels.

#### 9.2.4.2 Breakwater

Since the proposed terminal is exposed to waves of 2m, there is a requirement of breakwater

In order to reduce the operational downtime and provide tranquil conditions at berth an offshore breakwater is proposed. The breakwater is 900m long which is at the depth of 8m CD. The alignment of offshore breakwater is provided to effectively blocking the waves approaching from WSW direction. However, alignment of breakwater needs to be refined through model studies which shall consider its effect on the flow conditions and siltation at the proposed location and also confirm the tranquillity provided at containers berths.

#### 9.2.4.3 Berth

It is proposed to develop the berths in phases. Initially the port can develop berth of 600 m length which can later be increased by another 300 m.

#### 9.2.4.4 Capacity of Proposed Terminal

It is envisaged that the proposed container terminal will have a capacity of 1.5 million TEUs with an initial capacity of 0.8 million TEUs.

#### 9.2.4.5 Terminal Development

The salient features of this proposed facility is as below:

- Terminal is proposed to the west of existing coal terminal and located relatively near to shore. Utilisation of common channel with Adani in Tuna Tekra. Minimal dredging need to be carried out at berth and manoeuvring area.
- Proposed terminal shall be designed to cater to 14,500 TEUs container ships.
- An offshore breakwater of 900m length is proposed to provide tranquillity for round the year operations.
- One 900m long container berth is proposed which can be developed in phased manner with 600m in the initial phase which would later be increased to 900m. The berth shall be connected to the container yard through approximately 1 km long approach trestle. In the tidal zone up to shore area a rubble bund connecting the RCC trestle and shore will be constructed
- Rail and road connectivity to this proposed terminal can be tapped off from the existing Tuna bulk terminal.
- The berths will be a RCC cast-in-situ piled structure.

The phased development of Tuna Tekra Container Terminal is as shown in **Figure 9.7** and **Figure 9.8**.

**Figure 9.7 Phase 1 Development of Tuna Tekra Container Terminal**

**Figure 9.8 Phase 2 Development of Tuna Tekra Container Terminal**

### *9.2.4.6 Container Handling System*

The containers are loaded/ unloaded by Rail Mounted Quay Cranes (RMQCs) and will be transported to a container yard (CY) by Internal Transport Vehicles (ITVs) and placed in pre-designated slots with the help of Rubber Tyred Gantry Cranes (RTGCs). For evacuation, it is proposed to be handled through reach stackers.

### *9.2.4.7 Utilities and Infrastructure*

Utilities and infrastructure viz., power supply and distribution, firefighting, water supply, illumination, drainage, service roads, railway yard shall be planned to suit the terminal requirement.

### 9.2.5 Cost Estimates

The capital cost estimates have been prepared for the Phase 1 development of the project. The capital cost of Phase 1 development works out to INR 2,000 Crores. The annual operation and maintenance costs of the Phase 1 facilities work out to INR 190 Crores. These costs are indicative and based on the preliminary assessment of the available data and the proposed facilities for Phase 1 development.

The implementation of the Container Terminal development is likely to take about 40 months from start of construction. Breakwater construction is observed to be the key activities on the critical path.

## 9.3 Chemical Hub at KPT

KPT intends to develop the port as a chemical hub in the region and accordingly space has been identified by the port. As shown in the figure below approx. 1440 acres of land is available for the development of Chemical hub. This area is located to the north of Kandla creek near Jafarali bunder.

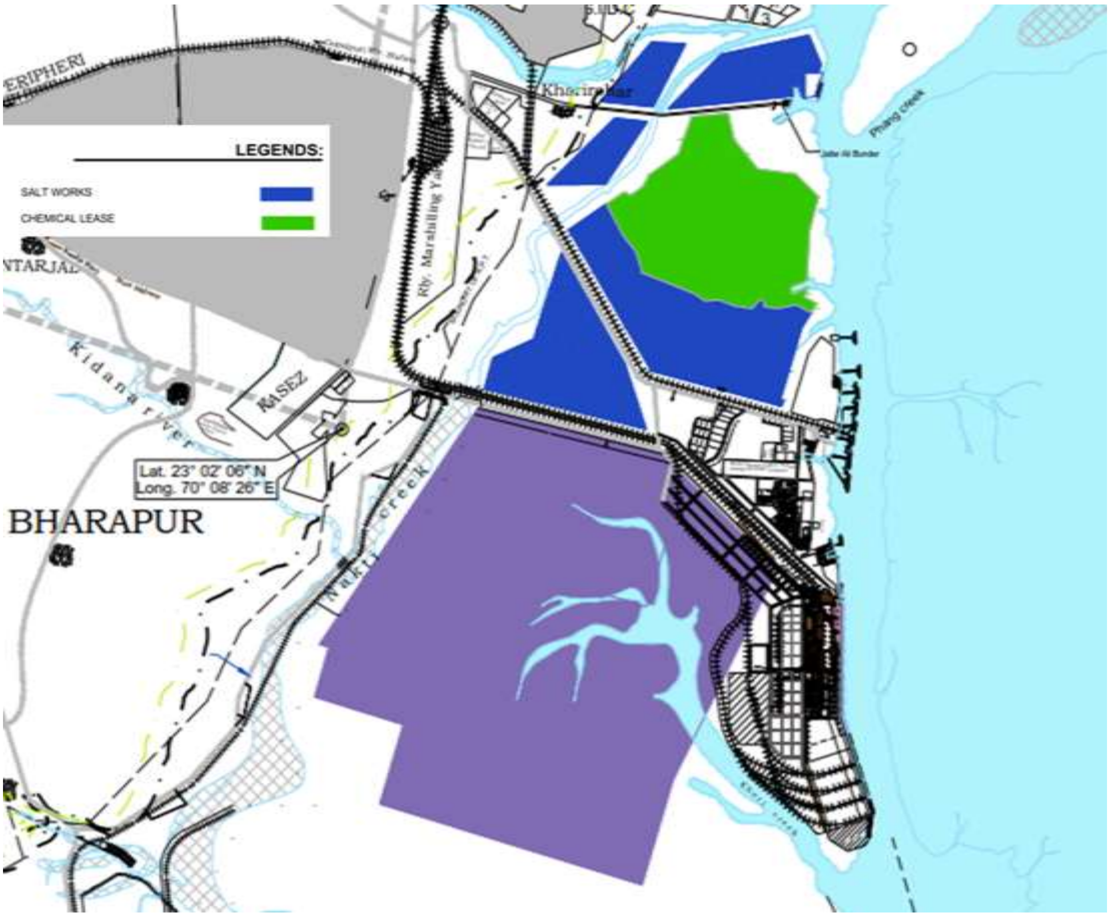



**Figure 9.9 Location for the Proposed Chemical Hub**

# 9.4 Container Freight Station (CFS)

The current capacity of the Berth 11 and 12 is ~0.5 MTEUs. KPT is already having a CFS which is located behind existing fertiliser shed with an area of ~13 ha. However, KPT had an agreement with CWC that KPT can't operate another CFS in the vicinity of port until existing CFS exceeds the capacity of 1,40,000 TEUs per annum.

With the planned mega container terminal at Tuna Tekra, there will be a need for to develop CFS to increase the competitiveness and for revenue generation for the port through leasing of land. Location of CFS is proposed to be near the existing rail yard. It may be noted that Development of CFS does not add any capacity, however it is an ancillary facility for revenue generation.

# 9.5 Land Use and Area Development

## 9.5.1 General

Land use becomes important as it gives direction to the future growth of the port and provides a better tool for port planning and management. The pattern of land utilization in Kandla area has been discussed in this section.

The new land policy guidelines for major ports-2014 envisaged that every major port shall have a land use plan covering all the land owned and / or managed by the port. The new land policy guidelines for major ports-2014 envisaged that every major port shall have a land use plan covering all the land owned and / or managed by the Port. At present, Kandla Port has a land area admeasuring 2,22,591 acres. To harness the maximum revenue by identifying and commercially exploiting the available land, it was needed to update the unutilised lands

## 9.5.2 Kandla Port Land

Kandla port is a natural tidal port. The port land area may be broadly categorised as Dry land and Intertidal land. The available land area split is shown in **Table 9.5**.

**Table 9.5 Land Area Splitup**

| Description | Area (acres) |
|---|---|
| Intertidal Land | 2,20,416 |
| Dry Land | 2,175 |
| **Total Area of Kandla Land** | **2,22,591** |

It may be noted that out of the total land only 1% is dry and readily usable land. Of the total port area, an area of 2,20,416 acres accounts to the submerged land and 10% i.e., 22,042 acres of this land is usable for salt production, as the other 90% is tide affected.

The location of the available land with Kandla port is shown in **Figure 9.10**.

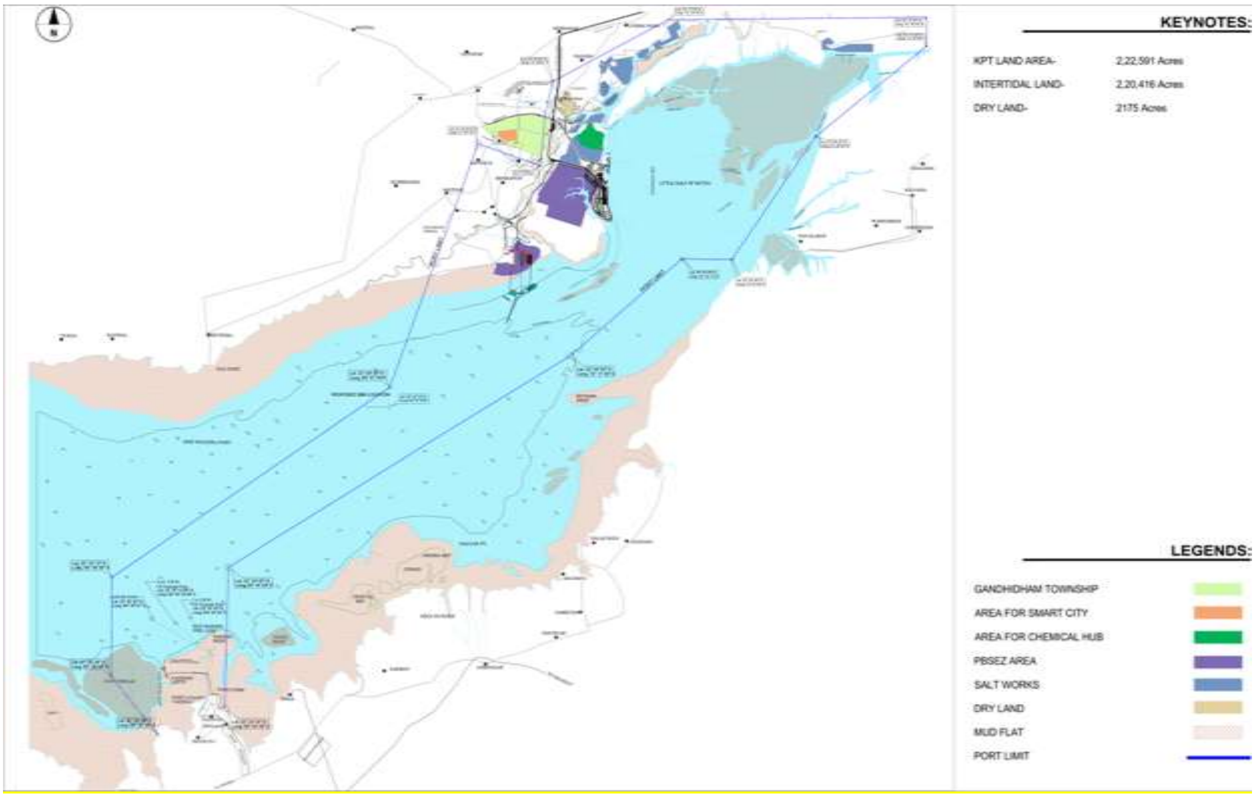



**Figure 9.10 Location of Land at Kandla Port**

**Figure 9.11** shows land proportions under intertidal land at Kandla Port.

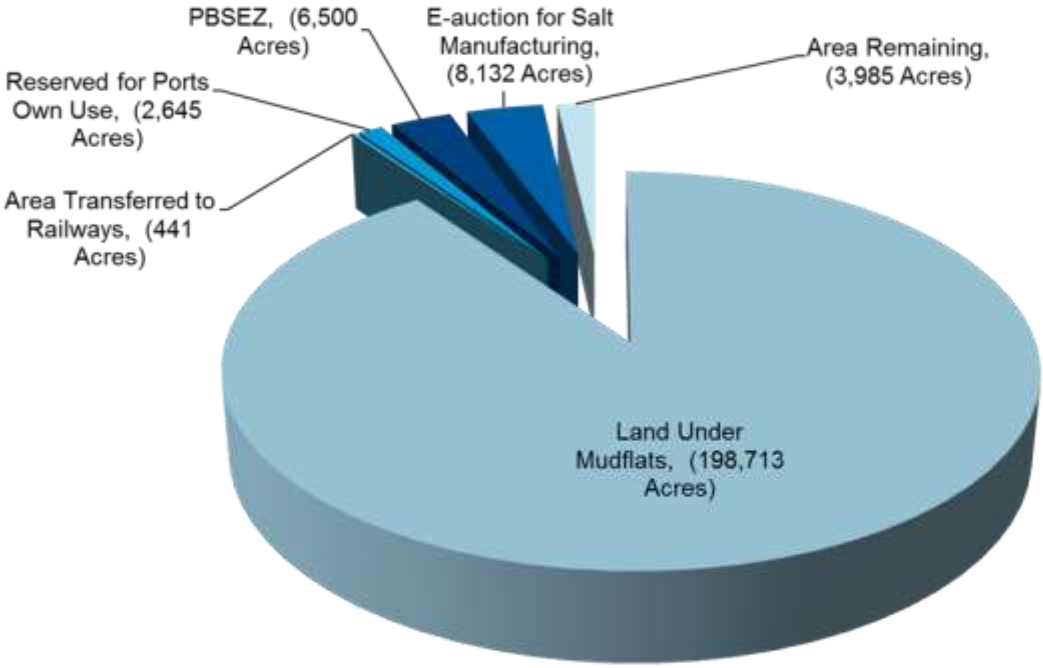



**Figure 9.11 Land Use Pattern of Intertidal Land at Kandla Port**

## 9.5.3 Land Area Utilisation

### *9.5.3.1 Intertidal Land*

An area of 220,416 acres is intertidal at Kandla Port. The intertidal land which is underwater most of the time form part of mud flats with week geological conditions. Developing these lands would involve huge amount of reclamation and extensive ground improvement at a significantly higher cost.

Further this land is governed under Coastal Regulation Zone Notification, 2011 and has sparse growth of mangroves; hence any activity taken up in this area must adhere to the guidelines, which prohibits development of any commercial and residential activities.

However, small portion of intertidal land area of 210 acres is proposed to be developed and utilised to provide backup area for storage and operations of deep draft coal and container terminals at Tuna Tekra.

### *9.5.3.2 Salt Land*

About 22,042 acres of intertidal zone is categorised as salt land and about 6,500 acres of salt land is proposed for the development of Port Based Special Economic Zone (PBSEZ). As Kandla port specializes in handling petroleum and chemical products, the focus of future development is more towards large industrial activities including chemical and petroleum based industries. Approximately 1,440 acres of salt land is proposed to be utilised for the shore based facilities to develop as chemical hub.

### *9.5.3.3 Dry Land*

The topography of Kandla provides limited land for the construction of facilities, as large area of this region is covered under marshy and boggy land (i.e., Little Gulf of Kutch). Kandla Port has total 2,175 acres of dry land available for development. Of this area,

- 631 acres of land is under dispute
- 651 acres of land for railways and defence
- 240 acres of area has already been transferred to various stake holders

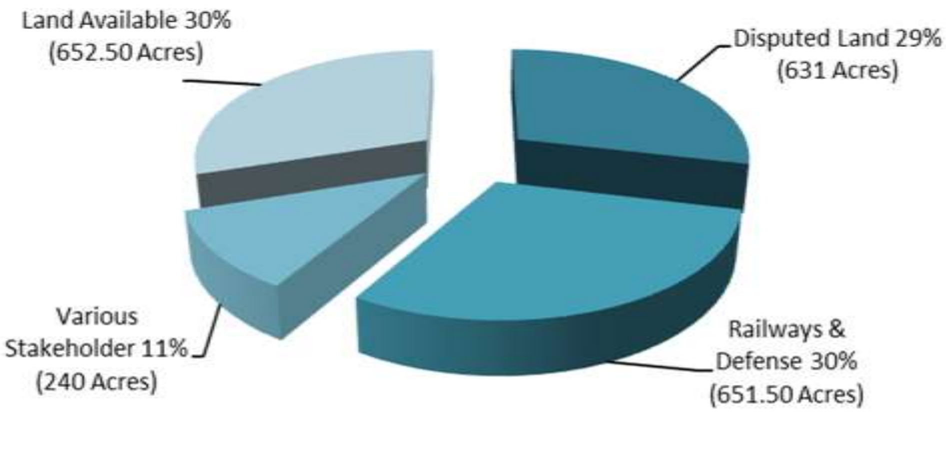



**Figure 9.12 Land Area Utilisation – Dry Land**

Only 652.5 acres of dry port land is available for development. The location of the proposed land is shown in **Figure 9.13**. It could be seen that this plot of land is very close to the main railway and road networks and therefore ideal for development as logistic park, offices and other commercial activities. Part of this area is already being planned to develop Industrial Park.

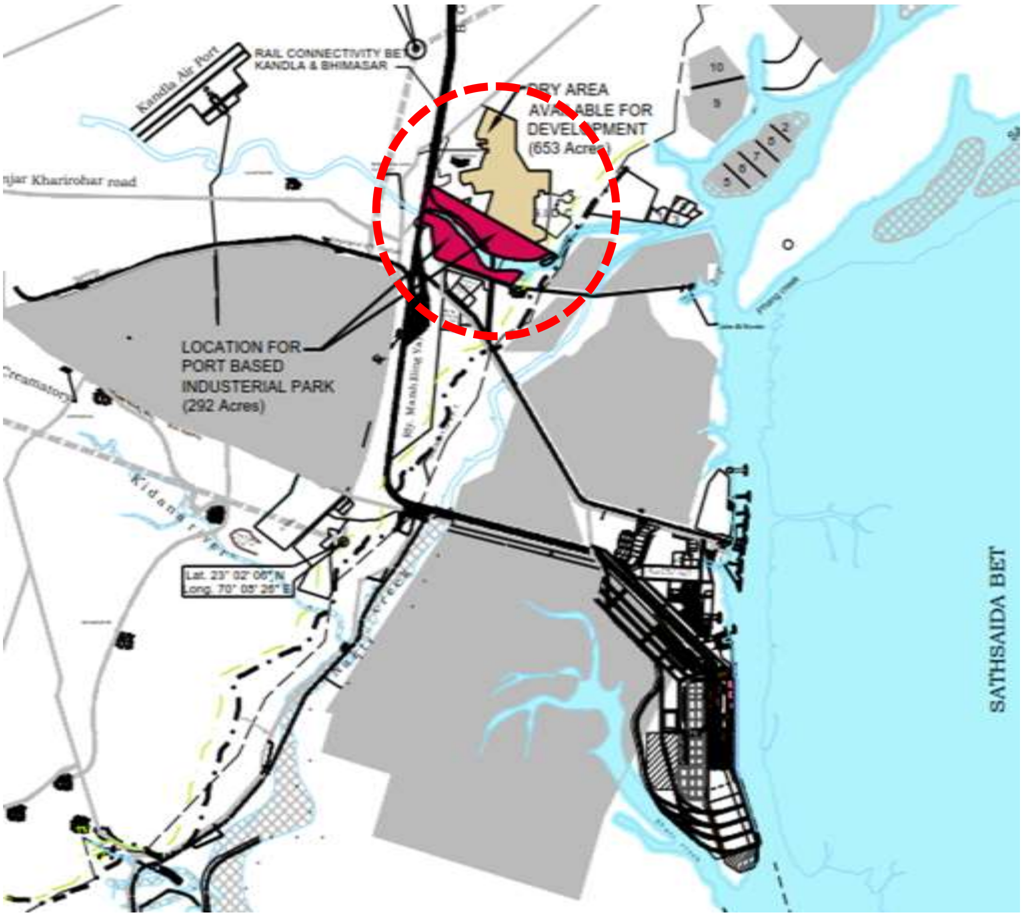



**Figure 9.13 Dry Land avaliable for Development**

# 10.0 Shelf of New Projects and Phasing

As part of Kandla 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.

### 10.1.1 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. | Development of Container Terminal facility at Berth 11 & 12 | 159 | 5.0 | PPP |
| 2. | Development of OJ 7 to handle General Oil Cargo | 45 | 2.5 | Port's funds |
| 3. | Development of Marine Liquid Terminal facilities at OOT, Vadinar on captive use basis. | 448 | 24.5 | 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 (Kandla Creek)**


**Figure 10.2 Port Layout along with Ongoing Developments (Vadinar)**

### 10.1.2 Projects to be completed by Year 2020

The details of the projects which are envisaged to be completed by 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 Crores) | Capacity Addition (MTPA) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Development of 14th and 16th Multipurpose Berth | 512 | 3.6 | Port's funds |
| 2. | Development of new Oil Jetty 8 | 233 | 3.4 | Port's funds |
| 3. | Mechanized Fertiliser Handling Facility | 235 | 5.0 | PPP |

The port layout after completion of projects mentioned above shall be as shown in **Figure 10.3**.


**Figure 10.3 Layout Plan 2020 (Kandla Creek)**

### 10.1.3 Projects to be completed by Year 2025

The details of the projects which are envisaged to be completed by 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. | Development of Tuna Tekra Additional Bulk Terminal- Phase 1 | 1,050 | 10.5 | PPP |
| 2. | Development of Tuna Tekra Container Terminal - Phase 1 | 1,500 | 17.0 | PPP |
| 3. | Mechanized Food Grains Handling Facility | 155 | 2.5 | PPP |
| 4. | Mechanized Barge Unloading Facility | 100 | 2.5 | PPP |
| 5. | Development of Ro-Ro Terminal at Berth 1 | 70 | 1.0 | PPP |

The port layout after completion of projects mentioned above at Tuna Tekra and kandla creek shall be as shown in **Figure 10.4**.


**Figure 10.4 Layout Plan 2025 (Tuna Tekra)**


**Figure 10.5 Layout Plan 2025 (Kandla Creek)**

### 10.1.4 Projects to be completed by Year 2035

The details of the projects which are envisaged to be completed by 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. | Development of Tuna Tekra Additional Bulk Terminal- Phase 2 | 400 | 10.5 | PPP |
| 2. | Development of Tuna Tekra Container Terminal- Phase 2 | 500 | 8.5 | PPP |

The port layout after completion of mentioned above shall be as shown in **Figure 10.6**.

**Figure 10.6 Layout Plan 2035 (Tuna Tekra)**

# Appendix 1 - **BCG Benchmarking Study for Kandla Port**

# Master Plan for Kolkata Port (KoPT)

Prepared for

Ministry of Shipping
Government of India

## Indian Ports Association/ Ministry of Shipping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| 4. | 03.09.2016 | | Comments on final Master Plan Report | Ritu Paliwal<br>Senior Env. Consultant |

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# 1.0 INTRODUCTION

## 1.1 Background

The Sagarmala initiative is one of the most important 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 the 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 a larger economy.

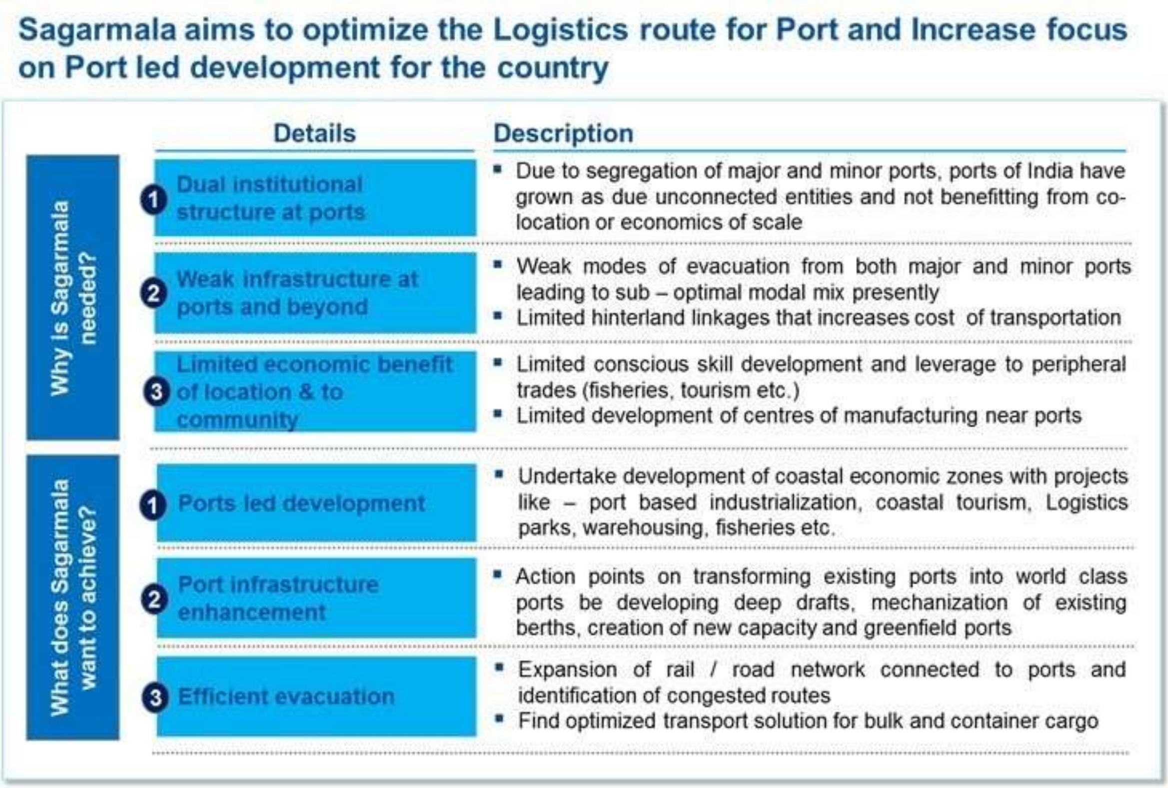


**Figure 1.1 Aim of Sagarmala Development**

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

The team of McKinsey and AECOM distilled learnings from the experience in port-led development and examined major engagement challenges to develop a set of governing principles for our approach as shown in **Figure 1.2**.

