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Annexure

1) Drawings
EXECUTIVE SUMMARY OF JETTY AND RELATED INFRASTRUCTURES

Adani Cementation Limited (ACL) is planning of setting up Cement Plant in Lakhpat Taluka, District Kutch in Gujarat. The proposed Cement plant will have potential to produce up to 12 Million Tonnes of Cement & Clinker. In order to serve the requirement of raw materials and product transportation ACL is planning to develop captive jetty as there are No ports in near vicinity.

ACL plans to develop a dry bulk terminal along with ancillary infrastructure facilities and desalination plant (30000 m3/Day intake which will generate 9000 m3/Day product) to cater the water requirement of the integrated project of Cement Plant, Captive Power Plant, Mines and Jetty. Desalination plant with intake and outfall will be provided within the backup area. Berthing Jetty is proposed in Kori Creek with anchorage in Gulf of Kutch of Arabian Sea, the taluka headquarter. The draft available at selected Jetty location is approximately 6m.

Location details of the Jetty and the Backup area are given in the table below:

<table>
<thead>
<tr>
<th>Water Front (Jetty)</th>
<th>Location</th>
<th>Dimension</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Dimension</td>
<td>Capacity</td>
<td></td>
</tr>
<tr>
<td>Latitude</td>
<td>Longitude</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23°44'50.99&quot;N, 68°34'41.81&quot;E</td>
<td>Jetty Length: 820m approx.</td>
<td>15 MMTPA</td>
<td></td>
</tr>
<tr>
<td>23°44'36.93&quot;N, 68°34'50.69&quot;E</td>
<td>Jetty Width: 28m approx.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23°44'53.27&quot;N, 68°35'21.23&quot;E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23°45'07.33&quot;N, 68°35'12.35&quot;E</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Back Up Storage Area</th>
<th>Location</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Area</td>
<td></td>
</tr>
<tr>
<td>Latitude</td>
<td>Longitude</td>
<td></td>
</tr>
<tr>
<td>23°44'10.41&quot;N, 68°36'48.04&quot;E</td>
<td>4.05 Ha approx.</td>
<td></td>
</tr>
<tr>
<td>23°44'17.86&quot;N, 68°36'49.96&quot;E</td>
<td>village Kapurasi of Tehsil</td>
<td></td>
</tr>
<tr>
<td>23°44'8.83&quot;N, 68°36'53.95&quot;E</td>
<td>Lakhpat, District Kutch</td>
<td></td>
</tr>
<tr>
<td>23°44'15.96&quot;N, 68°36'55.80&quot;E</td>
<td>(Gujarat)</td>
<td></td>
</tr>
</tbody>
</table>

Cargo Volumes of raw material and finished products are given below:

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Commodity</th>
<th>(MMTPA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clinker</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Cement</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Limestone</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Coal/Pet Coke</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Total</td>
<td>15</td>
</tr>
</tbody>
</table>

ACL will provide supporting mechanized handling facilities at the proposed location to handle raw material as well as finished products in phased manner. Jetty and Back up Area will be connected through conveyor corridor.
1 INTRODUCTION

1.1 Background

Adani Cementation Limited (ACL) is planning of setting up Cement Plant in Lakhpat Taluka, District Kutch in Gujarat. The proposed Cement plant will have potential to export up to 12 Million Tonnes of Cement & Clinker in phase wise manner. The commencement of production (clinker as well as cement) is proposed to be within 2 years (March 2020). In order to serve the export and import of materials requirement of the plant, ACL is planning to develop captive jetty in Kori creek near Koteshwar in Kutch. It is located about 160 km Northwest of Bhuj, Gujarat. The site is located inside Kori Creek, Gulf of Kutch Gujarat.

Local consumption of clinker or cement would be quite low. Therefore it is important that clinker would have to be transported to another location where cement plants would be established for local distribution. Looking to the non-availability of ports in near vicinity and to the scale of export potential, it is imperative for ACL to have dedicated captive facilities for the export/coastal shipping of its products to Global market and other parts of India. ACL plans to develop a dry bulk terminal along with ancillary infrastructure facilities at the proposed location to handle estimated throughput in phased manner.

1.2 Developer background

ACL is incorporated in 2017 and is based in Ahmedabad, Gujarat. ACL is a part of Adani Group. The Adani Group is one of India’s leading business houses with revenue of about $12 billion for the financial year 2015-16. Adani is a globally integrated infrastructure player with businesses spanning coal trading, coal mining, renewables, ports, multi-modal logistics, power generation and transmission, and gas distribution.

ACL is part of Adani Enterprise Limited (AEL), AEL is engaged in Mining, Trading, Gas distribution, Renewable energy, Agro etc.

Mining & Coal Trading
AEL is developing and operating mines in India, Indonesia and Australia. Apart from India, AEL supply coal to China and we aim to spread our wings to Taiwan, Vietnam, Korea etc. AEL extractive capacity of thermal coal has increased threefolds to 4 MMT in 2014 and aim to extract 200 MMT per annum by 2020. AEL is largest and one of the world’s largest coal suppliers. AEL supplies to all major SEB’s and private business houses in India. AEL is the largest coal importer from Indonesia and have a strong supplier base in South Africa, Australia, USA and Russia.

Gas
Adani Gas a subsidiary of Adani Enterprises Ltd., is developing City Gas Distribution (CGD) Networks to supply the Piped Natural Gas (PNG) to the Industrial, Commercial, Domestic (residential) and Compressed Natural Gas (CNG) to the transport sector.

Renewable Energy
AEL has invested in a 40 MW solar power plant in Bitta (Gujarat) marking Adani Enterprises’ major extension into the renewable energy sector (December 2011). AEL has its 648 MW solar power plant in Tamil Nadu is the largest single location solar power plant in the world, commissioned in September 2016.

AEL has also forayed into Wind Power and has commissioned 12MW of Wind Power in Madhya Pradesh by March 31, 2016. Incremental 100MW of Wind Power projects are under various stages of construction in high wind states of Andhra Pradesh and Rajasthan.

AEL has set an ambitious target to install 10,000 MW of Renewable Power capacity by 2022.

Agro Business
Adani’s Agro businesses entails modernizing the agriculture sector and bringing food security with self-reliance through its three main agro verticals - Adani Wilmar Limited (AWL), Adani Agri Logistics Limited (AALL) and Adani Agri Fresh Limited (AAFL).

- Adani Wilmar Limited is one of the largest food company in India with the flagship brand Fortune cooking oils, the number one edible oil brand in India.
- Adani Agri Logistics is proud to have established India’s first integrated bulk handling, storage & logistics system for food grains. It provides seamless end-to-end bulk supply chain to Food Corporation of India.
- Further, with ‘Farm-Pik’, Adani Agri Fresh Limited AAFL has instituted the largest integrated apple supply chain initiative with ultra-modern storage infrastructure in the country to provide fresh farm products.
1.3 Proposed Development

It is proposed that the port facilities shall be developed in a phased manner commensurate with traffic growth. Salient features of Phase I and master plan are shown in table below:

**Phase I Development**

- Three number of barge berths having total length of 360 m and 28 m wide
- One mechanised handling system of having 1000 TPH of export of clinker/cement / limestone
- Two semi - mechanised jetty for handling of Coal and limestone
- 3.2 km of approach combining of rock bund and trestle connecting landside facilities to jetty
- 10 acre of intermediate backup development for storage of cargo
- 9.1 km of conveyor connecting from Cement plant to jetty
- Equipment on jetty: 1 Number of ship loader, 1 Number of Mobile harbour crane and 2 number of Industrial excavators
- Mobile equipment like pay-loaders, excavators, back hoe in intermediate backup area
- 8.5 km of road connecting plant area to onshore storage area of captive jetty
- Supporting infrastructure

**Phase II Development**

- Four number of additional barge berths having total length of 460 m and 28 m wide
- Additional mechanised system of 9.1 km of conveyor connecting from Cement plant to jetty and ship loading arrangement on jetty export of clinker/cement /limestone
- Equipment on jetty: four number of ship loaders and two industrial excavators
- Supporting Infrastructure

1.4 Present Submission

The present submission is the Pre-Feasibility Report for “Development of Captive Jetty at Koriyani”, Gujarat. This report is organised in the following sections:

- Section 1 : Introduction
- Section 2 : Site Conditions
- Section 3 : Traffic Projection
Section 4 : Facilities Requirement
Section 5 : Planning of facilities
Section 6 : Material Handling System
Section 7 : Supporting Infrastructure
Section 8 : Project Timeline
Section 9 : Block Cost Estimate
Section 10 : Way Forward
2 SITE CONDITIONS

2.1 Project Location

Proposed project is located on the West Coast of India in Gulf of Kutch about 160 Km west of Bhuj in District Kutch of Gujarat state. Proposed Terminal site is about 35 Nautical Miles Northeast of existing Jakhau Port.

