V.O. CHIDAMBARANAR PORT TRUST

Preparation of Techno - Economic Feasibility Report for "Mechanisation of North Cargo Berth-III (NCB-III) for Handling Dry Bulk Cargo at V.O. Chidambaranar Port"

TECHNO - ECONOMIC FEASIBILITY REPORT
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Chapter – 1

1.0 Introduction

Ports play an important economic role in the maritime nations by facilitating foreign trade thus acting as important catalysts for social and economic development in any maritime nation. Maritime transport has been the lifeblood of world trade since time immemorial. Though the new modes of transportation have grown enormously, shipping continues to occupy the lion's share in the world trade. It is likely to remain most important mode for international trade in the foreseeable future because of the economics inherent in sea transportation.

Likewise, Indian ports and shipping industry too plays a vital role in sustaining growth in the country's trade and commerce. India is the sixteenth largest maritime country in the world, with a coastline of about 7,517 km. In India, according to the Ministry of Shipping, around 95% of its trading by volume and 70% by value is carried by maritime transport.

Subsequently to harness India's long coastline, of potentially navigable waterways and strategic location on key international maritime trade routes, the Government of India embarked on ambitious Sagaramala programme that aims to promote port-led development in the country.

The Sagarmala programme envisages transforming the existing ports into modern world-class ports, and developing new ports based on the requirement. It also aspires to efficiently integrate ports with industrial clusters, the hinterland and the evacuation systems, through road, rail, inland and coastal waterways. This would enable ports to drive economic activity in coastal areas.

V.O. Chidambaranar Port (VOC Port) is one such initiative. It is considered as a growing Major Port of India, which is strategically, located proximity to International main shipping sea route. In FY 2017-18, the port handled 36.58 million ton of traffic. The major commodities handled at the port are coal and containers, which together account for around 71% of the total traffic. Container traffic caters to the industrial regions in Central

and South Tamil Nadu, while coal is utilized by the thermal power plants in the port's vicinity (less than 50 km).

Considering the requirement of Mechanization facility at NCB-III, VOC Port endeavors to prepare a Techno - Economic Feasibility Report for Mechanization of North Cargo Berth-III (NCB-III) for handling Dry bulk Cargo at V. O. Chidambaranar Port.

1.1 Need for the study

VOC Port presently has 16 berths handling a total traffic of about 36.58 million tons in 2017-18. The major commodities are coal (12.48 MT) followed by containers (14.19 MT); Fertilizers (0.35MT); Liquid cargo (1.03 MT) with the remaining being all other general cargo and others. There are three coal berths exclusively handling thermal coal for captive power plants and one Oil berth for handling POL products, LPG and chemicals. The Existing Port Layout is shown in Drawing No. VOCP/NCB-III/MS-001.

Additionally, two exclusive Container Terminals (7th & 8th berth) each berth are operated by two different operators. Other berths handle all other cargo including thermal coal meant for private power plants, industrial coal, copper concentrate, fertilizers and general cargo.

At Berth No 9, cargoes are handled using HMCs/Ship gears and Hoppers, conveyors and stackers. The facilities envisaged are four numbers mobile hoppers, a closed conveyor system for a length of 3.2 Km to transfer the cargo from hoppers to the coal plots allotted in the coal stockyard.

Thermal coal meant for captive use of nearby power plants of TNEB & NTPL is handled in exclusive berths (CJ-I, CJ-II & NCB-I) and transported through belt conveyors. However thermal coal meant for private power plants, industrial coal, and pet coke all meant for multiple users are handled in multi-cargo berths through semi-mechanized methods for unloading, stacking and evacuation. Similarly all other Dry-bulk cargoes, whose quantity is considerable are handled and conveyed by semi-mechanized methods.

Construction of NCB-III has been completed. The Port is proposed to go for dredging in future for which action is being taken. The Port is proposed to develop the entire East

Berth and South Berth area comprising berths 1 to 9 as a clean cargo/container area by converting berth No.9 as container berth.

1.2 Techno - Economic Feasibility Report

On the instruction of Port this Report is being prepared which consist of installation of Coal Ship Unloader at NCB III and the stock yard to be located at Hare Island.

1.3 Organisation of Report

Based on the discussion with port official and comments received the Techno – Economic Feasibility Study has the following:

Chapter - 1 Introduction
Chapter - 2 Project Site Environment
Chapter - 3 Traffic Forecast
Chapter - 4 Development Needs & Planning Consideration
Chapter - 5 Component of Handling System
Chapter - 6 Material Handling System for NCB III
Chapter - 7 Electrical System for NCB III
Chapter - 8 Environmental Aspect
Chapter - 9 Cost Estimates
Chapter - 10 Implementation Schedule
Chapter - 11 Financial Analysis

Chapter – 2

2.0 Project Site Environment

2.1 Meteorological Condition

2.1.1 Wind

The governing wind direction in India is NE and SW influenced by monsoon. Monsoonal winds occur from WNW – WSW during May to August and N – ENE during November to February in this region. Wind speed of 40 km/h has been observed in Tuticorin.

2.1.2 Temperature

The mean daily maximum and minimum temperature were observed to be 35.8° C and 21.30° C respectively. The maximum temperature at Tuticorin ranges between 41.1° and 33.3° C, while minimum temperature varies between 21.3° to 15.3° C.

2.1.3 Visibility

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

2.1.4 Humidity

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

2.1.5 Oceanography condition

2.1.5.1 Tides

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

- ✓ Lowest Low Water Level (LLWL) + 0.11 m
- ✓ Mean Lower Low Water Springs (MLLWS) + 0.25 m

✓ Mean Low Water Springs (MLWS)	+ 0.29 m
✓ Mean Low Water Neaps (MLWN)	+ 0.55 m
✓ Mean Sea Level (MSL)	+ 0.64 m
✓ Mean High Water Neaps (MHWN)	+ 0.71 m
✓ Mean High Water Springs (MHWS)	+ 0.99 m
✓ Highest High Water Level (HHWL)	+ 1.26 m

2.1.5.2 Waves

Wave data for VOC Port is collected by National Institute of Oceanography as part of National Data buoy programme. The peak wave heights are of the order of 2-2.5 m with time period of 9 sec. The predominant wave directions are East and South.

2.1.5.3 Currents

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

2.1.5.4 Cyclone

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

Chapter – 3

3.0 Traffic Forecasting

3.1 Port Outlook in India

Ports in India act as the gateway to India's world trade. India has 12 major and 200 notified minor and intermediate ports, which are helpful in sea-trade and commerce and also the Government is also taking initiatives to develop the ports in order to enhance Trade and Commerce. Approximately 95% of India's merchandise trade (by volume) passes through seaports. Many ports such as JNPT, Mundra Port, Sikka Port, and Hazira Port, etc. are evolving into specialized centers of economic activities and services and are vital to sustain future economic growth of the country

However, Indian ports still have to address infrastructural and operational challenges before they graduate to the next level. For instance, operational efficiency of Indian ports has improved over the years but still lags behind the global average. Major portion of Indian freight uses either road or rail for transportation of goods. A significant share of this cargo experiences "idle time" during its transit to the ports due to capacity constraints on highways and railway lines connecting ports to production and consumption centers.

3.2 Market Size

As per Indian Brand Equity Foundation, Cargo traffic handled by India's major ports increased 4.97% year-on-year to 616.62 million tonnes (MT) during April 2017-February 2018. Cochin Port witnessed the highest growth at 17.63 per cent, followed by Paradip at 15.56 per cent, Kolkata (including Haldia) at 14.29 per cent and Jawaharlal Nehru Port Trust at 6.37 per cent. Container traffic saw the highest growth during this period at 8.37 per cent year-on-year and reached 8.302 million TEUs.

During 2016-17, major and non-major ports in India have accomplished a total cargo throughput of 1,133.09 million tonnes, an increase of 5.7 per cent previous year 2015-16. The growth in cargo handled at major and non-major ports in 2016-17, were 6.8% and

4.2%, respectively. The share of major ports in the total traffic handled by Indian ports increased from 56.5% in 2015-16 to 57.2 % in 2016-17.

3.3 Cargo traffic at major ports in India

Cargo traffic handled at major ports of India during 2016-17 vis-à-vis 2015-16 cargo handled at major ports of the country is given in Table 3.1 below:

Table 3.1 - Traffic handled at major ports2016-17 vis-a-vis 2015-16 (in Million Tonnes)

PORT	2016-17	2015-16	% Growth (+/-)
Kolkata	50.31	50.28	0.05
Paradip	88.95	76.39	16.45
Visakhapatnam	61.02	57.03	6.99
Kamarajar	30.02	32.2	-6.79
Chennai	50.21	50.05	0.31
V.O. Chidambaranar	38.46	36.84	4.38
Cochin	25	22.09	13.16
New Mangalore	39.94	35.59	12.26
Mormugao	33.18	20.78	59.7
Mumbai	63.05	61.11	3.17
JNPT	62.02	64.02	-3.13
Kandla	105.44	100.05	5.39
OVERALL:	647.63	606.47	6.79

Source : http://pibphoto.nic.in

Some of the major initiatives taken by the government to promote the ports sector in India are as follows:

- In March 2018, a revised Model Concession Agreement (MCA) was approved to make port projects more investor-friendly and make investment climate in the sector more attractive.
- Project UNNATI has been started by Government of India to identify the opportunity areas for improvement in the operations of major ports. Under the project, 116 initiatives were identified out of which 86 initiatives have been implemented.
- The Ministry of Shipping, Government of India, released Rs. 25 Crores (US$ 3.86 million) as grants-in-aid to Jawaharlal Nehru Port Trust (JNPT) and Rs 50 crores (US$

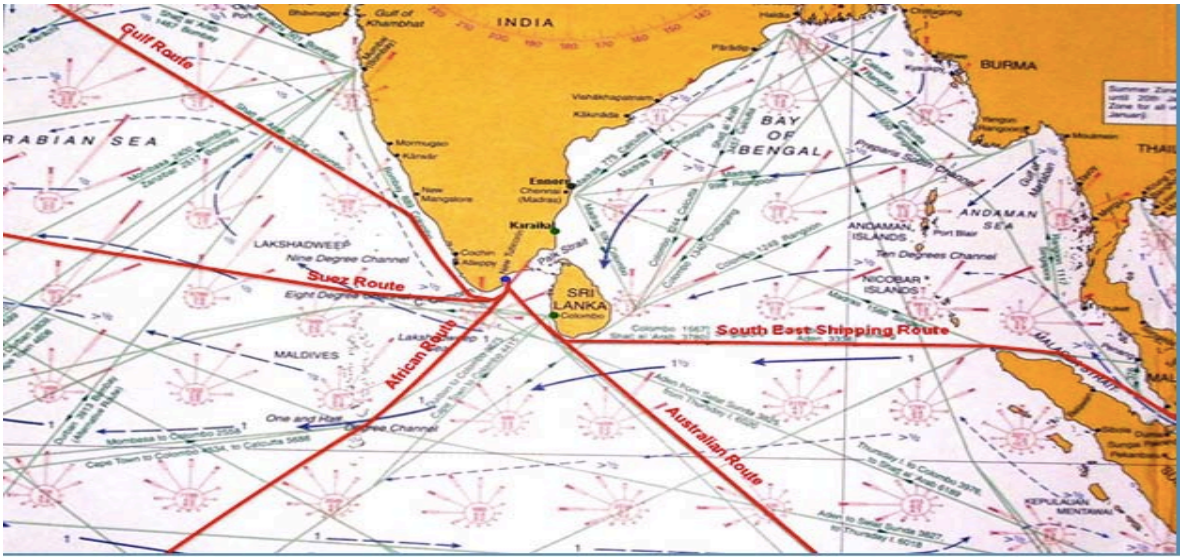
7.72 million) to the Government of Karnataka for Karwar port, for infrastructure development under the Coastal Berth Scheme of the Sagarmala programme.

- The Government also inaugurated a new sea route to Baratang Island and initiated various shipping projects in the Andaman and Nicobar (A&N) Islands; along
- With announcement of addition of 14 new ships in the A&N Islands over the next three years.
- VOC Port got Rs. 30 Crores for coastal berth as Grant in Aid and Rs. 20.88 Crores for dredging in front of coastal berth.

Additionally, Ministry for Shipping, Road Transport and Highways, announced a massive investment in India's ports and roads sector, which is likely to help boost the country's economy. The Indian government plans to develop 10 coastal economic regions as part of plans to revive the country's Sagarmala (string of ports) project. The zones would be converted into manufacturing hubs, supported by port modernisation projects, and could span 300–500 km of the coastline. The government is also looking to develop the inland waterway sector as an alternative to road and rail routes to transport goods to the nation's ports and hopes to attract private investment in the sector.

3.4 V.O. Chidambaranar Port

V.O. Chidambaranar Port, formerly Tuticorin Port, is one of the 12 major ports in India. The port of Tuticorin is a strong strategic place in India. It serves the State of Tamil Nadu, a very industrialized region of southern India, showing some of the best growth in the country. The Port is located strategically close to the East-West International sea routes on the South Eastern coast of India at latitude $8^{o}45'N$ and longitude$78^{o}13'E$. Located in the Gulf of Mannar, with Sri Lanka on the South East and the large landmass of India on the West, VOC Port is well sheltered from the fury of storms and cyclonic winds and is operational round the clock all through the year. The key sea routes from the port are shown as under:



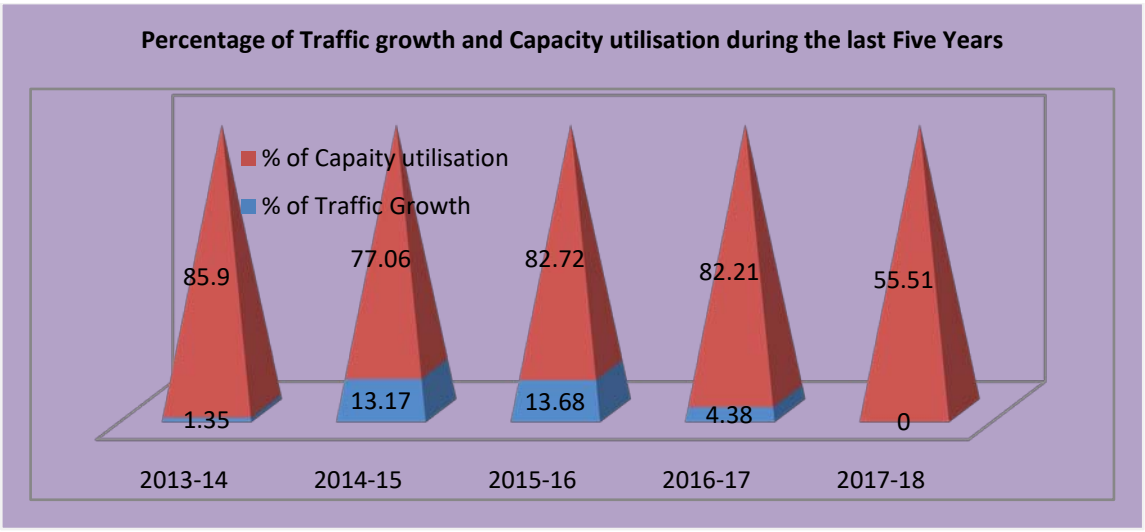
The performance indicators during the last five years for VOC Port are tabulated in Table 3.2 as under:

Table 3.2 – Performance indicators during the last five years

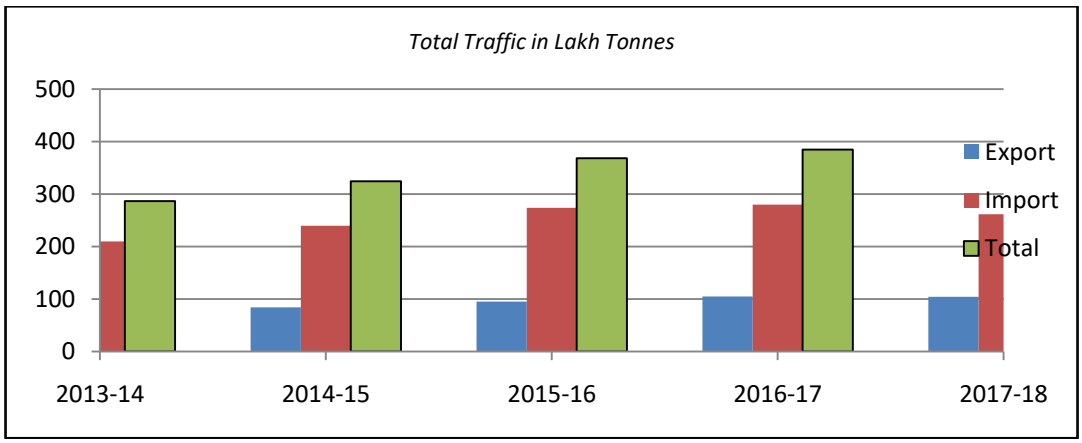
Indicators	2013-14	2014-15	2015-16	2016-17	2017-18
Capacity (in million tonnes)	33.34	42.06	44.55	46.78	65.9
Target in Million Tonnes	30	32	36.8	39.5	38
Traffic (In Million Tonnes)	28.64	32.41	36.85	38.46	36.58
Traffic in Lakh tonnes	286.42	324.14	368.49	384.63	365.83
VOC Port Website					

Over the years, the port has continuously increased its capacity to cater the market demand. In the year 2017-18, it raised the port capacity by more than 40% over the last year and it reached to the level of 65.9 Million Tonnes annually.

The percentage of traffic growth and capacity utilization has also shown a steady response in this port. The graph depicts the exact utility and growth during the last five years. Capacity utilisation of the port reached to the level of 82.21 % in the year 2016-17. However, in the year 2017-18, the port raised its overall capacity (65.9 MT) and thus lowering the capacity utilisation at 55.51%.



