Pre - Feasibility Report

Development of Captive Jetty, Conveyor Corridor with Backup Facilities and Approach Road for Cement Bulk Terminal (CBT) at Village Shahbaj and Shahpur, Taluka Alibag, District Raigad, Maharashtra

Adani Cementation Limited
Ahmedabad

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Contents

1 BRIEF SUMMARY

Adani Cementation Limited (ACL) proposes to set up Captive Jetty, Conveyor Corridor and Approach Road to cater traffic load of 5 Million MTPA capacity for Raigad Cement Bulk Terminal (RCBT) proposed along Amba River at village Shahbaj and Shahpur, Taluka Alibag, District Raigad, Maharashtra. The proposed project site is a part of Survey of India Toposheet No. E43H2. 2 MTPA PPC/PSC/OPC shall meet the requirement of proposed Bulk Terminal and other 3 MTPA commodities (Clinker, Flyash, Slag, Coal/AFR will be used for trading purpose).

It is estimated that around 6 hectare areas including 0.6497Ha. Mangrove Reserved Forest will be required to establish the proposed Captive Jetty, Conveyor Corridor with Backup storage facilities and Approach Road. Around 2.2 hectare has been allocated for the Berthing Jetty, 1.3 hectare (including 0.6497Ha. Mangrove Reserved Forest) will be used for Conveyor Corridor & Approach Road and 2.5 Ha shall be dedicated for Backup and storage facilities as per permissible activity in CRZ - Ill (Rural) area.

Estimated power demand will be less than 3MW and which will be sourced from MEB substation, approx. 7 km distance.

The water requirement will be limited to drinking purposes only i.e. around 500LPD and it will be sourced from local approved vendors.

ACL has planned to develop captive jetty to handle following materials for its proposed Cement Bulk Terminal:

Material	Incoming/ Outgoing	Quantity (MTPA)	Type of Loading/Unloading	Designed Handling Rate (TPH)
Clinker	**Incoming**	1.0	Grab Unloader	400
Cement	**Incoming**	2.0	Self-discharge Vessel	1000
Fly Ash	**Incoming**	0.5	Self-discharge Vessel	420
Slag	**Outgoing**	1.0	Mechanized	1000
Coal	**Incoming**	0.5	Grab Unloader	500
AFR	**Outgoing**		Mechanized	100

The required manpower during construction phase will be around 40 and during operation it will be less than 10
The nearest Railway Station is 'Pen' located at about 8km from the proposed project site. The nearest Airport is 'Chhatrapati Shivaji International Airport at Mumbai' located at about 80km from the proposed project site. The nearest habitation is 'Shahbaj' located at about 2km from the proposed project site.
It is estimated to complete the project within 24months from date of execution considering 6months for 'Main Machinery Ordering' and 18months for construction.
The estimated project cost is around Rs. 172 Crore

2 INTRODUCTION

2.1 INTRODUCTION

Adani Cementation Limited (ACL) proposes to set up Captive Jetty, Conveyor Corridor and Approach Road to cater traffic load of 5 Million MTPA capacity for Raigad Cement Bulk Terminal (RCBT) proposed along Amba River at village Shahbaj and Shapur, Taluka Alibag, District Raigad, Maharashtra.

The proposed Jetty will handle Cement, Fly ash & slag, Clinker, Coal, AFR in phase wise manner. Looking to the scale of cargo potential and facility requirements, it is imperative for ACL to have dedicated captive facilities for the handling of above mentioned materials in Dharamtar Creek, Maharashtra.

ACL plans to develop a dry bulk terminal along with ancillary infrastructure facilities at the proposed location to handle estimated throughput in phased manner. These facilities will be state of art, meeting the best of international bench marks in respect of quality, efficiency, economy and sustainable productivity. Berths will be designed with required facilities to carry such cargo load and connected to back up yard through approach trestle. In the above background the captive jetties are proposed inside the Dharamtar creek Amba River and back up facilities are proposed in the adjacent available land at village Shahbaj in Raigad district. This report outlines the salient features of the proposed development for the same.

2.2 PROJECT PROPONENT – ADANI GROUP

ACL is incorporated in December 2016 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, multimodal logistics, power generation and transmission, and gas distribution.

ADANI Group is manned by experienced and highly qualified professionals including technocrats of repute. The team has demonstrated capabilities in conceptualization and implemen-

tation of large projects excellent records of establishing benchmarks in the industry. ADANI Group has rich and extensive experience of liaison with government agencies, import, funding etc. With this track record of the organization in tying up finances, flow of funds will not pose any problem for implementation of the proposed project of its Cement Division.

Adani Cementation Ltd (ACL) has been formed for development of a number of Cement Projects (Integrated Cement Plant, Grinding Units & Limestone Mine).

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, and Korea etc. AEL extractive capacity of thermal coal has increased threefold to 4 MMT in 2014 and aim to extract 200 MMT per annum by 2020. AEL is 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 capacities by 2022.

Logistics Vertical

Adani Port and SEZ Limited (APSEZL) has extensive experience in design, construction, financing, operation and maintenance of world class ports with ability to create support infrastructure. It was incorporated as Gujarat Adani Port Limited in May 1998 and commenced phased operation at Mundra Port in October 1998. Adani Ports & SEZ handled over 168.72 million tons of cargo in 2016-17 across all ports in India. This makes us the no 1 port in India in terms of throughput and revenue.

APSEZL operates 8 ports / terminals spread over 5 maritime states of India- Gujarat, Goa, Tamilnadu, Andhra Pradesh and Odisha. APSEZL has around 40 berths to handle dry, liquid and container cargo; and 2 single point mooring facilities at the ports of Mundra, Tuna, Dahej, Hazira, Goa, Katupalli, Vizag, Ennore and Dhamra.

APSEZ's operational facilities has pan India presence and is equipped with all the modern cargo handling facilities which are not only best in class but capable of handling biggest vessels calling to Indian ports in dry, liquid and container categories.

2.3 PROPOSED DEVELOPMENT

It is proposed that the port facilities shall be developed commensurate with traffic growth. Salient features are described below:

- Barge berth having total length of 620 m and 35 m wide having mechanised handling system
- Development of CBT unit in non-CRZ area
- Captive Jetty (with related utilities and Amenities), plant approach road and the right of way of conveyor between jetty and bulk terminal unit in CRZ area as per the CRZ notification
- Approx. 535 m of conveyor connecting from jetty to CBT unit area
- Dredging in berth pocket area
- Unloading mechanism at jetty: self-discharging vessel/ mechanised unloading
- Support Back up Infrastructure for operations and maintenance of the proposed facility (Water, Power, Buildings, utilities and amenities including Fire Fighting, safety and security systems and environment protection measures).
- Design vessel size Barges / smaller vessels up to 8000 DWT
- Cargo handling capacity 5 MTPA
- Backup area development
- Incremental Supporting Infrastructure.

2.4 PRESENT SUBMISSION

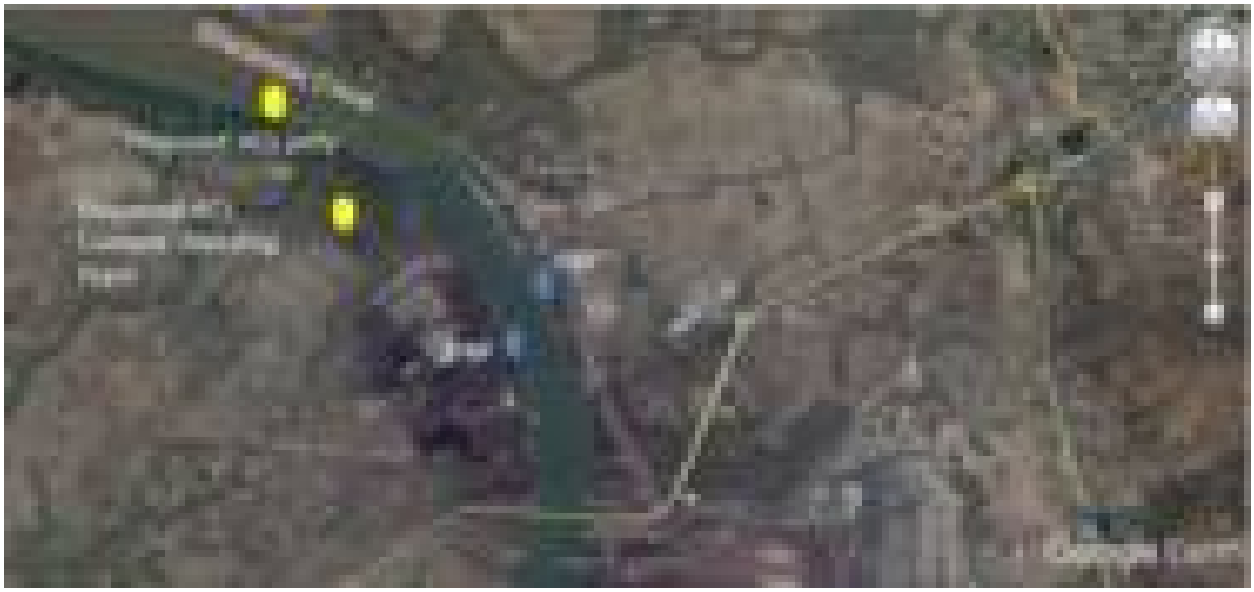
The present submission is the Techno Economic Feasibility Report for "Development of Captive Jetty for Cement Bulk Terminal at village Shahbaj and Shahpur, Raigad", Maharashtra. This report is organised in the following sections:

Section 1	:	Introduction
Section 2	:	Traffic Projection
Section 3	:	Site Conditions
Section 4	:	Facilities Requirement
Section 5	:	Planning of facilities
Section 6	:	Material Handling System
Section 7	:	Supporting Infrastructure
Section 8	:	Environmental Aspects
Section 8	:	Implementation Schedule and Block Cost Estimate
Section 9	:	Financial Analysis

3 SITE CONDITIONS

3.1 GEOGRAPHICAL LOCATION

Proposed ACL jetty is located on the right bank of Amba River (i.e. Dharamtar creek) about 25 NM from Mumbai Port lighterage area and 14 NM from Mumbai Port inner anchorage. It is situated inside the creek at latitude of N 18° 42' 20" and Longitude of E 73° 1' 11".



