/ Final Report /

KOLKATA PORT TRUST

(*An Autonomous Body under the Ministry of Shipping, Government of India*)

REJUVENATION OF KIDDERPORE DOCKS

ON PUBLIC PRIVATE PARTNERSHIP BASIS

DETAILED FEASIBILITY REPORT

INDIAN PORTS ASSOCIATION

1st Floor, South Tower, NBCC Place,
Lodi Road, New Delhi-110003

May, 2020

CONTENTS

1. *Kolkata Port Trust (KoPT) desires that the "Rejuvenation of KPD" is to be done be through PPP mode on Build, Equip, operate and Transfer for a period of 30 years. KoPT has done some preliminary assessment of the project and wants to execute it in two Phases. Phase-1 of the proposed Project shall have two dedicated container berths and one multipurpose berth with a total Quay Length of 400 m. In Phase-2, three more berths in the remaining 400 m of the Quay shall be developed. The project is expected to be tendered by June 2020 and Phase-1 is proposed to be commissioned within 24 months thereof.*

2. *For this purpose, KoPT engaged Indian Ports Association (IPA) to undertake the task of preparation of detailed Techno-economic Feasibility Report for Kidderpore Dock (KPD) of Kolkata Docks System (KDS) which is proposed to be developed as multipurpose cargo berth with the cargo mix viz. General cargo along with containers, and any other cargo to make the project technically and financially viable. IPA to also examine the capacity calculations as made for KPD of KDS under Phase I and II and to look into the project scope with equipment for ship shore transfer, jetty to stack yard equipment. The project site, yard, draft, berth, equipment shall be surveyed and recommendation on their upgradation or reconstruction shall be given by the resource team members, if felt necessary. The IPA team will also work out the technical and financial viability of the project considering Civil cost, Equipment cost and other costs.*

3. *IPA team visited the Port and various other places, including KPD docks to study the structural characteristics of KPD and adjoined areas in respect to entry to the docks, layout of KPD I & II docks, Quay wall structure, berths & transit sheds, soil date etc. IPA Team also had interactions with concerned senior officers of various department.*

4. *Traffic study was carried out with the help of secondary data provided by the port& various other sources, views of the officers of KoPT and other stakeholders etc., The objective of the traffic study was to identify the potential cargoes for the two KPD 1 clusters slated for rejuvenation and to assess the traffic potential of each cluster for the next 30 years, up to 2050.*

5. *The broad methodology adopted for the Traffic Study was - reviewing the traffic handled at the entire Kolkata port in the last 5 years in order to evaluate the pattern and trend of traffic handled at KDS and Haldia Dock Complex (HDC), scrutinizing HDC's traffic to explore the possibility of any part of its traffic moving to KDS examining the locations where the traffic of KDS are handled, which cargoes and how much of them are handled at each location,, analysing the traffic handled at KDS berths in the last 2 years to observe which traffic is growing, consistent, fickle or receding, applying two yard sticks and a filter to identify the final principal cargoes for Cluster 1 and Cluster 2.*

6. *ESTIMATED TRAFFIC FOR KPD 1 CLUSTERS*

Stage	Cargo	Cluster 1 (in Mn tons)	Cluster2 (in Mn tons)
1st Decade 2021-31	Container	1.8 (1.2 L TEUs)	1.8 (1.2 L TEUs)
	Pulses	0.30	0.00
	Fert/Limestone	0.00	0.35
	Total	**2.1**	**2.15**
2nd Decade 2031-41	Container	2.48 (1.65 L TEUs)	2.48(1.65L TEUs)
	Pulses	0.30	0.00
	Fert/Limestone	0.00	0.35
	Total	**2.78**	**2.48**
3rd Decade 2041-51	Container	2.93 (1.95 L TEUs)	2.93 (1.95L TEUs)
	Pulses	0.30	0.00
	Fert/Limestone	0.00	0.35
	Total	**3.23**	**3.28**

7. *Study has also been made to analyze the actual handling process – the ship size, average parcel size, service time etc.; ship-shore transfer; movement from berth to stackyard or storage shed; handling at the yard or shed and finally the evacuation .In these docks, containers are handled directly from container vessels. The other cargo such as pulses/peas,*

fertilizers and limestone are transloaded at anchorages from ships to barges and these barges only call at the dock berths. Some exceptionally small vessels only directly call at the berths .It is noted that while proper data have been maintained for ships calling at these berths, no such detailed data have been maintained for the barges. Hence the information furnished herein are obtained from discussions with the traffic department officials.

8. *A broad road map for the project development has been presented which will cover the expected volumes of identified cargo; the possible vessel and parcel sizes; the allocation of berths for the cargo; the equipment for ship-shore transfer; equipment for handling at the berth; equipment for transfer from berth to the stockyard; area required for the stockyard; equipment for stockyard handling, storage facilities etc*

9. *The port is planning to execute this project of KPD rejuvenation in two phases: in the first phase KPD I berths 2,4 & 6 will be developed to be followed by berths 8,10 & 12 in the second phase. In the first phase, the continuous berths 4 and 6 have a total length of 254 m while in the second phase, the continuous berths 8 and 10 have a total length of 289 m. Hence, these can each accommodate a container vessel of LOA 158 m.*

10. *The skewed berths 2 and 12 are each 162 m and 143 m long respectively. These can accommodate barges carrying the other cargo – pulses, fertilisers and limestone. These barges are normally having LOA 60 m to 82 m and with beam of 10 m to 17 m. Overall, the barges carry an average parcel size of 2020 MTs*

11. *As per the optimistic project schedule, it is expected that the time period from the start of pre-procurement activities till the signing of concession agreement will be around 15 months. This means that the Licensee will be at site only by the start of 2021-22. He is expected take another 2 years for commissioning Phase I of the project covering berths nos. 2, 4 & 6. This means that Phase I facilities will be in operation from the start of 2023-24.*

12. *The present handling of container traffic at KPD I, which started with the trade notification on March, 2019, will continue over this period. It is hoped that within 5 years from the commissioning of Phase I facilities, the projected traffic for the first decade i.e. 1.2 lakh TEUS, will be achieved.*

13. *This will encourage the Licensee to undertake the Phase II of the project by 2028-29 which will be completed within two years. By the start of the year 2030-31, both the facilities will be*

in operation. Assuming the 2nd Phase will take another 5 years to reach its projected traffic of another 1.2 lakh TEUs, the terminal will be handling more than 2.4 lakh TEUs by 2036-37.

14. *Going by the past data on the number of container vessels that could enter KPD I, it has been estimated that the total volume of container traffic for KPD could be 2.96 lakh TEUs. This volume has to be handled during the 3rd decade.*

15. *Study has also been made on identifying various aspects of projects details for handling containers & other cargo. Such details include- berthing facilities, , container parking yard & cargo storage areas, infrastructure & service facilities, cargo handling equipment , ship-shore transfers both for containers & other cargo, storage yard transfer , container parking yard equipment, electrical facilities etc.*

16. *The total capital cost of the project is estimated at **Rs. 91.21** Crores for Phase-1 and **Rs. 82.16** crores for Phase -2. The cost estimates are based on the prevailing market rates.*

17. *The project implementation period including detailed engineering for the above from the date of grant of concession is estimated at 24 months for each phase. The phasing of expenditure will be 40% in the first year and 60% in the second year.*

18. *The optimum capacity of the terminal, the operating & maintenance expenditure, and the average revenue requirement is worked out in line with TAMP Guidelines.*

19. *Replacement cost of the Outlived mechanical equipment during the license period is considered as per the life norms. The present value of the cost of equipment is escalated at 2% for working out the replacement cost in the relevant year of replacement.*

20. *The Financial Viability is worked out based on the Capital expenditure and its phasing, Traffic available for the project, Operating & Maintenance expenditure, the revenue that can be generated with reference to the investment and traffic etc.*

21. *Sensitivity analysis has been carried out to gauge the impact of increase in cost and reduction of revenue earnings on the viability of the proposal. The results of the analysis are presented below.*

Sensitivity Analysis - Considering IDC as per TAMP Guidelines)

S.No.	***Pre-Tax Project IRR***	***FIRR (%)***	***NPV @ 9%*** *(in Rs. cr)*
1	*Base case*	*16.11%*	*172.16*
2	*Capital Cost up by 10%*	*15.21%*	*157.65*
3	*Revenue down by 10%*	*13.03%*	*92.55*
4	*Annual O&M Cost up by 10%*	*14.12%*	*124.27*

22. *From the above, it is evident that the FIRR of the Project at Base case is **16.11%** and in all the other cases of adversity also gives more than 13%. Hence the Project is Financially viable for taking up through PPP in view of interest rates being much lower for investment of funds. The Payback in absolute net revenues works out to be between 13 to 14 years.*

23. *The PPP operator is permitted to increase the Tariff up to 15% on achieving the Performance Standards from the 2nd year onwards. But the effect of increase may take place from 3rd year onwards. In such case the IRR for the base case works out to **19.36%** with a payback of 12 to 13 years.*

24. *The Project is not only attractive, it has great economic impact in the region there by much economic benefits for the EXIM trade of the country. The Port may increase their throughput and can earn an incremental revenue not only by Revenue share but also through increased vessel related income besides the Lease rent.*

SECTION-1
INTRODUCTION

1.1 The Port has two Docks viz. Kidderpore Dock (KPD) and Netaji Subhas Dock (NSD). Kidderpore Dock (KPD) is the older one with 17 Multi-purpose berths and 1 berth for passenger-cum-cargo vessels, 6 Buoys/Moorings and 3 Dry Docks while Netaji Subhas Dock (NSD) is a relatively new one with 1 heavy lift berth, 10 berths including 4 dedicated Container Berths, 1 Liquid Cargo Berth, 4 multi-purpose berths, 2 Buoys/Moorings and 2 Dry Docks. Due to tidal variations in water level of Hooghly, both the docks operate under lock gate system.

The maximum dimension of vessel acceptable at NSD is 172 m LOA and 24.3 m Beam while the maximum dimension of vessel calling at KPD is 157 m LOA and 21.3 m.

Presently most of the traffic is handled at NSD and minimum traffic is handled at KPD. All the container traffic is handled at NSD while KPD handles logs, pulses wheat and fertilisers. During 2017-18, NSD handled a total of 10.12 million tonnes of which 9.79 million tonnes were through containers. During the same year KPD handled only 1.69 million tonnes.

In order to unlock the complete potential of KPD, the Port has initiated the project of "Rejuvenation of KPD" proposed to be executed through Public-Private-Partnership (PPP) mode.

1.2 KPD is split into two parts – KPD I and KPD II separated by a bascule bridge. KPD I has 10 berths while KPD II has eight berths. KoPT has now decided to develop the western side berths of KPD I for handling containers and other cargo under PPP mode. They have already initiated action for handling containers here. The Traffic Manager, vide his Trade Circular No. Tfc/6 KPD Cont. Terminal dt. 18th March, 2019 has informed all port users that "*an additional container handling facility has been created by KoPT for handling exim/coastal containers carried by KPD-size geared vessel coming to KDS. For this, a container yard with 100 TGS has been constructed at KPD -I West and the yard includes 6 reefer points for serving 24 reefer boxes at a time. The entire yard has been designed for handling by RST and all slots have been well marked. Container ships may be handled at any suitable berth at*

KPD West but the containers will be stored at the dedicated yard. Customs have also upgraded facilities at their end at the same place for serving the container lines/port users"

The KPD western berths with the newly developed container yard are shown in the following figures. The handling of containers is shown in figures 1.2 and 1.3.

FIGURE 1.1 – KPD I WESTERN BERTHS WITH NEW CONTAINER YARD

FIGURE 1.2 – CONTAINERS HANDLED BY SHIPS' OWN GEAR

FIGURE 1.3 – CONTAINERS STACKED BY REACH STACKER

As of now, ship-shore handling of containers would have to be managed by the feeder operator through their own stevedore/handling agent, as used to happen earlier when KPD used to handle containers. Rail-bound containers of KPD would be handled either at KPD II section (27-29 KPD) or at the present container terminal at NSD and inter-dock movement of containers would be allowed under escort of Customs' PD as per standard procedure.

1.3 Kolkata Port Trust desires that the "Rejuvenation of KPD" is to be done be through PPP mode on Build, Equip, operate and Transfer for a period of 30 years. KoPT has done some preliminary assessment of the project and wants to execute it in two Phases.

- Phase-1 of the proposed Project shall have two dedicated container berths and one multipurpose berth with a total Quay Length of 400 m.
- Phase-2, three more berths in the remaining 400 m of the Quay shall be developed.

The project is expected to be tendered by May/June 2020 and Phase-1 is proposed to be commissioned within 18 months thereof.

1.4 In this context, KoPT has commissioned IPA to prepare a Detailed Feasibility Report for this project vide their letter No DCK/WO/18/IPA dated 11.10.2019. The scope of work is defined in Appendix I.

IPA formed a team of experts to prepare the DFR and the team visited Kolkata Port during 13th – 15th November, 2019. The team started the visit with a meeting with the Chairman, Dy. Chairman and the Heads of the Departments. This meeting gave an indication of the background of this project, the demands of the Trade, how the project profile was defined and the way forward.

Later the team held discussions with the Traffic Manager, Chief Mechanical Engineer, Harbour Master (Port) and Harbour Master (River). The team also met Bharat Kolkata Container Terminals Private Limited (BKCT) officials. The team met Jt. Director (P&R) and collected relevant statistical data about the port performance.

The team also interacted with selected stakeholders viz. SCI, CMA-CGM, J.M. Baxi Group, Ocean Network Express Line (India) Pvt. Ltd., Seahorse Ship Agencies (P) Ltd., and Tuberose Logistics Pvt.Ltd,

The team visited both NSD and KPD. They saw the lock gate at both the dock systems and inspected the berths, yards and sheds.

At the request of the Chairman, KoPT an interim report with six sections upto the Planning Parameters was submitted to ensure that the approach to the project by IPA is in line with the thinking of the port. This interim report was submitted vide IPA letter no. IPA/CSD/353/2019 dated 17th December, 2019.

The interim report was reviewed by KoPT and they indicated, vide their letter no. Tfc/GZZY 241/Rejuvenation of KP Dock dated 20th January, 2019 that the project planning and the project development lifecycle is found to be in order. However, they had made certain observations. Further observations were also indicated through an email from Sr. ATM, KoPT.

This final report was prepared after incorporating the observations made and submitted to KoPT vide IPA email dated 4th February, 2020. At the request of the Chairman, KoPT, this

was subsequently followed by a power-point presentation by IPA team to the Chairman and port officials on 16th March, 2020 through video conferencing. Later, KoPT forwarded their comments on the draft final report through their letter no. Tfc/GZZY 24/Rejuvenation of KP Dock dated 2nd April, 2020. IPA responded to these comments vide their letter no. IPA/CSD/353/2019 dated 8th April, 2020. KoPT gave their final reply vide email from Mr. Girish Thomas dated 6th May, 2020 enabling IPA to finalise the report.

Accordingly, the final DFR has been prepared and is submitted.

Appendix-I

SCOPE OF THE STUDY

i) IPA to undertake detailed Techno-economic Feasibility Report for Kidderpore Dock (KPD) of KDS which is proposed to be developed as multipurpose cargo berth with the cargo mix viz. General cargo along with containers, and any other cargo to make the project technically and financially viable.

ii) IPA will also examine the capacity calculations as made for KPD of KDS under Phase I and II.

iii) The Traffic projections already made by the KoPT will be reviewed and supplemented, if necessary, for containers and other cargo. The assumptions and parameters considered by KoPT for traffic analysis will be examined critically by the IPA Team and modified, if necessary, with proper reasoning.

iv) The IPA team will look into the project scope with equipment for ship shore transfer, jetty to stack yard equipment.

v) The project site, yard, draft, berth, equipment shall be surveyed and recommendation on their upgradation or reconstruction shall be given by the resource team members, if felt necessary.

vi) IPA will also examine the requirement of stack yard area as required for the projected traffic.

vii) The capital expenditure indicated by KoPT will be reviewed and revised, if necessary.

viii) The IPA team will also work out the technical and financial viability of the project considering Civil cost, Equipment cost and other costs.

SECTION 2
THE PORT – AN OVERVIEW

2.1 KOLKATA DOCK SYSTEM

Port of Kolkata, the first Major Port in India, is a riverine port. It serves a vast hinterland comprising the States of West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh, Punjab, Haryana, Rajasthan, Assam, other North Eastern States and the two neighbouring landlocked countries viz. Nepal and Bhutan. The Kolkata Dock System (KDS) is situated at Latitude 22º 32' N, Longitude: 88º 18' E in the city of Kolkata,

The Port has two Docks viz. Kidderpore Dock (KPD) and Netaji Subhas Dock (NSD). In addition, there is a tanker terminal at Budge Budge. The details of these are given hereunder.

- Kidderpore Dock (KPD) with 17 Multi-purpose berths and 1 berth for passenger-cum-cargo vessels, 6 Buoys/Moorings and 3 Dry Docks
- Netaji Subhas Dock (NSD) with 1 heavy lift berth (with 200 tonnes shore-based Cantilever Crane), 10 berths including 4 dedicated Container Berths, 1 Liquid Cargo Berth, 4 multi-purpose berths, 2 Buoys/Moorings and 2 Dry Docks
- Budge Budge has 6 Petroleum Wharves
- Anchorages at Sandheads, Saugor and Diamond Harbour

The following picture shows the locations of the two dock systems:

KIDDERPORE DOCK (KPD)

The KPD comprises two dock basins separated by a bascule bridge. KPD I has 10 berths and KPD II has 8 berths as shown in the following picture. The entrance to basin is through twin locks. The available berthing facilities are listed in the Table hereunder.

DETAILS OF BERTHING FACILITIES AVAILABLE AT KPD

Sl. No.	Berth No.	Length (m)	Water Depth (m)	Commodity Handled
KPD I				
1	1	133	7.8	General Cargo
2	3	128	8.4	General Cargo
3	4	136	8.7	General Cargo
4	5/7	229	8.6	General Cargo
5	6	118	9.0	General Cargo
6	8	128	9.2	General Cargo
7	9	108	9.0	General Cargo
8	10	161	8.9	General Cargo
9	11	151	8.7	Passenger
10	12	143	8.9	General Cargo

KPD II				
1	22	151	8.6	General Cargo
2	23	147	8.8	General Cargo (Grain Silos)
3	24	152	9.1	General Cargo
4	25	169	8.8	General Cargo
5	26	185	8.4	General Cargo
6	27	195	7.7	General Cargo/Log,Heavy lift
7	28	195	8.5	General Cargo/Log, Heavy lift
8	29	183	7.4	General Cargo/Log, Heavy lift

NETAJI SUBHAS DOCK (NSD)

The NSD comprises a dock basin with a single lock entrance and has 10 berths and 2 dry docks as shown in the following picture. The available berthing facilities are listed in the Table hereunder:

DETAILS OF BERTHING FACILITIES AVAILABLE AT NSD

Sl. No.	Berth No.	Length (m)	Water Depth (m)	Commodity Handled
1	1	200	7.1	Heavy Lifts &General Cargo
2	2	187	7.8	General Cargo
3	3	183	9.0	General Cargo
4	4	181	8.6	Container
5	5	182	8.2	Container
6	7	192	8.5	Container
7	8	225	8.0	Container
8	12	152	8.1	Liquid cargo/POL
9	13	174	8.2	General Cargo
10	14	174	7.4	General Cargo

BUDGE BUDGE OIL JETTIES

Amongst the earliest handling facilities that were constructed on the River Hooghly, the Oil Jetties at Budge Budge continue to be operational. There are 6 jetties of different sizes with associated storage facilities. The available berthing facilities are listed in the Table hereunder

DETAILS OF FACILITIES AVAILABLE AT BUDGE BUDGE PETROLEUM WHARVES

Sl. No.	Berth No.	LOA (feet)	Water Depth (m)	Commodity Handled
1	1BB	620	11.5	Liquid Bulk
2	2BB	340	11.5	Liquid Bulk
3	3BB	460	11.5	Liquid Bulk
4	5BB	620	10.5	Liquid Bulk
5	7BB	460	8.5	Liquid Bulk
6	8BB	580	8.5	Liquid Bulk

ANCHORAGES AT DIAMOND HARBOUR, SAUGOR AND SANDHEADS

Round the year lighterage operation is undertaken at Sandheads, Sagar and Diamond Harbour. Whereas there is no restriction on the dimensions of the mother vessel handled at Sandheads, LOA of vessel is restricted to 275 metres at Sagar and 200 metres at Diamond Harbour. Depths at these anchorages have been stable over the years. However, lighterage operations at Sandheads is

undertaken near Eastern Channel Light Vessel during fair weather and the operation is shifted to off Kanika Sand within the extended western limit of KoPT in foul weather.

The Virtual Jetty at Sagour has been functional for loading and unloading operations in all seasons and takes care of Panamax size vessels with draft of 10.5 mtrs. Four mooring buoys have been placed in 2004 at four sides to tie-up the ship, so that the barges/small vessels can tie-up alongside for stable loading/unloading operation. The location of the mooring buoys is at a distance of about 1000m from the western bank of Saugor Island.

The main advantages of the lighterage operations are:

- Better flexibility in vessels operation,
- No more waiting for favourable tide
- No restrictions on dimension of vessels
- Variable draft depending on the location but stable over the years
- Shorter navigable distance from Sandheads
- Reduction in turn round time of vessels.

2.2 NAVIGATIONAL CHANNEL AND NAVIGATION

Kolkata Port Trust (KPT) maintains two approach channels from sea one via Eastern channel for vessels visiting to KDS and the other via Eastern channel / EDEN for vessels visiting to HDC as shown in Figure 2.1.

The pilotage distance to KDS is 223 km comprising 148 km of river and 75 km of sea pilotage. Remote pilotage assistance is provided through VTMS during the sea passage of the vessels in both the channels.

Both the KDS and HDC channels are well marked with nearly 125 light vessels / lighted buoys and 500 shore marks.

No vessel over 200 GRT is allowed to navigate without a qualified pilot of KoPT. The pilotage distance is about 126 nm. The Port maintains a Pilot Station/vessel at Saugor along with 2 pilot launches for transportation of pilots. The River Pilot embarks inbound vessels at Middleton Point and proceeds up the river. On arrival at Kolkata (Garden Reach), the River Pilot is relieved by a Harbour Pilot who takes the vessel inside the lock at KPD or NSD. From the lock, the vessel is guided to the nominated berth by a Dock Pilot. For the outbound passage, this process is reversed.