The total import and export traffic, along with the container traffic in VOC Port is shown in the graph under:



Source:vocport.gov.in

Also, Container traffic handling has shown impressive growth over the years. In the year 2017-18, total tonnage (containers traffic) has registered a growth rate of 9.24% over the last years. In the last 5 years, container traffic (tonnage) has registered a CAGR of 6.98%. In terms of TEUs, over the last 5 years, TEUs handling registered an impressive CAGR of 6.56%. The same has been shown in the table 3.3 below

Table : 3.3 – Container Traffic in VOC Port

Year	TEU's	Tonnage
2013-14	507735	10128703
2014-15	559727	11034442
2015-16	611714	12387904

2016-17	642103	12990926
2017-18	697631	14191602

3.5 Traffic Potential for NCB-III

3.5.1 Background

The VOC Port has implemented number of initiatives to increase cargo handling potential and to streamline the existing cargo handling facilities in the port. As explained earlier, the current project pertains to the Techno-Economic Feasibility Report for the project Mechanization of North Cargo Berth- III (NCB-III) for handling Dry bulk Cargo. It involves shifting the entire evacuation system from berth no-9 to NCB-III. Thus the study pertains to the estimation of traffic that are likely to be handled at the proposed NCB-III and doing the complete financial analysis for the same.

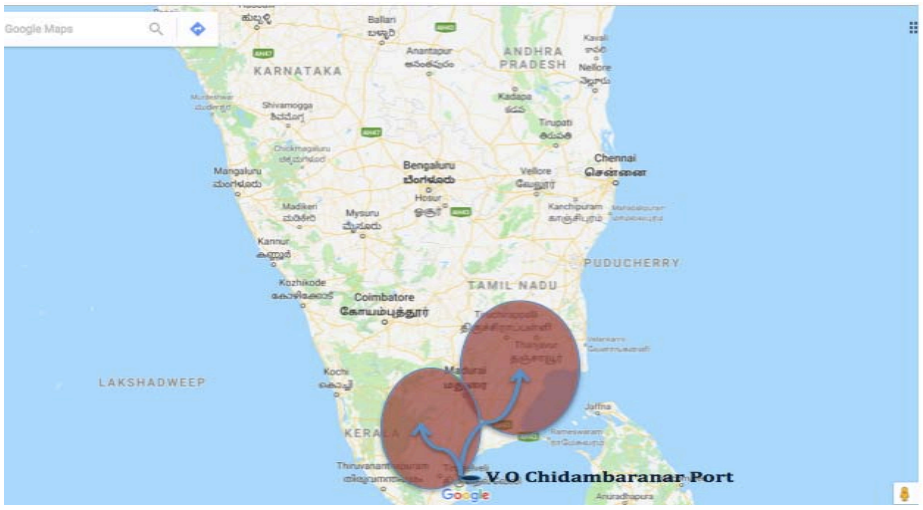
The Port has two operational wings viz. Zone "A" comprising the new port and Zone "B" constituting the old anchorage port, situated about 9 km away from the new port. Presently, Zone "A" has 14 cargo berths including ten alongside berths, one Oil Jetty, and three coal Jetties. The maximum draft available at Zone "A" is 13.0m. There are three coal berths exclusively handling thermal coal for captive power plants and one Oil berth for handling POL products, LPG and chemicals. There are two exclusive container terminals (berth No 7 & 8). Each berth operated by different BOT operators. The other eight berths handle all other cargo including thermal coal meant for other private power plants, industrial coal, copper concentrate, fertilizers, and general cargo. The Existing Port Layout is given in Drawing No. VOCP/NCB-III/MS-001.

In order to meet the traffic demand of dry-bulk cargos, the port has constructed NCB-III. The NCB-III has a length of 306 m & width of 22.9 m to accommodate 75,000 DWT size vessels having LOA of 225m, beam 32.26m. The Port is proposed to go for dredging in future for which action is being taken. It is also proposed to develop the entire East berth and South berth area comprising berths AB-I to AB-IX as a clean cargo/container area by converting berth No.9 as container berth. For converting this 9th berth into Container terminal, by shifting the existing project "Mechanization of Cargo evacuation from 9th

berth to coal yard on license basis under Revenue share mode for a period of 10 years" by the existing licensee to NCB-III is to be explored.

3.5.2 Approach and Methodology Adopted

Base year Traffic Estimation



The exercise began with the Strategic and location analysis of the entire region in which the proposed railway connectivity falls. Consequently, the consultants have defined a Project Influence Zone (PIZ) for the project. The zone covers adjoining area apart from the immediate zone falling around the port. The same has been depicted in the map above:

Analysis of secondary data available shows that majority of cargo imported are destined to locations in Tamil Nadu and Kerala. There are few thermal power plants present in the close vicinity of the port. All demand as well as origin centers for the port bound cargo was studied.

As it is mention earlier also various agencies have already carried out a detailed commodity wise Traffic Studies for the project. The consultants have extensively used the said reports for the estimation of the commodity wise traffic potential for the bulk cargo mainly coal.

3.5.3 Major Industries and Area Served

VOC Port serves one of the highly industrialized districts in Southern India. In fact VOC Port helped the district in attaining impressive growth, both in the manufacturing sector as well as service sector.The port has direct cargo and container vessel connectivity to all major ports in the world like Colombo, Singapore, JNPT(Mumbai), Mundra, Jebel Ali, Salalah, Rotterdam, Karachi, Hong Kong etc. There are many industrial areas developed in the district, which are directly and indirectly served by the port.

S. No.	Name of the Industrial Area	Land Developed (in hectare)	No. of units in production
1	Tuticorin	24.18 Acres	20
2	Kovilpatti	85.54	78
3	Sipcot Industrial Complex, Tuticorin	Phase-I 1032.68 Acres	79
4	Sipcot Industrial Complex, Tuticorin	Phase II 436.54 Acres (To be acquired 1179.74 Acres	1 Nos.

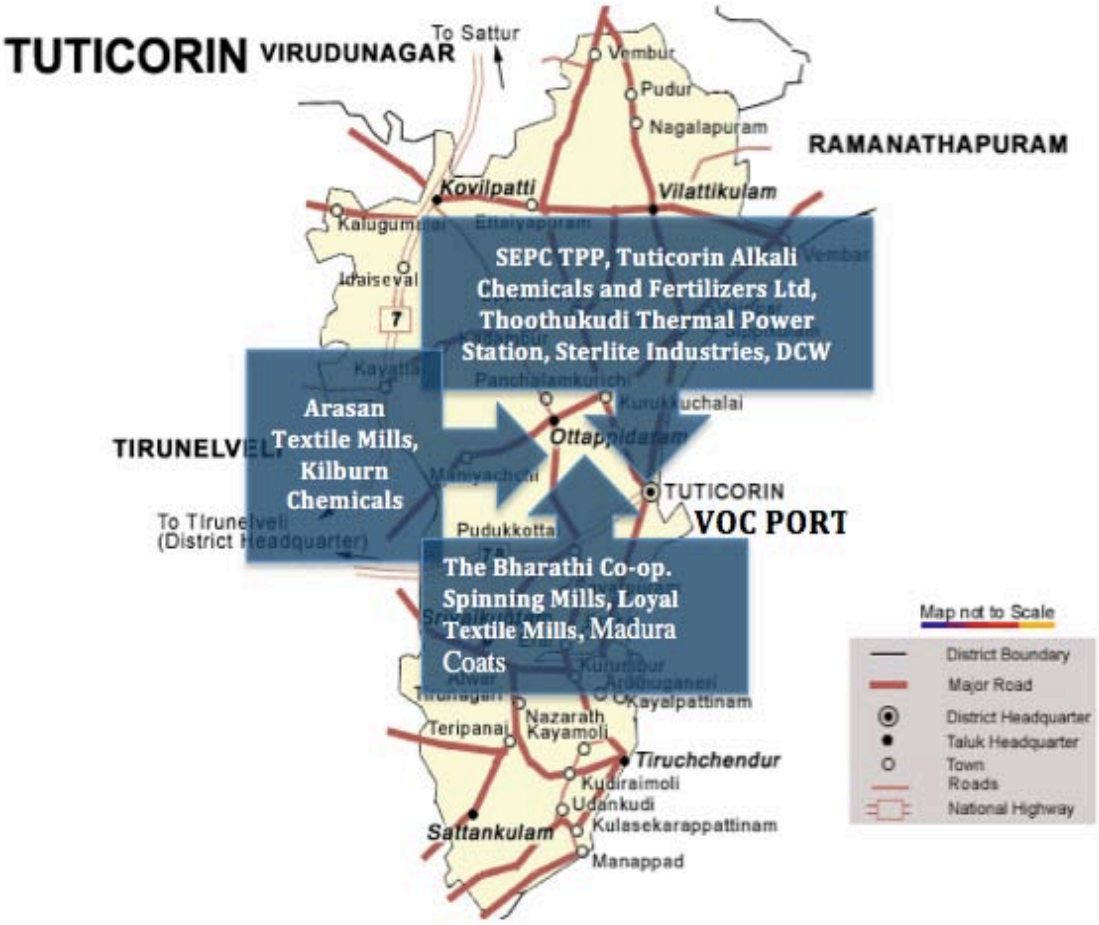
http://dcmsme.gov.in

There are many large-scale industries operating from the district. Additionally, there are number of thermal power plants operating in the district. Imported coal for these thermal Power plants is currently handled at the VOC Port. Some of the other big industries present in the close vicinity of the port are:

S. No.	Industry Name	Product
1	Tuticorin Alkali Chemicals and Fertilizers Ltd	Sulphates of Alumina ferric
2	Travancore Chemicals and Manufacturing Co. Ltd	Soda ash, heavy chemicals, ammonium chloride (fertilizer)
3	Dharangadara Chemical Works Ltd,	Caustic soda, liquid chlorine, Trichloroethylene, upgraded illuminate, P.V Rexene
4	The South India carbonic Gas Industries Ltd	Carbonic oxide
5	The Tuticorin Spinning Mills Ltd	Cotton yarn and thread
6	Thoothukudi Thermal Power Station Tuticorin	Power
7	Sterlite Industries (India) Ltd,	Copper Smelting
8	Arasan Textile Mills (P) Ltd	Textile
9	Kilburn Chemicals Ltd., SIPCOT Complex	Chemicals
10	Madura Coats	Cotton yarn and thread

http://dcmsme.gov.in

There are some other large-scale industries in the districts. VOC Port is acting as the major gateway for export and import for these industries



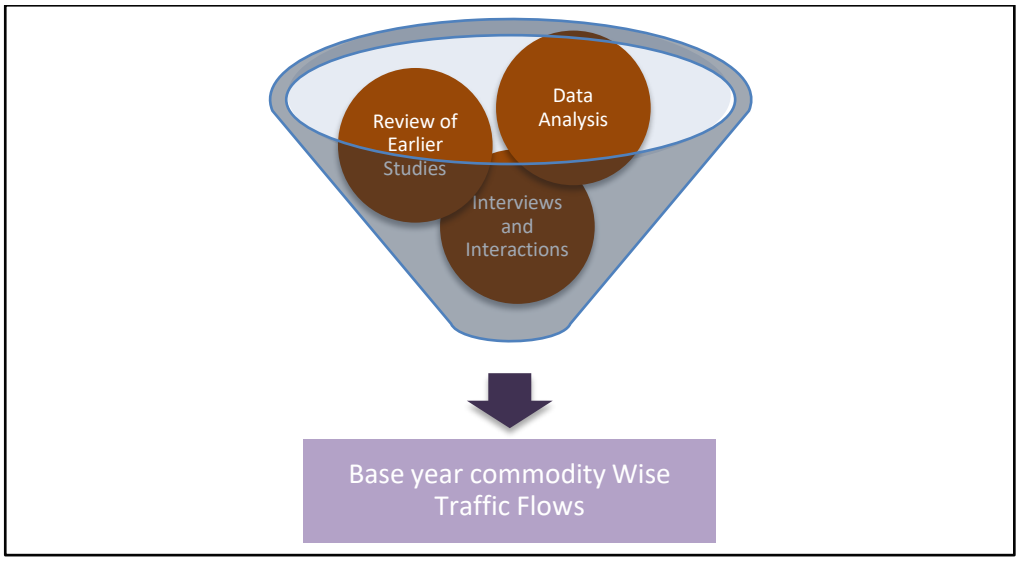
Some of the Major Industries near VOC Port

3.5.4 Review of Earlier Studies

All the relevant reports, documents and reports available with the client were collected and compiled. Available literature on consumption pattern in the port vicinity and other serving areas were also studied. This proved to be helpful in comparing the forecasted traffic demand for study area conditions by examining the suitability for implementation and operation.

It is pertinent to mention here that Drewry Maritime Services has already prepared a detailed Traffic Report for VOC Port. Moreover, AECOM also has prepared a detailed Master Plan for the port in the year of 2017. The consultants have extensively consulted the said reports for the estimation of cargo potential for the proposed project. Additionally, any relevant report or document available with the client like License Agreement with M/s Chennai Radha Engineering Works Pvt. Ltd. etc. was also taken into

consideration. The graphical depiction of the traffic estimation and forecasting methodology is depicted as under:



The forecast was done to cater the likely cargo traffic, which may get handled at NCB-III after shifting the conveyor system from Berth No -9. As every conveyor system has some capacity, it was kept in mind the handling capacity of the conveyor systems while forecasting the cargo traffic.

3.5.5 Secondary Data Collection

As discussed in the earlier paragraph, secondary data was collected from local as well as governmental agencies. Additionally, Port authority were also contacted and consulted for necessary data and statistics and their views were analysed on the traffic potential for the proposed services. Efforts were also made to collect relevant secondary information from private parties, transporters, industries or major traffic generation units. The data collected from various secondary sources includes the following:

- Historical freight data
- Industrial and Socio-economic characteristics of the PIZ
- Transport network details –Port facilities - Traffic flow characteristics on various corridors
- Freight movement characteristics
- Inventory of existing public transport system/ services of Rail, Bus etc.

There are many thermal power plants in the adjoining areas. The likely demand of coal from these thermal power plants was also studied. Other coal and bulk cargo consuming industries were identified and assessed. The berth NCB-III is likely to handled substantial part of coal meant for thermal power plants namely SEPC Thermal Power plant and Mutiara Thermal Power plant. Additionally coal meant for other private parties like Sterlite Industries, DCW etc., are also expected to partially handled at NCB-III berth.

3.5.6 Base Year Flows

Review of data/information provided in the earlier reports made on the subject and dialogue with the port authorities, trade & industry, user and government agencies as well as information arrived from the field visits and interaction helped us in establishing the base year traffic (2018-19).

3.5.7 Forecasting

The projects pertains to the Market study and demand assessment for the cargo that is likely to be handled at the new berth NCB-III by shifting entire coal handling facilities from berth no 9 to this berth. After estimating the base year cargo potential, the forecast was carried out on the cargo quantum that is likely to get handled at the proposed port i.e. NCB-III through the shifted cargo evacuation facilities.

While forecasting, consultant was reviewed and assessed the earlier forecasted traffic by various other agencies and organizations in traffic reports and master plan. Appropriate raising factors were used to forecast the cargo potential for the NCB-III. Forecasting has been done cargo wise. For certain commodities like Coal, forecasting is based on the consumption/demand centers projections. Traffic is presented in 5-year intervals starting from the base year traffic.

3.6 Synopsis of Drewry Traffic Report

3.6.1 VOC Port Container Traffic Forecast

Drewry forecasts VOC Port container traffic to reach 3.6 million TEU in base case, 4.3 million TEU in high case and 2.8 million TEU in low case, by 2048-49. The forecasted

figures of VOC Port container traffic in base, high and low case is tabulated below in Table 3.4:

Table 3.4 – VOC Port container traffic forecast (million TEU)

Forecast	FY 17	FY21	FY25	FY30	FY 35	FY 40	FY 45	FY 49
Low Case	0.64	0.86	1.1	1.43	1.78	2.09	2.46	2.81
Base Case	0.64	0.89	1.16	1.56	2.03	2.47	3.03	3.55
High Case	0.64	0.93	1.23	1.69	2.26	2.82	3.57	4.31

3.6.2 Coal Traffic Forecast

Coal is expected to meet approximately half of India's demand for power by 2047-48, with power generation from renewable sources taking up a share of more than 40%. In the base case scenario, Drewry forecasts that by 2039-40, coal traffic will reach 34.3 million tonnes and stagnate because of greater role of non-thermal power generation as depicted in table 3.5 below:

Table 3.5 – VOC Port Coal traffic forecast (million TEU)

Forecast Year	High	Base	Low
FY 18			12.5
FY 19	13.4	15.7	16.3
FY 20	14.7	17.2	18.1
FY 25	20.4	25.8	26.8
FY 30	26.1	32.9	34.8
FY 35	26.6	34	36.1
FY40	26.9	34.3	36.6
FY 45	26.9	34.3	36.8

3.6.3 Other Bulk and General Cargo

According to the Drewry analysis, the other bulk and general cargo of VOC Port has increased at a CAGR of 3.9% to 10.6 million tonnes over the last decade. The growth has been attributed to mainly by the progression in the import traffic. A sudden jump in wheat imports over the last two years has also provided some support to the port's other bulk and general cargo.

In base case scenario, VOC Ports other bulk and general cargo traffic could increase up to 23.8 million tonnes by 2047-48, and 28.1 million in high case scenario and 17.7 million in low case scenario. The same has been tabulated in Table 3.6 below:

Table : 3.6 - Total Other Bulk and General Cargo Forecast

Forecast Year	High	Base	Low
FY 18			9.9
FY 25	13.7	11.4	10
FY 30	16.3	13.3	11.3
FY 35	19	15.5	12.6
FY 40	22.2	17.8	14
FY 45	25.7	20.5	15.4

This cargo accounts for about 28% of the ports total cargo traffic. FRM, copper concentrate, limestone, POL, fertilizers are the kinds of general and bulk cargo which is accounted for.