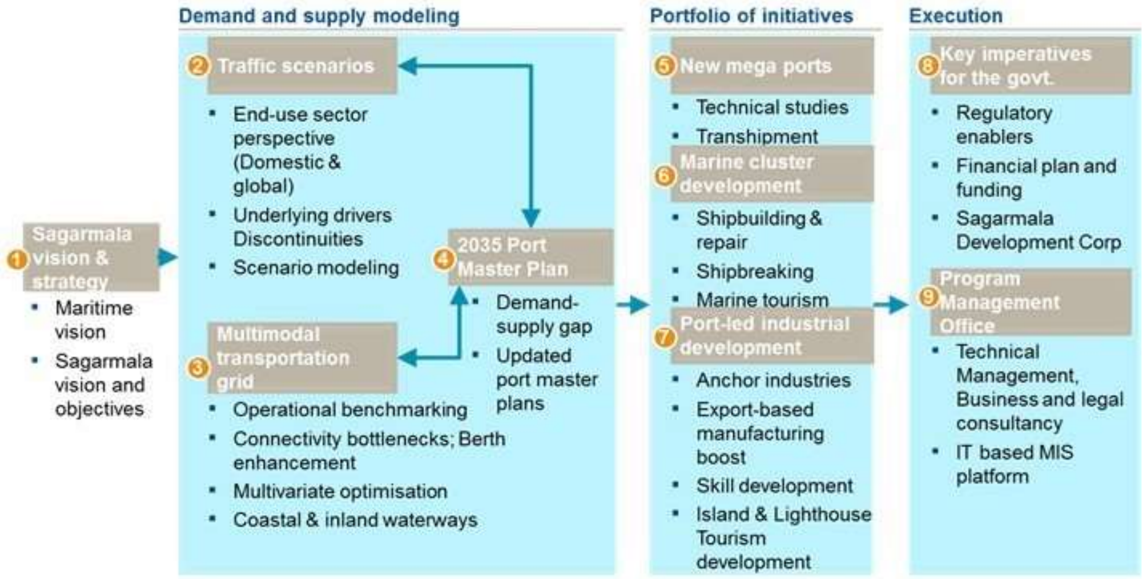


**Figure 1.2 Governing Principles of Our Approach**

As indicated above, the origin-destination of key cargo (accounting for greater than 85% of the total traffic) in Indian ports have been 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**.

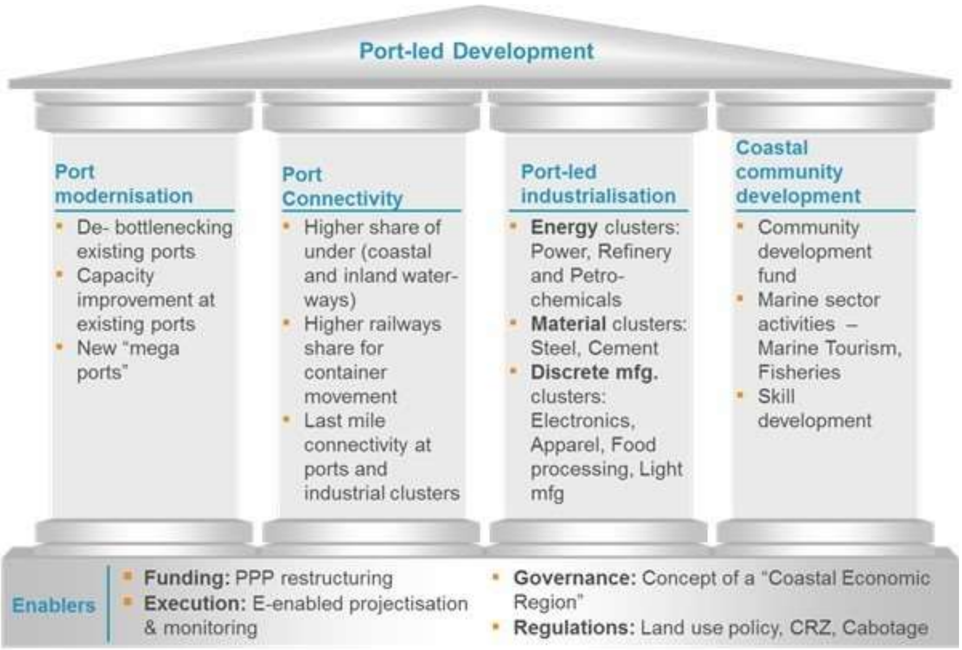


**Figure 1.3 Port Led Developments**

As part of the assignment, it was 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 Kolkata Port Trust as part of Sagarmala assignment. This report is organised in the following sections:

Section 1 : Introduction
Section 2 : The Port and Site Conditions
Section 3 : Details of Existing Facilities
Section 4 : Performance, Options for Debottlenecking & Capacity Assessment
Section 5 : Details of Ongoing Developments
Section 6 : Traffic Projections
Section 7 : Capacity Augmentation Proposals
Section 8 : Shelf of New Projects and Phasing

# 2.0 THE PORT AND SITE CONDITIONS

## 2.1 Kolkata Port

Kolkata Port comprises of two dock systems one at Kolkata and other at Haldia as shown in **Figure 2.1**. Both the docks are riverine in nature and located on the river Hooghly in the State of West Bengal. The Kolkata Dock System (KDS) is situated at Latitude 22º 32' N, Longitude: 88º 18' E in the city of Kolkata, while Haldia Dock Complex (HDC) is located at Latitude 22° 02' N and Longitude 80° 06' E at about 104 km downstream of KDS.

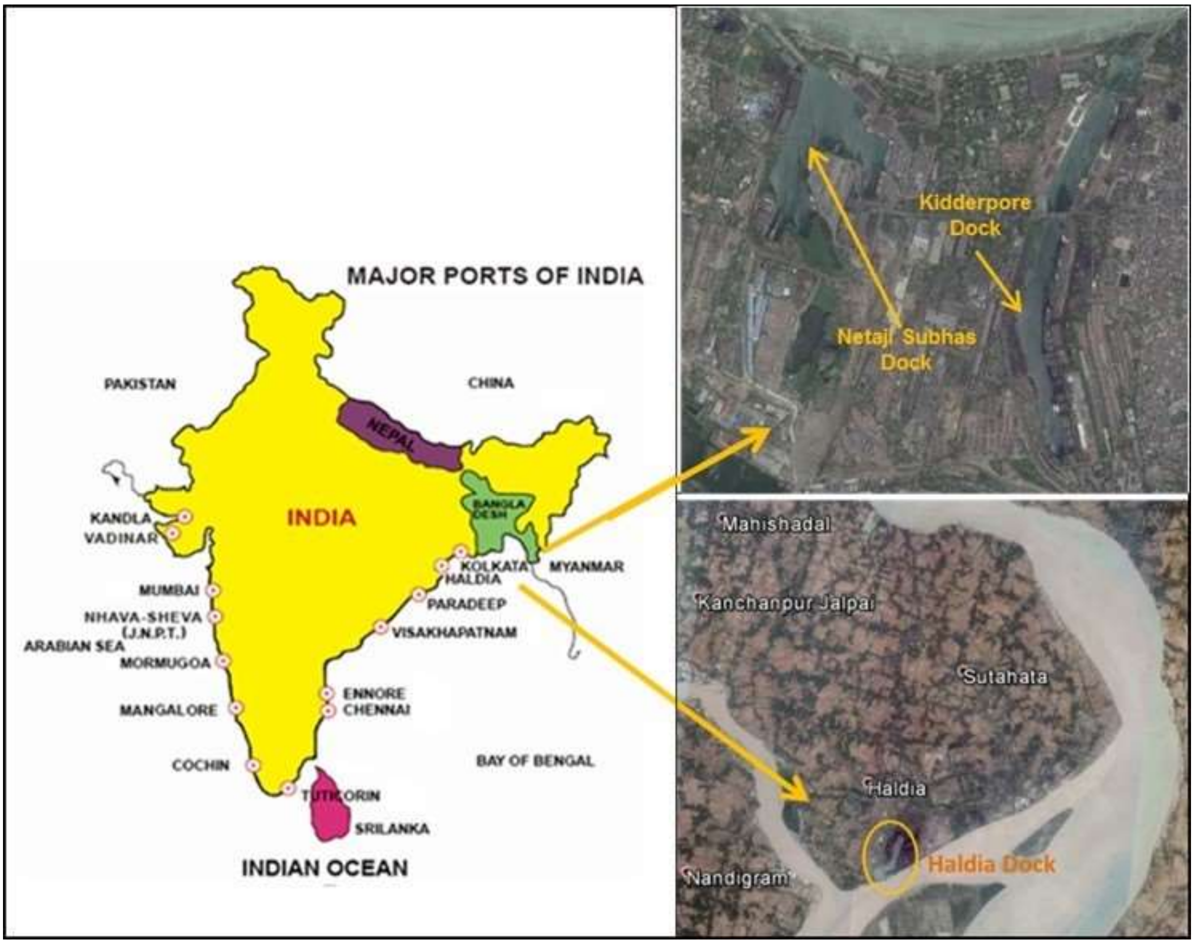


**Figure 2.1 Location of Kolkata and Haldia Dock Complexes**

Both of the port locations are well connected to nearby places by road, rail and ferry boats. National Highway (NH) 117 is about 1.5 km from KDS dock and connects to NH 6 (Mumbai – Kolkata road). Haldia is also accessible through NH 41, which links Haldia to Kolaghat and meets NH 6.

NH 6 (Mumbai – Kolkata road), make both the locations quite accessible to Maharashtra, Orissa, Jharkhand while passing through Kharagpur, Bankura and Purulia and Durgapur within the state of West Bengal as shown in **Figure 2.2**.


**Figure 2.2 Road Connectivity for Kolkata and Haldia Dock Complexes**

Both the ports are connected to South-Eastern railway network. Nearest railway stations to KDS and HDC are Majherhat and Panskura, respectively (**Figure 2.3**).

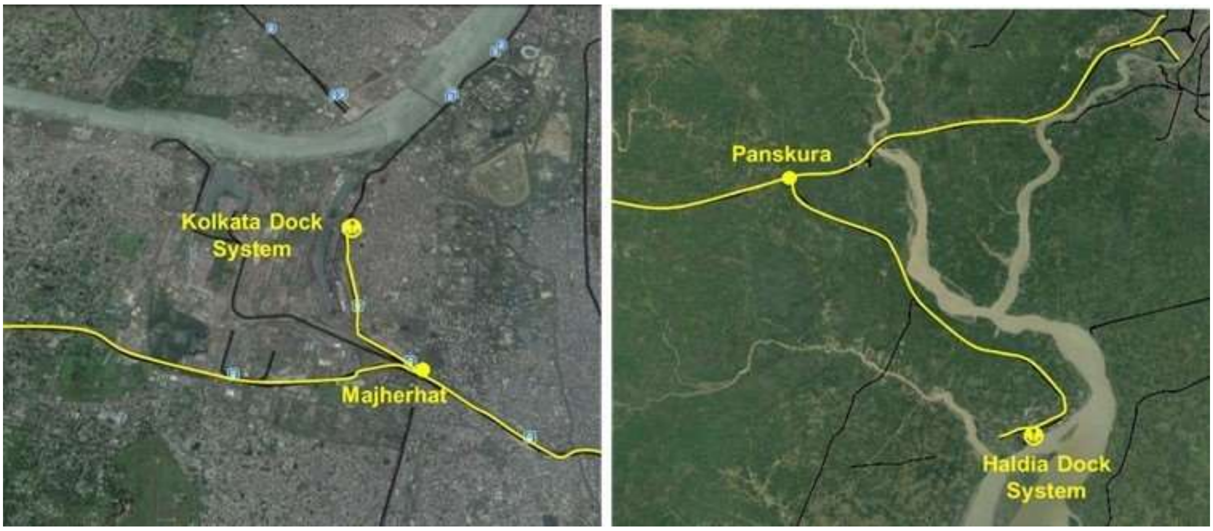


**Figure 2.3 Rail Connectivity for Kolkata and Haldia Dock Complexes**

## 2.2 Site Conditions

### 2.2.1 Climate

The climate of the West Bengal is tropical having four well-marked seasons, i.e., summer (March – May); monsoon (June – September); post monsoon (October – November); winter (December – February).

### 2.2.2 Temperature

The month of May is the hottest, whereas December and January are colder months for both Haldia and Kolkata. According to the IMD data between 1961 and 1990, the highest temperature recorded in 30 years is 40.6°C at Kolkata while 36.1°C at Sagar Island, which is closer to Haldia. The lowest temperatures were observed to be 9.7°C and 12°C for Kolkata and Haldia, respectively.

### 2.2.3 Rainfall Data

This region is mainly exposed to Southwest monsoon from June to September and an annual rainfall of more than 1700 mm were reported for the two locations. The IMD data suggests that the months of July and August are the wettest months having monthly rainfall of more than 350 mm. During northwest monsoon from November to March, monthly average rainfall of less than 50 mm is experienced.

### 2.2.4 Visibility

Visibility at Haldia is better compared to that at Kolkata, as the area is free from industrial smoke. At times due to heavy rainfall poor visibility is reported during the southwest monsoon. On an average, fog is reported on 5-7 days in each month from November to February during morning hours.

### 2.2.5 Wind

The predominant wind direction reported at Alipur, Kolkata and Sagar Island, is from south and southwest. About 25 % of the time wind was reported to be blowing from north and northeast. The highest wind speed of 16 knots was reported in the month of May. During the months of April to August wind speed was found to be higher than 10 knots.

## 2.2.6 Tide

The tidal details at Haldia and Kolkata are as follows:

| | Haldia | Kolkata |
|---|---|---|
| Highest High Water (HHW) | : (+) 7.26 m CD | : (+) 7.70 m CD |
| Mean High Water Spring (MHWS) | : (+) 5.70 m CD | : (+) 5.62 m CD |
| Mean High Water (MHW) | : (+) 5.01 m CD | : (+) 5.01 m CD |
| Mean High Water Neaps (MHWN) | : (+) 4.26 m CD | : (+) 4.10 m CD |
| Local Mean Water Level (LMWL) | : (+) 3.23 m CD | : (+) 3.19 m CD |
| Mean Low Water Neaps (MLWN) | : (+) 2.10 m CD | : (+) 2.00 m CD |
| Mean Low Water (MLW) | : (+) 1.34 m CD | : (+) 1.68 m CD |
| Mean Low Water Springs (MLWS) | : (+) 0.80 m CD | : (+) 1.41 m CD |
| Lowest Low Water (LLW) | : (-) 0.07 m CD | : (+) 0.14 m CD |

## 2.2.7 Earthquake

Most of the West Bengal including Haldia and Kolkata are found to lie in Zone III of Indian Map of Seismic zones (IS-1893 Part-1 2002) which is a moderate risk seismic intensity zone (**Figure 2.4**).

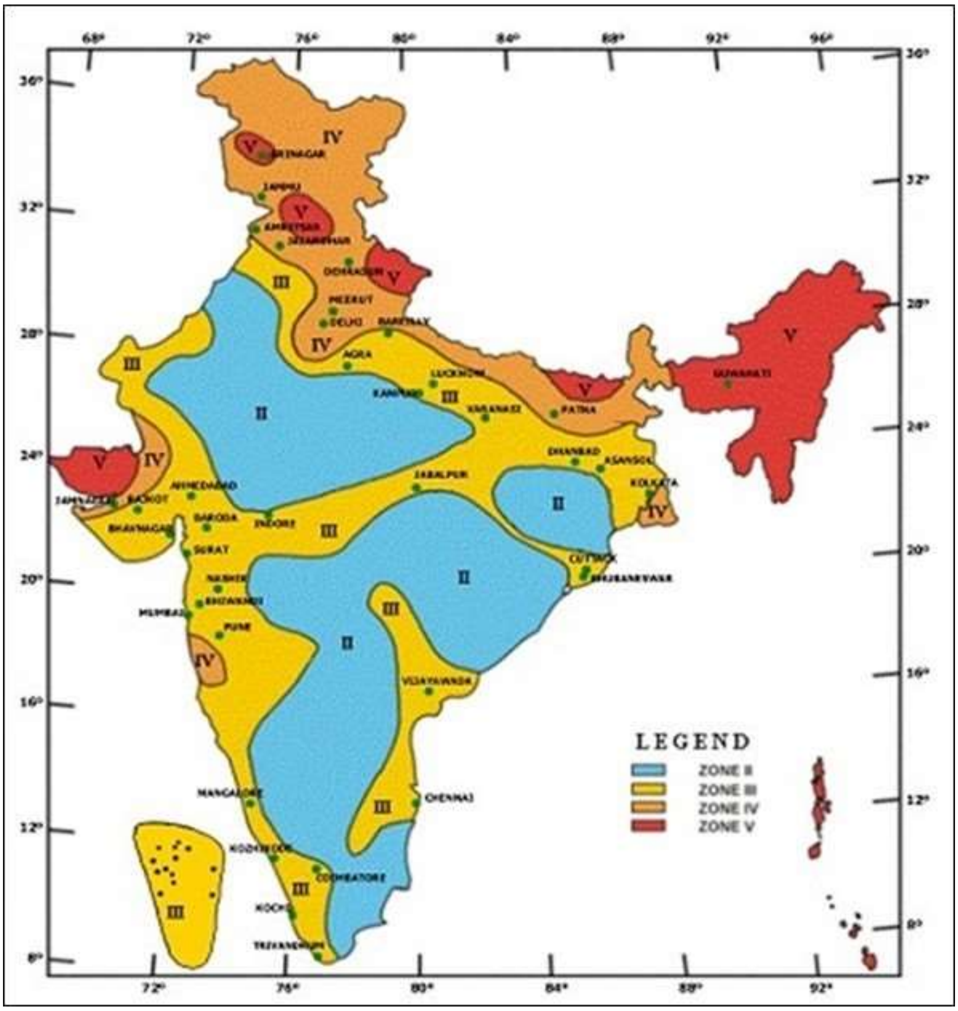


**Figure 2.4 Seismic Zoning Map of India as per IS-1893 Part 1 – 2002**

# 3.0 DETAILS OF EXISTING FACILITIES

Kolkata Port comprises of two dock systems one at Kolkata and other at Haldia. This section discusses facilities at both the docks in details.

## 3.1 Navigational Channel & Navigation

Kolkata Port Trust (KPT) maintains two approach channels from sea one via Eastern channel for vessels visiting to KDS and the other via Eastern channel / EDEN for vessels visiting to HDC as shown in **Figure 3.1**.

Whereas, the pilotage distance to KDS is 223 km comprising 148 km of river and 75 km of sea pilotage, the pilotage distance to Haldia is 125 km out of which 75 km is sea pilotage. Remote pilotage assistance is provided through VTMS during the sea passage of the vessels in both the channels.

Both the KDS and HDC channels are well marked with nearly 125 light vessels / lighted buoys and 500 shore marks. The Centre Pilot Control Station is located on Sagar Island. In addition to the pilot station, KoPT maintains a pilot vessel at around Sagar in foul weather. The pilot transfer is undertaken for the pilot station / pilot vessel through dedicated pilot launches. While the pilots for KDS vessels board at middle point south of Sagar, for Haldia vessels the pilot launching is undertaken south of Eden in fair weather and north of Eden during foul weather. For the outward passage the same process is used in a reverse order. At Haldia the pilot bringing the vessel hands over the vessel at the lock entrance to the Berthing Master but all vessels bound for oil jetties are taken alongside by the same Pilot.

Being a riverine port with numerous sand bars (shoals), the advantage of rise of tide is utilized to obtain the maximum draft for shipping. Variation in draft occurs between spring and neap tide and forecast of draft for inward and outward ships are published from Kolkata by the Harbour Master (River) about four/six week in advance. Because of the sharp bends in the river the length of the vessel that can be accommodated is restricted to 172 m at Kolkata and 189 m at Budge Budge. Due to the nature of river and the shifting of sand taking place regularly inside the channels regular hydrographic surveys are done to confirm the depth and width of the channel.

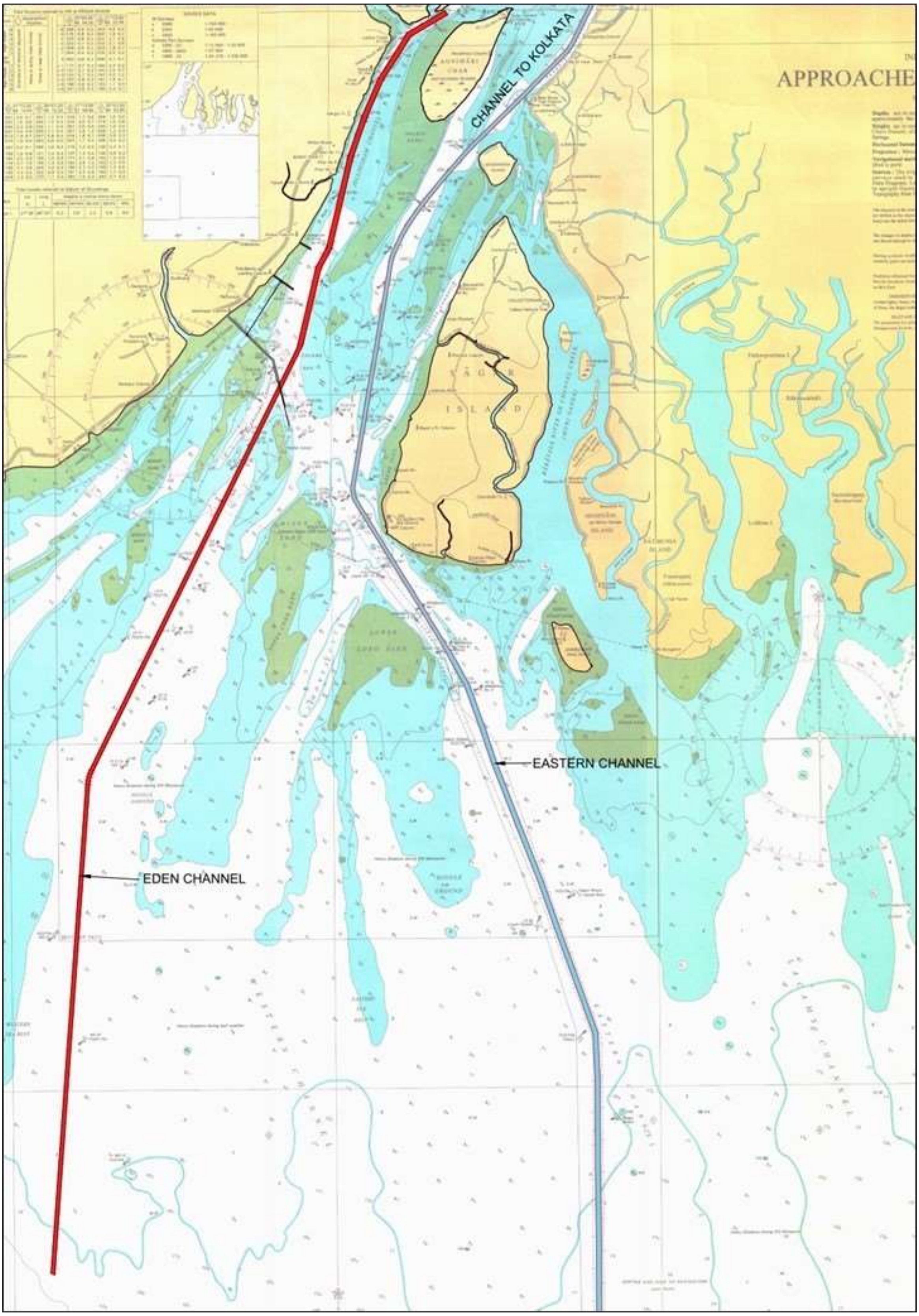


**Figure 3.1 Navigational Channel Layout to Kolkata and Haldia**

## 3.2 Port Layout and Facilities at Kolkata Dock System

Kolkata Dock System comprises of three sub components, i.e., Kidderpore Dock (KPD), Netaji Subhash Dock (NSD) and Budge Budge Oil Jetties. The Kolkata port is about 145 km from the Sagar Island and 232 km from sand head.

### 3.2.1 Existing Berths at Kolkata Dock System

#### *3.2.1.1 Kidderpore Dock*

The KPD comprises of two Dock basins – separated by a bascule bridge. KPD – I has 12 berths and KPD – II has 8 berths (**Figure 3.2)**. The total cargo handling capacity of all 20 berths is about 3.24 MTPA. The entrance to basin is through twin locks. The size of berths and the back-up storage facilities in KPD – I and KPD – II are listed in **Table 3.1** and **Table 3.2** respectively. It is important to mention that there are several dilapidated structures at KPD, i.e. KPD 16, 18, 19 and 21 which were earlier utilised for ship breaking activities.

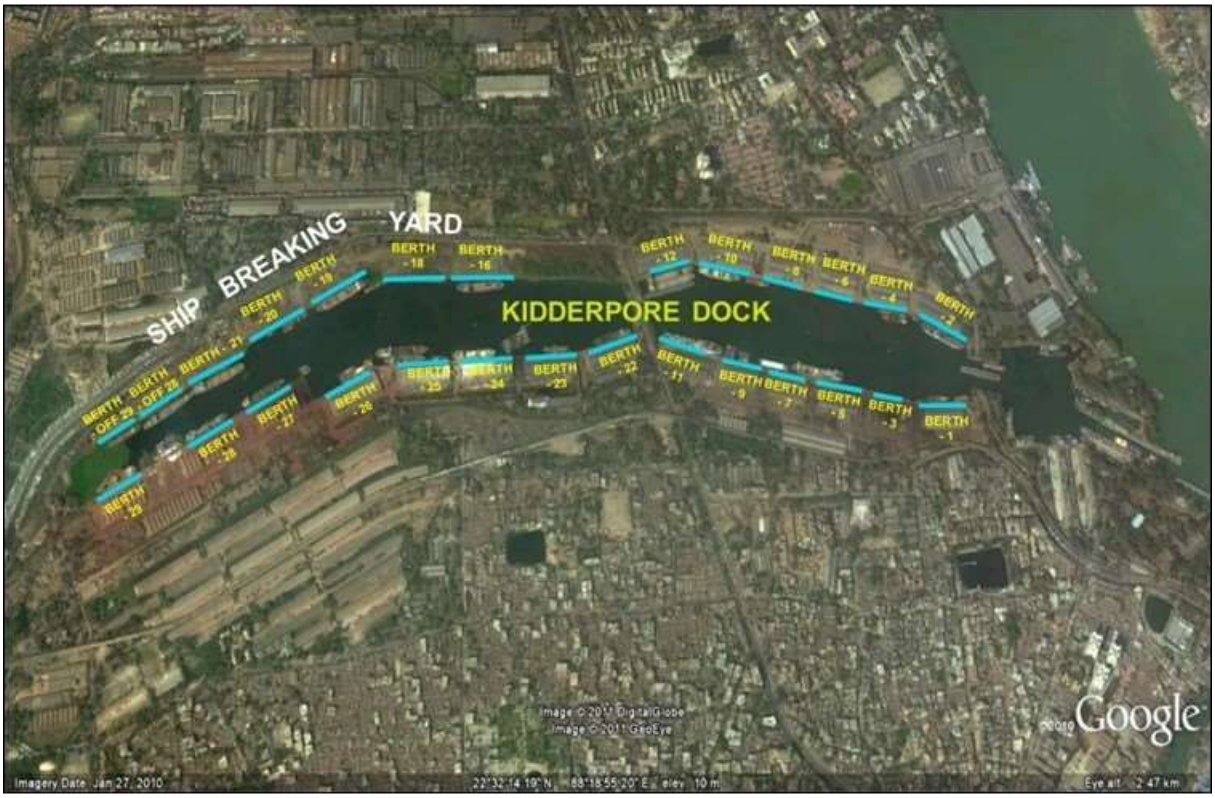


**Figure 3.2 Layout Plan of Kidderpore Dock**

**Table 3.1 Berth Wise Specifications of Storage Area (KPD - I)**

| Berth | | | Shed | | Major Commodity Handled in 2014-15 |
|---|---|---|---|---|---|
| No. | Length (m) | Width (m) | Covered (Sqm) | Open (Sqm) | |
| 1 | 133 | 18.29 | 3,345 | 2,565 | G/C |
| 2 | | | | 2,693 | Coastal |
| 3 | 128 | 18.29 | - | 3,887 | G/C |
| 4 | 136 | 15.24 | 3,344 | 9,098 | G/C |
| 5 | 229 | 18.29 | 6,689 | 4,128 + 4,374 | G/C |
| 6 | 118 | 15.24 | 3,345 | 11,849 | G/C |
| 7 | | | | | G/C |
| 8 | 128 | 15.24 | 3,344 | 4,647 | G/C |
| 9 | 108 | 18.29 | 3,345 | 3,812 | G/C/ |
| 10 | 161 | 15.24 | 3,345 | 5,683 | G/C |
| 11 | 151 | 18.29 | 3,344 | 1,604 | Coastal /Also passenger terminal for A&N islands |
| 12 | 143 | 15.24 | 3,344 | 5,699 | Coastal |

*[Source: KoPT Website and Admin Reports]*

**Table 3.2 Berth Wise Specifications of Storage Area (KPD - II)**

| Berth | | | Shed | | Major Commodity |
|---|---|---|---|---|---|
| No. | Length (m) | Width (m) | Covered (Sqm) | Open (Sqm) | |
| 22 | 151 | 12.2 | 8,919 | Nil | G/C |
| 23 | 147 | 12.2 | - | Nil | G/C |
| 24 | 152 | 12.2 | 6,919 | Nil | G/C |
| 25 | 169 | 12.2 | 8,919 | Nil | G/C |
| 26 | 185 | 12.2 | 9,033 | 2,616 | G/C |
| 27 | 195 | 21.3 | 3,623 | 3,680 | G/C |
| 28 | 195 | 21.3 | 3,523 | 3,726 | G/C |
| 29 | 183 | 21.3 | 3,623 | 3,440 | G/C |

*[Source: KoPT Website and Admin Reports]*

### 3.2.1.2 *Netaji Subhash Dock*

The NSD comprises of dock basin with a single lock entrance and has 10 berths and 2 dry docks (**Figure 3.3**). Sizes of berths and the storage space around these are given in **Table 3.3**.