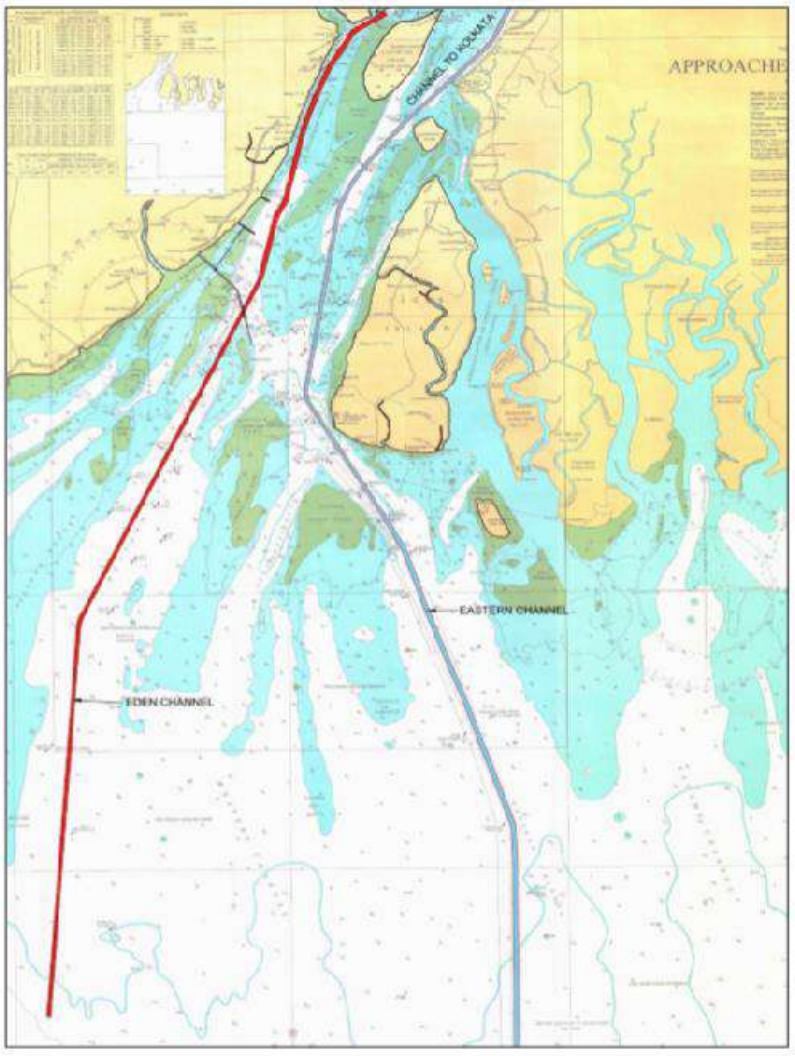


FIGURE 2.1: APPROACH CHANNELS TO KOLKATA & HALDIA

Kolkata being a riverine port, advantage is taken of the rise of tide so as to obtain the maximum draught for shipping. Variation of draught occurs between spring and neap tides and forecast of draught for inbound and outbound ships are published from Kolkata by the Harbour Master (River) about 4 to 6 weeks in advance.

Because of the sharp bends in the river, the length of the ship that can be accommodated at Kolkata is restricted to 172 m at Kolkata and 189 m at Budge Budge.

All vessels approaching Sandheads in the vicinity of Eastern Channel Light Vessel are required to contact Pilot Station situated at Saugor Island identified as Sandheads Pilot and VTMS control on channel 16 and 68 for instructions. Vessels are not allowed to proceed north of Lat 21^0 00' without a Pilot. On receipt of information about the vessel arrival, the pilot station intimates the vessel's entry timings and allocates a position in the convoy. The

following information is given to the vessel viz. Convoy number; number of ships in the convoy; names of preceding and succeeding vessels; Lower Gasper reporting time and Upper Gasper reporting time. The average convoy speed to be maintained is 12 knots and minimum separation of 1.5 nautical miles form up in their designated position in convoy. No overtaking is permitted.

2.3 PORT CONNECTIVITY

RAILWAY LINKAGE

Railway linkages are available to the KDS through the Sealdah station on the left bank of the river and to a couple of river side jetties including the oil terminal at Budge Budge as shown in figure 2.2. On the right bank railway connectivity is available through Oil terminal hub at Mourigram.

Container Corporation of India (CONCOR) runs Container train service to ICD Tughlakabad (TKD) from Kolkata Dock System (KDS) KoPT is also linked with ICDs at Amingaon (Assam) and Birgunj (Nepal). The service provides a hassle-free movement at a competitive rate.

CONCOR runs regular services for containers between KDS and ICD Birgunge in Nepal. This service was introduced in July 2004 and presently about 4-5 rakes per week leave for this ICD from KDS.

Regular service to Amingaon takes place only during the Tea Season with around two rakes per week. There is no regular container rail service between Jamshedpur ICD and KDS.

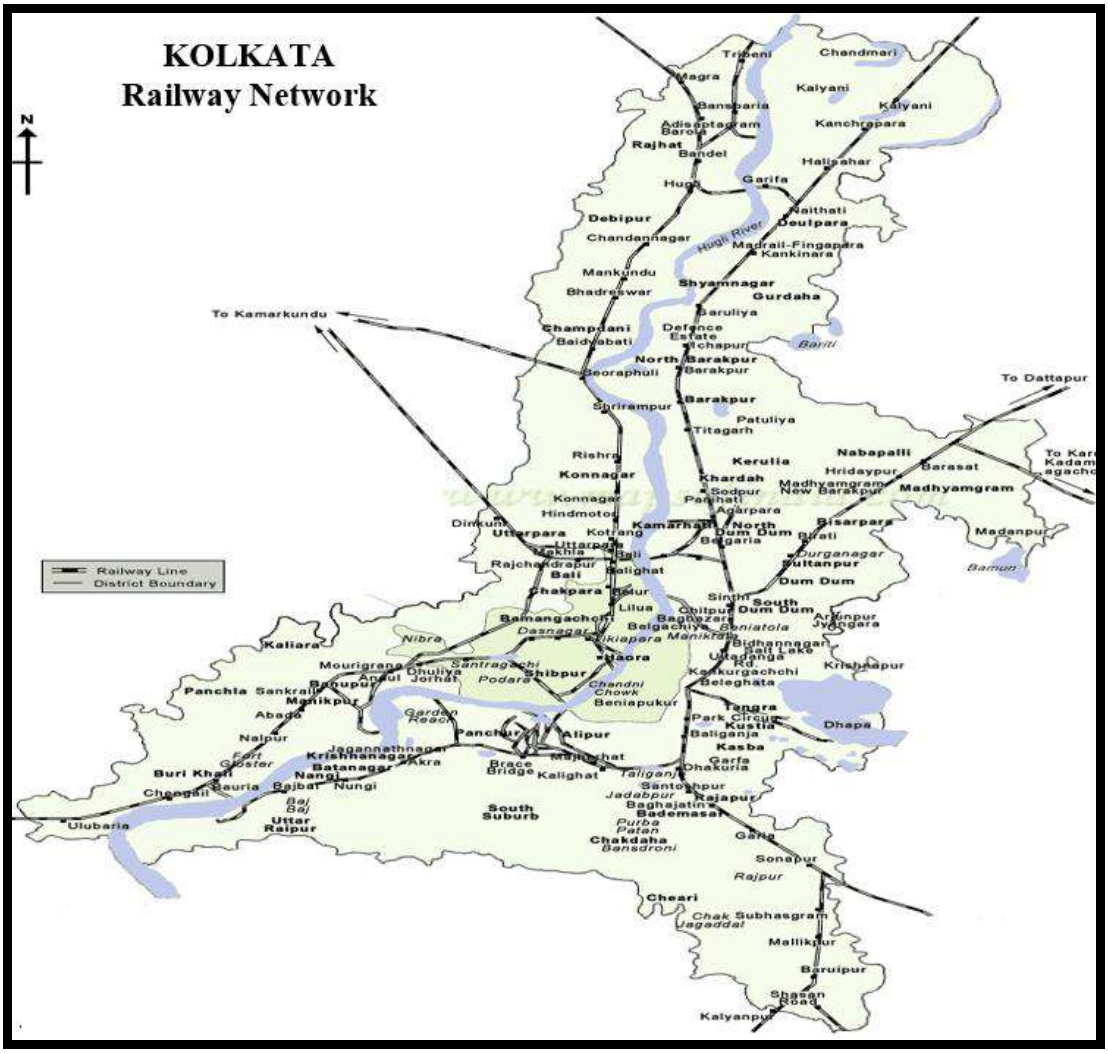


FIGURE 2.2 : RAILWAY NETWORK AROUND KOLKATA

ROAD ACCESS

Kolkata Dock System is contiguous with the Kolkata Municipal Corporation. The roads leading traffic into and out of KDS are crowded and narrow with major congestion and traffic jams.

The KPD & NSD are located at a distance of approximately 10 km from the junction of NH2 & NH6. The junction of NH34 and the Airport road is about 25 kms from the Dock area.

Diamond Harbour Road, Taratala Road and Garden Reach Road (peripheral roads) are 4-lane and periodically strengthened and upgraded, but due to a mix of local and cargo traffic often these are congested.

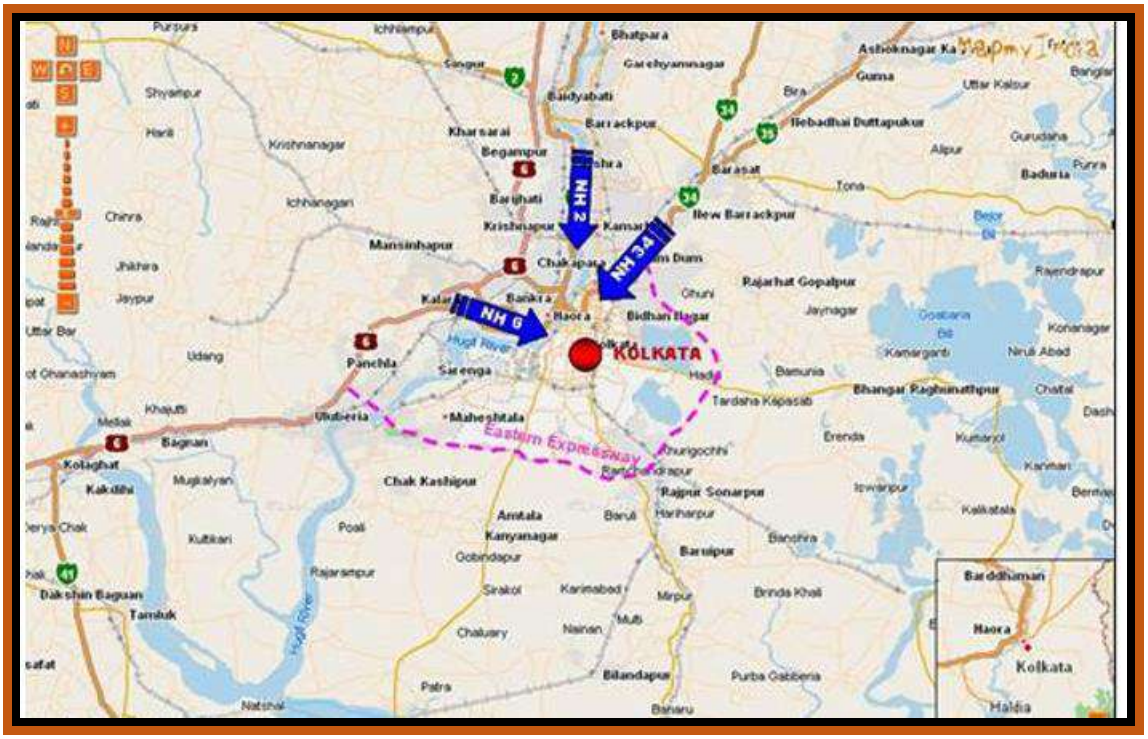


FIGURE 2.3 : REGIONAL ROAD CONNECTIVITY

INLAND WATERWAYS

Inland Water Transport assumes significance as KoPT can harness the immense potential of two of the existing water ways (National Waterway No 1 on Ganga River from Haldia to Allahabad and the National Waterway No. 2 on Meghna-Yamuna–Brahmaputra to North Eastern states as shown in Figure 2.4) to its advantage in the North-Eastern region. Operation of these two waterways was under the control of Central Inland Water Transport Corporation (CIWTC) in the recent past.

The major Inland Water (IW) traffic on the above-mentioned routes NW-1 & NW-2 plies under a renewable bilateral protocol with Bangladesh. The transit routes under the protocol are as follows (to & fro):

1. Kolkata-Haldia-Rajmangal- Chalna-Khulna-Mongla-Kaukhali-Barishal-Hizla-Chandpur-Narayanganj-Aricha-Sirajganj-Bahadurabad-Chimari-Dhubri-Pandu.
2. Kolkata-Haldia-Rajmangal-Mongla-Kaukhali-Barishal-Hizla-Chandpur-Narayanganj-Bhairavbazar-Ajmiriganj-Markuli-Sherpur-Fenchuganj-Zakiganj-Karimganj

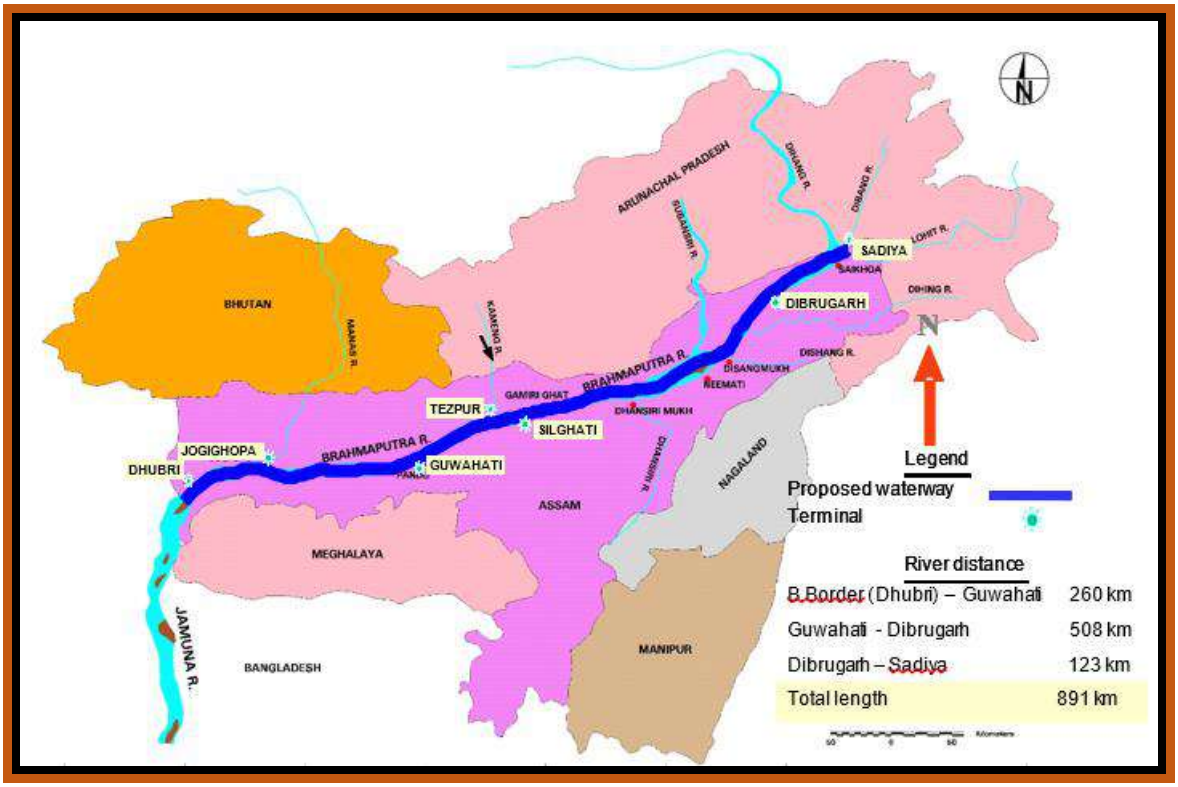


FIGURE 2.4 : IWT ROUTE THROUGH BANGLADESH

2.4 CLIMATIC CONDITIONS & TIDAL DATA

Climate

The climate of the West Bengal is tropical having four well-marked seasons, i.e., summer (March – May); monsoon (June – September); post monsoon (October – November); winter (December – February).

Temperature

The month of May is the hottest, whereas December and January are colder months. According to the IMD data between 1961 and 1990, the highest temperature recorded in 30 years is 40.6° C. The lowest temperature was observed to be 9.7°C.

Rainfall Data

This region is mainly exposed to Southwest monsoon from June to September and an annual rainfall of more than 1700 mm were reported for the two locations. The IMD data suggests that the months of July and August are the wettest months having monthly rainfall of more than 350 mm. During northwest monsoon from November to March, monthly average rainfall of less than 50 mm is experienced.

Visibility

At times due to heavy rainfall poor visibility is reported during the southwest monsoon. On an average, fog is reported on 5-7 days in each month from November to February during morning hours.

Wind

The predominant wind direction reported at Alipur, Kolkata and Sagar Island, is from south and southwest. About 25 % of the time wind was reported to be blowing from north and northeast. The highest wind speed of 16 knots was reported in the month of May. During the months of April to August wind speed was found to be higher than 10 knots

Tidal Data

The tide levels of River Hugli at Garden Reach above KODS at Garden Reach are as follows:

Highest High Water (HHW)	**:** (+) 7.70 m CD
Mean High Water Spring (MHWS)	**:** (+) 5.62 m CD
Mean High Water (MHW)	**:** (+) 5.01 m CD
Mean High Water Neaps (MHWN)	**:** (+) 4.10 m CD
Local Mean Water Level (LMWL)	**:** (+) 3.19 m CD
Mean Low Water Neaps (MLWN)	**:** (+) 2.00 m CD
Mean Low Water (MLW)	**:** (+) 1.68 m CD
Mean Low Water Springs (MLWS)	**:** (+) 1.41 m CD
Lowest Low Water (LLW)	**:** (+) 0.14 m CD

Earthquake

Seismic loads are estimated according to modified clause for the interim measures for seismic provisions clause 222 of IRC:6-2000. Horizontal seismic forces to be resisted shall be computed as follows:

Feq = A n x (Dead Load ± Appropriate Live Load)

A n = {(Z / 2) x (Sa / g)} / (R / I)

Horizontal Seismic Co-efficient = 0.18

Z = Zone Factor = 0.24 (Table 5)

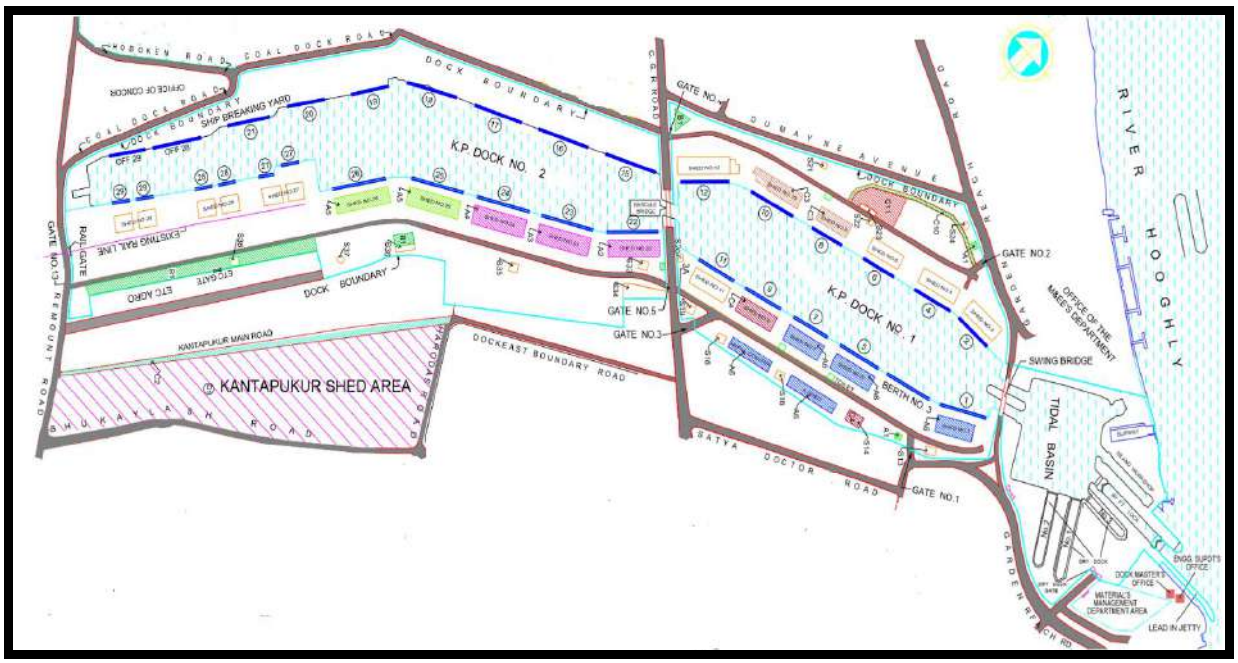
Sa / g = Average response acceleration coefficient = 2.50

R = Response Reduction Factor = 2.50

I = Importance Factor = 1.50

3.1 GENERAL

Kidderpore dock is the older of the two docks in Kolkata port. It is operated through a lock gate. It is divided into two parts – KPD I and KPD II. These two are separated by a bascule bridge.



OVERALL VIEW OF KIDDERPORE DOCKS I & II

Kidderpore docks are located at about 30 nautical miles from Diamond Harbour. This stretch of Hooghly river is having a number of bends and there are about 18 bars in between. In view of this, there is no night navigation in this stretch and the vessels sail in and out only during daytime.

When the vessels reach KDS sailing along with the tide, there is an anchorage available at Nazirgunj Flat north of Garden Reach where anchorages are available for accommodating 5 vessels to wait for their turn in getting the berths.

NAZIRGUNJ FLAT WITH ANCHORAGE FOR SHIPS

3.2 ENTRY TO KIDDERPORE DOCKS

The entry to the docks is through a lock gate. The lock barrel length is 176.8m (580 ft) and the width is 24.4m (80 ft). Accordingly, the maximum LOA of vessel will be 157 m (515 ft) and the maximum beam will be 21.35 m (70 ft).

The water level inside the tidal basin and the docks is maintained at 6.2 m. If the water level outside when the ship arrives at the lock is more than 6.5 m the gate is not opened. The ship waits till the water level comes down to 6.2 m.

The ship first positions itself along the lead-in jetty Then the front gate is opened and the ship moves inside the barrel. This movement is effected by passing the mooring ropes on to the bollards on the side wall and tightening the ropes through capstans on the ship. After it is fully inside the barrel, the front gate is closed. Then the second gate is opened and the ship gets into the tidal basin and the second gate is also closed.

Till sometime back, when the ship is inside the tidal basin, it is turned around with the use of four capstans so that the fore of the ship faces the lock gate. Over the years, with the number of ships calling coming down and the capstans getting disused, the ships are no longer turned around.