3.2 CONNECTIVITY

Proposed site is well connected through the following modes of transport:

Table 3-1 Connectivity to site

Mode	Details
Road	Proposed ACL project connects to central Maharashtra and Mumbai via Pen village. Pen is located at around 8 km from the port. The port is connected to Mumbai via NH- 166A and to central Maharashtra via SH -88 Pen-Khopoli road and NH-4.
Railway	The nearest rail station is at Pen which is around 8 km from the plant area. There is an existing railway line of Rashtriya Chemical and Fertilizers (RCF) at around 1.5 km from the project site area. This railway line is developed and owned by RCF
Airport	Nearest airport is at Mumbai which is about 110 km from the project site

3.3 LAND FOR THE PROJECT

Identified land for the project is near Shahbaj and Shahpur village of Raigad District. It is estimated that around 6 hectare areas including 0.6497Ha. Mangrove Reserved Forest will be required to establish the proposed Captive Jetty, Conveyor Corridor with Backup storage facilities and Approach Road. Around 2.2 hectare has been allocated for the Berthing Jetty, 1.3 hectare (including 0.6497Ha. Mangrove Reserved Forest) will be used for Conveyor Corridor & Approach Road and 2.5 Ha shall be dedicated for Backup and storage facilities as per permissible activity in CRZ - lll (Rural) area.

Figure 1 Proposed backup area

Figure 2 Proposed waterfront area

Table 3-2 Co-ordinates of the project

No	Type of area	Latitude	Longitude

No	Type of area	Latitude	Longitude
1	**Water front**		
	A	18° 42' 52.10"N	73° 01' 03.80"E
	B	18° 42' 54.35"N	73° 01' 05.44"E
	C	18° 42' 59.40"N	73° 00' 42.10"E
	D	18° 43' 03.90"N	73° 00' 44.88"E
2	**Conveyor corridor connecting waterfront of jetty 2 to the proposed plant location**		
	C - 1	18° 42' 37.62"N	73° 01' 03.00"E
	C - 2	18° 42' 37.48"N	73° 01' 03.57"E
	C - 3	18° 42' 52.37"N	73° 01' 03.20"E
	C - 4	18° 42' 52.10"N	73° 01' 03.80"E
3	**Backup and storage facilities as per the permissible activity in CRZ - III (Rural) area**		
	B - 1	18° 42' 37.54"N	73° 00' 58.43"E
	B - 2	18° 42' 36.14"N	73° 00' 59.31"E
	B - 3	18° 42' 30.14"N	73° 01' 13.53"E
	B - 4	18° 42' 31.69"N	73° 01' 14.37"E

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

3.4 TOPOGRAPHIC FEATURES

Onshore facilities of the Terminal are planned in the land generally flat with average Ground Level above Chart Datum. There is no habitation in the proposed onshore Facilities area. The land for setting up the proposed Unit has moderate vegetation. Certain patches of the land may require level raising. Detailed of topography survey to be carried out and result will be incorporated during detailed project report stage.

3.5 NAVIGATIONAL CHANNEL

Dharamtar creek is a tidal creek and present navigable channel is 135 m wide and around 2.5 to 3 m deep notified channel for navigation in the Dharamtar Creek. Channel is earmarked till the railway bridge at the south and Gul Island in the north. Presently JSW and PNP are using the Dharamtar creek for navigation purpose. Current users of the creek take tidal advantage for navigation inside the channel.

With available depth, presently barges of 2000-2500 DWT (Approx. L- 80 m, B: 16 m and D: 3.0 m) are handled in Dharamtar creek. Barges are handled at the port only during high tide.

Table 3-3 Details of anchorage for Dharamtar Creek

Anchorage area	Water Depth available	Approx. Distance from the proposed jetty for ACL
Outer anchorage	-25 m to -30 m CD	25 NM

Inner anchorage	-11.5 m CD	14 NM

It is learnt that JSW has already dredged the entire navigational channel to -5.3 m CD. Following dredging in the channel, 24 x 7 navigability will be possible in the creek.

3.6 USERS OF DHARAMTAR CREEK

PNP Maritime Services Pvt. Ltd (PNP) and JSW Dharamtar Port Pvt. Ltd. (JSW) have an operational fair-weather barge handling port at Dharamtar. PNP Port handles about 3.6 Million Tonnes of cargo whereas JSW steel plant at Dolvi, Maharashtra, imports about 8 Million tonnes of raw materials such as coal, limestone, iron ore, dolomite, clinker, etc. at the port. Presently, ships arrive at the inner or outer anchorages of the Mumbai Port; which is common anchorage for all users of Dharamtar Creek and use ship's gear to transfer cargo to/from barges. The barges commute between the ship at anchor and the respective user's jetties through the Dharamtar creek.

3.7 BATHYMETRY

Based on the available old admiralty chart, depth at proposed jetty are in range of 2.5 to 3 m CD. However, JSW is carrying out dredging activities in entire channel area up to -5.3 m CD. ACL has proposed to carry out fresh bathymetry investigation in proposed berthing area and navigational channel, the results of the same will be utilised for planning of the facilities.

3.8 METEOROLOGICAL AND OCEANOGRAPHIC CONDITIONS

Main site conditions parameters which have significant impact on Planning and Design of the proposed backup yard and the captive Jetty for cement facilities are described here in below.

3.8.1 Climatic Conditions

Dharamtar generally has humid and muggy weather, which is influenced by its proximity to Arabian Sea. This proximity is the main reason for ups and downs of the temperature. The month of May is the warmest wherein the temperature spins between 32 degree Celsius and 40 degree Celsius with relative humidity of 86 %. January is coolest month with maximum temperature 24 deg C, minimum temperature 18 deg C with relative humidity of 69 %.

The monsoon months are June to September that record the average rainfall of 2300 mm.

3.8.2 Tides

The tidal datum planes with respect to Chart Datum at Apollo Bandar (Latitude 18^0 55' N, Longitude 72^0 50' E) taken from IN Chart 2016 are as shown in Table below:

Table 3-4 Tidal

Tide	Height (m) above CD
Mean High Water Springs (MHWS)	4.4
Mean High Water Neaps (MHWN)	3.3
Mean Low Water Neaps (MLWN)	1.9
Mean Low Water Springs (MLWS)	0.8

Site specific tidal observations are necessary for design purposes therefore tidal data collection at jetty location will be carried out during site investigations.

3.8.3 Currents

Current at the proposed site of the jetty is almost negligible as it has situated in the inner part of channel and is of the order of 0.7 m/s to 1.2 m/s.

3.8.4 Cyclones

In general the west coast of India is less prone to cyclonic storms compared to the east coast. From the information reported by India Meteorological Department (IMD) during 1877-1992, only 10 storms endangering the Mumbai coast have occurred in the above said period that is at a frequency of once in 12 years.

3.8.5 Waves

The predominant directions of waves on west coast in the deep sea are from SW to NW. Dharamtar creek is sheltered creek. The wave disturbance reduces as one enters the Dharamtar creek and wave disturbance at the proposed jetty would be almost negligible.

3.8.6 Humidity

Minimum is a little less than 65 % highest is about 85 %.

3.8.7 Visibility

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

3.8.8 Seismic Conditions

The area falls in active seismic zone as per IS 1893 (Zone III). This will be considered at the time of detailed design.

3.8.9 Geo-technical Features

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.

4 TRAFFIC PROJECTION

4.1 INTRODUCTION

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.

Industrialization is the better way for growth & employment & also it is a strategic location connecting Indian markets. The industrialization and infrastructure growth have to go hand in hand. Cement is major component in infrastructure growth. Total Cement production in the area and nearby state does not match the demand growth and hence new capacities have to come up concurrently. The proposed plant will ensure that the supply situation in Maharashtra is comfortable in the coming times, as growth is expected to propel demand.

Adani group is known for its environment friendly initiatives across sectors it operates in and strong reputation for sustainable growth. In line with the existing agenda to make India Power sufficient in the future sustainably cement manufacturing unit are being planned close to coal based thermal power plants the group operates. Disposal of fly ash is an environmental concern which is faced all coal based thermal power generating plants. Cement grinding can consume up to thirty five percent of fly ash produced in the power plants and thus reduce environmental concern.