Proposed site is located at Koriyani village falling in Lakhpat Taluka. The natural water depths are available at least -6.0 m below CD. The location map is shown in table below:

![Figure 1 proposed project location](image.png)

2.2 External Connectivity

Road Connectivity: State highway Number 6 (SH6) is passing at about 4 kms from the proposed terminal backup site. Existing state highway is two lane road. As envisaged, there will be movement of cargo between cement plant and captive jetty/terminal by road, dumper movement is envisaged. Therefore road connectivity will be planned to connect cement plant and captive jetty and terminal area.

Bhuj airport is about 150 kms from the project location.
2.3 Location of Mine, Clinker unit and captive jetty

ACL has studied the region in detail with respect to location of mines, site for clinker grinding unit and position of captive jetty. Generally it is preferable to have the clinker facility of the cement / clinker plant within vicinity of 8 – 10 KM. A distance larger than this would start adversely affecting the total unit cost. ACL has acquired limestone mine block C in Mudhvay Village, District Kutch from Government of Gujarat through an online auction process. ACL has been exploring few sites for setting up clinker unit as close to the mines as possible for optimum logistics between mines and grinding unit. Location of proposed mining area, clinker plant and captive jetty are shown in below map:

2.4 Topographic Features

The site is located within the confines of Kori Creek at about 5NM from Narayan Sarovar towards Lakhpat side. Onshore facilities of the Terminal are planned in the waste lands generally flat with average Ground Level above Chart Datum. Area gently slopes towards sea coast. There is neither significant vegetation nor any habitation in the proposed onshore Facilities area.

Detailed of topography survey to be carried out and result will be incorporated during detailed project report stage

2.5 Bathymetry

Kori creek mouth starts at geographical location 23° 30’ N and 68° 15’ E and extends north-eastward up to 60 km. The Kori creek branches into two at about 30 km from
the mouth and a mud flat is present. The eastern branch is known as Koteshwar channel. The both banks of the creek channel have vast intertidal areas.

Depth at the mouth of Koteshwar channel is around 6 to 12 m below CD and it has shoals on either side. The depth gradually decreases towards the upstream. The creek narrows down at Lakhpat which is about 25 km from Narayan sarovar.

At the jetty location water depth available is approx. 6m below CD. We have completed partial survey of bathymetry in project area and entire survey will be completed post monsoon and results will be incorporated during detailed project report stage.

2.6 Metocean conditions

2.6.1 Tides

Tides in the region are mixed semidiurnal type with two unequal lows and highs in a tidal day. Based on the admiralty chart, following tides have been observed in Kori Creek area.

<table>
<thead>
<tr>
<th>Tide</th>
<th>Height in meters above datum</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHHW</td>
<td>3</td>
</tr>
<tr>
<td>MLHW</td>
<td>2.8</td>
</tr>
<tr>
<td>MHLW</td>
<td>1.3</td>
</tr>
<tr>
<td>MLLW</td>
<td>0.5</td>
</tr>
<tr>
<td>MSL</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Tidal observations for 1 month will be carried out by ACL; the data will be included on completion of the study.

2.6.2 Waves

Waves will not predominant at the location. Location is well protected and in the creek where direct waves may not predominate.

2.6.3 Currents

The current direction will be mostly was parallel to the coast line. The currents in the Kori creek will be largely tide induced and oscillations are mostly bimodal reversing in direction with the change in the tidal phase. Maximum current speed of 0.9 m/s is found in this region based on secondary information.
2.7 General meteorological conditions

2.7.1 Temperature

January is the coldest month with 11°C while May is the hottest month with 45.0°C.

2.7.2 Rainfall

The climate of the Kutch district is arid with scanty rainfall and moderate humidity. Based on secondary information on climatologically data (1995 to 2004) observed by IMD at Naliya Village, which is situated about 30 km from the project site, the annual average rainfall was around 343 mm. The monsoonal months (June to September) experience almost 95% of the total rainfall. The minimum rainfall (134.9 mm) was observed in 1999 while maximum rainfall of 672.7mm occurred in 2004.

2.7.3 Wind and Cyclone

Generally wind blows from the southwest from February to October and from the northeast in November to January. Average wind speed ranges from 12 to 19 km/h. However, the wind speed exceeds 20 km/h during monsoonal months. Number of cyclonic storms which struck the Gujarat coast region during the last 60 y is given in the figure below.

![Cyclone tracks of Gujarat](image-url)

Figure 2 cyclone tracks of Gujarat
2.7.4 Seismic Conditions

The area falls in most active seismic zone as per IS 1893 (Zone V). This will be borne in mind and duly considered at the time of detailed design.

2.7.5 Humidity

The maximum relative humidity is recorded in August during monsoon season whereas the minimum humidity occurs in December. The average relative humidity is around 65%.

2.7.6 Visibility

Visibility in this area is good except for short periods in early mornings for a few days in the month of January.

2.8 Soil Characteristics

Presently Geotechnical Data for the Berth location and backup area is not available. Soil investigation work for the Terminal location and jetty location will be taken up in while actual data shall be used for detailed design of the structures.
TRAFFIC POTENTIAL

Adani Cementation limited is setting up a Cement manufacturing plant with an investment of approx. Rs 3500 Crores in Lakhpat Taluka in Kutch district. Cargo at the proposed facilities is mostly of Captive nature.

Cement is an essential ingredient for the modern construction and infrastructure development. With Government's focus on infrastructure and housing development in coming years, there will be significant demand for Cement. There is a large demand for cement on the coastal areas where there is deficit in cement supplies. The main aim of the project is to supply cement to coastal locations through coastal shipping. Major demand centres / destinations for target cement target from proposed plant will be mainly Gujarat, Karnataka, Kerala, and Maharashtra.

The main finished commodities from the plant will be Clinker and Cement. Phase wise requirement of the Cargo Volumes of raw material and finished products are presented in the following Table:

Table 2 Traffic Projection - Phase wise

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Export/Import</th>
<th>Phase I (FY 2020)</th>
<th>Master Plan (FY 2025)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinker</td>
<td>Export</td>
<td>3.1</td>
<td>8</td>
</tr>
<tr>
<td>Cement</td>
<td>Export</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Limestone</td>
<td>Export</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Coal/Pet coke</td>
<td>Import</td>
<td>0.7</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>5.8</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

From above Table it can be easily inferred that volumes shall ramp up as above. Hence the Berths. Conveying system and backup infrastructure can be developed in phase wise manner with the requirement of facilities. While development of phase I, necessary provisions can be kept for future expansions to meet Phase II cargo.
4.1 Introduction

The layout of the master plan of any terminal should be based on the expected traffic at different timelines, size of ships, facility requirements in terms of number and length of berths, navigational requirements, and storage area required for each type of cargo, material handling system, road access for the receipt/dispach, evacuation of cargo, and other utilities and service facilities. The layout of the proposed terminal at Kori Creek is prepared based on these.