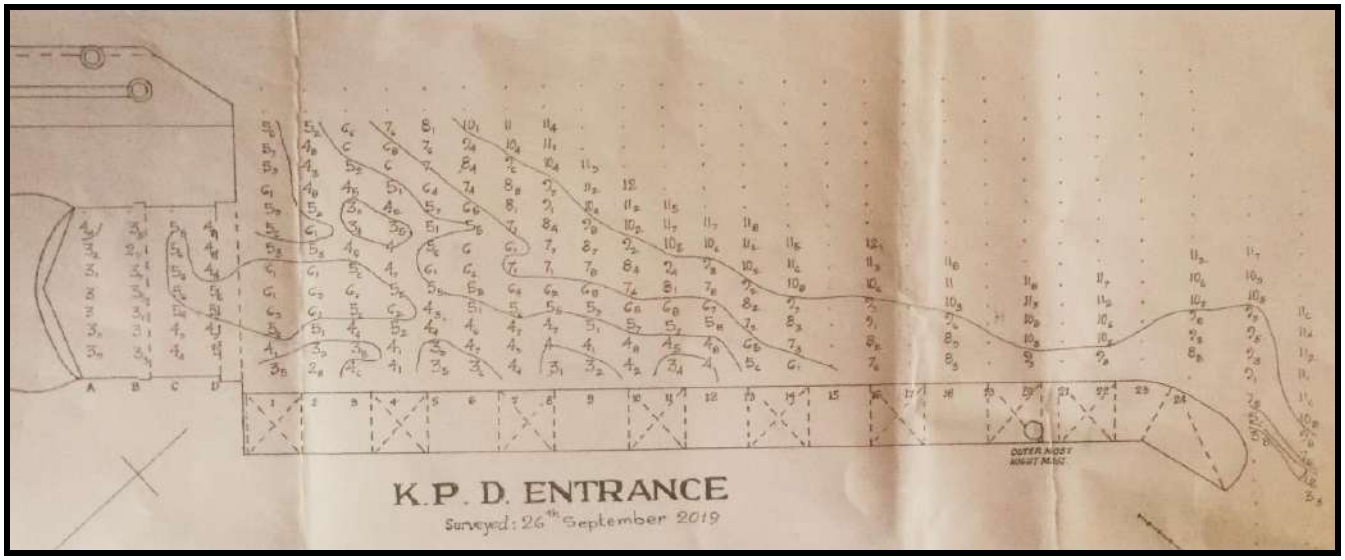
Thereafter, the swing bridge is turned around and the ship is taken inside the dock I or II with the help of tugs and berthed at the scheduled berth.

The whole operation through the lock gate normally takes around 1 to 1½ hours.

The depth in front of the lock gate is about 2.9 to 3 m. With the opening of the gate, this place gets silted up and there is a need to dredge this area daily with the help of grab dredger.

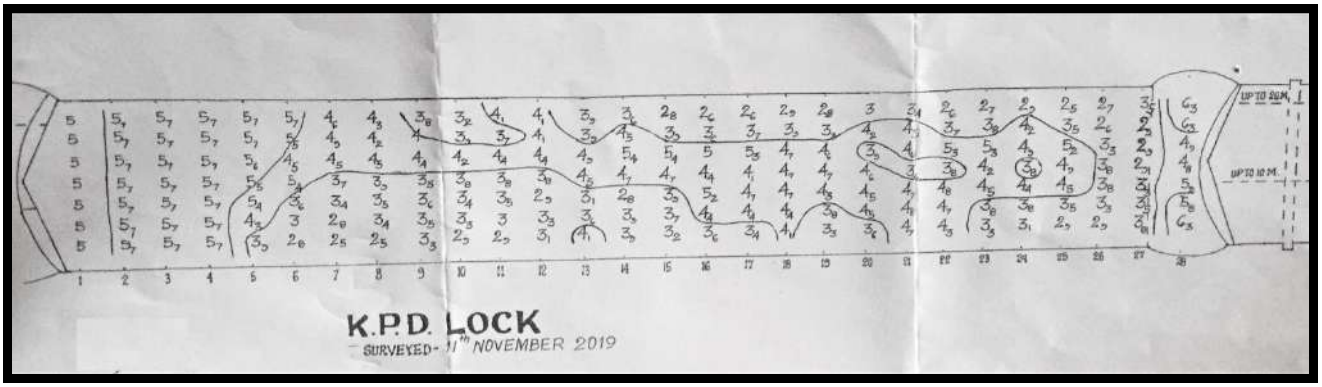
KIDDERPORE DOCKS – LOCK GATE AND TIDAL BASIN

LEAD-IN JETTY FOR ENTERING KIDDERPORE DOCKS



SOUNDINGS NEAR THE LEAD-IN JETTY

LOCK BARREL



SOUNDINGS INSIDE THE LOCK BARREL

INSIDE VIEW OF THE LOCK GATE

OUTSIDE VIEW OF THE LOCK GATE

A VESSEL INSIDE THE LOCK BARREL

3.3 KIDDERPORE DOCKS I & II

Once a ship enters the tidal basin, depending upon its scheduled berth, it proceeds to Kidderpore Dock I or Dock II. These two are separated by a bascule bridge. Since this bascule bridge is serving as a thoroughfare for city traffic, it is always congested. Hence the city authorities permit the opening of this bridge for passage of ships/barges only from midnight to 4.00 AM.

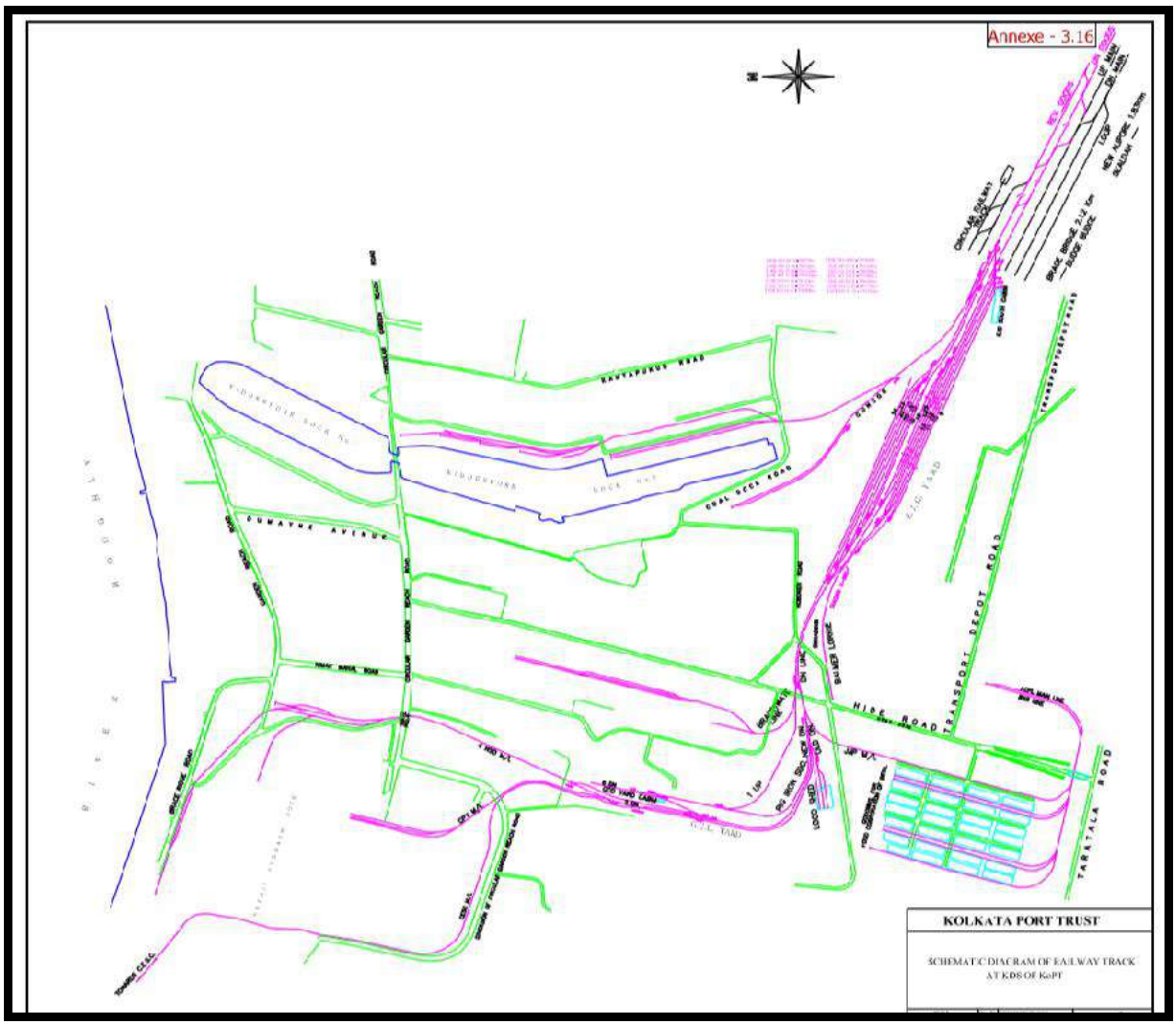
The details of these two docks are presented hereunder.

KIDDERPORE DOCK I

Dock Particulars	Berth Particulars		
	No	Length(m)	Width(m)
KPD I - EASTERN BERTHS	1	133	18.29
	3	128	18.29
	5/7	229	18.29
	9	108	18.29
	11	151	18.29
KPD I - WESTERN BERTHS	2	162	15.4
	4	136	15.24
	6	118	15.24
	8	128	15.24
	10	161	15.24
	12	143	15.24

KIDDERPORE DOCK II

Dock Particulars	Berth Particulars		
	No	Length(m)	Width(m)
KPD II BERTHS	22	151	12.2
	23	147	12.2
	24	152	12.2
	25	169	12.2
	26	185	12.2
	27	195	21.3
	28	195	21.3
	29	183	21.3



RAILWAY SYSTEM SERVING KIDDERPORE DOCK

3.4 KPD I – WESTERN BERTHS

Kidderpore docks are the oldest construction in the port which are more than 130 years old. No proper detailed drawings are available for the quay wall structure as well as the adjoining transit sheds. Immediately after the construction, there was a major disaster in the form of slippage of the eastern quay wall for about 457 m and bulging of about 137 m of southwest wall. In order to examine and for suggesting remedial measures, a GoI committee was formed and we are able to get an idea about the cross section of the quay wall and the later remedial measures taken. Taking into consideration these cross sections and relating this with the existing soil data, the civil engineering department was able to limit the possible loading on the quay wall and the back-up area.

Since the proposed project is to be located at this western portion of KPD I, this portion is examined in more details in this sub-section.

OVERALL LAYOUT OF WESTERN BERTHS

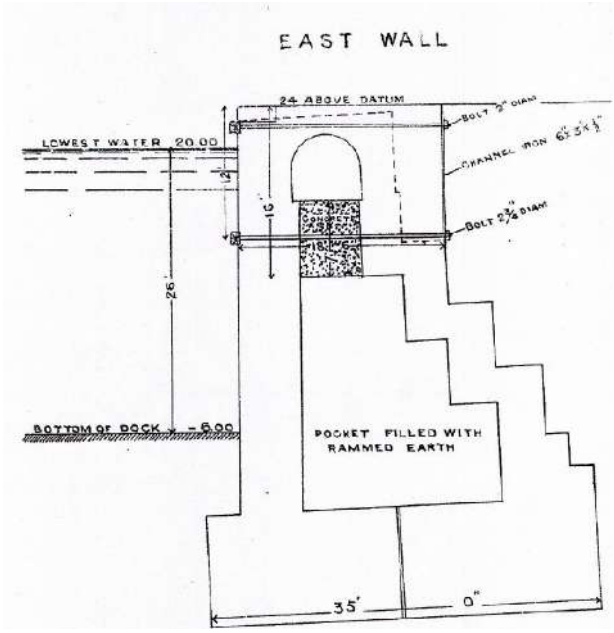
The overall layout of the western berths is shown in the following figure.

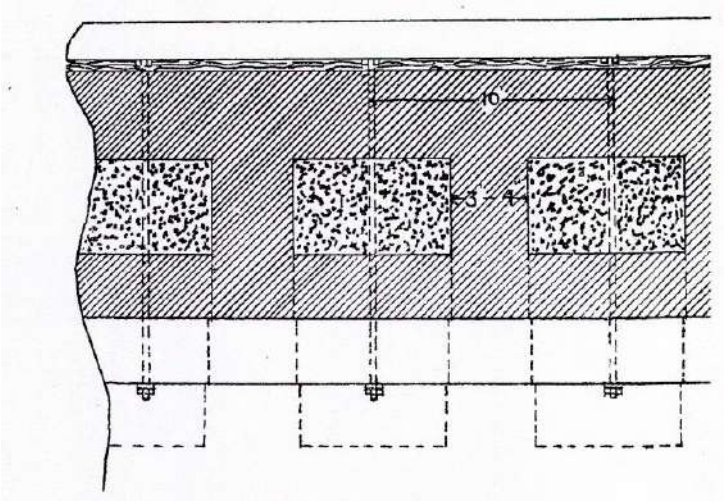
OVERALL LAYOUT OF KPD I WESTERN BERTHS

There are five berths located here viz. berths no. 2,4,6,8,10 and 12. The extreme berths Nos. 2 and 12 are laid out in a squew as compared to the other 4 berths which are in a straight line. All the berths are provided with transit sheds which are located at about 15.2 m from the berthing face. There are open spaces beyond the transit sheds as could be seen in the figure.

QUAY WALL STRUCTURE

Cross section of Eastern berths as given in the Proceedings of the GoI Committee dt.24.02.1891.





Extract from the proceedings of the Committee

CALCUTTA (KIDDERPORE) DOCKS.

Proceedings of a Committee appointed by the Government of India, under Resolution No. 72 M., of the 24th February 1891 to consider the engineering proposals made by the Engineer to the Calcutta Port Trust in connection with the movements that have occurred in the walls of Dock No. 1.

MEMBERS OF COMMITTEE.

F. L. O'CALLAGHAN, ESQ., C. S. I., C. I. E., M. I. C. E., ... *President.*
HON'BLE J. L. MACKAY, C. I. E.,
HORACE BELL, ESQ., M. I. C. E.,
G. E. ORMISTON, ESQ., M. I. C. E., } *Members.*

2. The Committee have carefully considered the Engineer's proposal to fix the minimum level of the water in the dock at 20 above datum, together with Captain Campbell's objections to this. They are of opinion that this proposal will not affect the safety of the shipping, or materially influence the efficiency of the dock; and as they consider it to be of vital importance to afford every possible support to the walls, they recommend that the Engineer's proposal be adopted.

3. The Committee hold that the movement of the east wall has resulted in splitting it into two halves longitudinally and for nearly its entire length. They consider that steps must be taken to prevent any further separation between the front and the back of this wall, and recommend that the earth filling in the "pockets" be taken out to a depth of 16 feet below coping level and substituted by good hydraulic lime concrete. Also that a 2¾-inch bolt be passed right through the wall and concrete in each pocket, a "green heart" walling being given as a horizontal washer-plate for these bolts on the dock face, and at the back a vertical channel iron will take these bolts and also a 2-inch bolt securing an upper walling of teak just below the coping.

It has been indicated that the cross section of western berths will be similar to the eastern berth except that the cement concrete under the service duct is replaced with rammed earth.

The committee report talks of a bolt passing through the wall and at the back a vertical channel iron will take these bolts.

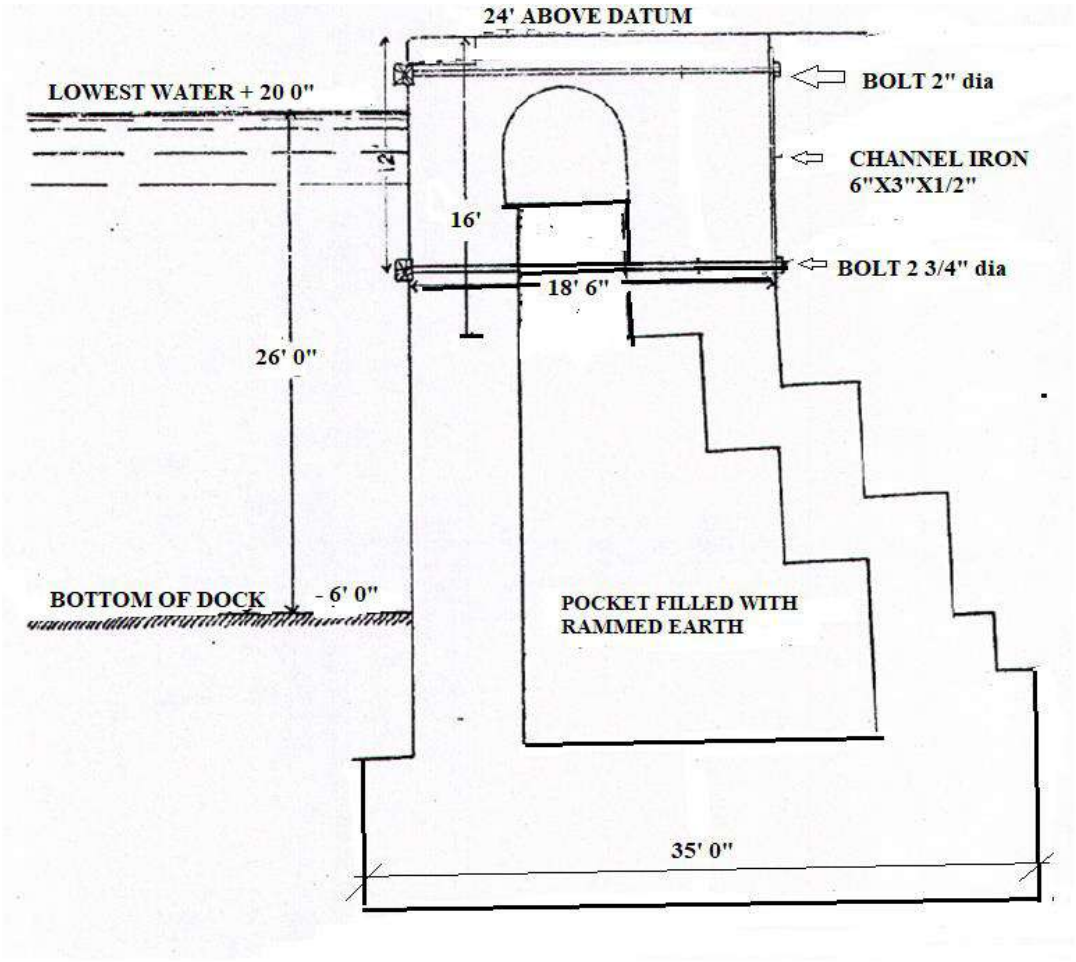
Photos taken of the berthing face of berths 2 and 4 on the western side confirm this. Hence it is presumed that the same cross section as the eastern side.

BERTHING FACE JUNCTION OF BERTHS 2 AND 4

BERTHING FACE OF BERTH 4

SURFACE OF BERTH No.4

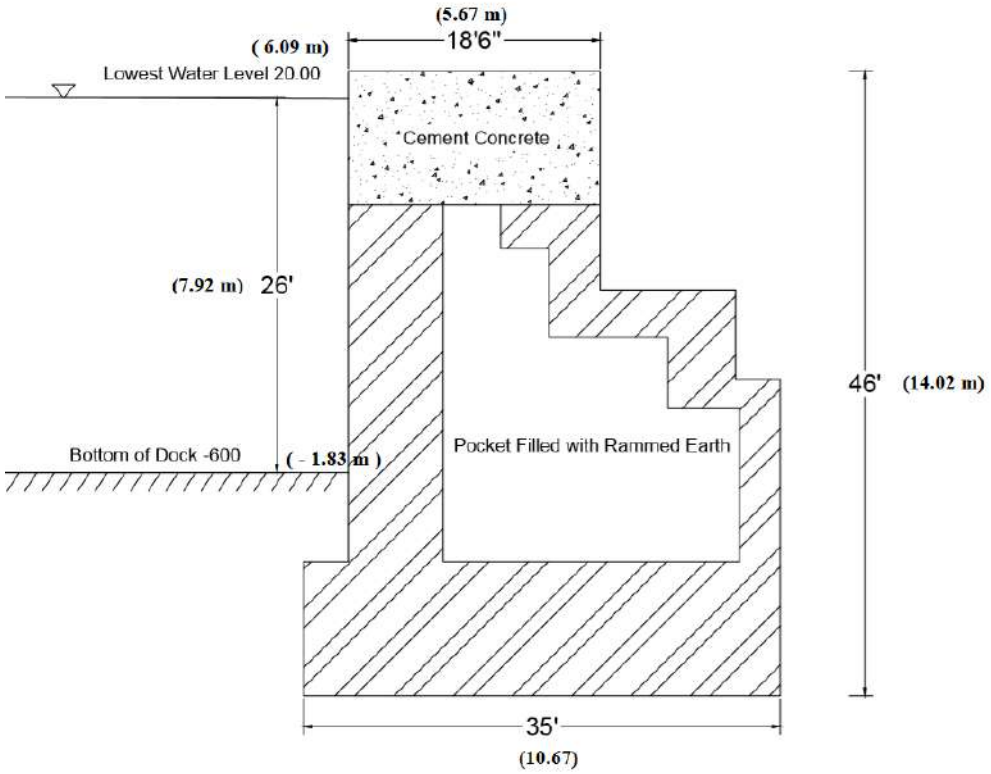
Based on these, the cross section of western berths 2 to 10 is shown as follows:



The top of the Berth surface is either laid with lime concrete or replaced with cement concrete, done during repairing of damaged top surface.

A clear width of 3.4m from quay wall should be left for the presence of service duct in the Berths. As such, the outer edge of the pad of MHC can be placed keeping a clear width of 3.4m from quay wall.

However, a quay length of 450' from the extreme end of south western corner of Berth No 12 towards North, referred as southwest wall in the committee report, has a different cross section which is shown hereunder.

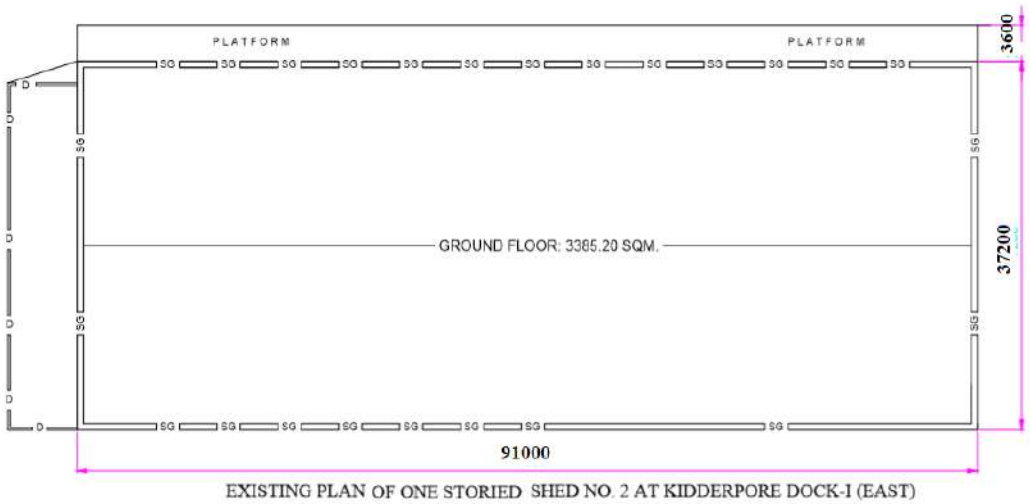


CROSSS SECTION OF THE EXISTING MASONRY QUAY WALL

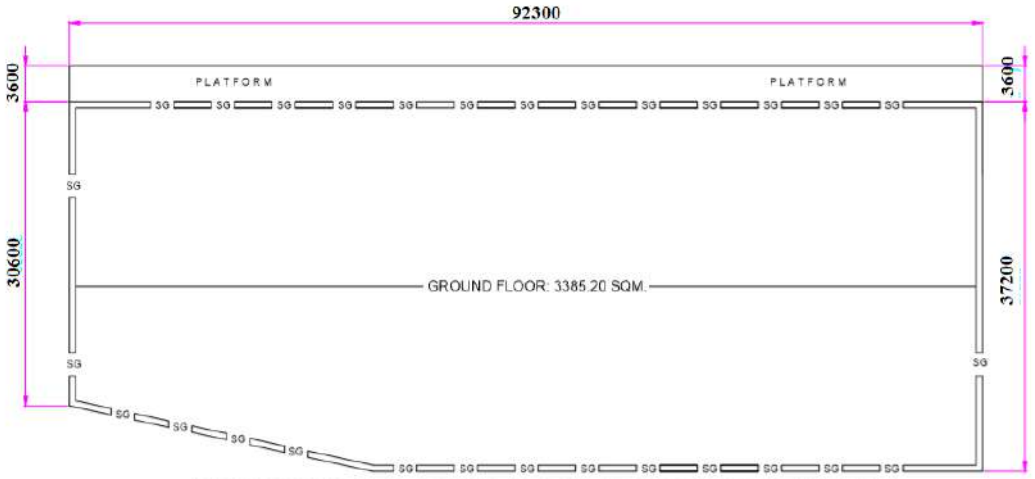
TRANSIT SHEDS AT BERTHS

As said earlier, all the berths on the western side are provided with transit sheds. These sheds are twin bayed with steel trusses supported on lattice girders and steel columns. The sheds at berths Nos. 2 and 4 are similar while the other sheds are having their own configurations.