The cement projects planned by group would also generate immense employment opportunities and significant contribution to the state & central exchequer., improvement of socio economics of the area by way of education, vocational training, animal husbandry, improving infrastructure facilities such as roads, transport, improvement in Drinking water supply, Medical facility etc. The Adani Group is committed to the development of the country and will put all efforts for comprehensive development of this area also as being practiced by us at other establishments.

4.2 FUTURE DEMAND & DOMESTIC / EXPORT MARKETS

The markets of interest for the proposed Bulk terminal unit have been depicted below

Figure 3 Markets of interest

The demand for different markets is given in the following table:

Table 4-1Demand of cement for different markets

Market	Consumption (MTPA)
Mumbai City	6.41
Mumbai Suburban/ Navi Mumbai	7.26
Raigarh	1.28
Thane	1.28
Mumbai Pune Corridor	8.54
Total	**24.77**

Mumbai-Pune Corridor is the biggest cement market with an estimated annual consumption of around 8.54 MT for FY 22, which is around 35% of the consumption in the total Markets of Interest. Navi Mumbai is the second biggest market with share of 30% followed by Mumbai city with share of 26%.

Optimized logistics have been a key challenge for the players in this region and low cost logistics both in term of inbound for raw material and distribution cost will be the key success factor in this region. Leveraging on the existing railway infrastructure and utilization of low cost sea logistics is expected yield greater advantage.

4.3 IMPORTS VS. INDIGENOUS PRODUCTION

Export Possibility

Currently there are no export plans from the project. Major production will be consumed in the state of Maharashtra.

Domestic/ Export Markets

The proposed cement production will cater to the cement demands in the state of Maharashtra.

4.4 LOCATIONAL ADVANTAGES

Site Selection Criteria:

- Strategically located in vicinity of hinterland
- Protected location and capable of accommodating barges/ Mini Bulk carriers
- Access to Amba river for inward transport of raw material (OPC/flyash/fine slag)
- Proximity to the sources of other raw materials such as fly ash and fine slag
- Availability of land, approach roads & accessibility
- Suitable topography of land and geological aspects
- Safe from site flooding possibility
- No archeologically important heritage monuments are located within 10 km radius.
- No declared biodiversity parks/sanctuaries are in the surroundings of site.

4.5 TRAFFIC SUMMARY

The main finished commodities from the plant will be Cement. The Cargo Volumes for entire masterplan are presented in the following Table:

Table 4-2Traffic Projection

Commodity	Incoming/Outgoing Commodity	Traffic (MTPA)
Cement	Incoming	2
Clinker	Incoming	1
Fly ash	Incoming	0.5
Slag	Outgoing	1
Coal/AFR	Outgoing (AFR), Incoming (Coal)	0.5
Total		5

The Berths, Conveying system and backup infrastructure shall be developed in phase wise manner with the requirement of facilities. While development of phase I, necessary provisions shall be kept for future expansions to meet Phase II cargo.

5 FACILITIES REQUIREMENT

5.1 DESIGN SIZE VESSEL

Selection of a maximum design vessel size for the cargo configuration of a proposed facility is among the most important inputs in the planning and design of facilities. In actual practice barges for transportation of the cargo may be carried in different sizes of vessels depending upon the availability of vessels for the transportation.

Proposed berthing facilities are likely to handle dry cargo like Fly ash and Cement. As understood upon completion of dredging, depth in the channel will in range of (-) 5.3 m, barges/ small bulk carriers will be the main size of vessels. The average vessel size for the proposed facility is around 2000 DWT to 8,000 DWT.
The dimensions of barges are shown in table below:

Table 5-1 Design vessel size

Tonnage (T)	Length (m) (Max.)	Beam (m)	Draft (m) (Max.)
8000 DWT	**125**	**23**	**5.0**
2000~2500 DWT	**80**	**16**	**3.5**

During the initial period, barges of around 2000 DWT may be used for cargo movement and will be serviced at proposed facilities. The marine infrastructure and shore based infrastructure shall be planned and developed to cater to the cargo forecast. Development of the terminal infrastructure will be carried out in phase wise manner.

5.2 SIZE OR MAGNITUDE OF OPERATION OF PHASE I

- Design vessel size – Barges / smaller vessels up to 8000 DWT
- Total quay length – Approx. 160 m
- Cargo handling capacity – 2 Million Tonnes per annum

5.3 OVERALL PLAN

For conceptualizing layout plans for the proposed facility, the requirements like navigation parameters, number of berths, cargo handling facilities, operational parameters, etc. are being identified. Based on that, suitable locations within the proposed port site have been identified where these facilities are to be developed.

The basic navigational needs for servicing the vessels are:

- Sufficient water depths and widths in approach channel
- Tranquillity conditions
- Adequate stopping distance for vessels of largest size
- Sufficient water area for easy manoeuvrability of vessels throughout the year
- Efficient fenders and mooring systems, etc.

5.4 BERTH REQUIREMENTS

5.4.1 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 unloading of the vessel/barge can be completed in faster and environmental friendly manner. 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.

5.4.2 Operation Time

Proposed berthing facilities will be developed within Dharamtar creek as anticipated, vessels in this channel will be large size seagoing barges. Working days for proposed project is considered to be 330 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 21 hours a day.

5.4.3 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, 2.5 hours per vessel call.

5.4.4 Handling Rates

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

Table 5-2 Handling rates for berth requirement calculations

Type of commodity	Export/Import	Type of loading /unloading	Designed Handling Rate (TPH)
Cement	Import	Mechanised	**1000**
Fly ash	Import	Mechanised	**400**
Clinker	Import	Mechanised	**800**
Slag	Export	Mechanised	**1000**
Coal	Import	Mechanised	**500**
AFR	Export	Mechanised	**100**

5.4.5 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 5-3 Average Parcel Size

Commodity	Parcel Size (MT)
Cement	8000
Fly ash	6600

5.4.6 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 berth and with random arrival of vessels, the berth occupancy levels have to be kept low to reduce this detention. 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 65% in phase-1 & 60% in Masterplan.

5.4.7 Berth Requirements

Based on the considerations discussed above, the requirements of cargo handling berths have been calculated as shown in table below.

Table 5-4 Berth Requirement for Master Plan

S. No.	Particulars	Unit	IMPORT		EXPORT		IMPORT	
			Cement	Fly ash	Slag	AFR	Clinker	Coal
1	Traffic Forecast	**MMTPA**	**2**	**0.5**	**1**	**0.15**	**1**	**0.35**
2	Average Parcel size	T	8000	6600	8000	2000	8000	2000
3	No. of Barges Calls per Annum	No.	250	76	125	75	125	175
4	Designed Handling Rate for mechanised system	TPH	1000	400	1000	100	800	500
5	System efficiency	%	65%	65%	65%	65%	65%	65%
6	Effective unloading rate	TPH	650	260	650	65	520	325
7	Time Required at Port Per Barge							
a.	Handling Time	Hours	12	25	12	31	15	6
b.	Berthing / Deberthing & Miscellaneous Time	Hours	2.5	2.5	2.5	2.5	2.5	2.5
c.	Total Time per Barge	Hours	15	28	15	33	18	9
8	Total Berth Days required for Barge	Days	176	101	88	119	106	72
9	Total Available Days per annum for operations	Days	330	330	330	330	330	330
10	Berth Availability	**%**	60%	60%	60%	60%	60%	60%
11	Total Berths Required	Number	0.89	0.51	0.45	0.60	0.54	0.36
12	Number of berths provided	Number			4			

Based on the above calculations, four numbers of berths will be required to handle the proposed cargo in master plan. Two berths will be dedicated for Cement/Fly ash handling whereas remaining two berths will be utilised for coal, clinker AFR and Slag.

5.5 NAVIGATIONAL

As a prerequisite for planning the layout of the proposed berth and related backup facility, it is essential to set the basic criteria for the design of various components like navigational aspects to handle different types of vessels likely to be handled in existing channel of Dharamtar Creek. These conditions are related to the marine environmental conditions at the location.

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.

5.5.1 Channel width Requirements

The width of the proposed navigational channel has been calculated based on the maximum beam of the largest barge to be used for the transportation of cement and fly ash. The maximum beam of largest vessel (8,000 DWT – Bulk Cargo vessel) is 24 m.

The channel is aligned considering the following aspects:

- Predominant wind, wave and current directions
- Channel aligned to reach the required deep water contour in the shortest possible distance and aligned along the deepest available bed depths (to reduce the quantity of dredging required)

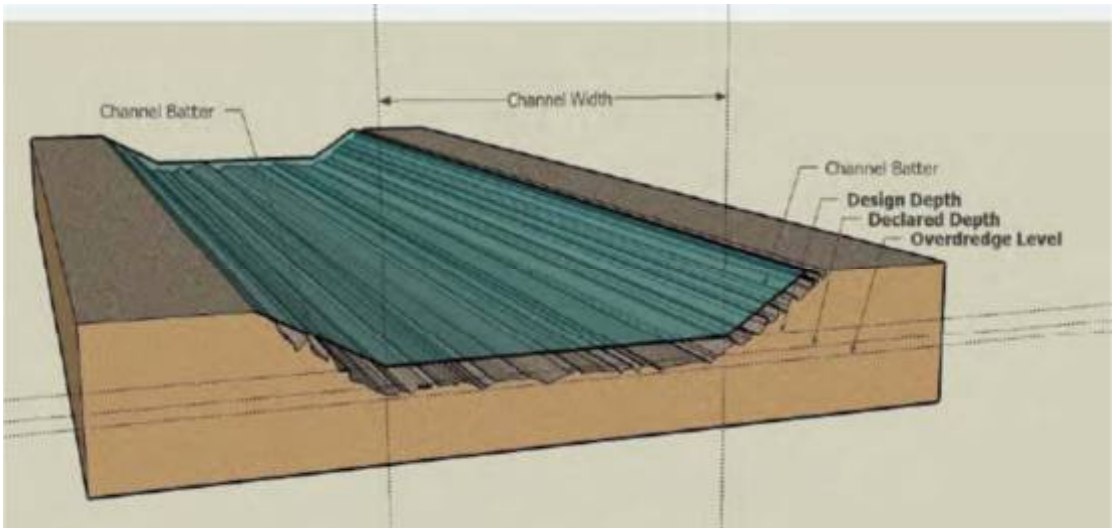


Figure 4 Typical Cross Section of Approach Channel

Based upon the guidelines given in the PIANC document titled "Approach Channels – A Guide to Design" approach channel width has been calculated and the width of about 100-120 m for one way movement is required for navigation of 8000 DWT barges.