4.2 Vessel Sizes

The size of vessels/barges that would call at any terminal will generally be governed by the following aspects:

- Availability of a suitable vessel in the market
- The trading route
- The available facilities for loading & unloading
- Available facilities mainly navigational channel and manoeuvring areas including the draft
- Volume of annual traffic to be handled and the likely parcel size as per the requirements of the end user/final destination requirements

Clinker is the main commodity to be handled at the proposed jetty. In addition to that dry bulk commodities like Coal, Pet coke, Cement and Limestone will also be likely to handle through proposed jetty facilities. Since proposed facilities are located in Kori creek area where depths are in range of 6 m, barges will be the main size of vessels.

In order to reduce huge capital cost of building deep water & direct berthing port infrastructure, it is envisaged that ACL will develop barge handling facilities for ~ 8000 DWT self-propelled barges. The main export/coastal going vessels (40,000 DWT to 80,000 DWT) will be handled in the deep sea at anchorage point.
The dimensions of barges are shown in table below:

<table>
<thead>
<tr>
<th>Category</th>
<th>Tonnage (T)</th>
<th>Length (m)</th>
<th>Beam (m)</th>
<th>Draft (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1</td>
<td>~2000 DWT</td>
<td>70</td>
<td>14</td>
<td>3.0 m</td>
</tr>
<tr>
<td>Category 2</td>
<td>~ 8000 DWT</td>
<td>100</td>
<td>24</td>
<td>5.0</td>
</tr>
</tbody>
</table>

The marine infrastructure and shore based infrastructure shall be planned and developed to cater to the cargo forecast. Development of the terminal infrastructure shall also be suitably phased in such a way that the initial phases integrate well with subsequent phase.

### 4.3 Berth Requirements

#### 4.3.1 Introduction

The required number of berths depends mainly on the cargo volumes and the handling rates. While considering the handling rates for various commodities, it must be ensured that they are at par or better as compared to the competing facilities so as to be able to attract more cargo. Allowable berth occupancy, the number of operational days in a year and the parcel sizes of ships are other main factors that influence the number of berths.

#### 4.3.1 Operation Time

Proposed jetty is located in Kori Creek. Primarily barges are aimed to be handled on proposed jetty in Kori creek.

For Conventional Barges: During monsoon, due to adverse weather conditions conventional river going barges can't operate/navigate in open sea area. Therefore excluding monsoon, it is assumed that proposed terminal will work seven days a week, which brings the effective number of working days to 240 days per year for mid - sea operations of smaller size barges.

For Seagoing barges: In addition to that, adequate sea going barges which can travel during monsoon are also being considered for the round year operation as looking to size of clinker plant and hinterland requirements. Therefore in this case, working days can be increased up to 350 days.

Further, it is assumed that the port will operate round the clock i.e. three shifts of eight hours each. This results in an effective working of 20 hours a day.
4.3.2 Time required for other activities

Apart from the time involved in loading of cargo, additional time is required for peripheral activities such as berthing and de-berthing of the barges, customs clearance, cargo surveys, positioning and hook up of equipment, waiting for clearance to sail, waiting at anchorage etc. These activities are assumed to take, on an average, 2 hours per vessel call.

4.3.3 Handling Rates

Considering the projected throughput and the competitiveness requirements, the handling systems assumed for various commodities are described below.

<table>
<thead>
<tr>
<th>Type of commodity</th>
<th>Form</th>
<th>Export/Import</th>
<th>Type of loading/unloading</th>
<th>Achievable Handling Rate (TPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinker</td>
<td>Dry Bulk</td>
<td>Export</td>
<td>Mechanised</td>
<td>850</td>
</tr>
<tr>
<td>Cement</td>
<td>Dry Bulk</td>
<td>Export</td>
<td>Mechanised</td>
<td>850</td>
</tr>
<tr>
<td>Limestone</td>
<td>Dry Bulk</td>
<td>Export</td>
<td>Mechanised</td>
<td>850</td>
</tr>
<tr>
<td>Coal/Pet coke</td>
<td>Dry Bulk</td>
<td>Import</td>
<td>Semi mechanised</td>
<td>500</td>
</tr>
</tbody>
</table>

For principal cargo like Clinker and Cement, it is proposed to provide a fully mechanised export system comprising of barge loader, conveyor system from directly plant to jetty area. With fully mechanised system, it is expected that around 16,000 T – 18,000 can be loaded per day at one berth on an average @ 21 working hours per day depending size of barge.

Since Coal, Pet coke and Limestone volume is not significant therefore dedicated mechanised system is not being planned. It is proposed to handle through semi mechanised mode from jetty to backup area. Suitable conveying system to combine handling of Clinker and cement in Export and Coal/pet coke in import is also can be thought of during engineering stage.

4.3.4 Parcel Size

Though the design vessel size is the guiding parameter in arriving at the dimensions of the navigable approach channel area, in actual practice vessels of various sizes will arrive at the proposed terminal area. For ascertaining the requirement of numbers
of berths, it is prudent to consider the average parcel size for each commodity and details of the same are presented below.

### Table 5 Average Parcel Size

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Parcel Size - 1 (For anchorage operation in mid sea loading)</th>
<th>Parcel Size - 2 For direct transfer to end destination in India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinker</td>
<td>2000</td>
<td>8000</td>
</tr>
<tr>
<td>Cement</td>
<td>2000</td>
<td>8000</td>
</tr>
<tr>
<td>Limestone</td>
<td>2000</td>
<td>8000</td>
</tr>
<tr>
<td>Coal/Pet coke</td>
<td>2000</td>
<td>8000</td>
</tr>
</tbody>
</table>

#### 4.3.5 Allowable Levels of Berth Occupancy

Berth occupancy 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 terminal operational days in a year. High levels of berth occupancy will result in bunching of vessels resulting in undesirable pre-berthing detention. For limited number of berths and with random arrival of vessels, the berth occupancy levels have to be kept low to reduce this detention. The norm generally followed for planning the number of berths, in ports worldwide and in Indian ports suggests berth occupancy in range of 40%-75% based on number of berths in the facilities.

In order to be competitive, it is important that the barges/ships calling at the proposed facilities should have minimal pre-berthing detention. At the same time, the investment at the port infrastructure has to be kept at optimum level. Proposed facilities are of captive nature therefore random arrival of vessels/barges can be reduced by regulation of the vessel movements. Keeping these in consideration, it is proposed to limit berth occupancy of 70%. This shall reduce the pre-berthing detention of ships/barges and offer reduced logistics cost to the shippers.
4.3.6 Berth Requirements

Based on the considerations discussed above, the requirements of cargo handling berths for captive jetty in Phase-1 and Phase-2 have been calculated as shown in tables below.

