Master Plan Report July 2016

MASTER PLAN FOR KANDLA PORT

Master Plan for Kandla Port

Prepared for

Ministry of Shipping / Indian Ports Association

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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 ▪ 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.) ▪ 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 ▪ 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.

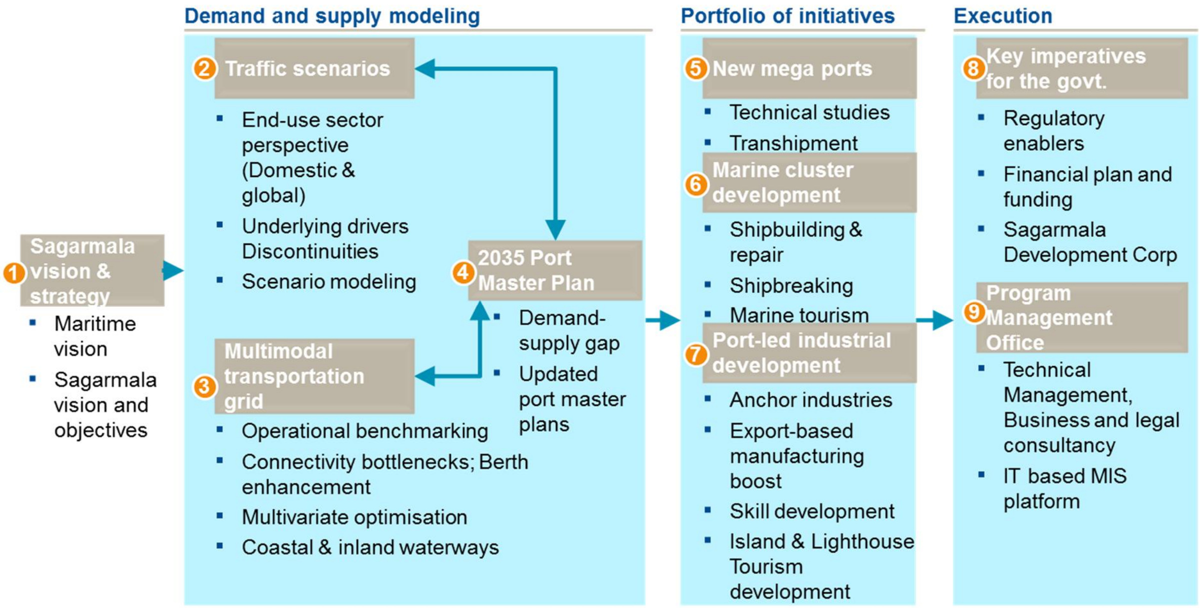

Figure 1.2 Governing Principles of our Approach

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**.

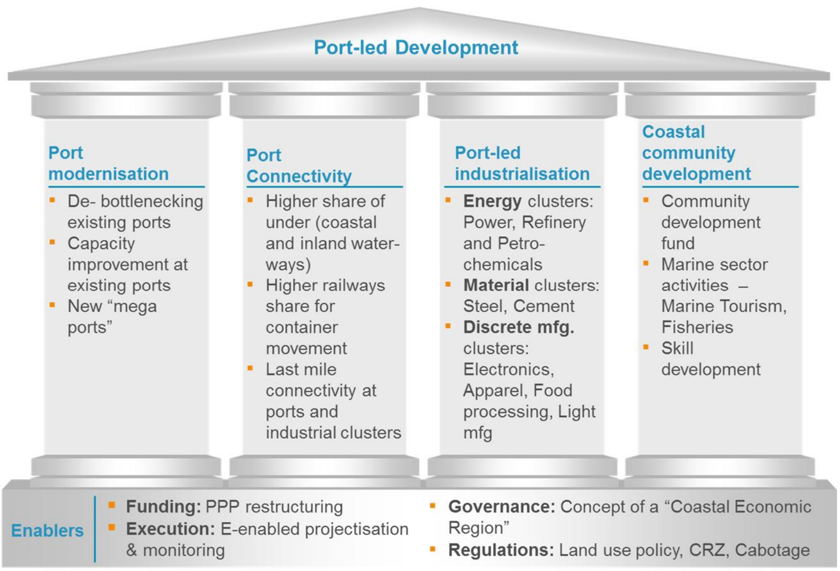

Figure 1.3 Port Led Developments

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**.

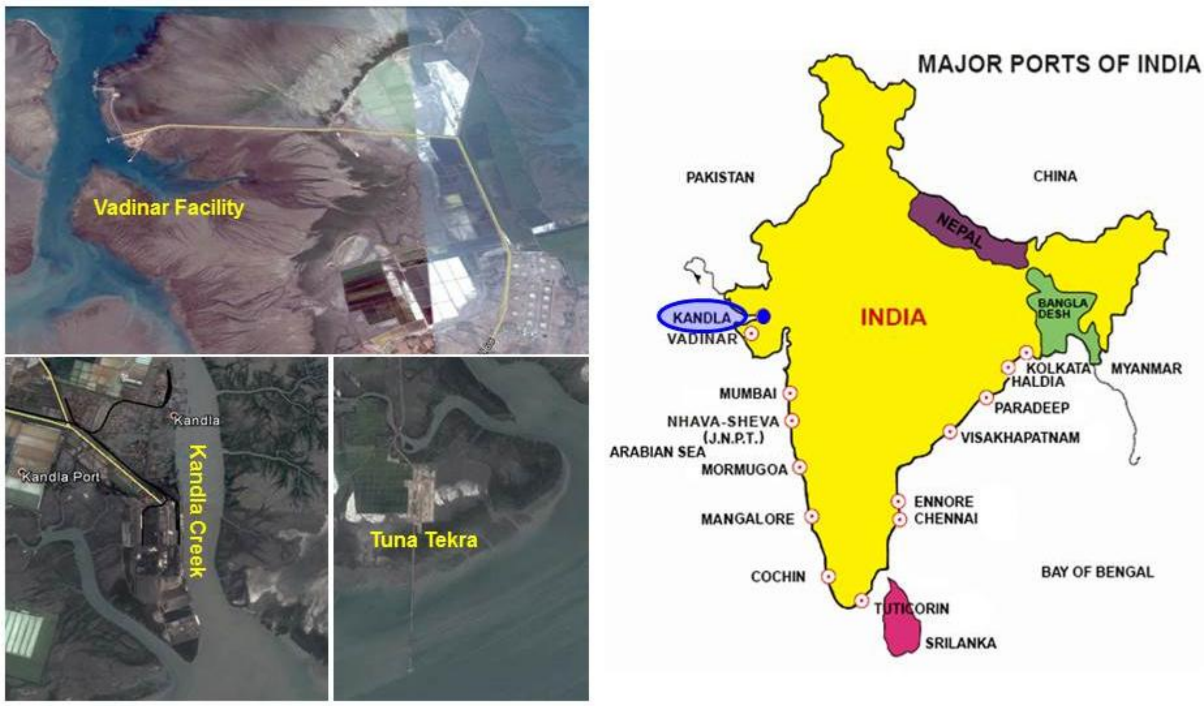

Figure 2.1 Geographic Location of Kandla Port

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.

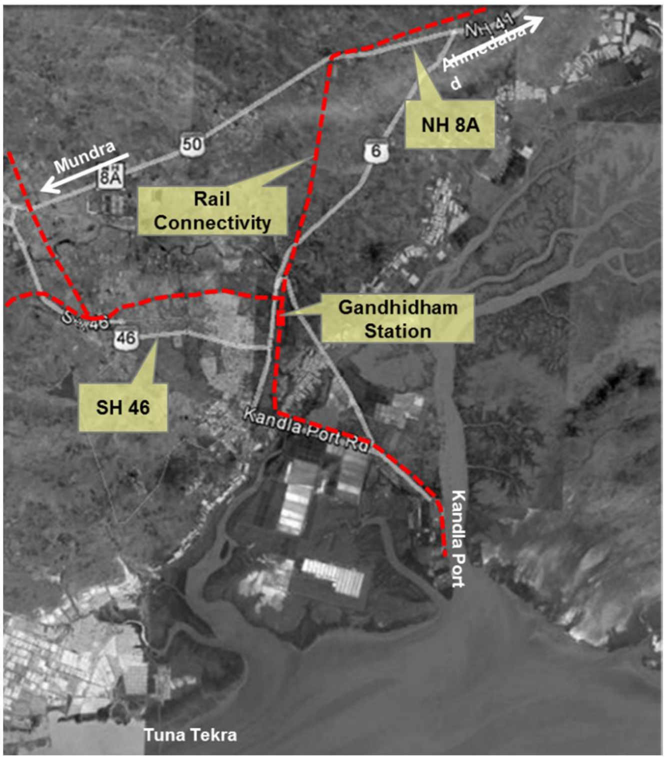

Figure 2.2 External Rail and Road Connectivity to Kandla

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**.

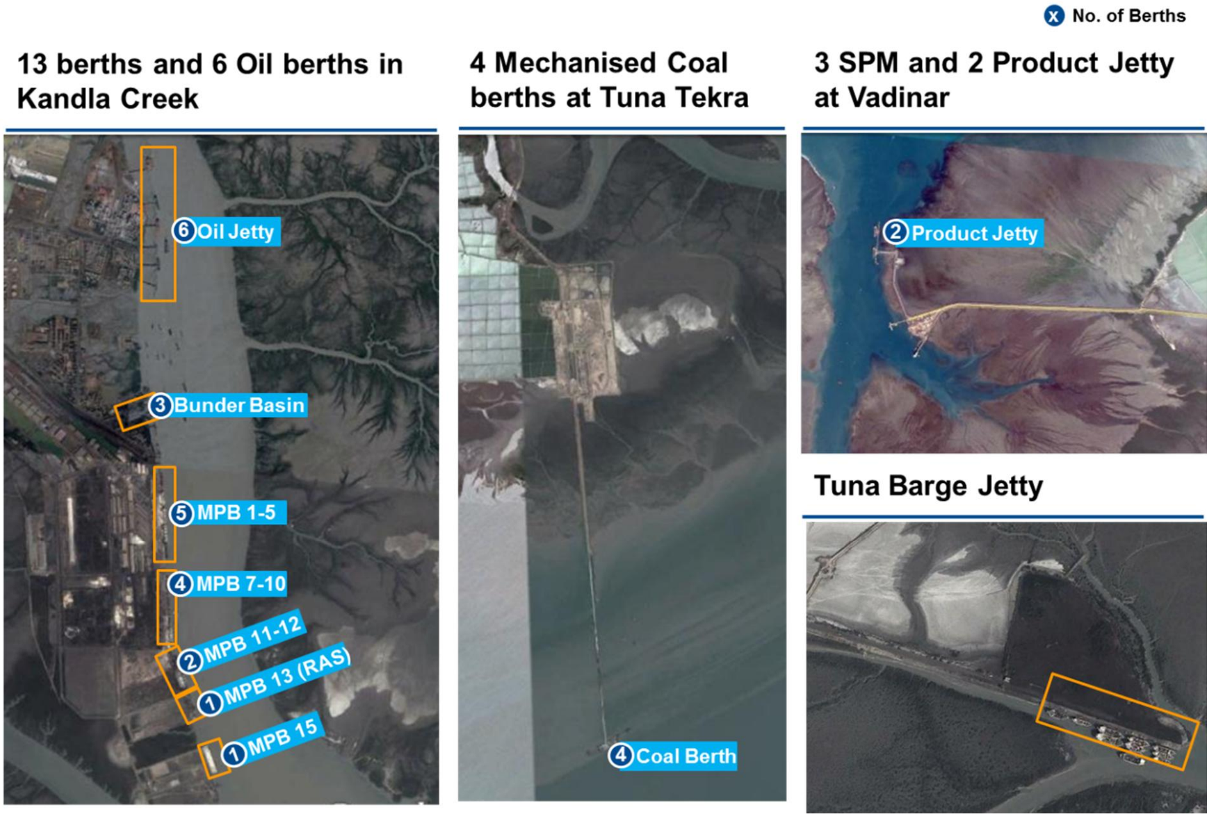

Figure 3.1 Existing Facilities

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**.

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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**.

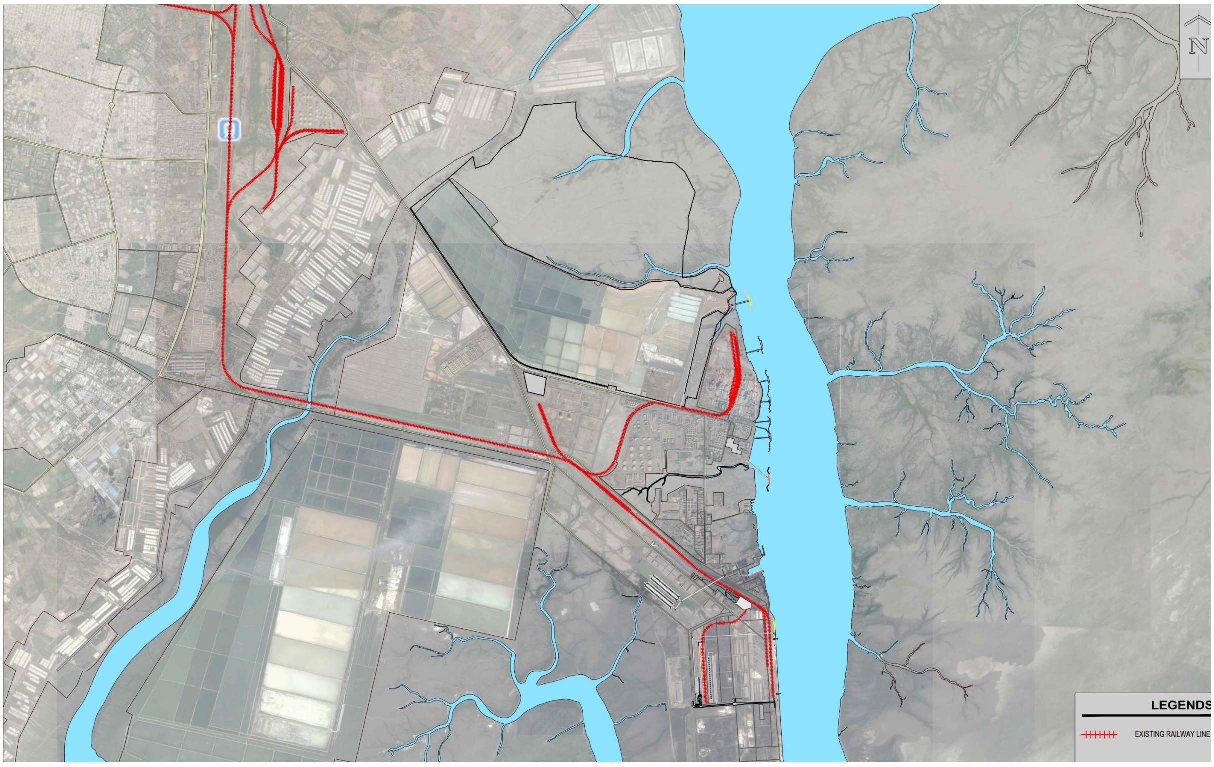


Figure 3.2 Internal Rail Network of Kandla Port

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.

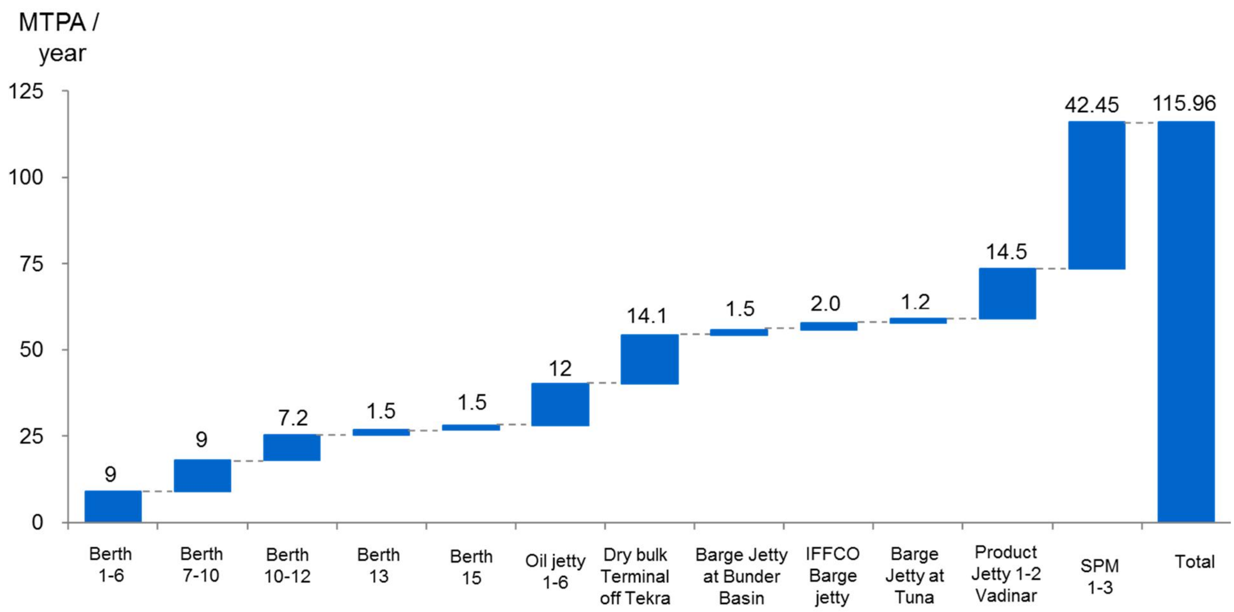


Figure 3.4 Design Capacity of Various Berths at Kandla Port

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.

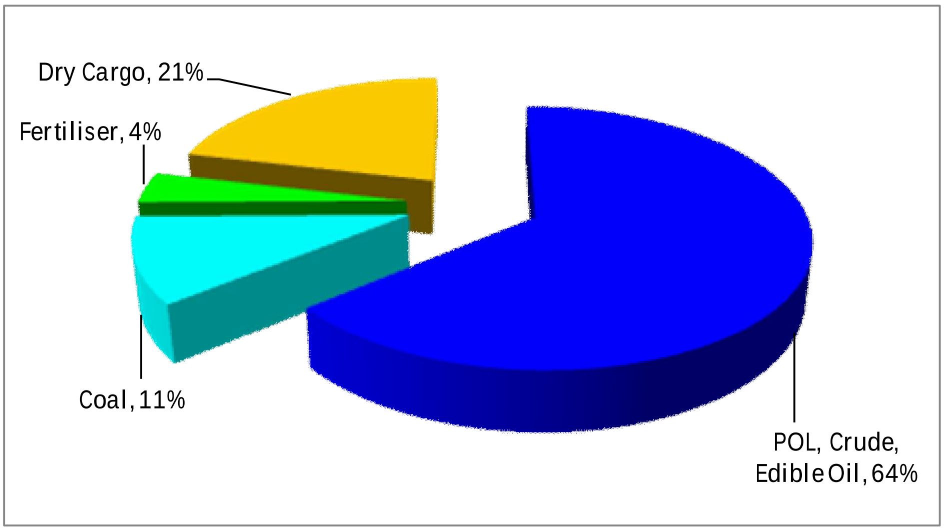


Figure 3.5 Cargo Traffic Share at Kandla Port

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**.