5.5.2 Channel Depth

The depth in the channel should be adequately greater than the static draft of the vessels using the waterway to ensure safe navigation. Generally, the depth in the channel is determined by:

- Vessel's loaded draft
- Trim or tilt due to the loading within the holds
- Ship's motion due to waves, such as pitch, roll and heave
- Character of the sea bottom, soft or hard
- Wind influence of water level and tidal variations

The maximum fully laden draft for design vessel is a 5.0 m. Considering the above factors and guidelines given in PIANC, the under keel clearance is taken differently for different areas and the depths required in the navigation channel at the proposal berthing area are worked out and presented below.

Table 5-5 Dredged depth requirements in proposed channel

Ship Size	Approach channel (Loaded draft+20% UKC) – Minimum tidal advantage of 0.8 m
8,000 DWT (5 m Draft)	5.3 m

As the mean highest low water is about +0.8 m CD at Apolo bunder, tidal advantage of +0.8 m during the traversing of the design ship through the channel area is

considered for navigational channel. Taking advantage of tide while entering and leaving the port is a normal practice in major ports.

5.5.3 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 navigation area for maneuvering
- 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 125 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.

5.5.4 Width of Bulk Berth:

Width of the berth is based on the functional requirement of conveyors, loading equipment, unloading equipment and adequate maneuvering space for other equipment. A total width of 35 m has been provided, keeping a provision for front clearance and conveyors and maneuvering space for other equipment and movement of dumpers.

5.5.5 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 5-6 Depth requirements in front of berth

Water depth at proposed berth	Under Keel clearance		Margin for siltation and squat allowance (approx. m)	Depth Requirement (m)
	(10 % of draft)	in m		
Maximum draft of barge considered – 5.0 m	0.5 m		0.5 m	6.0 m

5.5.6 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 and existing jetty levels in the vicinity, it is recommended to keep the deck elevation at +7 m above CD.

5.5.7 Port Crafts

No Tugs are envisaged for proposed facilities as barges will be of self-propelled types. In case if it is required during severe weather conditions then it will be taken on hire basis.

5.6 STORAGE REQUIREMENTS

The storage requirement at port/terminal for a particular commodity is mainly determined by the dwell time of the cargo at terminal. Since proposed facilities are more of transit facilities, It should also be ensured that the storage capacity at the terminal for a particular cargo to allow faster turnaround and/or avoid delays to unloading of the ship.

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

Table 5-7 Dwell time for various commodities

S No	Department	Storage, days
1	OPC cement	5
2	Fly Ash	14
3	PPC Cement	4
4	Coal /AFR	4
5	Clinker	8

6 MARINE AND ONSHORE FACILITIES

6.1 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
- 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 development on a fast track implementation schedule
- Optimum capital cost of the overall development and especially of 1st phase

6.2 PLANNING OF MARINE FACILITES

6.2.1 Jetty structure

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

The cargo complexion under dry bulk includes Cement and Fly ash for the captive terminal. As the transfer of dry bulk between berths and stockyard is through conveyors, berth will not require contiguity with land. The access to the shore for operations and maintenance is provided through trestle connecting the berths to the onshore area.

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.

6.2.2 Dredging

As per secondary sources, JSW is carrying out dredging up to 5.3 m in entire navigation channel area. Minimal dredging will be required in front of proposed berthing area. The indicative level capital dredging estimates work out to 60,000 m3 for entire berthing area. The dredge material will be utilized for area development.

6.2.3 Site Grading

There would be a need to raise the formation level at site to allow for planning of space for storage as well as better drainage system at site. The ground level is proposed to be +7.0 m CD and the quantity of fill is can be sourced through suitable material from local sources/ through dredging material. Actual requirements will be calculated based on the topography survey results.

6.2.4 Approach Trestle

The approach trestle will connect the land side of facilities to jetty area. The length of approach trestle is about 435 m. The approach shall be design for class AA loading and stable side slopes on both the sides such that it should be protected against the wave action as well as environment protection to safeguard mangroves.

6.3 LAND USE PLAN

The land use plan has been prepared after identifying the requirement of land for various port related activities of the proposed berthing facilities. While preparing the land use plan the extent and limits of surrounding development, limitation/ development needs of infrastructural facilities, ease of access, cargo handling requirements, environmental and safety requirements have been given due consideration.

7 MATERIAL HANDLING SYTEM (MHS)

7.1 TECHNICAL PLANNING OF OVERALL FACILITIES

7.1.1 Introduction

The plant comprises of cement Bulk Terminal facility with a rated capacity of 2.0 MTPA cement production. OPC/PPC/PSC cement will be received from ACL Lakhpat plant in 8,000 t barges. The details of composition required for the different cement manufacturing has been envisaged as below:

Cement Type	Required Raw Material (%)		
	OPC	**Slag** (Phase II)	**Fly ash**
PPC	65%	--	35%
OPC	100%	--	--
PSC	60%	40%	--
PCC	52%	20%	28%

7.1.2 Basic

The main machinery and storages have been sized in accordance with operating norms and local conditions for operation of. The operating hours and safety factor considered for arriving at the capacity of plant and machinery is given below:

Sn	Department	Operating			Safety Factor
		Hrs/Day	Days/Year	Hrs/Year	
1	Packer	15	360	5400	1.25

The provision of storages varies from plant to plant, depending upon the following:

- Lead distance of source from cement Bulk terminal
- Ownership of source i.e. self or “bought out”
- Transportation route
- Cost of resource
- Operators’ comfort
- Inventory carrying cost
- Seasonality

Based on above considerations, the following storage day’s capacities are proposed for the project as given below for phase 1:

Sn	Type of Cargo	Storage in Days
1	OPC cement	5
2	PPC Cement	4

7.1.3 System Detail

Cement Storage

PPC, OPC, PSC will be sourced from the integrated unit at Lakhpat, which will be packed and dispatched to the market from the proposed packing unit location.

Four RCC cement silos (two silos in each phase), each of capacity 6,000 t have been considered. Cement shall be fed to the packing unit through air slides and bucket elevator.

Flyash Storage

One RCC silo of 6000 T has been envisaged for storing of flyash.

Clinker Storage

One RCC silo of 25000 T has been envisaged for storing Clinker

Slag Storage

Slag shall be stored in 8000 T, longitudinal storage shade

Coal/AFR

Longitudinal Storage Shade of 2000 T has been envisaged for storage of Coal/AFR

Cement Packing Loading & Dispatch

Cement from the cement silo shall be transported to the packers with the help of a set of air slides and bucket elevator.

Two nos. of 180 TPH double discharge packer, 4 nos. hanging type semi-automatic truck loaders are envisaged.

Equipment and Storage Capacities in the backup yard

Table 7-1 Equipment in the backup yard

Equipment Description	Capacity
Roto Packer	2x 180 TPH with 4 nos. truck loaders

The storage capacities for various materials envisaged in the report are as given below:

Table 7-2 Storage Capacity Planning

Description	Recommended Capacity
Cement Silo	4 x 6,000 T
Clinker Silo	1 x 25,000
Flyash Silo	1 x 6,000T
Slag	8000T – Longitudinal Storage Shade
Coal/AFR	2,000T – Longitudinal Storage Shade

7.1.4 Quality control

The quality control department at the proposed unit shall have the following facilities:

Laboratory

Laboratory will be accommodated in the Central Control Room (CCR) building. The laboratory shall have the provision of chemical and physical testing facilities for cement.

For Chemical Analysis

Bench Top X-Ray Fluorescence

Cement is a blend of several minerals. It is critical to control the elemental composition to control properties like strength, setting time and colour. For this purpose Bench top XRF is proposed to be used to analyse cement.

For Physical Analysis

Facilities/ apparatuses shall be provided for testing physical properties like sieve analysis, setting time, soundness, fineness, moisture content, lime reactivity & drying shrinkage, etc.

Particle Size Distribution (PSD)

For determining the particle size distribution of cement, etc. a laser diffraction type PSD analyser may be installed having typical particle size range of 0.3 mm - 400 micron.