VOC Port handled about 8.2 million tonnes of OBGC imports in 2016-17. Copper concentrate, limestone, Fertilizer Raw Materials (FRM), finished fertilizers; POL and edible oil were the top six cargoes, accounting for about 62% of the total OBGC imports in 2016-17.

As per the Drewary Reports the share of these six commodities in total OBGC imports has mostly remained above 70% over the last 10 years, but a temporary spike in wheat imports brought down their share over the last two years.

Copper concentrate being one of the major import cargo of the port, is with steady volume of around 1.2 million tonnes. While fertilizer imports have declined in recent years with the expansion in fertilizer production capacity in the hinterland, FRM imports have increased briskly to compensate for the decline in imports of the former.

VOC Port other bulk & GC imports have increased at a CAGR of 6.7% over the last 10 years to 8.2 million tonnes in 2016-17. Imports declined by 1.3 million tonnes in 2012-13, mainly led by a sharp drop in fertilizer imports. Imports dipped by another 1 million

tonnes in 2013-14; mainly on account of a fall in POL and copper concentrate imports. The below table no 3.7 summarizes the other bulk and general cargo traffic forecast.

Table 3.7 - Summary of other bulk & general cargo traffic forecast(000tonnes at base case)

year	Copper Concentrate	POL	Fertilizer	FRM	Limestone	Edible Oil	Sand	Other OBGC	Total	Exports	OBGC Traffic
2017-18	1304	685	354	1350	1272	347	0	2991	8303	1607	9910
2018-19	1298	709	356	1418	1352	359	400	2387	8279	1822	10101
2019-20	1298	736	358	1488	1416	372	450	1877	7995	1885	9880
2020-21	1298	766	361	1563	1485	385	500	1970	8328	1951	10279
2021-22	1298	799	363	1641	1562	398	550	2069	8680	2020	10700
2022-23	1298	328	368	1719	1645	411	600	3772	10141	2086	12227
2023-24	1298	336	373	1801	1695	424	650	2270	8847	2155	11002
2024-25	1298	345	378	1886	1747	438	700	2372	9164	2226	11390
2025-26	1298	354	383	1976	1801	452	750	2479	9493	2300	11793
2026-27	1298	364	389	2069	1858	467	750	2591	9786	2376	12162
2027-28	1298	374	401	2163	1917	481	750	4307	11691	2447	14138
2037-38	1298	502	554	3303	2679	635	750	5512	15233	3241	18474
2047-48	1298	518	573	3435	2775	651	750	6731	16731	3322	20053

3.6.4 Total Traffic Forecast for the port

The commodity-wise traffic forecast is shown in the following table.

Table 3.8 Total Traffic Forecast

S. No.	year	Containers		Bulk Cargo (in '000tons)			Total Traffic (in '000 tons)
		TEU (A)	Tonnage('000tons) (B)	Total Coal	General Cargo (D)	Total Bulk (E= C+D)	Tonnage (E+B)
1	2017-18	697631	14192	12480	9910	22390	36582
2	2022-23	1014191	19270	24447	12227	36674	55944
4	2027-28	1393078	26468	30436	14138	44574	71042
5	2032-33	1853886	35224	33765	16175	49940	85164
6	2037-38	2300451	43709	34177	18474	52651	96360
7	2042-43	2804948	53294	34300	21010	55310	108604
8	2047-48	3405530	64705	34300	23772	58072	122777

As per the above table, coal remains to be the major commodity that is likely to get handled at the port in the coming years. In the base case scenario, Drewry forecasts that by 2039-40, coal traffic will reach 34.3 million tonnes. The forecasts shows that the container traffic to reach 3.6 million TEU in base case, 4.3 million TEU in high case and 2.8 million TEU in low case, by 2048-49. In base case scenario, other bulk and general cargo traffic could increase up to 23.8 million tonnes by 2047-48, and 28.1 million in high case scenario and 17.7 million in low case scenario.

3.7 Traffic Estimation for NCB-III

3.7.1 Development of NCB-III

The Port is proposed to develop the entire East berth and South berth area comprising berths AB-I to AB-9 as a clean cargo/container area by converting berth No.9 as container berth. For converting this 9th berth into Container terminal, a possibility of shifting the existing project "Mechanization of Cargo evacuation from 9th berth to coal yard on license basis under Revenue share mode for a period of 10 years" by the existing licensee to NCB-III is to be explored.

For the above exercise, the first and logical step is to estimate the likely quantum of cargo that is likely to get handled at the proposed berth. This shall have the direct impact on the financial feasibility of shifting belt conveyor system from Berth No-9 to NCB-III.

3.7.2 Basis for Traffic Estimation

The consultants have adopted multiple approaches to estimate the traffic potential of the NCB-III berth. All current and future thermal power plants and their likely coal demand were studied. This was required as the one of the major commodity that is likely to get handled at the proposed berth is coal. Moreover, all handling facilities that are expected to get installed (belt conveyor system, cranes etc.) are shifted from Berth No- 9. Till date, coal is one of the primary cargos that are handled at the Berth No- 9. Therefore, it is expected to be one of the prime commodities that shall be handled at the Berth No NCB-III.

Apart from above, consultants have studied and used the Drewry Report. The report deals with the detailed commodity wise traffic estimation and year wise forecasting for each commodity that is likely to get handled at the port. The basis of the report was the detailed study of the hinterland, nearly thermal power plants, all major industries etc.

3.7.3 Traffic Handled at Berth No-9

Apart from the Drewry report, consultants also studied the past performance of the various berths of the port. Especially, the historical data pertaining to the quantum and

types of cargo that were handled at the Berth No-9 are very relevant to study as the facilities including belt conveyor system and handling facilities that are proposed to installed at new Berth are getting shifted from Berth No- 9. It is expected that all current bulk cargo types that are getting handled at Berth No 9 shall be shifted to the proposed NCB-III Berth. Therefore, it is very pertinent to study the past performance of the Berth No-9, which shall have major bearing on the traffic potential for Berth NCB-III. Following table shows the commodity and quantum wise cargo handled at Berth No-9 over the years, which are considered, for estimation for NCB-III, Commodity wise Cargo Handled at Berth No-9 in **Table 3.9:**

Table 3.9 Commodity wise Cargo Handled at Berth No-9 (In Tons)

Commodity	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Coal	749256	3753394	4245256	4107001	3146925
Limestone	43557	419465	531310	562900	859374
Gypsum in bulk	48352	8343	4345	6182	64707
Rock Phosphate	NA	NA	NA	419922	446123

As explained in the table, in the year 2017-18, more than 77% of total cargo that are handled at Berth-9 is Coal. Limestone stood second in the list with more than 21% of total cargo. In the previous years, the percentage share was 87.8% and 12% for Coal and Limestone respectively. The quantum of Gypsum is negligible as compared to other two commodities. Additionally Substantial quantity of Rock Phosphate got handled at Berth-9 in past couple of years.

3.7.4 Commodity Wise Methodology and Assumptions

The present exercise is related to the commodity wise quantum of traffic that is likely to get handled at NCB-III for the horizon years. While estimating and forecasting for cargo for NCB-III, consultants applied some of the assumptions that are needed to achieve the desired goal. Underlying Assumptions for the Study are mentioned below:

1) It is proposed that NCB-III shall be used to handle bulk cargoes only. Therefore only bulk cargo namely Limestone, bulk Gypsum, Copper concentrate, Rock Phosphate and Coal are considered for the projections.
2) Currently, commodities like Limestone, Copper Concentrate, Gypsum, and Rock Phosphate are handled at multiple berths. However, to streamline the handling process, it is assumed that all projected quantum of above cargo types (as projected in earlier reports) shall be handled at proposed NCB-III.
3) Remaining berth capacity (total capacity- 8 MTPA) shall be used for coal handling.
4) Coal demand for private parties and two Thermal Power Plants (SEPC and Mutiara) are used for projections, which shall be shared, by NCB-II and NCB-III.
5) Berth NCB-II shall start operating with full capacity (7 MTPA) from the year 2018-19 and shall handle coal traffic only.

Additionally, to estimate the base year cargo potential along with the forecasting, it is very pertinent to study the future demand centers of cargo to present the more accurate and close-to-realty picture especially for Coal. Following paragraphs deals with the commodity specific methodology adopted to estimate the cargo potential for NCB-III.

3.7.5 Coal

VOC Port serves the number of thermal power plants in the state of Tamil Nadu. It is estimated that the Tuticorin produced 15.6 thousand GWh of power from coal, which is 22.3% of Tamil Nadu's total coal-based power generation in 2016-17. After the implementation of the forecasted coal-based power plants in Tuticorin, the share of Tuticorin in Tamil Nadu's total coal-based power generation is expected to reach 49.3% by 2027-28. Currently, VOC Port serves 3,657 MW of installed thermal power capacity in the hinterland, including captive power plants. By 2024-25, VOC Port could tune-up coal needs to 7,382 MW of thermal power capacity.

Table 3.10 Major Thermal Power Plants in the Port Hinterland along with Capacity in MW

Power Plant (MW)	Company	FY17	FY20	FY25	FY30	FY35	FY40	FY48
Mutiara TPP	Coastal	1,200	1,200	2,800	2,800	2,800	2,800	2,800
Tuticorin TPP	TANGEDCO	1,050	1,050	1,050	1,050	1,050	1,050	1,050

Power Plant (MW)	Company	FY17	FY20	FY25	FY30	FY35	FY40	FY48
Tuticorin (JV) TPP	NLC	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Udangudi TPP	TANGEDCO	0	0	1,320	2,640	2,640	2,640	2,640
Uppur TPP	TANGEDCO	0	0	1,600	1,600	1,600	1,600	1,600
SEPC TPP	SEPC	0	525	525	525	525	525	525

Table 3.11 List of Captive Power Plant along with Capacity in MW

Ind-Barath	Ind-Barath Power Gencom	189	189	189	189	189	189	189
Sterlite	Vedanta	160	160	160	160	160	160	160
DCW	DCW	58	58	58	58	58	58	58
Total installed TPP capacity		**3,657**	**4,182**	**8,702**	**10,022**	**10,022**	**10,022**	**10,022**
Capacity served by VOC Port (MW)		**3,657**	**4,182**	**7,382**	**7,382**	**7,382**	**7,382**	**7,382**

Coal that is directed to many of the above power plants are unloaded at captive port berth CJ-I and CJ-2. However, coal for some power plants and Captive Power plants for other industries, are unloaded at general cargo berths including berth No-9. List of these power plants and captive power plants are shown below:

Table 3.12 List of Power Plants along with Capacity in MW for NCB-III

Power Plant (MW)	Company	FY17	FY20	FY25	FY30	FY35	FY40	FY48
Mutiara TPP	Coastal Energen	1200	1200	2800	2800	2800	2800	2800
SEPC TPP	SEPC	0	525	525	525	525	525	525
Ind-Barath	Ind-Barath Power Gencom	189	189	189	189	189	189	189
Sterlite	Vedanta	160	160	160	160	160	160	160
DCW	DCW	58	58	58	58	58	58	58

It is informed that the coal meant for above demand centers are likely to get handled at NCB-II and NCB-III berths. As indicated above also, the berth capacity of NCB-II and NCB-III are 7 MTPA and 8.9 MTPA respectively. Coal requirement for above thermal plants are estimated based on the available conversion factors which is shown in following table:

Table 3.13
Estimated Coal Requirement for Thermal Power Plants including Captive Power Plants (in MT)

	FY17	FY20	FY25	FY30	FY35	FY40	FY48
Mutiara TPP	4.20	4.20	9.80	9.80	9.80	9.80	9.80
SEPC TPP	2.00	2.00	2.00	2.00	2.00	2.00	2.00
*Coal for Private Parties like Sterlite, DCW etc. (As per Drewry Report)	3.00	3.23	3.64	4.11	4.64	5.23	6.20
Total	9.20	9.43	15.44	15.91	16.44	17.03	18.00

Substantial portion of above estimated coal traffic shall be handled at the proposed NCB-III berth.

3.7.6 Limestone

To estimate the quantity of Limestone that is likely to get handled at Berth NCB-III, consultants have studied the past quantum of Limestone handled at VOC Port along with the berths on which the Limestone was handled. It was found that Limestone was getting handled at multiple berths.

Limestone Handled at VOC Port in Past Years (in 000 T)		
S. No.	**Year**	**Quantity**
1	2013-14	521
2	2014-15	870
3	2015-16	1,079
4	2016-17	1,109
5	2017-18	1,095

The Limestone handling saw and average growth of 14% in last few years. As per the Drewry Report, the quantity is expected to reach to the level of 1.5 MTPA in the year 2025-26 and 3.3 MTPA in the year 2047-48. As limestone is basically used in Cement manufacturing units, it remains to be one of the major importing cargo at Port due to country's ever increasing Cement demand.

3.7.7 Rock Phosphate

Rock Phosphate is other major commodity that is projected to get handled at NCB-III. The imported Rock Phosphate is currently being used by nearby industries like Sterlite

Industries and Tuticorin Alkali Chemicals and Fertilizers Limited. Consequently, in the last few years the substantial Rock Phosphate is imported which is shown in following table

Rock Phosphate Handling at Berth-9 (in T)		
S. No.	**Year**	**Quantity**
1	2016-17	419922
2	2017-18	446123
3	2018-19	105060

Further study of mentioned consuming industries shows that they have no immediate plan of expansion. Therefore, it is expected that the quantum of imported Rock Phosphate remains constant.

3.7.8 Other Commodities, like Gypsum, Copper Concentrate

Similarly, in case of Gypsum too, historical information on the pattern of Gypsum handled at Berth No-9 formed an important basis for estimation of Gypsum likely to be handled at Berth NCB-III. Similarly, Copper Concentrate (1.2 MTPA), which is primarily used in the Sterlite Industries, shall also get handled at NCB-III. Sterlite industries have no immediate plan of expansion in near future. Therefore, the quantum of imported Copper Concentrate is expected to the level of 1.2 MTPA in coming years.

3.7.9 Consolidated Traffic Estimation and Forecasting of Cargo for NCB-III

Based on the above traffic estimation and forecasting has been done for NCB-III. For commodity wise forecasting for horizon years, consultants have used the combination of quantitative forecasting techniques and inferences arrived in the past traffic reports. **Table 3.14** shows the commodity-wise forecasting for cargos that are likely to get handled at NCB-III.

Table 3.14: Cargo Projections for NCB-III (MTPA)

Year	Limestone	Gypsum	Copper concentrate	Rock Phosphate	Coal	Total Cargo Handling
2019-20	1.22	0.09	1.20	0.45	2.27	5.24
2024-25	1.50	0.14	1.20	0.45	2.67	5.96
2029-30	1.76	0.18	1.20	0.45	5.31	8.90
2034-35	2.09	0.18	1.20	0.45	4.98	8.90
2039-40	2.48	0.19	1.20	0.45	4.58	8.90
2044-45	2.97	0.19	1.20	0.45	4.09	8.90
2049-50	3.32	0.19	1.20	0.45	3.73	8.90

As already explained, coal meant for Mutiara and SEPC thermal Power Plants are expected to get handle at NCB-II and NCB-III berths. Additionally, coal meant for Private coal Importers like Sterlite Industries, DCW etc is expected to get handle at this berth.

Chapter – 4

4.0 Development needs and Planning Considerations

4.1 Introduction

The cargo and vessel traffic for VOC Port has been discussed in Chapter-3. The developmental needs to service the vessels and proposed traffic are discussed in this Chapter. Basic needs for servicing cargo with suitable cargo handling equipment, storage facilities and efficient hinterland transport linkages for cargo evacuation and aggregation. Developments should also provide other infrastructure facilities, such as power and water supply, firefighting and environmental control and protection. These aspects are dealt in the following paragraphs.

4.2 Vessels Servicing

4.2.1 Berth Length

The length of NCB III is 306 m and width of 22.9m. Vessel uptill 75,000 DWT can be berthed at this berth. This vessel shall have Length Over All (LOA) of 225 m.

4.2.2 Water Depth

Depending on the nature of sea bottom (whether soft or hard), for safety to vessels hull, a net under keel clearance (UKC) is provided after allowing for additional depth of water over and above the fully laden draft of the vessel (to be serviced in a particular area) to offset the effects of squat (vertical movements in case of moving ships), rolling and pitching, current velocity, inaccuracies in hydrographic survey, salinity etc. The under keel clearance depends upon the speed of the vessel and the degree of protection available. The squat for 75,000 DWT vessel at a speed of 8 knots are estimated as 0.6 m and 0.4 m.

As per PIANC ICORELS (International Commission for Reception of large Vessels), According to water depth requirements at the berth for the different vessel sizes are given in Table 4.1

Table 4.1 Under keel clearance and water depth at berth:

Vessel Size (DWT)	Fully Laden Draft (m)	Under keel Clearance (m)	Required Water depth at berth (m)
75,000	13.5	1.0	14.5
30,000	11.0	0.8	11.8
20,000	10.5	0.8	11.3

4.2.3 Tranquility

The tranquility conditions required at the berths for efficient cargo handling operations depends on vessel sizes, cargoes and packaging types. Bulk carriers like 75,000 DWT sized can operate upto 1.0 m wave height.

The tranquility conditions required for cargo handing operations for different cargoes and packaging types as per the India Standard Code of Practice (IS: 4651) and proposed for the NCB III at VOC Port is indicated below:

	IS: 4651 (Recommends)	VOC Port (Suggested)
Dry Bulk	0.90-1.2 m	1.0 m (75,000 DWT Vessels)

4.3 Cargo Servicing

4.3.1 Cargo

The terminal is to be designed for handling bulk solid cargo such as Coal, Lime Stone Gypsum, Rock Phosphate and Copper Concentrate based on the discussions with client and review of the previous data.