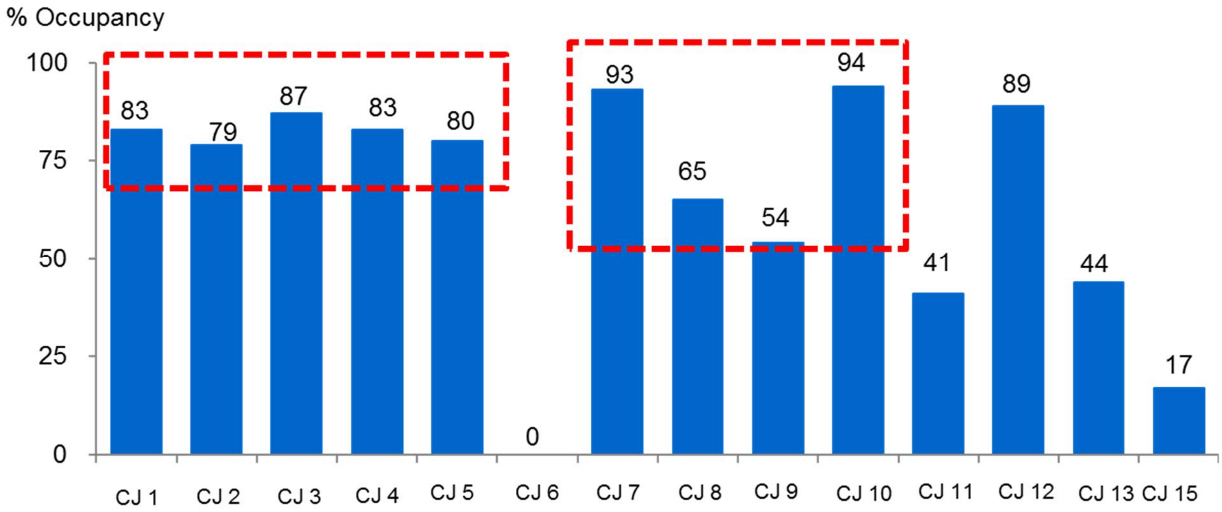


Figure 3.6 Berth Occupancy Details of Dry Cargo Berths

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.

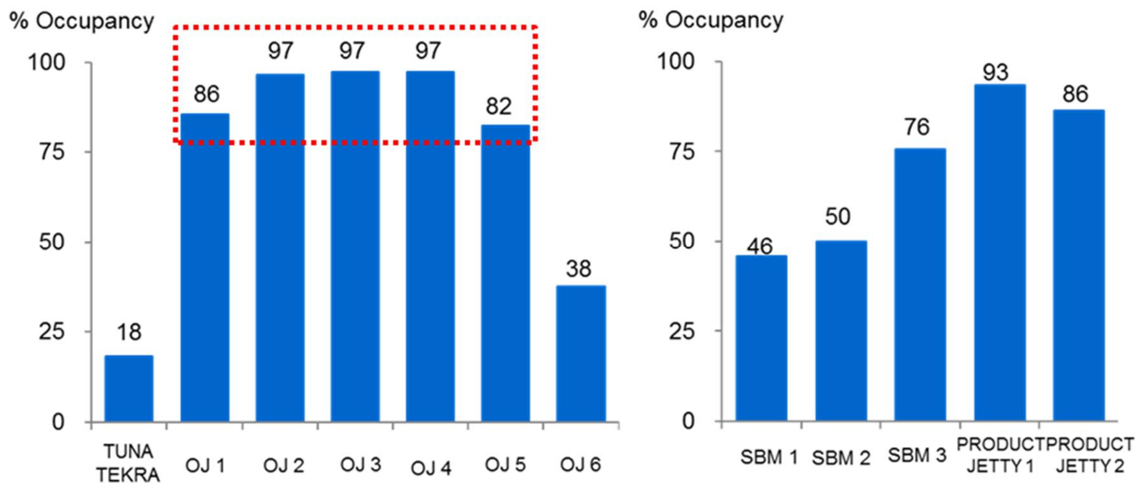


Figure 3.7 Berth Occupancy Details of Tuna Tekra, Oil Jetties and Vadinar Terminal

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**.

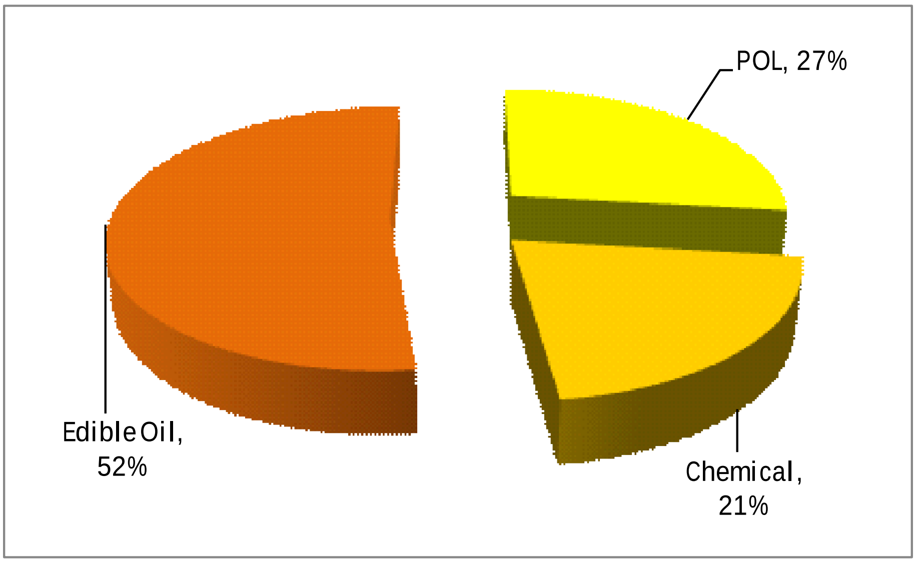


Figure 4.1 Proportion of Liquid Cargo Handling at Oil Jetties

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 7^{th} 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.

Vadinar Area

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**.

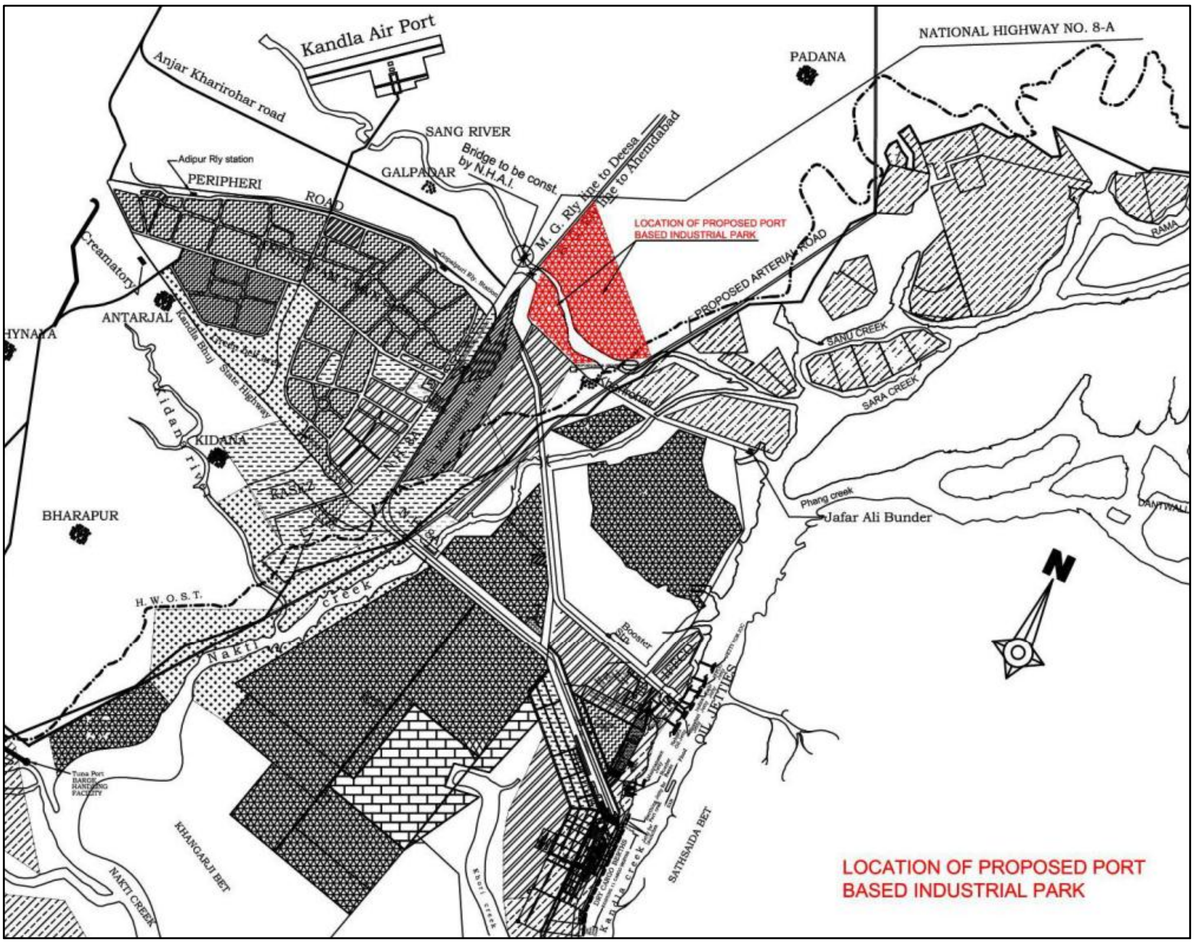


Figure 5.3 Location of Proposed Port based Industrial Park

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.

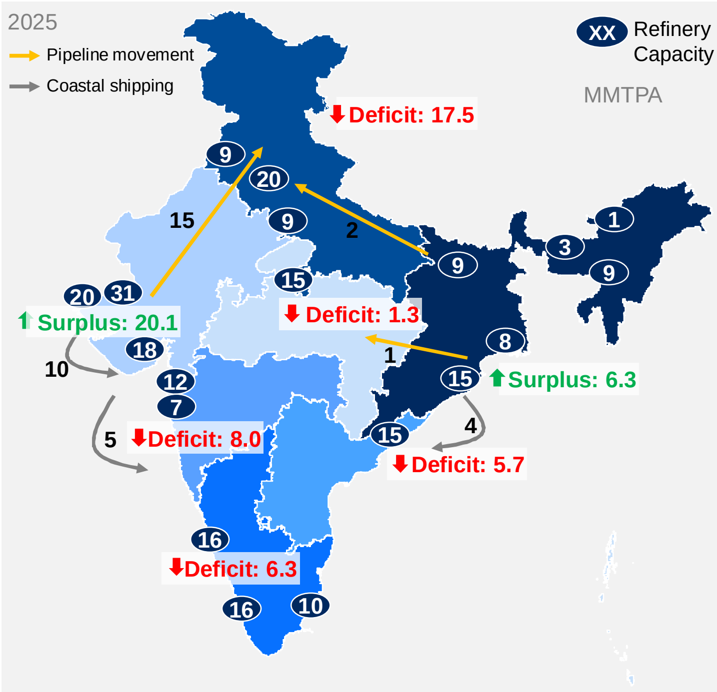
6.2 Major Commodities and their Projections

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**.

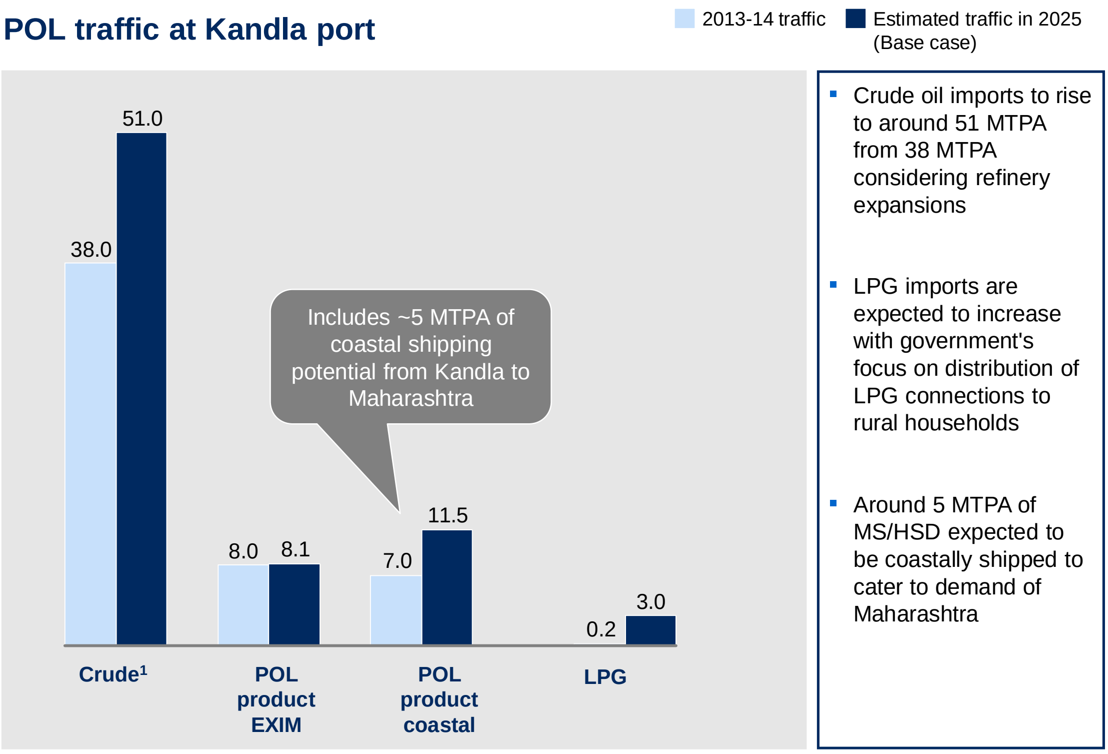
There is a potential for coastal shipping of ~5 MMTPA of MS/HSD from Kandla to Maharashtra by 2025



1. Assumes RIL Jamnagar and Essar Oil export nothing while Reliance SEZ exports 100% product

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**.



1. Includes Panipat, Koyali, Mathura and Bina refinery numbers

SOURCE: Indian Petroleum and Natural Gas Statistics 2013-14; Basic Port Statistics of India 2013-14

Figure 6.2 POL Traffic at Kandla Port

6.2.2 Thermal Coal

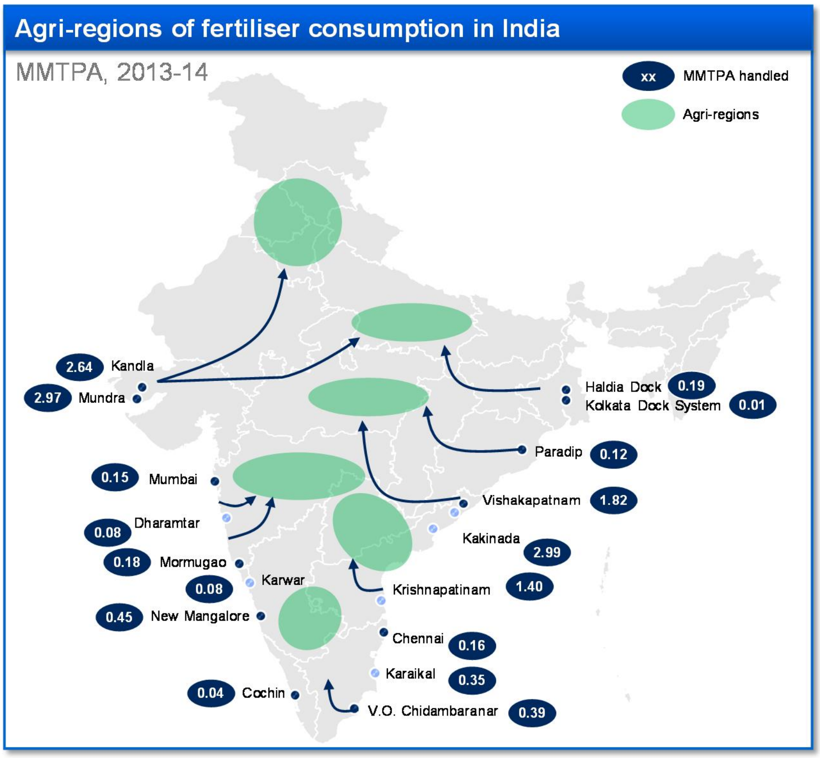
Currently the port imports 9.7 MTPA of thermal coal primarily for the consumption of non-power plants (>50% of the overall imports). This number is expected to grow at a healthy rate of 10-15% given the port already having developed a mega coal terminal at Tuna Tekra and further plans of expansion through 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.