**Table 6 Berth Requirements of Phase I**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particulars</th>
<th>Unit</th>
<th>Phase I</th>
<th>Clinker</th>
<th>Cement</th>
<th>Limestone</th>
<th>Coal/Pet coke</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Traffic Forecast</td>
<td>MMTPA</td>
<td>3.1</td>
<td>1</td>
<td>0.7</td>
<td>4.800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Type of loading/unloading</td>
<td></td>
<td>Mechanised</td>
<td></td>
<td></td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>% of barges distribution between</td>
<td>%</td>
<td>25%</td>
<td></td>
<td></td>
<td>75%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Traffic</td>
<td>MTPA</td>
<td>0.78</td>
<td>2.33</td>
<td></td>
<td>0.00</td>
<td>1.00</td>
<td>0.70</td>
</tr>
<tr>
<td>6.</td>
<td>No. of Barges Calls per Annum</td>
<td>No.</td>
<td>388</td>
<td>291</td>
<td>0</td>
<td>500</td>
<td>350</td>
<td>1529</td>
</tr>
<tr>
<td>7.</td>
<td>Handling Rate</td>
<td>TPD</td>
<td>15750</td>
<td>17850</td>
<td>17850</td>
<td>10000</td>
<td>10000</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Time Required at Port Per Barge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Handling Time</td>
<td>Days</td>
<td>0.13</td>
<td>0.45</td>
<td>0.45</td>
<td>0.20</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>Berthing / Deberthing &amp; Miscellaneous Time</td>
<td>Days</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>Total Time per Barge</td>
<td>Days</td>
<td>0.21</td>
<td>0.53</td>
<td>0.53</td>
<td>0.28</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Total Berth Days required for Barge</td>
<td>Days</td>
<td>81</td>
<td>154</td>
<td>0</td>
<td>142</td>
<td>99</td>
<td>477</td>
</tr>
<tr>
<td>10.</td>
<td>Total Available Days per annum for operations</td>
<td>Days</td>
<td>240</td>
<td>350</td>
<td>350</td>
<td>240</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Berth Occupancy</td>
<td>%</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Total Berths Required</td>
<td>Number</td>
<td>0.96</td>
<td>0.00</td>
<td>1.43</td>
<td>2.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Total Berths Required</td>
<td>Number</td>
<td>1.00</td>
<td></td>
<td>2.00</td>
<td>3.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Assumptions:

1) Working days/operation of River going/ conventional barges is considered to be completed during non-monsoon season.
Table 7 Berth Requirement for Master Plan

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particulars</th>
<th>Unit</th>
<th>Master Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clinker</td>
</tr>
<tr>
<td>1.</td>
<td>Traffic Forecast</td>
<td>MMTPA</td>
<td>8.0</td>
</tr>
<tr>
<td>2.</td>
<td>Type of loading/unloading</td>
<td></td>
<td>Mechanised</td>
</tr>
<tr>
<td>3.</td>
<td>% of barges distribution between</td>
<td>%</td>
<td>50%</td>
</tr>
<tr>
<td>4.</td>
<td>Traffic</td>
<td>MTPA</td>
<td>4.00</td>
</tr>
<tr>
<td>5.</td>
<td>Average Parcel size</td>
<td>T</td>
<td>2000</td>
</tr>
<tr>
<td>6.</td>
<td>No. of Barges Calls per Annum</td>
<td>No.</td>
<td>2000</td>
</tr>
<tr>
<td>7.</td>
<td>Handling Rate</td>
<td>TPD</td>
<td>15750</td>
</tr>
<tr>
<td>8.</td>
<td>Time Required at Port Per Barge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Handling Time</td>
<td>Days</td>
<td>0.13</td>
</tr>
<tr>
<td>b.</td>
<td>Berthing / Deberthing &amp; Miscellaneous Time</td>
<td>Days</td>
<td>0.08</td>
</tr>
<tr>
<td>c.</td>
<td>Total Time per Barge</td>
<td>Days</td>
<td>0.21</td>
</tr>
<tr>
<td>9.</td>
<td>Total Berth Days required for Barge</td>
<td>Days</td>
<td>421</td>
</tr>
<tr>
<td>10.</td>
<td>Total Available Days per annum for operations</td>
<td>Days</td>
<td>240</td>
</tr>
<tr>
<td>11.</td>
<td>Berth Occupancy</td>
<td>%</td>
<td>70%</td>
</tr>
<tr>
<td>12.</td>
<td>Total Berths Required</td>
<td>Number</td>
<td>2.80</td>
</tr>
<tr>
<td>13.</td>
<td>Total Berths Required</td>
<td>Number</td>
<td></td>
</tr>
</tbody>
</table>

Assumptions:

1) Working days/operation of River going/ conventional barges is considered to be completed during non-monsoon season.
Based on the above calculations, the berth requirements for has been summarised and presented in table below:

**Table 8 summary of berth requirements**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Number of Mechanised berth</th>
<th>Number of Semi Mechanised Berth</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Phase II</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

### 4.4 Marine infrastructure

The marine infrastructure comprises of jetties and manoeuvring areas like approach channels, turning circle, berthing pockets, holding area, etc.

#### 4.4.1 Navigational and Operational requirements

The basic navigational and operational requirements to service the vessels calling at a port / terminal are:

- Sufficient depth in manoeuvring area and at the berths
- Sufficient depth and width in approach channel
- Adequate berthing infrastructure including berth fixtures like fenders
- Mooring system
- Navigational aids


#### 4.4.2 Navigation Channel Dimensions

The channel alignment will be oriented considering the following aspects:

- The channel is aligned in a straight line as far as possible.
- The channel is oriented so as to reach the deep-water contours in shortest possible distance (this is to optimize the quantity of dredging).
The dimensions of the navigation channel are dependent on the vessel size, the behaviour of the vessel when sailing through the channel, the environmental conditions (winds, currents and waves) and the channel bottom conditions. Channel design primarily involves the determination of the safe channel width and depth for the dimensions of the design vessel.

**Table 9 Approach Channel Requirements**

<table>
<thead>
<tr>
<th>Description</th>
<th>Type of Channel</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach Channel bottom width (5 B)</td>
<td>One Way</td>
<td>120 m</td>
</tr>
</tbody>
</table>

Presently Kori Creek has adequate width therefore there is no requirement for widening of channel. Above requirements are preliminary and will be fine-tuned during DPR stage.

**4.4.3 Length of the Berths**

The size of berthing area and the berth will depend upon the dimensions of the largest barge and the number of barges to use the terminal. The following aspect needs to be considered.

- The size of the port basin for manoeuvring
- Satisfactory arrival and departure of vessels to and from the harbour
- Whether the vessels are equipped with stern and bow thrusters
- Availability of tugs, direction and magnitude of wind, waves and current

For 8000 DWT barges, the LOA will be about 100 m. This will not create problem for berthing as adequate clearance will be available as far as the length of the berth and width of the dredged area is concerned.

As per BIS: 4651 (Part V) – 1980, for preliminary assessment, the length of the berth is recommended to be 10% more than the overall length of the largest vessel expected, subject to a minimum of 15 m.

The requirement of the berth length for various commodities is estimated below:
Table 10 Berth Length

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Phase</th>
<th>Design Barge Size</th>
<th>Barge Length (m)</th>
<th>Clearance between vessels (m)</th>
<th>No. of Berths (Incremental)</th>
<th>Total Length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Bulk (Cement, Clinker, Limestone, Coal etc.)</td>
<td>I</td>
<td>8000 DWT</td>
<td>100</td>
<td>15</td>
<td>3</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td>II/Master Plan</td>
<td>8000 DWT</td>
<td>100</td>
<td>15</td>
<td>4</td>
<td>460</td>
</tr>
</tbody>
</table>

4.4.4 Width of Bulk Berth:

Width of the berth is based on the functional requirement of conveyors, loading equipment, unloading equipment and adequate manoeuvring space for other equipment. A total width of 28 m has been provided, keeping a provision for front clearance and conveyors and manoeuvring space for other equipment and movement of dumpers.

4.4.5 Depth opposite Bulk Berth:

BIS: 4651 (Part V) – 1980 recommends that the water depth should be 10% more than the loaded draft of design vessel in the sheltered parts viz. berths and hauling out spaces. The depth requirement in the area opposite the bulk berth was calculated and is given below:

Table 11 Depth requirements in front of berth

<table>
<thead>
<tr>
<th>Water depth at proposed berth</th>
<th>Under Keel clearance (%) of draft</th>
<th>Margin for siltation and squat allowance (approx. m)</th>
<th>Depth (m)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum draft of barge considered – 5.0</td>
<td>10</td>
<td>0.5</td>
<td>0.5</td>
<td>6.0 m</td>
</tr>
</tbody>
</table>
4.4.6 Deck Elevation:

BIS: 4651 (Part V) – 1980 recommends that the deck elevation is recommended to be at or above highest high water springs plus half height of an incident wave at the berth location plus a beam clearance.