**Figure 3.3 Layout Plan of Netaji Subhash Dock**

**Table 3.3 Berth Sizes and Storage Capacity at NSD**

| Berth | | | Shed | | Major Commodity |
|---|---|---|---|---|---|
| No. | Length (m) | Width (m) | Covered (Sqm) | Open (Sqm) | |
| 1 | 200 | 13.7 | - | 6,000 | G/C + H/Lift |
| 2 | 187 | 15.2 | 11,757 | 3,831 | G/C |
| 3 | 183 | 15.2 | 11,758 | 3,600 | Container |
| 4 | 181 | 15.2 | 11,758 | 3,400 | Container |
| 5 | 182 | 12.2 | - | 11,000 | Container |
| 7 | 192 | 21.3 | 9,000 | 50,000 | Container |
| 8 | 225 | - | - | - | Container |
| 12 | 152 | - | 1,872 | - | Liquid |
| 13 | 174 | 15.2 | 10,093 | 1,278 | G/C |
| 14 | 174 | 15.2 | 15,235 | 2,555 | G/C |

### 3.2.1.3 Budge Budge Oil Jetties

Budge Budge is located about 25 km downstream of Kolkata. Amongst the earliest handling facilities that were constructed on the River Hooghly, the Oil Jetties at Budge Budge continue to be operational. There are 6 jetties of different sizes with associated storage facilities which are operational with handling capacity of 3.0 MTPA as shown in **Figure 3.4**. Details of these jetties and the associated storage facilities are given in **Table 3.4** and **Table 3.5**.


**Figure 3.4 Layout Plan of Budge Budge Jetties**

**Table 3.4 Berthing Facilities at Petroleum Wharves at Budge Budge**

| Berth No. | Length (m)* | Commodity |
|---|---|---|
| 1 | 189 | POL, Veg. Oil & other liquid |
| 2 | 102 | -do- |
| 3 | 163 | -do- |
| 5 | 189 | -do- |
| 7 | 189 | -do- |
| 8 | 189 | -do- |

** Length mentioned in this Table refers to the maximum length of the vessel that can be berthed at these jetties*

**Table 3.5 Storage Capacities at Budge Budge**

| a) POL | | |
|---|---|---|
| IOCL | 26 Tanks | 10,3,550 KL |
| BPCL | 39 Tanks | 98,748 KL |
| HPCL | 18 Tanks | 77,000 KL |
| IBP | 18 Tanks | 30,571 KL |
| **Total** | **101 Tanks** | **3,09,869 KL** |
| **b) Non POL & Other Liquid** | | |
| HSD Co. Ltd. | 12 Tanks | 81,114 KL |
| JRE | 13 Tanks | 25,475 KL |
| Mundial | 5 Tanks | 9,822 KL |
| Surya | 12 Tanks | 24,445 KL |
| ARCO | 14 Tanks | 6,070 KL |
| S.K. Oil | 13 Tanks | 74,692 KL |
| NDDB | 5 Tanks | 9,822 KL |
| Others | 12 Tanks | 27,153 KL |
| **Total** | **86 Tanks** | **7,74,781 KL** |

### 3.2.2 Cargo Handling Equipment at Kolkata Dock System

KDS has self-owned as well as hired equipment for cargo handling (**Table 3.6**). In addition to the owned equipment, port has also hired 2 MHC of 40 T each, 6 reach stackers of 45 T each and 20 tractors.

**Table 3.6 Cargo Handling Equipment / Facilities**

| Self-owned Equipment | Quantity / Capacity |
|---|---|
| Mobile Crane | 1 No. – 9T<br>1 No. – 10 T<br>2 No. - 13 T<br>3 No. – 30 T |
| Wharf Crane | 1 No. – 200T |
| Fork Lift Truck | 10 No. – 3T<br>1 No. – 2 T |
| Tractor | 8 No. – 20 T |
| Reach Stacker | 3 No. – 45T |

| Self-owned Equipment | Quantity / Capacity |
|---|---|
| Rubber Tyred Gantry Cranes | 3 No. – 35.5 T<br>1 No. – 40 T |
| Trailers | 24 No. – 10 T<br>4 No. – 20 T<br>2 No. – 25 T<br>2 No. – 35 T<br>19 No. – 40 T<br>6 No. – 20 T |

### 3.2.3 Port Railways at Kolkata Dock System

KDS is connected to Eastern Railway (ER) at Majherhat Railway Station. Goods trains are brought upto the EJC (East Dock Junction), by locomotives of ER after which they are taken over by port owned locomotives (**Figure 3.5**).

Presently, the railway system serves berths number 27, 28 and 29 at KPD and CPY for containers at NSD. Though there are railway tracks from 22-26 KPD. These rail lines are unfit due to long disuse. Moreover this portion of the line is no longer connected to the main interchange yard. Similarly, the railway track 1-4 NSD since it is not connected to the main interchange yard.

Apart from these, there are following public/private sidings which have rail linkage with KDS railway and receive rail borne traffic.

- CESC (Southern Generating Station)
- FCI (JJP Depot)
- Balmer Lawrie & Co.
- Pig Iron Supply Syndicate.
- Braithwaite & Co.
- CONCOR EJC Terminal.


**Figure 3.5 Existing Rail Network at KDS**

The present dock bound rail traffic consists mainly of Containers for Nepal and Amingaon bound cargo. However, sporadic traffic like coal, wheat, tea, peas, coil, fertilizer, rice etc. is loaded/ unloaded at Dock-II as per requirement.

The traffic at private sidings are mainly Thermal Coal (CESC), Food grain/Sugar at FCI(JJP Siding), Iron & Steel from SAIL (handled at B.L. & Co. siding and PISS siding), Aluminium Plates made by NALCO for BL & Co. and materials for manufacturing wagons at B.W.Co. siding.

# 3.3 Port Layout and Facilities at Haldia Dock Complex

## 3.3.1 General

Haldia Dock Complex (HDC) consists of 17 berths out of with 14 berths are located inside the dock and three oil jetties are on the bank of the river Hooghly (**Figure 3.6**).


**Figure 3.6 Layout Showing Location of the Berths at HDC**

Haldia is an all-weather port having a 300.2 m long and 39.6 m wide lock gate and a turning basin of 450 m in diameter. The average draft availability at HDC is 8.0 m.

HDC is having 6,367 acres of land area for port use.

### 3.3.2 Existing Berths at Haldia Dock Complex

**Table 3.7** presents the details of existing berth and cargo handled during 2014-15 at HDC.

**Table 3.7 Details of Existing Berths**

| S. No. | Berth | Length (m) | LOA (m) | Cargo Handled (2014-15) MTPA |
|---|---|---|---|---|
| 1. | HOJ-I | 290 | 238 | 1.93 |
| 2. | HOJ-II | 330 | 270 | 2.21 |
| 3. | HOJ-III | 345 | 275 | 0.69 |
| 4. | Berth No. 2 | 260 | 238 | 1.63 |
| 5. | Berth No. 3 | 337 | 239 | 1.03 |
| 6. | Berth No. 4 | 284 | 230 | 1.17 |
| 7. | Berth No. 4A | 245 | 180 | 3.14 |
| 8. | Berth No. 4B | 181 | 183 | 4.3 |
| 9. | Berth No. 5 | 195 | 183 | 0.98 |
| 10. | Berth No. 6 | 234 | 212 | 1.58 |
| 11. | Berth No 7 | 234 | 212 | 1.28 |
| 12. | Berth No. 8 | 218 | 220 | 1.56 |
| 13. | Berth No. 9 | 218 | 210 | 2.42 |
| 14. | Berth No. 10 | 220 | 210 | 0.35 |
| 15. | Berth No. 11 | 220 | 210 | 1.18 |
| 16. | Berth No. 12 | 220 | 210 | 0.87 |
| 17. | Berth No. 13 | 220 | 210 | 1.54 |

*[Source: Data Received for HDC for 2014 -15.]*

The depth inside the impounded dock system at all the berths on an average is 9.5 m at HOJ I, HOJ II and HOJ III the depths are 9m, 11 m and 10 m respectively.

While HOJ1, can accommodate upto a maximum length of 238 m having a maximum DWT of 80,000, T, HOJ2 can handle vessels having maximum length of 250 m and maximum DWT of 1,30,000 T.

All the berths inside the impounded dock can accommodate Panamax size vessels having LOA up to 235 m and DWT of 75,000 DWT.

#### *3.3.2.1 Haldia Oil Jetty-I (HOJ-I)*

HOJ-I also known as Satish Samanta Oil Jetty is located upstream of the lock gate entrance to the dock and was commissioned during 1968 for handling crude and POL products, Paraxylene, LPG, Naptha, Benzene, Butadiene, Py Gas, MO Gas, Butene, FO, Bitumen Liquid ammonia. There are direct pipeline connections from this berth to the Indian Oil Refinery, Hindustan Fertilizer, Haldia Petrochemicals, Tata Chemicals and other users.

### 3.3.2.2 Haldia Oil Jetty-II (HOJ-II)

HOJ-II was commissioned in 1991 and is located adjacent to HOJ-I. It has modern and sophisticated facilities for handling crude and POL products (SKO, HSD, Naphtha, and FO) and has direct pipeline connection to user industries such as Haldia Petrochemical and IOC refinery. Apart from the above, facility of receiving Slop/Ballast water is also available. The jetty can handle tankers up to 150,000 DWT.

### 3.3.2.3 Haldia Oil Jetty-III (HOJ-III)

HOJ-III is a riverine Oil Jetty was commissioned in April 2000 and is located downstream of the lock gate. It has modern and sophisticated facilities for handling crude oil for refineries at Barauni and Haldia. It is also connected to the storage facility of Reliance Industries Limited at Haldia for marketing purposes. The jetty can handle tankers up-to 150,000 DWT.

### 3.3.2.4 Berth 2

Berth 2 is currently handling Iron Ore, Thermal Coal, Paraxylene, Coking coal, Non-Coking coal, Met coke, R.P coke, C.P coke, Limestone and Rock Phosphate. The berth can service ships upto 75,000 DWT.

### 3.3.2.5 Berth 3

Berth 3 has handling capacity of 2.25 MTPA and was originally designed for handling iron ore but at present handles thermal coal and non-dangerous POL products. The berth handles ships up to 90,000 DWT. This berth has open storage of 50,000 $m^2$.

### 3.3.2.6 Berth 4

Berth 4 is designed for shipping thermal coal with the help of mechanized loading system and it can handle ships up to 90,000 DWT. The berth has a backup storage area of 50,000 $m^2$.

### 3.3.2.7 Berth 4A

Berth 4A is a fully mechanized berth under the license agreement with the International Seaports (Haldia) Pvt Ltd for a period of 30 years with effect from May 2002 to handle ships of maximum DWT of 90,000 DWT. The berth is designed to unload gearless Panamax vessels.

### 3.3.2.8 Berth 4B

The berth was commissioned in February 2002 to handle coal, coke, iron ore and other dry and break bulk cargo. The berth can handle ships up to 90,000 DWT. The berth is connected to its backup area through a railway line.

### 3.3.2.9 Berth 5

Berth 5 is designed to handle Iron Ore, Coking Coal, and Fertilizer Raw Material and is equipped with two clam shell unloaders connected to storage area (open and covered). Direct rail connectivity has been provided from berth to the back-up area. Total storage areas available for this berth are 75,000 $m^2$.

#### 3.3.2.10 Berth 6 & 7

These two berths are located on each side of a Finger Jetty, conventionally handling bulk and break bulk cargos with the help of vessels' own gears. Besides, these berths have facilities for pipeline discharge of different liquid bulk cargo such as Phosphoric Acid, Carbon Black Feed Stock, Edible Oil, Molasses etc. A floating Pipeline Handling Facility for unloading Edible Oil at Berths 5 /off 5/ 6 /off 6 at HDC has also been recently commissioned.

#### 3.3.2.11 Berth 8

The cargo handled at this berth is mainly coking coal, limestone, steel, general and other bulk cargo. The berth is prioritised for TISCO and has dedicated back-up area and rail connectivity. The berth can handle ships up to 90,000 DWT.

#### 3.3.2.12 Berth 9

The berth 9 has a continuous quay face with berth 8 and has a capacity of 1 MTPA where a ship up to 90,000 DWT may be handled. It is a general cargo berth used for handling dry bulk, breakbulk and containerized cargo. This berth has covered storage shed of floor area of 100,000 sqft. This berth has direct rail connectivity to its back up area.

#### 3.3.2.13 Berths 10 & 11

These were general cargo berths and were used for handling containerized cargo along with break bulk, dry bulk. These berths have total combined area of 11,000 $m^2$. These berths have now been allocated to a BOT operator for development of container terminal. These berths have direct Broad Gauge rail access to Container Parking Yard.

#### 3.3.2.14 Berth 12

The physical construction of berth 12 was completed in September 2000 and was awarded to T.M. International Logistics Ltd in January 2002 for its mechanization, maintenance and management for a period of 30 years. The berth has an open storage area of 14,000 $m^2$ and a covered storage area of 3000 $m^2$. The berth mainly handles breakbulk cargo and can handle ships of maximum upto 90,000 DWT.

#### 3.3.2.15 Berth 13

Berth 13 is handling dry bulk and general cargo and it can handle ships of maximum upto 75,000 DWT.

### 3.3.3 Cargo Handling System at HDC

The HDC has a mix of conventional and mechanised handling at various berths (**Table 3.8**). In addition, the port has other equipment which is used as and when required for its operations (**Table 3.9**).

**Table 3.8 Cargo Handling Equipment / Facilities**

| Berth | Cargo Type | Equipment/ Facilities |
|---|---|---|
| 4 | Thermal Coal | 2 - 1500 TPH Wagon Tipplers,<br>2 - Stacker-cum-Reclaimers,<br>2 -1500 TPH Shuttle Boom type Ship Loaders,<br>2 - Wagon Feeding Systems. |
| 4A | Coking Coal | 2 - Stacker-cum- Reclaimers,<br>2 Wagon Loaders,<br>2 - Mechanized Grab un-loaders |
| 5 | liquid Cargo | - |
| 2 & 8 | Dry Bulk | 2 Mobile harbour crane of capacity 100 MT each. For Shore handling operation: 25 dumpers, 9 pay loaders, 1 bulldozer and 2 excavators |
| 9 | Dry Bulk, Break Bulk | Shore handling operation performed by licensed handling agents. |
| 10 &11 | Containers | 2 – Rail Mounted Quay Cranes (RMQC),<br>4 - Rubber Tyred Yard Gantry Cranes (RTYGC) [to be introduced shortly],<br>3 Reach Stackers, 20 Tractor-Trailer combinations, Fork-Lift & Top Lift trucks. |
| 13 | Dry Bulk and general Cargo | 2 Mobile Harbour Cranes (installation by September, 2016) |

**Table 3.9 Additional Port Equipment**

| Number | Type |
|---|---|
| 4 | RTYGCs (Each having capacity of 40 MT under spreader) |
| 2 | RMQCs (Each having capacity of 40 MT under spreader) |
| 2 | Mobile Crane (one having capacity 15 MT and the other 9 MT) |
| 12 | Locomotives |

### 3.3.4 Storage Area

HDC has adequate storage area for the serviced cargo (**Table 3.10**). Two covered transit sheds are located behind Berth No. 9 and Main Canteen of G.C. Berth respectively. Extensive cargo back-up hardstand area is available behind Berth 4B.

**Table 3.10 Details of Storage Area (Sqm)**

| Location/ Storage Type | Area ($m^2$) |
|---|---|
| Inside Custom Bonded Area | |
| – Transit Shed | 17,000 |
| – Hardstand | 3,57,000 |
| – Available bare land | 8,48,000 |
| Outside Custom Bonded Area | |
| – Liquid | 1,93,500 KL |
| – Dry Bulk/Container Storage etc. | 1,09,950 |
| – Available Storage area | 7,32,240 |

### 3.3.5 Power Distribution

HDC receives H.T. power supply from 132 KV substation of West Bengal State Electricity Board for Port Operations. HDC also has a standby D.G. sets for operation of Lock Gates of the impounded dock system.

### 3.3.6 Port Railways

Port Railways at Haldia is equipped with modern signalling and telecommunication facilities **(Figure 3.7)**. It has two wagon interchange yards connected to the South-Eastern Railways. Port Railways has an annual capacity of 18 MT. Port owns a fleet of 11 locomotives. Port Railways serves private as well as common users sidings. Common users' sidings are available inside Dock bounded area as well as outside Dock area for handling General and Bulk cargo. One Liquid cargo siding is also available.

HDC is connected with Durgachak (DZK) station of S E Railway and connects the Howrah-Kharagpur main line through Panskura, thereby providing the link to the all India rail network.

Berth wise details of port railways are as follows:

- Berth No. 2 has two full rake length lines.
- Berth No. 4 has two wagon tipplers connected to the stack yard through conveyors, stacker re-claimer and ship-loader.
- Berth No. 4A (BOT Berth) has one full rake length siding which has facility for mechanized loading of railway wagons.
- Berth No. 12 (BOT Berth) has a railway siding having two full rake length railway siding.
- Two full rake length railway lines in the extended dock boundary area.

#### *3.3.6.1 Connectivity to Berths*

- For Berth 4B there are two full length service lines used for loading imported coking coal.

- For Berth 5 there are 2 full length lines for loading imported coking coal.
- For Berth 8, there are 2 short lines which can together hold 59 wagons for loading coking coal to SAIL (10) and also for loading coking coal and limestone to TISCO by using 2 short lines, which can, together load a rake of 59 wagons.
- For Berths 9 to 12, two full length lines are available for loading fertilizers, food grains, oilseeds and containers and steel.

There are 2 Common Users Sidings I and II having 3 full length lines each. In addition, there are a number of private sidings for IOC, BPCL, PCC, SAIL, HMCPCL etc.

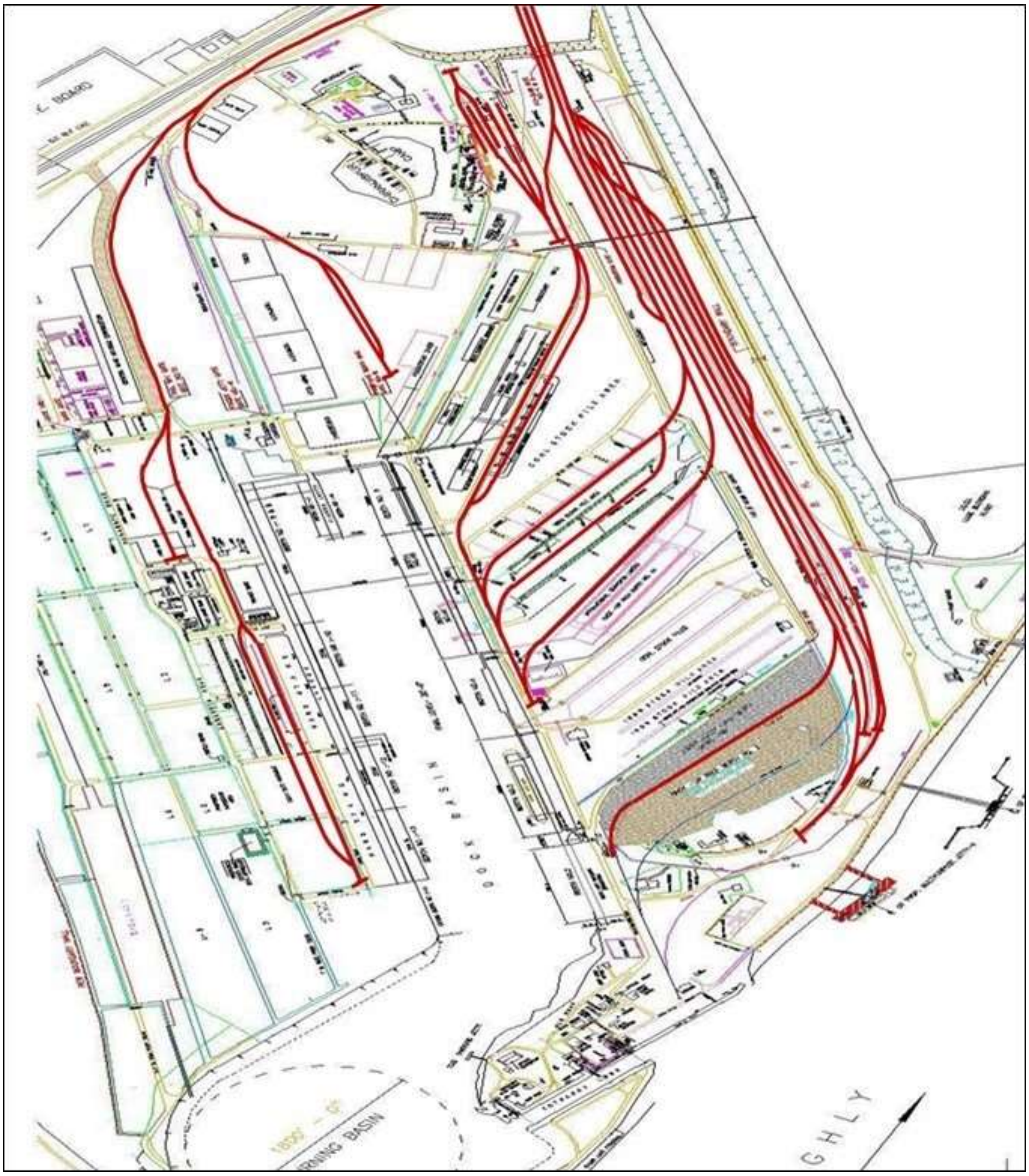

**Figure 3.7 Internal Rail Network of Haldia Port**

### 3.3.7 Navigational Aids

#### ***3.3.7.1 Lighthouse***

Sagar Lighthouse (21°39′N 88°03′E) is situated at Middleton Point on the Sagar Island which is about 1.5 km inshore. It is visible from a distance of 28 km in clear weather.

Dariapur Lighthouse (21°47′N 87°52′E) is situated on the right bank of Hooghly River south of Rasulpur river and is about 2.7 km inshore. It is visible from a distance of 35 km in clear weather.

#### ***3.3.7.2 Light Vessels***

There are four unmanned light vessels to aid in navigation and these are located at following locations:

- U.G.L.F. at 21°29′57″N 88°06′37.5″E
- L.G.L.F. at 21°21′57″N 88°10′05″E
- Talent WK L.V. at 21°17′21″N 88°11′17″E
- Eastern Channel L.V. at 21°04′19″N 88°11′07″E

#### ***3.3.7.3 Port Flotilla and Other Crafts***

There are nine tugs of different capacity with the port (**Table 3.11**). Apart from tugs, port has one grab dredger, one anti-pollution vessel and two multi-purpose launches. It was informed that port also engages private dredgers on contract basis for dredging the channel.

**Table 3.11 Details of Port Tugs**

| Number | Type |
|---|---|
| 1 | 22 T Bollard Pull |
| 1 | 32 T Bollard Pull |
| 3 | 30 T Bollard Pull |
| 2 | 45 T Bollard Pull |
| 2 | 35 T Bollard Pull |

#### ***3.3.7.4 River Marks and Buoys***

Over 500 (of which 140 are lighted) River Marks and Buoys are maintained by the KoPT. These are extremely useful in facilitating night navigation, pilotage and dredging. There are also 1 boat buoy, 30 lighted buoys and 72 unlit buoys marking the navigational channel from Sand heads to Kolkata.

#### ***3.3.7.5 Vessel Traffic Management System (VTMS)***

Navigational aid information is provided through VTMS for plying vessels. KoPT is having VTMS console at Haldia with four X band RADAR and AIS stations at Haldia, Frasergaunj, Dadanpatra and Sagar with communication system, metro logical system, microwave communication link etc.

# 4.0 PERFORMANCE, OPTIONS FOR DEBOTTLENECKING & CAPACITY ASSESSMENT

## 4.1 General

The total cargo handled through the existing facilities, during the past 5 years for KDS and HDC are presented in the following **Table 4.1** and **Table 4.2**.