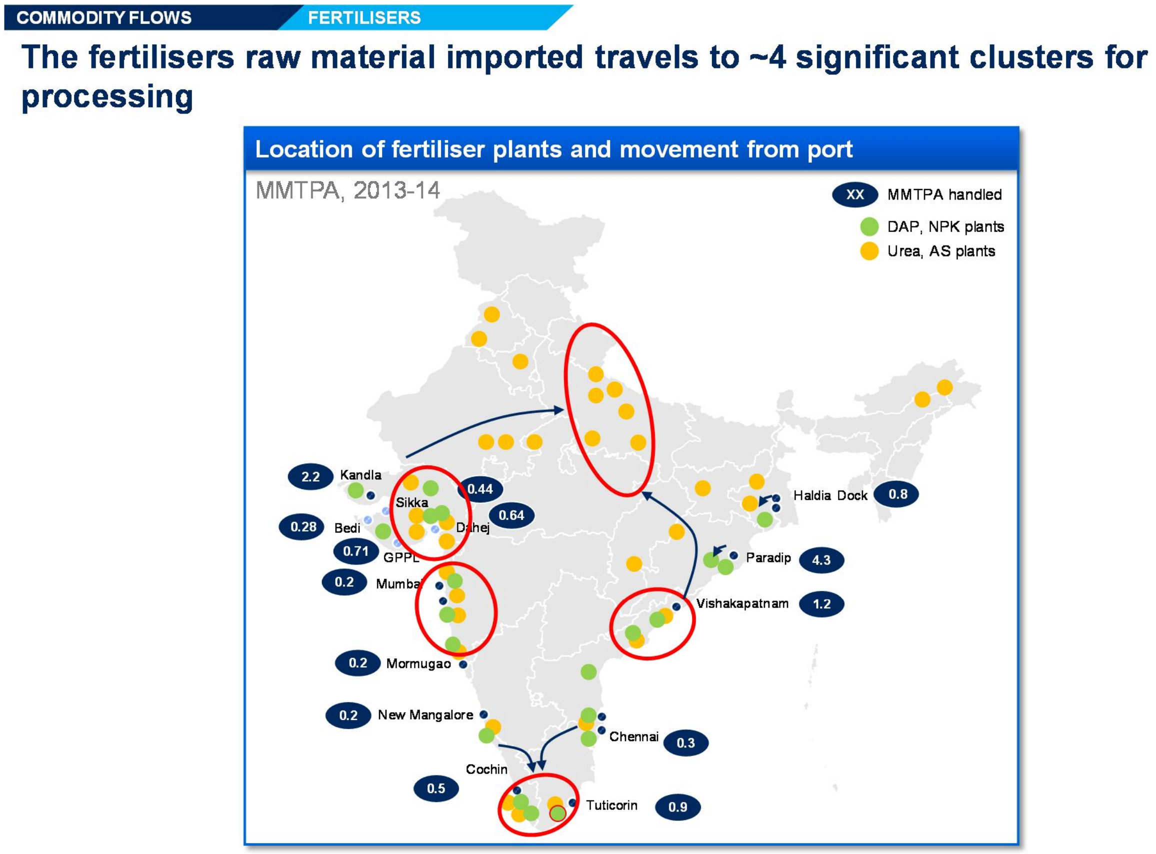
COMMODITY FLOWS FERTILISERS

Imported finished fertilisers travels to agricultural region for the final consumption



SOURCE: Ministry of fertilisers

Figure 6.3 Fertiliser Consumptions Centres in India



SOURCE: Ministry of fertilisers

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

Kandla 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	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

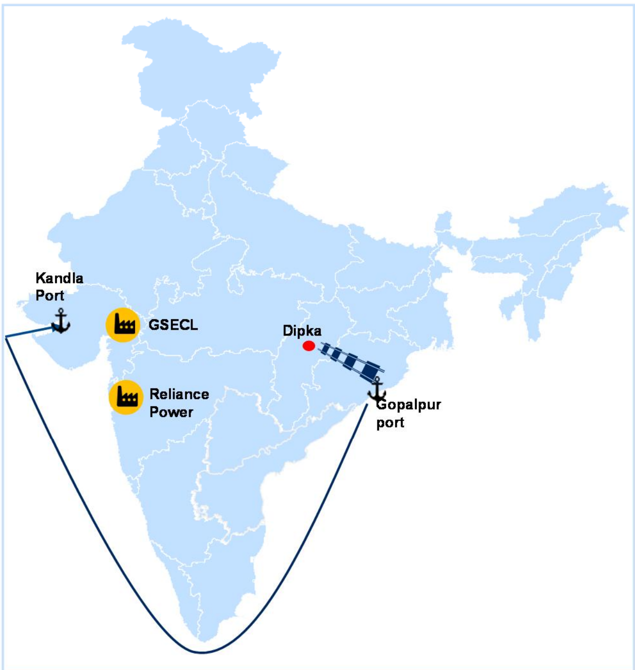
6.3 Coastal Shipping Potential

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

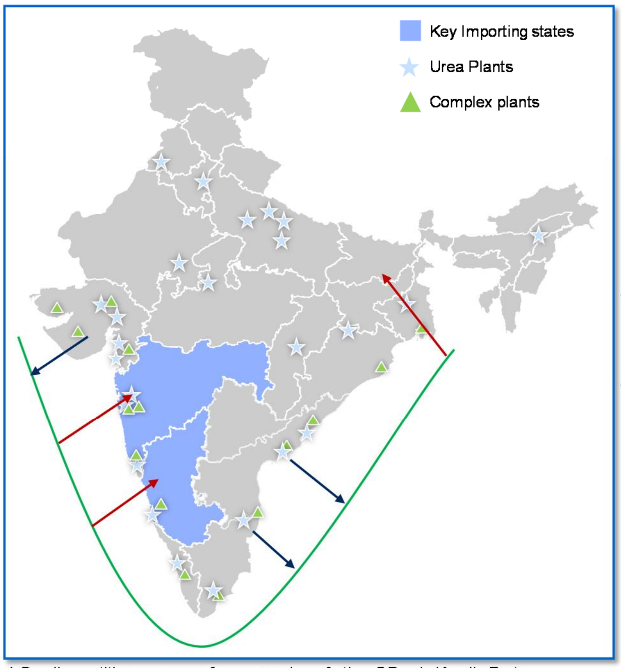
1 Considering linkage rationalization from Pakri Barwadih to Talcher does not happen

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.

COASTAL SHIPPING | FERTILISERS

~1.3 MTPA fertilizer can be shipped via Kandla Port by 2025; Maharashtra and Karnataka will be the key demand states



Key ODs with coastal shipping potential from Kandla Port

Route[1]	Volume, '000 TPA
Gujarat to Maharashtra	1,071
Gujarat to Karnataka	180

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

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**.

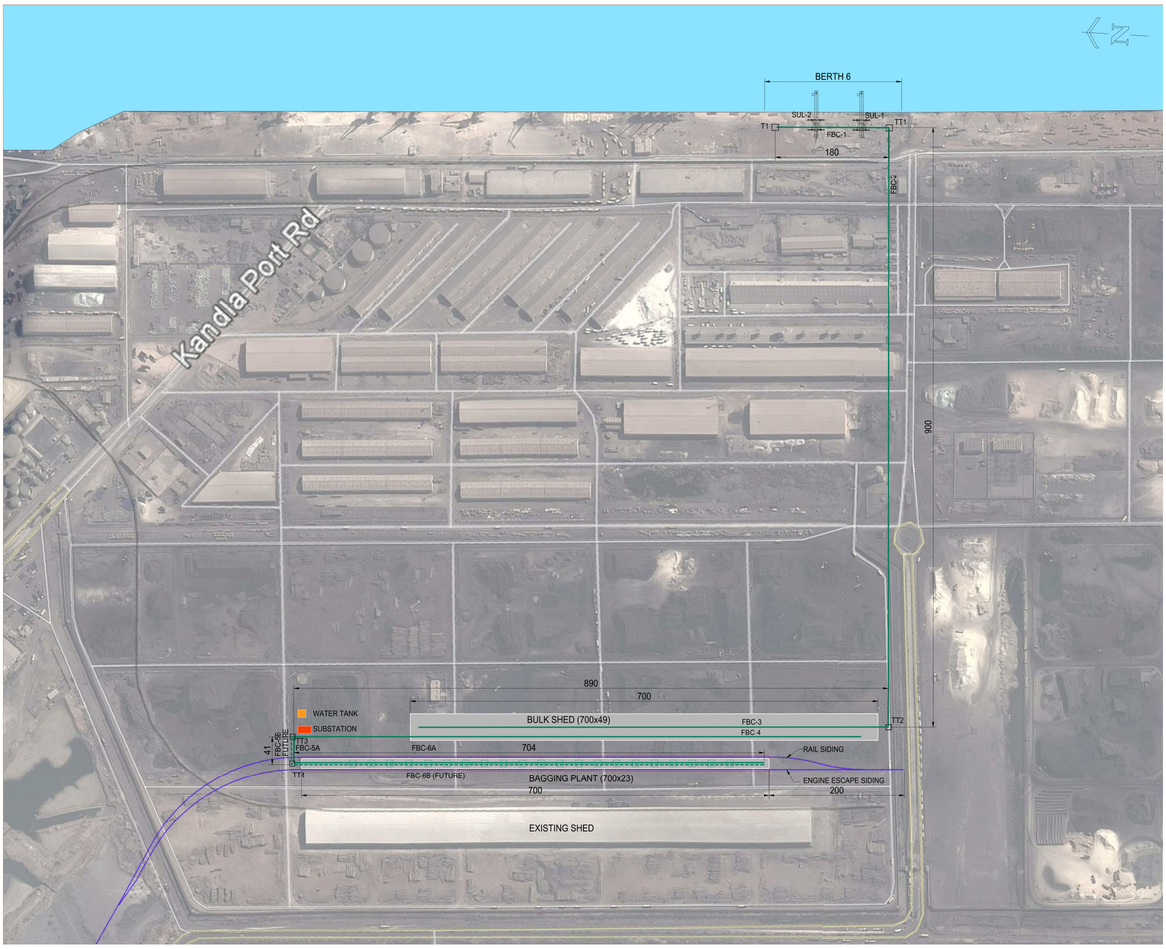


Figure 7.1 Layout of Mechanised Fertiliser Terminal

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**.

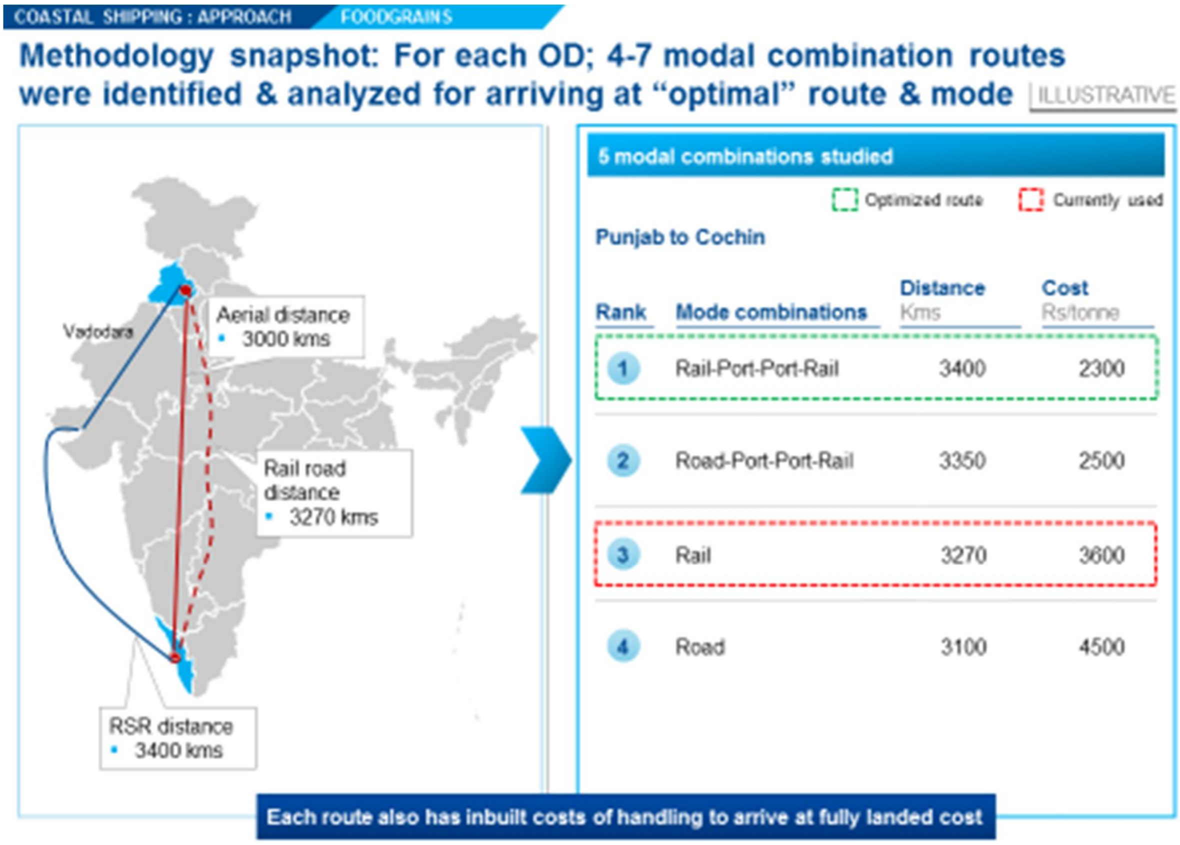


Figure 7.2 Modality Analysis of Cargo Shipment

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

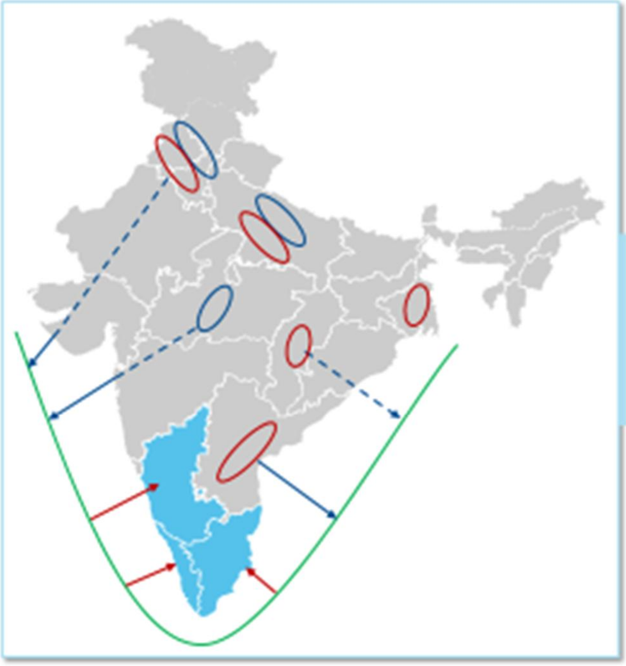
Commodity Type	Quantity (T)	No. of Vessels	Max. Vessel (DWT)	Min. Vessel (DWT)	Max. Parcel size (T)	Min. Parcel Size (T)	Average Parcel Size (T)
Food Grains Dry Bulk	19,46,205	62	73,127	9,650	52,192	8,805	31,390
Food Grains Break Bulk	3,39,801	25	38,888	6,568	32,602	2,750	13,592

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**).

COASTAL SHIPPING FOODGRAINS

Total opportunity for coastal movement of foodgrains is 8-10 MTPA



Route	Volume, MTPA
Punjab to coastal Karnataka	0.95
Madhya Pradesh to Tamil Nadu	1.02
Haryana to coastal Karnataka	0.87
Andhra to Tamil Nadu	0.75
Punjab to Tamil Nadu	0.57
Haryana to Tamil Nadu	0.51
Punjab to Coastal Kerala	0.42
Madhya Pradesh to Coastal Karnataka	0.39
Rajasthan to Tamil Nadu	0.38
Chattishgarh to Tamil Nadu	0.31
Uttar Pradesh to Coastal Karnataka	0.27

Figure 7.3 Opportunity for Coastal Movement of Foodgrains

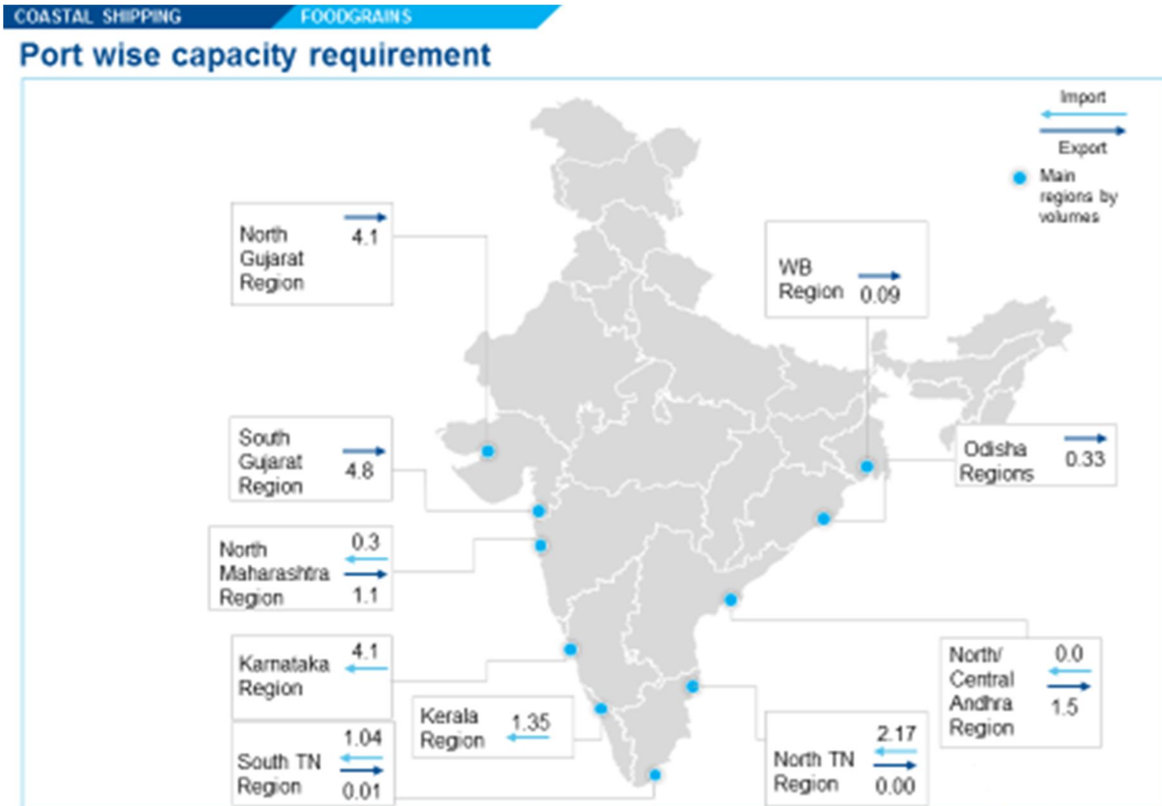


Figure 7.4 Portwise Capacity Requirements

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/m^2) 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.