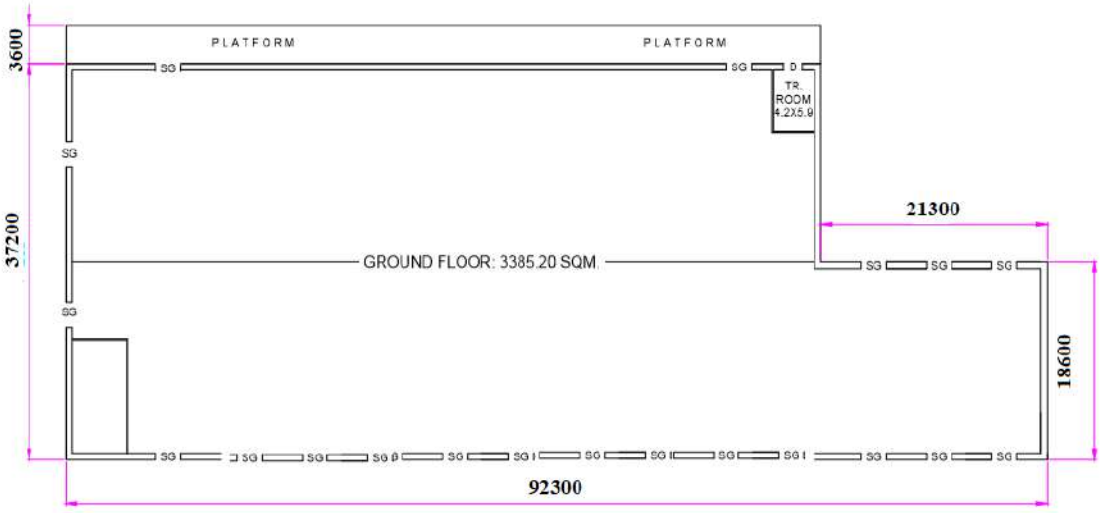
The plan with the dimensions and area of all these sheds are presented hereunder.



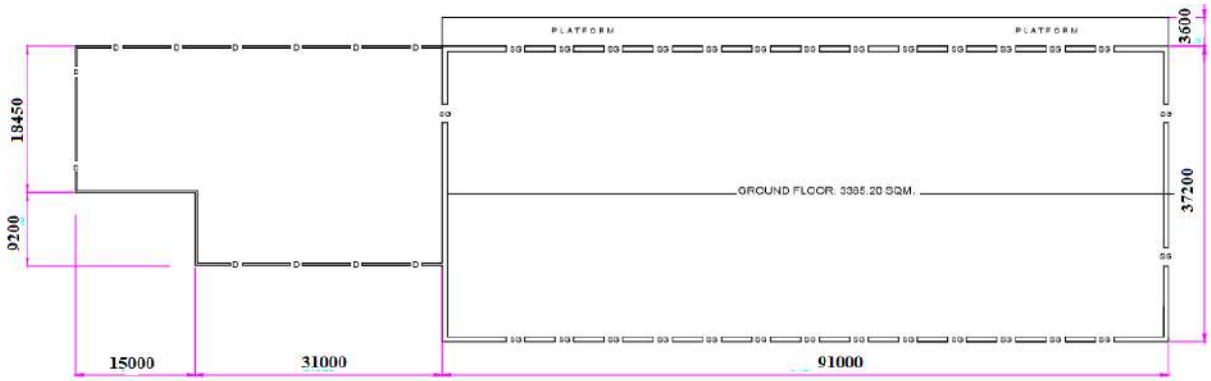
EXISTING PLAN OF ONE STORIED SHED NO. 2 AT KIDDERPORE DOCK-I (EAST)



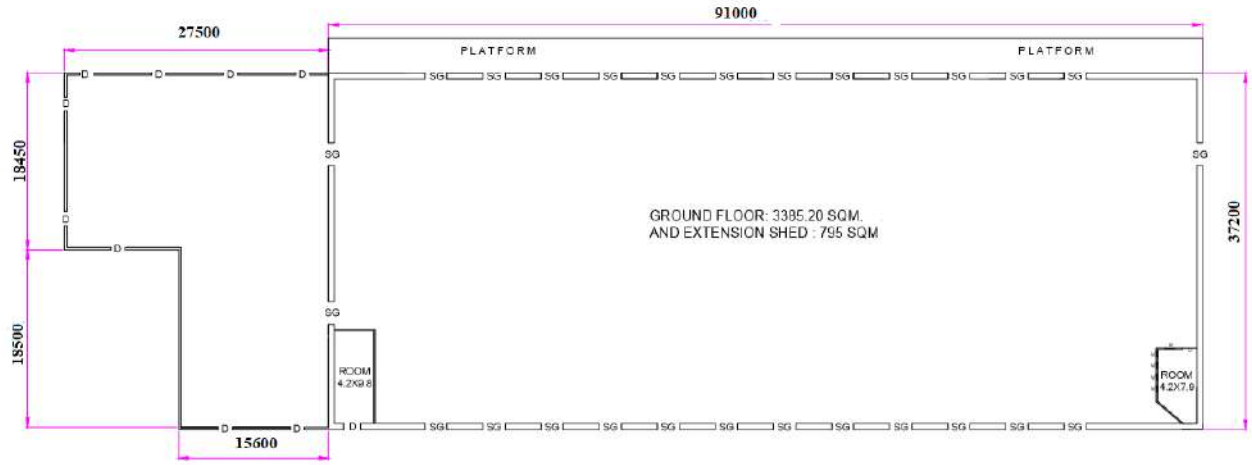
EXISTING PLAN OF ONE STORIED SHED NO. 6 AT KIDDERPORE DOCK-I (EAST)



EXISTING PLAN OF ONE STORIED SHED NO. 8 AT KIDDERPORE DOCK-I (EAST)



EXISTING PLAN . OF ONE STORIED SHED NO. 10 AT KIDDERPORE DOCK-I (EAST)



EXISTING PLAN OF ONE STORIED SHED NO. 12 AT KIDDERPORE DOCK-I (EAST)

LOCATION OF SHEDS RELATIVE TO THE QUAY WALL

FRONT VIEW OF SHEDS Nos 2 & 4

INSIDE VIEW OF THE SHED

ANOTHER VIEW OF SHED INSIDE

ONE MORE VIEW OF SHED INSIDE

STEEL COLUMN SUPPORITNG THE LATTICE GIRDER

ROOF TRUSS SUPPORTING ARRANGEMENT

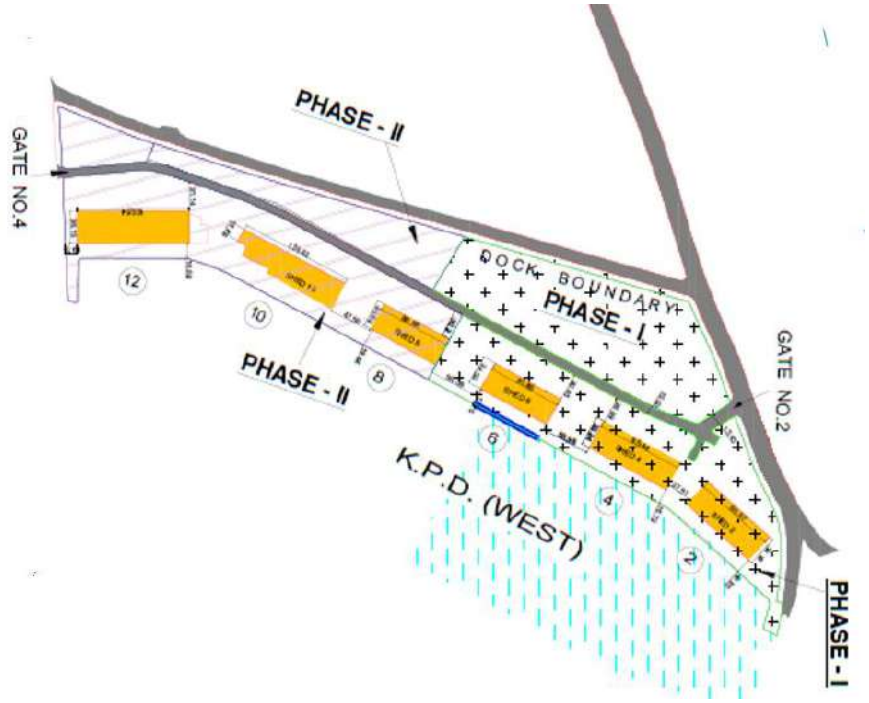
BACK UP AREA BEHIND THE BERTHS

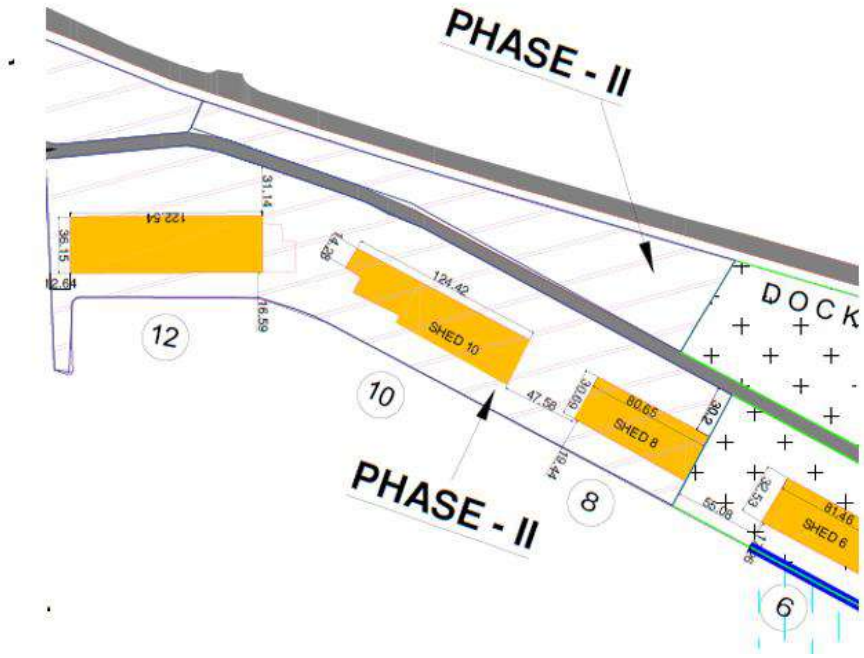
The back-up area behind the berths on the western side is shown in the above figure. In this area, the port has recently developed a container yard with 100 TGS which includes 6 reefer points serving 24 reefer boxes at a time. The entire yard has been designed for handling by RST and all slots have been well marked.

The port has planned to execute this rejuvenation project in two phases and has tentatively earmarked back-up areas for each phase as indicated hereunder.

AREA STATEMENT : PHASE-I		
SR. NO.	DESCRIPTION	AREA (IN Sqm)
1	Phase - I	67,761.00
a	SHED 2 (Incl.)	3,109.00
b	SHED 4 (Incl.)	3,198.00
c	SHED 6 (Incl.)	2,619.00

AREA STATEMENT : PHASE-II		
SR. NO.	DESCRIPTION	AREA (IN Sqm)
1	Phase - II	54,705.00
a	SHED 8 (Incl.)	2,475.00
b	SHED 10 (Incl.)	3,521.00
c	SHED 12 (Incl.)	4,988.00

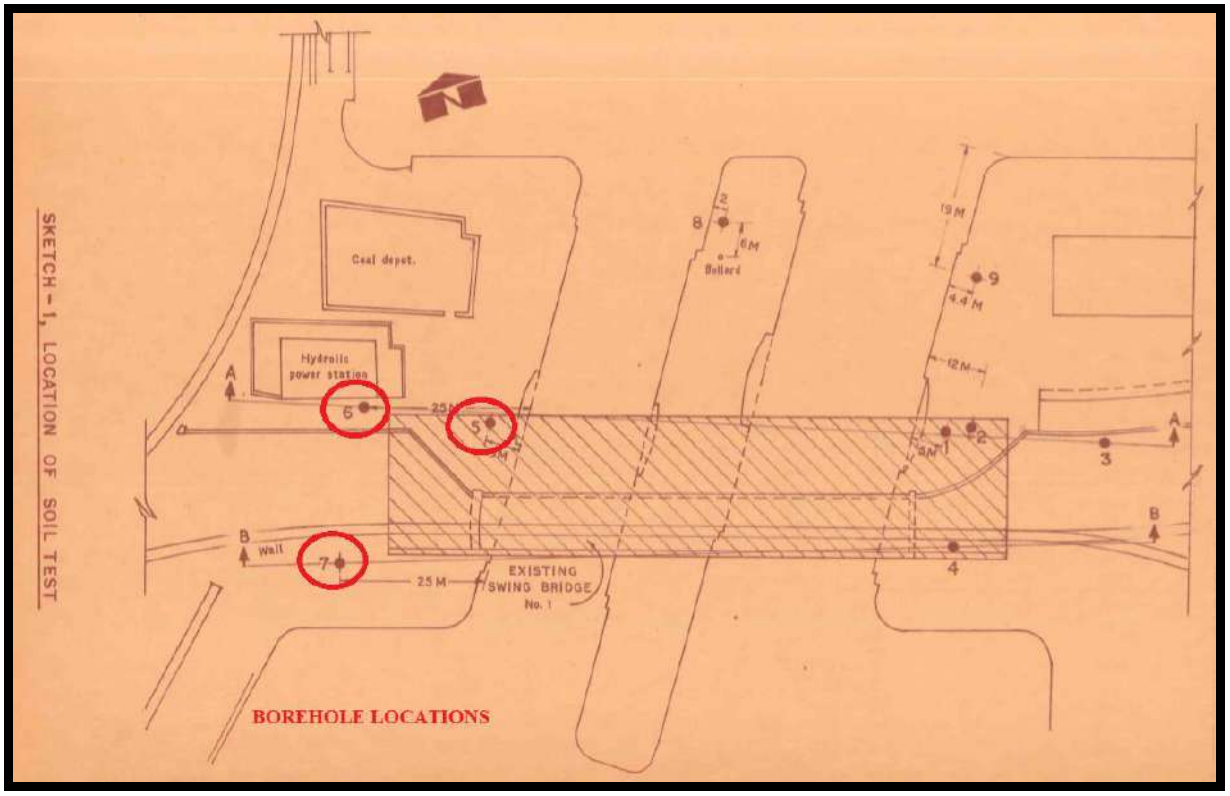




SOIL DATA

No recent soil data of the western side is available. The only data available is when soil investigations were carried out during January – February 1978 by K.N. Dadina in connection with the proposal to replace the swing bridge.

The boreholes nearer to the western side are shown in the following figure. Key excerpts from the report are reproduced hereunder.

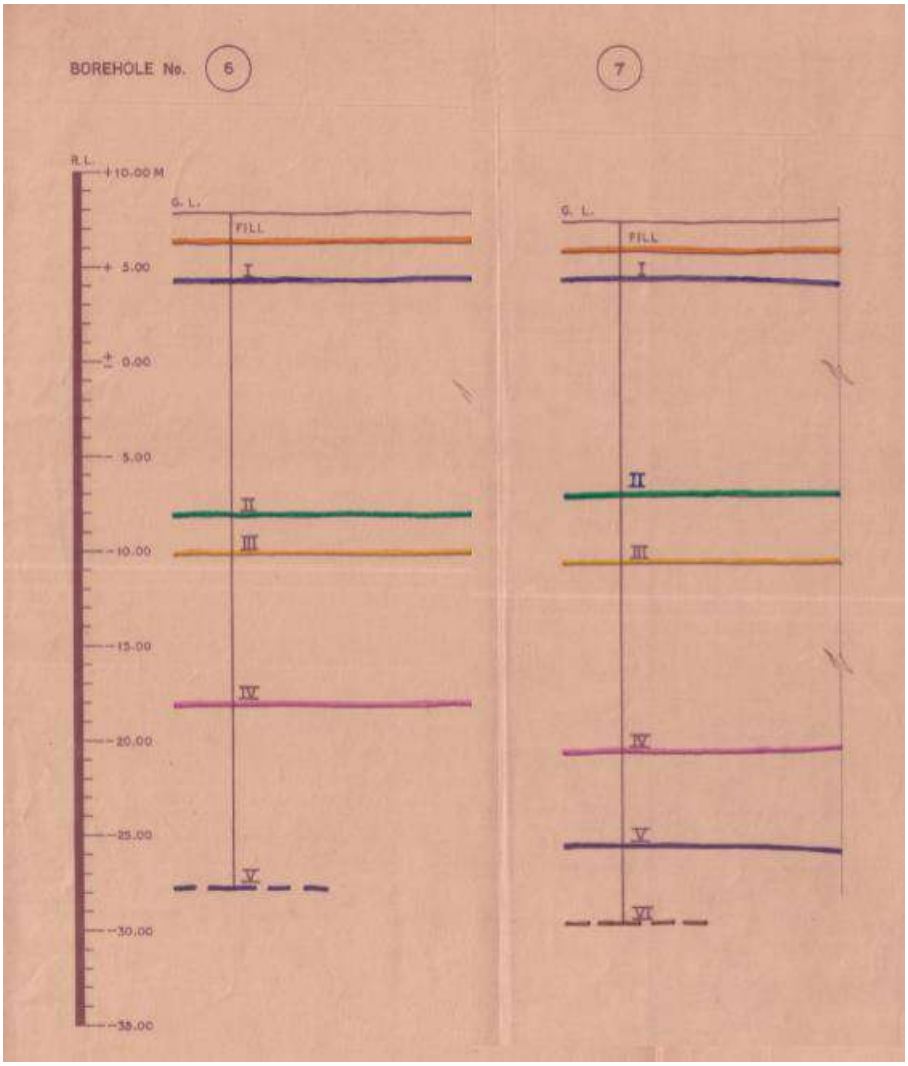


The object of this investigation was to study the sub-soil characteristics of the underlying deposits and recommend safe bearing capacity of soil for design of foundations.

TABLE I - DEPTH OF BOREHOLES WITH REDUCED LEVELS

Borehole No.	Depth Bored (m)	Reduced Level (m) From	Reduced Level (m) To	Remarks
5.	5.63	+ 7.33	+ 1.70	In Dockwall (Western side)
6.	35.70	+ 7.81	- 27.89	In Soil (Western Side)
7.	37.05	+ 7.36	- 29.69	In Soil (Western Side)

DOCK WALL MASONRY: Drilling through Dock Wall Masonry was carried out in Borehole Nos. 1, 5, 8 & 9. It is to be noted that the dock-wall is made up of brick masonry with lime mortar. The drilling records and subsequent testing of core samples reveal that the brick masonry is in good condition and the crushing strength of core samples selected from top 3m depth was found to vary from 76.6 kg/cm^2 to 98.0 kg/cm^2.



Strata I - Very loose yellow-brown to brownish-grey SANDY SILT with little Cohesion (ML/MI) :- This deposit is absent in Boreholes 1 & 2 and is found in the remaining boreholes which were put down through soil. It is predominantly Silty and contains fine-grained Sand particles. In Borehole 4 this deposit exists as Clayey Silt containing traces of fine-grained micaceous Sand. The thickness of this strata at Boreholes 3, 4, 6 & 7 is observed to be 1.5m, 3m, 2m and 1.5m respectively. Due to its limited thickness undisturbed samples were not collected and only penetrometer & vane shear tests were carried out in this deposit.

Strata II - Soft to medium dark bluish-grey CLAYEY SILT to SILTY CLAY with decayed vegetation (MH/CH) :- This strata is mainly found in a soft to medium state and is dark bluish-grey in colour. It contains presence of semi-decayed wood pieces and decayed vegetation. As already indicated earlier, due to excessive thickness of Fill at Borehole 2 the thickness of Strata II at this location is found to be only 2m. At the remaining boreholes, the thickness of this strata is observed to vary from 9m to 12.5m.

Strata III - Stiff to very stiff bluish to greenish-grey SILTY CLAY with Kanker (CH) :- This deposit is predominantly cohesive but in Boreholes 1 & 3 it is observed to contain a high percentage of Silt. It contains kanker nodules generally varying from 10mm to 25mm size and lenses of rust-brown Silt are also observed in some boreholes in the lower portion of this deposit. The thickness of this strata varies from 2m to 4.5m.

Strata IV - Medium to dense and very dense mottled-brown SANDY SILT with very little cohesion (MI) :- This deposit is predominantly Sandy Silt and contains fine-grained micaceous Sand particles. In Boreholes 1 and 4, the deposit has a high cohesive component and is found as stiff to hard Clayey Silt mixed with fine-grained Sand particles. The percentage of Sand particles vary considerably in this deposit. It is to be clarified that this deposit contains cohesive pockets, at different depth and even though it is predominantly a Sandy Silt, classification tests reveal presence of moderate cohesive component. This is attributed to the deposit being found between Strata III& V which are both predominantly cohesive. The thickness of this strata varies from 7m to 10m.

Strata V - Very stiff to hard mottled-brown SILTY CLAY to CLAYEY SILT (CI) :- This deposit is found in a very stiff to hard state in all boreholes and contains few Siltstones and also pockets of rust-brown Silt. Fine-grained micaceous Sand particles are observed in the lower portion of this deposit. It would be observed that Borehole 6 was terminated in this deposit while the other boreholes were taken deeper through this strata. The thickness of this deposit is observed to vary from 5.0m to 11.5m.

Strata VI - Dense to very dense rust-brown SANDY SILT with little cohesion (ML) :- This deposit is predominantly Silty and contains fine-grained micaceous Sand particles in increasing percentage with depth. It exhibits little cohesive touch mainly in its upper reaches. In-situ density of the deposit generally increases with depth. As all boreholes at site were terminated in this deposit, the range of thickness of this strata has not been ascertained.