**Table 4.1 Cargo Handled During Last 5 Years at KDS (in MTPA)**

| Commodity | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|---|---|---|---|---|---|
| POL+ Crude + Product + other | 0.878 | 0.682 | 0.708 | 0.717 | 1.434 |
| Iron Ore | 0.104 | - | - | - | 0.133 |
| Fertilizer | 0.028 | 0.014 | 0.042 | 0.004 | 0.098 |
| Coal | 0.042 | 0.003 | 0.009 | 0.028 | 1.675 |
| Containers | | | | | |
| − Tonnage | 6.220 | 6.818 | 6.960 | 7.063 | 8.110 |
| − TEUs | 0.377 | 0.412 | 0.463 | 0.449 | 0.528 |
| Others | 5.268 | 4.716 | 4.125 | 5.062 | 3.833 |
| **Grand Total** | **12.540** | **12.233** | **11.844** | **12.874** | **15.283** |

*[Source: Major Port of India Profile, IPA and Administrative reports, KoPT]*

**Table 4.2 Cargo Handled During Last 5 Years at HDC (in MTPA)**

| Commodity | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
|---|---|---|---|---|---|
| POL+ Crude + Product+ other | 9.654 | 7.907 | 6.195 | 6.098 | 9.422 |
| Iron Ore | 5.952 | 3.943 | 1.715 | 2.170 | 2.338 |
| Fertilizer | 0.459 | 0.519 | 0.386 | 0.560 | 0.205 |
| Coal | 8.183 | 7.285 | 6.479 | 6.948 | 11.624 |
| Containers | | | | | |
| − Tonnage | 2.835 | 2.619 | 2.869 | 2.230 | 1.958 |
| − TEUs | 0.149 | 0.140 | 0.137 | 0.113 | 0.102 |
| Others | 7.922 | 8.742 | 10.440 | 10.505 | 5.463 |
| **Grand Total** | **35.005** | **31.015** | **28.084** | **28.511** | **31.010** |

*[Source: Major Port of India Profile, IPA and Administrative reports, KoPT]*

## 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 Kolkata Port is given in the **Appendix 1**.

### 4.2.1 Recommendation for KDS

Regarding NSD, major recommendation is to improve container handling capacity. Out of 5 container handling berths (3, 4, 5, 7, and 8), two berths i.e. 3 and 7 are crane-less and it is posing a constraint. It is further assessed that berth 7 will not be able to support MHC load and hence only berth 3 may be considered for mechanisation. Moreover, it is further recommended that NSD 2, which handles break bulk, may be converted to container handling berth as it is close to container yard.

Extension of railway line at KPD was also recommended to allow complete rake loading in port premises.

### 4.2.2 Recommendation for HDC

HDC handled 30 MT of cargo in FY 14–15, of which dry bulk constituted ~60% volumes. It has capacity constraints and most of the berths are conventional berths and liquid berths are working at more than 70% occupancy (**Figure 4.1** & **Figure 4.2**).

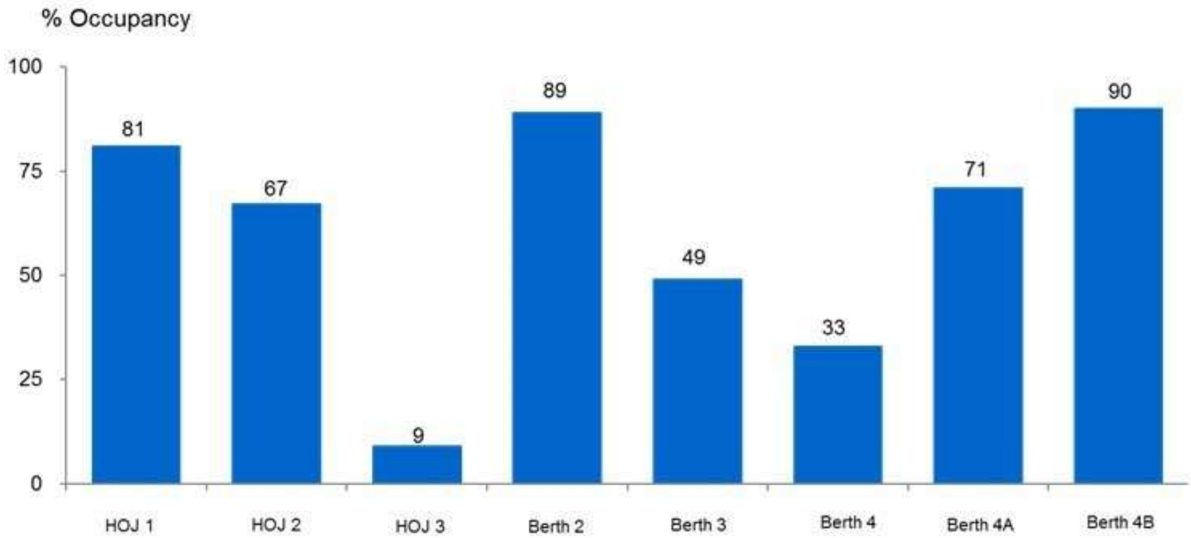


**Figure 4.1 Berth Occupancy Details of HOJ 1, HOJ 2, HOJ 3, Berth 2 to 4, Berth 4 A & 4 B**

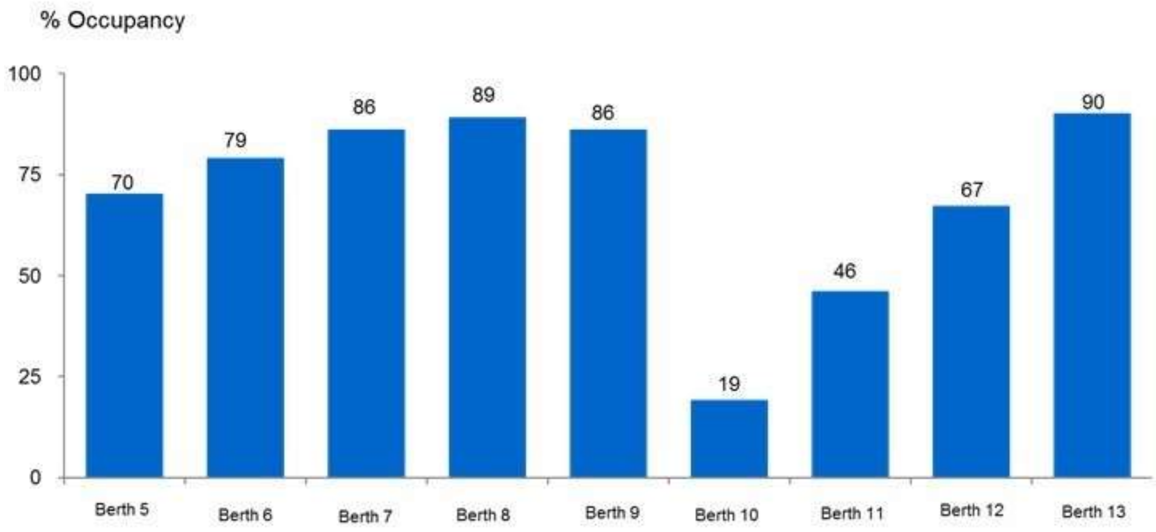


**Figure 4.2 Berth Occupancy Details of Berth 5 to Berth 13**

The BCG study highlighted that there is a need to add MHCs to berths 2, 8, 9 and 13 to increase berth capacity.

The study also suggested that vessels serviced at HDC generally stay for about 3 days at conventional berths and 2.5 days at Mechanised berths. The time spent at these berths also includes non-working time of 21-24 hr on account of shift breaks (14 hr) and waiting time for tide to sail out of lock gate (6 hr). To deal with these delays the report suggests bringing vessels in anticipation, creating additional waiting space inside the Dock and also providing for 2 additional tugs for timely shifting of the vessels.

The major bottleneck at HDC is the capacity of the lock gate which can allow entry and exit of limited number of ships per day. As the liquid bulk handled at berths 3, 5, 6 and 7 comes in low parcel sizes and higher number of ships results in wastage of lock gate capacity. Thus, it is advisable to shift these vessels outside the lock gate probably to HOJ II and HOJ III, which are operating at low occupancy.

## 4.3 Performance of Berths at KDS

### 4.3.1 Berths Inside KPD

Out of total 20 berths in KPD, only 13 berths were utilised to handle 0.5 MTPA of cargo during 2014 - 15. A total of 203 ships were handled with average parcel size ranging from 58 T to 5,928 T. All the berths were found to work at very low occupancy rate except berth KPD 8, which is handling container and is servicing 1.2 lakh T of cargo as shown in **Table 4.3**.

**Table 4.3 Analysis of Berths inside KPD**

| Berth No. | Cargo | Volume (T) | No. of Ships | Average Output '000 (TPD) | Berth Occupancy | Pre-Berthing Detention in Ship Days | Average Parcel Size, T |
|---|---|---|---|---|---|---|---|
| KPD 1 | Coal Tar Pitch, General | 24,405 | 6 | 1,317 | 10.9% | 1.6 | 4,068 |
| KPD 3 | Pet Coke, General | 80,579 | 15 | 1,753 | 16.5% | 12.6 | 5,372 |
| KPD 4 | General, Wooden logs | 65,906 | 18 | 1,433 | 20.9% | 9.6 | 3,661 |
| KPD 5 | Container, General, Sand, Salt, Steel, Wooden Log | 46,156 | 12 | 2,194 | 9.3% | 7.4 | 3,846 |
| KPD 6 | General | 11,695 | 3 | 1,794 | 2.9% | 0.9 | 3,898 |
| KPD 7 | General | 58 | 1 | 2,900 | 0.8% | 0.4 | 58 |
| KPD 8 | Container, General | 119,306 | 81 | 616 | 73.2% | 15.3 | 795 |
| KPD 9 | General | 2,899 | 2 | 950 | 1.2% | 3.0 | 1,450 |
| KPD 10 | General, Wooden logs | 11,169 | 4 | 1,249 | 3.3% | 0.9 | 2,792 |
| KPD 11 | Container, General | 11,880 | 29 | 532 | 29.6% | 3.6 | 410 |
| KPD 12 | General, Peas | 2,320 | 2 | 527 | 3.2% | 0.3 | 1,160 |
| KPD 27 | Coke, General, Iron Ore, Limestone, Sand, Wooden Logs | 130,422 | 22 | 2,860 | 16.5% | 10.4 | 5,928 |
| KPD 28 | Coke, Iron Ore, Sand, Wooden Logs | 79,113 | 8 | 3,748 | 9.0% | 2.7 | 9,889 |
| **Total** | | **505,938** | **203** | | | | |

However, on detailed examination it was noted that although the berth occupancy on account of vessels servicing cargo is low but these berth also handle many non-cargo vessels, i.e. barges, passenger vessels, repair vessels, Navy vessels etc. Therefore the actual berth occupancy at these berths is much higher as presented in **Table 4.4.**

**Table 4.4 Berth Occupancy at KPD Accounting All Vessel Types in 2014 - 15**

| Berth | No. of days | | | | | | | Percentage of Occupancy |
|---|---|---|---|---|---|---|---|---|
| | Available | Occupied | | | | | | |
| | | By Vessels | | | By Barges Working | Others | Total | |
| | | Working | Non-Wkg. | Repair | | | | |
| **1** | 365 | 51.0 | 0.0 | 0.0 | 47.0 | 74.0 | 172.0 | 47.1 |
| **3** | 365 | 70.8 | 0.0 | 0.0 | 8.5 | 97.0 | 176.3 | 48.3 |
| **4** | 365 | 101.4 | 0.0 | 0.0 | 65.7 | 65.0 | 232.1 | 63.6 |
| **5/7** | 365 | 46.0 | 1.2 | 0.0 | 172.0 | 23.0 | 242.2 | 66.4 |
| **6** | 365 | 10.4 | 3.8 | 0.0 | 95.3 | 3.0 | 112.5 | 30.8 |
| **8** | 365 | 273.4 | 0.0 | 0.0 | 20.3 | 12.0 | 305.7 | 83.8 |
| **9** | 365 | 10.1 | 5.1 | 0.0 | 91.5 | 0.0 | 106.7 | 29.2 |
| **10** | 365 | 24.1 | 0.0 | 0.0 | 70.2 | 78.0 | 172.3 | 47.2 |
| **11** | 365 | 127.7 | 34.2 | 178.8 | 0.0 | 24.0 | 364.7 | 99.9 |
| **12** | 365 | 11.6 | 0.0 | 234.9 | 31.1 | 70.1 | 347.7 | 95.3 |
| **22** | 365 | 0.0 | 0.0 | 114.2 | 13.6 | 150.0 | 277.8 | 76.1 |
| **23** | 365 | 0.0 | 0.0 | 0.0 | 74.7 | 289.3 | 364.0 | 99.7 |
| **24** | 365 | 0.0 | 0.0 | 12.0 | 63.6 | 221.5 | 297.0 | 81.4 |
| **25** | 365 | 0.0 | 0.0 | 0.0 | 173.8 | 133.0 | 306.8 | 84.1 |
| **26** | 365 | 0.0 | 0.0 | 17.2 | 118.8 | 0.0 | 136.0 | 37.3 |
| **27** | 365 | 60.4 | 0.0 | 0.0 | 122.1 | 0.0 | 182.5 | 50.0 |
| **28** | 365 | 33.0 | 45.6 | 0.0 | 155.1 | 66.0 | 299.7 | 82.1 |
| **29** | 365 | 0.0 | 0.0 | 0.0 | 78.9 | 285.2 | 364.0 | 99.7 |

*[Source: KoPT]*

### 4.3.2 Berths at NSD

The actual cargo handled in the impounded dock system of KDS, excluding traffic handled at Budge Budge Jetties and anchorages / IWT Jetties / IV Wharves, etc. for 2014-15 is **10.32 MT**. Berths NSD 4, 5 and 8 together service 70% of the cargo. These berths are found to have acceptable berth occupancy rates. Most of the other berths have very low occupancy rates and average parcel sizes were also found to be smaller. Bharat Kolkata Container Terminals Pvt. Ltd. (a wholly owned unit of PSA International) has been given a contract for integrated ship-to-shore services including back-up operations at berth no. 3, 4, 5, 7 & 8 NSD of KDS as shown in **Table 4.5**.

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### Table 4.5 Analyses of Berths Inside NSD

| Berth No. | Cargo | Volume (T) | No. of Ships | Average Output '000 (TPD) | Berth Occupancy | Pre-Berthing Detention in Ship Days | Average Parcel Size (T) |
|---|---|---|---|---|---|---|---|
| NSD 1 | Container, General, Project Cargo, Rock Phosphate, Steel, Wagon | 54,430 | 34 | 1,535 | 17.1% | 14.1 | 1,601 |
| NSD 2 | Container, General, Mach, Rock Phosphate, Steel, Wagon | 378,998 | 56 | 5,720 | 26.2% | 13.7 | 6,768 |
| NSD 3 | BMO, Container, Furnace Oil, HSD, LDO, Benzene, Palm Oil, Sulphuric Acid | 970,461 | 129 | 6,271 | 59.7% | 48.7 | 7,523 |
| NSD 4 | Container | 2,381,500 | 197 | 10,488 | 78.5% | 115.4 | 12,089 |
| NSD 5 | Container, General | 1,354,421 | 123 | 9,123 | 54.6% | 60.4 | 11,012 |
| NSD 7 | Container | 891,470 | 93 | 6,548 | 50.5% | 44.6 | 9,586 |
| NSD 8 | Container, General | 2,016,114 | 170 | 9,243 | 74.8% | 70.5 | 11,859 |
| NSD 12 | BMO, Container, Lube Oil, Palm Fatty acid | 51,671 | 14 | 2,811 | 8.4% | 8.7 | 3,691 |
| NSD 13 | Coke, Container, General, Peas, Sand, Sulphur | 58,308 | 30 | 1,306 | 19.4% | 9.8 | 1,944 |
| NSD 14 | Coal, Coke, Container, General, Salt, Steel, Wooden Log | 81,372 | 28 | 2,069 | 16.8% | 20.6 | 2,906 |
| **Total** | | **8,238,745** | **874** | | | | |

As explained earlier for KPD, at NSD also there are many other vessels which occupy berth in addition to cargo vessels (**Table 4.6**).

**Table 4.6 Berth Occupancy at NSD Accounting All Vessel Types in 2014 - 15**

| Berth | No. of Days | | | | | | | Percentage of Occupancy |
|---|---|---|---|---|---|---|---|---|
| | Available | Occupied | | | | | | |
| | | By Vessels | | | By Barges Working | Others | Total | |
| | | Working | Non-Wkg | Repair | | | | |
| **1** | 365 | 142.88 | 0 | 0 | 7.82 | 11 | 161.7 | 44.30 |
| **2** | 365 | 158.64 | 0 | 0 | 16.35 | 0 | 174.99 | 47.94 |
| **3** | 365 | 200.77 | 0 | 0 | 38.82 | 0 | 239.59 | 65.64 |
| **4** | 365 | 292.38 | 0 | 0 | 0 | 0 | 292.38 | 80.10 |
| **5** | 365 | 206.29 | 0 | 0 | 0 | 0 | 206.29 | 56.52 |
| **7** | 365 | 196.81 | 0 | 0 | 0 | 0 | 196.81 | 53.92 |
| **8** | 365 | 281.71 | 0 | 0 | 0 | 0 | 281.71 | 77.18 |
| **13** | 365 | 142.37 | 0 | 0 | 48.79 | 2 | 193.16 | 52.92 |
| **14** | 365 | 141.07 | 0 | 0 | 31.31 | 0 | 172.38 | 47.23 |

*[Source: KoPT]*

### 4.3.3 Budge Budge Jetties

A total of 1.1 MTPA of cargo was handled at 6 budge budge jetties. The main cargo handled is POL and three berths (BB1, B7 and BB8) together handle 76% of the total cargo. The berth occupancy was recorded to be low for all the berths. The pre berthing time at BB 7 and 8 is quite high (**Table 4.7)**.

**Table 4.7 Analyses of Jetties at Budge Budge**

| Berth No. | Cargo | Volume (T) | No. of Ships | Average Output '000 (TPD) | Berth Occupancy | Pre-Berthing Detention in Ship Days | Average Parcel Size (T) |
|---|---|---|---|---|---|---|---|
| BB 1 | HSD, LDO, Benzene, Lube Oil, Motor Sprit, Palm Oil | 238,851 | 47 | 6,558 | 19.5% | 23.8 | 5,082 |
| BB2 | Benzene, Lube Oil, Palm Oil | 3,771 | 3 | 3,697 | 0.5% | 2.0 | 1,257 |
| BB 3 | Lube Oil, LDO | 13,010 | 5 | 7,837 | 1.0% | 1.7 | 2,602 |
| BB 5 | HSD, LDO, Benzene, Lube Oil, Motor Sprit, Palm Oil, MTBE, Phenol | 134,428 | 29 | 4,253 | 12.7% | 20.6 | 4,635 |
| BB 7 | ATF, BMO, Lube Oil, MTBE, Palm Oil, Paraffin, Phenol, Kerosene | 326,794 | 74 | 4,183 | 34.7% | 87.7 | 4,416 |
| BB 8 | ATF, BMO, Motor Sprit, MTBE, Paraffin, Palm Oil, Phenol, Sulphuric Acid | 388,633 | 75 | 4,894 | 34.5% | 66.4 | 5,182 |
| **TOTAL** | | **1,105,487** | **233** | | | | |

Berth Occupancy at Budge Budge considering both cargo and non-cargo vessels is presented in **Table 4.8**.

**Table 4.8 Berth Occupancy at Budge Budge Accounting All Vessel Types in 2014 - 15**

| Berth | No. of days | | | | | | | Percentage of Occupancy |
|---|---|---|---|---|---|---|---|---|
| | Available | Occupied | | | | | | |
| | | By Vessels | | | By Barges Working | Others | Total | |
| | | Working | Non-Wkg | Repair | | | | |
| 1 | 365 | 142.88 | 0 | 0 | 7.82 | 11 | 161.7 | 44.30 |
| 2 | 365 | 158.64 | 0 | 0 | 16.35 | 0 | 174.99 | 47.94 |
| 3 | 365 | 200.77 | 0 | 0 | 38.82 | 0 | 239.59 | 65.64 |
| 4 | 365 | 292.38 | 0 | 0 | 0 | 0 | 292.38 | 80.10 |
| 5 | 365 | 206.29 | 0 | 0 | 0 | 0 | 206.29 | 56.52 |
| 7 | 365 | 196.81 | 0 | 0 | 0 | 0 | 196.81 | 53.92 |
| 8 | 365 | 281.71 | 0 | 0 | 0 | 0 | 281.71 | 77.18 |
| 13 | 365 | 142.37 | 0 | 0 | 48.79 | 2 | 193.16 | 52.92 |
| 14 | 365 | 141.07 | 0 | 0 | 31.31 | 0 | 172.38 | 47.23 |

## 4.4 Performance of Berths at HDC

### 4.4.1 Oil Jetties Outside Dock

There are 3 oil jetties outside the dock, handling more than 4.3 MT of cargo annually. HOJ I and II have very high pre-berthing detention. HOJ I handle small vessels with average size of 7,000 T and hence have very limited handling capacity of only 8,500 TPD (**Table 4.9**).

**Table 4.9 Analysis Oil Jetties Outside the Dock**

| Berth No. | Volume, (MT) | No. of Ships | Average Output '000 (TPD) | Berth Occupancy (%) | Pre-Berthing Detention in Ship Days | Average PBD in Ship Day | Average Parcel Size (T) |
|---|---|---|---|---|---|---|---|
| HOJ I | 1.93 | 270 | 8.5 | 81% | 412 | 0.66 | 7133 |
| HOJ II | 2.21 | 181 | 26.7 | 67% | 265 | 0.68 | 12208 |
| HOJ III | 0.69 | 32 | 40.0 | 9% | 29 | 1.12 | 21584 |

At HOJ III facilities have been created for handling edible oil so that more number of dry bulk cargo vessels can be handled inside the impounded dock basin.

## 4.5 Berths inside Dock

AECOM has also evaluated the performance of these dock basin berths for a sample year of 2014-15. For this purpose, these berths are set in three groups:

- Berths on the eastern side of the basin;
- Berths on the western side of the basin and
- The finger jetty.

### 4.5.1 Berths on the Eastern Side of the Basin

As per KoPT, the berth wise details are as follows. The annual capacity of berths mentioned is based on the equipment provided and cargo proposed to be handled.

**Berth no. 2:** The berth is primarily utilised for handling dry bulk cargo operated through to MHC's having capacity of 20,000 MT per day. The berth has an annual capacity of 3.5 MT.

**Berth no. 3:** After dismantling of the mechanised loading system the same is primarily utilised for handling liquid bulk cargo like paraxylene, SKO, furnace oil, HSD and edible oil. Dry bulk and breakbulk cargo is also handled at this berth in conventional method using ship's gears. At the moment this berth has an annual capacity of 1.5 MT.

**Berth no. 4:** this berth has fully mechanised handling facility for handling coastal thermal coal at 20,000 MT per day. This berth has an annual capacity of 3.5 MT.

**Berth no. 4A:** this berth has fully mechanised facility for handling primarily coal as well as other dry bulk cargo. This berth has an annual capacity of 3.5 MT.

**Berth no. 4B:** This berth is equipped with 2 MHC's for handling primarily dry bulk cargo at 20,000 MT per day. The berth has an annual capacity of 3.5 MT.

**Berth no. 5:** the berth is utilised for handling liquid bulk cargo through pipelines. This berth has an annual capacity of 1.0 MT.

Berths on eastern side of dock are shown in **Figure 4.3**.

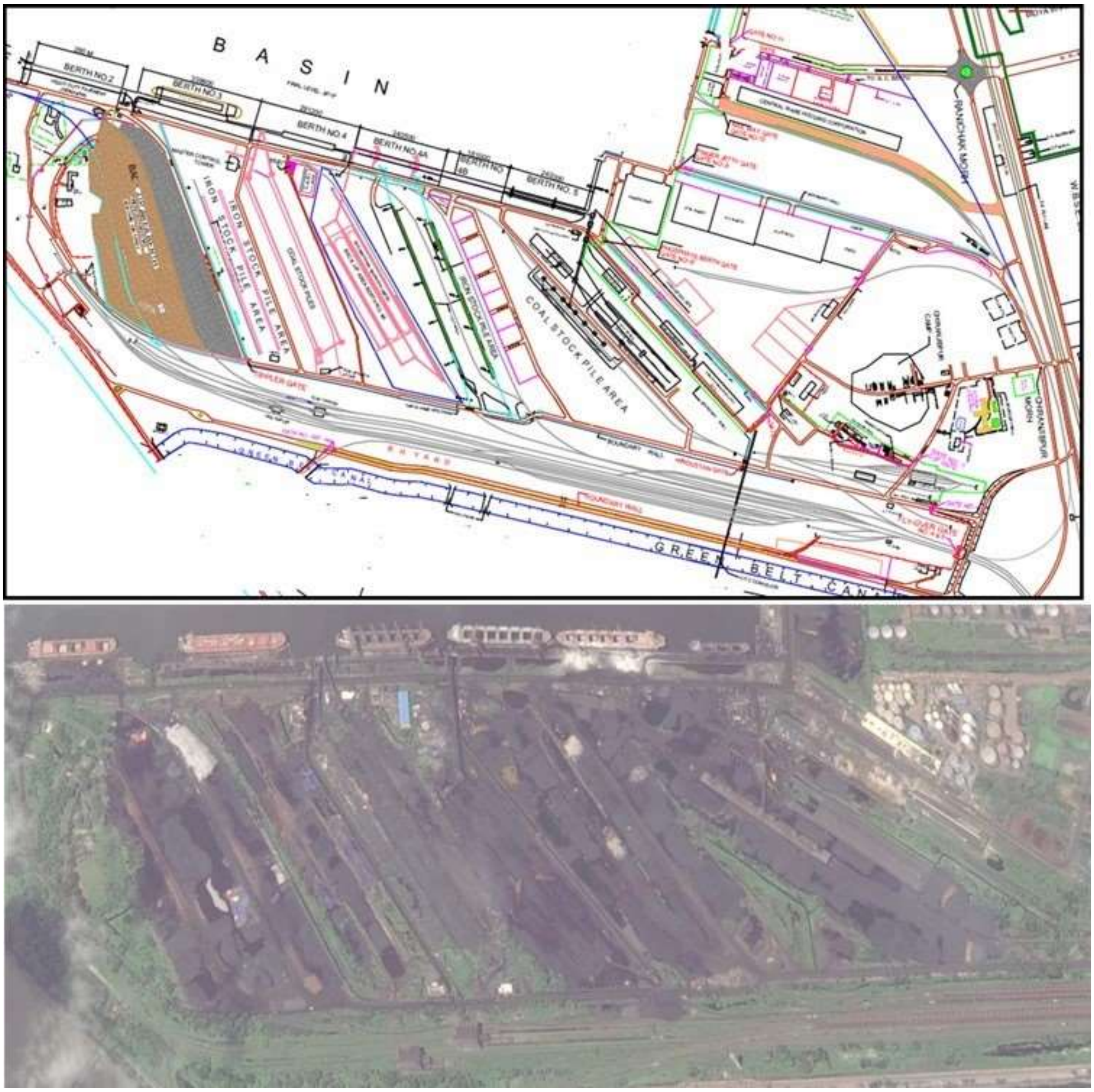



**Figure 4.3 Berths on the Eastern Side of Dock Basin (Map- Top; Satellite Image – Bottom)**

### 4.5.2 Berths on the Western Side of the Basin

As per KoPT, the berth wise details are as follows. The annual capacity of berths mentioned is based on the equipment provided and cargo proposed to be handled.

**Berth no. 8:** The berth is equipped with 2 MHC's for handling primarily dry bulk cargo at 20,000 MT per day. The berth has an annual capacity of 3.5 MT.

Berth no. 9: The berth I s primarily utilised for handling dry bulk cargo and breakbulk cargo in conventional methods using ship's gears. The annual capacity of this berth is 2.0 MT.