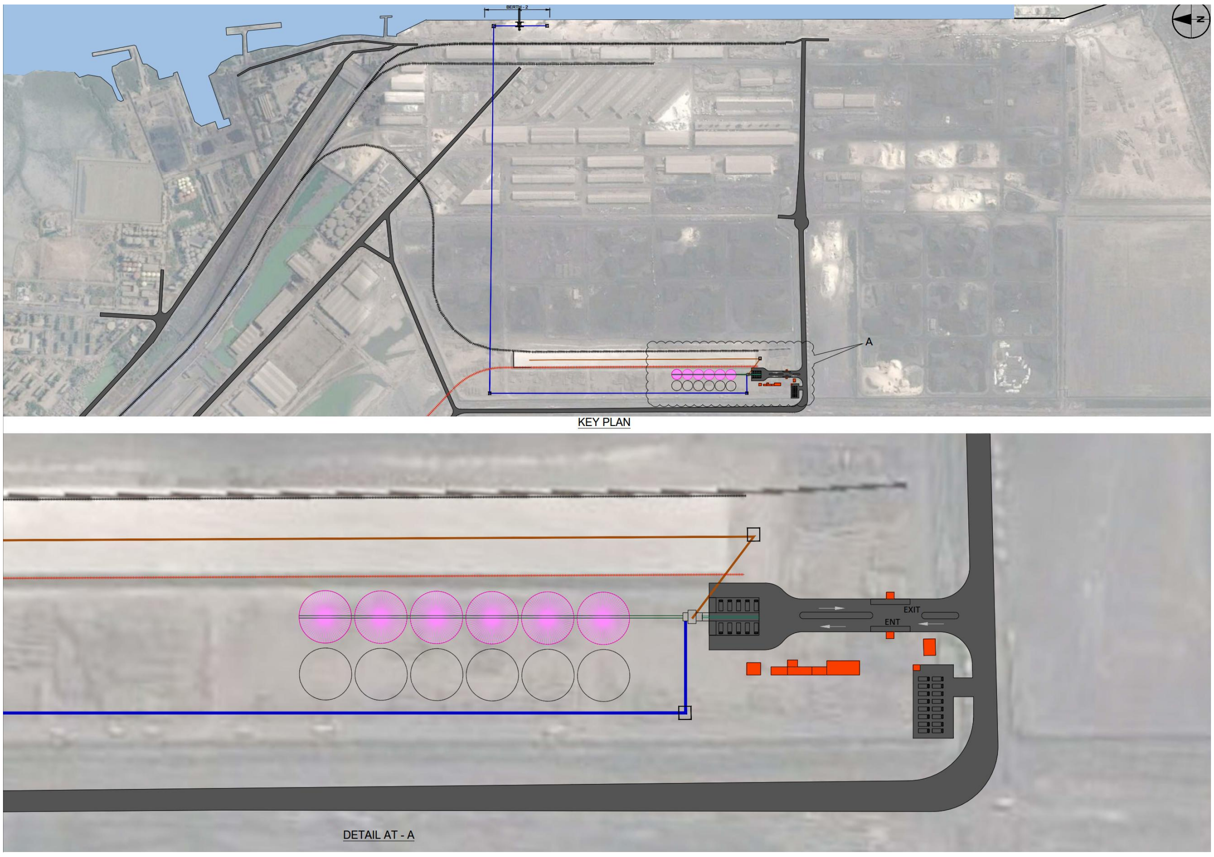


Figure 7.5 Terminal Layout for Mechncaised Food grain Handling Facility

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**.

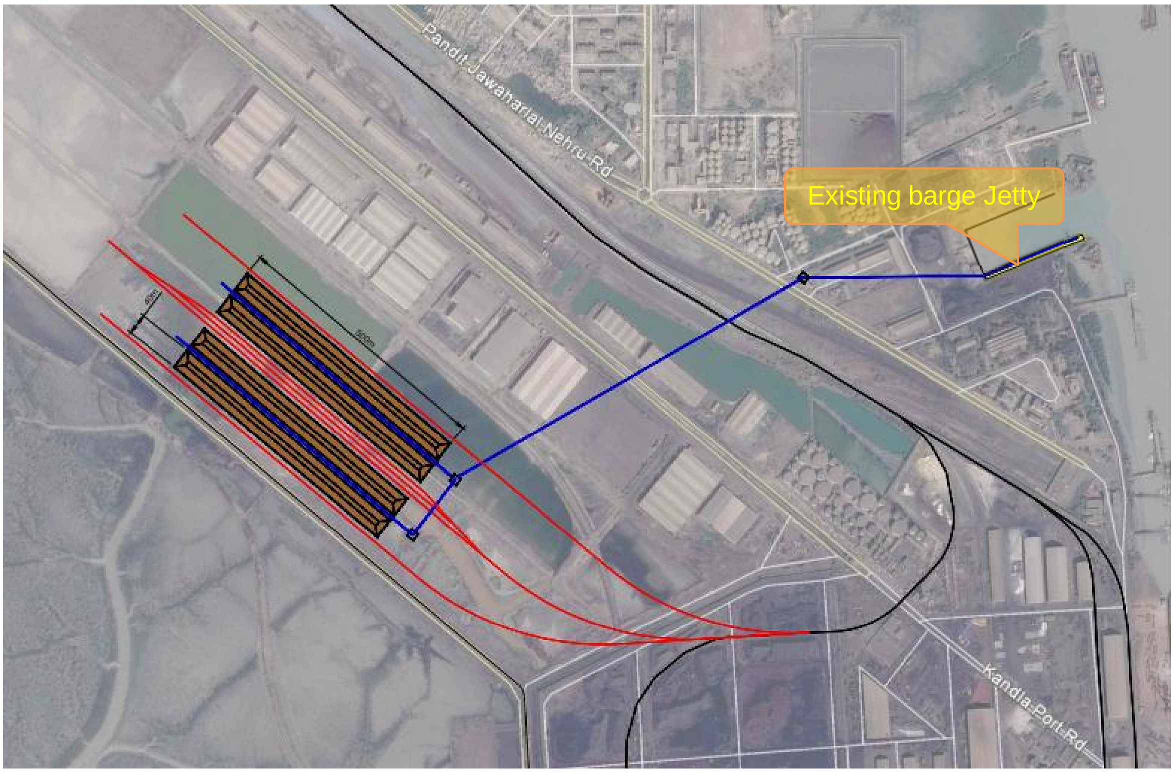


Figure 7.6 Mechanised Handling of Barge Berths at Bunder Basin

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

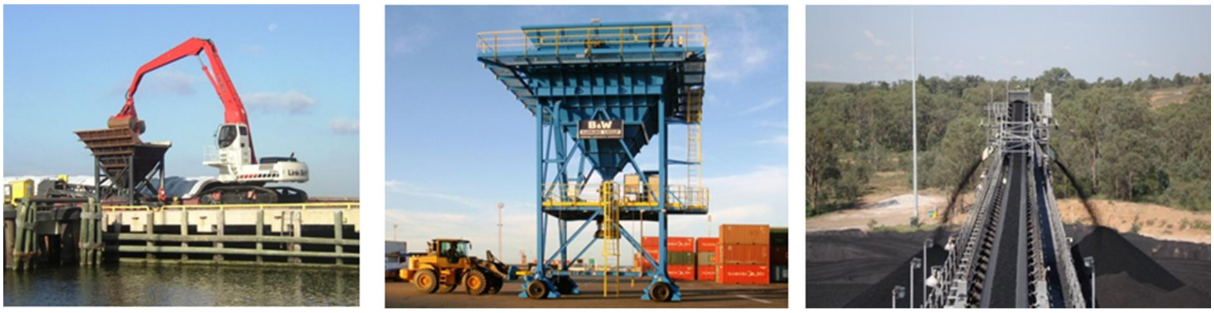


Figure 7.7 Typical Barge Unloading Equipment

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 manufactures 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.

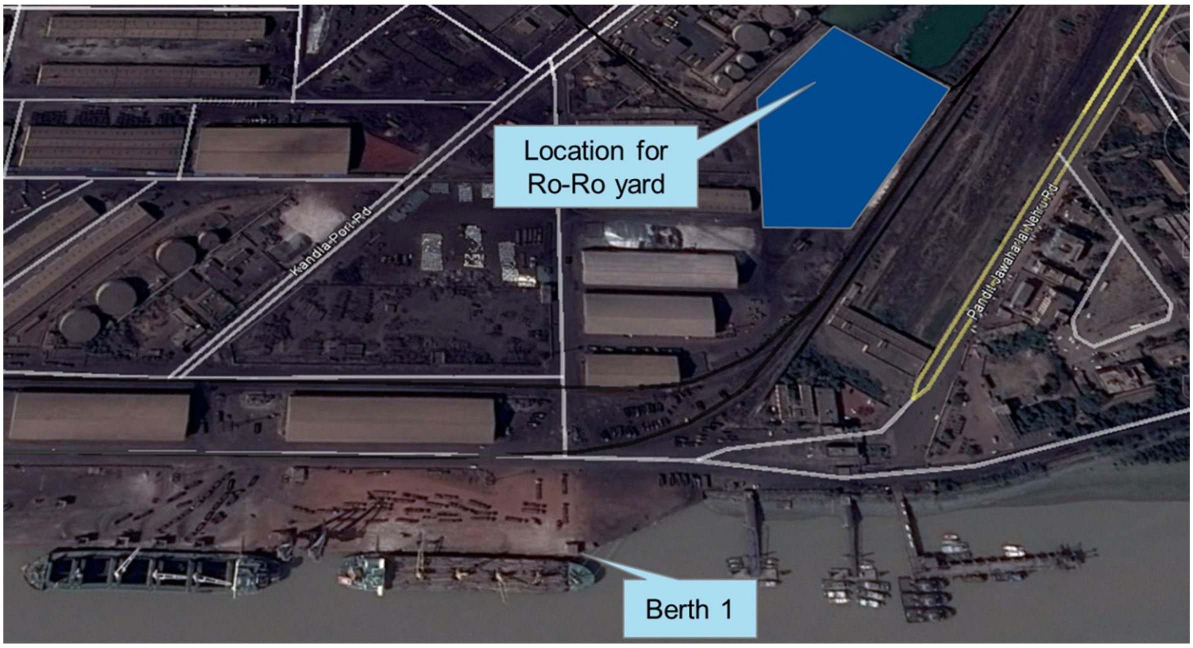


Figure 7.8 Location for Ro-Ro Facility

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.

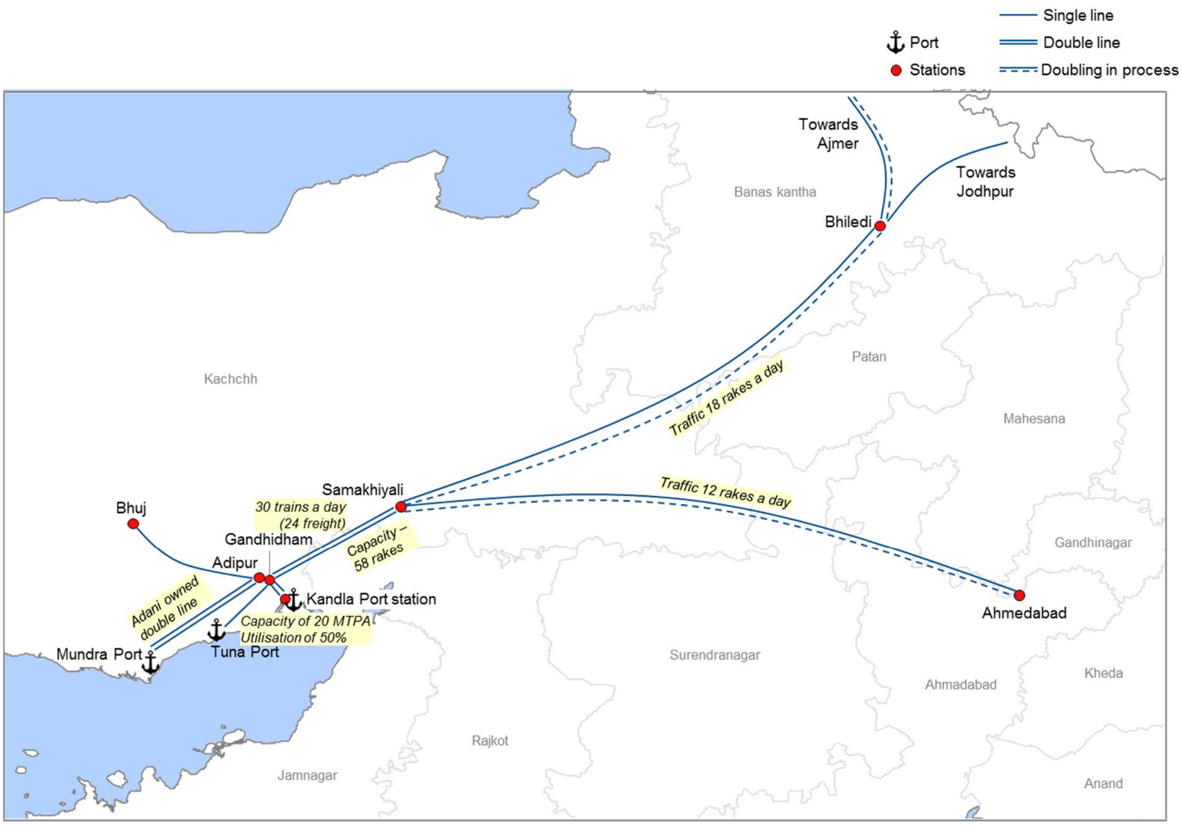


Figure 8.1 Current Rail Connectivity and Ongoing Improvements

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**.

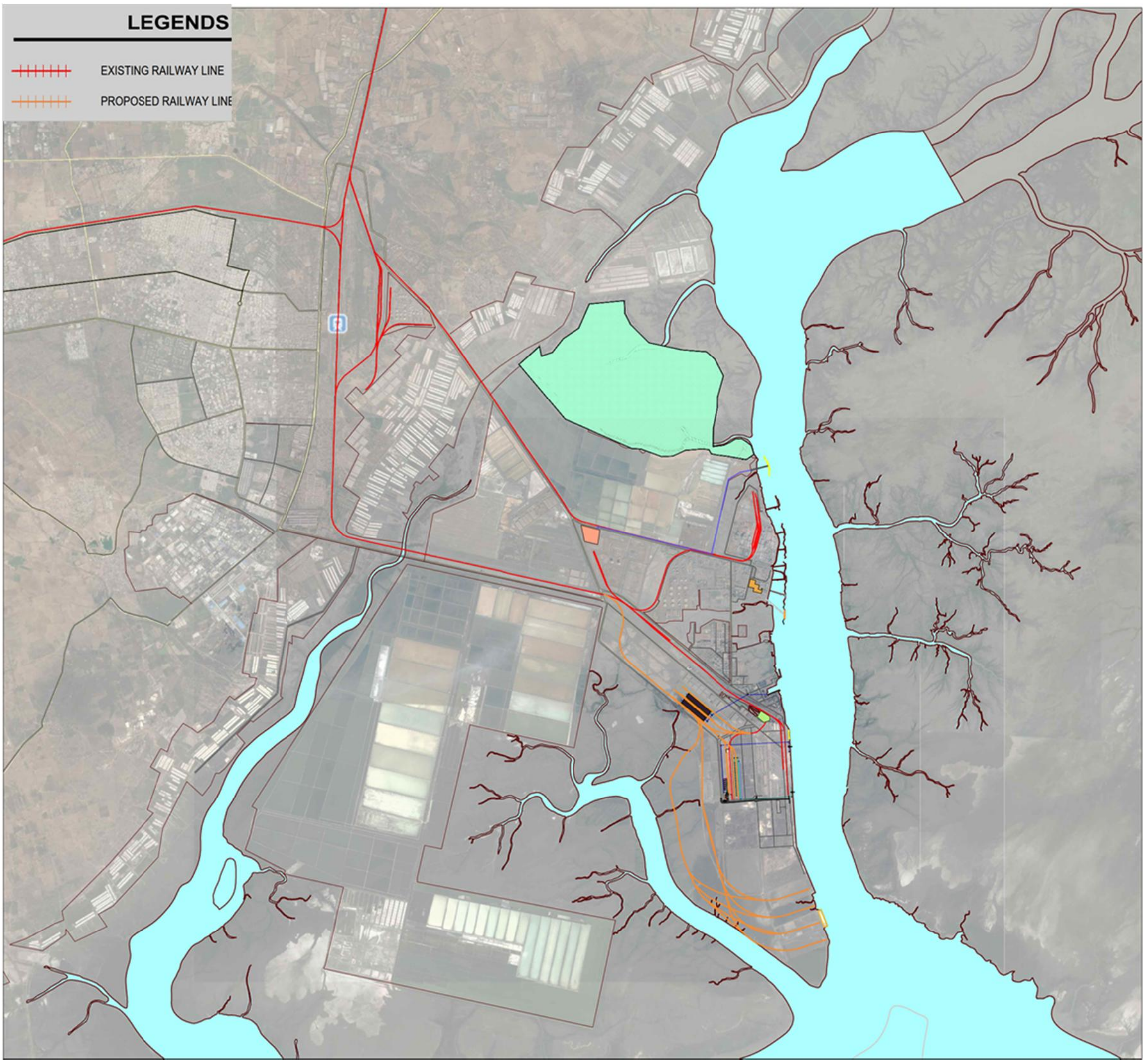


Figure 8.2 Proposed Internal Rail Network

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.