Considering all the standard provisions, it is recommended to keep the deck elevation at +7 m above CD.

4.4.7 Turning circle dimensions

The turning circle, required to swing and berth the vessels, is very important and must have proper configuration, dimensions and access. As per IS: 4651 (Part V) – 1980, the minimum diameter of the turning circle should be 1.7 to 2.0 times (1.7 for protected locations and 2.0 for exposed locations) the length of the largest vessel.

Keeping these requirements in view, the dimension of the turning circle would be as 200 m. However, proposed berthing area has natural draft of more than 6 m therefore no artificial turning circle is required. Turning area can be marked with navigational aids.

4.5 Storage Requirements

In present project, where the berth and yard are separated from about 9-10 kms of distance therefore it is proposed to create intermediate storage. This storage will be for mainly semi-mechanised cargo. Storage area will serve following purposes:

- Storage of cargo during any exigency
- Enhance the productivity in case of requirements
- Inadequate space in plant area in case of any seasonal peak/

The storage requirement at port for a particular commodity is mainly determined by the dwell time of the cargo at terminal. It is a common practice to assume a dwell time of 20-30 days for imported bulk cargo like Coal. It should also be ensured that the storage capacity at the port for a particular cargo is at least 1.5 times the parcel size per berth so as to allow faster turnaround and/or avoid delays to unloading of the ship.

Looking to above considerations, about one parcel of 40,000 to 50,000 tonne of storage should be developed at intermediate storage area.
5 PLANNING OF FACILITIES

5.1 Planning considerations

The main criteria that have been considered in arriving at selected marine layout. The main factors are:

- Availability of area with suitable draft
- Proximity with captive mine and plant
- Suitability to provide required waterfront and land area for the infrastructure requirements
- Adequate back-up space behind the berths for cargo handling and storage
- Optimum capital and maintenance dredging
- Suitability for development in phases with traffic growth
- Environmental issues
- Ability to construct and commission 1st phase development on a fast track implementation schedule
- Optimum capital cost of the overall development and especially of 1st phase

5.2 Planning of marine facilities

Productivity is a key element which needs to be worked out very carefully. The proposed jetty for development of Dry bulk terminal is "L" Shaped with required approach length.

The cargo complexion under dry bulk includes Clinker, Cement, Limestone coal and Pet coke for the captive terminal. As the transfer of dry bulk between berths and stockyard is through conveyors and dumpers, these berths do not require contiguity with land. The access to the shore for operations and maintenance is provided through an approach bund/ trestle connecting the berths to the onshore area.

Overall master planning comprises of seven berths (820 m) to meet the traffic demand. Berths are located in natural water depth of about 6 m. 3.2 km of approach connecting from onshore to jetty is also planned. Overall map is shown in CJCPK-PFR-DWG-001

A mechanised system is proposed to handle clinker, cement and limestone at one bulk berth in Phase I and provisions for two mechanised berths in Phase II. The berths shall be provided with a conveyor system which will carry the Cement/Clinker from directly plant area to the berth area.
### Table 12 Phase wise planning of Berths

<table>
<thead>
<tr>
<th>Phase</th>
<th>Number of Berths</th>
<th>Berth Length</th>
<th>Number of Mechanised Berth</th>
<th>Number of semi mechanised berth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>3</td>
<td>360 m</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Phase II</td>
<td>4</td>
<td>460 m</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>820 m</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

The minimum width of the berth, keeping in view the rail span of the ship loaders, service ducts, dumper movements and the end clearances should be about 28m. The total length of dry bulk berths is taken as 360 m. Considering the additional mechanization requirements in Phase II, width of berth may be increased during detailing stage.

In view of the above arrangement of berth and its location, piled foundation is assumed as best option for the structural system. The proposed indicative structural scheme consists of four rows of vertical bored cast-in-situ RCC piles.

In the transverse direction, main beams will be provided supported over the piles, which in turn support beams in the longitudinal direction. Bollards and rubber fenders will be provided along the berthing face. A service trench will be provided on the berthing side to accommodate cables/utilities.

The typical cross section of bulk berths are as shown in Drawing CJCPK-PFR-DWG-005 & DWG-006.

### 5.3 Dredging

Berths are proposed in natural water of at least 6 m depth. Therefore there is a no requirement of dredging in front of berth area. Entire navigational channel from the anchorage to berth pocket has varying depths. Our bathymetry survey will be carried out post monsoon which will identify the requirement of dredging or deepening of pockets if any. However, based on the available information it is evident that no dredging is required for immediate phase.

### 5.4 Site Grading

Based on the secondary information, existing average ground level at the backup area is about +5 m CD and there would be a need to raise the formation level at site
to about +7.0 m CD to allow for planning of space for transit storage as well as better drainage system at site. The ground level is proposed to be +7.0 m CD and the total quantity of fill is estimated as 1.2 Lakh cum which can be sourced through suitable material from local sources.

Actual requirements will be optimized based on the topography survey results and engineering of structures.

5.5 **Rock bund connecting landside towards jetty**

Rock bund of length 3200 m is proposed from land side of facilities till approach trestle. Rock bund is proposed till – 2 m contour. Rock bund will have two basic components, core portion of lighter rocks/local available material followed by heavier armour rock layers. Typical section is rock bund considered for proposed captive jetty project is as shown in CJCPK-PFR-DWG-008.

The design of rock-bund will be determined based on the detailed analysis of the site specific data as well as soil conditions at the time of DPR.

5.6 **Approach Trestle**

The approach trestle will connect the rock bund to jetty. The length of approach trestle is about 150 m. Trestle will also have provisions for class AA loading and stable side slopes on both the sides such that it should be protected against the wave action. Construction of 150 m long x 11 m wide approach will be with RCC deck supported Bored Cast-in situ pile foundation.

5.7 **Right of way from Plant to Onshore terminal**

Right of way (ROW) of 30 m will be required connecting the Clinker plant to Onshore terminal area. This ROW will comprise of

1. Two lane road
2. Provisions for conveyors
3. Utilities like electricity, water, power, Storm water drainage etc.
5.8 Project co-ordinates

Following table shows proposed waterfront and backup/onshore area co-ordinates for overall development:

**Table 13 Preliminary backup co-ordinates**

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Co-ordinates (Backup)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X = 460593.000        Y = 2625077.000</td>
</tr>
<tr>
<td>2</td>
<td>X = 460648.000        Y = 2625306.000</td>
</tr>
<tr>
<td>3</td>
<td>X = 460760.000        Y = 2625028.000</td>
</tr>
<tr>
<td>4</td>
<td>X = 460813.000        Y = 2625247.000</td>
</tr>
</tbody>
</table>

**Table 14 preliminary waterfront co-ordinates**

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Co-ordinates (waterfront)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>X = 457023.918            Y = 2626335.887</td>
</tr>
<tr>
<td>B</td>
<td>X = 457273.918            Y = 2625902.874</td>
</tr>
<tr>
<td>C</td>
<td>X = 458139.944            Y = 2626402.874</td>
</tr>
<tr>
<td>D</td>
<td>X = 457889.944            Y = 2626835.887</td>
</tr>
</tbody>
</table>

Overall drawing with co-ordinates can be seen as CJCPK-PFR-DWG-003

Above co-ordinates are preliminary and it may change based on detailed investigations and approval from authority.
6 MHS SYSTEM

6.1 Overview of MHS System

Overview of Material Handling system of proposed facilities is shown in below figure:

![Diagram of MHS System]

Export - Mechanised (Clinker, Cement and Limestone)
- Barge Loader
- Conveyor from plant to jetty

Import - Semi Mechanised (Coal and Petcoke)
- Mobile Harbour Crane & Industrial Excavators & Truck Loading Hoppers
- Transport of material via dumpers / conveyor to storage yard / plant