For further classification and properties, full report is available with the Civil Engineering Department.

SECTION 4
TRAFFIC STUDY&ESTIMATES

4.1. INTRODUCTION

For the rejuvenation of KPD 1, the Port has chosen the 6 berths on the west arm and grouped them in two clusters. The first cluster comprises berths 2, 4, 6 and the second 8, 10 and 12. The Port wants to implement the rejuvenation in 2 phases. In the first phase it will redevelop the first cluster and in the second phase the second cluster.

The Port proposes to use the PPP mode to revitalize KPD. Under the plan the PPP operator will handle all dry cargoes at both the clusters but dedicate 2 of the 3 berths in each cluster for container, and handle container and other cargoes with appropriate and specialized equipment like harbour mobile cranes, reach stackers, payloaders, dumpers, etc.

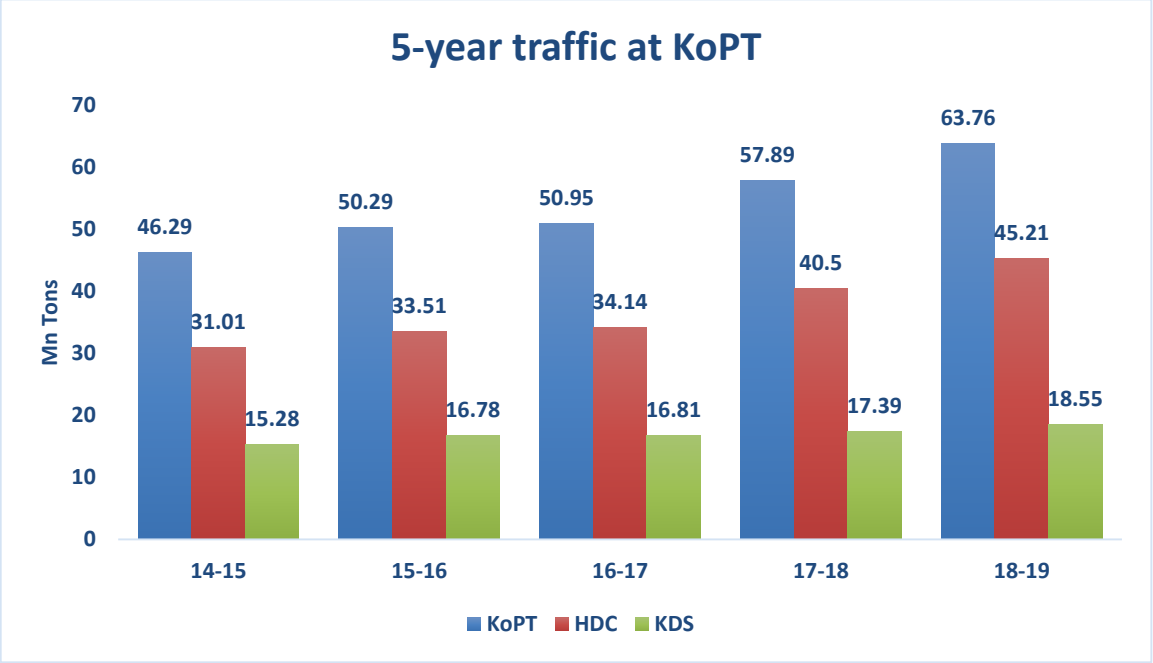
The objective of the traffic study is to identify the potential cargoes for the two KPD 1 clusters slated for rejuvenation and to assess the traffic potential of each cluster for the next 30 years, up to 2050,

4.2 METHODOLOGY

- reviewing the traffic handled at the entire Kolkata port in the last 5 years in order to evaluate the pattern and trend of traffic handled at Kolkata Dock System and Haldia Dock Complex
- scrutinizing HDC's traffic to explore the possibility of any part of its traffic moving to KDS
- examining the locations where the traffic of KDS are handled, which cargoes and how much of them are handled at each location, in order to determine which commodities have the prospect to come to KPD 1 Clusters
- analysing the traffic handled at KDS berths in the last 2 years to observe which traffic is growing, consistent, fickle or receding
- applying two yard sticks and a filter to identify the final principal cargoes for Cluster 1 and Cluster 2

4.3 REVIEW OF OVERALL TRAFFIC

The following chart shows the traffic handled at the entire Kolkata Port including Kolkata Dock System (KDS) and Haldia Dock Complex (HDC) in the last 5 years, up to 2018-19.



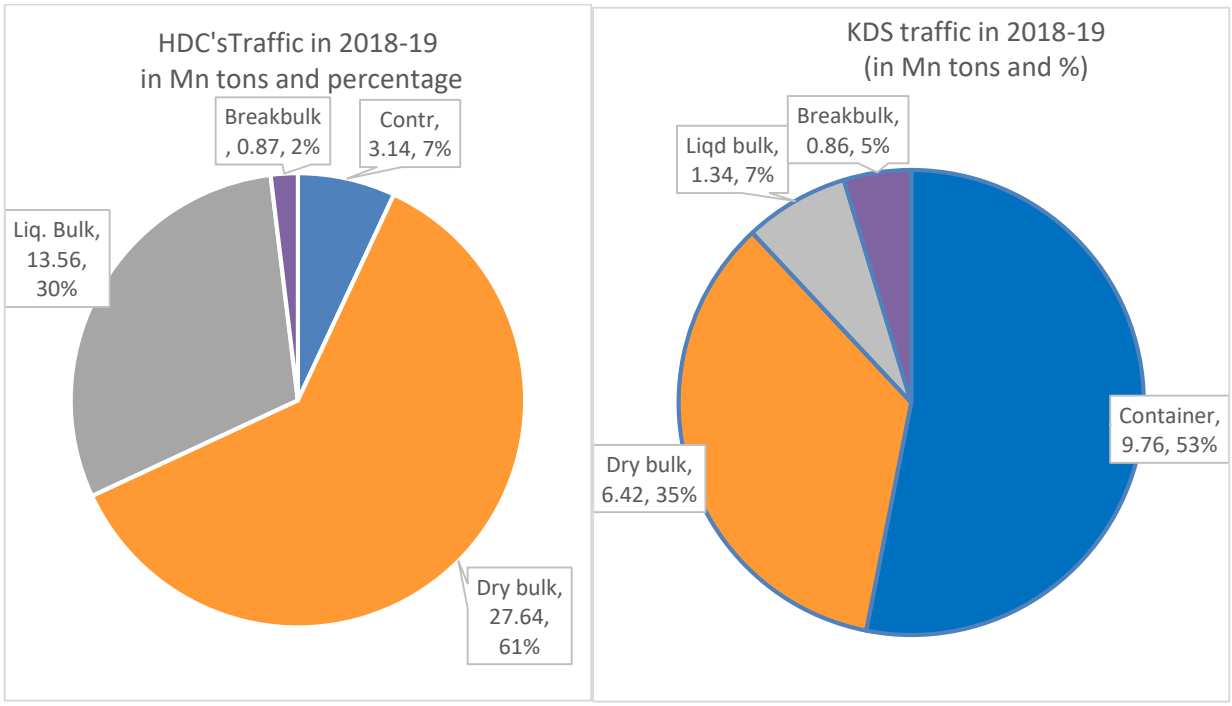
Observations on the Traffic

While the traffic at the whole of Kolkata Port grew at 6.61% CAGR in the above period, it was muted at KDS at a CAGR of 3.95%, and sharp at HDC at 7.83 % CAGR.

- HDC's traffic, both in volume and growth, has been consistently higher because it predominantly handles bulk cargoes, both dry and liquid (90%)
- KDS traffic on the other hand is largely driven by general cargo, container and breakbulk (60%), and so it tends to be subdued both in quantity and growth

Comparison of KDS's traffic with HDC's

The following pie chart shows category-wise split-up of KoPT's and HDC's traffic



Observations

- It can be seen from the chart while general cargo – container and breakbulk- constitutes only 9% of HDC's traffic, it contributes 58% to KDS's traffic
- Dry bulk and liquid bulk items constitute 91% of HDC's traffic while they form 42% of KDS's traffic
- This pattern will not change because
    - HDC has in its hinterlands a host of large and heavy industries like power, steel, oil, refinery, fertilizer and petrochemicals and it also is close to two mineral- and ore-rich states, Orissa and Chattisgarh, which will continue to pump up volume and growth at HDC.
    - KDS on the other hand has in its hinterland no major industries that would require bulk materials like coal, iron ore, etc in large quantities. KDS draws its traffic mostly from consumer items, finished or semi-finished products, or materials that are required by small and medium scale industries. These items largely come or go in container or breakbulk form and these cargoes give neither volume or velocity
    - Possibility of some traffic shifting to KDS from HDC

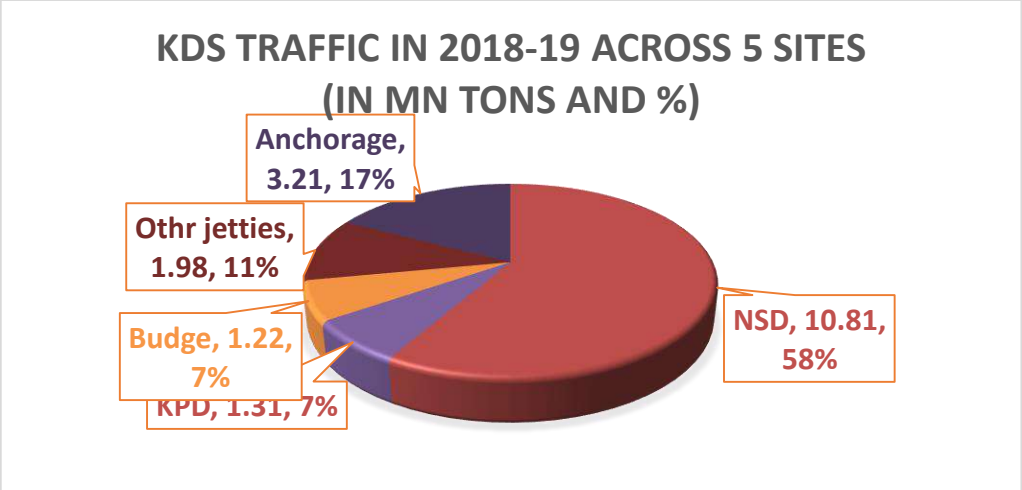
- Almost all the bulk materials handled at HDC are consumed or generated by the industries and mines located in the immediate hinterlands of HDC. Hence, there is little chance that these cargoes will move to KDS, especially given the road traffic issues in Kolkata city
- Most of the container and breakbulk cargoes handled at HDC also are consumed or generated by the industries or businesses located in its immediate and intermediate hinterlands and hence by and large these cargoes, too, may not shift to KDS.
- However, capacity constraint at HDC may drive some traffic to KDS. HDC's capacity is 45 million tons whereas it already has exceeded it in 2018-19. The traffic handled in that year was 45.21 million tons and it will continue to rise. Therefore, there is some possibility that some of the overflowing cargoes might end up in KDS. Especially cargoes whose destinations or origins are in the distant hinterlands of HDC or in the common hinterlands with KDS.
- For example, HDC handles a variety of cargoes for Nepal. Three main cargoes handled at HDC for Nepal are container, fertilizer and breakbulk items like iron and steel materials. These are handled by KDS as well. Therefore, a portion of these traffic (handled at HDC) could come to KDS, especially during periods when there is rake shortage or any other rail evacuation problem at HDC
- Limestone is another commodity that has some potential to move to KDS, for the same reason of rake shortage at HDC. In 2018-19, KDS handled 4 lakh tons of limestone, which was over 500% more than what it handled in 2017-18. It is understood that this spurt was mainly due to rail evacuation hiccups at HDC.
- Hence, if KDS improves its rail infrastructure, it may attract some part of HDC's traffic including Nepal's container, fertilizer and breakbulk traffic, and also minor bulk items like limestone, gypsum, etc imported for the industries located in the immediate or intermediate hinterlands of HDC. This also may reduce pressure on overstretched resources of HDC

4.4 OPERATIONAL AREAS OF KDS

KDS's traffic is handled at 5 sites:

- NSD comprising 10 berths out of which 5 berths, 2,3,5,7 and 8 dedicated for container. Out of the balance 5, four for dry cargoes and one for liquid bulk.
- KPD containing 18 berths handling all categories and kinds of cargoes and traffic including coastal cargo, and passenger
- Budge Budge including 7 jetties handling bulk liquids including POL, chemicals and vegetable oil
- A cluster of 7 outside jetties handling fly ash and sand
- 3 anchorages at Sandheads, Saugor Road and Diamond harbour transloading all categories and types of cargoes that come in bigger, deeper-drafted vessels

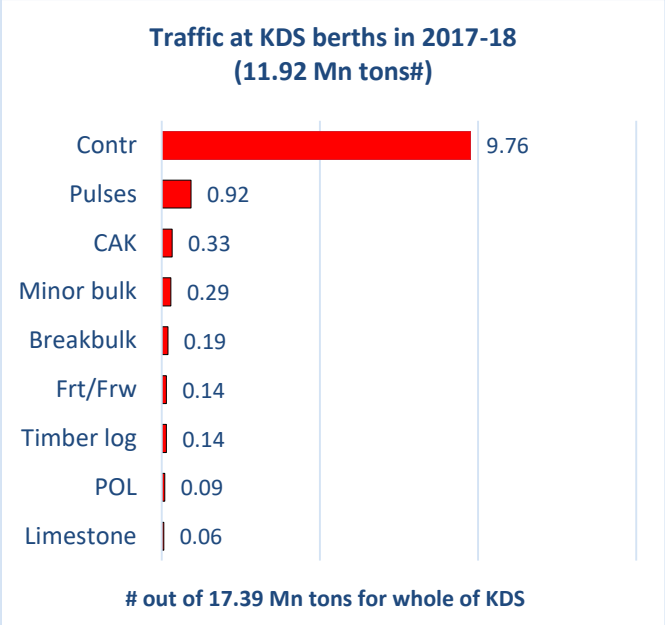
The traffic handled at KDS in 2018-19 across its 5 sites is shown below

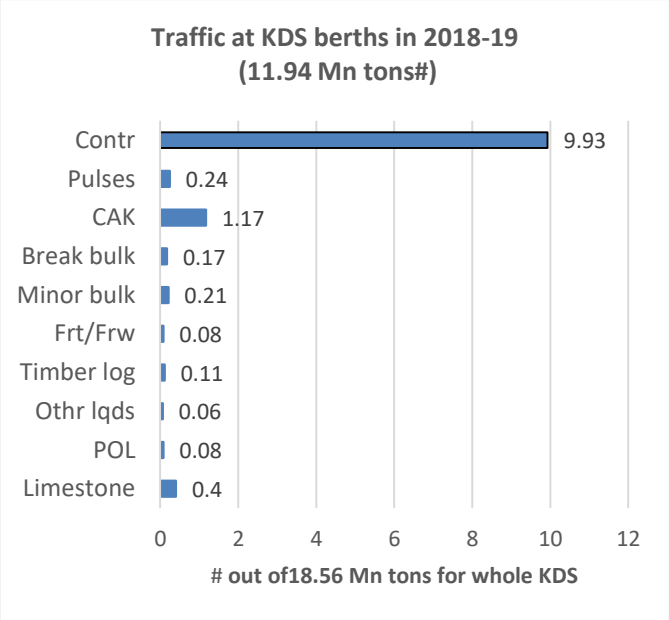


Observations on KDS's traffic in the context of KPD's rejuvenation

- 35% of KDS's traffic is handled outside NSD and KPD
- The 35% include cargoes handled at Budge Budge, anchorages, sea and outside jetties
- Cargoes handled at Budge Budge and Outside jetties' will not come to KPD
- Traffic handled at anchorages/sea subsequently come to NSD/KPD and hence that traffic cannot be counted again for KPD
- Hence, for KPD clusters 1 and 2 what will count is the traffic that is solely handled at NSD-KPD berths proper

4.5 TRAFFIC AT NSD-KPD BERTHS





The following juxtaposed charts and the accompanying table compare the traffic handled in 2017-18 with 2018-19 at NSD-KPD berths

Year	Overall	At berths	Contr	Pulses	CAK	B.Bulk	Minor bulk	Frt/Frw	Log	POL	Lime stone
2018-19	18.56	11.94	9.93	0.24	1.17	0.17	0.21	0.08	0.11	0.08	0.4
2017-18	17.39	11.92	9.76	0.92	0.33	0.19	0.29	0.14	0.14	0.09	0.06
% variation	6.73	0.17	1.74	(-) 74	255	(-) 11	(-) 28	(-) 43	(-) 21	(-) 11	567

The comparison of the two years' traffic reveals the following:

- Overall traffic has remained more or less the same
- Container traffic grew slightly at about 2%
- CAK and Limestone have shown appreciable increase @ 250% and 575% respectively
- Pulses plunged by 70% and timber by 20%
- All other cargoes including fertilizer, minor bulk and breakbulk have declined

4.6 IDENTIFICATION OF CARGO FOR KPD CLUSTERS 1 AND 2

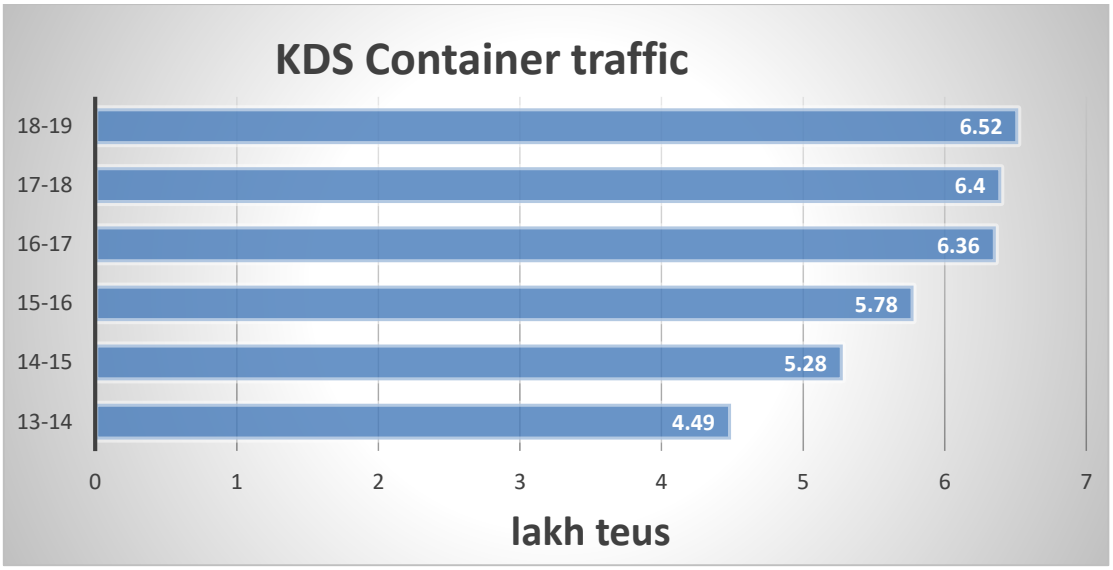
Based on the foregoing analysis and on the performance of key cargoes in the past, cargoes that have better prospects at the two clusters have been identified using the following yardsticks and filter.

Yardstick 1: consistent or increasing traffic

Container:

Container is the dominant and preeminent cargo at KDS, which grew at a blistering pace of 9% CAGR per year for 9 years up to 2015-16. However, it lost its momentum since then as the rate dropped to less than 1% CAGR in the 3-year period after that.

The following chart shows the progression of container traffic at KDS from 2015-16 to 2018-19



Though the growth has slackened of late container traffic's preeminent position in KDS will never diminish.

Coal All Kinds or CAK

CAK has shown a phenomenal increase at KDS berths in 2018-19. Though its volume has been low in the prior past, because of its steep increase in 2018-19 it is worth considering it for the two clusters

Limstone:

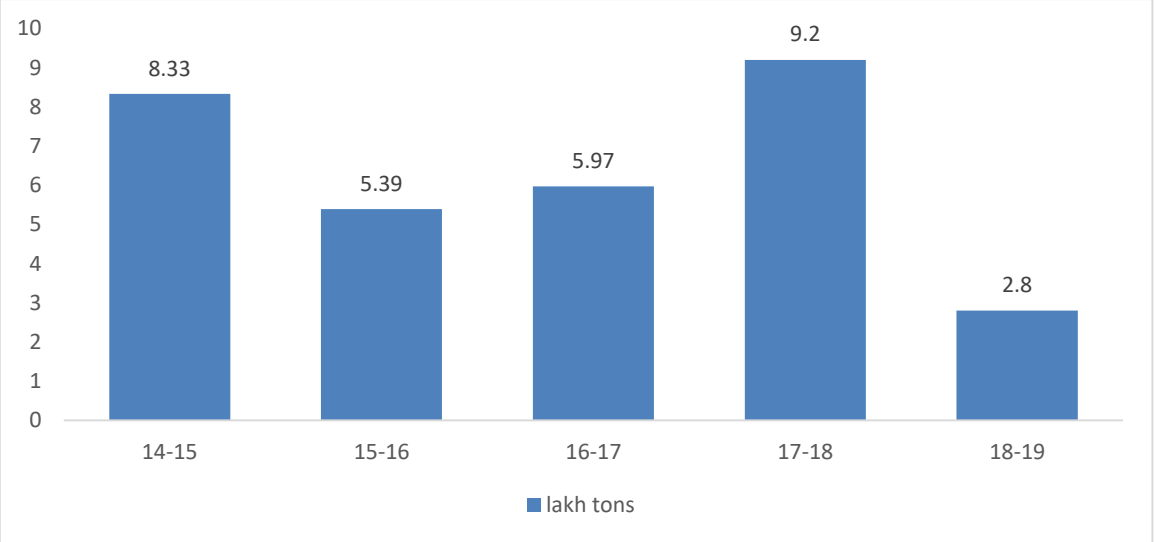
Limestone traffic at KDS in 2018-19 rose even higher than CAK . So, it also qualifies for consideration for the two clusters

Yardstick 2: cargoes in decline but with good track record

Pulses:

Next to container, pulses was the most voluminous cargo at KDS. Its traffic had been relentlessly ascending up to 2017-18, when it hit a record traffic of almost a million tons. But, it plunged to about 3 lakh tons in 2018-19 (see chart below) and the portents are it will further go down in 2018-19. The upside, however, is this may be a temporary setback and the traffic may bounce back sooner or later. Hence, considering its consistent past performanc and its likely revival in the not too distant future, it also can be regonized as a possible cargo for the twoclusters

Pulses/peas traffic at KDS



Fertlizer:

On avergae KDS handle per year about 1.5-2.0 lakh tons of fertilizer like urea and DAP, mainly for Nepal. However, this volume came down sharply in 2018-19, possibly because KPD was closed for about 4 months in the year, which coincided with the peak fertilizer import season. In the current fiscal, up to 2019-20, it already has handled 1.5 lakh tons and so may end up at 3 lakh tons by the end of the year. So, fertizer also can be accounted for KPD clusters

Fillers:

There are certain breakbulk cmmodities like steel, timber log, etc and minor bulk items like gypaum, sand and food grains whose volume widely fluctuates. Hence, they were not identified as primary cargoes for the 2 clusters. However, these cargoes may together add up to about 3 lakh tons a year on average. So, they can be considered as alternative or supplemntary cargoes for the clusters whenever the traffic of their key cargoes go down in any year.