Berth no. 10 & 11: These berths are utilised for handling container vessels in an integrated manner and is equipped with 2 RMQC's. The annual capacity of these berths is 2.0 MT. With the increase in container traffic additional equipment at these berths could be deployed to achieve the capacity upto 6 MTPA.

Berth no. 12: This BOT berth is utilised for handling clean dry bulk as well as breakbulk cargo using ship's cranes and also one MHC. The annual capacity of this berth is 2.0 MT.

Berth no. 13: At this moment this berth is utilised for handling clean dry bulk cargo as well as breakbulk cargo through conventional methods using ship's own gears and its annual capacity is about 2.0 MT. However, after installation of 2 MHC's by September 2016, the capacity will be 3.0 MT.

Berths on western side of dock are shown in **Figure 4.4**.

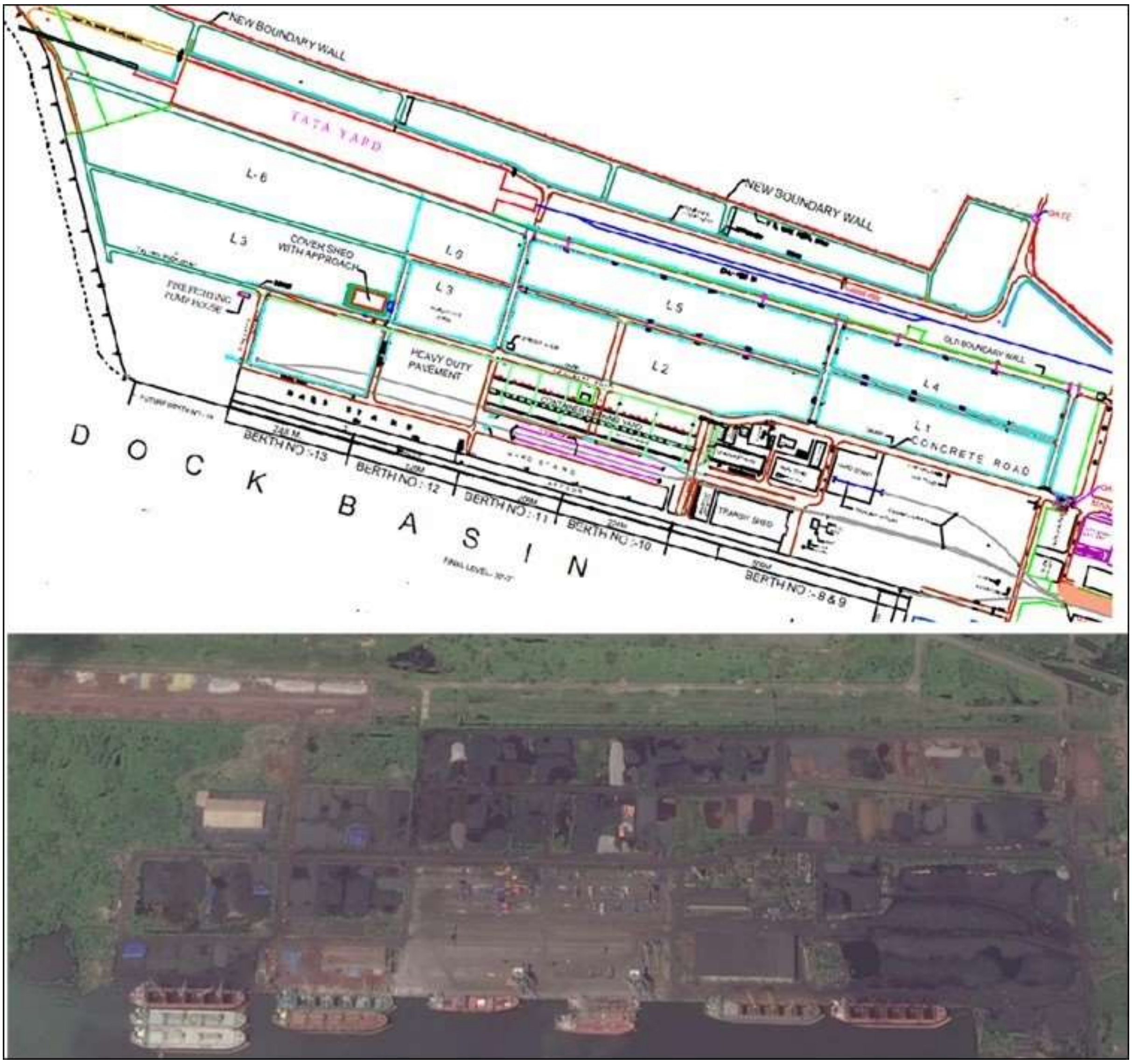



**Figure 4.4 Berths on the Western Side of Dock Basin (Map-Top; Satellite Image – Bottom)**

## 4.6 Berths on the Finger Jetty

There are two berths on the Finger Jetty namely berth no. 6 & 7 (**Figure 4.5**). The said berths are primarily utilized for handling various liquid bulk cargo like phosphoric acid, CBFS, Sulphur Acid, MEG, edible oil etc.

There is also provision of handling edible oil through floating pipeline from vessels in double banking position at the Finger Jetty.

After procurement/deployment of additional tugs, Berth no. 7 will be declared as waiting jetty. The annual capacity of Finger Jetty is estimated to be 2.0 MT.


**Figure 4.5 Berths on the Finger Jetty (Map- Top; Satellite Image – Bottom)**

# 4.7 Performance of the Navigation Channel and Lock Gates

## 4.7.1 Approach Channel

HDC has depth limitation on account of high siltation, which results in high annual maintenance dredging. Most of the vessels sail taking advantage of tide. Vessels start navigation just before the high tide level of the day through Eden and proceed towards Haldia port in a convoy. A separation time of about 15 minutes is kept between vessels so as to allow some response time in case of any emergency. About 2 hours is taken by these vessels to reach the Lock Gate. Thus, only 7 to 8 vessels having draft close to about 8 m navigate the channel to Haldia port during each high tide.

## 4.7.2 Lock Operation

HDC lock is sized to handle a Panamax size ship having 301 m in length, 36.9 m in width and floor level of 10.99 m w.r.t. CD. The lock is aligned west – southwest to facilitate entry during flood time. Three caisson gates have been provided at the lock, each with a recess area to allow ship passage. The central one has capability to be utilised as dry dock for repair of gate.

Currently, ship can enter the dock basin through the lock gate in about 80 to 90 minutes. Similarly departure of the ship from turning circle to outside lock takes about 90 to 100 minutes. The original design allowed for passage of 10 ships (5 in + 5 out) per high tide but with the passage of time the operating system of the lock has slowed down and currently on an average of 5 to 6 ships per tide could be taken in / out, which limits the number of ships that could be handled at the dock annually.

# 5.0 DETAILS OF ONGOING DEVELOPMENTS

## 5.1 General

Kolkata Dock seems to have lots of capacity lying un-utilised and the cargo potential is also low. Considering these aspects no new development is planned at Kolkata Dock.

On the other hand, HDC has good prospects to handle import coal (coking, non-coking coal, coke) for the steel plants (SAIL at Durgapur, Bokaro and Rourkela; IISCO at Burnpur; TATA Steel at Jamshedpur) and power plants (NTPC at Farakka and Kahalgaon; CESC at Budge Budge). Besides, HDC is suitably located to handle iron ore originating from states of Jharkhand and Orissa. Thus, to meet the demand of anticipated traffic growth, HDC has envisaged a number of projects outside the dock basin and these are shown in the **Figure 5.1**.


**Figure 5.1 Location of Ongoing Developments near Haldia Dock**

While Outer Terminal 1 (OT1) and Outer Terminal 2 (OT2) are at a planning stage, the contract for the floating jetty has already been awarded. The fly ash jetty is already commissioned.

In addition, the port had earlier planned total four berths at Shalukhali, which is about 15 km north of the existing Dock Complex. It was proposed to develop two fully mechanized berths for handling imported coal and two multi-purpose berths with MHC for handling other bulk cargoes like imported coal and iron ore. The location plan for the proposed port facilities are shown in **Figure 5.2**.

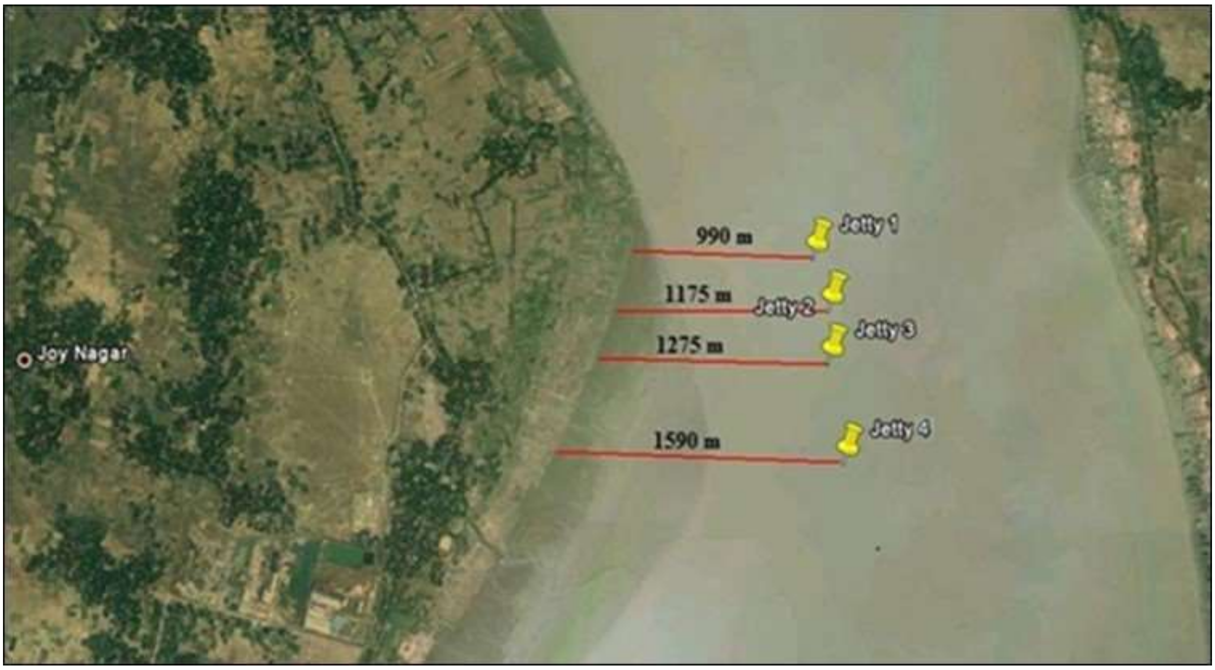



**Figure 5.2 Location of Jetties at Shalukhali alongwith Approaches**

### 5.1.1 Multipurpose Jetty (OT-I)

Due to depth limitations at the HDC, it was planned to ramp up transloading operations at the Sand heads during dry season and at Kanika Sands, an island off the Orissa coast, during monsoon. For this, a 270 m multipurpose jetty is planned to be constructed upstream of Oil Jetty III to be known as Outer Terminal 1 (OT1). The planned capacity for the jetty is about 5 MTPA and it will require a capital investment of INR 413 crores.

### 5.1.2 Multipurpose Jetty (OT-II)

The space available between the 2nd Oil Jetty and lead-in Jetty has been proposed to develop a jetty for handling vessels of maximum 185 m LOA. The new riverine jetty shall be designed to handle vessels/barges up to 22,500 DWT/10,000 GT with parcel load of 15,000 T. It is estimated that this jetty will handle about 2.0 MTPA of cargo.

The jetty is mainly planned to support import of coal and also export of iron ore. The operation at the jetty shall be mechanised having a grab unloader with conveyor system to unload a vessel and thereafter a stacker cum reclaimer will be used for aggregation of cargo at back up area. Mechanized wagon loader of 1,500 TPH capacity will be utilised to transfer cargo from back up area to wagons.

### 5.1.3 Floating Riverine Barge Jetty

Upstream of 3rd oil jetty, a floating barge jetty is proposed to handle Mini Bulk Carriers (MBC) of about 10,000-12,000 DWT to handle cargo like coal etc. The proposed jetty will be capable to handle barges of 106 m LOA and 26 m beam. It is proposed that cargo from the vessels will be unloaded by means of a crane fitted over a floating pontoon and from there it will be transferred to shore hardstand through a conveyor. The proposed barge jetty will have an annual handling capacity of 2.55 MTPA. The projected cost for the facility is 73.7 crore.

### 5.1.4 Oil Terminal at Haldia Dock – II / Shalukhali

The bulk and breakbulk terminal planned at Shalukhali could not be taken up due to weak response from the bidders. Now KoPT plans to set up a liquid jetty at that location. As regards chemicals, Paraxylene is likely to be shifted to the new jetty at Shalukhali along with the proposed LPG imports of Aegis Logistics as the capacity of the three existing oil jetties is exhausted.

All the above mentioned projects are to create new facilities but HDC has also foreseen many capacity augmentation projects at the already existing berths to enhance the cargo handling capacity. Some of the projects are as follows:

- Integrated Container Handling at Berths 10 & 11

Supply, Operation & Maintenance of different cargo handling equipment (MHC) at berths 2 & 8

- Procurement of 1 Stacker-cum-Reclaimer for Coal Export Plant at HDC

It is important to note that the above mentioned enhancement projects will overcome some of the constraints highlighted in previous sections of the report.

# 6.0 TRAFFIC PROJECTIONS

## 6.1 Projections Based on OD Study at National Level

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 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 Kolkata Dock System & Haldia Dock Complex up to 2035 is presented in this chapter (**Table 6.1** and **Table 6.2**).

## 6.2 Kolkata Dock System (KDS)

Kolkata handles containers, coking coal, iron ore and fertilizers in dry and break bulk cargo and POL in liquid bulk. Out of these commodities, Containers alone constitute ~53% of the cargo. Kolkata currently has West Bengal as its primary hinterland for containers with other hinterlands including Bihar, Jharkhand, North East and Orissa.

### 6.2.1 Major Commodities and their Projections

Assessment of traffic has been done based on analysis of past traffic at Kolkata, interviews with Port authorities, West Bengal Industrial Development Corporation (WBIDC) as well as several stakeholders in the shipping and user industries.

Hinterland for container traffic at Kolkata is expected to remain the same going forward. Tidal draft, limited plans for capacity expansion and no mainline vessel call for containers in India limit growth in hinterland for Kolkata.

Kolkata port currently handles ~0.5 MTEUs of containers, catering primarily to West Bengal hinterland. Kolkata, Durgapur, Haldia are the key container generating hinterlands for HDC and KDS generating ~60% of the overall traffic and small volume move to/from Bihar, Jharkhand and other parts of West Bengal. Kolkata’s GDP is expected to grow at 9-11% while most other hinterlands are expected to grow at 8-10% CAGR.

Based on above, Kolkata is expected to handle 0.7-0.8 MTEUs by FY25 and further increase in traffic is limited by the port’s planned capacity of 0.8 M TEUs. **Figure 6.1** to **Figure 6.3** show the current and projected container traffic for both Kolkata and Haldia which is shared between the two.

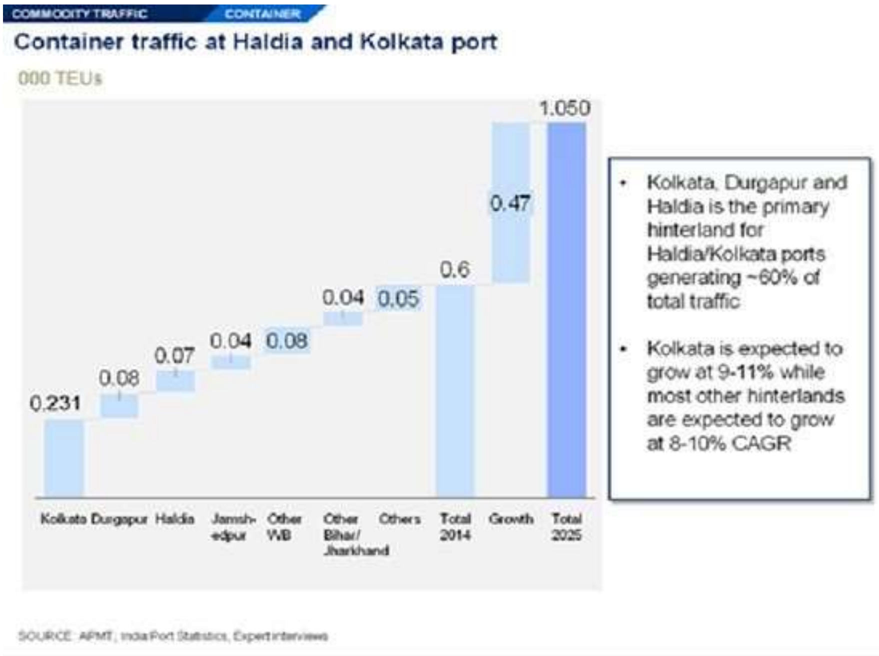



**Figure 6.1 Container Traffic Projection of KoPT**

COMMODITY TRAFFIC CONTAINER

**West Bengal is the primary hinterland of Kolkata and Haldia port with small traffic from Bihar and Jharkhand**

Primary hinterland of port

| EXIM container volumes, '000 TEUs, FY14 | JNPT | Mundra | Chennai | Pipavav | Tuticorin | Kolkata/ 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 |
| Chhattisgarh | 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

**Figure 6.2 Hinterland of Container Traffic**

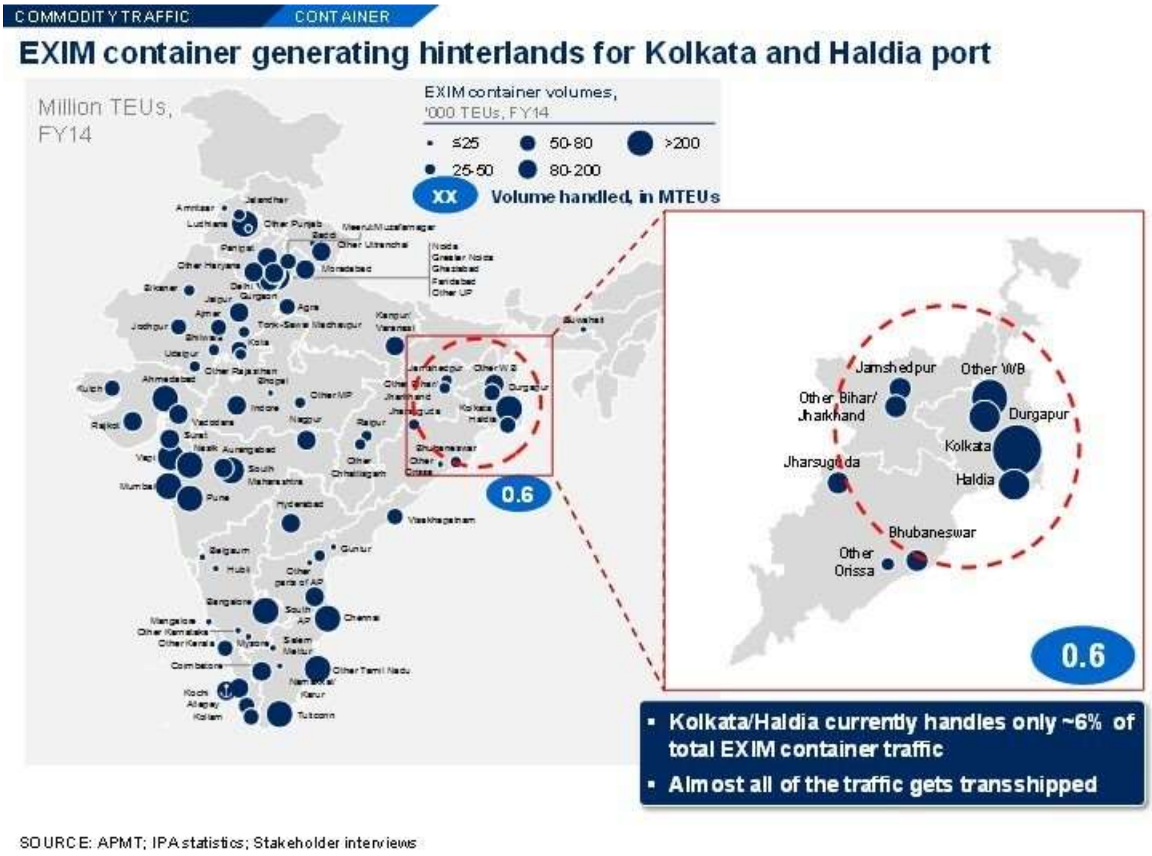



**Figure 6.3 EXIM Container Generating Hinterland**

**Table 6.1 Traffic Forecast for Kolkata Dock System (MTPA)**

**Kolkata Port - Traffic Projections**

Units: MMTPA (except Containers)

xx Base Scenario   xx Optimistic Scenario

| Commodity | 2014-15 | 2020 | 2025 (Base) | 2025 (Optimistic) | 2035 (Base) | 2035 (Optimistic) | Remarks |
|---|---|---|---|---|---|---|---|
| **Liquid Cargo** | | | | | | | |
| POL | 0.6 | 0.9 | 1.1 | 1.5 | 1.8 | 2.2 | |
| **Dry and Break Bulk Cargo** | | | | | | | |
| Thermal Coal (Loading) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Thermal Coal (Unloading) | 0.0 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | |
| Coking Coal | 0.12 | 0.17 | 0.2 | 0.3 | 0.4 | 0.5 | |
| Iron Ore | 0.13 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Fertilizers | 0.20 | 1.0 | 1.0 | 1.0 | 1.3 | 1.3 | |
| **Containers and other Cargo** | | | | | | | |
| Containers (MnTEU) | 0.53 | 0.65 | 0.7 | 0.8 | 0.8 | 0.8 | ▪ If any capacity constraints, some traffic may move to Dharma/ Haldia |
| Others | 6.1 | 7.7 | 10.3 | 10.8 | 13.2 | 19.4 | ▪ Highly fragmented |
| **Total (MMTPA)*** | **15.3** | **20.3** | **23.9** | **26.4** | **29.5** | **36.2** | |

Conversion Factor Used for Containers Projections: 1 TEU = 15.4 Tons

* Currently, the port is limited by its capacity of ~20 MTPA. It has limited scope of expansion and will not be able to capture all of its traffic potential post 2025.

# 6.3 Haldia Dock Complex (HDC)

HDC is a major port in West Bengal handling ~31 MTPA of cargo. It handles containers, coking coal, iron ore, fertilizers and POL. Out of these commodities, liquid bulk and coking coal constitute ~50% of the cargo. Haldia currently has West Bengal as its primary hinterland with other hinterlands including Bihar, Jharkhand, North East and Orissa. Going into the future we expect to see this traffic to go up to 54-65 MTPA by 2025.

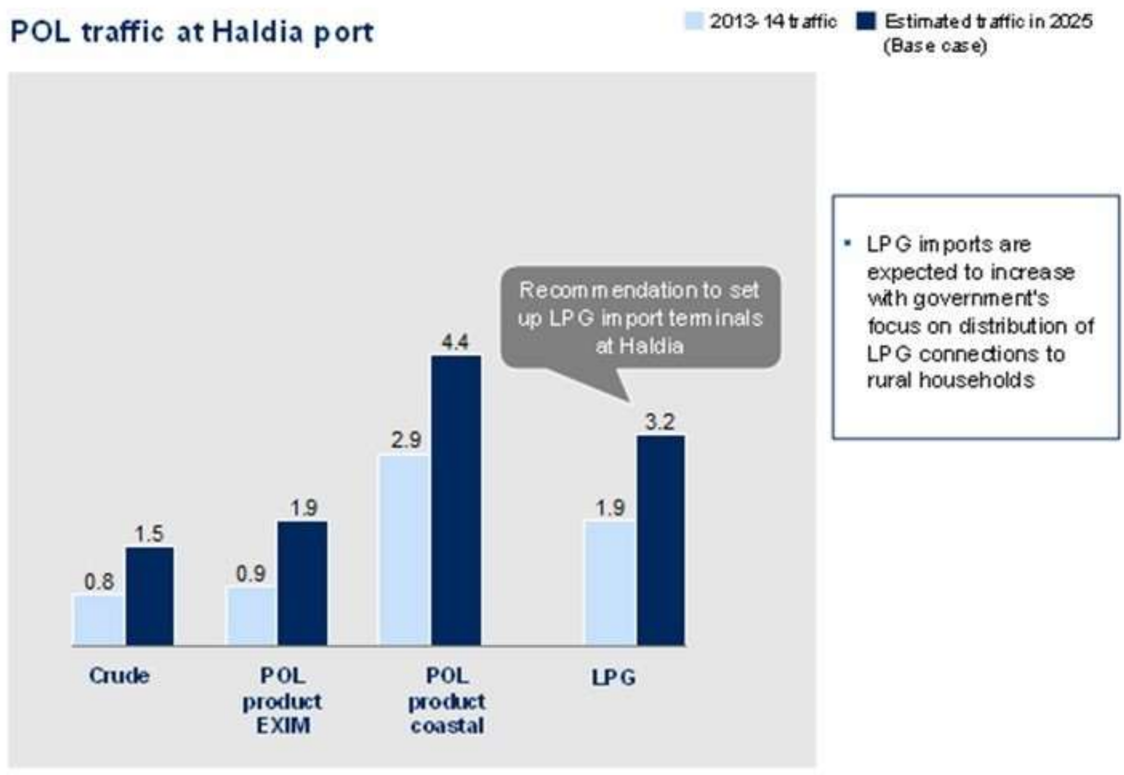
The traffic projections suggest that significant additional capacity is required to be created at HDC in order to cater to increasing traffic that may be serviced at HDC (**Table 6.2**).

## 6.3.1 Major Commodities and their Projections

### *6.3.1.1 POL*

POL crude and product constitute 18% of traffic handled. The current traffic of 5.5 MTPA is split between crude, POL product-EXIM and coastal movement and LPG. IOCL Haldia is the key player for the crude oil imports. The current and the estimated traffic of POL in 2025 is shown below.

With no significant capacity expansion expected at Haldia and no new facility planned, POL crude traffic is increasing minimally. However, LPG imports are expected to increase with government's focus on distribution of LPG connections to rural households. It has also been proposed to setup LPG import terminal at Haldia.




SOURCE: Indian Petroleum and Natural Gas Statistics 2013-14; Basic Port Statistics of India 2013-14, Team analysis

**Figure 6.4 POL Traffic Projections (HDC)**

### *6.3.1.2 Thermal Coal*

Currently Haldia imports 3.5 MTPA of thermal coal to meet the blending requirement of the power plants in the hinterland (NTPC Farakka). In addition, it also exports 1.2 MTPA of thermal coal, which is coastally shipped to TNEB power plants. Going forward, with the output of ECL increasing, overseas coal imports is unlikely to increase. By 2025, thermal coal imports is likely to range around 3-4 MTPA while the coastal coal exports will be around 2 MTPA.

### *6.3.1.3 Coking Coal*

Currently Haldia imports 6 MTPA of coking coal primarily to meet the energy requirement of the steel plants in the hinterland. Haldia is the nearest logical port for 4 major steel plants – Durgapur, IISCO, Bokaro and Rourkela. But due to low draft, only a part of these plants' requirement is met by Haldia, the remaining is catered by Dhamra and Paradip port which have a much higher draft, allowing for bigger vessels to call at the port. Going forward, coking coal import is expected to increase and touch 8 MTPA by 2020 and 11-12 MTPA by 2025.