7.2 UNLOADING SYSTEM AT JETTY

There are multiple options available for unloading of Cement at jetty. Major

unloading mechanisms used in the industry are as follows:

- Pneumatic unloading
- Vacuum/suction based unloading
- Mechanical unloading
- Self-discharging cement carriers

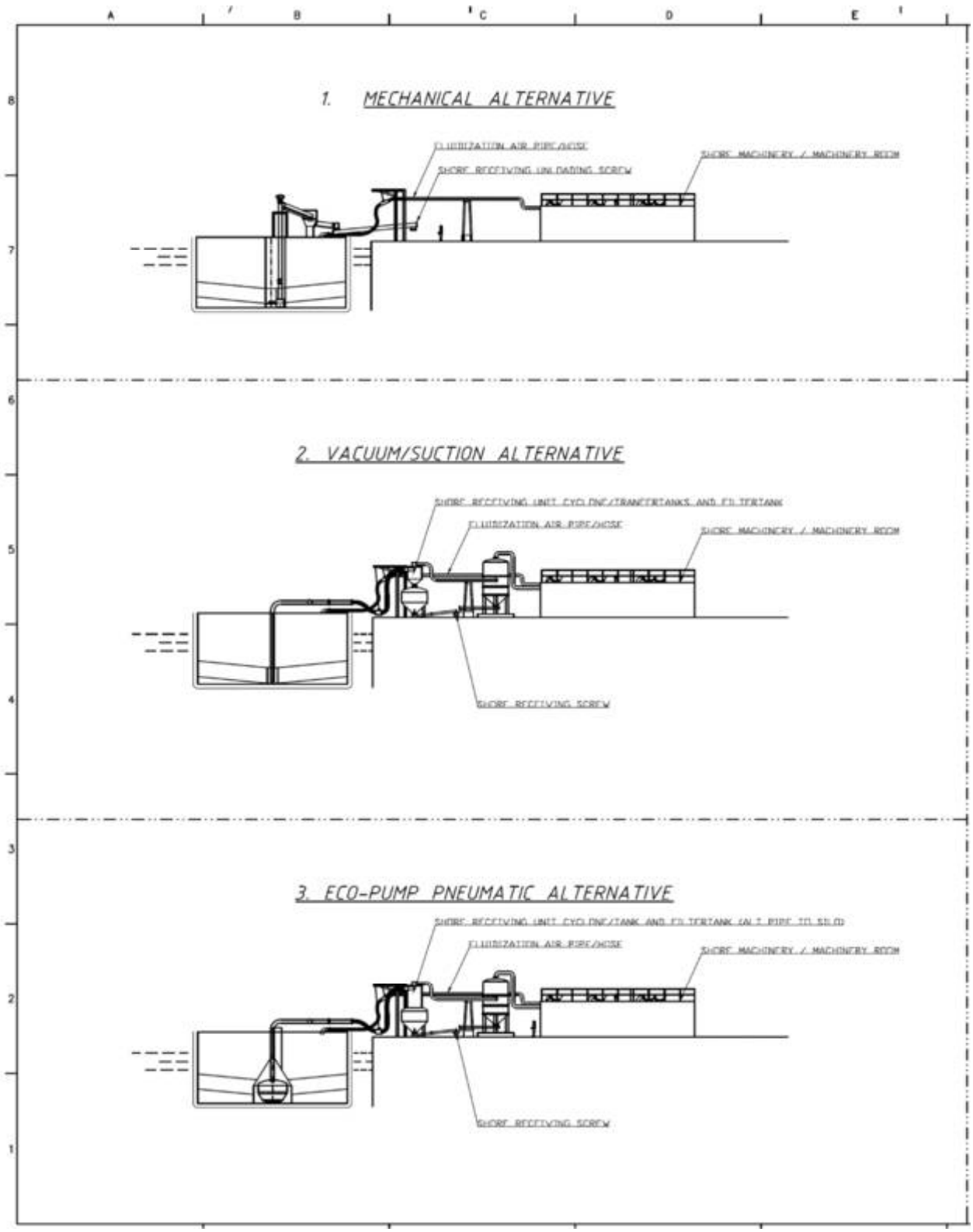


Figure 5 various options of unloading of cement

All above mentioned systems are proven and have their advantages and their inconveniences. ACL is studying out all available options in the market considering the overall logistics and investment factors. Mechanical/Pneumatic type of unloading arrangement shall be considered further to detail investigation at DPR stage.

7.3 CONVEYING SYSTEM

7.3.1 Conveyor system from Jetty to Plant

The cement unloaded at the jetty are proposed to be transported directly to the plant via conveyor. It is proposed to install one stream of conveyor of 1000 TPH from jetty to cement BT area in phase 1.

7.3.2 Choice of conveyor system

Considering the cargo mix and distance between the storage and the jetty, suitable conveyor system shall be selected for the proposed project:

A. Troughed belt conveyor system

B. Pipe conveyor system

Trough conveyor

The Material from the Jetty can be transported through a Trough conveyor. The completely covered (Closed type gallery) shall be used for preventing the material from ingress caused by wind and rain. Maintenance walkway with ample space will be provided inside the gallery.

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.

7.3.3 Alignment of conveyor corridor

Proposed conveyor alignment has been developed based on jetty location and silo area. The proposed conveyor corridor is free from any major encumbrances and it does not pass through any inhabitation. This alignment may change during detailed engineering stage after getting further information.

7.3.4 Proposed conveyor system

The Conveyors at Jetty shall be Trough conveyor. However for the Approach conveyor connecting the jetty to plant, suitable conveyor (Pipe conveyor/ Trough conveyor) shall be selected which better suits the application and layout. This approach conveyor shall be of approx. 535 meter length to transport OPC cement / Fly ash from the jetty to plant. The rated capacity of conveyor shall be 1000 TPH for cement conveying and 400 TPH for Fly Ash conveying.

7.4 ROAD WEIGH BRIDGE

The weigh bridge structure shall be robust in construction with ample safety margin above the rated capacity. The lower structure of the platform shall comprise of wide flanged steel beams and high grade tested steel. The structure shall be sand blasted to SA 2½ grade and suitably painted with special anti-corrosion epoxy based paint.

The assembly shall be designed to compensate for expansion and contraction between the Weigh Bridge and foundation, caused by temperature variation. The load cells shall be sealed and compression type suitable for pit less weigh bridge installation.

7.5 OVERALL MATERIAL FLOW

Schematic representation of overall material flow between jetty infrastructure and plant as below.

The Cement, clinker, coal and Fly Ash will be unloaded from the respective berths and transferred to the jetty conveyor using unloading and transfer systems and it further transferred to the plant storage location using approach conveyors. It will further conveyed to the specific storage location using interplant material handling systems. The figure below shows the schematic representation of import cargo from jetty infrastructure to the plant.

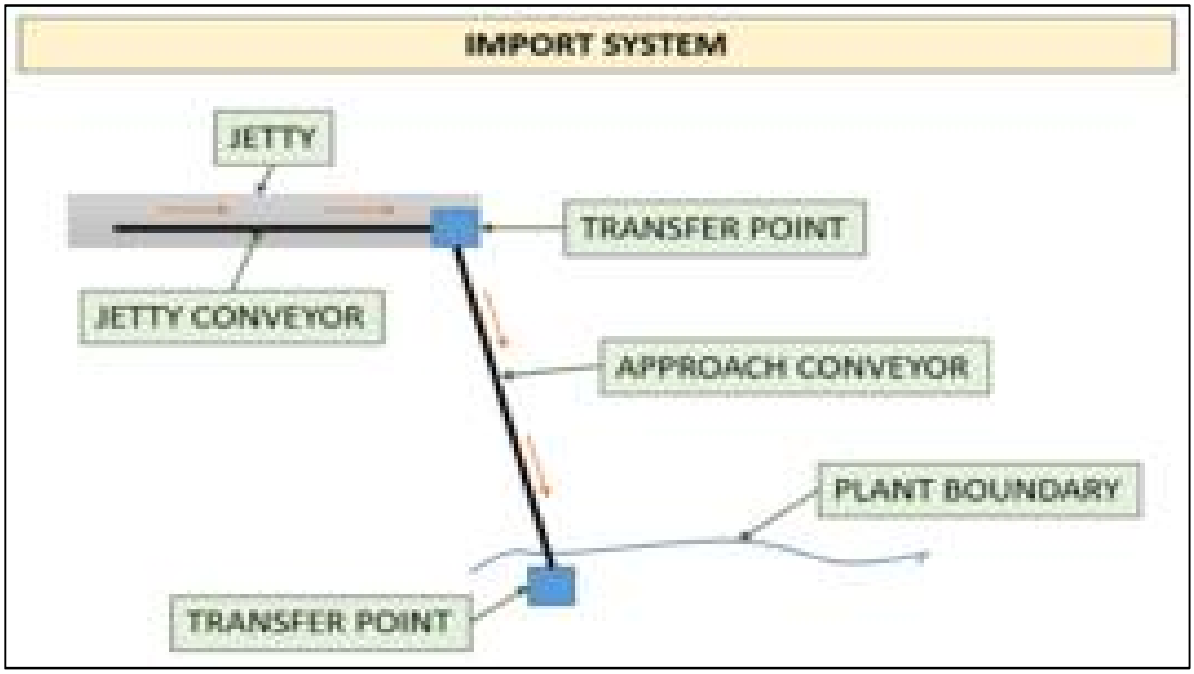
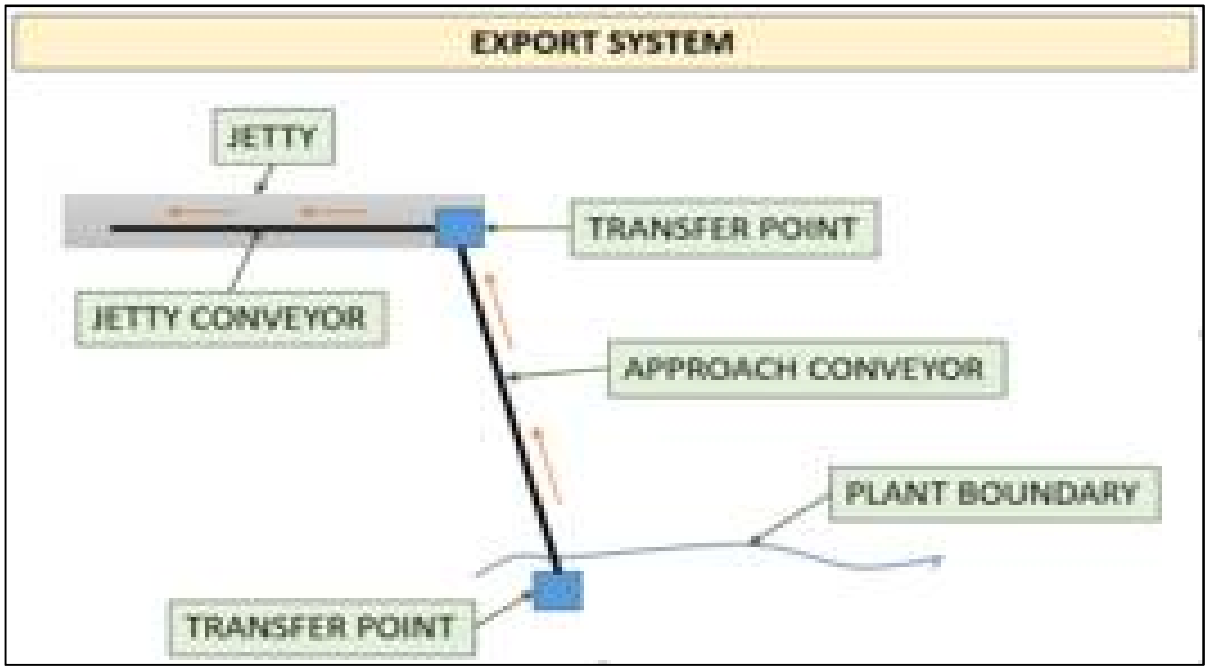