Filter: Cargoes that will not be compatible

Though CAK was handled in sizeable quantity at KDS in 2018-19, it is advisable not to handle them at berths where container traffic is handled on a regular basis and in good volume. So, we should rule out CAK for KPD 1 clusters.

Final principal cargoes for KPD 1 clusters

After the above exercise the items that are finally identified as potential cargoes are:

1. Container ; 2. Pulses ; 3. Fertlizer ; 4. Limestone

4.7 PROSPECTS & ESTIMATED TRAFFIC FOR PRINCIPAL CARGOES FOR KDS AS A WHOLE

Methodology

- Evaluating the prospects for each identified cargo for the whole of KDS
- Estimating the rate of growth and the volume of traffic for the identified cargoes for the whole of KDS over the next 30 years
- Forecasting how much of each identified cargo KPD1 Clusters can expect over the next 30 years

(A) Containers

Opportunities

- KDS is the exim gareway to 7 northern states and eastern UP, Chattisgarh and Jharkand. They are the most populous and underdevrloped regions with a potential for 1 million teus per year
- Eastern Freight Corridor : Passes through 6 states ; Start/end point: Dankuni, just 30 kms from KDS
- ADKIC or Amritsar Delhi Kolkata Industrial Corridor : Spread across 20 cities in 20 states
- A shelf of projrcts planned in and around Kokata including Multimodal logistic park at Dankuni ; Kolkata biotech park at Rajarhat in Kolkata ; Chemical Innovation Hub in Kokata and its surroundings
- Nepal containers bottlenecked at Haldia because of rake shortage

Threats

- Competition from Dhamra and Paradip international container terminals
- Competition from Vishakapatnam for Nepal containers
- Maturing of demand in the hinterlands
- Likely development of deep sea port at Tajpur
- Possibility of container terminal coming at Kulpi

Estimated Container traffic for KDS

Taking into account the opportunities and the threats mentioned above, and the weak growth KDS has been witnessing in in the last 2 years, the rate of growth and the volume of container traffic KDS can expect over the next 30 years upto 2050 is projected below:

Base: 2018-19 traffic (in million teus)

Zero year 2020-21	1st decade 2021-31	2nd decade 2031-41	3rd decade 2041-2051
0.7 @ 4 % CAGR	0.94 @3% CAGR	1.03 @1% CAGR	1.09 @0.5

(B) Pulses

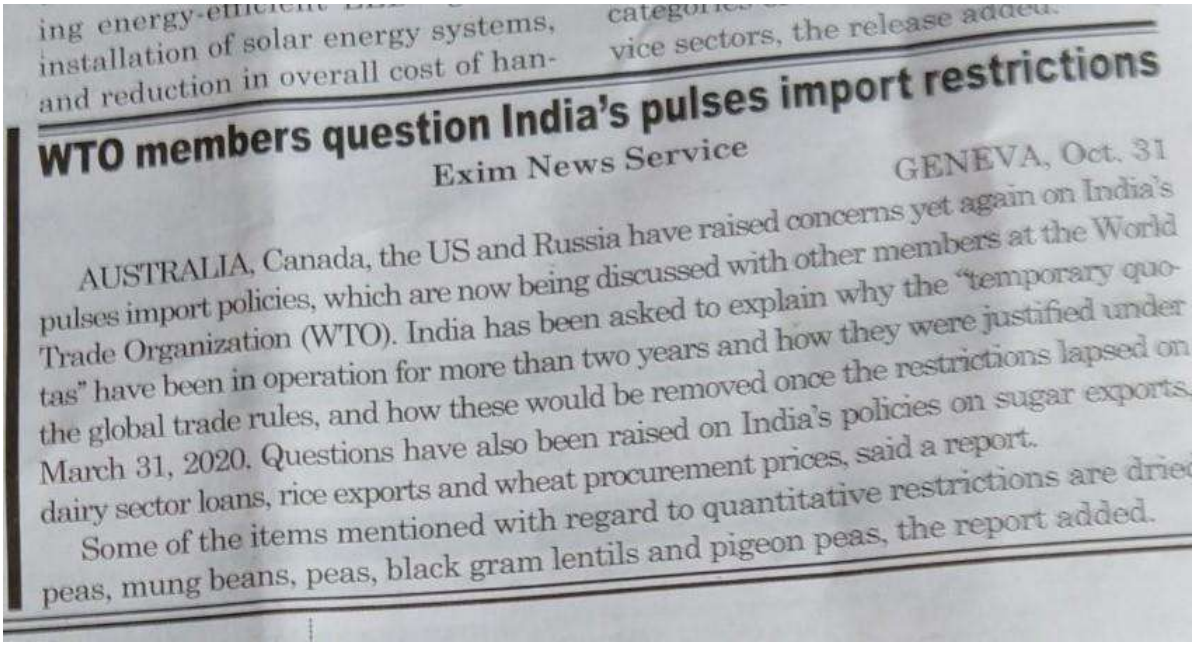
Prospects

- Pulses import is an unpredictable traffic because it depends on the waether, size of harvest in India and governmen's policy from time to time.
- Up till 2017-18 pulses/peas import had been robust and rising. However, it started declining from 2018-19 due to surfeit of pulses in domestic market as a result of normal to good monsoon in the previous 2 years
- The volume is expected to hit rock bottom this year, 2019-20. Glut in the local market has forced the government to restrict import this year to about 1 million tons, and the government also has raised the duty from zero to 50%
- Following table shows the pulses import into India over the years

Year	Quantity in Mn tons
2013-14	3.2
2014-15	4.6
2015-16	5.8
2016-17	6.6
2017-18	5.6
2018-19	2.4

- However, like any other agricultural poroduces/products like vegetable oil, etc, that are dependent on weather, production of pulses, too, fluctuates in the country from year to year. For example, the severe El nino in 2014 and its aftermath caused import of pulses to soar consecutively for the next 3 years and as the weather improved in the following years import started falling.
- Further, there is a pressure from pulses/peas-growing countries on the Indian government for restricting import and raising duty. Some of the countries like Canada are grwoing peas almost solely for India. So, they won't put up with the curb. For the ongoing

curtailment of import, countries have already complained to World Trade Organiztion, WTO, vide the newspaper item placed below.



ing energy-efficient ... installation of solar energy systems, and reduction in overall cost of han- ... vice sectors, the release added.

WTO members question India's pulses import restrictions

Exim News Service

GENEVA, Oct. 31

AUSTRALIA, Canada, the US and Russia have raised concerns yet again on India's pulses import policies, which are now being discussed with other members at the World Trade Organization (WTO). India has been asked to explain why the "temporary quotas" have been in operation for more than two years and how they were justified under the global trade rules, and how these would be removed once the restrictions lapsed on March 31, 2020. Questions have also been raised on India's policies on sugar exports, dairy sector loans, rice exports and wheat procurement prices, said a report.

Some of the items mentioned with regard to quantitative restrictions are drie peas, mung beans, peas, black gram lentils and pigeon peas, the report added.

- Further, the restrictions are operative only up to the end of this financial year
- It is therefore certain that pulses import will revive, though it may not reach the record level of 6.6 million tons it hit in 2016-17.
- A guestimate is it, after surging again, will stabilize at around 3 million tons per annum, on average

Estimated pulses traffic for KDS

- KDS handles per year about 10-15% of the total pulses imported into the country. So, we can reckon for it a pulses trafic of 3 lakh tons per annum for the next 30 years. This is only an average and it may go up and down this level depending on vagaries of weather and other factors
- Estimated pulses/peas traffic at KDS,

In million tons

Zero year 2020-21	1st decade 2021-31	2nd decade 2031-41	3rd decade 2041-51
0.3	0.3	0.3	0.3

(C) Fertilizer

Prospects

- Fertilzer handled at KDS is primarily for Nepal
- Nepal's current requirement for fertlizers is about 7 lakh tons per annum out of which 30% comes through official import, that is about 2.0 lakh tons per annum. Out of which both KDS and HDC on average handles 50 % or 1 lakh tons each.
- Nepal's demand for fertilizer is predicted to increase to about 1.5 million tons over the next 2 to 3 decades
- Because a large proportion of fertilizer goes into Nepal through unofficail sources, it is difficult to predict how much quantity will come through KDS in the future
- However, going by the past volume, we can presume a traffic of 1 to 3 lakh tons per annum over the next 30 years.
- Further, whenever, HDC faces rail evacuation problems for despatch of its Nepal fertilizer cargo by rail, we can expect some part of it to detour to KDS

Estimated Fertilizer traffic for KDS

- Taking into account all these facotrs, the fertilizer traffic projected for KDS is:

In million tons

Zero year 2020-21	1st decade 2021-31	2nd decade 2031-41	3rd decade 2041-51
0.1	0.15	0.2	0.3

(D) Limestone

Prospects

- Limestone is almost a monopoly cargo of Haldia Dock Complex because limsestone is a key ingredient in steel and cement industries which abound around Haldia
- Haldia handles on average 2 million tons of limestone per annum
- Compared to that, limestone handled at KDS is less than a lakh ton per annum
- However, the volume spurted to 4 lakh tons at KDS in 2018-19
- The reason for the surge, it is understood, was shoratge of rakes in HDC

- This raises a hope for increased limestone traffic at KDS
- In 2018-19 HDC handled 2.64 million tons of limestone, which is the highest so far. In the same year, KDS also handled a rcord 0.4 million tons. This means that when the volume goes up in HDC, some of the traffic will flow into KDS

Estimated Limestone traffic for KDS

- Limestone is an occasional and fringe traffic at KDS. It is a second hand traffic from Haldia, which may rise from time to time due to the reason mentioned above
- So, we cannot expect it to maintain the high level it reached in 2018-19 at KDS.
- Given this reality, the traffic projected for limestone at KDS is as below

In Million tons

Zero year 2020-21	1st decade 2021-31	2nd decade 2031-41	3rd decade 2041-51
0.1	0.2	0.25	0.3

4.8. Prospects and Estimated traffic for KDP 1 clusters

(A) Container

Prospects

Present optimum yard capacity at NSD

- Total number of TEU ground slots as indicated by Traffic Department: 4600
- Average stacking height: 2.5
- Weighted average dwell time: 6 days (turnover: 61)
- Optimum capacity: 46000×2.5×61 = 701500 TEUs, say **7.0 lakh TEUs**
- The tradffic is set to go beyond 9 lakh teus from the frist decade
- So, some of the excess traffic can move to the rejuvenated KPD1
- On that basis, the container traffic estimated for KPD1 is shown below

Estimated Container traffic for KPD1 clusters

Stage	Overflow from NSD (in lakh teus)	Cluster 1 (in lakh teus)	Cluster 2 (in lakh teus)
1st decade 2021-31	2.4	1.2	1.2
2nd decade 2031-41	3.3	1.65	1.65
3rd decade 2041-51	3.9	1.95	1.95

(B) Pulses

Prospects for KPD 1 clusters

- The quantity of pulses/peas estimated for whole of KPD is 0.3 million tons for all the 3 stages
- The entire quantity can come to KPD cluster 1. That means no pulses for Cluster 2
- Alternative/supplemanatry cargoes for Cluster 1: in case there is a shortfall in pulses/peas, cluster 1 may handle timber log and other breakbulk cargoes like iron and steel materials

Estimated Puses/peas traffic for KPD1 clusters

Stage	Cluster 1 (in lakh tons)	Cluster 2 (in lakh tons)
1st decade 2021-31	3	Nil
2nd decade 2031-41	3	Nil
3rd decade 2041-51	3	Nil

(C) Fertlizer/Limestone

Prospects

- Only Cluster 2 will handle ferlizer and limestone as entire pulses traffic has been allocated to Cluster 1
- KDS handles fertilizer primarily for Nepal. In addition, it may get to handle seconhand traffic from HDC when it faces problem for despatch of the cargo by rail to Nepal
- As for as limstone is concerned, as alredy mentioned, limstone volume goes up in KDS only when HDC struggles to despatch its cargo by rail as a result of ahoratge of rakes. Almost the entire quantity of limestone HDC handles goes by rail and this puts a tremendous pressure on its rail infratructure, creating an opportunity for KDS. For example, in 2018-19, HDC handled a record 2.64 million tons of limstone. In addition to that KDS handled 4 lakh tons, which is a record for it.
- So, prospects for limestone and fertilizer at KPD looks almost equipoised. If fertilizer traffic comes down, limestone can pick up the slack or vice versa
- Alternative cargoes for Cluster 2: if the limestone/fertilizer traffic falls below the expected level in any year, the other cargoes Cluster 2 can handle are minor bulk items like gypsum, dolomite, manganese ore, etc.

Estimated Fertilizer/Limestone traffic for KPD1 Clusters

Stage	Cluster 1 (in lakh tons)	Cluster 2 (in lakh tons)
1st decade 2021- 31	nil	3.5
2nd decade 2031-41	nil	3.5
3rd decade 2041-51	nil	3.5

4.9 SUMMARY OF ESTIMATED TRAFFIC FOR KPD 1 CLUSTERS

Stage	Cargo	Cluster 1 (in Mn tons)	Cluster2 (in Mn tons)
1st Decade 2021-31	Container	1.8 (1.2 L TEUs)	1.8 (1.2 L TEUs)
	Pulses	0.30	0.00
	Fert/Limestone	0.00	0.35
	Total	**2.1**	**2.15**
2nd Decade 2031-41	Container	2.48 (1.65 L TEUs)	2.48(1.65L TEUs)
	Pulses	0.30	0.00
	Fert/Limestone	0.00	0.35
	Total	**2.78**	**2.48**
3rd Decade 2041-51	Container	2.93 (1.95 L TEUs)	2.93 (1.95L TEUs)
	Pulses	0.30	0.00
	Fert/Limestone	0.00	0.35
	Total	**3.23**	**3.28**

SECTION 5
PERFORMANCE OF NSD & KPD

5.1 TRAFFIC IN IDENTIFIED CARGO

Having identified the probable cargo that could be handled at KPD I clusters, i.e. Containers, Pulses/Peas, Fertilisers and Limestone, an attempt has been made to examine the traffic pattern of these cargo at both NSD and KPD during the past two years. These are provided in the following tables.

These tables give the volumes in each cargo handled by each berth in NSD, KPD I and KPD 2. It can be seen that almost all the container traffic is handled at NSD berths only. As regards the other cargo viz. pulses/peas, fertilisers and limestone are mostly handled in KPD I and KPD II.

Having observed these data, the next step is to dive deep into the actual handling process – the ship size, average parcel size, service time etc.; ship-shore transfer; movement from berth to stackyard or storage shed; handling at the yard or shed and finally the evacuation.

In these docks, containers are handled directly from container vessels. The other cargo such as pulses/peas, fertilisers and limestone are transloaded at anchorages from ships to barges and these barges only call at the dock berths. Some exceptionally small vessels only directly call at the berths.

As regards the barge traffic at Kidderpore docks, data for the past two years ie. 2018 – 19 and 2019 – 20 were collected and are being analysed in detail.

2018 - 19				
DOCK	BERTH	Pulses /Peas	Container	
		(Imp)	(Imp)	(Exp)
NETAJI SUBHAS DOCK	1	3,972	1,622	8,646
	2	0	539	1,135
	3	0	6,67,454	5,32,237
	4	0	12,92,400	11,61,066
	5	0	12,11,473	11,40,207
	7	0	7,13,793	5,97,723
	8	0	12,43,759	12,86,957
	12	0	0	
	13	0	0	14,551
	14	0	0	13,748
Sub Total for NSD		3,972	51,31,040	47,56,270

2018 - 19					
DOCK	BERTH	Pulses /Peas	Fertiliser	Limestone	Container
		(Imp)	(Imp)	(Imp)	(Exp)
KIDDERPORE DOCK I	1	9,247	0	0	0
	2	8,267	0	18,990	0
	3	0	0	0	0
	4	6,394	0	6,000	0
	5/7	42,017	0	13,148	1,339
	6	12,239	0	0	200
	8	7,852	0	0	33,967
	9	24,615	0	0	0
	10	5,837	0	0	716
	11	0	0	0	2,551
	12	13,327	0	12,460	0
Sub Total		1,29,795	0	50,598	38,773
KIDDERPORE DOCK II	19	0	0	0	0
	22	8,279	0	0	0
	23	0	2,951	0	0
	24	0	0	2,400	0
	25	0	0	0	0
	26	4,655	0	4,591	0
	27	4,529	66,242	43,580	0
	28	84,356	0	1,35,139	0
	29	2,499	2,971	58,600	0
Sub Total		1,04,318	72,164	2,44,310	0
Total for KPD I & II		2,34,113	72,164	2,94,908	38,773
The highest traffic handled by a single berth was KPD II No.28 : 2.5 lakh tonnes					

2017 - 18						
DOCK	BERTH	Pulses /Peas	Fertiliser	Limestone	Container	
		(Imp)	(Imp)	(Imp)	(Imp)	(Exp)
NETAJI SUBASH DOCK	1	11,067	0	0	6	0
	2	26,383	0	0	176	0
	3	1,940	0	0	7,46,948	5,09,671
	4	0	0	0	13,29,878	10,69,287
	5	0	0	0	20,55,211	16,83,312
	6	0	0	0	0	0
	7	0	0	0	0	0
	8	0	0	0	11,16,816	11,46,567
	12	0	0	0	0	0
	13	0	0	16,500	106	10,568
	14	20,578	0	0	2,940	26,442
Sub Total for NSD		**59,968**	**0**	**16,500**	**52,52,081**	**44,45,847**

2017 - 18						
DOCK	BERTH	Pulses /Peas	Fertiliser	Limestone	Container	
		(Imp)	(Imp)	(Imp)	(Imp)	(Exp)
KIDDERPORE DOCK I	1	31,289	0	0	0	0
	2	35,324	0	0	0	0
	3	1,889	0	0	0	0
	4	26,884	0	0	0	0
	5/7	1,02,995	0	0	0	0
	6	42,164	0	0	83	0
	8	15,351	0	0	9,591	48,173
	9	41,372	0	0	170	1,027
	10	38,286	0	0	293	0
	11	0	0	0	443	2,151
	12	43,074	0	0	0	0
Sub Total		**3,78,628**	**0**	**0**	**10,580**	**51,351**
KIDDERPOPRE DOCK II	13	0	0	0	0	0
	14	0	0	0	0	0
	19	0	0	0	0	0
	22	36,111	4,719	0	0	0
	23	32,149	412	0	0	0
	24	63,609	2,288	0	0	0
	0	55,258	0	0	0	0
	26	73,218	2,365	0	0	0
	27	55,673	33,821	26,750	0	0
	28	1,49,894	60,182	9,350	0	0
	29	15,504	36,977	8,550	0	0
Sub Total		**4,81,416**	**1,40,764**	**44,650**	**0**	**0**
TOTAL FOR KPD I & II		**8,60,044**	**1,40,764**	**44,650**	**10,580**	**51,351**
The highest traffic handled by a single berth was KPD II No.28 : 2.4 lakh tonnes						

5.2 CONTAINER HANDLING AT NSD

The port run container terminal was first commissioned at Berth No. 7at NSD on 18th February, 1992. Since then about 90% container traffic is handled at the berths Nos. 7, 8, 4 and 5 NSD and remaining 10% at other berths of NSD and KPD. All the reputed container operators are operating at Kolkata Port.

The stacking area is 1,10, 000 sq. m with 6,000 sq.m. behind berths 7 & 8 and 5,000 sq.m. behind berths 4 & 5. There is also a CFS measuring 9,000 sq.m.away from berths nos. 7 & 8. There about 3,000 TEU ground slots with 3 x 48 reefer points.

The layout of these berths along with the back-up area are shown in the following figures.

Later KoPT decided to outsource the container handling operations and for this purpose invited global tenders for "Supply, Operation and Maintenance of equipment for container handling operations". Through this process the port selected Bharat Kolkata Container Terminals Private Limited (BKCT), a special purpose vehicle (SPV) held by PSA International Pte Limited of Singapore (PSA) through its subsidiaries. The SPV was incorporated on April 1, 2014. The contract was awarded on 17th February, 2014 with a contract period of 10 years. The contract provided for integrated ship-to-shore services including back-up operations at berths 3, 4, 5, 7 & 8 NSD. The project was commissioned on 23.12.2014.

Under the contract, BKCT had to deploy 4 nos. Mobile Harbour Cranes, 4 nos. Rubber Tyred Gantry Cranes, 9 nos. Reach Stackers and 30 nos. Tractor-trailers. It has been clarified that at any point of time 3 MHCs should be made available and there will be no penalty for non-availability of the 4th MHC. Berths Nos, 4, 5 & 8 will be MHC operated berths and berths Nos. 3 & 7 will be non-MHC operated berths.

The scope of work includes supply, operation and maintenance of these equipment at their cost with manpower and management. The onboard operations will be carried out by KoPT acting as stevedores. BKCT has to unload/load containers from/to the ships; transport between quay and yards and vice versa using tractor trailers; stacking/un stacking at the yards using RTGs or Reach Stackers; loading/unloading to/from trucks/rail wagons at the yards using RTGs or RSTs and handling of break-bulk cargo of damaged containers separately or together.

The minimum productivity has been fixed as 20 moves per hour per MHC and for non-MHC operations, 8 moves per hook per hour.

As agreed, BKCT provided 3 MHCs at berths 4, 5 & 8. Recently during September, 2019, they have provided the fourth MHC at berth no. 3.

The performance of BKCT over these five berths during the past 5 years are brought out in the following tables. The details covered bring out the difference in the performance of the berths with MHC and without MHC.