COMMODITY TRAFFIC COKING COAL

**Haldia the nearest port ( in rail kms) for 4 SAIL plants which contribute ~30% of total imports...**

Short distance

Shortest distance rail route (siding to siding) kms

| | Durgapur | IISCO | Bokaro | Rourkela | Bhilai |
|---|---|---|---|---|---|
| Vizag | 984 | 656 | 940 | 665 | 550 |
| Dhamra | 485 | 453 | 499 | 531 | 808 |
| Paradip | 617 | 585 | 630 | 504 | 735 |
| Haldia | 308 | ~308 | 366 | 401 | 852 |

SOURCE: Indian railways, SAIL

**Figure 6.5 Comparative Rail Route Distance**

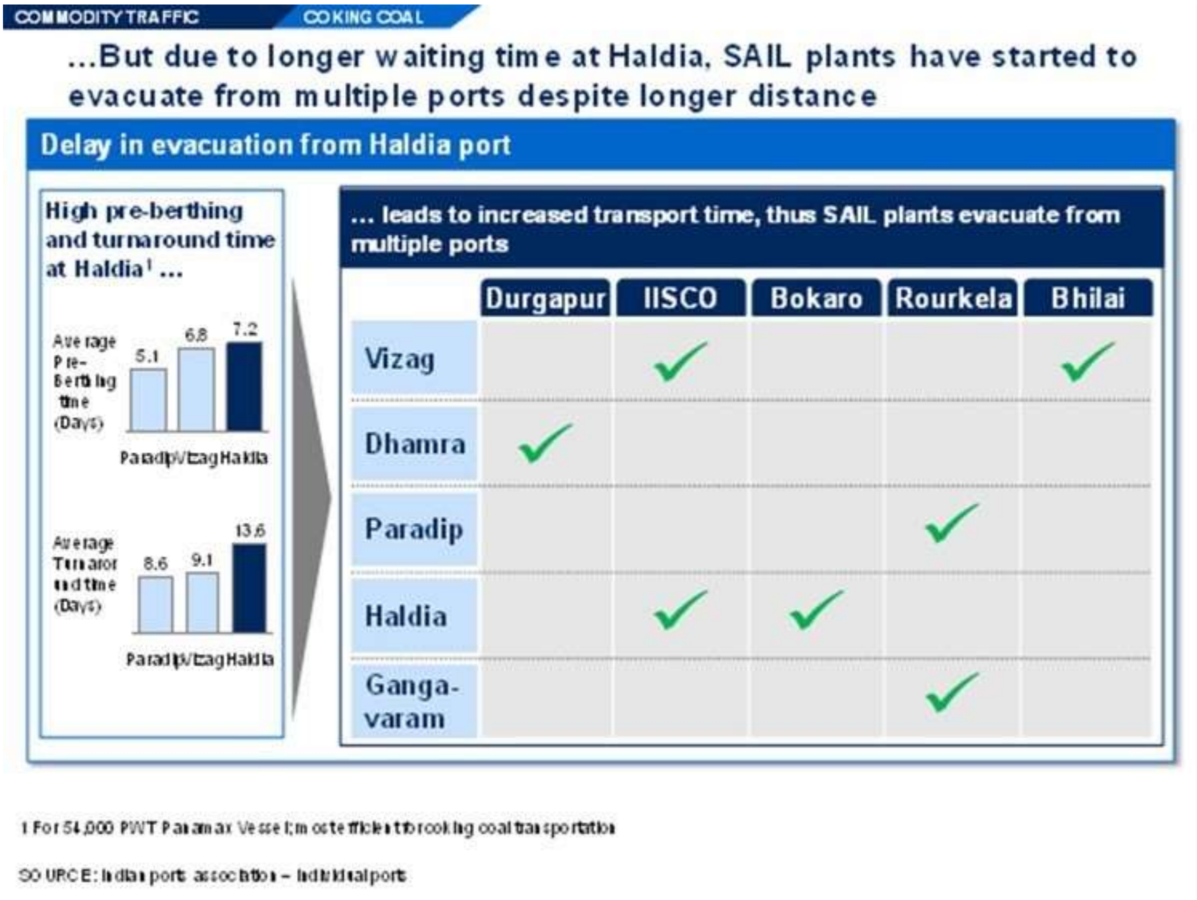



**Figure 6.6 Comparative Analysis of SAIL Plants Coal Evacuation**

### *6.3.1.4 Containers*

Haldia port currently handles 0.1 MTEUs of containers, catering primarily to West Bengal hinterland. Kolkata, Durgapur, Haldia are the key container generating hinterlands for HDC and KDS generating ~60% of the overall traffic and small volume move to/from Bihar, Jharkhand and other parts of West Bengal. Kolkata's GDP is expected to grow at 9-11% while most other hinterlands are expected to grow at 8-10% CAGR.

With the capacity at KDS getting saturated, spill over traffic is expected to come to Haldia port. Going forward, container volumes are expected to touch 0.15 MTEUs by 2020 and 0.2-0.3 MTEUs by 2025. The exhibits below show the current and projected container traffic for both Kolkata and Haldia which is shared between the two. In case of capacity constraints, part of this traffic will move to Dhamra and Sagar.

### *6.3.1.5 Other Localized Commodities*

Other commodities include iron ore, manganese, vegetable oil, chemicals, limestone etc. With the mining ban on iron ore, exports are expected to remain low, while chemicals and vegetable oil will grow at a healthy rate.

**Table 6.2** summaries the traffic potential for key commodities for Haldia port.

**Table 6.2 Traffic Forecast for Haldia Dock Complex**

Units: MMTPA (except Containers)

**Haldia Port - Traffic Projections**

xx Base Scenario xx Optimistic Scenario

| Commodity | Current | 2020 | 2025 (Base) | 2025 (Optimistic) | 2035 (Base) | 2035 (Optimistic) | Remarks |
|---|---|---|---|---|---|---|---|
| **Liquid Cargo** | | | | | | | |
| POL | 5.5 | 9.9 | 11.0 | 12.1 | 13.6 | 15.3 | ▪ Growth coming from LPG import terminals proposed to set up in east coast ports |
| Vegetable Oil | 1.6 | 3.5 | 4.5 | 5.5 | 5.5 | 6.5 | |
| Chemicals | 2.9 | 3.0 | 4.5 | 5.5 | 6.5 | 7.5 | |
| **Dry and Break Bulk Cargo** | | | | | | | |
| Thermal Coal (Loading) | 1.2 | 1.6 | 2.1 | 2.3 | 3.4 | 4.1 | |
| Thermal Coal (Unloading) | 3.5 | 3.3 | 3.3 | 4.0 | 4.0 | 5.0 | ▪ Overseas coal imports likely to decline as CIL production rises |
| Coking Coal | 6.0 | 8.0 | 11.2 | 11.9 | 19.9 | 23.1 | |
| Iron Ore | 2.3 | 1.0 | 1.3 | 4.6 | 2.3 | 8.7 | ▪ Mostly exports; likely to remain low. Optimistic case is related to the volumes handled before ban |
| Limestone | 1.4 | 2.0 | 2.8 | 3.2 | 4.8 | 5.5 | |
| M.Ore | 1.4 | 2.0 | 2.5 | 2.6 | 4.1 | 4.7 | |
| Other Ore | 0.9 | 1.5 | 1.8 | 2.2 | 2.8 | 3.2 | |
| Fertilizers | 0.8 | 1.0 | 1.5 | 1.6 | 1.8 | 2.2 | |
| **Containers and other Cargo** | | | | | | | |
| Containers (MnTEU) | 0.10 | 0.15 | 0.2 | 0.3 | 0.4 | 0.6 | |
| Others | 1.4 | 2.5 | 3.4 | 3.6 | 4.6 | 6.7 | ▪ Highly fragmented |
| **Total (MMTPA)** | **30.8** | **42.2** | **53.7** | **64.9** | **81.0** | **104.0** | |

Conversion Factor Used for Containers Projections: 1 TEU = 19.2 Tons

### 6.3.2 Coastal Shipping Potential

Apart from the above mentioned traffic, there is additional opportunity of coastal shipping that can be potentially tapped:

- **Thermal Coal:** 12.4 MTPA of thermal coal can be coastal shipped to NTPC Kudgi (Karnataka) and NTPC Simhadri from Pakri Barwadih and Khottadih OC mines respectively.

COMMODITY TRAFFIC COAL

**~11 MTPA Coal can be moved from Pakri Barwadih to Kudgi1 and ~1.4 MTPA from Khottadih to Simhadri via coastal shipping through Haldia port**


**Pakri Barwadih to Kudgi** (Optimimum route: 1)

| S. No. | Route (Modal combination) | Distance Kms | Cost Rs/tonne |
|---|---|---|---|
| 1 | Road-Rail-Port-Road-Rail | 3,833 | 2,883 |
| 2 | Road-Rail | 2,035 | 3,300 |

**Khottadih to Simhadri** (Optimimum route: 1)

| S. No. | Route (Modal combination) | Distance Kms | Cost Rs/tonne |
|---|---|---|---|
| 1 | Rail-Port-Rail | 1,074 | 1,318 |
| 2 | Rail | 1,024 | 1,783 |

1 Considering linkage rationalization from Pakri Barwadih to Talcher does not happen

**Figure 6.7 Coastal Shipping Potential for Coal**

- **Cement:** ~2.5 MTPA of cement can be coastally shipped to Haldia port from Andhra Pradesh by 2025. This would primarily be consumed in West Bengal, Bihar and Jharkhand. Additional ~5 MTPA of cement can be coastally shipped to West Bengal via Haldia port from central Andhra Pradesh by 2025 is the central AP port comes up.

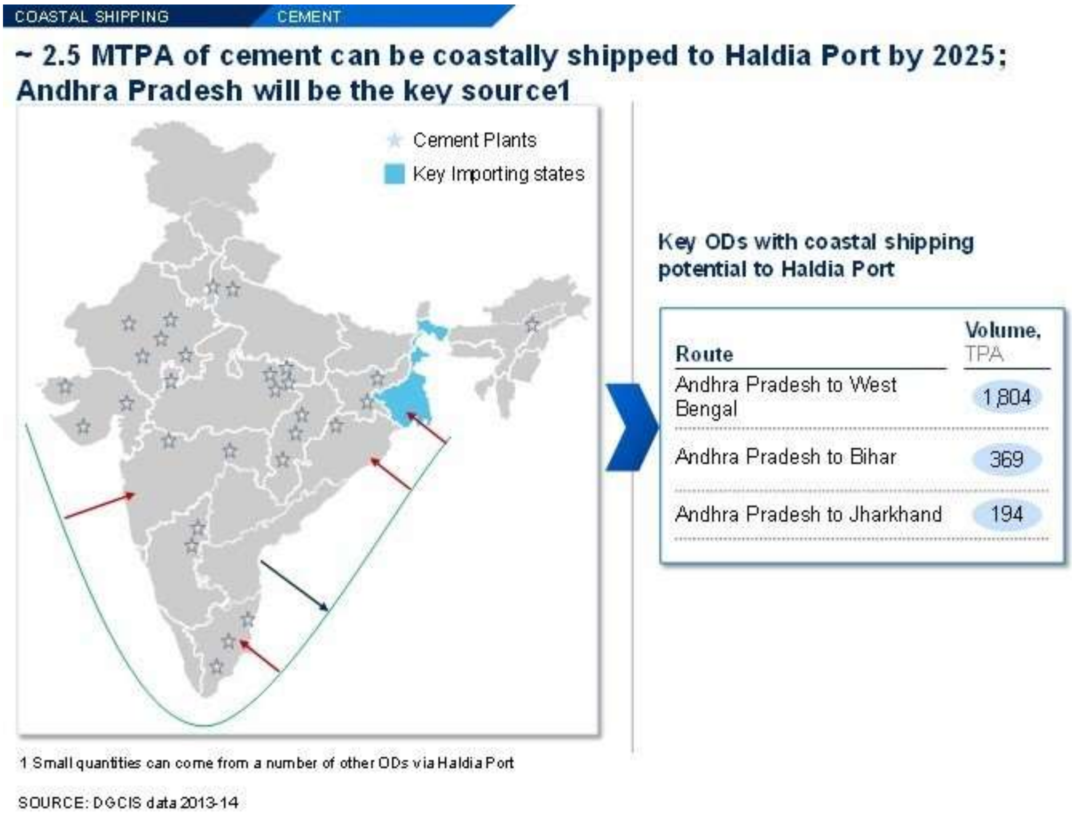



**Figure 6.8 Coastal Shipping Potential for Cement**

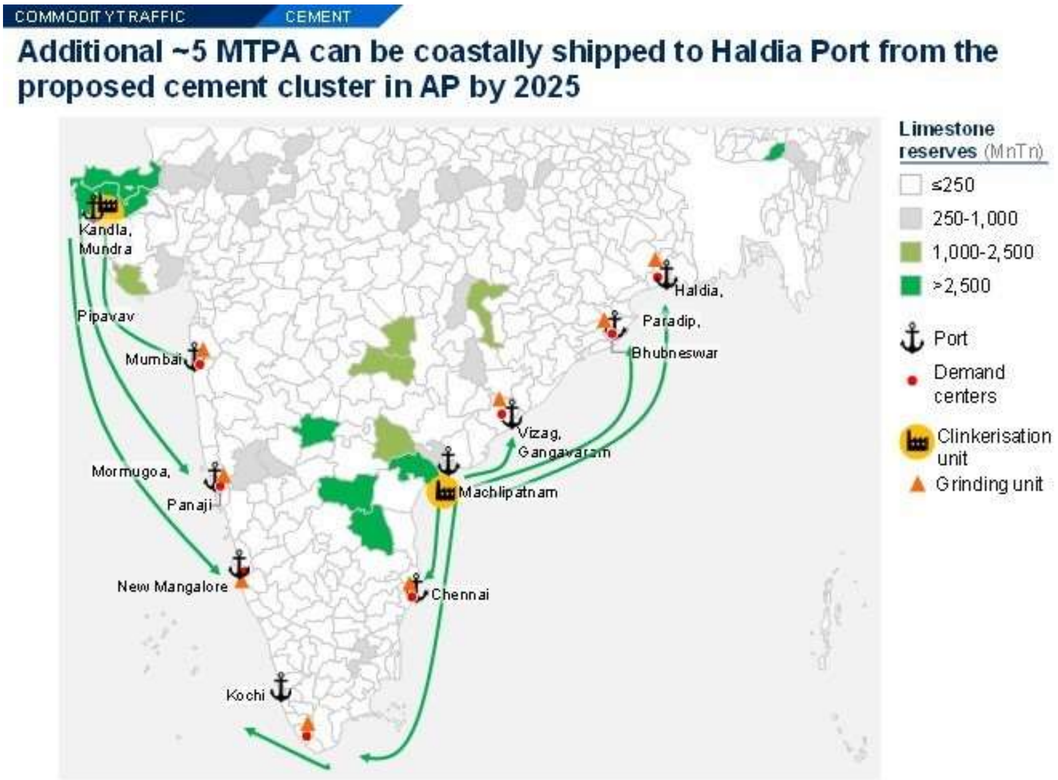



**Figure 6.9 Additional Coastal Shipping Potential for Cement Via Andhra Pradesh**

■ **Fertilizers:** ~2-2.5 MTPA of fertilizers can be coastally shipped to Bihar and West Bengal via Haldia port by 2025. Andhra Pradesh would account for most of this supply.

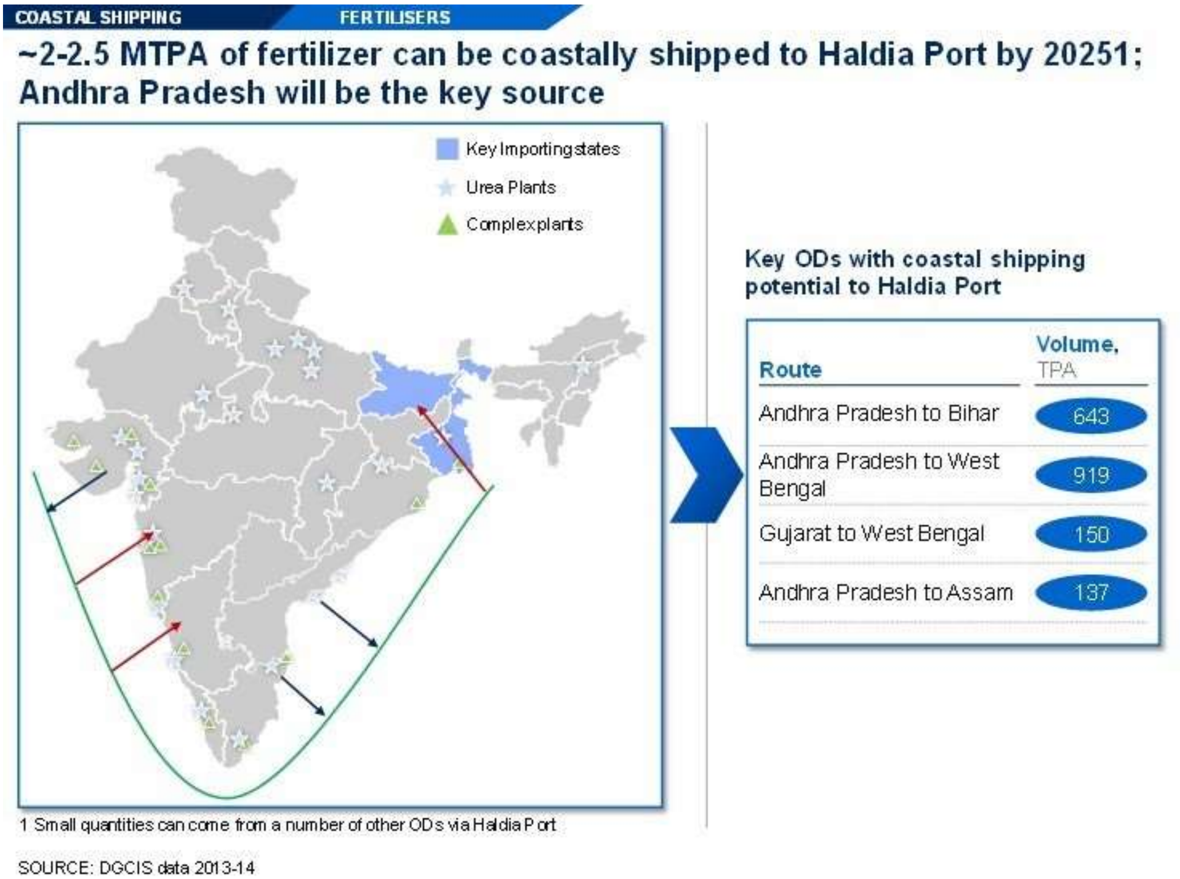



**Figure 6.10 Coastal Shipping Potential for Fertilizer**

■ **Steel:** ~3-4 MTPA of steel can be coastally shipped by 2025 from Haldia port to demand states of Maharashtra, Andhra Pradesh, Tamil Nadu and Gujarat. Tata steel plant in Jamshedpur and SAIL plants in Durgapur, Bokaro and Burnpur has the maximum potential for coastal movement.

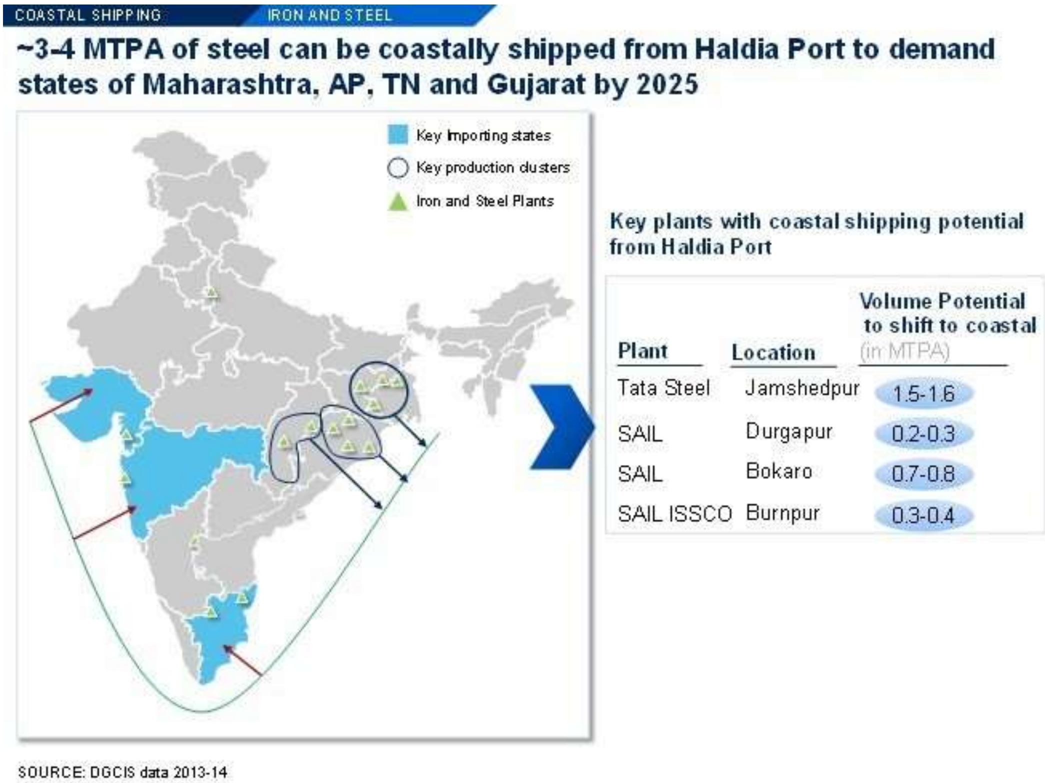



**Figure 6.11 Coastal Shipping Potential for Steel**

The **Table 6.3** summarizes the potential of coastal movement for key commodities.

**Table 6.3 Coastal Shipping Potential**

Units: MMTPA (except Containers)

| Commodity | 2020 | 2025 | 2035 |
|---|---|---|---|
| Thermal Coal (Loading) | 12.4 | 12.4 | 12.4 |
| Steel (Loading) | 2.74 | 3.66 | 6.56 |
| Steel (Unloading) | 0.39 | 0.52 | 0.94 |
| Cement (Loading) | 0.00 | 0.00 | 0.00 |
| Cement (Unloading) | 1.88 | 7.5 | 9.49 |
| Fertilizer (Loading) | 0.00 | 0.00 | 0.01 |
| Fertilizer (Unloading) | 1.92 | 2.34 | 3.46 |
| Food Grains (Loading) | 0.11 | 0.13 | 0.20 |
| Food Grains (Unloading) | 0.00 | 0.01 | 0.01 |

- Additional Coastal shipping from Pakri Barwadih in Jharkhand to Kudgi I in Bijapur; and Khottadih OC to NTPC Simhadri
- 5MMTPA can be shipped from Central AP cement cluster ( If Central AP port comes up)

* The coastal opportunity identified is contingent on a number of enablers like last mile connectivity, availability of handling infrastructure at the ports, rationalization of port charges, availability of aggregators for different commodities wherever individual parcel sizes are small. The handling charges and sea freights assumed for the analysis is INR 150 per tonne per handling and INR 0.2 per tonner per km respectively

# 7.0 CAPACITY AUGMENTATION PROPOSALS

## 7.1 Requirement for Capacity Expansion

HDC has 17 berths in total and most of the berths are having very high pre-berthing detention. Out of these 10 berths are already working at high berth occupancy and remaining 7 berths (HOJII, HOJ III, 3, 4, 4A, 10 and 11) are found to be working at lower occupancy. A number of inefficiencies are noticed in the port operations on the following accounts:

- High detention time due to limitation of lock operation
- Conventional way of cargo handling
- Mix of cargo handled at many of the berths
- Lack of mechanisation
- Low parcel size of cargo

The improvements to the operations and augmentation of the existing port facilities at Haldia Dock Complex (HDC) have already been taken up. In additional new port facilities will be required to be built to cater to the traffic projections over the master plan horizon. The need for capacity augmentation is given in **Table 7.1**.

**Table 7.1 Capacity Augmentation Required at HDC (MTPA)**

| Cargo Handled | Current Capacity (MTPA) | 2020 | | 2025 | | 2035 | |
|---|---|---|---|---|---|---|---|
| | | Projected Traffic (MTPA) | Capacity Augmentation Required (MTPA) | Projected Traffic (MTPA) | Capacity Augmentation Required Over Current (MTPA) | Projected Traffic (MTPA) | Capacity Augmentation Required Over Current (MTPA) |
| Liquid Cargo | 11.7 | 16.4 | 4.7 | 20.0 | 8.3 | 25.6 | 13.9 |
| Coal | 12.0 | 12.9 | 0.9 | 16.6 | 4.6 | 27.3 | 15.3 |
| Breakbulk and Other Dry Bulk (Limestone, M. Ore, Other ore, Fertiliser, etc) | 15.0 | 10.0 | 0.0 | 13.3 | 0.0 | 20.4 | 5.4 |
| Containers | 2.0 | 2.9 | 0.9 | 3.8 | 1.8 | 7.7 | 5.7 |
| **TOTAL** | **40.7** | **42.2** | **6.5** | **53.7** | **14.7** | **81.0** | **40.3** |

As far as Kolkata Dock System (KDS) is concerned, it has unutilised berth capacity mainly operational improvements are required at KDS.

## 7.2 Suggested Measures for KDS

### 7.2.1 An exclusive Berth for Bulk Cargo

During one of the discussions, it was understood that there is a demand to handle coal for Nepal with estimated annual throughput of 0.5 MTPA. The evacuation of this cargo would require rail connectivity which is possible only at KPD II. Earlier this coal was handled on the eastern side berths of KPD II but due to the recent allocation of nearby sheds for agro products, coal cannot be handled at that location.

Thus, it is suggested to provide an exclusive berth as replacement to erstwhile berth 17 for about 120 m length, on the western side of KPD II for handling coal on confirmation of the assessed coal traffic. The berth shall be provided with barge handlers for unloading coal to berth from whether it shall be shifted to stacking area behind by means of pay loader-dumper combination. As the cargo needs to be evacuated through rail, therefore a rail siding from Marshalling yard shall be built up to the western side of KPD II. The indicative details are shown in **Figure 7.1**.