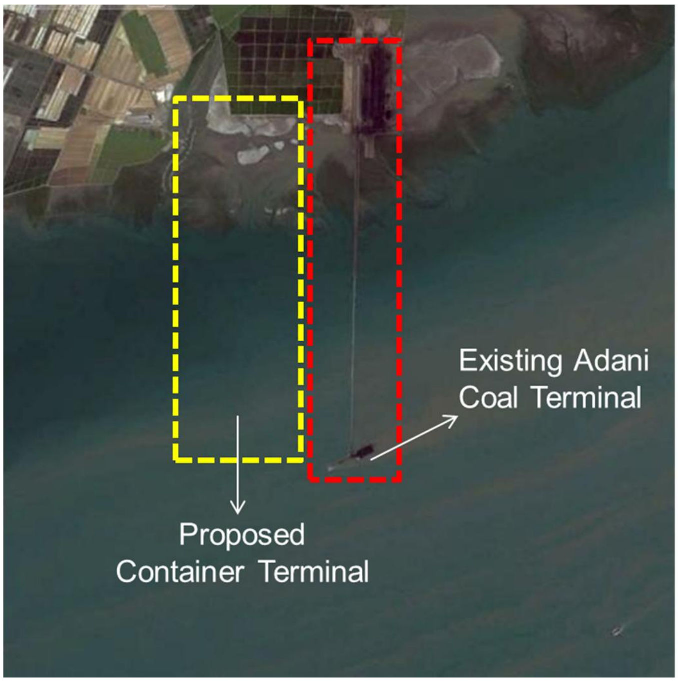


Figure 9.6 Terminal Location

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

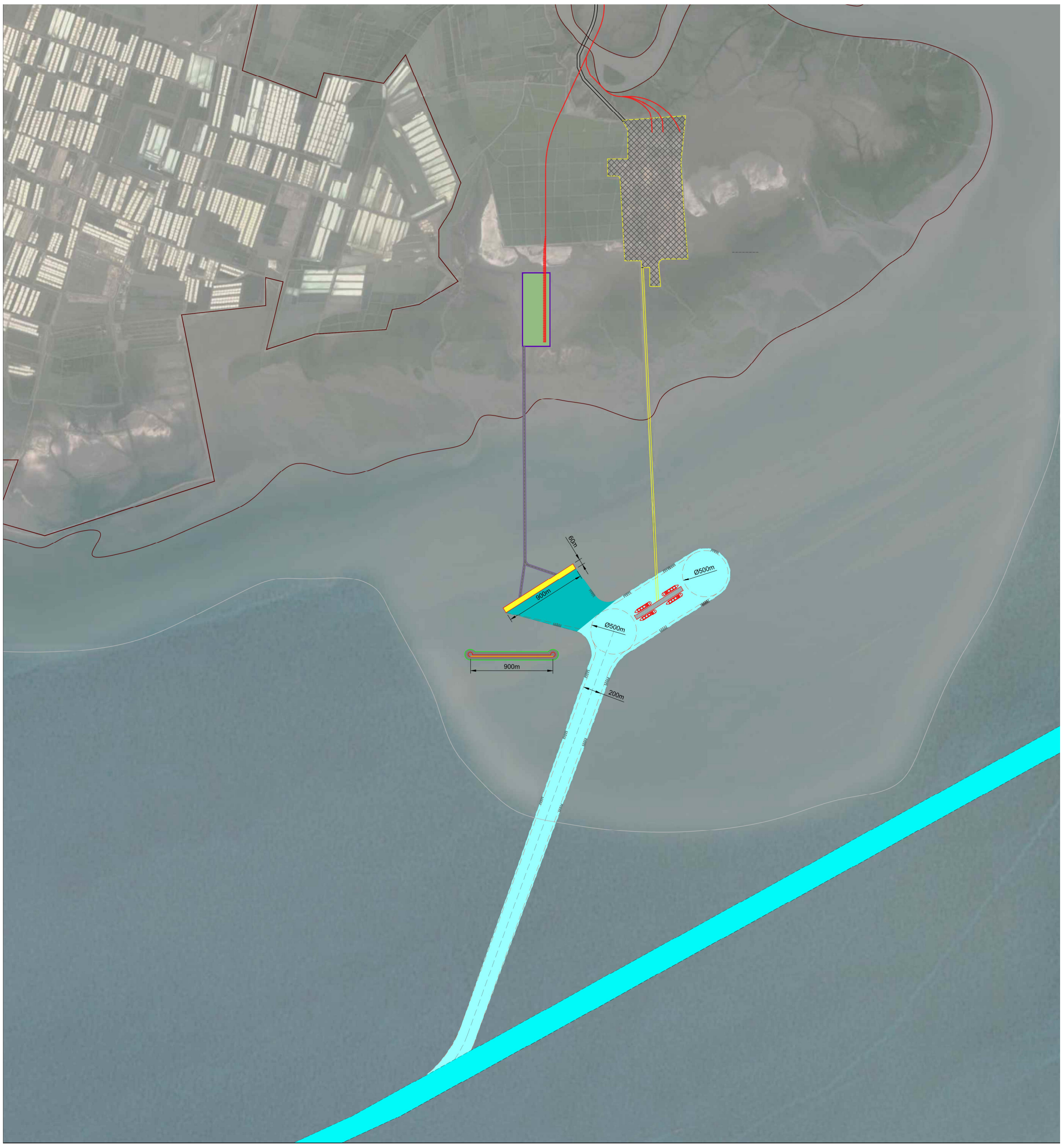


Figure 9.8 Phase 2 Development of Tuna Tekra Container Terminal

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.

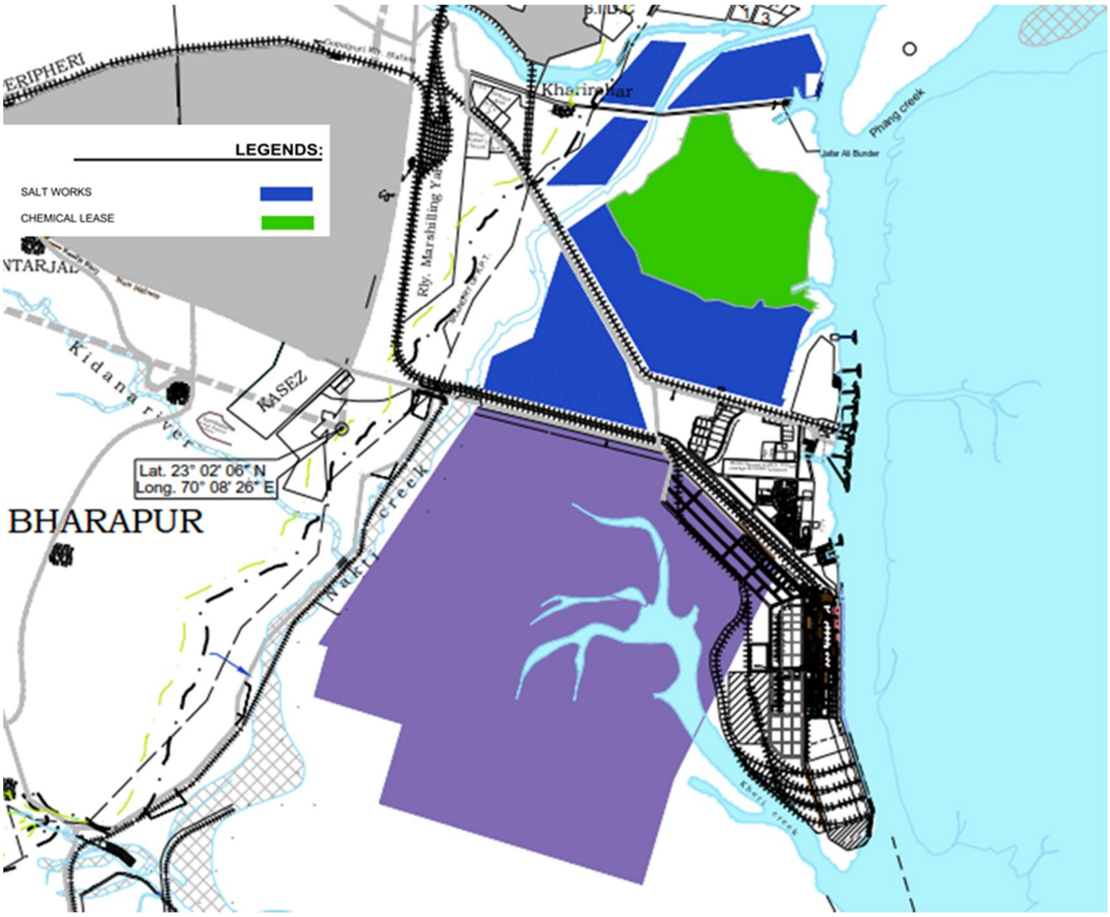


Figure 9.9 Location for the Proposed Chemical Hub

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**.

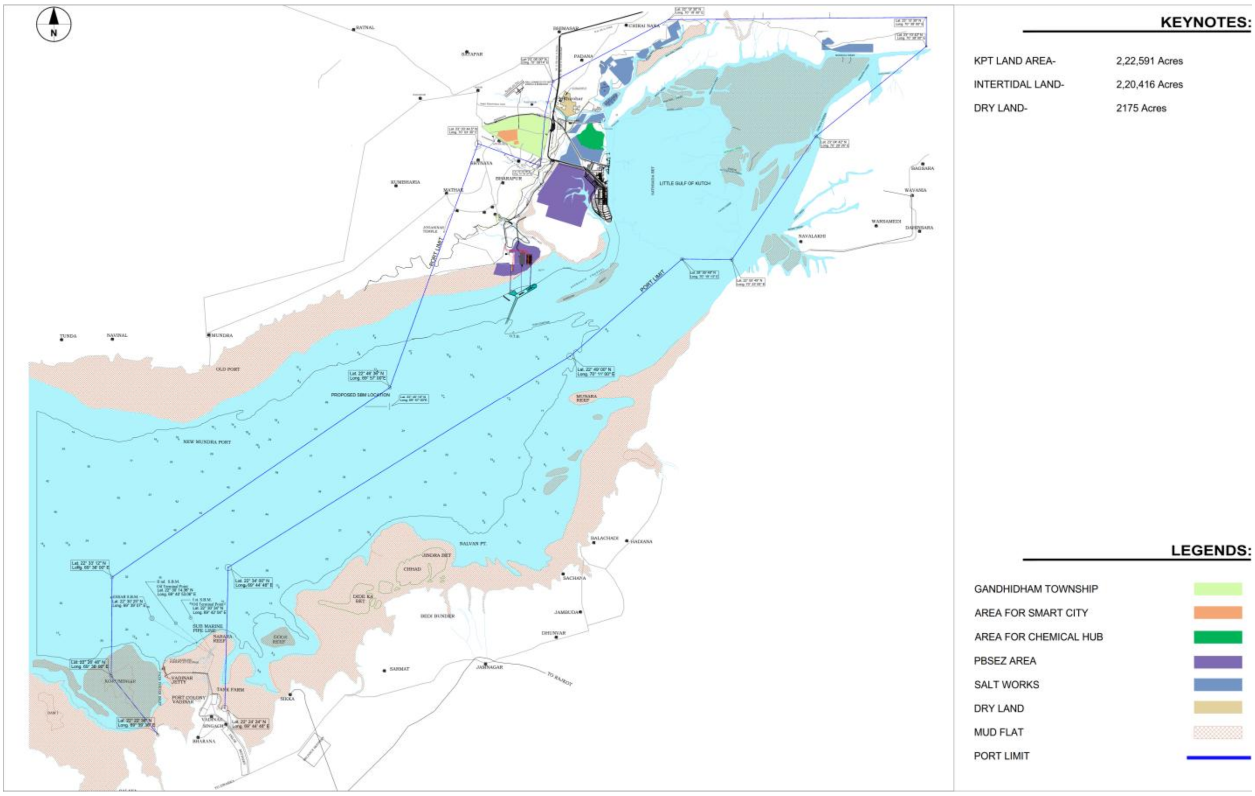


Figure 9.10 Location of Land at Kandla Port

Figure 9.11 shows land proportions under intertidal land at Kandla Port.

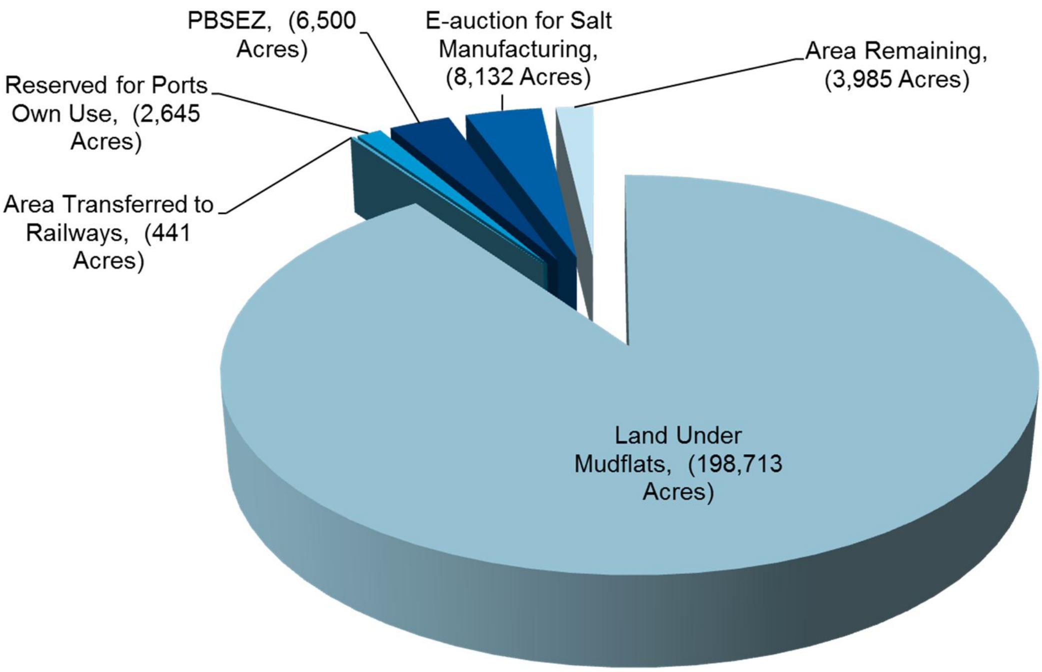


Figure 9.11 Land Use Pattern of Intertidal Land at Kandla Port

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

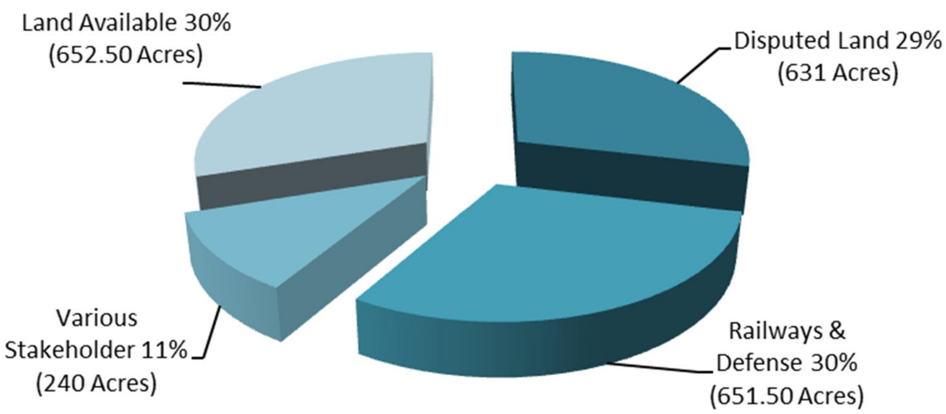


Figure 9.12 Land Area Utilisation – Dry Land

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.

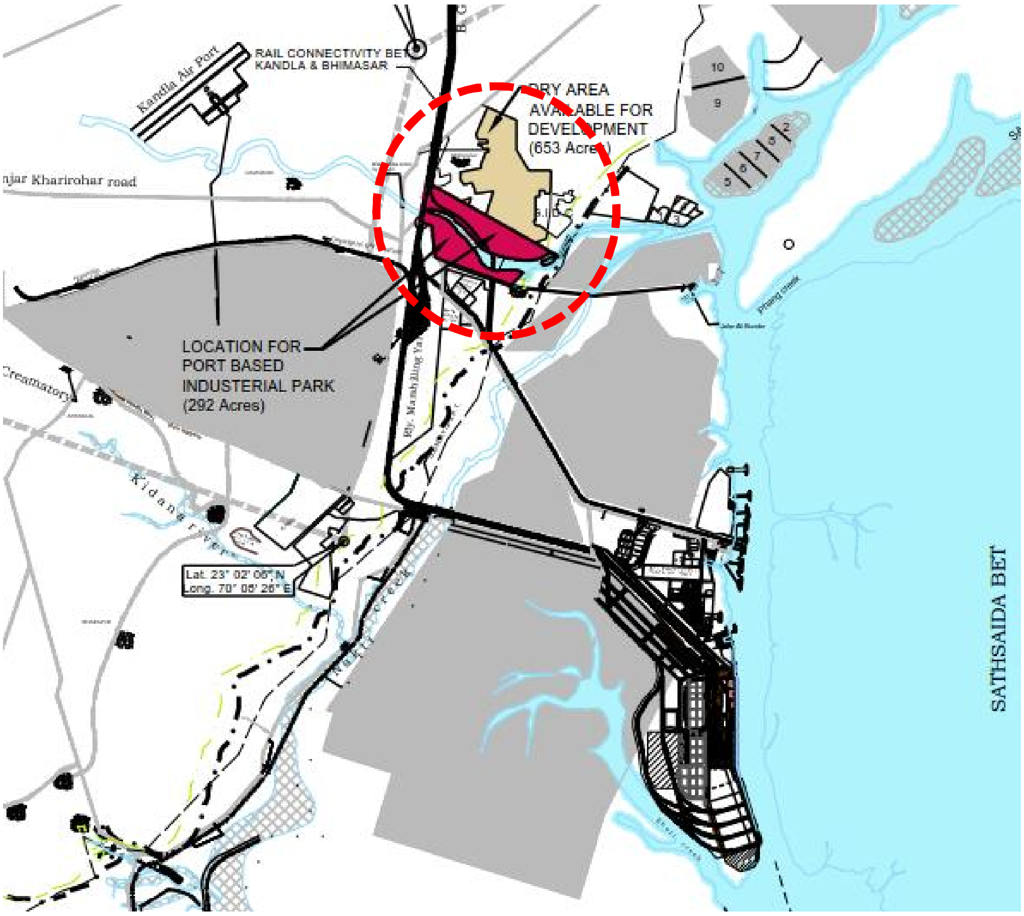


Figure 9.13 Dry Land avaliable for Development

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**.

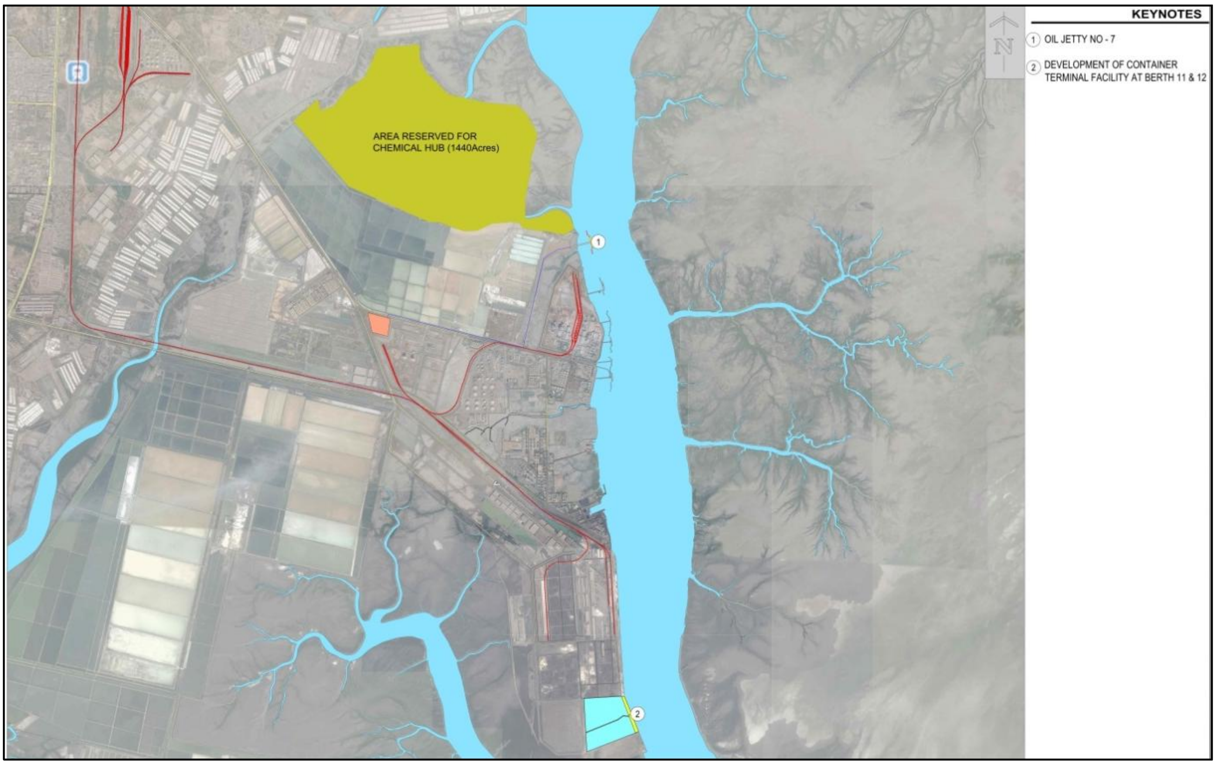


Figure 10.1 Port Layout along with Ongoing Developments (Kandla Creek)

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	Port's funds

The port layout after completion of projects mentioned above shall be as shown in **Figure 10.3**.