Figure 7 Import material flow from jetty infrastructure to the plant

The slag and AFR will be conveyed from plant storage through approach conveyor and transferred it on to the jetty conveyor for export using barge loader arrangement. Slag and AFT will be imported by road and stored at the plant storage area.



8 UTILITIES

8.1 POWER AND LIGHTING

The electric power is required for the following operations:

- Unloading operations at Jetty
- Backup area equipment
- Lighting of the jetty and backup yard
- Miscellaneous

The maximum power demand for the proposed cement Bulk Terminal has been estimated as about 3 MW. Power for plant operation shall be received from nearby MEB sub-station through 20kV transmission line. The system MV voltage shall be 415V at main bus bar.

8.1.1 Electrical System Parameters

Following table represents electrical system parameters being considered for planning of the facilities:

Table 8-1 Electrical System Parameters

Description	
Voltage	415 V ± 10%
Phase	3 Ph
Frequency	50 Hz, ± 3%
System Earthing	
415 V	Solidly Earthed

8.1.2 Electrical Distribution

Primary Medium Voltage (20 KV) Power Distribution System

The MV power shall be received in plant directly at 20 kV from MEB SS by 20kV transmission line which shall be terminated in the plant premises. Further distribution shall MV cables shall be laid in overhead cable gallery.

The single bus switchboards in the load centres shall be fed from the Main Substation. The power to plant loads shall be distributed via Load Centres, located close to the electrical loads.

The power at 20 KV will be stepped down to 415 V at these load centres through 20/ 0.415 KV distribution transformers and connected to LT switchboards to cater to LT loads of the plant.

Power to various decentralized consumers spread over the plant layout shall be provided by means of cables installed on cable trays placed on utility bridges and/ or support structures of conveying equipment inter-connecting the major plant departments.

Low Voltage Power Distribution and MCC (415 V 50 Hz)

The low voltage power distribution scheme has to comply with the process requirements. Independent process departments shall receive independent power supplies and distributions. These transformers will supply power to low voltage distribution switchgears,

to which all consumers, such as lighting, motor control centres (MCC), large low voltage motors and non-process equipment (e.g. auxiliary buildings), will be connected. The low voltage distributions systems will be equipped with controlled capacitor banks in the respective electrical rooms close to the loads for power factor correction.

The entire power distribution system (MV and LV) shall be designed to guarantee selective fault isolation, isolating a faulty circuit from the remainder of the electrical system and thereby eliminating unnecessary power outages.

The low voltage power distribution switchgear and the MCC shall be located in decentralized electrical rooms in the respective plant buildings. All electrical rooms shall be generously sized and provide enough space for future modifications and additions. In order to fulfil the operational requirements and to allow fully automatic control and supervision (digital and analogue) through PLC from the Central Control Room, all LV-Distribution equipment and MCC's shall be equipped with I/O-units as an integral part of the LV-Distribution or MCC-panels.

The I/O-units shall provide a compatible standard bus system and protocol for the signal exchange with the Process Control System applied. The I/O-unit hardware shall be located in a separate section of the LV-or MCC-panel. The status of each individual Input or Output at the I/O-unit shall be visible from outside of the panel.

20 kV/ 415 V Distribution Transformers

For the distribution of low voltage power at level 415 V, 50 Hz, the 3 phase, Dyn11, mineral oil filled, ONAN, copper wound distribution transformers complete with off load tap changers (OCTC) and all specified accessories have been considered to feed the low voltage loads at the respective departmental MCCs'. To attain transformer standardization, the transformers shall have rating 2,500 kVA. Special transformers for variable speed drives may deviate from above standardization. The transformer capacity shall be selected within above-mentioned sizes and shall not be less than total connected load but include some 30% spare capacity.

Motor Control Centres

Department wise intelligent MCCs controlling a group of interconnected and simultaneously operated loads during the process are envisaged and shall be located in decentralized electrical rooms in the respective departmental sub-stations/ plant buildings.

Each feeder module of the MCCs shall incorporate a mini-processor for serial bus connectivity, and shall be connected to the CPU through daisy-chain serial data link. Further, the MCCs shall comprise of all equipment for a safe remote control of the different plant sections and consist of process power feeders only.

Power Factor Correction

The plant power factor shall be corrected on two levels. The first level includes two centralized power factor and harmonics filtration units connected to each section of medium voltage busbar e.g. mill motors, as well as high voltage fed variable speed drive systems shall be corrected by central power factor correction and harmonics filtering equipment. An overall power factor of approx. 0.95 shall be achieved at LV & MV Bus (considering MV and LV-compensation). And the second level of correction is done at the LV level across the distribution transformer, on the LT switchboard bus bar.

Electrical System Components

Drives

The type of drives considered is based on following requirements:

- Speed/ torque characteristics of the driven equipment
- Enclosure protection depending upon the work environment
- Performance characteristics i.e. high-power factor and efficiency at operating point
- Accuracy and range of speed control required for specific application

All motors equal to and above 300kW shall be on Medium voltage (20 kV) level for fixed speed application and above 1200kW shall be on Medium voltage (20kV) level for variable speed application. The fixed speed MV motor shall be slip ring type and variable speed MV motors shall be squirrel cage type with suitable deration.

Power saving equipment like medium voltage AC variable frequency (MVAC) drives and low voltage AC variable frequency (LVAC) has been taken into consideration to minimize energy costs as to achieve precise speed control. VVVF drive motor <300KW shall be 415Volt AC motor. VVVF drive motor 300KW to 1200KW shall be 690 Volt AC motor. Above 1200KW VVVF drive motor shall be 20KV motor.

All motors shall be furnished with class F insulation. The required motor size shall be determined on the basis of a loading according to class B temperature increase. If motors are derated due to ambient factors, IEC-as well as reduced data shall be indicated on nameplates.

Low Voltage Motors

Induction motors shall be used for constant speed drives. All motors shall be totally enclosed fan cooled (TEFC) of the protection type IP55 or better.

The individual drive's specific starting and operating requirements shall be carefully considered. To minimize maintenance, squirrel cage motors shall be applied where possible. To cope with high inertia drives, squirrel cage motors in conjunction with fluid couplings or electronic soft-start devices are preferred.

Direct-on-line starting may be applied for low voltage motors if technically allowable. It is assumed that motors of rating 132 kW or larger will require a starter in order to limit the starting current.

All motors shall be furnished with class F insulation. The required motor size shall be determined on the basis of a loading according to class B temperature increase. If motors are derated due to ambient factors, IEC-as well as reduced data shall be indicated on nameplates.

Lighting, Small Power Distribution and Socket Outlets

Centralized lighting transformers arranged in the various electrical rooms shall provide the required supply for all departmental lighting equipment as well as for plug sockets.

Emergency lighting has been foreseen for major areas, emergency escapes, stairs etc.