4.3.2 Cargo Characteristics

The cargo characteristics considered for arriving at the size of storage as well as planning of the material handling system are given in Table 4.2 below:

Table 4.2: Cargo Characteristics

Material	Average Bulk Density (t/cum)	Angle of Repose (degrees)
Coal	0.8	34
Limestone	1.3	30
Gypsum	1.4	38
Copper concentrate	1.9	40

Rock Phosphate	0.9	40

4.3.3 Cargo Volume

The cargo volume likely to be handled at VOC Port has been discussed in Chapter 3. The facility planning for the cargo handling has been made for the traffic growth in stage (5.4MTPA in 2020-21 AD, 8.9 MTPA in 2026-2027 AD).

4.3.4 Parcel Size

On an average 90% of the DWT size of a particular vessel has been taken as the cargo parcel size the vessel would carry, leaving 10% for carriage of fuel oil, freshwater etc. the average parcel size for coal shall be 60,000 T and 13,000 T for other bulk cargo.

4.3.5 Cargo handling Rates

The main commodities to be handled are Coal, Lime Stone, Copper Concentrate, Rock Phosphate and Gypsum. The ship to shore transfer of cargo at NCB III is expected to be carried out by existing mobile harbour cranes or by grab ship unloader installed on NCB III. The effective handling rate per ship-berth cargo-wise, as adopted is presented in Table 4.3.

Table 4.3: Cargo-wise ship sized and Handling Rates

Cargo Size	Ship Size ('000 DWT)	Handling Rate (TPH)
Domestic Coal	75	2,000
Lime Stone	30/20	2,000
Gypsum	30/20	2,000
Copper	30/20	2,000
Rock Phosphate	30/20	2,000

4.4 Berth Occupancy at NCB III

The terminal operations take place round the clock and throughout the year. Considering holidays and whether down his effective working days per year shall be 320 days. For the purpose of calculating the berth occupancy and daily throughput. Based on the Consultant experience productive cargo handling time at the berth has been taken as 20

hours to account for shift changes, equipment repositioning/shifting from one hatch to the other and for any unplanned stoppage.

The berthing-deberthing time and the miscellaneous time requirement for pre starting and post completion of a vessel at berth is assumed to be 4 hours per ship call.

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 operational days for a berth in one year. As per the norms generally followed the berth occupancy is presented in **Table 4.4**.

Table 4.4 Norms for Berth Occupancy Factor

No. of berths	International Standard	Indian Practice
1	40%	60%
2	50%	70%
3	55%	70%
4	60%	70%
5	65%	70%

A single bulk cargo berth for multiuser should be limited to about 60% as per Indian practice. For two berths the same could be increased to 70% also. Higher levels of berth occupancy will result in bunching of ships resulting in undesirable pre-berthing detention. For limited number of berths and with random arrival of ships, the berth occupancy levels have to be kept to norms as indicated in Table 4.5 and 4.6.

Table 4.5 - Berth occupancy for cargo of 2020-21 with 4000 TPH conveyor system

S. No.	Particulars	Unit Coal	Coal	Limestone	Gypsum	Copper Concentrate	Rock Phosphate
1.	Proportion of Cargo Type handled at the Terminal	%	43	24	2	23	8
2.	Quantity of Cargo Type Handled at the Terminal	MTPA	2.3	1.28	0.1	1.2	0.45
3	Ship size	DWT	75,000	15,000	15,000	15,000	15,000
4	Proportion of Cargo Handled through ship	%	100	100	100	100	100
5.	Average Parcel size	T	60,000	13,050	13,050	13,050	13,050
6.	No. Of Ship Calls per Annum	No.	38	98	8	92	34
7.	Average Handling Rate	TPD	48,000	25,000	25,000	25,000	25,000
8.	Time Required at Port Per Ship						

S. No.	Particulars	Unit Coal	Coal	Limestone	Gypsum	Copper Concentrate	Rock Phosphate
a.	Handling Time	Days	1.25	0.52	0.52	0.52	0.52
b.	Berthing / Deberthing& Miscellaneous Time	Days	0.17	0.17	0.17	0.17	0.17
	Total Time per Ship	Days	1.42	0.69	0.69	0.69	0.69
9.	Berth Days Occupied by each cargo	Days	54	68	5	64	24
10.	Total Days for which berth in Occupied	Days	215				
11.	Berth Days Available per Berth	Days	350				
12.	Berth Occupancy During Peak Period	%	61				

In case rock phosphate cannot be handled at this facility, then the berth occupancy shall be 55%.

Table 4.6 - Berth occupancy for cargo of 2029-30 with 4000 TPH conveyor system

S. No.	Particulars	Unit Coal	Coal	Limestone	Gypsum	Copper Concentrate	Rock Phosphate
1.	Proportion of Cargo Type handled at the Terminal	%	60.3	19.2	2.0	13.5	5.0
2.	Quantity of Cargo Type Handled at the Terminal	MTPA	5.31	1.76	0.18	1.2	0.45
3	Ship size	DWT	75,000	15,000	15,000	15,000	15,000
4	Proportion of Cargo Handled through ship	%	100	100	100	100	100
5.	Average Parcel size	T	60,000	13,050	13,050	13,050	13,050
6.	No. Of Ship Calls per Annum	No.	90	130	12	92	34
7.	Average Handling Rate	TPD	48,000	25,000	25,000	25,000	25,000
8.	Time Required at Port Per Ship						
a.	Handling Time	Days	1.25	052	0.52	0.52	0.52
b.	Berthing / Deberthing& Miscellaneous Time	Days	0.17	0.17	0.17	0.17	0.17
	Total Time per Ship	Days	1.42	0.69	0.69	0.69	0.69
9.	Berth Days Occupied by each cargo	Days	128	90	8	64	24
10.	Total Days for which berth in Occupied	Days	314				
11.	Berth Days Available per Berth	Days	350				
12.	Berth Occupancy During Peak Period	%	90				

It is observed that the berth occupancy for the 2028 – 2029 AD is 90%.

In case rock phosphate cannot be handled at this facility, then the berth occupancy shall be 83%.

4.5 Storage Facilities

4.5.1 Stackyard

The stackyard in a coal unloading port is required to temporarily store bulk cargo for transit purpose before evacuation to hinterland for end user. The quantity of stock piled should commensurate with the number and types of bulk cargo's to be handled, their throughput requirements, rate of unloading, vessel size, evacuating system proposed etc.

The volumetric capacity of bulk cargo stack yard will depend on the bulk density of the material and the volume in turn depends upon the angle of repose of material, the length, width and height of stock pile. The volume of stackyard will further depend on the length, width and height of stockpile. If the height and width of stockpile is restricted, then the length has to be increased which may not be prudent for that will mean too frequent travel for the yard machines over long distances. Also the land area should be judiciously used as it will involve cost in developing. The best way to optimize the capacity is to optimize the height. There are three aspects that impose a limitation in stack height and is as follows.

- The load bearing capacity of the soil which can be overcome by soil improvement methods.
- If the stack height is increased abnormally, then the surcharge angle of boom conveyor will become high making it technically unworkable. Further due to the limitation imposed by the angle of repose, the capacity increase will not be directly proportional to increase in height.
- The characteristic of coal that cause combustion due to auto ignition on account of burden of coal in high stockpiles. This is more pronounces if the coal stays in the stackyard for too long.
- With increase in height, there is a possibility of air borne pollution due to windage.

The problems as in the last two bullets are prominent during hot and dry summer months. To limit the problem of auto ignition in case of coal and contain pollution due to windage and optimize on the cost of improving soil for increasing load bearing capacity of stackyard area it is proposed restrict stack height to 10 meters for coal and 6 meters for other cargos initially.

It is proposed to adopt a stackyard with an arrangement of parallel rows of stacks on either side of stacker / reclaimer. The storage area may be open to the elements with an effective system of pollution control and fire fighting measures.

4.5.2 Stackyard capacity

The storage has been calculated based on the UNCTAD manual on 'port development', Storage area for different cargo has been calculated based on the 1/15 of the annual throughput as 1.5 times the maximum parcel size. The storage requirement for 2020 2021 is as given in Table 4.7.

Table 4.7 - Storage requirement for 2020-2021

Cargo	1/15 of annual throughput (T)	1.5 times the maximum parcel size (T)
Coal	153,000	90,000
Lime Stone	85,000	20,000
Gypsum	6,700	20,000
Copper Concentrate	80,000	20,000
Rock Phosphate	30,000	20,000

For the purpose of planning the facilities the stackyard requirement has been worked out based on 1.5 times the maximum parcel size.

Chapter – 5

5.0 Component of Handling System

5.1 General

The Material Handling System for the facilities shall be considered based on the conveying system from NCB III to stack yard to be 4000 TPH.

5.2 Design Criteria

All design will conform to the relevant Indian Standards and Codes of Practice. In case any information is not available in the Indian Codes, equivalent codes issued elsewhere will be suitably adopted subject to approval.

Equipment and conveying system to be designed with careful consideration of the accessibility of all drives and other machinery for inspection and maintenance.

Machine components such as motors, reducers, bearings, etc., shall be standardised.

All equipment shall be suitable for heavy duty and continuous operation.

Provision of space for future requirement shall be kept wherever applicable.

5.3 Design System

5.3.1 Berth to Storage area

The conveying system from the berth to the stackyard are to be designed for 4000TPH.

5.3.2 Gantry Type Ship Unloaders

The rail mounted Gantry Type Ship Unloaders shall be installed for handling the cargo at NCB III. Two unloaders each having capacity of unloading 2,000TPH shall unload the cargo at NCB III. The unloader shall directly discharge the cargo on belt conveyor installed on the jetty.

5.4 Conveyor System

Conveyor system in a facility of this type is expected to meet the basic requirements of reliability, sustained operation with minimum maintenance and operation costs.

5.4.1 Conveyor System Components

The belt conveyor depending upon the take-up travel length and preference to vertical gravity type take-up, belting of Nylon-Nylon type will be selected. Keeping in view the duty, belt flexing, elongation characteristics (permanent and elastic suitable safety factor) will be provided in selecting the belt.

Convex and concave vertical curves in the conveyor profile will be used only wherever necessary. Generous radius will be provided to minimise edge tensions and to eliminate belt lifting off the idlers and consequent spillage.

All carrying idlers shall be three roll interchangeable rolls fixed type having 2 degree forward tilt, with 45^{o}troughing angle for receiving/dispatch conveyors and return idlers shall be V-Type with 10 degree trough.

Impact type idlers shall be three (3) roll type provided with number of tough rubber discs with minimum shore hardness of 55 to 60 deg. on shore 'A' scale.

The self-aligning idlers with side guide rollers shall be provided.

The idlers shall be maintained by provided greased for life bearings and having a friction factor not exceeding 0.022.

To maintain belt sag within permissible limits of 2% which otherwise will lead to material spillage and also to provide minimum belt tension required for effectively driving the belt suitable tension through counter weight will be provided.

Pulleys provided will be of sturdy construction, with shaft mounted on spherical roller bearings. All drive pulleys will have grooved lagging and non-driven pulleys will have plain lagging.

Plummer blocks shall be 4 bolt centre split type, cast steel construction equipped with double row self-aligning spherical roller bearings with labyrinth seals and grease nipples suitable for use in saline atmospheric condition.

Multiple blade spring operated type belt scrapers (primary & secondary) will be provided at discharge end of each conveyor for removing the heavy residue of materials adhering to the belt surface. The v-plough (internal) scrapers shall be fitted in front of tail pulley and take-up pulley to prevent the material which is falling on the top surface of return belt.

Effective guards or shrouds shall be provided for all rotating pulleys, shafts, couplings etc.

5.4.2 Transfer Points & Galleries

The main considerations guiding the designing of conveyor system are as follows:

- The transfer points design will limit the material fall to the minimum from one conveyor to another which will not only reduce impact on the belt and idlers but also keep the dust generation to the minimum. Special seals and hoods will be provided to minimise the dust escape. Chutes will be provided with suitable type of liners and all joints forming edges will be ledged.

- To enable easy and quick clean-up, if spillage does occur at transfer points, certain minimum clearance under the conveyors will be maintained. Floors at transfer houses will have a suitable slope so that the wash down or any water which may come in due to leakage of cover sheeting will be drained off quickly. At all transfer points, necessary scrapers, return plows and deck plates will be provided to stop material falling onto return belt in case of spillage, which otherwise will get lodged between belt and pulley and ultimately damage the belt.

- To guide the falling material onto the lower belt, skirt boards upto 5 m length to be provided at all feeding points.

- The conveyors will generally be provided with covers. However, for the conveyor at the berth shall be open in the entire loading zone and elevate with covered gallery connecting with the first transfer point.

5.4.3 Drives

All conveyor drives will be generously sized to take care of occasional surges or overloads. Drive unit consisting of motor, fluid coupling, gear reducer and flexible coupling will be mounted on common steel base. Motors, reducers, couplings, etc., will be rated to meet the duty requirements and will be standardised to facilitate inter-changeability.

5.4.4 Safety Devices and Interlocking

Belt conveyor system; though less troublesome, can at times prove hazardous if proper safety precautions have not been taken. Pull cord, under speed, and belt sway switches at suitable intervals will be provided all along the length of conveyors. Chutes will be provided with plug chute switches to indicate any undue build-up of material at transfer points.

To ensure that belt conveyor is running at the designed speed, under speed switches will be mounted on tail pulley of each conveyor, which, apart from indicating the slippage between pulley and belt, will also control the sequential starting of the conveyor system.

For preventing material build up in chutes caused by differential coasting times of the following and preceding conveyors, brakes of compatible ratings will be provided on the drives. The brake ratings will be based on the inertia of the conveyors and will be selected for the required torque and thermal ratings. Where ever found necessary hold back will be provided on the drive pulley of an inclined conveyor so as to ensure that no rolling back of conveyor occurs when the loaded belt is stationary.

5.4.5 Maintenance

Generally, belt conveyors are the least troublesome equipment known in material handling systems. However, unforeseen breakdowns requiring minor on the spot repairs or major maintenance, cannot be ruled out. Long shutdown of plant can be altogether avoided by keeping suitable spares handy. The number of necessary spares will be kept to a minimum by providing a system design incorporating inter-changeability and standardisation of components involved.

For easy maintenance of heavy components like the drive units located at elevated transfer houses, necessary monorail hoists will be provided.

Transfer towers will be designed to suit easy replacement and vulcanising of belts.

5.4.6 Suspended Magnets and Metal Detector

- Suspended Electro-Magnets shall be provided on conveyors to remove tramp metals being carried along with the material on the belt.
- Two (2) nos. of metal detectors shall be provided for each magnet. One (1) no. before the magnet and One (1) no. after the magnet which shall detect presence of any metallic pieces and subsequently send signal to the magnet to remove it.

5.4.7 Belt Weigher

The weigh scale shall be automatic and electronic type. It should be designed for continuous automatic weighing, metering and printing of cargo flow for a range of 20% to 120% of design capacity

5.4.8 Hoisting and Handling Facilities

Suitable hoists shall be provided for erection & servicing of all major equipment. The equipment to be covered shall include (but not limit to) all conveyor drive units, all pulleys, magnetic separators, various service water/potable water pumps, gravity take up units, removal of any other major equipment.

5.4.9 Dust Control System

Dust from the operation of belt conveyors originates mainly at the tail pulley where material is received and at the head pulley where material is discharged. Dust generation depends on belt width, belt speed and height of fall of material to be conveyed.

5.4.10 Design Requirements for D.C.S.

- Dust control and abatement systems shall be provided to contain escape of dust into atmosphere while the facilities are in operation. The systems shall be designed to conform to the permissible limit of dust emission by the concerned statutory pollution control authorities.
- The concentration of RSPM-10 shall be limited to an average 2 mg/normal cum over and above the ambient dust concentration measured at a circumferential distance of 5 m from the dust generation source.
- The filtering efficiency shall not be less than 95%.

5.4.11 Belt Cleaning System

As rock phosphate is also to be handled at this terminal. The cleaning and washing of the belt is needed, before rock phosphate is handled. The cleaning of the belt can be carried with the help of scrubbers and washing the belt. The transfer tower also needed to be cleaned before handling the rock phosphate.

5.5 Proposed Dust Extraction System:

The Dust Extraction system to be provided in the Transfer Towers shall be compact reverse pulse jet type with Insertable Filter Bags at the dust generation points with a provision to feed the dust collected in the bags back to the conveyor/system without any loss of material.

Chapter – 6

6.0 Material Handling System for NCB III

The Material Handling System shall consist of:

Two gantry types ship loaders each with a capacity of 2,000 TPH with one conveyor streams of 4,000 TPH capacity.

The stackyard area is located at North West of the berth in the Hare Island area. The location stackyard and the conveyor route is shown in the Drawing no. VOCP/NCB III/MS-002.

6.1 Handling System

The overall handling system is depicted in the form of flow diagram as shown in drawing no VOCP/NCB III/MS-003. Conveyor profiles are shown in the Drawing No. VOCP/NCB III/MS-004/005/006.

The components of system consist of the following:

- Conveyor System: with number of conveyor and their design parameters proposed are given in **Table 6.1**.