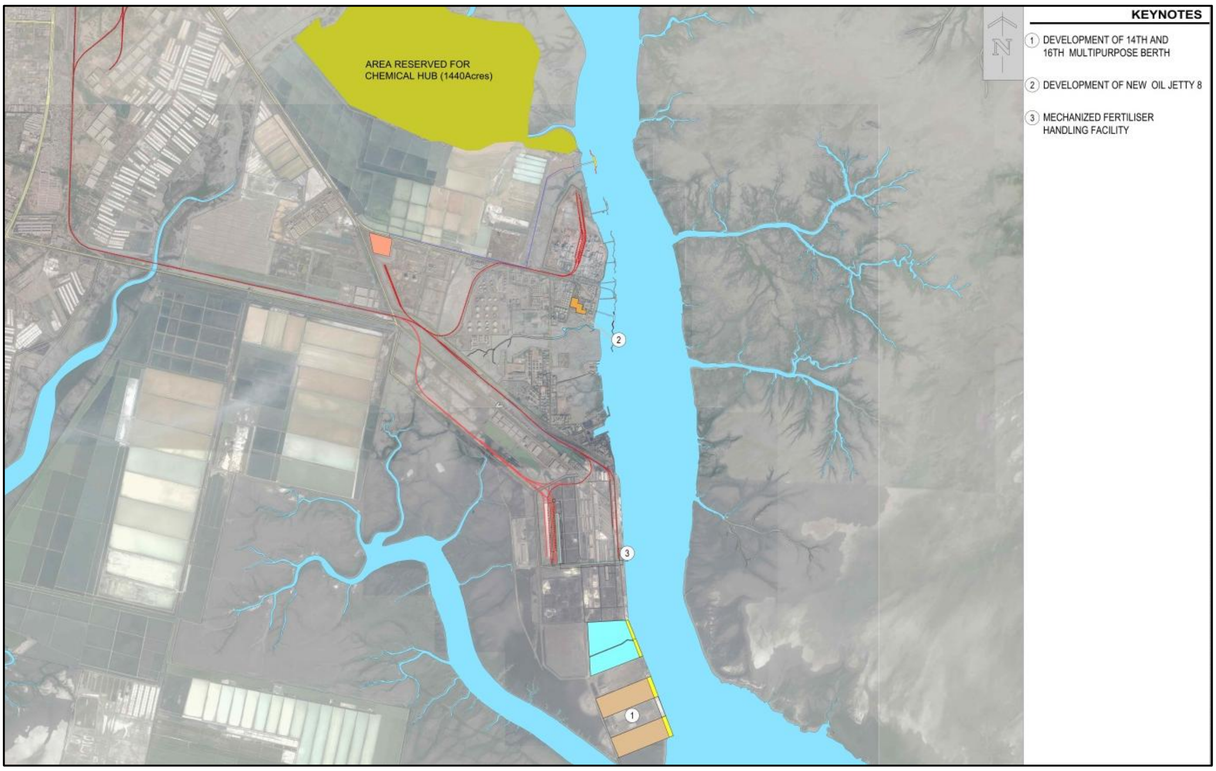


Figure 10.3 Layout Plan 2020 (Kandla Creek)

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**.

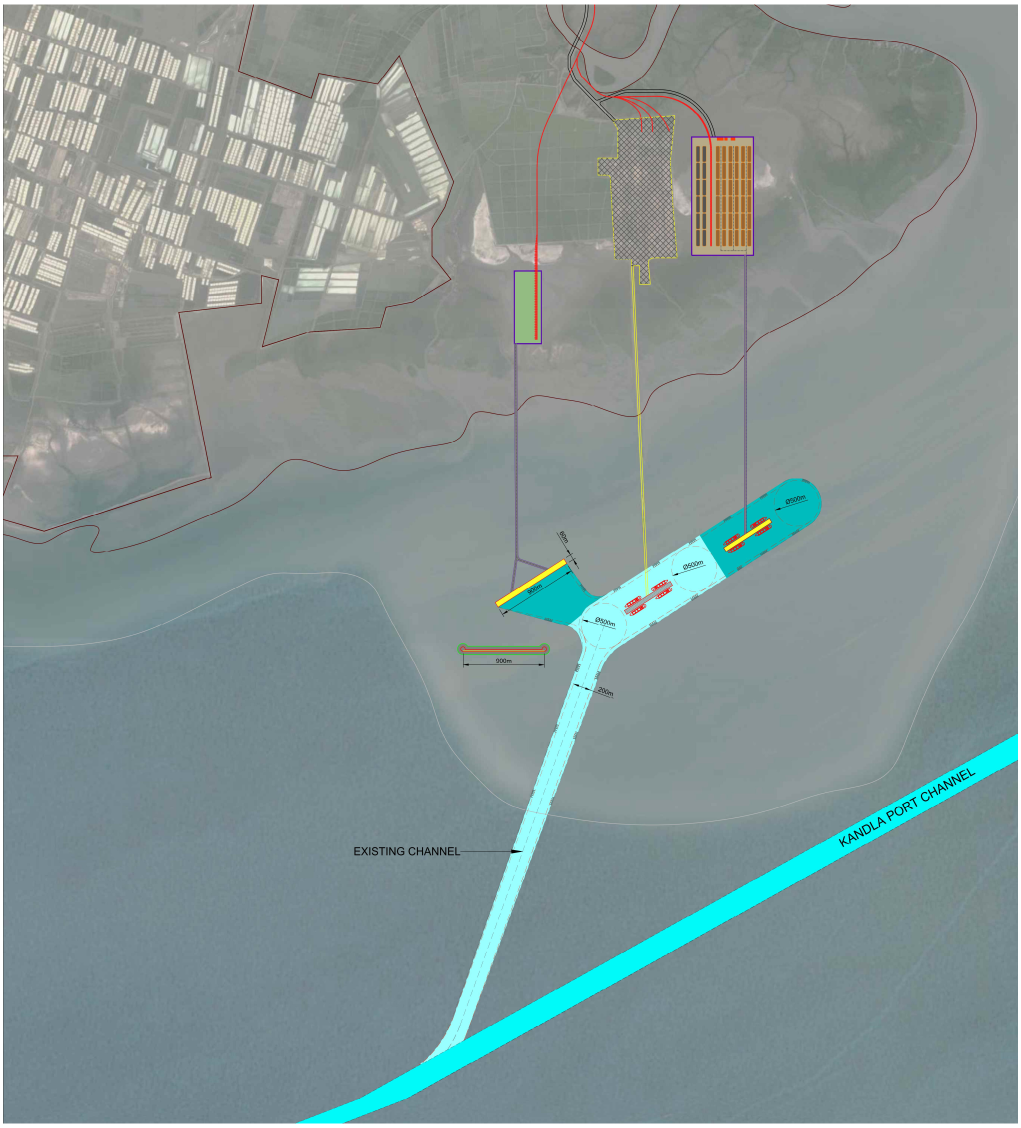


Figure 10.6 Layout Plan 2035 (Tuna Tekra)

Appendix 1 - **BCG Benchmarking Study for Kandla Port**

8 Kandla Port Deep-dive

8.1 Port overview

Kandla port (KPT) is located on the Gulf of Kutch on the western coast of India in Gujarat. Constructed in the 1950s as the chief seaport serving western India, it has 23 berths, of which 3 are private berths, and 3 SBMs. With a significant land parcel of 2.2 lac acres, it has location freight advantage over its competitors.

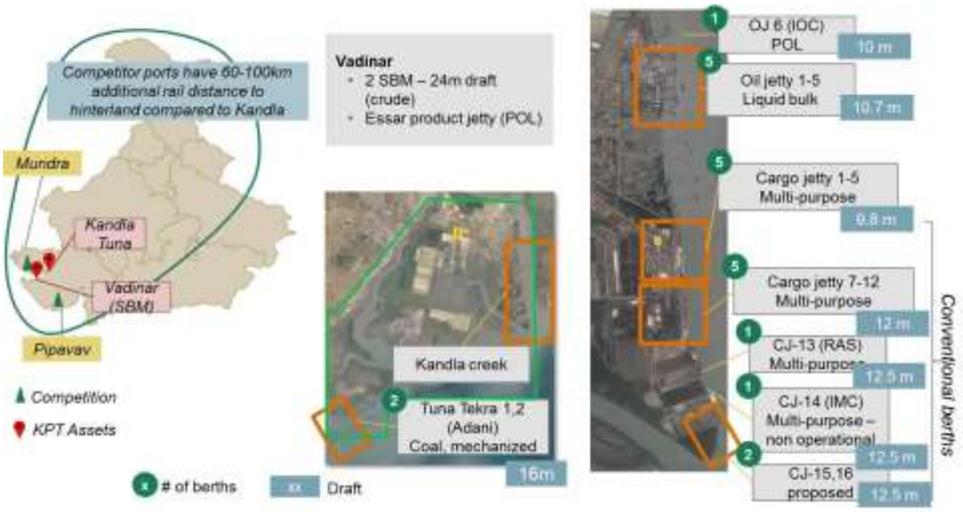
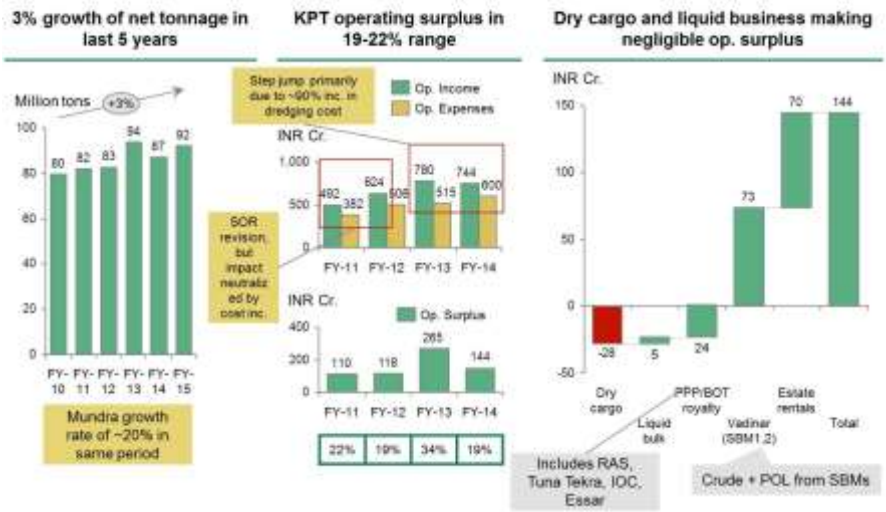


Figure 232: Berths and SBMs at Kandla port

Kandla port has an operating surplus of approximately 22%, despite cargo handling operations making losses (except for Vadinar).



Source: KPT data; BCG analysis

Figure 233: Net tonnage and operating surplus data

Kandla handled a volume of 92 MMT in 2014–15, of which POL and liquid cargo constituted approximately 60% of the volumes, with coal amounting to 10% and fertilizers 4% of volumes.

Source: KPT data

Figure 234: Kandla port volume break-up

Mundra has grown much faster with volumes growing at 22% compared to a meager 4% at Kandla. Even Mundra's financials and EBITDA are significantly higher than Kandla.

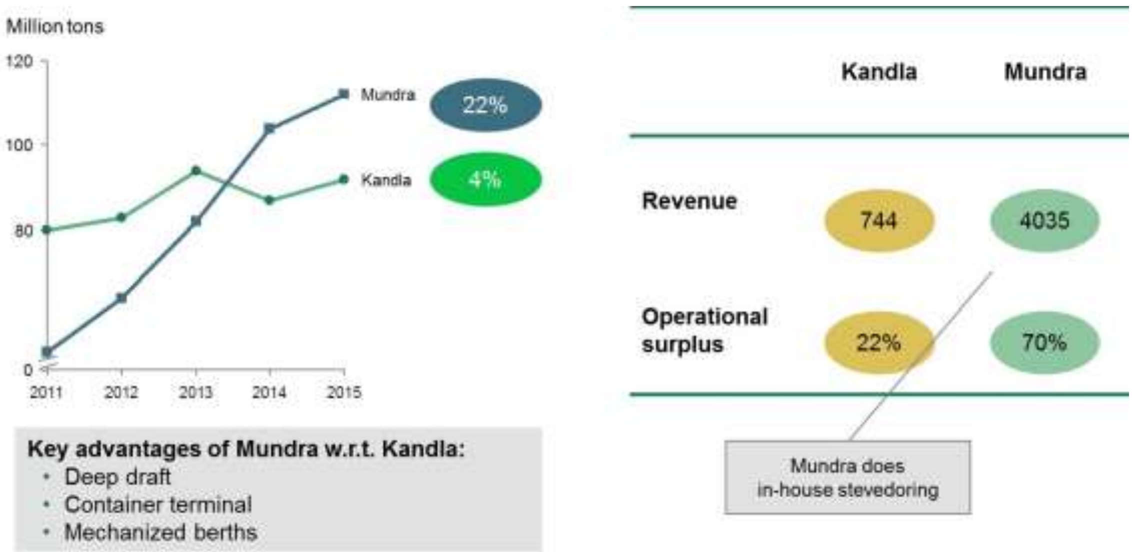


Figure 235: Kandla versus Mundra: Volumes and Financials

8.2 Key findings and initiatives from deep-dive

Key levers for improving productivity at Kandla are optimization of grabs, improving crane capacity, and reducing NWT.

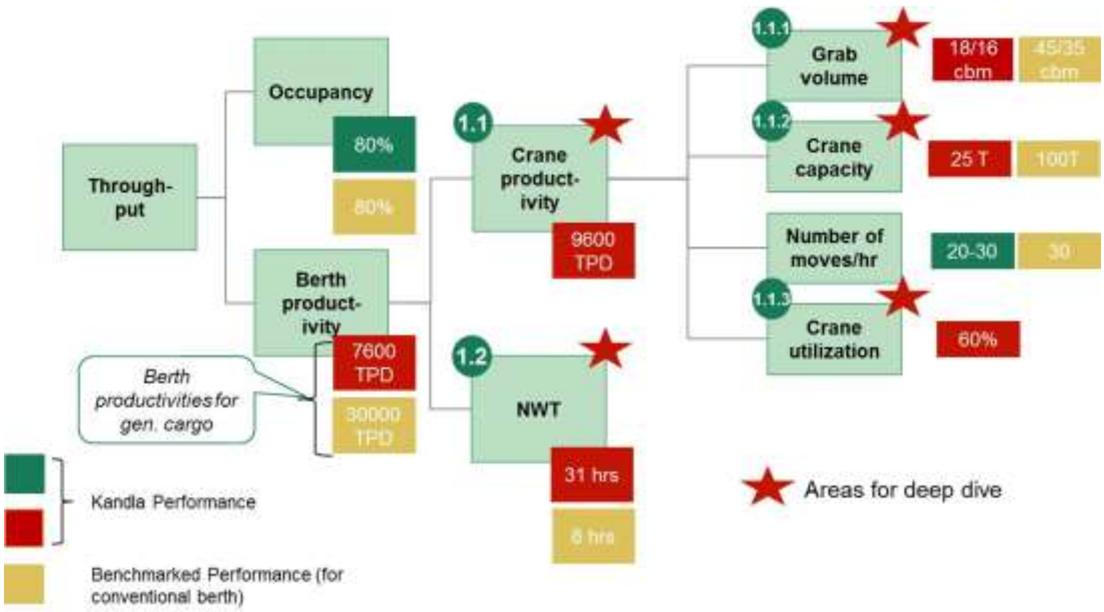


Figure 236: Productivity driver tree for systematically identifying issues at Kandla

There are no incentives for tank-farm operators to increase productivity at berth. On-berth preparatory activities also amount to a lot of time wastage.

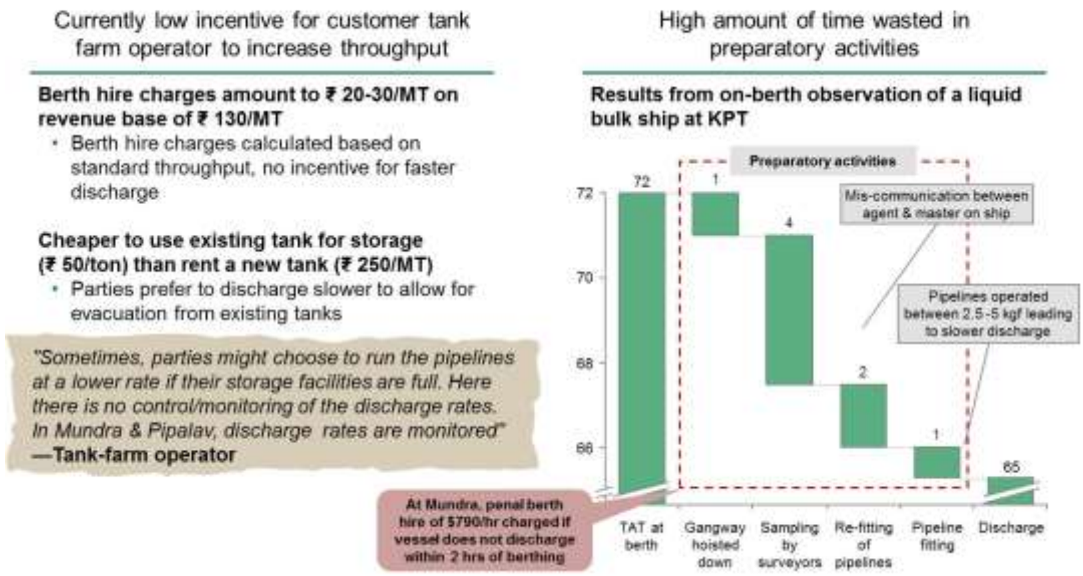


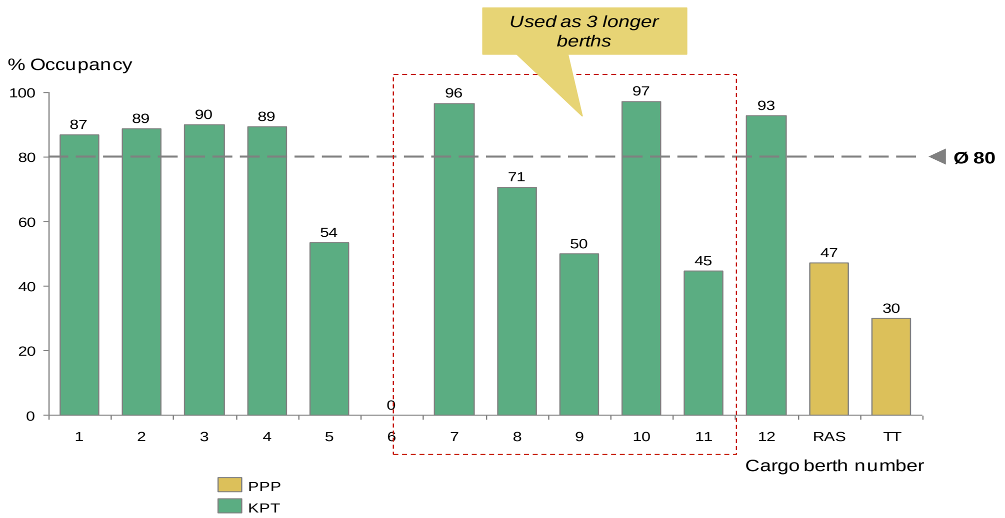
Figure 237: Berth productivity

Most of the dry bulk berths and liquid berths have high occupancy. Their occupancy is more than the benchmark of 80%.