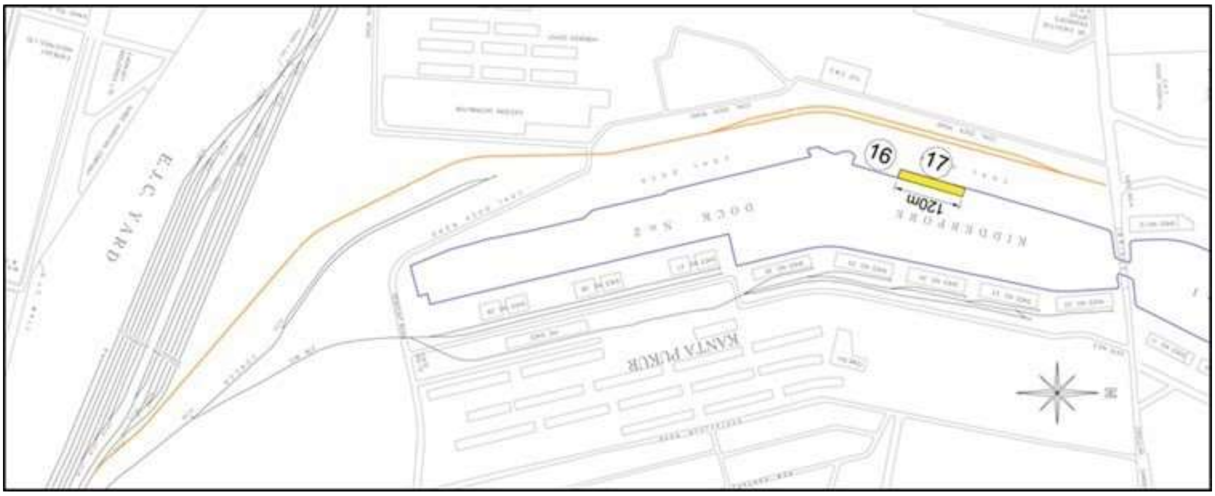



**Figure 7.1 Proposed Rail Connectivity**

### 7.2.2 Traffic Management

Gate no. 07 (as shown in **Figure 7.2**) is the bottle neck inside the port, for movement of trucks and this area needs to be widened. This would in turn reduce the queue of the trucks inside the NSD dock and allow faster movement of containers ship to yard.

It was observed that most of the empty as well as loaded trucks are parked on the roads leading to port area. During discussions with port officials, two to three locations were identified as parking lots for the vehicles, i.e. area in front of Gates 4 and 5; area behind berth 8 at NSD and some area in Alif Nagar.


**Figure 7.2 Location Near Gate 7 for Road Widening**

The options are to be analysed for development as a parking bay for the container trucks this in turn will minimizes the traffic congestion within and outside port premises.

# 7.3 Suggested Measures for HDC

## 7.3.1 Improvement in Berthing Pattern

One of the shortfalls noticed in the HDC operations is handling mix cargo at most of the berths. Thus it is suggested that berths on the Eastern side shall be dedicated for Bulk Cargo, while Containers may be handled on the Western side of the dock.

This will enable to segregate cleaner cargo towards Town side while cargo having dust potential will be handled towards river, reducing impacts on humans.

### 7.3.2 Reallocation of Cargo between Berths

As explained in **Section 4.7.2** only limited number of vessels can enter the dock basin due to constraints in lock capacity. Therefore vessels with higher parcel size should be preferred inside the dock to enable handling of higher cargo throughput. It is therefore important the oil tankers of edible oil and chemicals are shifted outside the dock basin. This would improve the dock capacity by way of handling higher parcels of dry bulk.

Similarly the cargo like iron and steel, machinery and spare parts and some project cargo are handled in small parcels and therefore could also be shifted to a multipurpose berth outside to create additional capacity.

### 7.3.3 Development Possible within the Existing Haldia Dock

#### *7.3.3.1 Capacity Assessment of Dock Basin*

An analysis of data for the ships visiting the Haldia dock for the last year reveals the following:

1. About 520 ships of liquid cargo ships carrying about 3.7 MT visited lock with average parcel size of about 6,000 T
2. Similarly about 70 ships of breakbulk carrying about 0.5 MT visited the lock with average parcel size less than 6,000 T.
3. If the riverine jetties are developed to handle vessels of smaller parcel size the dock facilities could be utilized for handling bigger ship with average parcel size of about 20,000 T.
4. Considering that about 10 ships can enter/exit a dock per day, the total dock capacity would work out to 35 MTPA, considering 350 working days in a year.
5. However, the concession for the container terminal at berths 10 and 11 has already been awarded and therefore there is no possibility to shift the container vessels, which bring cargo in smaller parcels, to the riverine jetty. Based on the profile of the container ships visiting KoPT it is observed that the average parcel size is about 500 TEUs only.
6. Considering that the container vessel calls in the dock would be about 400 for the planned capacity of 0.2 MTEUs. This would result in loss of dock capacity by about 5 MTPA (i.e. 400*(20,000-7,500)/10,00,000) i.e. the capacity of dock shall be 30 MTPA.
7. In case the traffic throughput of container increases to 0.3 MTPA, the capacity of the dock shall further reduce to about 27.5 MTPA.

The productivity of the berths within the dock basin needs to be improved and as part of that following projects are recommended:

1. Providing mobile harbour cranes at berths 2 and 8 and associated backup area development
2. Mechanisation of berths 2 and 3

### 7.3.3.2 Mechanisation of Eastern Berths 2 and 3

The eastern berths 2 and 3 could be taken up for upgradation and these berths shall be developed only for handling dry bulk cargo and all the liquid cargo shall be taken away to berths outside the basin (**Figure 7.3**).

However it is proposed that the initial mechanisation be taken up at berth 3, which was earlier being used for handling iron ore exports. The berth 2 could continue to handle the cargo using MHC, dumper and front end loader combination and a suitable decision of its full mechanisation shall be taken later.

**Figure 7.3 Suggested Backup Area for Berths 2 and 3**

The overall layout of the proposed scheme is shown in **Figure 7.4**. The salient features of the mechanisation of berth 3 are:

1. It is proposed that two mobile harbour cranes with integrated hoppers be provided for unloading the cargo from ships.
2. The hoppers shall discharge the material to underneath connected conveyor which shall transfer the bulk material to the stackyard, where it shall be handled using stacker cum reclaimer.
3. Two rows of stockpiles with total storage capacity of 0.37 MT shall be built. Assuming the dwell time of import cargo as 30 days, the stackyard can support the terminal capacity of about 3.0 MTPA.
4. The wagon loading shall be undertaken by rapid loading system with a silo provided over a rail line. The cargo shall be reclaimed by stacker cum reclaimer and transferred to silo through conveyor system.

5. It is understood that the foundation of berth 3 are on Monoliths of size 6.55 m wide and 13.7 m long. The centre to centre distance of monoliths is about 13.7 m and the gap is bridged by superstructure comprising of longitudinal beams and slab. Based on the berth details provided above by HDC, it can be inferred that the berth is structurally suitable to support mobile harbour cranes. It has however to be ensured that during operations the cranes are placed within the extents of monolith.
6. The berth structure is however old and damaged at several locations and requires thorough rehabilitation, the cost of which would me marginal as compared to building a new berth.
7. However an approach trestle of about 20 m width needs to be newly built connecting the berth 3 to shore to allow passage of mobile harbour cranes and the conveyor system. In addition conveyor trestles would need to be built in the rear of the berth.
8. Most of the old structures, conveyor system have been cleared from site. Existing two bunkers at site which would need to be demolished before installation of the new bulk import system.

As yard space is limited the cargo has to be evacuated faster and if the dwell time could be reduced to about 20 days, the berth 3 will be able to handle about 4.0 to 4.5 MTPA of dry bulk import.


**Figure 7.4 Proposed Mechanisation of Berth 3**

### 7.3.4 Development Possible Outside the Existing Haldia Dock

There is a very limited waterfront with deeper draft outside the dock basin as shown in **Figure 7.5**.


**Figure 7.5 Location of Waterfront with Deeper Draft**

As part of the planned projects already OT1, OT2 and floating jetty are planned and there is just space to provide a mechanised barge jetty upstream of HOJ1. This project can be taken up once the transloading operations get stabilised.

#### *7.3.4.1 New Exclusive Berth Outside Dock for Edible Oil & Chemicals*

The liquid bulk traffic other than crude & POL products during the past 5 years is presented in the following **Table 7.2**.

**Table 7.2 Oil Traffic Handled at HDC in Last 5 Years (in MTPA)**

| Commodity | 2014 - 15 | 2013-14 | 2012-13 | 2011-12 | 2010-11 |
|---|---|---|---|---|---|
| LPG | 1.91 | 1.53 | 1.40 | 1.32 | 1.11 |
| Chemicals | 1.94 | 1.83 | 1.59 | 1.48 | 1.61 |
| Edible oil | 1.96 | 1.55 | 1.54 | 1.19 | 1.02 |
| **Total** | **5.81** | **4.91** | **4.53** | **3.99** | **3.74** |

It could be seen that the growth of the chemical traffic has been nominal while the growth of LPG and Edible oil are significant. Edible oil traffic is growing at the rate of almost 15% per annum which is confirmed by the trade. Interaction with the trade indicated that the growth is on account of demand for this cargo in the north eastern states and Haldia being the nearest feeder port, this traffic is bound to maintain the same rate of growth. However due to of the congestion, pre-berthing detention and the consequent demurrage (US$ 10,000 to US$ 20,000 per day) HDC is not one of the preferred destination. It was reported that the edible oil tankers are given the last priority and thus the pre-berthing detention sometimes extends even up to 15 days.

Considering the demand and also the limitation liquid cargo presents in terms of inefficiencies due to small parcel size, it is advisable to shift the edible oil and chemical traffic to berths outside the basin, where the tankers can directly berth so as avoid pre berthing detention and consequent demurrage. This move will also ease the congestion at the lock gates and the bulk carriers will not suffer any appreciable pre-berthing detention.

Presently, four agencies, viz. Adani Wilmer Ltd., Ruchi Soya Industries Ltd., Emami Biotech Ltd., and Gokul Refoils and Solvent Ltd., are having their edible oil refineries at Haldia and are importing the edible oil. There are dedicated 12" pipelines having the discharge rate of 250 to 300 TPH only. These pipelines originate from Berths 5, 6 and 7 of dock basin and are 4.2 km, 4.5 km, 2.7 km and 4.2 km away from the tankfarms of Adani Wilmer Ltd., Ruchi Soya Industries Ltd., Emami Biotech Ltd., and Gokul Refoils and Solvent Ltd respectively (**Figure 7.6**).


**Figure 7.6 Location of Various Oil Refineries with Respect to HDC**

Considering the relative locations of the industries and their terminals, there are following options for locating the new facility:

Location 1: Upstream of HOJ 3 where the port is planning its OT-I.
Location 2: Downstream of HOJ 2 where port is planning OT-2.

**Table 7.3** presents relative merits and demerits of the considered locations.

**Table 7.3 Relative Merits and Demerits of the Two Locations**

| S. No. | Parameter | Location 1 | Location 2 |
|---|---|---|---|
| 1. | Relative distance between the users and jetty | About 6 to 8 Km | About 1 km less as compared to option 1 |
| 2. | Cost of Laying pipeline | About 4 km of new pipelines are to be laid | Only about 1 km of pipelines need to be laid as pipelines already exist up to berth no. 3 |
| 3. | Due to increased distance of unloading point as compared to berths 6 and 7, the flow rate of unloading tankers would reduce. The measures to improve the flow rate | The new pipeline laid could be of higher diameter to reduce the head loss.<br>Additional tank farms could be built by users to unload the tankers very fast | As the existing pipeline is proposed to be used, the cargo to be unloaded with reduced flow rate. |
| 4. | Space for additional tank farms for users on account of their increased handling requirements | Adequate area is available where users can built their tank farms for transit storage. This would result in faster turnaround of ships | Not possible due to the presence of bulk stack yard |

As could be observed from the above that while location 2 offers advantage in terms of reduced initial investment, location 1 could be better as it can allow transit storage tanks to ensure that the tankers discharge at their optimum capacity and turn round faster.

Based on the analysis of data on the oil tankers for edible oil and chemicals it is noticed that average parcel size is only about 7,500 T and the handling rate low at about 6,500 TPD only. As mentioned above the handling rate would further reduce at either of the location OT1 or OT2. Even considering the same handling rate it is assessed that the capacity of the one oil jetty for products would only be limited to about 1.3 MTPA at 70% berth occupancy and that about 1.7 MTPA at 90% berth occupancy. Considering the current throughput of oil tankers as over 3.0 MTPA (out of which palm oil, handled in small parcels itself constitutes about 1.2 MTPA), only one oil jetty would not be adequate. Therefore following is suggested:

1. Though the port has planned OT1 to handle bulk vessels using fully mechanised system, provision for handling oil tankers to be kept (by way of flexible hoses and pipeline manifold and accordingly the length of OT1 be increased to 330 m to enable handling two small oil/bulk tankers simultaneously.
2. Providing an additional jetty in between OJ1 and OJ2 may be examined for handling small tankers with LOA limited to 120 m (as shown in **Figure 7.7)** through navigational simulation study. However, this could be taken up at a later date once the proposed OT2 gets saturated.
3. In the event this additional jetty in between OJ1 and OJ2 is not found feasible, developing oil jetty at Shalukhali should be taken up by port.

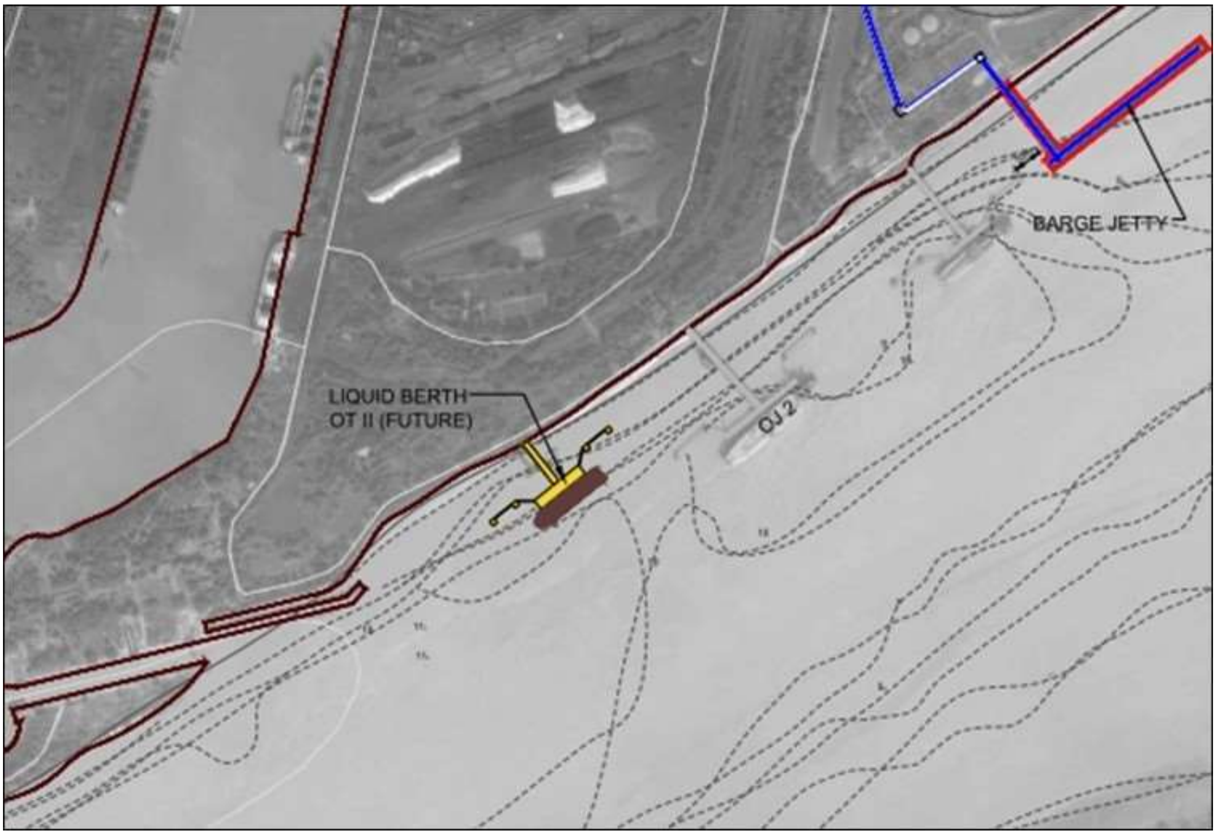



**Figure 7.7 Proposed OT 2**

#### *7.3.4.2 Building a Multipurpose Berth Outside the Dock Basin to Handle Breakbulk and Other Dry Bulk Cargo*

The proposed bulk and breakbulk terminals at Shalukhali are not being pursued further due to lukewarm response of the bidders. However considering the increasing volume of bulk import cargo at HDC and the requirement to reduce the waiting time for entry/exit to the dock there is a requirement to create bulk import facility outside the lock gate. Such bulk import facility shall also support the transloading and lighterage operations and thus would reduce the turnaround of the ships.

The proposed facility (already planned at OT1 by HDC) shall comprise of a berthing jetty of 270 m length and width of 25 m. The system for bulk unloading shall be fully mechanised comprising of mobile harbour cranes at berth with mobile hoppers and conveyor system underneath. The conveyor shall be located about 20 m behind the berthing line and shall carry the bulk cargo to the mechanised stackyard. The schematic layout of the proposed terminal is shown in **Figure 7.8**.

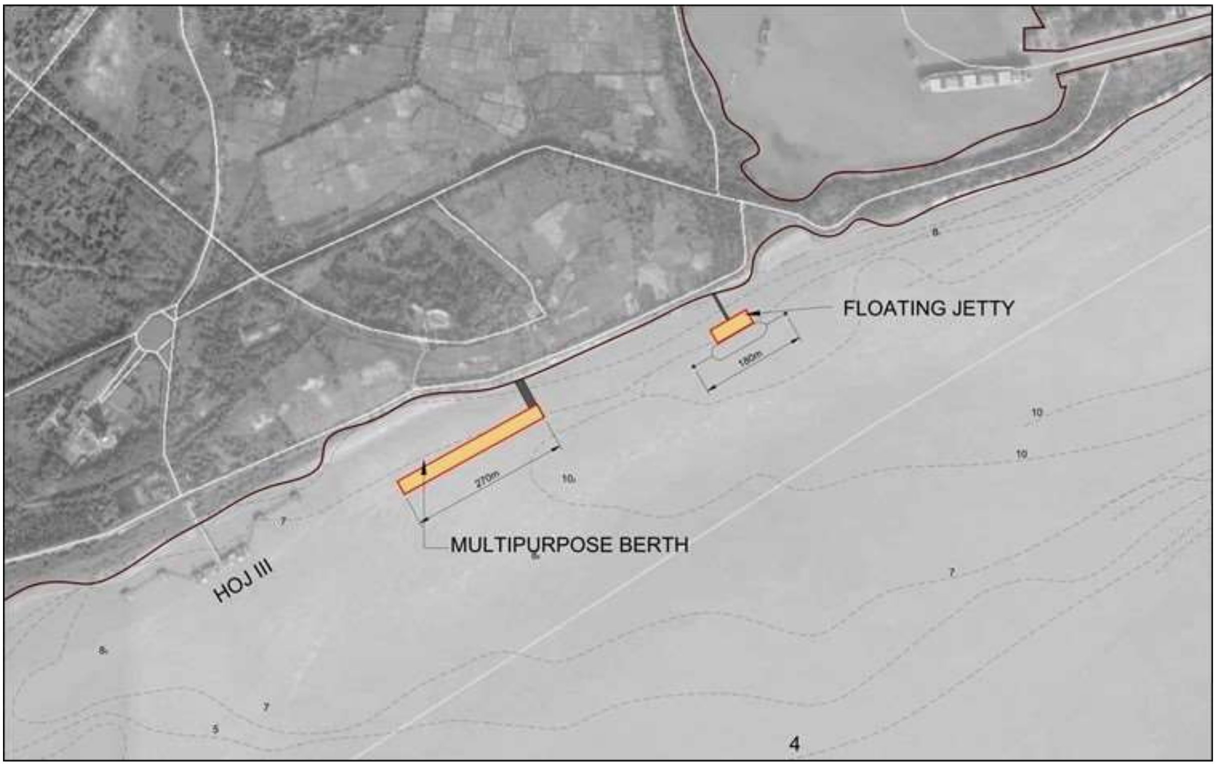



**Figure 7.8 Proposed OT 1 and Floating Jetty**

#### *7.3.4.3 Building Barge Jetties to Support the Anchorage Operations*

In order to compete with ports like Dhamra, Gangavaram, Vizag etc. which are capable of handling the Cape size ships, KoPT should also be plan similar facilities. Handling of cape size ships is only possible in the outer anchorages as per the details as shown in **Figure 7.9**. While it is not yet established that round the year operations would be possible at anchorage, the facility is expected to be operational for about 225 to 250 days in a year.

OT1 is already planned to handle the handy to Panamax size ships of direct call or as daughter vessels of the cape ships at anchorage. However the capacity of this berth would also be limited to only about 5.0 MTPA which matches with the capacity of one transloading station for handling cape size ships.

Currently barges are deployed at Sagar roads for lightering of the ships and it is also feasible to deploy barges for supporting the transloading operations at anchorage. It is therefore required that additional berths are needed to support the barges utilised for transloading/ anchorage operations. The barges could be easily hired from different suppliers and could also support the IWT movement in NW1. The following options exist for building barge berths outside the dock basin.

1. Floating jetty upstream of HOJ3 as already awarded
2. Mechanised barge unloading jetty be built upstream of the HOJ1.

A barge jetty with mechanised cargo handling system has a capacity of only about 2.2 MTPA at 70% berth occupancy. The floating jetty has been planned for handling only one barge at a time and therefore there is still a need to add one more jetty for barge unloading to support the lighterage operations. Further there is a need to have additional jetty to support the anchorage operations. The layout plan is shown in **Figure 7.9**.

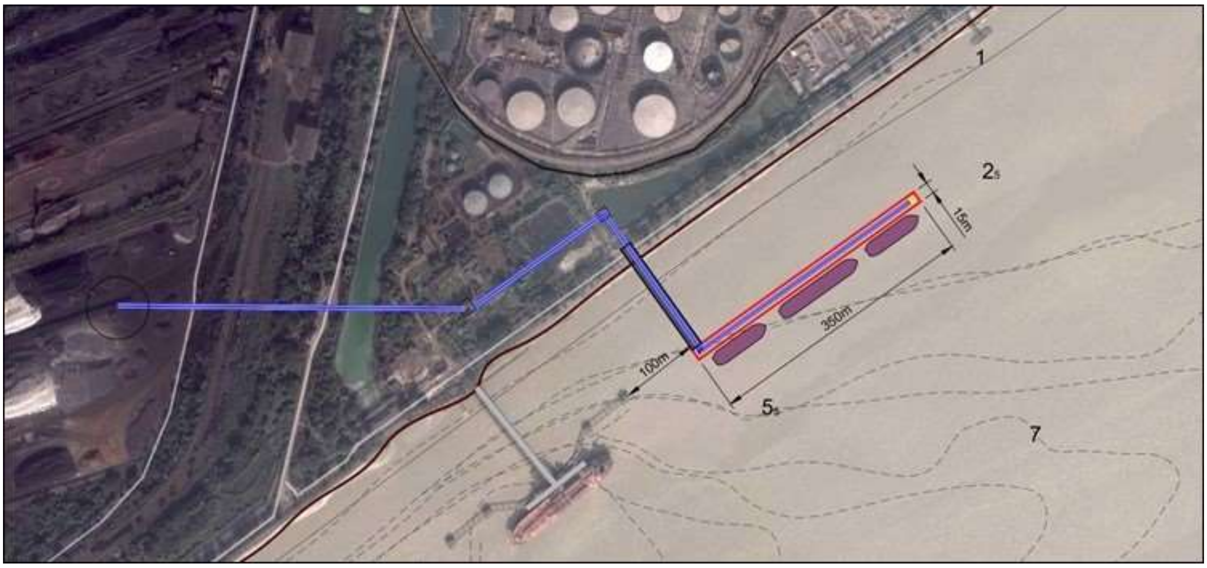



**Figure 7.9 Layout Plan of Barge Jetty**

This jetty shall be designed to simultaneously handle two barges of size upto 3000 DWT drawing a draft of about 2.5 to 3.0 m. The minimum water depth needed at the berth would be about 3.5 m below CD. The berth would be sized 300 m long and 20 m wide. The bulk material shall be unloaded using barge handlers and put on to mobile hoppers with a conveyor system. The conveyor shall transport the material to the stackyard already available behind the dock-basin eastern berths.

### 7.3.5 Transloading Operations

In order to be competitive with the nearby deep draft ports, KoPT should have a provision for handling cape size ships in the long term. Though unloading the cape size ship at anchorage to daughter vessels/ barges, transfer to the HDC and then unloading it there would be a costlier operation as compared to the direct unloading of cape size vessels at the competing port, but the overall logistics cost could still be comparable due to better rail and road connectivity from Haldia to the cargo destination centres.

The cargo unloaded may be unloaded using transloaders or floating cranes at the anchorage and shall be taken by daughter vessels of handy size or Panamax size or by barges to the HDC and gets unloaded again. The handy or Panamax size vessels have draft restrictions and they have to be light loaded to the permissible draft only. For the cargo that has to go upstream using inland waterways the cargo can be transferred to riverine barges at the Sagar roads. Alternatively the riverine barges could also be loaded at the HDC.

During fair weather the Capesize ship can be unloaded at the anchorage. However, during foul weather location near Kanika Sands has to be used but it is likely to have significant weather downtime as shown in **Figure 7.10**.

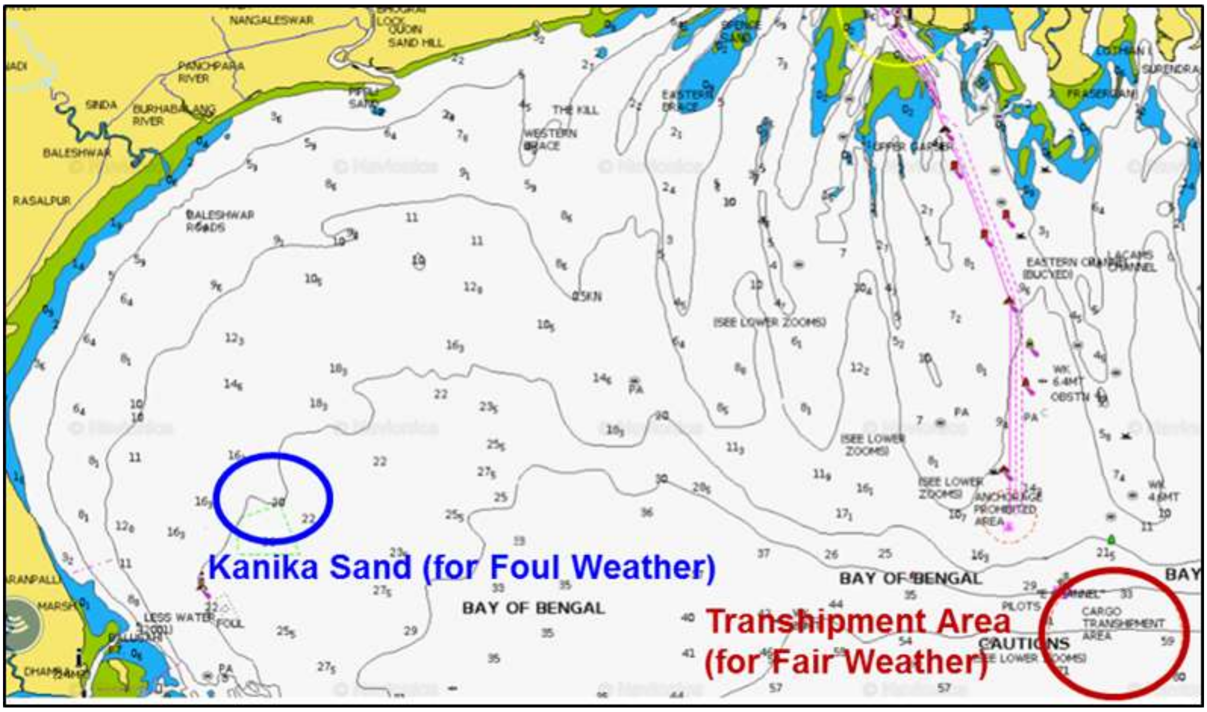



**Figure 7.10 Transloading Points of KoPT**

## 7.3.6 Creation of New Dock Basin at Haldia

### *7.3.6.1 Need for New Dock Basin*

Even with the mechanisation and improvements of operations within dock the overall capacity would be limited to about 27.5 MTPA due to the constraints in the lock gate capacity. Similarly fully building up the riverine jetties would add additional capacity of about 19 MTPA. Therefore the overall capacity of HDC can reach upto 46.5 MTPA as shown in **Table 7.4**:

**Table 7.4 Estimated Capacity of HDC**

| S. No. | Cargo Handling Area | Estimated Capacity (MTPA) |
|---|---|---|
| 1. | Dock Complex | 27.50* |
| 2. | HOJ1, 2 and 3 | 9.70** |
| 3. | OT1 | 4.00 |
| 4. | Floating Jetty | 2.50 |
| 5. | OT2 | 2.00 |
| 6. | Barge Jetties to support transloading | 4.00 |
| 7. | Fly ash jetty | 1.00 |
| **Total Capacity (MTPA)** | | **50.70** |

** Assuming that the container traffic within dock shall increase to 0.3 MTEUs*
*** Based on the type and proportion of products being handled currently*

As the projected traffic for HDC beyond year 2025 are higher, there is a need to expand the berthing facilities and creation of second dock basin could meet this requirement.