Export - Semi Mechanised loading operations for Limestone
- Mobile Harbour Crane / Industrial Excavators & Truck Loading Hoppers
- Transport of material via dumpers from plant to jetty

6.2 Export Mechanised System - Barge Loader

6.2.1 General

A typical Bargeloader is a machine, used for loading bulk solid materials like iron ore, coal, clinker, fertilizers, limestone, grains into barges for transportation by sea or inland waterway. A barge loader generally consists of a loading boom with a belt conveyor having receiving point at the rear side to receive materials from feeder source or conveyor. Further there will be a base structure with stay or props to support the boom. The loading boom with its belt conveyor will elevate the material it receives from its source conveyor and transfer it up to its discharge end to drop the material into the barge hold by gravity.
6.2.2 Types of Barge Loaders

The barge loaders deployed for loading bulk cargoes can be broadly classified as:

a. Fixed Loaders

b. Mobile Loaders

A fixed loader is fixed at a point close to the middle along the length of the berth where the barge is moored. In other words it cannot travel along the length. It can still have other functions like slew, luff and shuttle or telescopic arrangements. As it is a fixed installation, the power supply system becomes simple as there will be no trailing cables. Also the feeding conveyor that precedes the loader can be easily connected to the loader with a transfer chute.

A mobile loader while retaining all the functions of a fixed loader can additionally travel along the length of the berth. It can be tyre mounted or rail mounted. This makes it versatile for handling barges of different lengths.

6.2.2.1 Fixed Barge Loader - Broad Arrangement

In the case of a fixed barge loader the support structure of the loading boom will be mounted on the berth. The fixed point acts as a fulcrum around which the boom rotates. This radial or rotating feature of the boom will to some extent allows reaching of material to various locations in the hatch or into different holds (in case of barge with more than one hold).
The required barge loader for Kori Creek facility is meant for loading a barge of 8,000 DWT with a LOA of 100 m and the loader needs to reach the length of entire cargo hold. A typical barge of this LOA will have its cargo hold length of 80 m. For a fixed barge loader to reach such barge hold fully need a lengthy boom of more than 50 m and yet will not be able to reach the full width of hold for a considerable length of hold. This would necessitate frequent mooring of the barge to maintain even keel. Alternatively an excavator cum dozer has to be deployed inside the hold to spread the material evenly.

Such a proposition will be unviable as frequent mooring would mean dedicated mooring crew for the full duration of loading. For such mooring operation, the berth should be longer than normally required. Further for putting and taking out an excavator to carry out the task of spreading clinker/cement evenly for trimming would need an additional adequate crane as such type of excavator itself weighs about 12 tons.

6.2.2.2 Mobile Barge Loader - Broad Arrangement

A mobile barge loader is usually mounted on rails and sometimes on tyres and can move longitudinally in order to cover the whole length of the ship/barge. The boom also can be designed for telescopic movement i.e. Boom can move front and back and/or luff in and luff out so that it can fill all the corners of the barge holds. In reality, a mobile barge loader is a smaller version of Ship loader.

Mobile barge loaders for loading bulk materials into barges and small ships are widely used in many ports. Their mobility makes it possible to load a complete range of vessels with ease. It needs no civil foundation except the support structure for rails. Unlike a fixed loader, the loads on account of mobile loader can be spread more evenly on the berth structure with multiple wheels in each corner. The mobile loader can be easily fed from a fixed conveyor system viz., a source conveyor.

Thus a mobile barge loader with complete range of flexibility can have universal movements consisting of:

- Long travel movement of the complete loader along the length of the berth
- Luffing in or out of the loading boom
- Slew or rotation of boom
- Shuttling of entire loading boom or extending/retracting a part of it

A discharge chute into the barge’s hold with arrangement to extend or retract, thus regulating the height of free fall of material thus minimizing the generation of dust.

The final discharge point of the discharge chute inside the barge will have arrangement to direct/spread the material evenly.
A tyre mounted mobile loader is mounted on four sets of twin motorized tires with two sets on the front and two sets on the rear. Each set of twin tires is mounted at a vertical kingpin and can rotate 360 degrees about that vertical axis. Thus, without repositioning, it can be set up to travel in any direction. With the tail tires fixed, the front tires can be oriented and travelled for a slewing motion. The tyre mounted mobile loader can be trucked to the dock when required and removed after completion of loading. The rear end of a mobile loader is provided with a special trap with feeder into which bulk material is fed by means of a front end loader or dumper.

Tyre mounted mobile loaders are manufactured with booms of different shapes like straight boom, snake shaped boom. The straight or snake shape barge loader elevates the bulk material over the ship's deck to the hatch where it is discharged into the ship's hold. At the discharge, a special telescoping chute, with rotating, pivoting spoon, facilitates even and complete filling of the holds. Some designs have barge loaders equipped with radial or telescopic features with a chute thus offering universal trimming capabilities.

The rail mounted mobile loaders are similar in function as that of tyre mounted loaders except that their movement path is well defined and also their movement in longitudinal direction is faster as compared to tyre mounted mobile loaders. The loads on berths due to the loaders are applied at the crane rails only.

### 6.2.3 Conventional Barge Loader

Gantry and quadrant bridge type barge loaders are constructed in proven, eco-friendly designs and a wide range of sizes to service vessels from 2000 to 250,000 dwt. Rail-borne gantry mounted, slewing and shuttling boom barge loaders, which also have a certain luffing function, are designed to cover length of the barge through a combination of luffing, slewing and longitudinal travel. To enable vessels to berth, they are slewed parallel to the quay.
Barge loaders have certain advantages when compared to other type of loading mechanisms, such as

- Less pollution
- More efficient in operation under favourable conditions, like tranquillity, characteristics of cargo, etc.
- Less degradation of material during handling

6.2.4 Retractable (Shuttle type) or Telescopic Conveyor

Telescopic conveyor (Telestacker) may also be utilised for cargo movement from jetty to barge. This arrangement can be tailor-made for capacity of 1000 TPH cargo evacuation. The conveyor can be either wheel mounted or rail mounted. The design can be optimised as per manufacturer during detailed design stage.
Advantages:

- Eliminates the high cost of using a wheeled loader and driver
- Eliminates downtime
- Faster set-up and removal times
- The large range up to 1500 t/h and more
- Reduce production costs
- Long reach for barge operation
- Environmentally sound, windblown dust can be reduced

### 6.2.5 Recommended Barge Loader at Kori Creek facility

Since the barge loader (conventional type and telestacker) at Kori Creek facilities is proposed and to be fed using a conveyor system. Both the options are being considered for planning and engineering purpose.

The barge loader will have the following broad parameters:

a. Length of travel - For the full length of barge berth
b. Design capacity - 1100 TPH (1000 TPH Rated)

- Outreach - For a barge with a beam of 26 m
d. Feeding arrangement – To be fed from a feeding conveyor on the rear side through a travelling tripper.

e. Boom - Telescopic type or with shuttle arrangement
f. Discharge end - With a telescopic or spiral chute to restrict/control the height of fall
g. Rail span – To be confirmed by supplier.

In the Phase I, Tele stacker type of barge loader is being recommended to export the anticipated cargo whereas the conventional type of barge loader can be installed at later stage in the case of requirements for second stream of export cargo.

### 6.3 Conveying System

#### 6.3.1 Conveyor system from Plant to Jetty

The Clinker loaded at the plant is proposed to be transported directly to the vessel via conveyor. From the transfer point in the backup area of Clinker plant to transfer point of the jetty it is proposed to install one stream of conveyor of 1,000 TPH.

Based on the secondary information and reconnaissance survey of the proposed jetty & Clinker plant sites as well as the adjoining areas in the vicinity of the sites, a conveyor alignment connecting the plant stockpile and the jetty has been proposed.
The proposed belt conveyor routing between the jetty and plant has been planned avoiding the built up area as much as possible to minimize relocations.