Berth 6, RAS berth and Tuna Tekra berth have lower occupancy due to the following reasons:

1. Berth 6 was not operational in FY14-15
2. RAS and Tuna Tekra do not have access to Railways yet since it is not in ready condition and their per day storage costs are higher, making it more expensive to bring cargo to these berths
3. Additionally, RAS berth is not allowed to handle ships with less than 13m draft as per their contract with KPT

The occupancy for Liquid cargo berths is also above the benchmarks. Due to such high occupancy, there are increased pre-berthing delays.



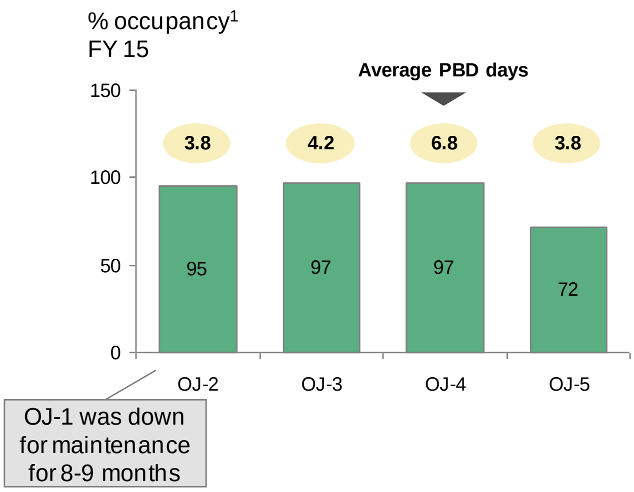


Figure 238: Occupancy of Dry Bulk and Liquid Bulk

Despite the above benchmark occupancy, KPT productivity for dry cargo berths, as compared with berths of other major ports and private benchmarks, remains quite low. Despite the high pre-berthing delays, KPT capacity utilization remains quite low.

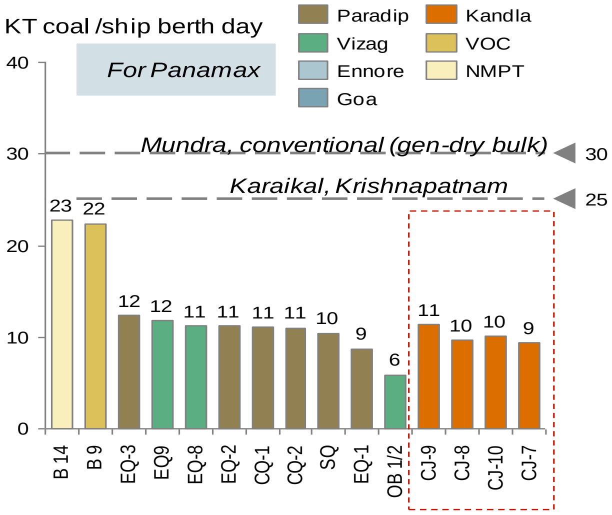


Figure 239: Productivity for Dry Bulk

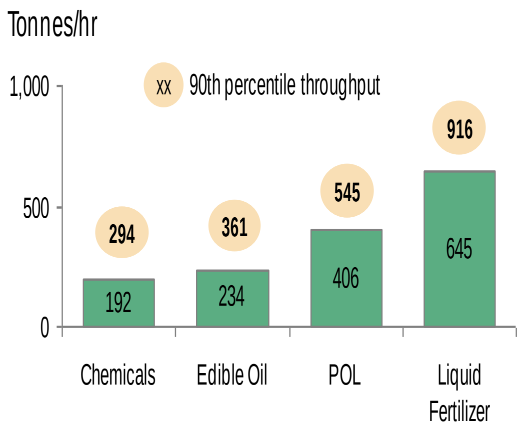


Figure 240: Capacity utilization for Liquid Bulk

8.2.1 Increase cape handling capacity

KPT Supramax is less cost competitive versus Mundra capesize vessels due to the following:

1. Higher TAT (KPT ~7 days, i.e., 50K Tons at productivity of 10K TPD + 2 days for pre-berthing detention vs. Mundra ~ 2 days, i.e., 50K Tons at productivity of 60TPD + 0 days for pre-berthing detention)
2. Higher dwell time (KPT up to 18 days vs. Mundra ~2-3 days)
3. Inability to handle large vessels

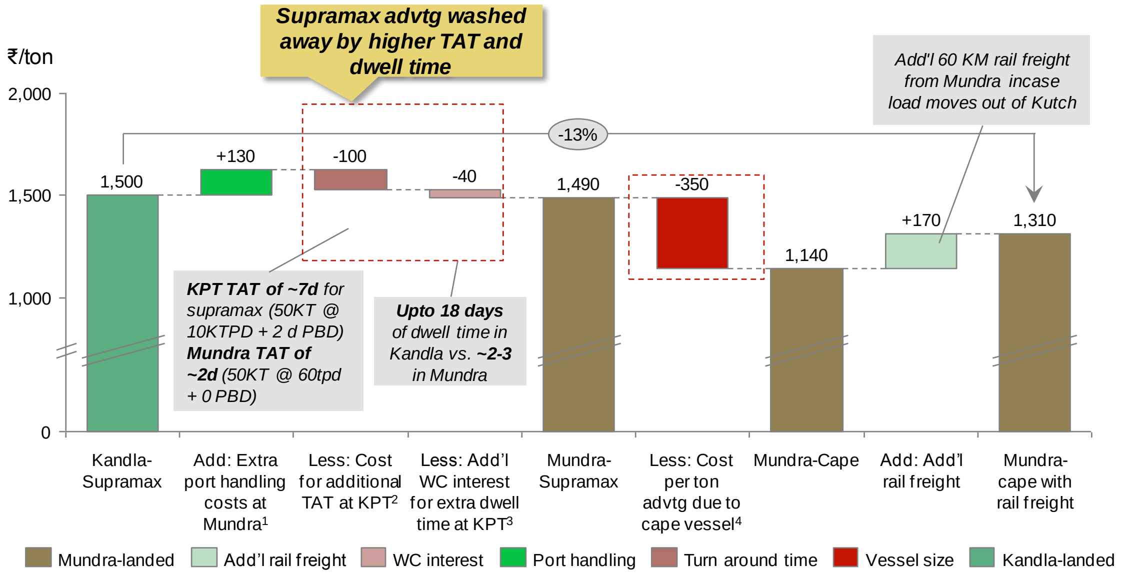


Figure 241: End-to-end cost comparison of Kandla vs. Mundra

8.2.1.1 Initiative: KPT 1.1 Allowing dredging at Tuna Tekra to increase draft of 18m to handle cape vessels

Initiative Overview

The following two options are proposed to enable Kandla port to handle cape size vessels:

a. Increase Lighterage

- End-to-end cost: Rs. 1340/MT
- Revenue: Rs. 73/MT for the port
- This option is not scalable in the long term

b. Allow dredging at Tuna Tekra

- End-to-end cost: Rs. 1300/MT
- Revenue: Rs. 169/MT for the port
- Potential loss to existing floating crane operators: Up to 7 floating crane licenses issued (each crane ~70Cr)
- Potentially lower interest in the long term: Tuna – Rs. 147/T (excl. storage); Mundra – Rs. 260/T (excl. storage)

Option (b) is more beneficial to customers as well as KPT.

Recommendations

Allow dredging at Tuna Tekra under scope extension of existing concession as per the merit of the proposal:

- Currently being evaluated by independent engineer

In case dredging is not possible under scope extension, negotiate additional dredging in Tuna channel as a separate project:

- Explore options to increase minimum guarantee such that Kandla increases share in non-captive coal from current ~30% to ~50%

Establish an additional bulk handling terminal via PPP route by a different party in Tuna. Continue to allow lighterage:

- No minimum guarantee offered to existing players; continue for future licensees as well
- Business will be hit for existing players

Expected Impact

Since Mundra is Kandla's key competitor and is also more cost effective, equipping Kandla with ability to handle cape size vessels in a cost competitive manner will help safeguard KPT volumes in the long run, and will also improve productivity and provide all other benefits of handling larger parcel size vessels.

8.2.2 Improve productivity in dry cargo berths

8.2.2.1 Initiative: KPT 2.1 Increase crane throughput by optimizing grab sizes to commodities

Initiative Overview

Currently, KPT is operating 6 ELL cranes of 25MT, 4 ELL cranes of 16MT, and 2 ELL cranes of 12MT between berths CJ1 to 12. Kandla already has the disadvantage of operating these old and low capacity cranes, impacting the overall productivity. Increasing the volume per lift will help increase the crane productivity. Thus, defining the size of grab by crane capacity and type of commodity is important to improve crane productivity.

Key Findings

Currently, there is no norm or metric defining what type and size of grab should be used for what type of crane or commodity. Common grab is used for all ELL cranes. This standardization is reducing the crane productivity. Thus, the following grab sizes were identified for the 25MT ELL cranes, differing by material type and density:

Cargo type	Current Grab used (cbm)	Optimal Grab Capacity (cbm)	% increase possible
Coal	10	18	80%
Fertilizer	10	18	80%
Salt	10	16	60%
Food grains	16	20	25%

Figure 242: Grab Chart

Recommendations

Identify optimal grab size on the basis of commodities handled, and use those for crane operations.

Expected Impact

Utilization of optimal grab size will result in increase of volume per lift by ~50%, crane productivity by ~25%, and increase in operating surplus by ~ Rs. 5 Cr.

8.2.2.2 Initiative: KPT 2.2 & 2.4 Relocation of TIL ELL cranes and adding 100 MT mobile harbor cranes

Initiative Overview

Currently, 3 ELL cranes of 25MT are used across berth CJ7 to CJ12, however CJ6, 9, 10 have stronger load bearing capacity, therefore, these berths can handle more productive cranes as well as more number of cranes.

Key Findings

Due to utilization of ELL cranes and limited use of 2 Italgru harbor mobile cranes of 63MT, the average crane capacity at Kandla port is much lower than key competitors. The tons per day handled at KPT are ~9600 vs. ~19000 of Pipavav and ~28000 of Hazira.

Hence, upgrading cranes by improving the crane capacity, i.e., purchase at the stronger berths is very important to help improve productivity as well as to enable handling larger volumes.

Propose reallocation of 3 ELL cranes of 25MT to berth CJ10 to free up berth CJ9 for addition of 100MT HMCs. Berths CJ6, 9, 10 have strong load bearing capacity, thus these berths can handle more productive cranes as well as more number of cranes. The final picture would look like this:

1. CJ7 & 8 – two existing 63MT Italgru HMCs
2. CJ9 – two additional 100MT HMCs
3. CJ10 – three existing 25MT ELL cranes
4. CJ6 – two additional 100MT HMCs

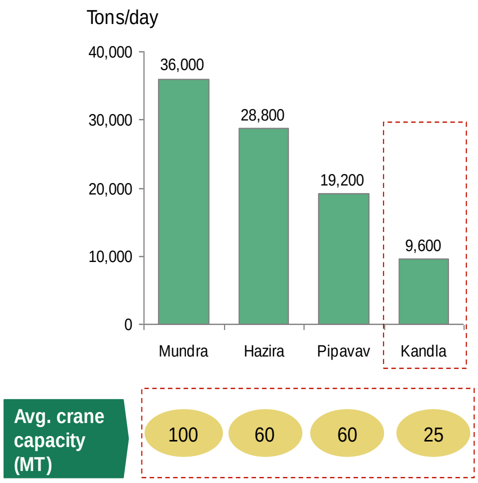


Figure 243: Crane capacity of Kandla vs. competition

Three models of crane ownership are evaluated:

Option 1: KPT to own MHC:

Advantages	Disadvantages
Higher flexibility on deployment	Potential issues in maintenance: Currently limited capability to oversee maintenance contract performance due to low manpower
	Relatively low productivity: Own crane operators typically less productive than private operator*s*
	Lock-in for long duration: KPT will be stuck with asset for 20 years during which technology can change

Option 2: MHC operation on PPP basis

Advantages	Disadvantages
Maintenance taken care by PPP operator: Need to build in clauses like maximum down time and penalties	Will need change in tariff and berthing policy: Mandatory use of wharf cranes in given berths and tariff rationalization for own cranes
Productivity can be incentivized through step tariff	
Limited lock-in (5 years)	

Option 3: Allow private MHC on license basis

Advantages	Disadvantages
High flexibility for KPT	Does not create common facility: Not all stevedores will own MHCs
No lock-in for KPT	Not possible to enforce usage of cranes: Cannot force non-crane owning stevedores to use them

The tariff for existing cranes needs to be rationalized (i.e., increase tariff to ensure cost per ton is in the same range as the cost per ton that will be charged for the 100MT HMC) to encourage customers to opt for the 100MT HMCs.

Rationalization for own cranes to ensure parity for PPP cranes can be done in the following manner:

	CJ 7 (Italgru cranes)	CJ 10 (25MT ELL cranes)	CJ -8,9 (Proposed 100MT cranes)
Current crane capacity	2x63MT	3x25MT	2x100MT
Total CBM	40	54	64
Crane productivity (TPD)	18360	19829	29376
Working time (days)	2.2	2.0	1.4
Cranage charges (Rs./ton)	19[2]	14[3]	55[1]
Vessel wait cost (Rs./ton)	10	10	0
Total cost (Rs./ton)	29	24	55
Proposed additional charge (Rs./ton)	**20**	**30**	**0**

Figure 244: PPP tariff rationalizations

Recommendations

Shift the ELL cranes to CJ10 and add 100T HMCs to CJ6 to 9 by finalizing the PPP terms by leveraging the models followed at Vizag (enforcing mandatory use of MHCs for the berths where they are allocated). In additions to this, parity price for 63T HMCs needs to be implemented.

Expected Impact

This initiative will enable KPT to handle additional 4 to 5 million tons of cargo, impacting operating surplus by ~ Rs. 50-60 Crs.

8.2.2.3 Initiative: KPT 2.3 Improving performance of own MHC by optimizing boom length and grab volume

Initiative Overview

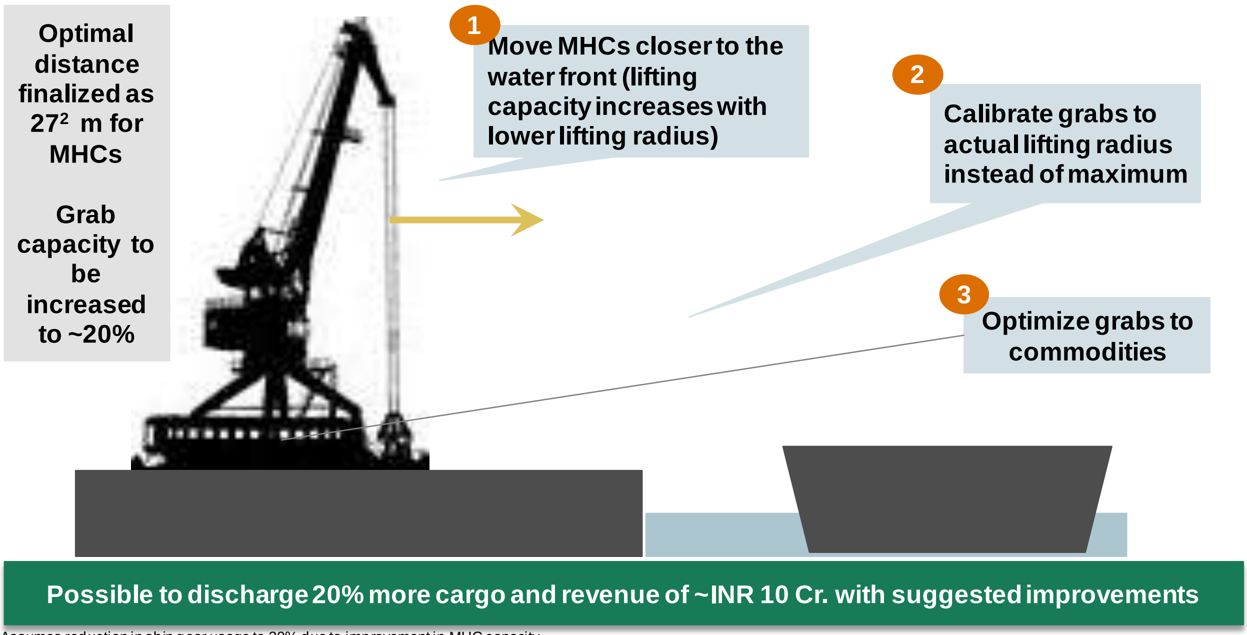
The existing 63MT Italgru HMCs are not used at their most optimal performance. The cranes are not placed at the most optimal distance from the vessel, and the grab size that these cranes use is not per the lifting capacity of the cranes or the density of the commodity being loaded/unloaded. We need to optimize the productivity of these cranes.

Key Findings

Currently, the two Italgru MHCs operate with 18cbm grab, making them similar in effect to 25T ELL cranes which use 16cbm grabs. A grab is a factor of the lifting capacity of the crane as well as density of the commodity. Optimal grab size will help lift maximum possible cargo in one movement.

1. Placing the crane at optimal distance (as close to the vessel as possible) will reduce the lifting radius, thereby increasing the lifting capacity.

2. Calibrating the grabs to the actual lifting radius will enable using a larger volume grab, which will increase the volume per lift and thus increase the productivity.
3. Optimizing grab size per respective commodity density will ensure maximum productivity for each commodity.



1. Assumes reduction in ship gear usage to 30% due to improvement in MHC capacity
2. From center of crane to center of ship: center tp edge of crane (6.25m) + duct area on berth (1.8m) + fender (1m) + half beam length of Panamax (18m)

Figure 245: Optimizing existing HMCs

Recommendations

Finalize the minimum distance at which the HMC can be located per the maximum lifting capacity, determine the optimal size of grabs for all key commodities to be handled by these HMCs.