Table 6.1 – Design parameter for conveyor

VOC PORT, TUTICORIN	Conveyor No. >>>>>	1	2	3	4	5	6	7	8	9	10	11	11	11	12	13
		Conv. BC-1	Conv. BC-2	Conv. BC-3	Conv. BC-4	Conv. BC-5	Conv. BC-6	Conv. BC-7	Conv. BC-8	Conv. BC-9	Conv. BC-10 A/B	Conv. BC-11	Conv. BC-12	Conv. BC-13	Conv. BC-14	Conv. YC-1 A/B
	No. Of Conveyor	1	1	1	1	1	1	1	1	1	2	1	1	1	1	2
Belt Width	mm	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Horizontal CRS	m	296	91	856	148	456	826	206	1040	363	116	126	35	170	21	712
Vertical Lift	m	6000	3.3	2.8	0	3.7	3.7	3.7	3.5	0.0	10.5	15.5	0.0	37	0.0	11.4
Rated Capacity	t/h	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
Design capacity	12	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800
Belt Speed	m/s	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6

The stockyard area is located far from berth NCB-III at Hare Island area, adjacent to other coal stockpile. The stockpile are available is about 47,000 sqm which can accommodate 1,70,000 T storage capacity.

- One stacker cum reclaimer and one reclaimer with boom length of 42 m shall be installed in the stackyard. Yard conveyors transfer the cargo to the Stacker/Reclaimer. The stackers shall prepare stockpiles having 40 m wide and 10 m in height. Stacker shall have stacking capacity of 4,000 TPH. Reclaimer shall have reclaiming capacity of 2,000 TPH.
- Cargo reclaimed by reclaimer is transferred to the silos of Truck or Rapid Rail Loading Systems. The Rapid Rail Loading System as shown in Drawing No. VOCP/NCB-III/MS-006. By this system the cargo shall be faster and is environmental friendly.
- Reclaiming can also be done by front end loader and dumper truck, if required

6.2 Rapid Rail / Truck Loading System

For evacuating bulk materials speedily, rapid wagon loading systems have come into use in a big way, this is also called flood loading system. It has a precision & intelligent train loading system and is the most advanced train loading system today. It can weigh and load material continuously and automatically as per the applicable weight restriction.

The system broadly consists of the following elements

- A receipt and despatch yard.
- Railway lines from R&D yard to loading station for movement of railway wagons.
- A steel or concrete silo for holding enough bulk material to ensure uninterrupted loading into wagons.
- A rapid load out system from the silos into wagons.

A silo can be either steel or an RCC structure and normally has a capacity to hold 2,000 T to 4,000 T of coal. The silos are fed from the coal stackyard by means of a conveyor system onto the top of the silo. The cylindrical shaped silos have a conical discharge chute with gate system, load cells to automatically discharge coal, limestone into a moving rake. The silos have necessary chute level sensors, heat sensors, and raw water sprinkling system for efficient, safe and clean operations. The capacity of silo depends upon the operational requirement of no. of rakes to be loaded per day, number of grades of coal handled, handling rate of conveyor system that feeds cargo into the silo etc.

6.3 Truck Loading System

The cargo reclaimed by the reclamer in the stack yard is conveyed through a conveyor for loading to the Truck Loading System having capacity of 400 tonnes with a weigh bridge. For loading of a truck is driven and positioned right below the silo. There will be a traversing telescopic chute / swing chute below the silo positioned above the truck loading body. After the truck arrives at the loading area and positioned below the silo, the operator at the station triggers the operation and loads coal in the truck with precision.

There is also an advanced system in which the truck driver himself operates the truck through the light signals. When the loading is complete, the driver is signaled to leave. The entire process is managed by the PLC so that the driver never has to leave in cabin. The system is capable of identifying different truck lengths and heights, thus ensuring continuous loading process and enhancing the loading efficiency.

Chapter – 7

7.0 SWOT Analysis

7.1 General

In chapter-6 the development of NCB III berth is elaborated and discussed in details. SWOT analysis is carried out for the development and is given below;

7.2 SWOT

STRENGTHS (+)		**WEAKNESSES (–)**	
a.	Berth is designed for grab unloader which is recommended equipment for handling bulk cargo. In this system port can deploy two grab unloader, with the capacity of 2000 TPH each.	a.	No future expansion is possible at stockyard area due to space limitation.
b.	The system shall be able to achieve 4000 TPH handling rate.		
c.	Adequate storage area is available to store coal and other cargos as well. Have a provision to store 1.5 times of average parcel size of each cargo which shall be handled by NCB III.		
d.	Rapid rail and truck loading facilities can be provided in this system.		
e.	System is environmental friendly.		
OPPORTUNITIES (+)		**THREATS (–)**	
a.	The capacity of the terminal shall be about 8.9 MTPA.	a.	The conveyor has to be routed by the side of the road, which shall restrict the road widening in future.

Chapter – 8

8.0 Electrical System for NCB III

8.1 General

NCB III berth and the material handling system requires power round the clock for smooth operation of material unloading, transportation upto the stackyard by conveyor belts, reclaiming the material for loading in the railway wagons/trucks. In addition to this, power is required for lighting, fire pumps, jockey pumps, warning system e.g. sirens and PA system, battery charging, welding etc.

8.2 Power supply to the facilities

22KV supply will be taken from the port's existing arrangement. This will be further stepped down to 3.3 KV and 0.433 KV by using suitable transformers. To maintain power factor at 0.85 to 0.9 capacitor banks of suitable size will be used. Voltage drop and frequency variation will be maintained within permissible limit of ± 5%.

It is proposed to build a two storied substation measuring 30m x 7.5m.

8.3 Load requirement

8.3.1 Details of load requirement

The electrical load requirement is given in **Table 8.1** below:

Table 8.1 Power Demand

S. No.	Equipment Description	Qty	Unit	Installed Load (KW)		Diversity Factor	Demand Load (KW)
				Per Equip	Total		
1.	Conv. BC-1 (284 m)	1	No.	225	225	0.5	**113**
2.	Conv. BC-2 (89.45 m)	1	No.	110	110	0.5	**55**
3.	Conv. BC-3 (856 m)	1	No.	275	275	0.5	**138**
4.	Conv. BC-4 (148 m)	1	No.	85	85	0.5	**43**
5.	Conv. BC-5 (465 m)	1	No.	200	200	0.5	**100**
6.	Conv. BC-6 (826 m)	1	No.	310	310	0.5	**155**

S. No.	Equipment Description	Qty	Unit	Installed Load (KW)		Diversity Factor	Demand Load (KW)
				Per Equip	Total		
7.	Conv. BC-7 (206 m)	1	No.	150	150	0.5	**75**
8.	Conv. BC-8 (330 m)	1	No.	350	350	0.5	**175**
9.	Conv. BC-9 (363 m)	1	No.	150	150	0.5	**75**
10.	Conv. YC-1 (712 m)	1	No.	310	310	0.5	**155**
11.	Conv. BC-10 (115 m)	1	No.	160	160	0.5	**80**
12.	Conv. BC-11 (167 m)	2	No.	300	600	0.5	**300**
13.	Conv. BC-12 (21 m)	1	No.	85	85	0.5	**43**
14.	Stacker/Reclaimer	1	No.	600	600	0.3	**180**
15.	Reclaimer	1	No.	600	600	0.3	**180**
16.	Magnet	1	No.	30	30	0.2	**6**
17.	Metal Detector	2	No.	0.5	1	0.2	**0**
18.	Belt Weigher	1	No.	1	1	0.5	**1**
19.	Electric Hoist	14	No.	3.5	49	0.1	**5**
20.	Conveyor Gallery lighting (length-3600 m)	180	No.	0.02	3.6	0.8	**3**
21.	High Mast Lighting in Jetty and Yard	8	No.	15	120	0.8	**96**
22.	Dust Extraction System	4	No.	10	40	0.8	**32**
23.	Fire Fighting Pumps	3	No.	10	30	0.3	**9**
	Total Load in kW				**4,601**		**2,436**
	Power Factor						0.85
	Demand in KVA						**2,800**

In addition to the conveyors, power supply to the unloaders is also required.

The total required at 0.85 pf shall be 6250 KVA (5312 KW)

To meet these load requirements, 8MVA, 22KV/3.45 KV. Dynll ONAN Transformer will be required:

8.4 System Arrangement

1. Main transformer 22KV/ 3.45KV. 8 MVA can take the entire load.

2. Schematic Electrical distribution diagram is shown in the Drawing No. VOCP/NCB-III/ES-001.

3. All outdoor cables will be directly buried and internal cables will be routed through trench. Armoured XLPE aluminium cables of suitable size will be used. Copper wires will be used for all internal wiring.

4. LED lamps will be used for all outdoor as well as indoor lighting. Since the facility is being developed for day and night operation, it is proposed to illuminate the Jetty in the night and low visibility conditions by erecting high mast lights near the jetty. High masts are proposed for stackyard area lighting too. Along the conveyor belts, it is proposed to provide 20 watt LED lamps at every 20 mts interval.

Chapter – 9

9.0 Environmental Aspects

9.1 Introduction

This chapter deals with anticipated positive as well as negative impacts to the construction and operation of the proposed facilities.

9.2 Identification of impacts

The proposed project will have impacts on the environment in following distinct phases.

- Construction Phase -which is a temporary or short-term and is rectifiable.
- Operational Phase.

9.2.1 Construction Phase

9.2.1.1 Impacts due to construction activities

The main impact to the environment of port area during is on account of Pre-construction activities generally do not cause significant damage to environment. Preparatory activities like the use of existing access road, construction of storage area etc. being spread over a large area, would have no further significant impact during construction, clearing, stripping and leveling the sites, will lead to improvement of the habitat.

9.2.1.2 Operation stage

Based on past experience, the negative impacts on environment during project operation stage are not expected.

- Solid waste
  During operation phase solid waste generated has to be disposed off.
- Fugitive dust
  The various cargoes to be handled at the port in the project operation phase include coal and other bulk solid cargo. The cargoes to be handled at the port will

be conveyed by a closed conveyor system. Thus, no solid waste is expected to be generated. However, at the point of the transfer of cargo like coal and limestone etc. through the conveyor belt to the stack yard, dust may get deposited on the ground. The dust could be higher in case of coal. As the major cargo to be handled is coal, major source of air pollution during project operation phase during coal handling are;

- Dust caused by displacement of air.
- Dust blown out by the wind.
- Wind erosion from stack yard site.

The above sources are described in the following paragraphs:

- Dust caused by displacement of air
  As the coal is loaded, it displaces air of quantum equal to its volume, which leads to entrainment of dust. As the air enters the environment at the location, where the coal is released at the stack yard, the air entrains the coal dust along with it and leads to entrainment of fugitive dust.
- Dust blown out by the wind
  As soon as the product leaves the spout, the wind can blow through the falling stream of product and will blow out the smaller and lighter particles.
- Wind erosion from coal stack pile
  The coal dust gets enters in the atmosphere due to wind action. The emissions are greatest during periods of material movement, high winds and dry periods.
- Loading and unloading
  The receival and disposal of dusty materials, releases the dust which is mechanically agitated by the movement of the excavating equipment and the turbulent air eddies created during the process. The amount of dust generated depends on particle size, wind velocity and the material moisture content.

It is recommended that adequate wind screens are provided in the stackyard and the conveyors are covered so that dust is not blown by air.

9.2.2 Risk Assessment

Cargos like coal, limestone etc. are not categorised as 'hazardous substance material' per MSIHC Rules, 1989. Coal, being flammable, basically poses following hazards.

1. Coal fire hazard in coal storage.
2. Coal dust explosion hazard in handling of coal in confined spaces.

Fire in bulk stored coal stockpile is a very common occurrence. The risk of fire exists wherever significant amount of coal is stored or used. Coal, being combustible, is susceptible to a variety of causes of ignition. However, the most common reason for fire in a coal stockpile is spontaneous combustion, i.e. combustion without contact by any external ignition source.

Spontaneous combustion depends on many complex and different factors such as:

1. Type of coal
2. Age of coal
3. Composition of coal
4. Method of storage
5. Moisture content

Spontaneous combustion fires usually begin as “hot spots” deep within the reserve of coal. The hot spots appear when coal absorbs oxygen from the air. Heat generated by the oxidation then initiates the fire. Such fires can be very stubborn to extinguish because of the amount of coal that is involved and the difficulty of getting to the seat of the problem. Moreover, coal is in either the smouldering or flaming stage may produce methane and carbon monoxide gases. In addition to their toxicity, these gases are highly explosive in certain concentrations, and can further complicate efforts to fight this type of coal fire.

The firefighting efforts must be concentrated on extinguishing the fire rather than on wetting the whole of coal stockpile. It is advisable that water be applied from a safe distance. It helps if a proper plan is first made as and when fire is detected and information about the extent of the fire spread is available, then the fire can be extinguished efficiently, completely and safely.

In case of coal fire, the coal fire spreads at a very slow rate that allows sufficient time mount an adequate firefighting strategy depending on the type and the quantity of coal on fire.

Hazards commonly associated with coal fire are burn injuries to the workers and fire fighters. These can be avoided with proper firefighting techniques and personal protective equipment.

- Coal Bust Explosion

A dust explosion is defined as rapid burning of combustible particulate within a confined area those results in the generation of shock wave and intense heat.

The areas where dust explosion is likely in the proposed Port are as follows:

1. Transfer towers in the conveyor streams
2. Section of conveyor galleries

In the design coal conveyors, dust control provisions, preventive maintenance, and regular maintenance of dust control devices such as bag dust collectors, common spark exclusion measures and provision of explosion vents/flaps are generally adequate to avoid and mitigate occasional explosions in the coal transfer stream. As the coal in VOC Port will be handled in pre-sprinkled condition and in lump form, likelihood of coal dust explosion will be reduced significantly.

Chapter – 10

10.0 Cost Estimates

10.1 Capital Cost Estimates

The cost estimates for the proposed development of the facilities are based on the project description and drawings given under the relevant sections of the report.

The following are to be noted with respect to the cost estimates:

- Estimates have been prepared on the basis of rates for various items of work prevailing and cost of such works in recent port development within India
- The costs of equipment and machinery are based on in-house data and information from manufacturers.
- All costs towards overheads, labour, tools, materials, insurance etc., are covered in the rates for individual items.
- The costs towards plant and machinery include manufacture, supply, installation and commissioning of the respective items.
- Provision towards contingencies, engineering and establishment has been included separately.

Table No. 10.1 – Cost summary

S. No.	Item	Amount in Million
1.	Gantry Type Ship Unloaders (2 Nos.)	800.00
2.	Conveying System including structure and E&I	799.12
3.	Electrical Substation works	162.69
4.	Civil works	224.82
5.	Stacker cum Reclaimer	275.00
6.	Reclaimer	220.00
7.	Rapid Rail Loading System	159.50
8.	Truck Loading System	49.50
9.	**Grand Total**	**2690.63**

The detailed cost estimates is given in **Annexure – 10.1.**

10.2 Budgeting offer

The Consultants have obtained budgeting offer for the cargo handling system and the same is given in **Annexure -10.2.**

Annexure – 10.1

S. No.	Description	UNITS	Total Req.	Rate	Cost	E&C Rate	E&C Cost	Total Cost	Contingency @ 10%	Total Cost
1	Belt Conveyors 2000 BW/4000 TPH Open Galleries with Local Hood	mts.	5543.00	61,000	338,123,000	10,000	55,430,000	393,553,000	39,355,300	**432,908,300**
2	Gantry type Grab Ship Unloader 2000 TPH	No.	2.00	400,000,000	800,000,000		0	800,000,000		**800,000,000**
3	Stacker cum Reclaimer 4000 TPH	mts	1.00	250,000,000	250,000,000		0	250,000,000	25,000,000	**275,000,000**
4	Rail for Stacker cum reclaimer	mts	600.00	2,016	1,209,600	2,400	1,440,000	2,649,600	264,960	**2,914,560**
5	Base Plate & Foundation Bolts for Stacker	m	600.00	1,200	720,000	225	135,000	855,000	85,500	**940,500**
6	Reclaimer 2000 TPH	No.	1.00	200,000,000	200,000,000		0	200,000,000	20,000,000	**220,000,000**
7	Conveyor Hood	MT	5543.00	1,200	6,651,600	20,000	110,860,000	117,511,600	11,751,160	**129,262,760**
8	Transfer Towers & Galleries	m2	2430.00	65,000	157,950,000	140	340,200	158,290,200	15,829,020	**174,119,220**
9	Sheetings	LOT	3258.00	140	456,120	140	456,120	912,240	91,224	**1,003,464**
10	Dust Supression System	LOT	1	20,000,000	20,000,000	1,200,000	1,200,000	21,200,000	2,120,000	**23,320,000**
11	Fire Fighting	LOT	1	16,000,000	16,000,000	4,000,000	4,000,000	20,000,000	2,000,000	**22,000,000**
12	Electrical, C&I	MT	1	3,000,000	3,000,000	4,000,000	4,000,000	11,500,000	1,150,000	**12,650,000**
13	Rapid Rail Loading System	No.	1	145,000,000	145,000,000			145,000,000	14,500,000	**159,500,000**
14	Truck Loading System	No.	1	45,000,000	45,000,000			45,000,000	4,500,000	**49,500,000**
15	Electrical works	No.	1	147,900,000	147,900,000			147,900,000	14,790,000	**162,690,000**
16	Civil Work	m	5543.00	13500	74830500					**74830500**
17	Stackyard area development including road connection and boundary wall	Lot		150000000	150000000					**150000000**
	Grand Total									**2,690,639,304**

Lepton Projects Private Limited
(An ISO 9001-2008 Certified Company)

Budgetary offer for Coal Handling Plant at Tuticorin Project

CLIENT	**Aarvee Associates Architects Engineers & Consultants Pvt. Ltd.,**
PROJECT	**CHP at Tuticorin Port**
OFFER NO	**LPPL/18-19/568.CS/R0 dtd 11.08.2018**

Rev. No	**Date**	**By**	**Description**
R E V I S I O N H I S T O R Y			

Table of Contents

1. Drawing Reference No :

1.1. VOCPT/ / / 17, V.O.CHIDAMBARANAR PORT LAYOUT

1.2. CREW/M/VOC/9th Berth/BE-001, PLOT PLAN

1.3. DRAWINGS OF CHENNAI RADHA ENGG.WORKS (P) LTD.

2. Scope of work

OPTION – 1

S.No.	Description
1	Dismantling, Loading, Transportation and Unloading of existing system comprising of existing Belt Conveyors, BC-1, BC-2, BC-3, BC-4, BC-5 & BC-6 (1400 BW / 2000 TPH) with open Galleries and local hood, transfer towers, sheeting, dust suppression system, fire fighting system including electrical and C&I.
2	Revamping the existing system and construction of the new conveying system comprising of Belt Conveyors 1400 BW / 2000 TPH with open Galleries and local hood, transfer towers, sheeting, dust suppression system, fire fighting system including electrical and C&I.
3	Revamping and erecting of Stacker including rail, base plate & foundation bolts.
4	Civil works.