Welding supply sockets will be fed directly from the auxiliary LV-distribution section of the individual departments with the required voltage level.

The lighting and power installation comprises the whole plant illumination including distribution boards and emergency lighting as well as power distribution boards and receptacles for hand tools, welding machines etc. It comprises all plant, jetty, any ancillary buildings such as power distribution, service and social buildings, roads and places, etc.

Separate distribution boards shall be provided for each building or parts of large buildings. Warning lights for aircrafts shall be provided according to regulations.

The system shall further inform and guide the truck drivers with regard to the cement loading activities.

Cabling

Following type of cables shall be used in the plant:

Power (MV) cables	:	20 kV (UE) PVC sheathed XLPE insulated Aluminium cables
Power (LV)	:	1.1 kV PVC sheathed XLPE insulated Aluminium cables
Control and 2.5 mm2	:	1.1 kV PVC sheathed PVC insulated copper cables 1.5

Instrumentation : 1.1 kV screened PVC insulated copper cables 1.0 mm2

All the power MV, LV and control cables shall be armoured. Wherever, XLPE cables are used, armouring shall be round wire of aluminium in place of GI wire. In XLPE cable, GI wire armour is likely to cause heating due to pronounced setting up of eddy current and loss on account of magnetic fields.

The cables marks shall be placed/ tied over vintage points over the cables for proper identification.

The routing of electrical power and control cables shall be so selected that the parallel running of these cables in the close vicinity with instrumentation cables is avoided otherwise the instrumentation cables are likely to pick up noise/ erratic signals from electrical duty cables causing malfunctioning of instrumentation and controls.

For main cable routing outside plant process buildings Overhead cable gallery has been envisaged. Inside the process buildings the cables shall be routed in the cable trenches or along the columns/ beams.

Earthing / Lighting Protection

System and Equipment earthing are considered for safety of operating man and machinery as well as for the stability of the electrical system. The MV system shall be earthed through resistance.

Earth continuity conductor shall be run along with major cable routes to provide grounding to the equipment. Tall structures like storage silos shall be protected against lightning by use of horizontal mesh of conductors and vertical spikes. All the lightning rods, lightning mesh wires and down conductors shall be of GI.

A separate electronic earth matting and network has been considered respectively for DCS with other associated control panels and UPS.

Each category of earthing system i.e. Electrical, Instrumentation and Lightening protection shall be independent and isolated from each other. This shall be ensured to cater to safety, security and overall protection.

8.1.3 Illumination

The illumination level in various areas will be maintained as mentioned below and for other areas not mentioned below it will be based on National Electric Code.

Table 8-2 Recommended Lux levels at various facilities

Area	Lux level
Substation, pump house and fire houses	250
Roads and Parking	15-20
Berth	50
Conveyor gallery	50
Stockpile area	20-30

For illumination of street and road poles of suitable height with HPSV fittings will be installed. Power supply will be made available from suitably located feeder pillars.

For illumination of roads 9 m high steel tubular type pole with 36 W LED street light fixtures will be provided.

8.2 WATER

Water is required at the proposed facility for the following activities.

- Supply to port staff and port users
- Pollution control and fire fighting purposes
- Environmental conservation and maintenance of greenery in the port
- Miscellaneous

The water requirement for Bulk Terminal is estimated about 10 m3/day. To cater this requirement, water shall be received through tankers/Local source.

8.3 COMPRESSED AIR SUPPLY

Compressors and blowers have been -envisaged for operation of process equipment. The compressed air is also used for various bag filters installed to minimise air pollution and diverting gates, valves, blasters etc. Blowers are mainly used for aeration of silos.

8.4 CONTROL & INSTRUMENTATION

Distributed control system comprising of programmable controllers and operator stations with peripherals are considered for remote operation of plant from a central control room.

Plant Control System

For sequential control of drive and supervision of various process variables, distributed microprocessor based control system has been considered. An elaborate instrumentation comprising of field sensors, transducers, etc. shall be set up for monitoring of processes. The Control system envisaged shall incorporate following essential features for safe operation of

plant & machinery and provide necessary operating data to evaluate the plant performance and fault monitoring:

- Client/ server configuration for easy configuration and maintenance.
- Programmable controllers for sequence interlocking and automatic closed loop control through PI and PID action.
- Serial bus connectivity for MCC, Drives, Sub-controls etc.
- Operator stations with colour graphic and alphanumeric display with equipment fault monitoring system and plant remote control.
- Process optimization system to achieve improved process stability.
- An engineering station, which shall provide engineering tools to update PLC, programmes.
- An energy monitoring system for power consumption report generation.
- MIS station which shall generate reports and provide process mimics as well.

Process Instrumentation

Necessary field sensors shall be installed to monitor process variables like pressure, temperature, flow, level, speed etc. The sensors shall be linked to Plant Control System through field transmitters/ transducers to display the parameters on Operation Station and exercise the desired controls.

Intercommunication Equipment

Public Address System with paging and party facility for CCR operator to contact the field operator and vice versa has been considered in order to facilitate plant operations. For administrative purpose and interdepartmental communication, a telephone exchange is considered which shall also supplement the public address system.

Fire Alarm and Detection System

For detection of fires in electrical buildings, cable cellars, switchgear rooms, and control rooms etc., suitable designed detectors shall be installed. Multi zone type fire alarm panel shall be deployed for audio-visual alarm.

Uninterrupted Power Supply

Each location housing automation equipment shall have its own UPS and shall also provide power to microprocessor-based sub controls, process instruments etc. The capacity of UPS shall be chosen to cater to such loads and to have some spare capacity as well. The battery bank shall be Ni-Cd high discharge type to provide adequate backup time.

8.5 MISCELLANEOUS FACILITIES

- Elevators, Hoists and Maintenance Tools: Elevators and hoists and all required specially designed maintenance tools for equipment and plant shall be provided.
- Passengers and Goods industrial elevators are to be supplied for- Cement Silo – 1.0 t capacity
- Air-conditioning: Suitable air conditioning systems as appropriate have been considered in dedicated rooms i.e. electrical and control rooms, laboratories etc.
- Empty Bags Godown: Space shall be provided in the packing plant department for the storage of empty bags.
- Parking: Adequate parking space shall be provided outside the plant premises for the parking of vehicles.

8.6 DRAINAGE

In order to facilitate drainage, the formation level of the stockyard will be sloped towards Dharamtar creek wards so that width of the longitudinal drains does not become unwieldy.

The Storm water drainage system will be designed during detailed engineering for the following criteria.

- Return period to be 30 years for permanent branch drainage.
- Run-off coefficient: K=1 (to take account of fully saturated ground conditions)
- Roughness coefficient for concrete pipes and channels:
- Maximum velocity at design flow
- Minimum velocity at design flow
- Minimum cover to pipes :
- In roads, footway and threshold

The size and the length of the storm water drainage line will be decided during the detail engineering stage.

Storm water drain will run along the main approach road near the stockyard and will be mainly RCC or stone masonry type.

8.7 BUILDINGS

Based on the functional requirements, suitable number of buildings shall be provided in the terminal area:

- Administrative building /Central Control Room Building: A central control room building shall be considered at strategic location of the plant and shall be common in case of any similar capacity expansion. The central control room building shall house a spacious central control room, laboratory, admin building. All buildings shall be provided with sufficient toilets.
- Gate Houses including space for vehicle marshalling/ queuing, guard room, time office and retiring room (for security officers)
- Maintenance Workshop comprising of a workshop plus store room, and an annex building to provide space for offices of the workshop foremen, mechanics, electricians, technicians and the storekeepers and rooms for off duty operational personnel and maintenance labour.
- Warehouse and Spare Parts Store: A separate building for storing tools, spare parts, and consumables is being considered. Sufficient spare parts have been considered as part of supply with the initial plant delivery for the first two years of operation.
- Substation building to house the transformers and other electrical equipment shall be provided as per the load requirements in the different parts of the port area.
- Weigh bridge, Stores Worker's toilet, water tank for port users.

8.8 COMMUNICATIONS

Provisions will be made in the civil works for the installation of fibre optic data and telephone cables by the installation of ducts and draw pits to allow connection between the jetty equipment, the central control building, the gate house, Customs, and all other major installations. In general duct runs for data cables will follow the main service routes.

8.9 SEWERAGE SYSTEM

There will be a mobile type bio toilet facility provided on jetty.

8.10 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. All the process equipment and dust transfer points are envisaged with dust collection equipment which shall reduce the emissions to <30 mg/Nm^3. Fogging Systems are high and

medium-pressure misting systems which create fine mist to trap dust particles mid-air is commonly used for dust suppression for handling of material like cement/ clinker etc. This arrangement includes a high pressure pump and a spray nozzle designed to produce water droplets as small as 5 microns (5 millionth of a meter). As a result, the particles in air gets heavier and automatically settle at the bottom.

8.11 SOLID WASTE MANAGEMENT

Municipal wastes in the form of canteen wastes, domestic wastes, papers, etc. will be generated. Disposal of municipal solid waste will be carried out as per prevailing norms. No solid waste will be generated from the cement manufacturing process.