Expected Impact

Utilization of optimal grab size will result in increase of volume per lift by ~30%, and an increase in operating surplus by ~ Rs. 5 Cr.

8.2.3 Automation

8.2.3.1 Initiative: KPT 3.1 Tug fuel cost reduction

Initiative Overview

Tug fuel costs are ~Rs. 30Cr annually. The following issues have been identified resulting in high fuel consumption:

- No contractual obligation is incorporated for hired tugs to meet a set norm (not captured in the contract, though used for bid evaluation)
- Fuel usage is not monitored daily

- Actions that will reduce tug fuel cost are rarely enforced

If the aforementioned problems are tackled, the fuel consumption per hour will reduce.

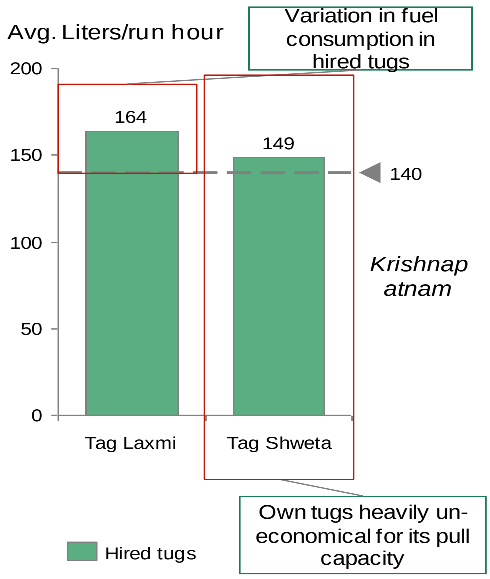


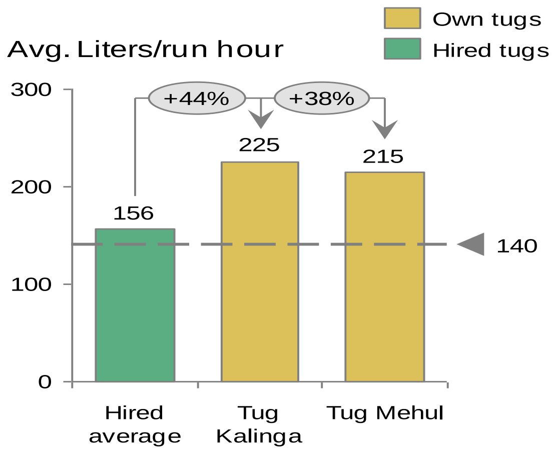
Figure 246: Average Ltrs/hr compared to other ports

Key Findings

1. Current practices vs. BDP

Current Practices	Best Demonstrated Practices
Fuel usage not monitored regularly for hired tugs: Currently review monthly report submitted by tug owners	Fuel usage to be monitored real time: Flow meters to be installed, or else manual level measurement to be done by sounding
Actual hours of utilization not independently validated: No process to regularly tally log books submitted with actual assignments	GPS systems to be installed to track the actual usage of hired tugs independently
Fuel consumption of tugs used to evaluate bids, but not captured in contract	Fuel consumption norms laid out and are checked against daily actual usage
Corrective actions rarely enforced on tug owners: Lack of enough manpower to do condition monitoring	Corrective measures imposed: Engine maintenance, hull cleaning, propeller polishing

2. Own tugs consume more fuel due to age of the tugs (~10yrs) and lack of maintenance. They are also used for all types of movements, i.e., shifting, berthing and sailing.



Note: Own tags consumption extrapolated for like to like comparisons

Figure 247: Average Ltrs/hr hired vs. own tugs

10-15 % reduction in fuel consumption is possible through smart usage and maintenance:

a. 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).

b. Explore O&M contracts / improve current AMC with performance guarantee: Guaranteed availability, guaranteed maximum fuel consumption per hour, guaranteed maintenance of pull capacity.

c. Install flow meters and GPS trackers on hired tugs.

Recommendations

To address the high fuel costs, the following is proposed:

1. Add the fuel consumption norm submitted along with norms to contract
2. Install flow meters in hired tags (enforce the same while renewing contract)
3. Track fuel consumption daily (for all tags), and enforce corrective action as and when necessary—engine maintenance, hull and propeller cleaning

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Expected Impact

Reduction in fuel consumption from ~160LPH for hired tugs to ~140LPH, This will result in an increase in operating surplus by ~Rs. 3 Crs.

8.2.3.2 Initiative: KPT 3.2 Improve night navigation by using advanced navigational aids

Initiative Overview

Currently, only buoys are used as navigation aid. During night, the pilot has to navigate just by looking at the buoys. The buoys move around the mooring causing uncertainty in identifying channel boundary. This has resulted in lesser number of movements at night compared to day. Restriction on number of movements at night impacts the berth occupancy, thereby affecting/increasing the pre-berthing delays. Night navigation restriction needs to be reduced to enable handling more vessels.

Key Findings

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.

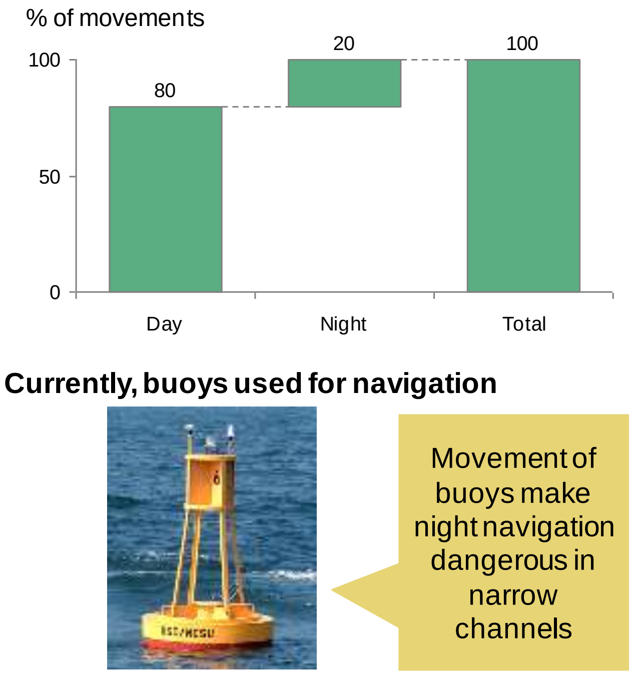

Figure 248: Night navigation

Recommendations

Navigation aids can be used to make night navigation easier and safer, thereby increasing the % of movements at night.

Figure 249: Navigation Aids

To address the issue, 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.

Expected Impact

This initiative will result in improvement of berth occupancy by increasing the % of movements at night, and incremental operating surplus of ~ Rs. 5Cr.

8.2.3.3 Initiative: KPT 3.3 Reducing fertilizer rake loading time by adding automated bag loader

Initiative Overview

Currently, fertilizer bags are transported outside the KPT gate and loaded manually into the rakes. This takes ~18 hrs whereas competition turn around a rake in ~6 hrs. 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.

Key Findings

Currently, the siding inside KPT is considered to be a private siding. This private siding costs Rs. 10-15 more per ton. As a result of this higher cost, most of the cargo is loaded from rakes outside of KPT.

The siding within KPT must be converted to public siding. This practice is followed in other major ports as well. In order to be more competitive in TAT and enhance fertilizer volumes, KPT needs to set up a fertilizer bag loading plant next to the fertilizer bagging plants on PPP basis. Existing fertilizer bagging plants may be connected to this plant through moveable conveyor belts as is feasible. Therefore, combination of reduced cost and automated fertilizer rake loading will not only encourage customers to load rakes inside KPT, but will also help reduce the TAT.

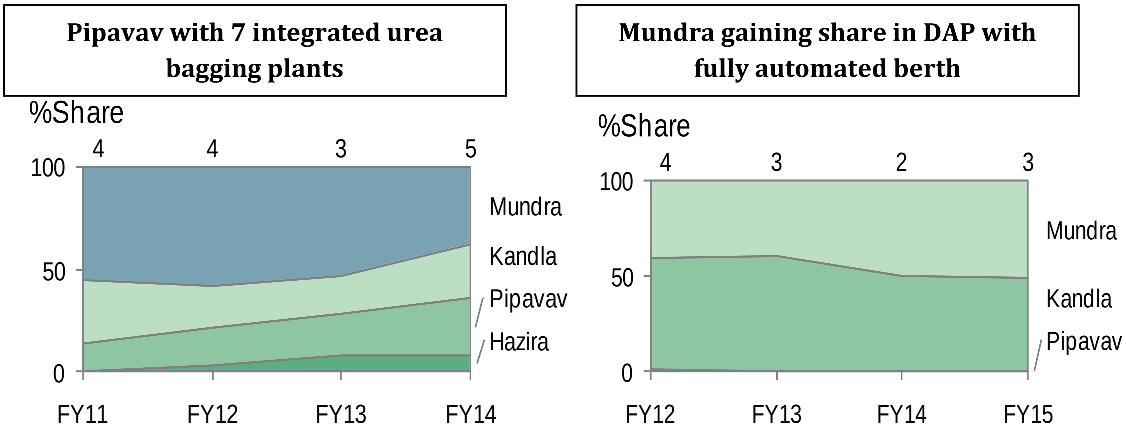

Figure 250: Competitor rake loading facility

Recommendations

Coordinate with rail ministry to convert the private siding within KPT into public siding, and design and set up a fertilizer bag loading plant next to the fertilizer bagging plants on PPP basis.

Expected Impact

Reduced TAT to ~6hrs from ~18hrs, resulting in additional demand of ~1-2 million tons of fertilizer, which will increase operating surplus by ~ Rs. 10 Crs.

8.2.4 NWT and delays

8.2.4.1 Initiative: KPT 4.1 Increase overall dry bulk productivity by instituting berth productivity norms

Initiative Overview

Berth productivity norms for cargo berths needs to be upgraded per the planned equipment upgrade.

Recommendations

Current norms	Proposed Norms
2 for government cargo – else FCFS	2 for government cargo – else for vessel promising 12KTPD productivity
1 for coastal cargo – else FCFS	1 for coastal cargo – else for vessel promising 10 KTPD productivity
1 for vessel promising 24 hr turnaround	Only project cargo providing ad-valorem wharfage to be admitted under 24 hr priority group – else for vessel promising 12KTPD productivity
1 for vessel promising 10KTPD productivity	1 berths for vessels promising 12KTPD productivity (up from 10)
1 for vessel promising 6KTPD productivity	1 berth for vessel promising 10KTPD productivity (up from 6)
3 free berths	3 berths on first-come-first-serve mode with a minimum productivity of 5000KT (up from 3000KT) for all commodities except timber (3000KT for timber due to safety issue)
	2 for government cargo – else for vessel promising 12KTPD productivity

The aforesaid proposed norms are necessary to ensure that the planned upgraded equipment is put to full use for achieving higher productivity.

Expected Impact

This initiative will increase productivity by ~20%, creating capacity of 0.5-1 million tons. Incremental operating surplus will be ~Rs. 5Cr.

8.2.4.2 Initiative: KPT 4.2 & 4.3 Reduce non-working time by instituting hot seat change and changing shift schedule

Initiative Overview

Currently, the shift change time takes between 30 minutes to 1 hour per shift per day. However, this can be resolved by instituting hot seat shift change.

Key Findings

On an average, a vessel idles for almost 30% of the total time at berth. Of this ~30%, more than half is on account of time wasted between shift changes and time wasted during breaks between shifts.

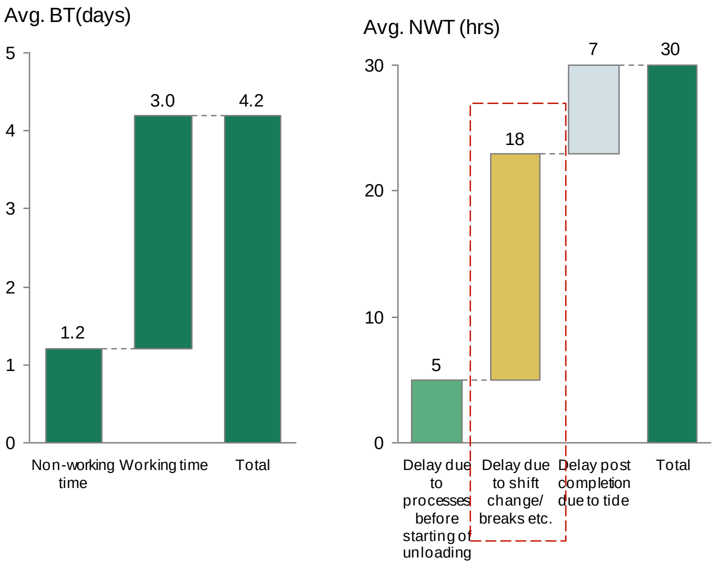

Figure 251: Percentage of NWT and break-up of NWT

Current shift timings are as follows:

1. First shift – 8 AM to 4 PM
2. Second shift – 4 PM to 12 AM
3. Third shift – 12 AM to 8 AM

Time between shifts is wasted due to workforce leaving earlier than shift end time, and the next shift arrives in time or is late at the gate, therefore, by the time the next shift resumes, more time is wasted. In total, ~30-45min per shift change per day is lost. Introducing hot seat changes can prevent this loss of time.

In addition to the time loss during shift changes, there is additional time lost during breaks that fall in the middle of the shifts. Not only is ~30min per break per shift lost (which is further extended to ~1hr), but additional ~10-15min is lost in rebuilding momentum and resuming operations. Aligning the break time with the shift timings will help reduce the overall delay. By realigning the shifts as per standard practice (6 AM – 2 PM, 2 PM – 10 PM, 10 PM – 6AM), the extra break time can be reduced.

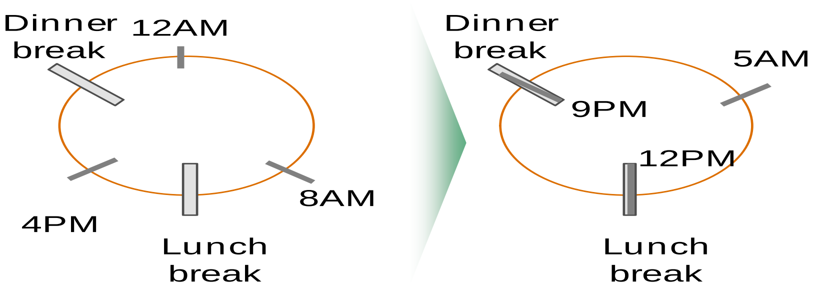

Figure 252: Old and proposed shift time

Recommendations

Implement hot seat changes by finalizing the plan with unions to add 30 minutes to each shift, or give one hour overtime.

Implement shift time changes by finalizing the plan with the unions.

Expected Impact

There is potential to reduce idle time by ~2.5 hrs per day, resulting in incremental operating surplus of ~Rs. 25Crs.

8.2.4.3 Initiative: KPT 4.4 Increase overall liquid productivity by instituting berth productivity norms

Initiative Overview

Currently, the productivity of liquid berths at KPT (220TPH) 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 the maximum possible rate. This can be addressed through stringent berth productivity norms.

Key Findings

Currently, there is low incentive for customer tank farm operator to increase throughput because of the following tariff structure:

1. Berth hire charges amount to Rs. 20-30/MT on a revenue base of Rs. 130/MT: Berth hire charges are calculated based on standard throughput, and there is no incentive for faster discharge.

2. It is cheaper to use existing tank for storage (Rs. 50/ton) than rent a new tank (Rs. 250/MT): Parties prefer to discharge slower to allow for evacuation from existing tanks.

Essentially, it is cheaper to discharge slowly as opposed to renting a new tank and paying the storage charges.

Additionally, due to lack of incentive, there is no control on the amount of time wasted in preparatory activities on the berth. Only ~30-40% of pipeline capacity is utilized even if ships are waiting their turn for berthing, resulting in increased pre-berthing delays as well.

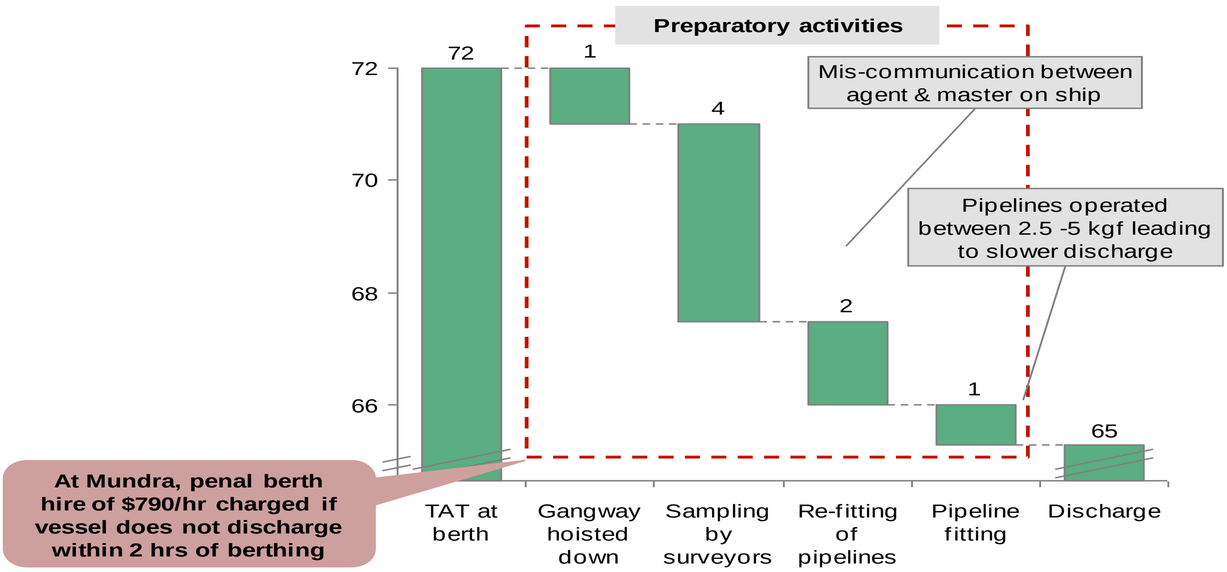

Figure 253: Time wasted at liquid berths in preparatory activities

Incentive can be created through establishing targets for berth performance, and penal actions may be implemented if these performance targets are not achieved. The following norms are proposed on the basis of industry practices and KPT best-demonstrated performance:

1. Target of 300 tons per hour
2. One berth to be given to vessel promising highest productivity
3. Ship to be unberthed and moved to the back of the queue if target not met

Expected Impact

This initiative will increase productivity by ~30% for liquid, and release capacity of ~0.5-1 million tons. Incremental operating surplus will be ~ Rs. 5 Cr.