OPTION – 2

S.No.	Description
1	Gantry Type Ship Un-loaders (2 Nos)
2	New Conveying System BC-1, BC-2, BC-3, BC-4, BC-5, BC-6, BC-7, BC-8, BC-8A, BC-8B, BC-9 & BC-YC1 (2000 BW / 4000 TPH) including open gallery structure with local hood, transfer tower, sheeting , dust suppression system, fire fighting system including electrical and C&I.
3	Electrical Substation works
4	Civil works
5	Stacker cum Reclaimer (4000 TPH) including rail, base plate & foundation bolts.
6	Reclaimer
7	Rapid Rail Loading System
8	Truck Loading System

OPTION – 3

S.No.	Description
1	Gantry Type Ship Un-loaders (2 Nos)
2	New Conveying System BC-1, BC-2, BC-3, BC-4, BC-5, BC-6, BC-7, BC-8, BC-9, BC-10, BC-10A, BC-10B, BC-11, BC-12 & BC-YC1 (2000 BW / 4000 TPH) including open gallery structure with local hood, transfer tower, sheeting , dust suppression system, fire fighting system including electrical and C&I.
3	Electrical Substation works
4	Civil works
5	Stacker cum Reclaimer (4000 TPH) including rail, base plate & foundation bolts.
6	Reclaimer
7	Rapid Rail Loading System
8	Truck Loading System

3. Exclusions

Following items are not included in our scope of work :

3.1 Construction power supply.
3.2 Drinking / Industrial water.
3.3 Labour Hutment.
3.4 Area Lighting, TH-4 lighting.
3.5 Any other item / specification which is not specifically mentioned in our offer.

4. Painting

4.1	Surface Cleaning	- Clean Dust/Oil Free surface with wire brush
4.2	Primer	- 2 Coats of red oxide primer (25 micron each)
4.3	Finish paint	- 2 Coats of synthetic enamel paint (25 micron each)
4.4	Total DFT	- 100 microns $\pm$ with 10% tolerance

5. Completion Schedule

14 months from the effective date of contract. However, to meet your schedule we are open for discussion.
The Effective Date to start activities shall be date of order and date of receipt of advance payment, whichever is later. The above time schedule assumes that all information, data, reports, drawings, working fronts etc., as may be requested by us from time to time shall be made available in time by client.

6. Commercial Terms &Conditions:

a. **Price :** Please refer Annexure-1 enclosed herewith.

b. **Price Basis :** F.O.R site.

c. **Packing & Forwarding Charges :** Inclusive

d. **Third Party Inspection Charges :** The third party inspection charges (if any) shall be borne by you.

e. **GST :** Shall be charged extra as applicable.

f.Payment Terms :

i. 20% advance along with order.
ii. 10% against submission of the GA drawing.
iii. 60% against as per approved Billing Break-up against proforma invoice (before dispatch).
iv. 10% after successful commissioning of the system.

g. **Warranty :**12 months from the date of commissioning or 18 months from the date of despatch, whichever is earlier.

h. **Validity of offer :** One month from the date of our offer.

Hope our offer is in line with your requirement. In case you need any clarifications, please feel free to contact us.

Thanking you and assuring you of our best services at all times.

Sincerely yours,

For **Lepton Projects Private Limited**

Vimal Kapoor
Sr.General Manager - Operations

ANNEXURE – 1
(Price Schedule)

S.No.	Description	Option-1 (Rs in million)
1	Dismantling of existing system	42.00
2	Revamping the existing system and construction of the new conveying system	75.00
3	Revamping and erecting of Stacker	20.00
4	Civil works	22.00
Total		**159.00**

S.No.	Description	Option-2 (Rs in million)
1	Gantry Type Ship Un-loaders (2 Nos)	685.00
2	Conveying System including structure and E&I	556.00
3	Electrical Substation works	155.00
4	Civil works	190.00
5	Stacker cum Reclaimer	270.00
6	Reclaimer	215.00
7	Rapid Rail Loading System	165.00
8	Truck Loading System	60.00
Total		**2296.00**

S.No.	Description	Option-3 (Rs in million)
1	Gantry Type Ship Un-loaders (2Nos)	685.00
2	Conveying System including structure and E&I	850.00
3	Electrical Substation works	155.00
4	Civil works	262.00
5	Stacker cum Reclaimer	270.00
6	Reclaimer	215.00
7	Rapid Rail Loading System	165.00
8	Truck Loading System	60.00
Total		**2662.00**

Chapter –11

11.0 Implementation Schedule

11.1 General

The facilities to be developed at NCB III can be developed by the port or through the public private partnership route. If the facilities are developed by the port, then engineering for the same has been carried out before tenders are floated. The consultants have worked out the time schedule if the port developed the facilities on their own.

11.2 Implementation Schedule

New Gantry Type Ship Unloaders has to be installed at NCB III and the conveyor system from NCB III to the stackyard has to be of 4,000 TPH. Stacker cum Reclaimer and Reclainer has to be installed in the stackyard. The schedule for implementation is given in **Fig. 11.1**.

Figure 11.1

IMPLEMENTATION SCHEDULE

		PERIOD IN MONTHS																							
	Project Month →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	21	22	23	24	25	26
	ITEM																									
1	Design of the conveyor system and civil work																									
2	Preparation of tender documents: • Unloaders • Conveyor System including Stacker / Reclaimer • Civil works (Leveling & Boundary wall)																									
3	Tendering and award of tenders																									
4	Civil work																									
5	Fabrication and installation of conveyor system and Stacker cum Reclaimer and Reclaimer including civil work																									
6	Fabrication and installation in Unloader																									
7	Electrical works																									
8	Testing & Commissioning																									

Chapter – 12

12.0 Financial Analysis

12.1 Introduction

In a new initiative, VOC Port is planning to develop NCB-III berth for handling bulk cargoes like Gypsum, Copper Concentrate, Rock Phosphate, and Coal. To handle these cargoes, the port is planning to construct a new conveyor system for NCB-III. This Chapter deals with the assessment of financial viability of the proposed investment through estimation of Financial Rate of Return to the implanting agency i.e. VOC Port.

This section assesses the viability of the project after taking into consideration the likely costs and earnings by constructing Material Handling System. Such analysis will assist VOC Port in the decision making process for construction, operation and maintenance of the facilities.

The traffic potential, terminal layout etc. along with costs has been detailed in the preceding chapters.

12.2 Approach and Methodology

Project Details

The Project shall have Gantry Type Ship Unloaders installed at the berth. The conveying system to the stackyard (located at Hare Island) shall be 4,000 TPH. In this system there is a Rapid Rail Loading System and a Truck Loading System

The basic assumptions undertaken for the financial appraisals are as under:

- Traffic Projections for NCB-III are based on earlier reports and interactions with port authority
- For the current Financial Analysis, the traffic has been projected till the year 2049-50
- The project life in the current financial analysis is taken till the year 2049-50.
- Year of Construction period is 2020-21 to 2022-23

- The operation is expected to start in the year 2023-24.

The financial appraisal reflects the viability of the project for the implementing organization i.e. VOC Portby comparing expected revenues and expenses (investment, maintenance and operation costs). The financial viability of the project has been determined by following financial indicators:

- The Financial Internal Rate of Return (FIRR), and
- The Net Present Value (NPV).

All costs to be incurred and earnings likely to accrue have been computed on a year-to-year basis over the project life for working out the FIRR & NPV.

12.3 Projected Traffic

Revenue estimations are based on the commodity wise projected traffic for NCB-III is discussed in earlier chapter. The projections for cargos were done using various techniques including end-use method. The projected traffic includes the bulk cargos like Limestone, Gypsum, Copper Concentrate, Rock Phosphate, and Coal.

A summary of the total traffic likely to be handled at NCB-III during project period are shown in following **Table 12.1:**

Table 12.1: Cargo Projections for NCB-III (MTPA)

S. No.	Year	Total Cargo Handling
1	2023-24	5.24
2	2024-25	5.96
3	2029-30	8.90
4	2034-35	8.90
5	2039-40	8.90
6	2044-45	8.90
7	2049-50	8.90

The berth shall start working on its full potential capacity (8.9 MTPA) after 2029-30 and continue to attain that level till the terminal year of the project i.e. 2049-50.

12.4 Capital Cost Estimates

The cost estimates for the proposed development of the facilities are based on the projectdescription and drawings given under the relevant sections of the report.

The following are to be noted with respect to the cost estimates:

- Estimates have been prepared on the basis of current rates for various items of work prevailing and cost of such works in recent port development within India
- The costs of equipment and machinery are based on in-house data and information from manufacturers.
- All costs towards overheads, labor, tools, materials, insurance etc., are covered in the rates for individual items.
- The costs towards plant and machinery include manufacture, supply, installation, and commissioning of the respective items.
- Provision towards contingencies, engineering and establishment has been included separately.

Cost estimates has been worked out and is summarized in following **Table 12.2**.

Table 12.2: Cost Estimates

S. No.	Item	Rs in Million
1	Gantry Type Ship Unloaders (2No.s)	800.00
2	Conveying System including structure and E&I	799.12
3	Electrical Substation works	162.69
4	Civil works	224.82

5	Stacker cum Reclaimer	275.00
6	Reclaimer	220.00
7	Rapid Rail Loading System	159.50
8	Truck Loading System	49.5
	Total	**2690.64**

Under this project, the capital is employed phase wise in 3 years of construction.

12.4.1 Phasing of Capital

Phasing of capital is shown in following **Tables 12.3**:

Table 12.3: Phasing of Capital Cost (in Cr)

S. No.	Year	Capex for Project
1	2020-21	**175.52**
2	2021-22	**60.14**
3	2022-23	**33.40**
Total		**269.06**

12.5 Variable Costs Operating Expenses (OPEX)

Apart from bearing the fixed cost on creation of infrastructure facilities, implementing agency would incur general annual expenses on maintenance of facilities.

For this project, the O&M cost is as follows:

Table 12.4: % Share of O&M Cost

S.No.	O&M Head	% Of Respective Capital Cost/Annum
1	On Civil Works	2%
2	On Electrical Works	5%
3	On Mechanical Works	5%

By adopting the above norms, maintenance costs are worked out. O&M cost is shown in following **Table 12.5:**

Table 12.5: Year wise O&M Cost (Rs in Cr)

S. No.	Year	Operating Expre.
1	2023-24	47.16
2	2028-29	52.07
3	2033-34	57.49
4	2038-39	63.48
4	2043-44	70.08
5	2049-50	78.93

In the above total O&M cost, charges incurred on electricity consumption as well as likely cost incurred on account of insurance (1%) are also duly incorporated. Additionally, due provision were also made on account of misc. expenses on YoY basis.

12.6 Escalation Factor

Annual escalation factors are duly incorporated in the financial appraisal as mentioned below:

- 2% on O&M and other costs
- 2% of revenue estimation

12.7 Project Revenue

As explained earlier, the project shall start generating revenue from the year 2023-24, which marks the year of commencement of operation of Material Handling System at NCB-III. Based on the projected traffic, O&M costs, and expected ROCE, project revenue is estimated.

Table 12.6: Year wise Revenue (in Rs Cr.)

S. No.	Year	Inflow
1	2023-24	65.42
2	2028-29	82.18
3	2033-34	135.44
4	2038-39	149.54
5	2043-44	165.10
6	2048-49	182.28
7	2049-50	185.93

To calculate the revenue, the tariff chargeable includes 16% return on ROCE.

12.8 Financial Internal Rate of Return (FIRR)

The project costs and project benefits calculated above are thus arrayed in the form of cash flow on year-to-year basis. FIRR has been worked out under consideration for project. Consequently, the FIRR for the project is worked out as **14.46%.** The year wise cash flow is shown in following **Table 12.7:**

Table 12.7: Project IRR for Mechanization of NCB-III (In Rs Cr.)

S. No.	Year	Capex for Project	Operating Expre.	Inflow	Net Inflow
1	2020-21	175.52	-	-	-175.52
2	2021-22	60.14	-	-	-60.14
3	2022-23	33.40	-	-	-33.40
4	2023-24		47.16	65.42	18.25
5	2024-25		48.11	75.92	27.81
6	2025-26		49.07	77.44	28.37
7	2026-27		50.05	78.99	28.94
8	2027-28		51.05	80.57	29.52
9	2028-29		52.07	82.18	30.11
10	2029-30		53.12	125.13	72.01
11	2030-31		54.18	127.63	73.45
12	2031-32		55.26	130.18	74.92
13	2032-33		56.37	132.78	76.42
14	2033-34		57.49	135.44	77.95
15	2034-35		58.64	138.15	79.51
16	2035-36		59.82	140.91	81.10
17	2036-37		61.01	143.73	82.72
18	2037-38		62.23	146.60	84.37

S. No.	Year	Capex for Project	Operating Expre.	Inflow	Net Inflow
19	2038-39		63.48	149.54	86.06
20	2039-40		64.75	152.53	87.78
21	2040-41		66.04	155.58	89.54
22	2041-42		67.36	158.69	91.33
23	2042-43		68.71	161.86	93.15
24	2043-44		70.08	165.10	95.02
25	2044-45		71.49	168.40	96.92
26	2045-46		72.92	171.77	98.86
27	2046-47		74.37	175.21	100.83
28	2047-48		75.86	178.71	102.85
29	2048-49		77.38	182.28	104.91
30	2049-50		78.93	185.93	107.00
		269.06			**1750.60**

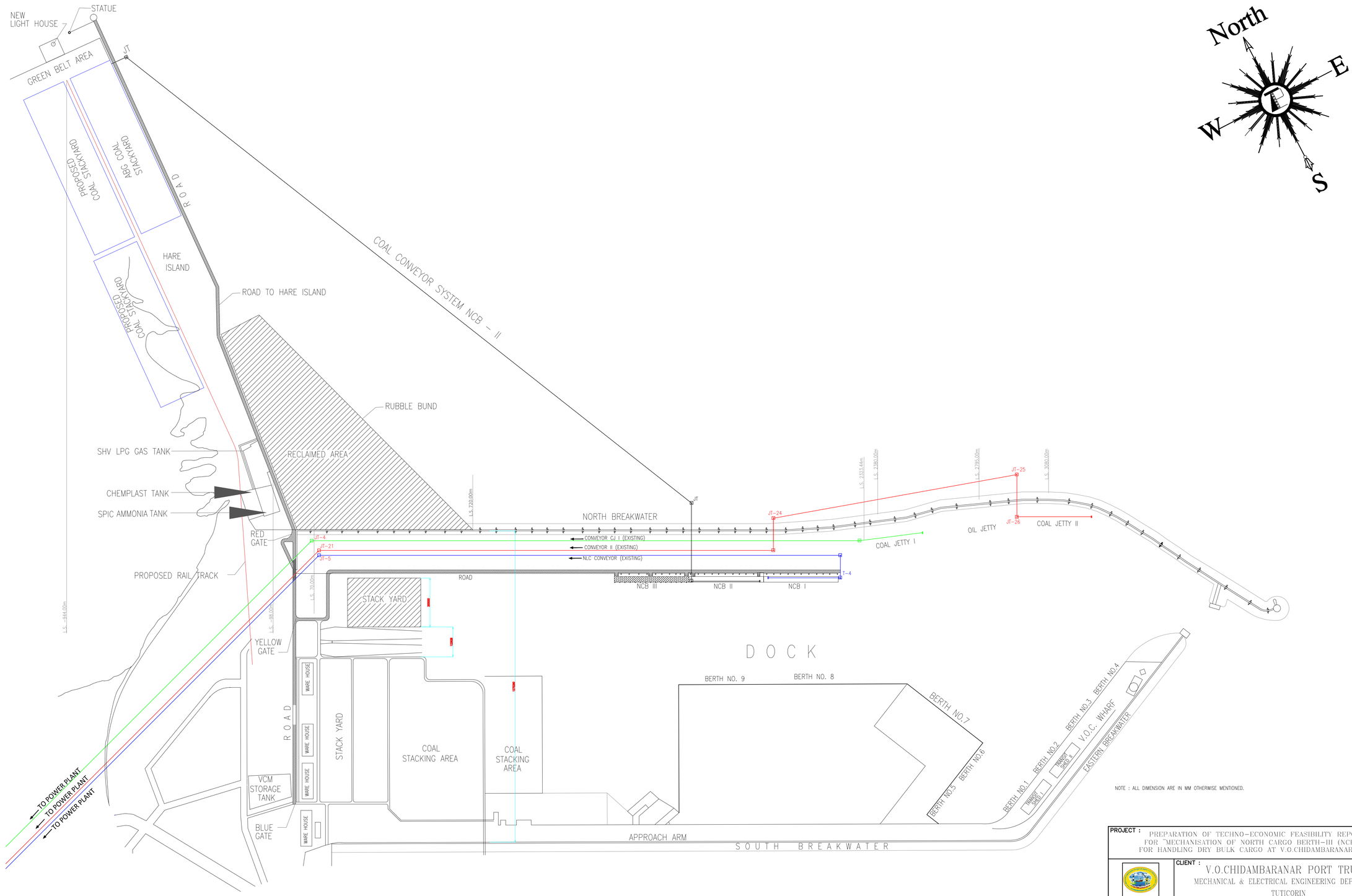
FIRR: 14.56%

NPV @ 12% (cr.): 72.44

13.0 List of Drawings:

S. No.	Title	Description
01	VOCP/ NCB-III/MS-001	Existing Port Layout
02	VOCP/ NCB-III/MS-002	Proposed Layout
03	VOCP/ NCB-III/MS-003	Flow Diagram
04	VOCP/ NCB-III/MS-004	Conveyor Profile
05	VOCP/ NCB-III/MS-005	Conveyor Profile
06	VOCP/ NCB-III/MS-006	Conveyor Profile
07	VOCP/NCB-III/ES-001	Schematic Electrical Distribution Diagram

Drawings



NOTE : ALL DIMENSION ARE IN MM OTHERWISE MENTIONED.