### *7.3.6.2 Alternative Options*

The following three alternatives are available for creation of the additional dock:

**Figure 7.11 Alternative 1**

**Figure 7.12 Alternative 2**


**Figure 7.13 Alternative 3**

***Alternative 1 (Figure 7.11 )***

1. This alternative makes use of the existing turning circle with minor increase in the size.
2. The movement of vessels need to be staggered to utilise the common turning circle.
3. Dredging in the dock basin is minimised thus offering economy.
4. The lock entry is oriented for ebb entrance making navigation relatively difficult. Waterfront adjacent to HOJ3 would be required for lock entrance, where two riverine jetties could be located

***Alternative 2 (Figure 7.12)***

1 In this alternative a totally independent dock basin is proposed.
2 The movement of vessels in the lock is independent and thus offers larger number of entry / exit of vessels (about 20 % additional) as compared to alternative 1.
3 Dredging in the dock basin is significantly high and therefore initial investment is higher by about 120 crores as compared to Alternative 1.
4 The navigation to in and out of dock is relatively easier.
5 Waterfront adjacent to HOJ3 could be used for locating two riverine jetties.
6 This option would involve utilising land near the existing HDC installations.

***Alternative 3 (Figure 7.13)***

1. This alternative is similar to alternative 1 except that no additional dock basin would be developed.
2. Initially the existing berths would be fully mechanised to achieve the maximum possible berth capacity
3. Subsequently additional berths would be developed in the existing dock basin.
4. This scheme involves least capital expenditure but the achievable capacity would also be limited.

#### *7.3.6.3 Preferred Option*

The proposed OT1 stockyard is located in the space shown for the second dock basin in alternatives 1 and 2. Therefore alternative 3 seems to be the only feasible option but this would involve dismantling of the floating jetty (being built for handling bulk cargo through barges) if and when this project is taken up.

#### *7.3.6.4 Capacity*

The additional lock gate can provide overall capacity addition of about **20 MT** per annum, which could be developed in a phased manner.

### 7.3.7 Development of Cargo Handling Facilities at Shalukhali

Additional berthing facilities alongwith the associated infrastructure could be created at Shalukhali located towards north east at a distance of about 15 km from the Haldia dock:

1. Initially it was planned as two separate projects with each project comprising of one mechanised berth and one multipurpose berth for handling dry bulk and breakbulk cargo.
2. The advantage of this site is availability of atleast 9 m natural water depth currently. Therefore berths with same draft as at main Haldia port could be planned.
3. Railway connectivity to Shalukhali is possible -- land to be given by State Government (about 40 acres)

The access to this site is through Rangafala channel leading to Kolkata Port. HDC has proposed to provide a liquid jetty of capacity 2.0 MTPA. Additional jetties could be provided in case of any capacity addition requirements.

Further the port would need to create additional support infrastructure to manage the terminals at Shalukhali, the cost of which, if apportioned to a small standalone terminal, may not be financially viable.

## 7.4 Rail and Road Infrastructure Augmentation at HDC

As discussed in the previous sections, it is proposed to develop additional facilities outside the HDC particularly for bulk cargo. Thus it is required that new road and rail connectivity is provided to these facilities for effective evacuation of cargo.

**Figure 7.14** and **Figure 7.15** provide the rail and road augmentation respectively that is required to be carried out as part of capacity enhancement of the port.

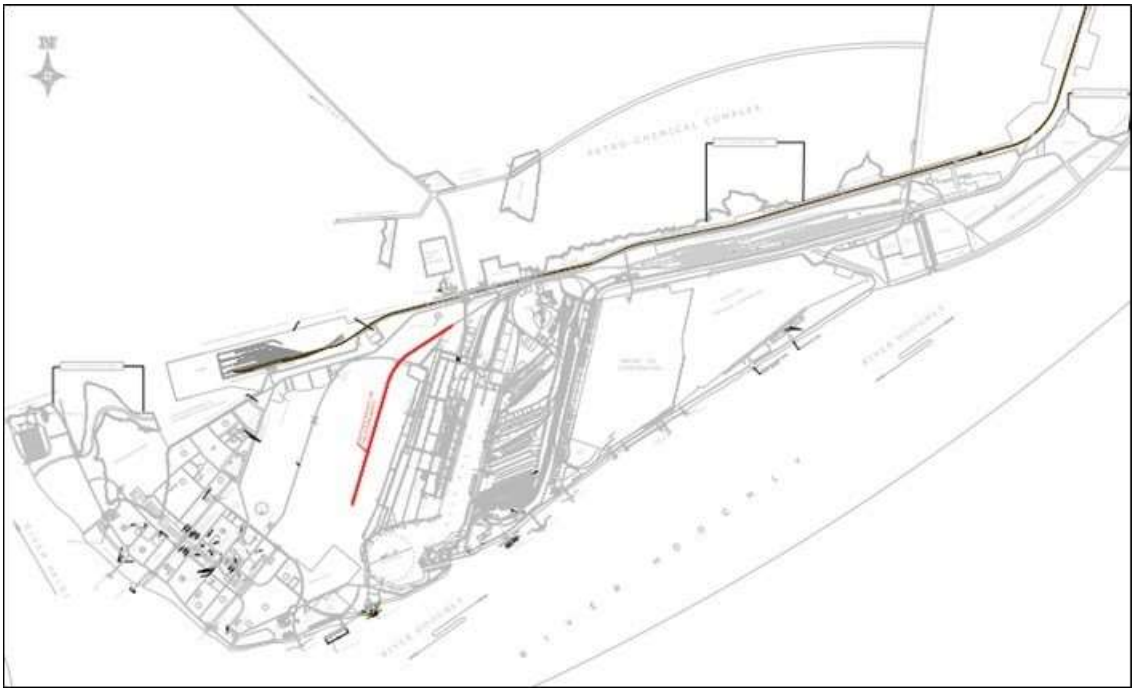


**Figure 7.14 Proposed Rail Connectivity at HDC**

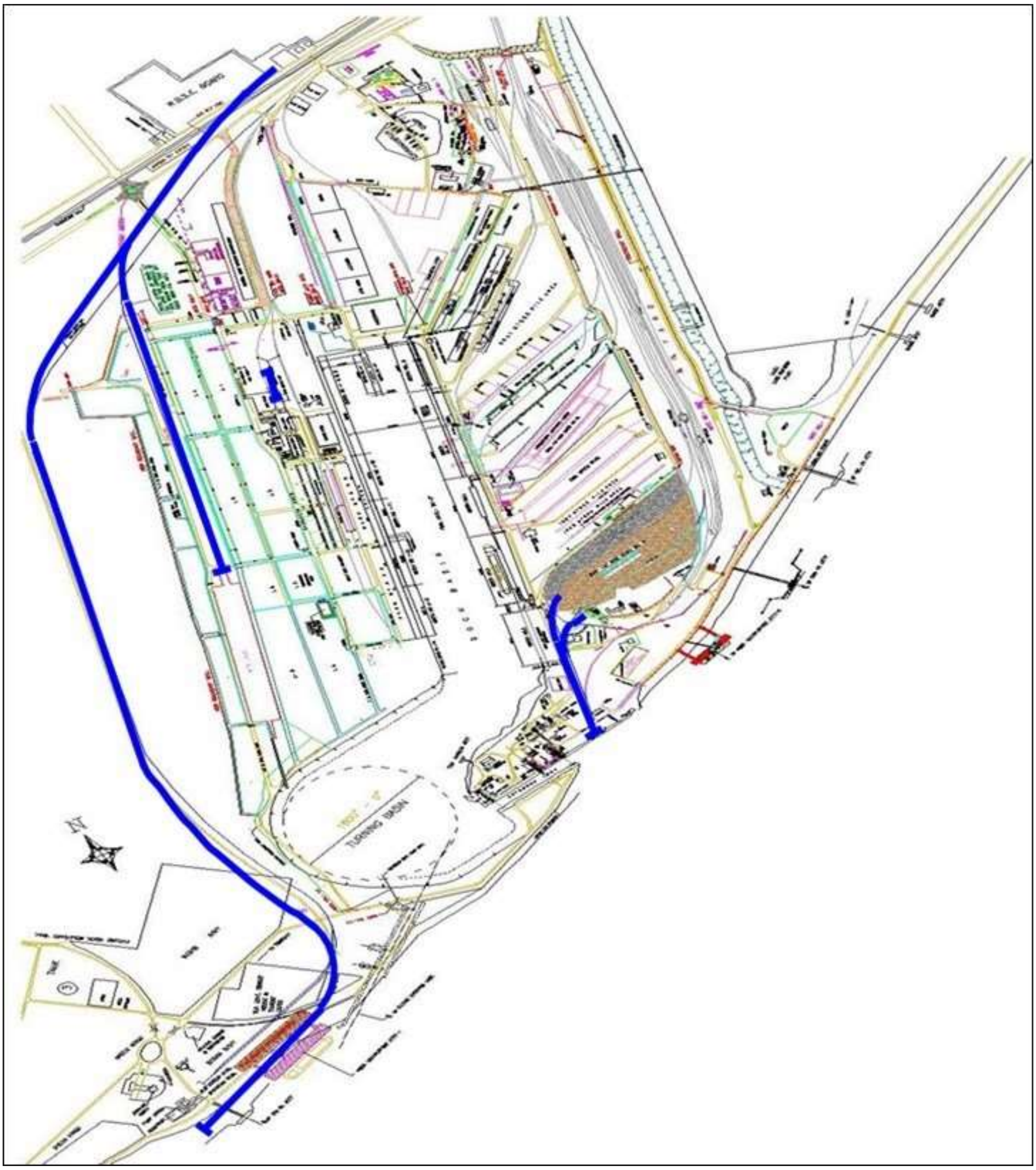


**Figure 7.15 Proposed Road Connectivity at HDC**

# 7.5 Development of Anchorage Berths at Sagar

## 7.5.1 Current Anchorage Operations at Sagar

The fully loaded Handy size to Panamax size ships visit KoPT after partly discharging their cargo at other ports such as Paradip, Vizag etc. Panamax ships light loaded to about 24,000 T are taken to Haldia/Kolkata docks directly. As draft at Sagar Roads is about 2.0 m higher than Haldia port, Panamax ships light loaded to 30,000 T can be brought to Sagar Roads. Their draft is reduced after lightering by about 9,000 T, and then they can proceed to Haldia/Kolkata docks. Barges of about 3,000 DWT are used for lightering operations.

At present there are 5 anchorages available at Sagar as shown in **Figure 7.16**.


**Figure 7.16 Location of Existing Anchorages at Sagar**

Two of these anchorages i.e. T1 and T2 are for holding the transit ships whereas at A1 to A3 lighterage operations are carried out to reduce the draft of the ships to the level enabling them to proceed to Haldia/Kolkata ports.

### 7.5.2 Additional Anchorages

There is demand for additional anchorages which would enable handling more ships of higher parcel size within KoPT. However, due to availability of limited deep water there is no further space to provide the additional conventional anchorages.

It is therefore proposed to provide fixed anchorage comprising of mooring dolphins as shown in **Figure 7.17**.

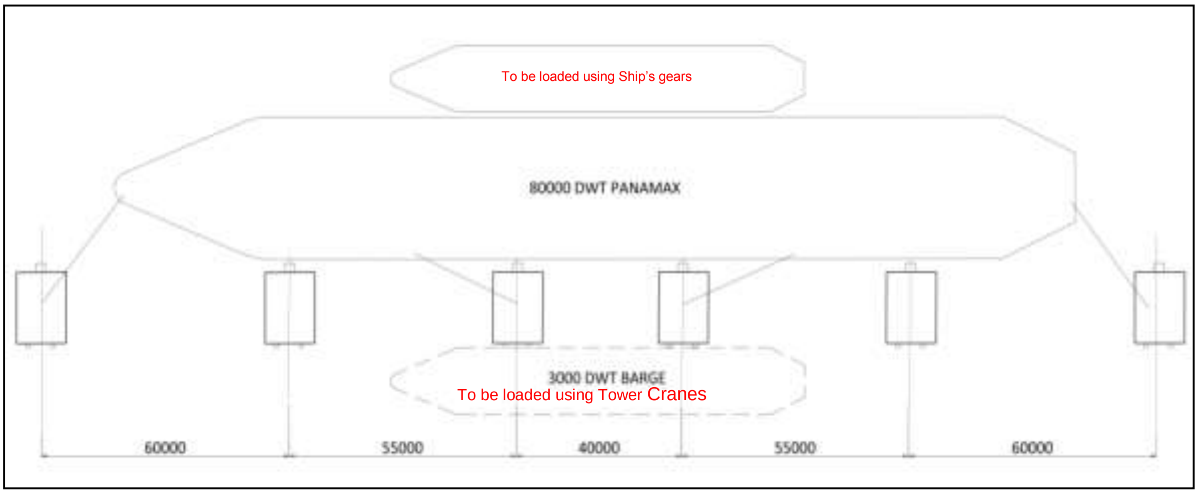



**Figure 7.17 Fixed Anchorage with Mooring Dolphin Arrangement**

As could be seen above the mother vessel is berthed against the dolphins and it is held in position using mooring ropes to the dolphins. The self-geared vessels shall unload the material to the barge placed alongside.

It shall also be possible to unload the gearless vessels for which tower mounted cranes could be provided on the dolphins. In such case the barge is berthed on the other side of the dolphins to receive the cargo unloaded by the cranes. This option shall obviate the need of providing costlier floating cranes at the anchorage. However if placing the crane option is not to be exercised a relatively less costlier multiple buoy mooring could also be considered, which can also meet the objective of holding the mothership which can unload the material to barges using self gears.

The proposed scheme would need the following:

- Locating the jetty in deep water just clear off the proposed Sagar Channel. The jetty shall be aligned along the current direction
- Provision of two tugs for berthing assistance
- One mooring boat

This scheme could be implemented in case there is significant delay in building of the proposed port at Sagar Island.

The location plan showing two fixed anchorages at Sagar is shown in **Figure 7.18**.

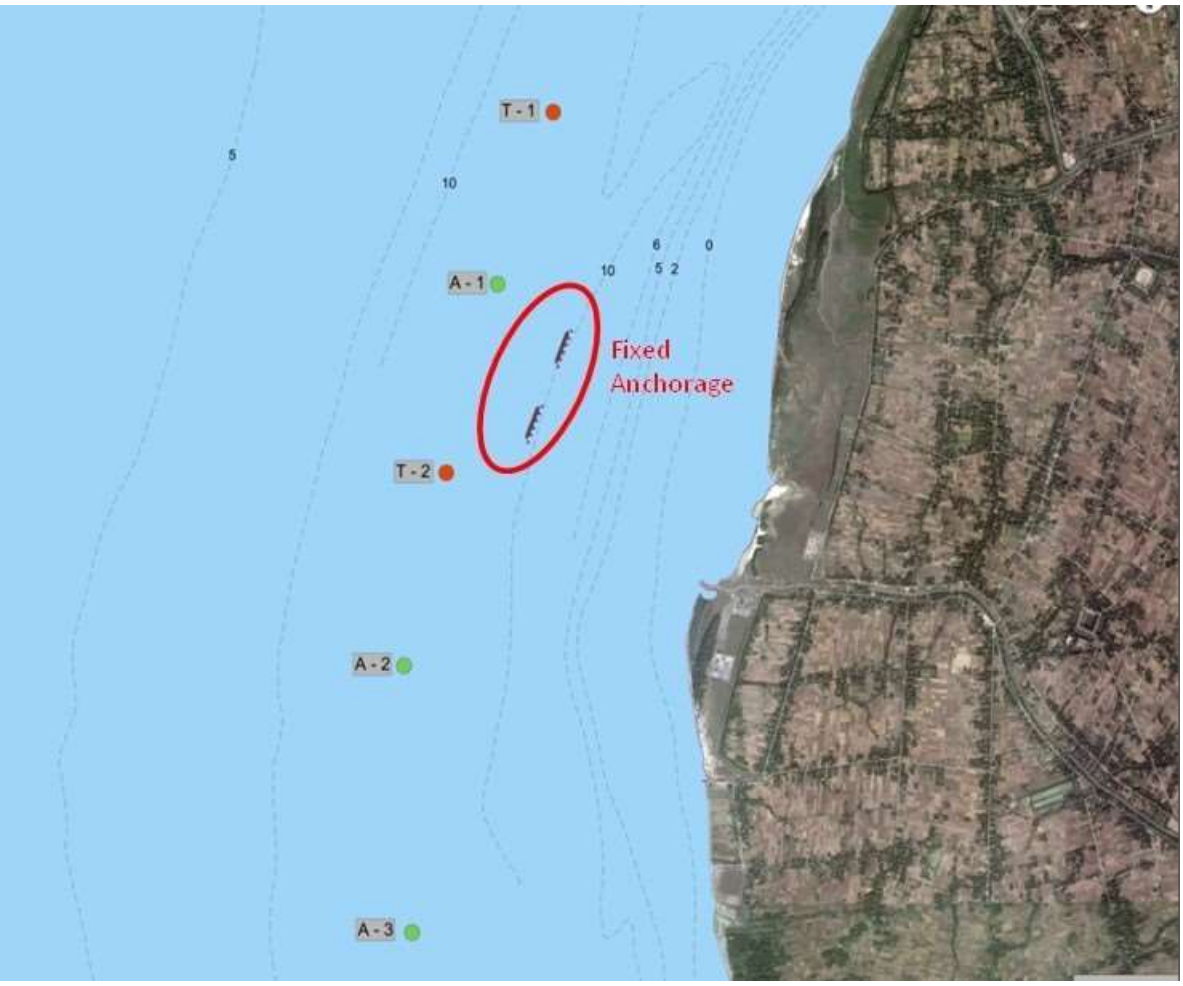



**Figure 7.18 Location Plan of Two Fixed Anchorage at Sagar**

## 7.6 Development of Satellite Port at Sagar

Due to the challenges being faced by KoPT in terms of draft limitations, limited headroom for expansion and efficiency, there is a need to look for a new port nearer to the sea, avoiding long river navigation with limitations in draft due to high dredging costs.

After a detailed study the location at Sagar Island has been selected for locating a Satellite port of KoPT. The Sagar Island is the southernmost Island of the Hooghly Estuary and forms one of the biggest deltas in Sunderban group. It is located 100 km downstream of Kolkata and separated by Muriganga River from mainland. The island is 30 km in length and has a maximum width of 12 km. Presently, there is no rail-road connectivity to Sagar Island with the mainland and rail-cum-road bridge across the Muriganga River has been proposed to provide connectivity.

At Sagar anchorage an additional draft of about 2.0 m is available as compared to HDC and KDS respectively. Accordingly it is proposed to initially develop the Sagar port to handle vessels with draft of 9.0 m with tidal advantage and subsequently the draft could be increased to suit the trade requirements.

The vessel size for Phase 1 is carefully chosen so that no capital dredging is needed in the long eastern approach channel. This would still enable carrying about 30,000 T of parcel size of bulk in Panamax ships round the year with minimum waiting time. The recommended port master plan layout is as shown in **Figure 7.19**.

**Figure 7.19 Layout of the Satellite Port – Phase 1**

State of the art material handling system shall be provided to ensure faster turnaround of ships. In the Phase 1 a 600 m quay length is provided which shall go upto 2,000 m in the master plan phase.

The recommended master plan layout of port is shown in **Figure 7.20** and it shall be developed in various phases as per the built up of traffic. The entire area for port operations and storage shall be created by way of reclamation. It is proposed to reclaim an area of 96 Ha in Phase 1 and that 197 Ha in master plan stage of the port.

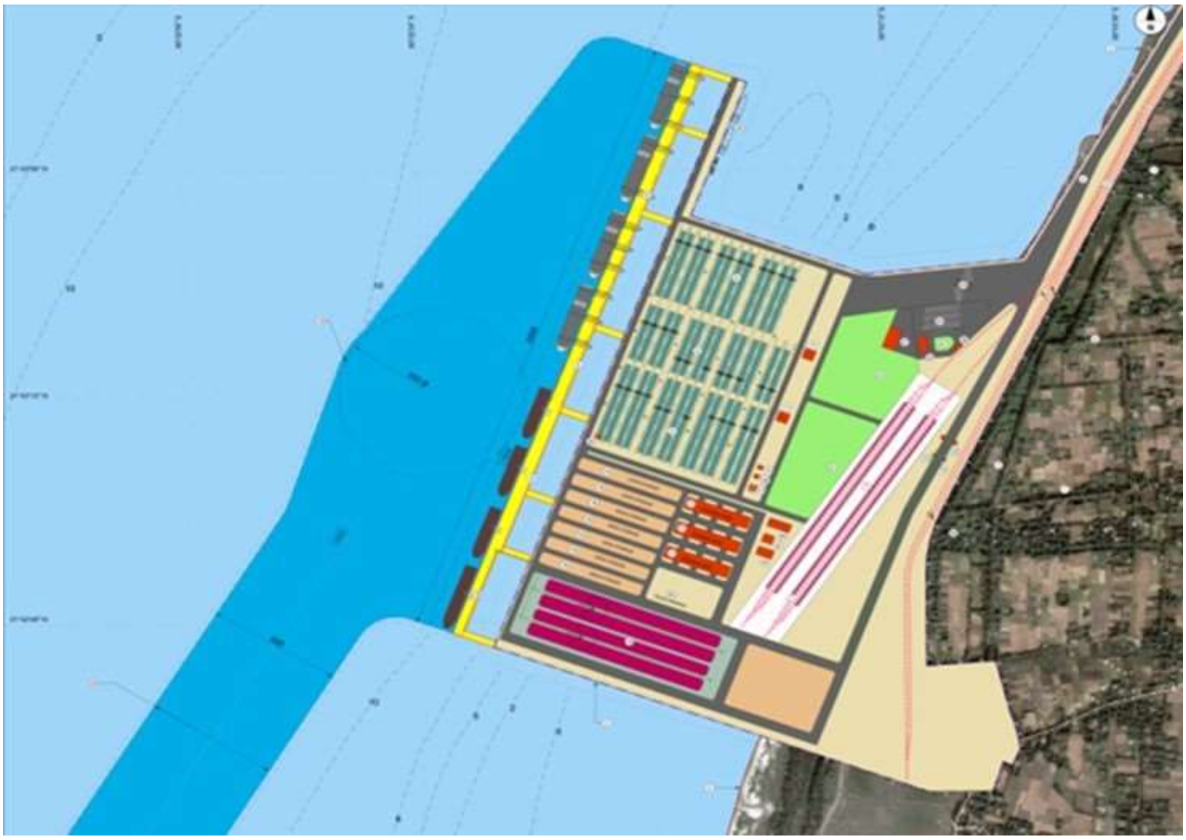


**Figure 7.20 Layout of the Satellite Port – Master Plan**

# 8.0 SHELF OF NEW PROJECTS AND PHASING

As part of the KoPT 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. Many of these projects are subject to outcome of detailed techno economic studies, which shall be conducted as part of the project development.

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.

## 8.1 Ongoing Projects

The details of the projects which have already been awarded and development is ongoing are given in **Table 8.1**.

**Table 8.1 Ongoing Projects**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (INR in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Floating Barge Jetty | 2.5 | 73 | Port's Funds |
| 2. | Mechanisation of Berth 3 at Haldia Dock Complex | 4.5 | 150 | PPP |
| 3. | Building Barge Jetties to Support the Anchorage Operations at Haldia | 4.0 | 120 | PPP |
| 4. | Setting up of 2nd Railway Line from Durgachak take off point to 'A' cabin at Durgachak at HDC, Haldia | – | 100 | Port's Fund |
| 5 | Deployment of 2 floating cranes near Sagar | 2 | 75 | PPP |

## 8.2 Projects to be completed by Year 2020

The details of the projects which are envisaged to be completed by year 2020 are given in **Table 8.2**.

**Table 8.2 Projects to be Completed by Year 2020**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (INR in Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | New Exclusive Berth (OT 2) outside Dock for Edible Oil and Chemicals at Haldia | 2.0 | 75 | Port's funds |
| 2. | Development of Multipurpose Berth (OT 1) outside the Dock Basin at Haldia | 4.0 | 450 | PPP |
| 3. | Oil Terminal at Shalukhali (LPG and Chemicals at Haldia) | 2.5 | 150 | PPP |

## 8.3 Projects to be completed by Year 2025

The details of the projects which are envisaged to be completed by year 2025 are given in **Table 8.3**.

**Table 8.3 Projects to be Completed by Year 2025**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (In Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Building Barge Jetty for Coal in KPD II and associated rail siding | 0.5 | 25 | PPP |

## 8.4 Projects to be completed by Year 2030

The details of the projects which are envisaged to be completed by year 2030 are given in **Table 8.4.**

**Table 8.4 Projects to be Completed by Year 2030**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (In Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Creation of Second Lock at HDC - Phase 1 | 10 | 1,600 | PPP |

## 8.5 Projects to be completed by Year 2035

The details of the projects which are envisaged to be completed by year 2035 are given in **Table 8.5.**

**Table 8.5 Projects to be Completed by Year 2035**

| S. No. | Project Name | Capacity Addition (MTPA) | Investment Required (In Crores) | Mode of Implementation |
|---|---|---|---|---|
| 1. | Creation of Second Lock at HDC - Phase 2 | 10 | 800 | PPP |

# Appendix-1: BCG Benchmarking Study for Kolkata Port Trust