8.12 FIRE FIGHTING SYSTEM

Fire fighting system for the proposed facility will be planned, implemented and maintained as per best industry norms considering the size of the facility. It will conform to Tariff Advisory Committee's Guidelines and meet the relevant codal provisions. System would comprise Fire stations, Hydrants network, Fire Tanks, Pumping stations with standby arrangements and requisite number of Fire Tenders. Fire Alarm arrangements will be built in the design.

The system of fire lines and hydrants will be designed to ensure that adequate quantity of water is available at all times, at all areas of the facility where a potential fire hazard exists. Each hydrant connection will be provided with suitable length of hoses and nozzles to permit effective operation.

8.12.1 Fire Hydrant

Required fresh water should be stored in water storage tank. This tank should be in the form of two interconnected tanks such that the storage tank can be taken up for cleaning without starving the system.

The system should be maintained under pressure with the help of a jockey pump. There will be two electrically driving fire water pumps and one diesel driven fire water pump of required capacities. A water fire pump house should provide as a backup. This pump house will house diesel driven fire pumps. The fire hydrant outlets should be double header.

8.12.2 Fire Extinguishers

Fire extinguishers of CO2, DCP type should be placed near electrical systems in Fire pump houses, Transformer areas, electrical Distribution Boards, electrical switch panels etc. Water type of fire extinguishers should be placed in areas where A-class fires could occur.

Foam type of fire extinguishers should be placed near diesel driven fire water pumps on the engine side and near diesel storages. Fire extinguishers of various capacities should be distributed at the site.

- 5 Kg DCP Extinguishers
- 10 Kg DCP Extinguishers
- 4.5 Kg CO2 Extinguishers
- 22.5 Kg CO2 Extinguisher
- 9 litres Mechanical Foam Extinguisher
- 9 litters pressurised Water Extinguisher

Following equipment shall be deployed with appropriate size and numbers.

- Trolley mounted portable water monitors.
- The hand operated fire extinguishers should be placed at suitable distances.
- The fire hydrant outlets should be placed at suitable distance.

8.12.3 Fire Alarm and detection system

For detection of fires in electrical buildings, cable cellars, switchgear rooms, and control rooms etc., suitable designed detectors shall be installed. Multi zone type fire alarm panel shall be deployed for audio-visual alarm.

8.13 INTERNAL ROADS, PAVED AREAS, FENCING ETC

Internal road network is planned for interconnectivity between the Gate and Operational areas as well as amenities Buildings. It is estimated that the total length of internal roads, mostly two lanes, will be approximately about 2 km.

All the other areas other than yard will be open paved which is required to take the load of Truck Holding and general Parking etc.

3m Height with pre-cast panel accordance to ISPS requirement will be carried out the periphery of the land area.

8.14 EXTERNAL ROAD CONNECTIVITY

Two lane road is available from National Highway passing from PNP Port boundary till boundary of the plot is available; therefore no new external road development is envisaged as part of development. Widening of existing road will be taken care of by respective government agency.

8.15 SECURITY

The security systems of the proposed facility shall be designed to comply with International Shipping and Port Security Code (ISPS). The following security measures will be provided in the terminal:

- Access Control System for restricted entry to certain places
- Provision of emergency exit gate
- Security booth at gate for 24 hours security guard

8.16 DISASTER MANAGEMENT PLAN

Prior to commencement of Operations at the terminal a comprehensive Disaster Management Plan will be prepared in consultation with other industrial units in the vicinity and District Officials. This plan will become integral part of the District Plan for the area and duly agreed by the Local Authorities if so required. This plan will be updated from time to time so as to remain current and valid at all times.

9 ENVIRONMENTAL ASPECTS

9.1 PROJECT DETAILS

The site is located in the Dharamtar creek and thus can be classified as a riverine port. The project is not located in an ecologically sensitive area. The site visits indicate there are mangroves alongside the waterfront of proposed jetty and tidal creeks, which need to be preserved to the best possible extent and mangrove afforestation to be taken up to compensate for potential losses if any. Proposed jetty, approach trestle and plant area are planned to avoid areas with existing mangroves and maintain water circulation to these locations.

Project may require deepening alongside berths as part of capital dredging. The dredged spoils will be used to raise the port backup areas above flood levels. The project also does not involve any reclamation works in the creek area that alter flow patterns in the creek and geomorphology.

9.2 ENVIRONMENTAL MANAGEMENT PLAN- PRELIMINARY

AIR ENVIRONMENT

- All major sources of air pollution will be provided with Bag houses & Bag filters to maintain emissions within the prescribed norms i.e. 30 mg/Nm3 for particulate matter emission from the stacks.
- Bag filters will be provided at all loading /unloading points and transfer points.
- OPC will be stored in closed OPC silo and cement in Cement Silo. Fly ash will be stored in silos and closed shed.
- Proper maintenance of vehicles will be done to reduce gaseous emissions.
- Operators will be provided with personal protective equipment like safety Goggles, dust mask, ear plugs, helmets etc.
- Periphery of plant and surrounding areas of office building will be covered by thick green belt to attenuate the pollutants emitted by the Plant.
- Ambient air quality and stack emissions will be regularly monitored to keep emission levels below the prescribed limits.

WASTE WATER GENERATION & TREATMENT

- No industrial waste water will be generated during cement manufacturing process.
- Domestic waste water generated from the office toilets will be treated in the STP and treated water will be used for green belt development.
- Rain water harvesting will be practiced at plant.

NOISE ENVIRONMENT

- Walls and ceilings of the concerned buildings will be lined with sound absorbing materials.
- Properly insulated enclosures will be provided for high noise generating plant machinery.
- Personal Protective Equipment like earplugs and earmuffs will be provided to the workers.
- Regular monitoring of noise level will be carried out and corrective measures in concerned.

SOLID WASTE GENERATION AND UTILIZATION

- No solid waste will be generated from the cement manufacturing process.
- Dust collected from air pollution control equipment will be totally recycled in process.
- Sludge from Sewage Treatment Plant (STP) will be used as manure for green belt development.
- A part of used oil will be utilized for lubrication purpose & remaining will be sold to authorized members

Table 9-1 Waste disposal method

S.No.	Waste	Method of Disposal	Area
1	Used Oil	Used internally for lubrication of scraper chains	Plant
2	Used Grease	Given to PCB approved agencies	
3	Lead Acid Batteries	Exchanging with PCB approved agencies and OEMs	
4	Transformer Oil	Given to PCB approved agencies	

S.No.	Types of Waste	End Use/ Disposal
1	Dust collected from air pollution control equipment	Totally recycled in process
2	Sludge is generated from Mobile Bio Toilet	Manure for green belt development

GREENBELT DEVELOPMENT/PLANTATION

A thick greenbelt all along the roads and plant will be developed.

- 80% survival rate will be maintained with all possible efforts.

- The trees will be planted at suitable grid spacing to encourage proper growth.
- Local plant species have been preferred.

10 IMPLEMENTATION SCHEDULE & COST ESTIMATE OF PHASE I

10.1 IMPLEMENTATION SCHEDULE

An overall implementation program for the construction of proposed berthing and backup yard has been prepared. The estimated construction period is 24 months.

10.2 BLOCK CAPITAL COST

The block cost 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. Total capital cost for jetty and related infrastructure cost for master plan is around Rs 172 Cr. Breakup of the same is shown in the table below:

Table 10-1 Block cost for Jetty and related infrastructure

Sr No	Item (INR Crore)	Master Plan
1	Jetty	118.00
2	Dredging	4.00
3	Approach trestle	0
4	Conveyor from Jetty to Plant	24.60
5	Unloading system on jetty	25
	Total Jetty and related infrastructure	**171.6**

11 FINANCIAL ANALYSIS

11.1 FINANCIAL ANALYSIS

This section addresses the financial feasibility for the project, encompassing:

- Estimates of Investment Cost
- Estimates of Operational Cost
- Financial viability based on the following indicators:
  - Internal Rate of Return on Investment
  - Break Even Point
  - Payback Period
  - Risk and Sensitivity Analysis

11.1.1 FINANCIAL ANALYSIS

Financial analyses reveal the performance results as given below

Table 11-1 Financial analysis

Sn	Indicator	Results
1	IRR on Total Investment	19.65%
2	IRR on Equity	32.24%
3	Net Present Value @ 10.0 % (Rs. Lakhs)	26,612
4	Payback Period	5 years and 6 months

11.2 SOCIAL BENEFITS

Adani Group is committed to inclusive growth and sustainable development in not only the communities it operates in, but also in contributing towards nation building.

The focus of the activities are mainly on three major dimensions of human development which include expansion of sustainable livelihood opportunities, improving the status of health and education and broadening the range of choices by creating rural infrastructure. The aim is to walk with the communities, help people look ahead, make the right choices and secure a bright and beautiful future, together.

Company conceptualizes its purpose by consolidating the activities under the working areas that are as follows:

- Education
- Community Health
- Sustainable Livelihood Development
- Rural Infrastructure Development
- Rain Water Harvesting
- Drip Irrigation Programs
- Water Conservation Programs
- Afforestation and environment enhancement

Need based assessment will be a continual action during the entire construction as well as operation phases and based on the outcomes of the assessment, support for the above mentioned four core areas will be provided to the locals.

During construction stage, direct employment generation of about 200 is expected. The project when fully operational also brings in direct employment potential of about 70 nos. hereby opening up employment opportunities for the youth in the catchment region. Additionally, the induced development can bring indirect employment. The proposed project will therefore immensely add to the social economic value of the region.