PROJECT : PREPARATION OF TECHNO-ECONOMIC FEASIBILITY REPORT FOR "MECHANISATION OF NORTH CARGO BERTH-III (NCB-III) FOR HANDLING DRY BULK CARGO AT V.O.CHIDAMBARANAR PORT"

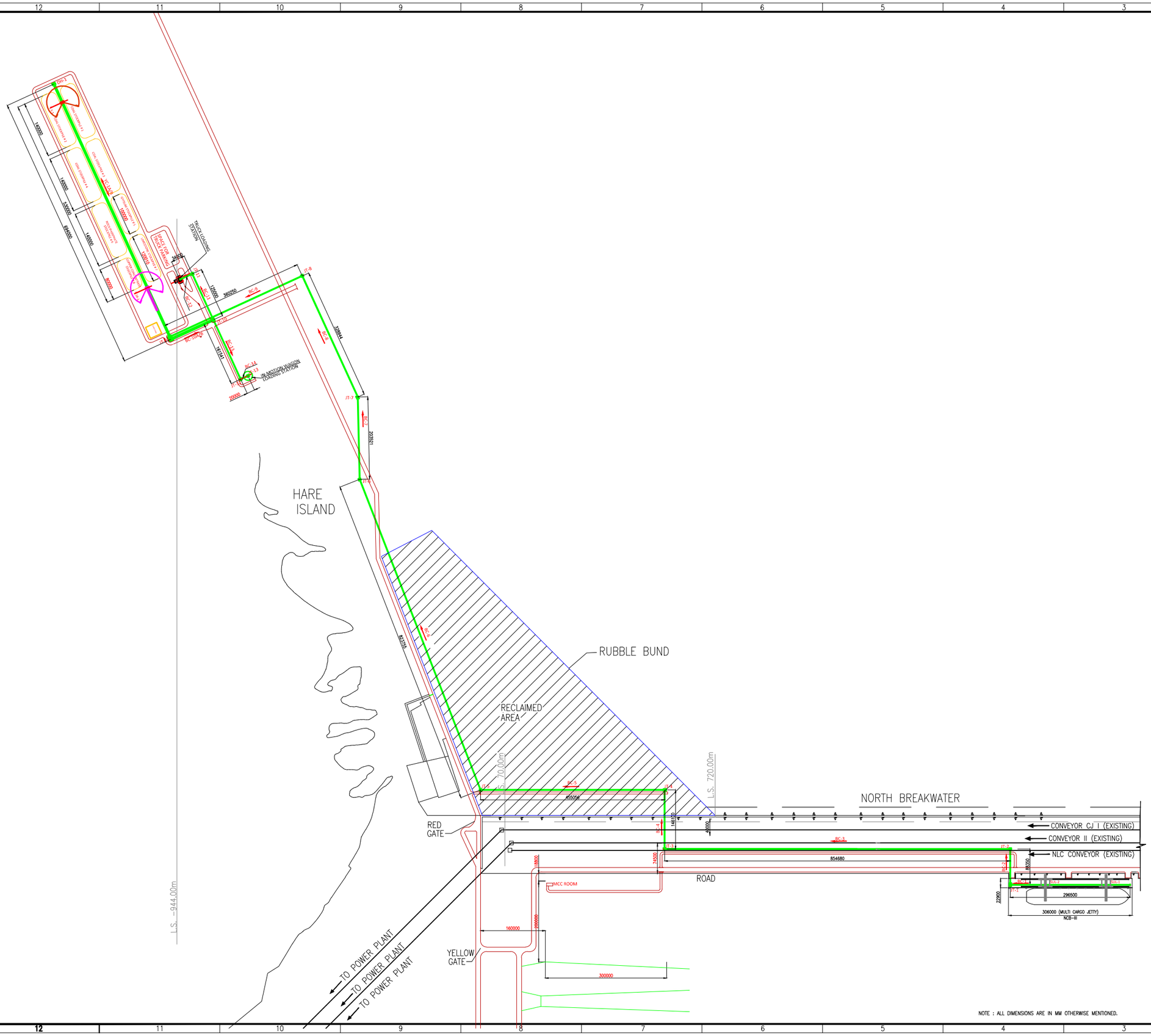
CLIENT : V.O.CHIDAMBARANAR PORT TRUST
MECHANICAL & ELECTRICAL ENGINEERING DEPARTMENT
TUTICORIN

AARVEE ASSOCIATES
ARCHITECTS ENGINEERS & CONSULTANTS PVT. LTD.
RAVULA RESIDENCY, SRINAGAR COLONY MAIN ROAD, HYDERABAD-500082

DRG. TITLE:- EXISTING PORT LAYOUT

	NAME	SIGN.	DATE
DRN.	PARTHA		23.10.2019
CHKD.	A K		23.10.2019
APPD.	S O		23.10.2019

DRG.NO. VOCP/NCB-III/MS-001 | REV. 0 | Sheet Size : A1



NOTE : ALL DIMENSIONS ARE IN MM OTHERWISE MENTIONED.

PROJECT :
PREPARATION OF TECHNO-ECONOMIC FEASIBILITY REPORT
FOR "MECHANISATION OF NORTH CARGO BERTH-III (NCB-III)
FOR HANDLING DRY BULK CARGO AT V.O.CHIDAMBARANAR PORT"

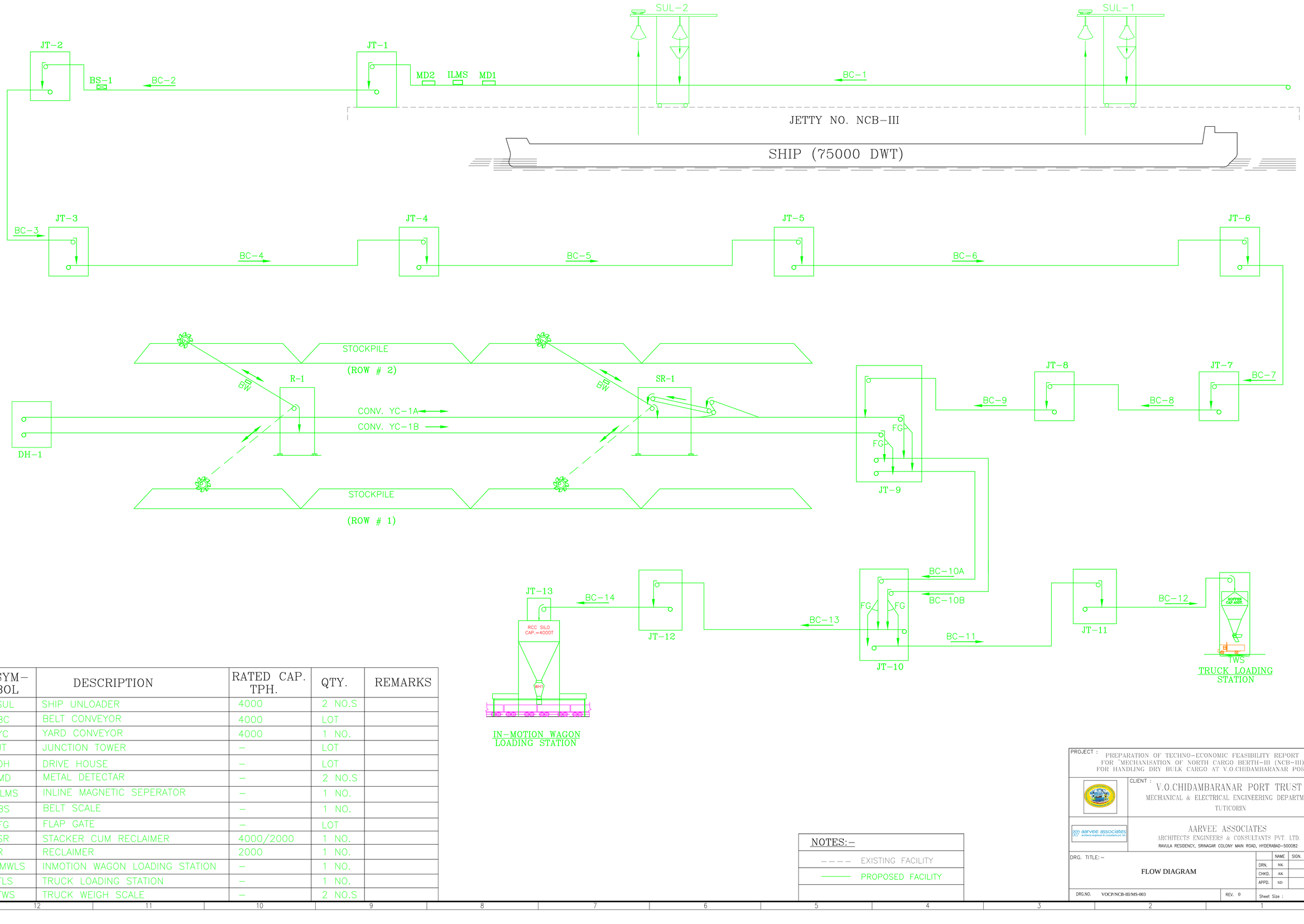
CLIENT :
V.O.CHIDAMBARANAR PORT TRUST
MECHANICAL & ELECTRICAL ENGINEERING DEPARTMENT
TUTICORIN

AARVEE ASSOCIATES
ARCHITECTS ENGINEERS & CONSULTANTS PVT. LTD.
RAVULA RESIDENCY, SRINAGAR COLONY MAIN ROAD, HYDERABAD-500082

DRG. TITLE:-
PROPOSED LAYOUT

	NAME	SIGN.	DATE
DRN.	PARTHA		23.10.2019
CHKD.	A K		23.10.2019
APPD.	S D		23.10.2019

DRG.NO. VOCP/NCB-III/MS-002 | REV. 0 | Sheet Size : A1



SYM-BOL	DESCRIPTION	RATED CAP. TPH.	QTY.	REMARKS
SUL	SHIP UNLOADER	4000	2 NO.S	
BC	BELT CONVEYOR	4000	LOT	
YC	YARD CONVEYOR	4000	1 NO.	
JT	JUNCTION TOWER	–	LOT	
DH	DRIVE HOUSE	–	LOT	
MD	METAL DETECTAR	–	2 NO.S	
ILMS	INLINE MAGNETIC SEPERATOR	–	1 NO.	
BS	BELT SCALE	–	1 NO.	
FG	FLAP GATE	–	LOT	
SR	STACKER CUM RECLAIMER	4000/2000	1 NO.	
R	RECLAIMER	2000	1 NO.	
IMWLS	INMOTION WAGON LOADING STATION	–	1 NO.	
TLS	TRUCK LOADING STATION	–	1 NO.	
TWS	TRUCK WEIGH SCALE	–	2 NO.S	

NOTES:–

– – – – EXISTING FACILITY

——— PROPOSED FACILITY

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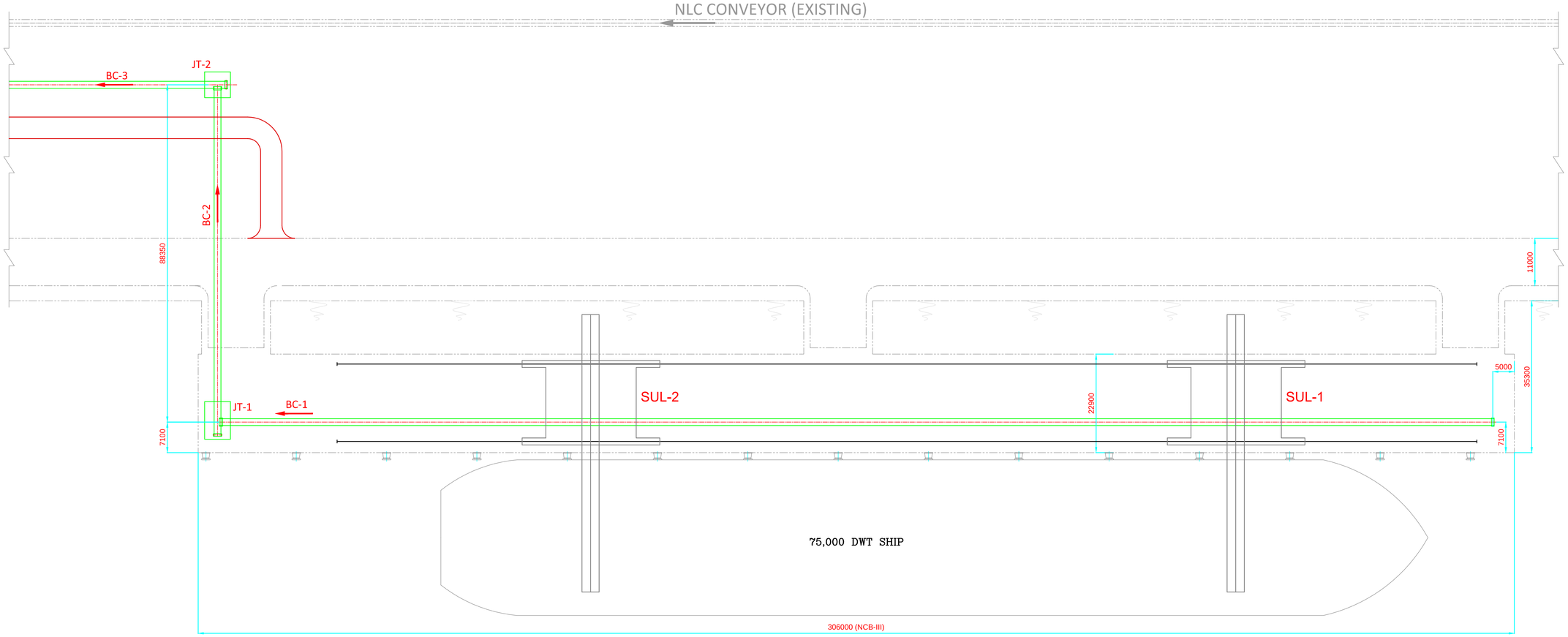
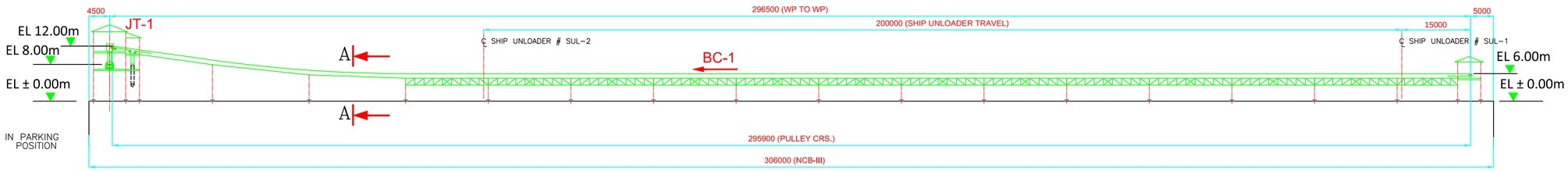
DRG. TITLE:– FLOW DIAGRAM

	NAME	SIGN.	DATE
DRN.	NK		23.10.2019
CHKD.	AK		23.10.2019
APPD.	SD		23.10.2019

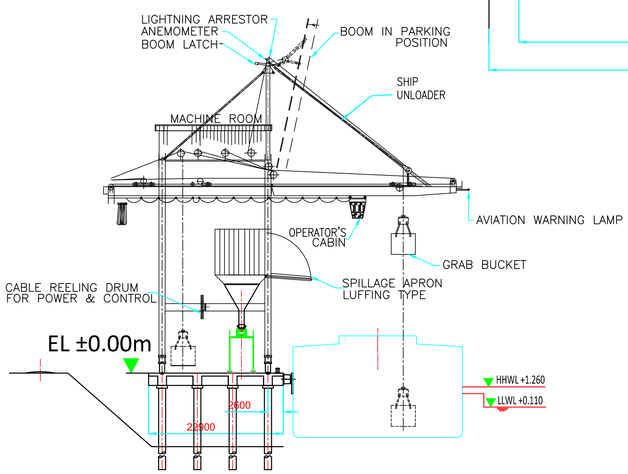
DRG.NO. VOCP/NCB-III/MS-003 REV. 0 Sheet Size : A1



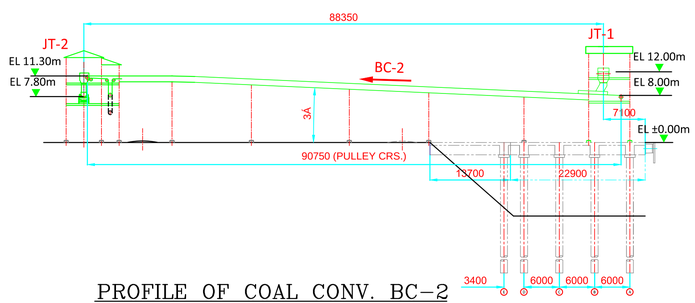
PLAN VIEW OF JETTY



PROFILE OF COAL CONV. BC–1



SECTION–AA



PROFILE OF COAL CONV. BC–2

NOTES:-

1. ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METRE.
2. EL (+) 0.00m LEVEL CORRESPONDS TO RL (+) 3.600m.