6.3.2 Choice of conveyor system

Considering the distance between the Clinker plant stockpile and the jetty, the following two types of conveyors have been examined to arrive at the optimum type of system for the proposed project:

A. Troughed belt conveyor system

B. Pipe conveyor system

6.3.2.1 Troughed Belt Conveyor System

The proposed system shall consist of one stream of troughed pipe conveyor in covered overhead galleries from transfer point at the plant stockpile to jetty and further loading in barges.

6.3.2.2 Pipe conveyor system

The pipe conveyor system is essentially like troughed belt conveyor except that after the loading point at tail end, the belt passes through a series of belt folding idlers to form a tubular shape.

The pipe form is maintained throughout the length of transport by means of hexagonal arrangement of idlers around the belt. The pipe form is opened at the discharge end for transfer of material and again formed into pipe on the return run. In addition, the pipe conveyors have the flexibility to accommodate both the horizontal and vertical flights and the profile can be suited to meet the recommended conveyor alignment depending upon the terrain.

Advantages of the Pipe Conveyors

Pipe conveyors have following advantages in comparison to the conventional belt conveyors:

- Elimination of multiple transfer points
- Elimination of multiple drive units
- Elimination of spillage and dust generation
- Significantly lower power requirements
- Lower space requirement for installation
6.3.3 **Alignment of conveyor corridor**

Based on secondary data, proposed conveyor alignment has been developed. The proposed conveyor corridor is free from any major encumbrances and it does not pass through any inhabitation. This alignment may change during detailed project report stage after getting further information.

6.3.4 **Proposed conveyor system**

Considering the several advantages of the Pipe Conveyor System over the conventional Belt Conveyor system, a dual side pipe conveyor system is recommended for transportation of clinker/cement/limestone from the plant to the proposed jetty/marine terminal. In the proposed conveyor system, it will also be designed to transport unloaded coal/pet coke from the jetty to plant area.

Considering the future requirements and simultaneously loading/unloading arrangements, provisions of additional conveyor stream is kept between jetty and clinker plant of same capacity.

6.4 **Import - Export Semi Mechanised System**

During the development phase and low volume import and export cargoes, semi mechanized material handling systems are proposed using various equipment and transport combinations as follows.

6.4.1 **Mobile Harbour Cranes**

Various type of mobile harbour cranes available in the market. These cranes are selected considering its functionality, operation location, infrastructure requirement and cargo to be handled to suite techno-economic solutions for the project.

6.4.1.1 **Type of Mobile Harbour Crane**

There are basically two types mobile harbour cranes based on the mobility mechanism for its travel.

A. Tyre Mounted

B. Rail Mounted
6.4.1.2 Tyre Mounted Mobile Harbour crane

It is a tyre mounted rope operated portal crane. It has luffing and slewing boom with rope reeving system mounted on it. It can travel on tyre and have hydraulic jacking pads while handling the load. It can be used for Hook as well as Grab operations.

These cranes are available with different capacities and outreach. It can travel any location on jetty. Due to tyre mounted under carriage, vehicle cannot be passed under the crane. It can also be available in electric and diesel version. There is no special requirement of rail infrastructure for this kind of cranes.

6.4.1.3 Rail Mounted Mobile Harbour Crane

It is a Rail mounted rope operated portal crane. It has luffing and slewing boom with rope reeving system mounted on it. It can travel on Rail using wheel bogie carriage and handling the load. It can be used for Hook as well as Grab operations.

These cranes are available with different capacities and outreach. It can travel on straight line alongside location on jetty. Due to rail mounted movement and lifted carriage; vehicle can be passed under the crane. It can also be available in electric and diesel version. There is special requirement of rail infrastructure for this kind of cranes.
6.4.1.4 Proposed Mobile Harbour Crane

Considering the several advantages, project requirement and cost effectiveness, it is proposed to have tyre mounted mobile harbour crane on jetty to handle coal as an import cargo and limestone as an export cargo using grab operations. For import cargo, Barge will be unloaded using grab operations and discharge in to truck loading hopper. Further, cargo will be loaded to trucks and transferred to destination. For Export cargo, cargo will be transferred from plant through truck dumpers, unloaded at jetty and barge will be loaded using grab operations using mobile harbour crane.

6.4.2 Industrial Excavators

During the phase of development and cargo volumes requirements, barge sizes differ. For small barges like 2000 DWT, having lower beam and LOA can be handled using long boom industrial excavators with grab. It is available with various combinations of long stick and boom with high and low reach having different capacities. It can be selected considering the cargo to be handled, barge size, draft, water level available etc. It is also available in tyre mounted and crawler mounted versions.
6.4.3 Truck Loading Hopper

It is a simple Tyre mounted hopper generally used to load the truck dumpers. It can be moved or located anywhere using any auto motive movers to suite loader equipment reach. It will travel on tyre and stand on jacking pad during working. 2 sets of hydraulically/Electrically operated sector gates are installed at hopper bottom to control the loading flow. Controls for sector gates are located on hopper itself.

Material will be unloaded from barge and discharged to hopper using grab operation and further material will be transferred to the truck dumpers using sector gate operation.

6.5 Recommended Material Handling System

Following table shows recommended MHS for phase wise development:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Number of ship loader</th>
<th>Number of conveyor from plant to jetty</th>
<th>Number of industrial excavator to handle smaller barges per berth</th>
<th>Number of Mobile Harbour crane to handle bigger size barges per berth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Phase II</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

* Conveyor for Phase II will have adequate capacity to feed two ship loader/berths at a time.
### 6.6 Summary of proposed facilities for Phase I

The terminal facilities provided, for Phase I development has been presented in Table below:

**Table 16 Summary of Phase I Development**

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Marine Infrastructure</strong></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Berth Development for barges</td>
<td>360 m x 28 m</td>
</tr>
<tr>
<td>1.2</td>
<td>Approach Trestle</td>
<td>150 m long x 11 m Wide</td>
</tr>
<tr>
<td>1.3</td>
<td>Rock Bund</td>
<td>3200 m long X 12m Top Width</td>
</tr>
<tr>
<td>2</td>
<td>Intermediate storage area development for exigency operations</td>
<td>Backup Development (10 acres)</td>
</tr>
<tr>
<td>3</td>
<td><strong>MHS System</strong></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Conveyor from Plant to Jetty (1000 TPH)</td>
<td>Pipe Conveyor (9.220 km long x 1000 TPH) @ 1 Number</td>
</tr>
<tr>
<td>3.2</td>
<td>Ship Loader</td>
<td>1 No.</td>
</tr>
<tr>
<td>3.3</td>
<td>Industrial Excavators</td>
<td>(2 Nos)</td>
</tr>
<tr>
<td>3.4</td>
<td>Mobile Harbour Crane</td>
<td>1 No</td>
</tr>
<tr>
<td>3.5</td>
<td>Road Weighbridge (100 T)</td>
<td>For Road bound cargo</td>
</tr>
<tr>
<td>3.6</td>
<td>Truck loading Hopper with 2-Manual Sector gates, wheels</td>
<td>For Road bound cargo</td>
</tr>
<tr>
<td>4</td>
<td><strong>Supporting Infrastructure &amp; Utilities</strong></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>• Electrical distribution system &amp; IT communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Dust control system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fire fighting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Water supply and distribution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Storm water drainage works</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sewerage</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Fencing (Alongside the 10 acre plot)</td>
<td>3m Height with pre-cast panels</td>
</tr>
<tr>
<td>4.3</td>
<td>Approach road from plant to jetty</td>
<td>Bituminous 2 lane motorable road x 8.5 km long x 7.5m wide</td>
</tr>
<tr>
<td>5</td>
<td><strong>Buildings</strong></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>Terminal administration building</td>
<td>500 sqm</td>
</tr>
<tr>
<td>5.2</td>
<td>Electrical substation building</td>
<td>240 sqm</td>
</tr>
<tr>
<td>5.3</td>
<td>Weigh Bridge</td>
<td>2 Nos</td>
</tr>
<tr>
<td>5.4</td>
<td>Security office &amp; Gate house complex (Pota Cabin)</td>
<td>2 Nos</td>
</tr>
<tr>
<td>5.5</td>
<td>CSS</td>
<td>1 Number - On Jetty</td>
</tr>
<tr>
<td>5.6</td>
<td>Wharf office (Pota cabin)</td>
<td>1 Number - On Jetty</td>
</tr>
<tr>
<td>5.7</td>
<td>High Mast</td>
<td>Three on Jetty and three at backup yard</td>
</tr>
<tr>
<td>5.7</td>
<td>Toilet block</td>
<td>Two on Jetty and two at backup yard</td>
</tr>
</tbody>
</table>
7  SUPPORTING INFRASTRUCTURE