DETAILS OF CONTAINER HANDLING AT NETAJI SUBHAS DOCK

Sl.No	Details	Berth NSD 3 without MHC				
		2018-19	2017-18	2016-17	2015-16	2014-15
1	Number of container vessels	102	113	108	116	103
2	Total number of containers handled in TEUs	79,996	88,345	75,030	67,317	62,846
3	Av. Number of import containers per ship in TEUs	412	404	358	294	300
4	Av. Number of export containers per ship in TEUs	372	378	337	286	310
5	Av. Number of containers handled per ship in TEUs	784	782	695	580	610
6	Av. Working time per ship in days	2.17	2.12	1.88	1.48	1.43
7	Productivity per day in TEUs	361	369	370	392	427

DETAILS OF CONTAINER HANDLING AT NETAJI SUBHAS DOCK

Sl.No	Details	Berth NSD7 without MHC				
		2018-19	2017-18	2016-17	2015-16	2014-15
1	Number of container vessels	104	108	106	114	84
2	Total number of containers handled in TEUs	82,851	93,317	72,759	70,155	54,668
3	Av. Number of import containers per ship in TEUs	404	437	383	307	327
4	Av. Number of export containers per ship in TEUs	390	418	303	308	324
5	Av. Number of containers handled per ship in TEUs	794	855	686	615	651
6	Av. Working time per ship in days	2.11	2.23	1.71	1.42	1.58
7	Productivity per day in TEUs	376	383	401	433	412

DETAILS OF CONTAINER HANDLING AT NETAJI SUBHAS DOCK

Sl.No	Details	Berth NSD 4 with MHC				
		2018-19	2017-18	2016-17	2015-16	2014-15
1	Number of container vessels	195	186	190	195	175
2	Total number of containers handled in TEUs	1,60,725	1,58,608	1,54,255	1,54,300	1,48,958
3	Av. Number of import containers per ship in TEUs	416	452	424	409	454
4	Av. Number of export containers per ship in TEUs	408	401	388	382	397
5	Av. Number of containers handled per ship in TEUs	824	853	812	791	851
6	Av. Working time per ship in days	1.50	1.53	1.40	1.20	1.28
7	Productivity per day in TEUs	549	558	580	659	665

DETAILS OF CONTAINER HANDLING AT NETAJI SUBHAS DOCK

Sl.No	Details	Berth NSD 5 with MHC				
		2018-19	2017-18	2016-17	2015-16	2014-15
1	Number of container vessels	190	182	184	185	114
2	Total number of containers handled in TEUs	1,53,963	1,51,185	1,57,013	1,39,082	85,909
3	Av. Number of import containers per ship in TEUs	407	432	446	390	385
4	Av. Number of export containers per ship in TEUs	403	399	407	362	368
5	Av. Number of containers handled per ship in TEUs	810	831	853	752	753
6	Av. Working time per ship in days	1.46	1.53	1.48	1.18	1.29
7	Productivity per day in TEUs	555	543	576	637	584

DETAILS OF CONTAINER HANDLING AT NETAJI SUBHAS DOCK

Sl.No	Details	Berth NSD 8 with MHC				
		2018-19	2017-18	2016-17	2015-16	2014-15
1	Number of container vessels	182	169	188	183	154
2	Total number of containers handled in TEUs	1,53,427	1,36,067	1,60,091	1,40,132	1,31,165
3	Av. Number of import containers per ship in TEUs	423	407	426	399	442
4	Av. Number of export containers per ship in TEUs	420	398	430	367	410
5	Av. Number of containers handled per ship in TEUs	843	805	856	766	852
6	Av. Working time per ship in days	1.38	1.40	1.44	1.17	1.42
7	Productivity per day in TEUs	611	575	594	655	600

In addition, an analysis of the details of the container vessels calling at NSD and KPD for the past five years were analysed for their LOA and Beam. These are presented in the following table.

DETAILS OF CONTAINER SHIPS CALLING AT NSD AND KPD

Sl.No	Particulars	2018-19	2017-18	2016-17	2015-16	2014-15
1	Number of container vessels called	662	687	777	791	673
2	Number of vessels with LOA less than 157 m	532	538	650	696	617
3	Number of vessels with LOA ≤ 157 m & Beam ≤ 21.5 m	322	309	390	445	396
4	Average of beam of such vessels as in no. 3	20.86 m	20.29 m	20.86 m	20.86 m	20.89 m

DETAILS OF CONTAINER DWELL TIME AT NETAJI SUBHAS DOCK

(Wighted average of dwell time in days)

Sl.No	Details	2018-19	2019-20 (6 months)
1	All empty containers by **Road**	3.0	3.2
2	All loaded containers by **Road**	5.2	4.9
3	All empty containers by **Rail**	7.5	6.9
4	All loaded containers by **Rail**	10.5	8.6
5	With 92 % moving by road and 8% moving by rail, weighted average dwell time for loaded containers for all	5.9	5.5

A scrutiny of these data indicates that

- every year, on an average, 370 container vessels calling at the KDS are capable of entering KPD.
- On an average the container exchange per vessel could be around 700 TEU for geared vessels (based on vessels calling at NSD berths without MHC) or 800 TEU for gearless vessels (based on vessels calling at NSD berths with MHC).
- Average productivity per day is 400 TEU for geared vessels and 600 TEU for vessels operated through MHC.
- The average dwell time of containers could be taken as 6 days.

5.3 CARGO HANDLING AT KPD

In recent times, Kidderpore Docks I & II have been handling only barges. Only from early 2019 container vessels have started calling at KPD I.

The data on cargo handled through barges were collected for the past two years, viz. 2018-19 and 2019-20. These were analysed and the details are presented hereunder.

BARGE TRAFFIC IN KIDDERPORE DOCKS

Sl.No.	Name of Cargo	2018 - 19			2019 - 20		
		Number of barge calls	Total volume handled	Av. Parcel size	Number of barge calls	Total volume handled	Av. Parcel size
1	Cement, clinkers	6	13,632	2,272	21	51,249	2,440
2	DAP	9	20,105	2,234	43	85,110	1,979
3	General dry bulk (unspecified)	1	983	983	0	0	0
4	Gypsum	12	28,000	2,333	4	7,500	1,875
5	Iron & Steel	6	5,581	930	24	38,145	1,589
6	Limesone	116	2,96,716	2,558	60	1,50,111	2,502
7	Logs, timber, veneer	69	81,242	1,177	29	36,571	1,261
8	Machinery	0	0	0	1	490	490
9	Maize	0	0	0	26	47,766	1,837
10	Manganese Ore	0	0	0	3	8,501	2,834
11	Metallurgical coke	64	1,06,711	1,667	50	88,547	1,771
12	Other coal	5	7,956	1,591	0	0	0
13	Petroleum coke	0	0	0	12	25,890	2,158
14	Project cargo, materials	0	0	0	3	1,724	575
15	Pulses	6	14,331	2,389	35	77,809	2,223
16	Peas	126	2,33,754	1,855	0	0	0
17	Pyroxinite	0	0	0	4	10,550	2,638
18	Rapseed	2	2,720	1,360	0	0	0
19	Rice	2	2,570	1,285	0	0	0
20	Steam coal	119	2,85,451	2,399	166	4,30,942	2,596
21	Thermal coal	0	0	0	5	11,000	2,200
22	Urea	27	52,059	1,928	151	2,88,397	1,910
		570	**11,51,811**	**2,021**	**637**	**13,60,302**	**2,135**

5.4 DETAILED ANALYSIS OF BARGE HANDLING OF PULSES & FERTILISERS

Having got an idea of barges bringing in different cargoes to KPD berths, it is now proposed to get into the details of barges bringing in the proposed cargo viz. Pulses/Peas and fertilisers. These are presented hereunder.

It is understood that, presently, the pulses are handled in three different ways:

- The bulk pulses are bagged in the barge itself and the bags are discharged on the berth and moved to the sheds for storing.
- The bulk pulses are unloaded in bulk onto hopper on the berth and are bagged at the hopper and moved to the sheds for storing.
- One agency has set up a factory at berth no. 22 in KPD II and the bulk pulses are sucked from the barge and pumped directly to the factory.

In the earlier two cases, pulses are stored in the shed in bagged form only.

Fertilisers handled at KPD are mainly DAP and Urea. While DAP is normally shipped in bagged form, urea is received in bulk and bagged at the berth.

These are moved from the berth to the sheds and stored in bagged form.

PULSES TRAFFIC DURING 2019-20

Sl.No.	Name of Barge	Dimensions in metres				Number of trips	Total no. of days at berth	Total volume handled	Av. Parcel size
		DWT	LOA	Beam	Draught				
1	AKSHATA	2,420	69.80	13.40	4.35	2	7	3,269	1,635
2	ASHRAF I	2,700	75.00	14.00	3.50	1	3	1,034	1,034
3	AVI	2,876	80.00	14.00	2.50	3	17	8,326	2,775
4	ITTPL I	2,700	75.00	14.00	3.60	5	23	12,585	2,517
5	MAHADEV	2,491	75.00	14.00	4.75	2	11	4,147	2,074
6	MONI					2	9	1,181	591
7	NITYA	2,147	72.00	14.00	4.25	1	3	2,146	2,146
8	PRABAL	2,500	73.40	13.40	3.60	3	12	6,444	2,148
9	SEAHORSE VIII	2,850	76.00	15.00	4.60	1	3	2,347	2,347
10	SHAMBHAVI	2,500	78.00	13.00	5.80	1	6	2,231	2,231
11	SOHOM II	2,849	82.00	13.50	3.40	2	11	4,192	2,096
12	SOHOM III	2,700	72.50	14.50	3.46	1	3	2,050	2,050
13	SUPREME	2,165	69.80	13.40	4.35	1	7	1,751	1,751
14	TIPISHIP I	3,101	74.75	14.00	4.90	1	8	2,263	2,263
15	TIPISHIP II	3,892	70.06	14.00	5.35	3	15	9,209	3,070
16	TIPISHIP III	3,208	71.00	16.00	5.35	3	20	9,204	3,068
17	TIPISHIP IV	3,897	71.00	16.00	4.60	1	1	405	405
18	WATERWAYS I	3,182	74.75	14.00	4.90	2	4	5,024	2,512
						35	**163**	**77,808**	**2,223**

PULSES & PEAS TRAFFIC DURING 2018-19

Sl.No.	Name of Barge	Dimensions in metres				Number of trips	Total no. of days at berth	Total volume handled	Av. Parcel size
		DWT	LOA	Beam	Draught				
1	AHSHATA	2,420	69.80	13.40	4.35	6	23	10,674	1,779
2	ASHRAF I	2,700	75.00	14.00	3.50	6	23	15,428	2,571
3	ASHRAF II	2,700	75.00	14.00	3.50	2	7	5,499	2,750
4	AVI	2,876	80.00	14.00	2.50	3	10	6,912	2,304
5	BHABYA	2,142	72.00	14.00	4.25	3	12	7,404	2,468
6	BARGE NO 8	2,177	69.80	13.40	4.35	6	19	13,723	2,287
7	BDS SP III	2,200	70.00	14.00	4.50	1	3	2,198	2,198
8	DEVSENA	2,150	72.00	14.00	4.25	2	10	2,828	1,414
9	DRISHTI	2,110	71.00	14.20	4.35	3	11	7,191	2,397
10	GOOD EARTH I	2,000	67.40	12.50	4.25	3	11	5,781	1,927
11	ITTPL I	2,700	75.00	14.00	3.60	6	23	15,178	2,530
12	JAY MAHAGAJANT LAXMI	2,208	69.80	13.40	4.35	3	11	6,398	2,133
13	JOY BASUDEB	1,470	60.00	12.50	3.18	2	5	1,600	800
14	JUBILEE VI	2,300	70.00	14.00	3.20	1	3	2,070	2,070
15	MOHAN BHAGAN IV	2,100	69.12	12.00	3.40	2	5	3,045	1,523
16	MOHAN BHAGAN VII	5,100	81.18	17.40	4.50	1	12	4,985	4,985
17	MOHAN BHAGAN IX	2,200	70.00	14.00	3.30	1	7	2,100	2,100
18	MAHESHWAR	2,185	72.00	14.00	4.25	2	7	4,810	2,405
19	MAHESHWARI	2,186	72.00	14.00	4.25	2	11	4,841	2,421
20	MEDHA	2,157	72.00	14.00	4.25	4	17	9,389	2,347
21	MONI					2	4	1,112	556
22	NIDHISHWARI	2,198	72.00	14.00	4.25	1	7	2,111	2,111
23	PASHYANTI	2,170	72.00	14.00	4.25	2	9	4,637	2,319
24	PACIFIC	1,539	68.90	10.60	1.70	1	1	700	700
25	PRABAL	2,500	73.40	13.40	3.60	2	9	4,412	2,206
26	PRADYUN	2,400	69.75	13.40	4.65	1	4	2,157	2,157
27	PRAKRITI					3	6	2,219	740
28	PRUTHVI	2,700	75.00	14.00	4.75	2	18	5,595	2,798
29	ROYAL SHARYU	2,538	74.90	14.30	4.20	2	6	5,173	2,587
30	ROHI					3	18	6,489	2,163
31	S-867					1	1	127	127
32	S-907					1	1	48	48
33	SAI SAURABH	1,980	66.50	12.80	4.20	3	7	4,593	1,531
34	SAISHREY	2,200	69.80	13.40	4.35	4	15	8,595	2,149
35	SANGHI III	2,090	68.50	13.00	4.20	4	13	6,567	1,642
36	SANGHI IV	2,213	69.70	13.40	4.35	1	3	1,656	1,656
37	SEAHORSE VIII	2,850	76.00	15.00	4.60	1	2	2,410	2,410
38	SHAMBHAVI	2,500	78.00	13.00	5.80	3	16	7,205	2,402
39	SOHOM I	2,849	82.00	13.50	4.50	2	6	5,729	2,865
40	SOHOM II	2,849	82.00	13.50	3.40	1	1	750	750
41	SRIJOY I	2,516	72.50	14.50	4.50	3	13	8,018	2,673
42	TIPISHIP I	3,101	74.75	14.00	4.90	1	3	2,975	2,975
43	TIPISHIP II	3,892	70.60	14.00	5.35	1	3	2,960	2,960
44	TIPISHIP III	3,847	71.00	16.00	5.35	2	6	6,643	3,322
45	VARUNI	2,148	72.00	14.00	4.25	1	4	2,129	2,129
46	VISHAMBAR	2,191	72.00	14.00	4.25	1	7	2,300	2,300
47	WATERWAYS I	3,182	74.75	14.00	4.90	2	6	5,800	2,900
48	WELZEA I	2,700	75.00	14.00	4.75	1	4	2,806	2,806
49	WB I - 5109					1	1	115	115
						112	**424**	**2,38,085**	**2,126**

UREA TRAFFIC DURING 2019-20

Sl.No.	Name of Barge	Dimensions in metres				Number of trips	Total no. of days at berth	Total volume handled	Av. Parcel size
		DWT	LOA	Beam	Draught				
1	AARTI	2,081	68.50	13.00	4.20	9	43	16,019	1,780
2	AKSHATA	2,420	69.80	13.40	4.35	4	13	5,444	1,361
3	ASHRAF I	2,700	75.00	14.00	3.50	7	37	18,072	2,582
4	ASHRAF II	2,700	75.00	14.00	3.30	8	35	20,534	2,567
5	AVI	2,876	80.00	14.00	2.50	6	23	13,364	2,227
6	BDS SP III	2,200	70.00	14.00	4.50	2	8	3,759	1,880
7	BULKER I	1,911	67.10	12.00	3.30	5	16	7,749	1,550
8	GANESHWAR	2,189	72.00	14.00	4.25	2	11	4,101	2,051
9	GARUDAWAHANA	2,162	72.00	14.00	4.25	2	13	3,460	1,730
10	GOOD EARTH I	2,000	67.40	12.50	4.25	4	13	5,640	1,410
11	ITTPL I	2,700	75.00	14.00	3.60	10	42	21,999	2,200
12	MAHADEV	2,491	75.00	14.00	4.75	10	49	21,175	2,118
13	MAHESHWAR	2,185	72.00	14.00	4.25	1	6	1,860	1,860
14	MEDHA	2,157	72.00	14.00	4.25	10	42	19,415	1,942
15	MESSISSIPPI I	2,600	69.70	13.40	4.25	1	9	2,009	2,009
16	MONI					7	17	2,582	369
17	NIDHISHWARI	2,198	72.00	14.00	4.25	1	3	1,284	1,284
18	NITYA	2,147	72.00	14.00	4.25	10	46	20,290	2,029
19	PASHYANTI	2,170	72.00	14.00	4.25	1	5	1,658	1,658
20	PRABAL	2,500	73.40	13.40	3.60	8	38	16,501	2,063
21	SAI SAURABH	1,402	66.50	12.80	4.20	2	5	2,636	1,318
22	SAISHREY	2,200	69.80	13.40	4.35	3	14	4,927	1,642
23	SANGHI III	2,090	68.50	13.00	4.20	2	6	2,027	1,014
24	SEAHORSE IV	2,950	70.00	14.00	3.20	5	19	8,357	1,671
25	SEAHORSE VIII	2,850	76.00	15.00	4.60	1	6	1,997	1,997
26	SOHOM II	2,849	82.00	13.50	3.40	2	12	4,617	2,309
27	SOHOM III	2,700	72.50	14.50	3.46	1	5	1,762	1,762
28	SUPREME	2,165	69.80	13.40	4.35	15	56	28,396	1,893
29	TIPISHIP I	3,101	74.75	14.00	4.90	1	4	2,357	2,357
30	VARUNI	2,148	72.00	14.00	4.25	1	5	2,089	2,089
31	VISHAMBAR	2,191	72.00	14.00	4.25	1	5	2,132	2,132
32	WELEZA I	2,700	75.00	14.00	4.75	10	38	22,263	2,226
						152	**644**	**2,90,475**	**1,846**

UREA TRAFFIC DURING 2018-19

Sl.No.	Name of Barge	Dimensions in metres				Number of trips	Total no. of days at berth	Total volume handled	Av. Parcel size
		DWT	LOA	Beam	Draught				
1	AADYA	2,600	75.00	14.00	3.38	1	5	2,048	2,048
2	AKSHATA	2,420	69.80	13.40	4.35	1	5	847	847
3	ASHRAF I	2,700	75.00	14.00	3.50	3	39	7,296	2,432
4	ASHRAF II	2,700	75.00	14.00	3.30	1	12	2,697	2,697
5	AVI	2,876	80.00	14.00	2.50	1	12	2,459	2,459
6	BHABYA	2,142	72.00	14.00	4.25	1	4	1,872	1,872
7	BDS SP III	2,200	70.00	14.00	4.50	1	5	2,130	2,130
8	DEVSENA	2,150	72.00	14.00	4.25	1	5	1,836	1,836
9	JOY BASUDEB	1,470	60.00	12.50	3.18	2	7	2,629	1,315
10	GANESHWAR	2,189	72.00	14.00	4.25	1	9	2,405	2,405
11	ITTPL I	2,700	75.00	14.00	3.60	2	12	4,770	2,385
12	MAHESHWARI	2,186	72.00	14.00	4.25	1	13	1,001	1,001
13	MOHAN BAGAN IV	2,100	69.12	12.00	3.40	1	2	903	903
14	NITYA	2,147	72.00	14.00	4.25	1	8	2,090	2,090
15	PASHYANTI	2,170	72.00	14.00	4.25	2	10	4,537	2,269
16	PRABAL	2,500	73.40	13.40	3.60	2	17	4,430	2,215
17	SANGHI IV	2,213	69.70	13.40	4.35	1	9	1,101	1,101
18	SEAHORSE IV	2,950	70.00	14.00	3.20	1	2	711	711
19	SOHOM II	2,849	82.00	13.50	3.40	1	6	2,570	2,570
20	VARUNI	2,148	72.00	14.00	4.25	2	13	3,727	1,864
						27	**195**	**52,059**	**1,928**

A scrutiny of these data indicates the following:

- Size of the barges is less than 3000 DWT with LOA varying from 60 m to 82 m
- The average parcel sizes vary from a minimum 700 T to a maximum of 2750 T with the overall average at around **2020 T.**
- Each barge stays at the berth from a minimum period of two days to a maximum of 16 days. The overall average stay at the berth is **just over 4 days**.

SECTION 6
PLANNING PARAMETERS

6.1 GENERAL

In this section a broad road map for the project development will be presented. The project development is planned in two phases with two clusters of berths viz. Berths 2,4 & 6 in the first phase and berths 8,10 & 12 in the second phase.

This section will cover the expected volumes of identified cargo; the possible vessel and parcel sizes; the allocation of berths for the cargo; the equipment for ship-shore transfer; equipment for handling at the berth; equipment for transfer from berth to the stockyard; area required for the stockyard; equipment for stockyard handling etc. The operational aspects, layout of stockyards, number and specification of the equipment will all be detailed in the next section on Project Details.

6.2 ESTIMATED POSSIBLE TRAFFIC

Under Traffic Study, having evaluated the present scenario in the volumes of selected cargo and examined the reasons for increase or decrease, the future volumes have been estimated taking into consideration possible changes in the scenario with the rationale therefor. The possible traffic volumes for selected cargo over the years have been indicated and these are presented hereunder. The cargo and volumes have been assessed for the two berth clusters.

Stage	Cargo	Cluster 1 (in Mn tons)	Cluster2 (in Mn tons)
1st Decade 2021-31	Container	1.8 (1.2 L TEUs)	1.8 (1.2 L TEUs)
	Pulses	0.30	0.00
	Fert/Limestone	0.00	0.35
	Total	**2.1**	**2.15**
2nd Decade 2031-41	Container	2.48 (1.65 L TEUs)	2.48(1.65L TEUs)
	Pulses	0.30	0.00
	Fert/Limestone	0.00	0.35
	Total	**2.78**	**2.48**

3rd Decade 2041-51	Container	2.93 (1.95 L TEUs)	2.93 (1.95L TEUs)
	Pulses	0.30	0.00
	Fert/Limestone	0.00	0.35
	Total	**3.23**	**3.28**

In this optimistic scenario during the first decade i.e. 2021-31 2.4 lakh TEUs of containers, 3 lakh tons of pulses and 3.5 lakh tons of limestone will be available for KPD. During the second decade i.e. 2031-41 an incremental volume of 90,000 TEUs of containers will be added. During the third decade the container volume will increase by 35,000 TEU.

It has to be noted that since the port decided to handle containers at KPD and issued relevant trade notice in March, 2019, KPD has handled about 6,000 TEUs till recently.

However, based on the data for the last five years as presented in the earlier section, on an average **370 container vessels** can pass through KPD lock gate. Taking the average container handling per vessel as 800 TEUs, KPD can access **2.96 lakh TEUs** of the total container traffic at KDS.

As regards the other cargo, the traffic in pulses and fertilisers depend on the change in Government policy. It is hoped that the present situation will improve and the volumes will increase as expected.

6.3 BERTH ALLOCATION

The port is planning to execute this project of KPD rejuvenation in two phases: in the first phase KPD I berths 2.4 & 6 will be developed to be followed by berths 8,10 & 12 in the second phase.

As could be seen in the layout of KPD I western berths, berths nos. 2 and 12 are not in line with the other berths and are slightly skewed.

In the first phase, the continuous berths 4 and 6 have a total length of 254 m while in the second phase, the continuous berths 8 and 10 have a total length of 289 m. Hence these can each accommodate a container vessel of LOA 158 m.

The skewed berths 2 and 12 are each 162 m and 143 m long respectively. These can accommodate barges carrying the other cargo – pulses, fertilisers and limestone. These barges are of size less than 3,000 DWT and having LOA varying from 60m to 82 m and with beam varying from 10 m to 17 m. Overall, the barges carry an average parcel of 2,020 T.

Referring to the past five-year data at NSD, a single berth with MHC can handle, on an average, 145,000 TEUs per annum. Hence, in the two phases the two proposed combined lengths of berths 4 & 6 as well as berths 8 & 10 will be able to handle the total container traffic that could be assessed by KPD.

As regards the other cargo, the daily productivity of the barge berths could be 2,000 T per day. With 70% occupancy of either berth no. 2 or berth no. 12 will have about 255 working days which can give a throughput of 5.1 lakh tons per annum which is more than the projected traffic.

6.4 SHIP – SHORE CARGO TRANSFER

CONTAINERS

For ship-shore transfer of containers a mobile harbour crane has to be provided for better productivity. The container vessels that can call at KPD berths should have LOA of 157 m and beam of 21.5 m. These vessels can carry containers 8 across. As has been done by BKCT at NSD berths, LHM 425 of Liebherr or IMHC 2120 of Italgru could be provided.