PROJECT : PREPARATION OF TECHNO–ECONOMIC FEASIBILITY REPORT FOR "MECHANISATION OF NORTH CARGO BERTH–III (NCB–III) FOR HANDLING DRY BULK CARGO AT V.O.CHIDAMBARANAR PORT"

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MECHANICAL & ELECTRICAL ENGINEERING DEPARTMENT
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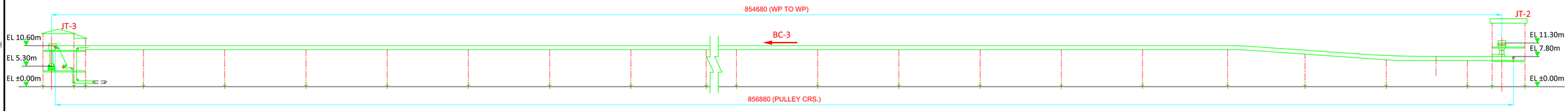
AARVEE ASSOCIATES
ARCHITECTS ENGINEERS & CONSULTANTS PVT. LTD.
RAVULA RESIDENCY, SRINAGAR COLONY MAIN ROAD, HYDERABAD–500082

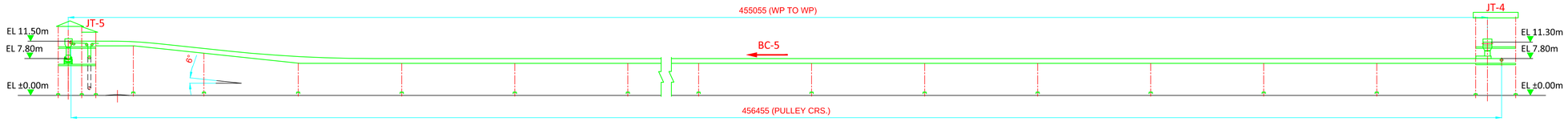
DRG. TITLE: – CONVEYOR PROFILE

	NAME	SIGN.	DATE
DRN.	NK		23.10.2019
CHKD.	AK		23.10.2019
APPD.	SD		23.10.2019

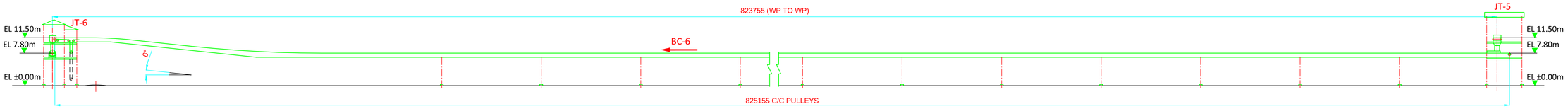
DRG.NO. VOCP/NCB-III/MS-004 REV. 0 Sheet Size : A1



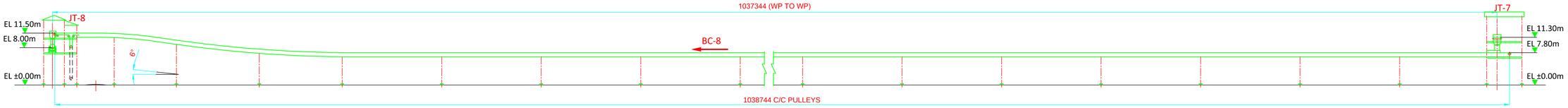
PROFILE OF COAL CONV. BC–3



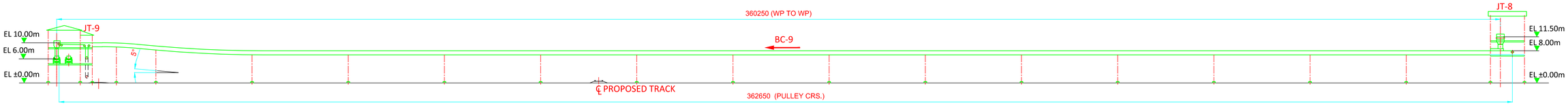
PROFILE OF COAL CONV. BC–5



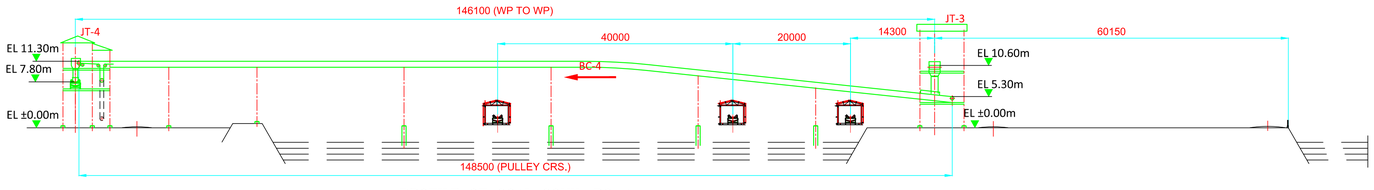
PROFILE OF COAL CONV. BC–6



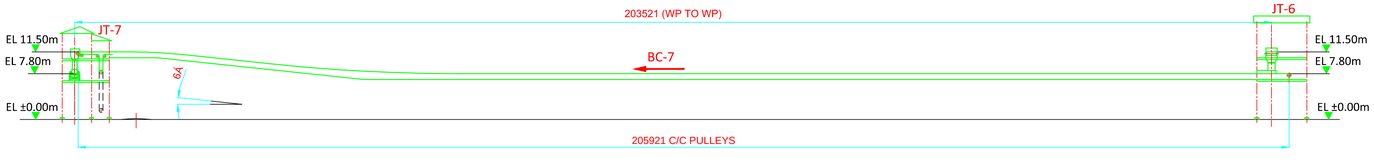
PROFILE OF COAL CONV. BC–8



PROFILE OF COAL CONV. BC–9



PROFILE OF COAL CONV. BC–4



PROFILE OF COAL CONV. BC–7

NOTES:-

1. ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METRE.
2. EL (+) 0.00m LEVEL CORRESPONDS TO RL (+) 3.600m.

PROJECT : PREPARATION OF TECHNO–ECONOMIC FEASIBILITY REPORT FOR "MECHANISATION OF NORTH CARGO BERTH–III (NCB–III) FOR HANDLING DRY BULK CARGO AT V.O.CHIDAMBARANAR PORT"

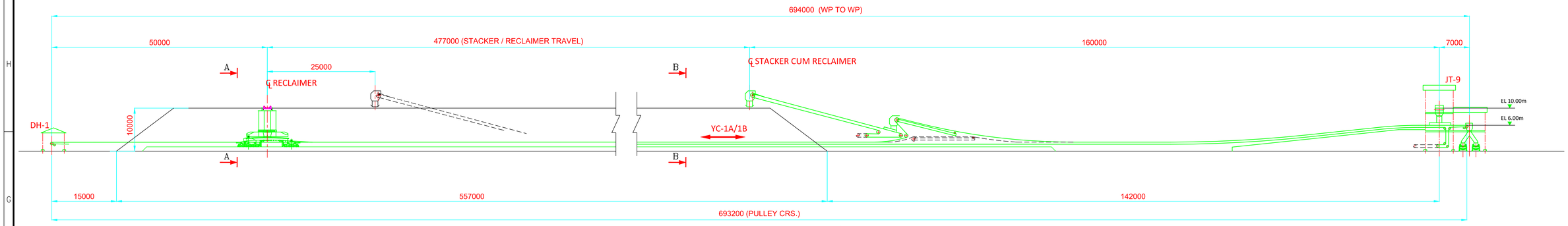
CLIENT : V.O.CHIDAMBARANAR PORT TRUST
MECHANICAL & ELECTRICAL ENGINEERING DEPARTMENT
TUTICORIN

AARVEE ASSOCIATES
ARCHITECTS ENGINEERS & CONSULTANTS PVT. LTD.
RAVULA RESIDENCY, SRINAGAR COLONY MAIN ROAD, HYDERABAD–500082

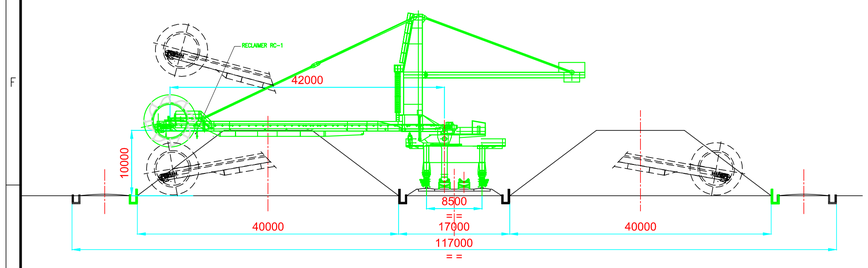
DRG. TITLE: –
CONVEYOR PROFILE

	NAME	SIGN.	DATE
DRN.	NK		23.10.2019
CHKD.	AK		23.10.2019
APPD.	SD		23.10.2019

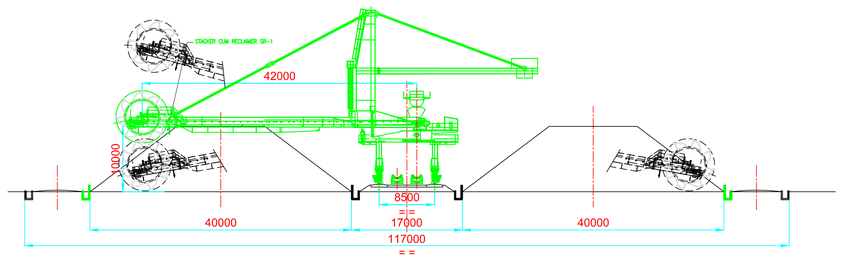
DRG.NO. VOCP/NCB-III/MS-005 | REV. 0 | Sheet Size : A1



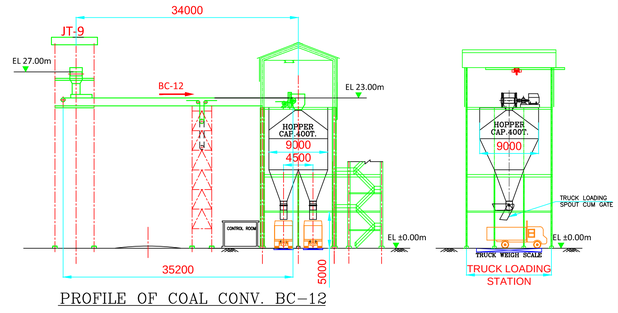
PROFILE OF COAL CONV. YC–1A/1B



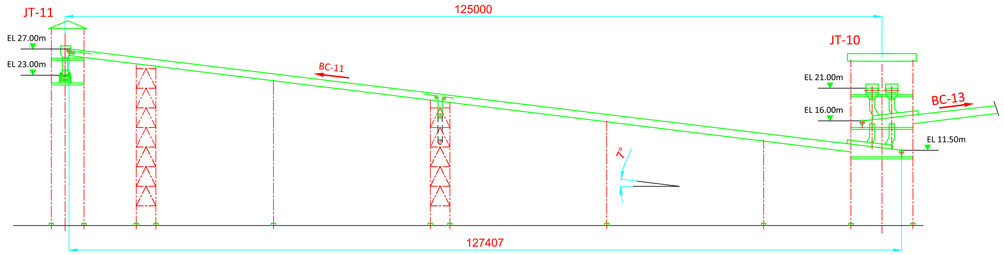
SECTION AT 'A A'



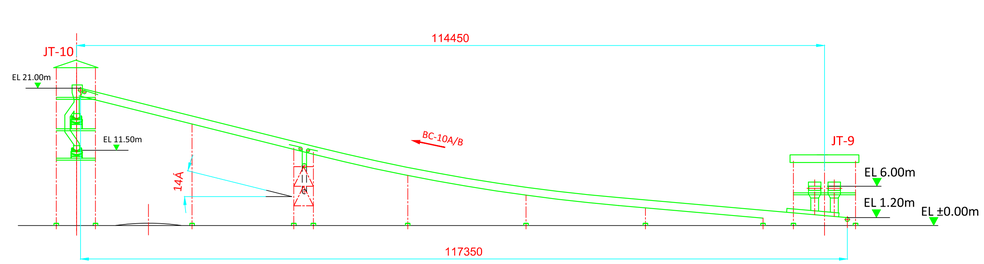
SECTION AT 'B B'



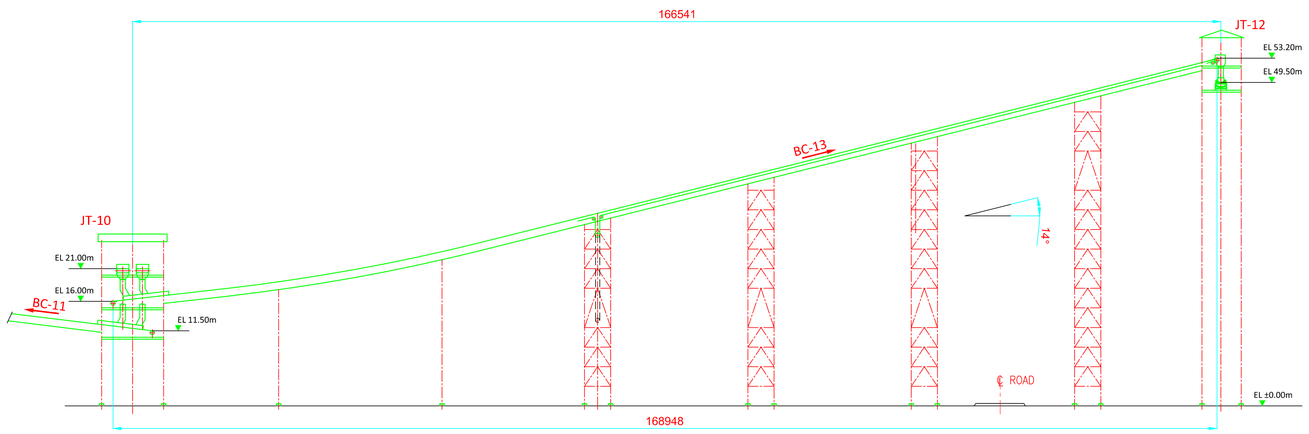
PROFILE OF COAL CONV. BC–12



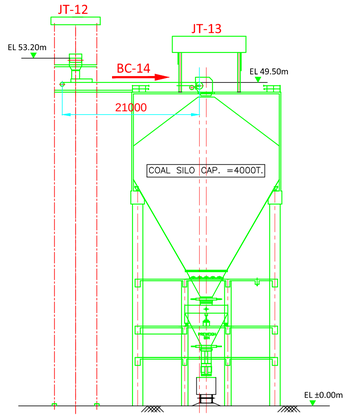
PROFILE OF COAL CONV. BC–11



PROFILE OF COAL CONV. BC–10A/10B



PROFILE OF COAL CONV. BC–13



PROFILE OF COAL CONV. BC–14
RAPID RAIL LOADING STATION

NOTES:-

1. ALL DIMENSIONS ARE IN MM & LEVELS ARE IN METRE.
2. EL (+) 0.00m LEVEL CORRESPONDS TO RL (+) 3.600m.

PROJECT : PREPARATION OF TECHNO–ECONOMIC FEASIBILITY REPORT FOR "MECHANISATION OF NORTH CARGO BERTH–III (NCB–III) FOR HANDLING DRY BULK CARGO AT V.O.CHIDAMBARANAR PORT"

CLIENT : V.O.CHIDAMBARANAR PORT TRUST
MECHANICAL & ELECTRICAL ENGINEERING DEPARTMENT
TUTICORIN

AARVEE ASSOCIATES
ARCHITECTS ENGINEERS & CONSULTANTS PVT. LTD.
RAVULA RESIDENCY, SRINAGAR COLONY MAIN ROAD, HYDERABAD–500082

DRG. TITLE:– CONVEYOR PROFILE

	NAME	SIGN.	DATE
DRN.	NK		23.10.2019
CHKD.	AK		23.10.2019
APPD.	SD		23.10.2019

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PORT SCOPE

22KV POWER SUPPLY
FROM EXISTING SUBSTATION

CREW SCOPE

METERING AND PROTECTION

22 KV/3.45 KV
3 MVA, DynII, ONAN

3.3 KV PANEL

CAPACITOR PANEL

3.3 KV FEEDERS FOR
CONVEYORS AND STACKER

3.3 /0.415 KV
200 KVA, DynII, ONAN

BUSDUCT

LT PANEL BOARD FOR
SUBSTATION LIGHTING, JETTY
LIGHTING, HIGH MASTS,
FIRE FIGHTING, DUST EXTRACTION
AND ELECTRICAL HOISTS

PROJECT :
PREPARATION OF TECHNO-ECONOMIC FEASIBILITY REPORT
FOR "MECHANISATION OF NORTH CARGO BERTH-III (NCB-III)
FOR HANDLING DRY BULK CARGO AT V.O.CHIDAMBARANAR PORT"

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ARCHITECTS ENGINEERS & CONSULTANTS PVT. LTD.
RAVULA RESIDENCY, SRINAGAR COLONY MAIN ROAD, HYDERABAD-500082

DRG. TITLE:-
SCHEMATIC ELECTRICAL DISTRIBUTION DIAGRAM

	NAME	SIGN.	DATE
DRN.	PARTHA		23.10.19
CHKD.	A K		23.10.19
APPD.	S D		23.10.19

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