7.1  Electrical System

The mechanised handling systems for bulk loading is power intensive and hence require considerable high tension electrical power for their operation. This apart the illumination of the stacking areas, roads and auxiliary services viz., firefighting system, dust suppression system, and port buildings would all require considerable HT and LT power.

The various terminals within terminal will contain all the features of a modern first class terminal, and as such will require a reliable power supply system.

Based on the proposed port facilities the total installed power load for the proposed Phase 1 is around 6 MVA.

Power supply to proposed captive jetty is to be tapped from Cement Plant which is located at around 9 km area. Adequate power connection with step down arrangement will be made in cement plant area and it is proposed that the transmission lines will be extended up to the proposed location of the main receiving substation.

Incoming Supply – System Requirements

The HT power shall be brought at 33 KV till the boundary of the stockpile area, where the main substation shall be located.

The distribution of power shall be through this secondary substation.

The illumination level in various areas will be maintained as per the industry standards and shall generally be as in Table below:

<table>
<thead>
<tr>
<th>Area</th>
<th>Lux level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substation, pump house and fire houses</td>
<td>250</td>
</tr>
<tr>
<td>Roads and Parking</td>
<td>15-20</td>
</tr>
<tr>
<td>Berth</td>
<td>50</td>
</tr>
<tr>
<td>Conveyor gallery</td>
<td>50</td>
</tr>
<tr>
<td>Stockpile area</td>
<td>20-30</td>
</tr>
<tr>
<td>Gate house, buildings</td>
<td>50</td>
</tr>
</tbody>
</table>
33 KV feeders from main receiving substation will feed to secondary substation for the bulk terminal. The substation will be equipped with 11KV /0.415 KV transformer of suitable capacity to cater to LT loads of different buildings for illuminations, area lighting, firefighting, water supply system, road lighting etc.

7.2 Firefighting system

Firefighting system of the terminal will be planned, implemented and maintained as per best industry norms considering the size of the facility. It will be conformed to Tariff Advisory committee's Guidelines and meet the relevant codal provision. System comprises Fire pump house, Hydrants network, water storage Tank, Pumping stations with standby arrangements.

Sea water based firefighting system is recommended near water front (jetty side) to cater fire emergency of jetty and temporary stacking and utility area.

Diesel engine operated firefighting pumps and electrically operated jokey pumps will be installed in firefighting pump house. Hydrant and fire monitor system will be installed with pipe network. Water pipe line for berthing face shall preferably be routed through conveyor gallery. Pipe line is supported at regular interval.

7.3 Water supply

The potable water demand for the phase 1 development of captive jetty has been worked out to about 200 persons @ 45 Litres = 9000 Litres per day. Demand for firefighting and dust suppression will be separate. There is no government or any other assured water supply source for industrial consumption in the surrounding areas. To meet the water demand of the present proposed development, the possibilities of installing a Desalination Plant is being explored by ACL.

7.4 Road Network

7.4.1 Road connecting from cement plant area to captive jetty

Two lane motorable road is proposed for movement of cargo (Limestone and Coal) between cement plant area and jetty area. Length of this road will be approx. 8.5 km and will be of bituminous type. Adequate gate arrangement with security set up is also proposed at the entrance of captive jetty terminal. Road is planned in such a way that natural flow of water is not hindered and suitable box culvert and small bridge is considered while connectivity.
7.4.2 Internal Road

Internal road network is planned within the operational areas of terminal as well as for interconnectivity between the jetty to backup area. Two lane motorable road is proposed within the terminal area for cargo handling movements. This road will be motorable road to suffice the requirement of dumpers and trailers for carrying out EXIM requirements of captive jetty.

7.5 Green Belt

A green belt will be developed around the periphery of the terminal by plantation of suitable trees and bushes. Open area pockets inside the port not required for hard core operations will be landscaped and greened. Avenue plantation will be undertaken by planting ornamental trees and bushes alongside internal roads as well as road connecting from jetty to cement plant area.

7.6 Dust control system

Dust control equipment is proposed for efficient control of dust pollution to the environment during storage and handling of various cargo the berth & stockyard. An efficient dust control system will suppress/collect dust particles before it becomes airborne.

7.7 Buildings in the terminal area

Suitable number of buildings as per their functional requirements shall be provided in the terminal area. Various buildings in the terminal are as follows:

- Substation building
- Operation & administrative Building
- Weigh bridge, Stores Worker’s toilet, septic tank, water tank for port users.

7.8 Security

Keeping in view the importance of various areas in the terminal the following proposals are made:

- Fencing adjacent to land area will be provided with a 3.0 m high with pre-cast panels
- A security office and check post at the entrance to the port.
7.9 Sewerage

Number of users is limited in the proposed facilities and the area of terminal and jetties are relatively small, therefore all the functional buildings will be provided with impermeable septic tank and soak pit arrangement. Sewage treatment plant (STP) will be planned and developed in case of the requirements.

7.10 Storm water Drainage

Drainage system is for disposal of precipitation inside the demarcated storage area as well as along the road corridor from plant to storage area. The drainage system should also take care of the natural drainage courses passing through the area either barring the outside water from entering the premises and drain out the same through some other path or the internal drainage shall be designed so as to take care of the discharge of external drain passing through the area.

The area drain can either be rectangular or trapezoidal surface drain or underground drain with manholes at suitable interval for entry of storm water. The details of drain with invert level etc. will be worked out after detailed study of topography of the nearby area, rainfall runoff analysis etc.

Before discharging the collected storm water into the main drainage system of the port it would be passed through the necessary filters for further reduction of PPM.
8 PROJECT SCHEDULE

The main components for the Development of captive Port facilities at Koriyani village comprises of construction of berths and approach trestle, supply and installation of material handling equipment, onshore infrastructure.

Overall project is likely to be completed in 36 months. It is estimated that about 12 months of time will be required to complete all the studies, engineering, clearances and approvals. Thereafter, the construction time of Phase 1 development of captive jetty at Koriyani is likely to take over 24 months.
9 BLOCK COST ESTIMATES FOR PHASE I DEVELOPMENT

The block cost estimates of Phase I has been prepared based upon available site information, suitable assumptions, wherever required, and the database available for similar projects. These costs are based on preliminary block planning and need to be developed and refined during the detailed project stage, and, therefore, costs shown under some of the items may undergo revision.

It is estimated that cost of Phase I development will be around 300 Crores Rs excluding conveyor system from plant to jetty.
10 WAY FORWARD

The following action plan is recommended for implementation of the project:

1. Preparation of detailed project report by including following studies:
   1.1. Carrying out detailed site specific studies and investigations to provide a database for detailed design of port facilities
   1.2. Engineering of the Marine Structures, material handling system and onshore infrastructure to work out detailed cost estimates
   1.3. Mathematical model studies on the final layout for further optimisation.
2. Coordination with state government for land acquisition
3. Preparation of EIA report and approval of MoEF
4. Coordination with various agencies for getting project/statutory approvals.