As indicated earlier, the port plans to execute the rejuvenation project in two phases through PPP mode. The port can continue to handle the existing container traffic at KPD through berths 8 and 10 while the licensee is carrying out the developments at the berths 4 and 6. During this period, no shore crane will be available and the present system of using ships' gear will continue.

By the time the first phase developments are finished and the traffic has sufficiently picked up, the licensee can deploy the MHC at this berth. Depending on the rate of growth of container traffic, he can time the start of phase two execution.

Based on data available from the operation of BKCT at NSD berths, it can be concluded that each MHC can handle about 145,000 TEUs per annum. So, one MHC each for the two phases will be able to meet the projected traffic demands.

TYPCIAL MHC FOR SHIP-SHORE CONTAINER HANDLIING

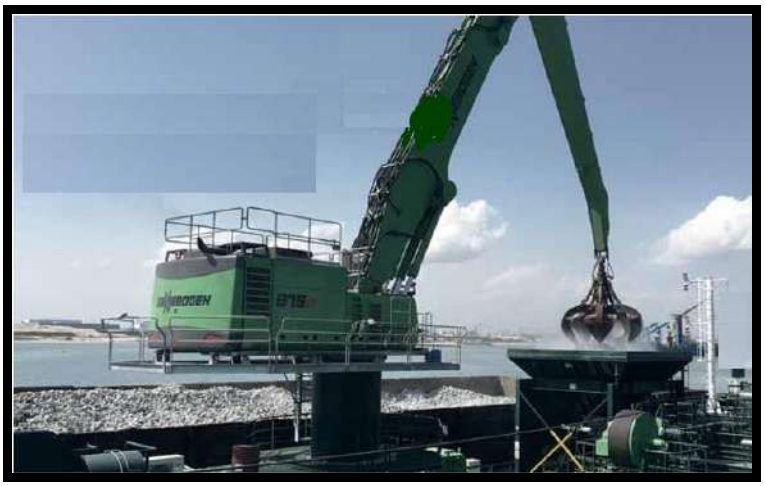
OTHER CARGO – PULSES, FERTILISERS AND LIMESTONE

As indicated earlier, it is difficult to specify at this juncture what other cargo will have to be handled at KPD berths by the time the first phase is commissioned. However, the scenario may change over the next few years and hopefully the traffic in pulses and fertilisers will pick up. Hence the equipment selected for ship-shore transfer should have the flexibility to handle any of the designated cargo.

Accordingly, Liebherr grab unloader LH 150 or similar equipment is selected. Since all the designated cargo are to be received in bulk in barges, this grab can handle all of them.

Depending on the requirement, the cargo could be discharged into a hopper for bagging or into a dumper to be taken to the stockyard.

TYPICAL BARGE UNLOADER FOR BARGES



UNLOADER DISCHARGING INTO A HOPPER

UNLOADER DISCHARGING INTO A DUMPER

It has been indicated that the other cargo will be handled at berths 2 or 12 and each berth will accommodate one barge at a time with an average parcel of 2,020 T which could be discharged within a day with a single grab unloader. Considering that presently each barge, on an average spends more than 4 days at the berth, clearing it within a day will enhance the productive utilisation of the barges.

6.5 CARGO HANDLING ON THE QUAY

CONTAINERS

The containers off loaded from the ship by the MHC have to be loaded on to trailers and moved on to the parking yard. The minimum productivity of MHC has been fixed as 20 moves per hour. Hence there will be a move once in 3 minutes. In this case, the container parking yard is in close proximity to the berth. Assuming a tractor-trailer unit takes 25 minutes to reach the farthest slot in the parking yard and return to the berth, there is a need for 8 tractor trailer units per MHC. Providing extra for breakdowns and repair, 10 TT units are required per MHC.

PULSES & FERTILISERS

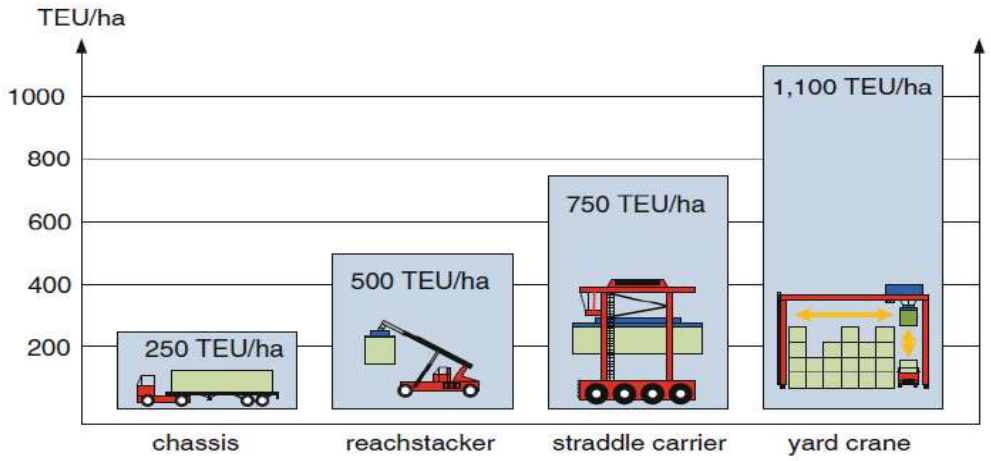
These two will be unloaded from the barges in bulk into hoppers on the berth and bagged there. The bagged cargo will thereafter be moved to the storage shed. Each bag will weigh 50 kg. The bags have to be moved on to the storage shed through Forklift Trucks. Normally these FLTs cannot take more than 20 bags per trip which means one ton of cargo can be transported per trip. Taking the cycle time for the FLTs as 5 minutes per trip, each FLT can make 12 trips per hour. Considering 20 hrs working per FLT, one equipment can handle 240 Tons. For handling a barge parcel of 2,000 tons, nine FLTs will be needed. One additional FLT will be needed for evacuation. Hence a minimum of 10 trucks will be needed. In order to avoid bottleneck in bagging, two hoppers are preferred.

Accordingly for each berth, for each grab unloader, two hoppers with a fleet of 10 FLT trucks will be needed.

6.6 CONTAINER PARKING YARD & CARGO STORAGE AREA

CONTAINER PARKING YARD

Depending upon the equipment to be used in the parking yard, the layout and requirement of the container parking yard will vary. The yard could be based on chassis, reach stackers, straddle carriers or rubber-tyred gantry cranes. The yard density for these different types of equipment is presented hereunder.

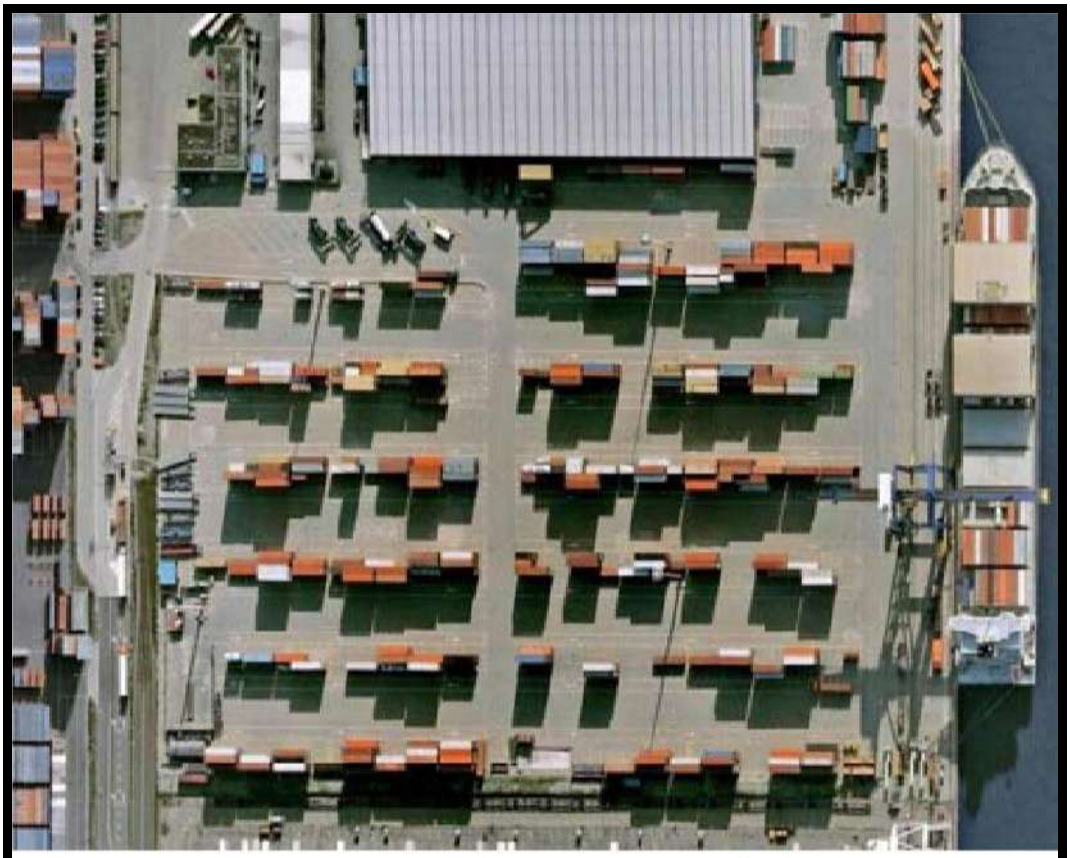


Storage-equipment-dependent yard density (based on Kalmar 2011a)

Generally, these equipment are selected based on the size of the terminal i.e. depending on the annual traffic volumes. It has been maintained in the industry that Reach Stackers are ideally suited for terminals with an annual throughput of 2 lakh TEUs even though occasionally they have handled throughput of about 4.5 lakh TEUs per annum. It has to be noted here that the BKCT terminal is handling more than 6 lakh TEUS per annum, of course, in association with two RTGs.

The main advantages of RS are their flexibility and low capital and operating costs. The major disadvantages are they need more space because of wide turning circle and have low handling rates of about 12 to 15 lifts per hour. Since space is not a constraint at KPD and the traffic volumes are also low, Reach Stackers have been selected.

Typical container parking yard operating with Reach Stackers are presented hereunder



Typical reach-stacker terminal (ITR, Rotterdam)

The yard density of 500 TEUs /Ha is based on 4 deep and 4 high stacks. If the stack height is reduced to 3, the density comes down to 350 TEUs/Ha.

CONTAINER STACKS AT KPD I

CONTAINER STACKS AT NSD

Looking at the way the containers are stacked presently at both NSD and KPD as seen in the pictures above, we can easily assume a yard density of 500 TEUs/Ha. But as a prudent measure, it has been proposed to adopt 350 TEUs/Ha.

Considering an average stack height of 2.5 and an average dwell time of 6 days as considered by the port, the requirement of ground slots during the first phase is worked out as hereunder:

Throughput	145,000 TEUs
Average Stack height	2.5
Average dwell time	6 days
No. of TEU ground slots required	(145,000/2.5 x 61) = 951
Area of the parking yard	951 x 30 = 28,525. m or **2.9 Ha**

As regards the number of Reach Stackers, 2 numbers will be required for serving the MHC and one more will be required for receipt and despatch of containers. On the whole 3 Reach Stackers will be required for the first phase.

The same yard area requirement and the number of Reach Stackers will have to be repeated for the second phase of development.

As regards the area available for the parking yard, those marked by the port as available keeping the transit sheds in place are all odd shaped. This will not allow optimal and efficient usage of the yard equipment. Hence it is recommended that the sheds at berth nos. 4,6 ,8 & 10 be removed and a proper rectangular shaped parking yard. It is to be noted that all these sheds are presently not much in use. A possible demarcation of the area is shown hatched in the figure hereunder.

However, it has to be noted that such proper demarcation results in reduced utilisable area. The hatched area works out to only 6.42 Ha as against the required area of 9.6 Ha for both the phases of development. This is still sufficient as the required area is only 5.8 Ha.

It is suggested that initially the sheds at berth nos. 4 & 6 are removed during the first phase and a proper parking yard made and operated. Based on its performance, the planning for the second phase could be decided.

RECOMMENDED SHAPE FOR CONTAINER PARKING YARD

STORAGE AREA FOR PULSES & FERTILISERS

As indicated earlier, pulses and fertilisers will be handled and stored in bags. These bags will be stored in the shed in stacks. One stack of size 6 m x 6 m and 1.5 m high will have 3,600 bags (estimated size of a 50 Kg bag is 50 cm x 30 cm x 10cm), i.e. 180 tons. This gives a ground pressure of 5 tons/sq.m which is the permissible limit.

In this case also the dwell time is taken as 15 days and the traffic volume is taken as 3 lakh tons per annum. Therefore, at a time the volume to be stored will be 12,330 tons. As per the earlier calculation, 180 tons of bags will require 36 sq. m area. Accordingly, the total storage area required will be (12,300 /180) x 36 = 2,460 sq.m. Allowing 20% additional area for circulation, the total area will be 2,952 sq.m. This could be easily accommodated in shed at berth no. 2 whose floor area is 3,386 sq.m.

The shed at berth no. 12 has an extension with an area of 795 sq.m. This will be able to accommodate another 0.5 lakh tons making the total capacity to 3.5 lakh tons.

7.1 PROJECT SCHEDULE

It is expected that the time period from the start of pre-procurement activities till the signing of concession agreement will be around 15 months. This means that the Licensee will be at site only by the start of 2021-22. He is expected take another 2 years for commissioning Phase I of the project covering berths nos. 2, 4 & 6. This means that Phase I facilities will be in operation from the start of 2023-24.

After handing over the berths 2,4 &6 to the Licensee, the port will have berths 8,10 & 12 under its control. The present handling of container traffic by the Port at KPD I, which started with the trade notification on March, 2019, will continue over this period at these berths. The Port will also retain the parking yard developed by it for this purpose.

Once the Licensee commissions its first phase by 2023-24, the container operations handled by the Port will be taken over by the Licensee. However, the Port can continue to handle other cargo at berths 8,10 & 12 till the Licensee starts the second phase.

It is hoped that within 5 years from the commissioning of Phase I facilities, the projected traffic for the first decade i.e. 1.2 lakh TEUS, will be achieved. This will encourage the Licensee to undertake the Phase II of the project by 2029-30 which will be completed within two years.

By the start of the 2nd decade, i.e. 2031-32, both the facilities will be in operation. Assuming the 2nd Phase will take another 5 years to reach its projected traffic of another

1.2 lakh TEUs, the terminal will be handling 2.4 lakh TEUs by 2036-37.

Going by the past data on the number of container vessels that could enter KPD I, it has been estimated that the total volume of container traffic for KPD could be 2.96 lakh TEUs. This volume has to be handled during the 3rd decade. It may be possible that over the years the number of container vessels that could enter KPD could increase over

and above that estimated and the volume of container traffic that could be handled will increase.

7.2 ENABLING WORKS TO BE DONE BY THE PORT

- The existing transit sheds at berths 4&6 as well those at berths 8&10 have to be removed before handing over the sites to the Licensee during the first and second phases. Considering the columns and roofing with old structural steel, the Port can auction these sheds in "as is where is" condition. In this way, the Port can get these sheds removed as well earn some revenue out of them.
- Earlier the Tidal Basin used to have four capstans for turning the ship around after entering, so that it will always fore forward. Sometimes, the ship can be berthed either port side along or starboard side along depending on the requirement of the agent. This was abandoned later with the decrease in the number of ships calling at KPD. Now with the proposed rejuvenation plan, these four capstans are recommended to be re-established.
- With the increased number of ships calling at the dock and the regular opening and closing of the lock gates, there is a need for an exclusive grab dredger to dredge the accumulated silt at the lock entrance. This dredger could be taken on a five-year charter as is being done now.
- As desired by the port, the existing Gate No. 2 has to be re-located as shown hereunder for ensure ease of vehicular movements.

7.3 BERTHING FACILITIES

KPD I - WESTERN BERTHS	2	162	15.4
	4	136	15.24
	6	118	15.24
	8	128	15.24
	10	161	15.24
	12	143	15.24

CONTAINERS

As indicated earlier, the Licensee will commence his operations under Phase I by 2023-24. Till that time, the present container traffic at KPD I will continue to be handled but at berth nos. 8 & 10.

During the first phase of the operations, container vessels will be handled at the combined berths 4 & 6. They have a total length of 254 M. This can easily accommodate a container vessel of LOA 157 M which will require a total length of 157 m + 2x15 m for mooring = 187 M. Taking a daily productivity of 600 TEU with one MHC, the berth will require 200 operational days to handle the projected annual traffic of 1.2 lakh TEU during the first phase. Assuming 25% extra time, (as derived from the past performance at NSD), for peripheral activities including waiting for the tide, the berth will be occupied for 250 days which works out to 68% berth occupancy. This will be the status at the later part of the first phase.

When the second phase of development is commissioned by 2031-32, berths nos. 8 & 10 will also be available. They have a total length of 289 M. Taking this in isolation, this can also accommodate one container vessel of LOA 157 M. Like the berth in phase one, this can also handle the projected annual traffic of 1.2 lakh TEU per annum with 68% berth occupancy. But in reality, the combined length of the four berths viz. 4, 6,8 & 9 works out to 543 M which can accommodate 3 vessels of LOA 157M. This means that when both the phases of development are completed, there will be three berths available. With these three berths, the terminal will be able to handle the projected final traffic of 2.96 lakh TEUs per annum.

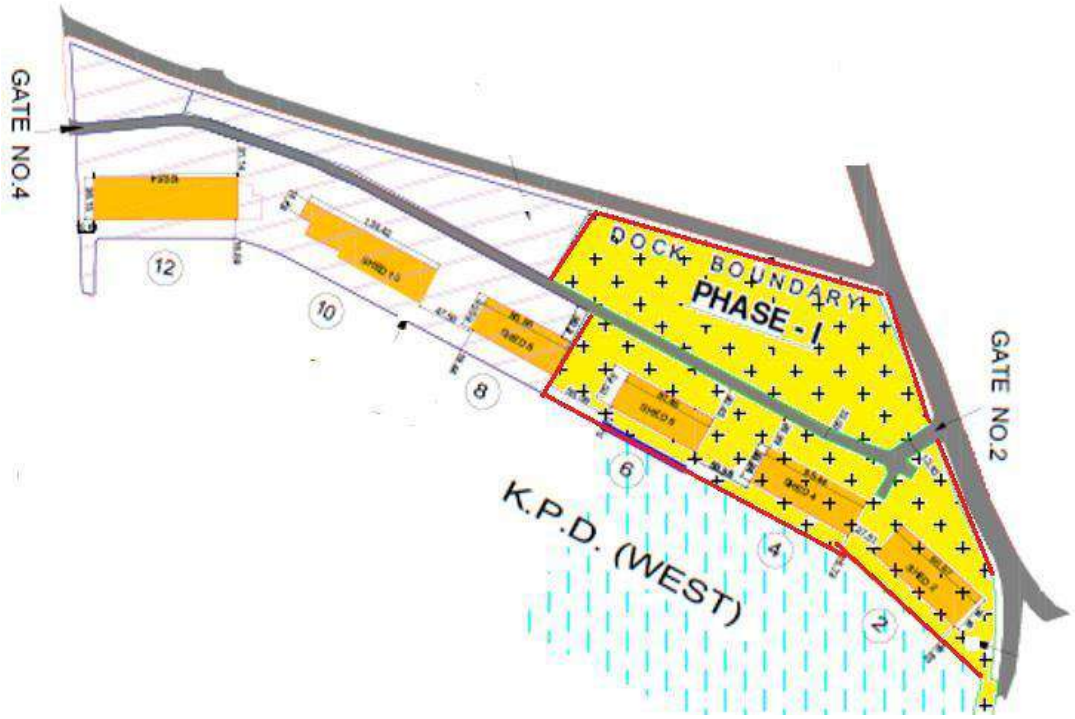
OTHER CARGO

During the first phase, berth no. 2 will be available for other cargo. This berth is 162 M long. It has been indicated that the other cargo will be moved only through barges of size LOA between 60 M to 82 M and with beam of 10M to 17 M. Since the average parcel size is about 2,000 T, it is sufficient that a single barge is berthed which could be cleared in a single day. At this rate, with a berth occupancy of just over 41% the projected traffic of 3 lakh tons could be handled.

During the second phase, berth no. 12 will also be available. This berth is 143 m long. This berth also needs to berth a single barge which could be cleared in a single day. It should be possible to handle the project traffic of 3.5 lakh tons with about 48% berth occupancy.

7.4 CONTAINER PARKING YARD & CARGO STORAGE AREA

It has been proposed by the port that for the first phase of development, the area demarcated hereunder will be handed over to the Licensee.

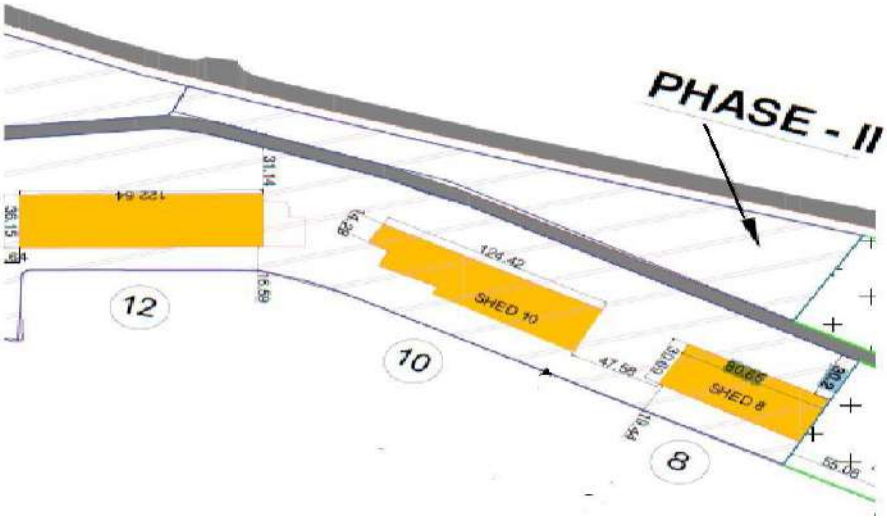


AREA TO BE HANDED OVER FOR THE FIRST PHASE DEVELOPMENT

AREA STATEMENT : PHASE-I		
SR. NO.	DESCRIPTION	AREA (IN Sqm)
1	Phase - I	67,761.00
a	SHED 2 (Incl.)	3,109.00
b	SHED 4 (Incl.)	3,198.00
c	SHED 6 (Incl.)	2,619.00

SATELLITE PICTURE OF THE FIRST PHASE AREA

During the second phase of development, the following demarcated area will be handed over to the Licensee.



SATELLITE PICTURE OF THE SECOND PHASE AREA

AREA STATEMENT : PHASE-II		
SR. NO.	DESCRIPTION	AREA (IN Sqm)
1	Phase - II	54,705.00
a	SHED 8 (Incl.)	2,475.00
b	SHED 10 (Incl.)	3,521.00
c	SHED 12 (Incl.)	4,988.00

CONTAINER PARKING YARD

It could be seen that during the first phase the existing container yard has been proposed to be handed over in full. This will ensure that the present container handling at KPD I will continue till the first phase facilities are commissioned.

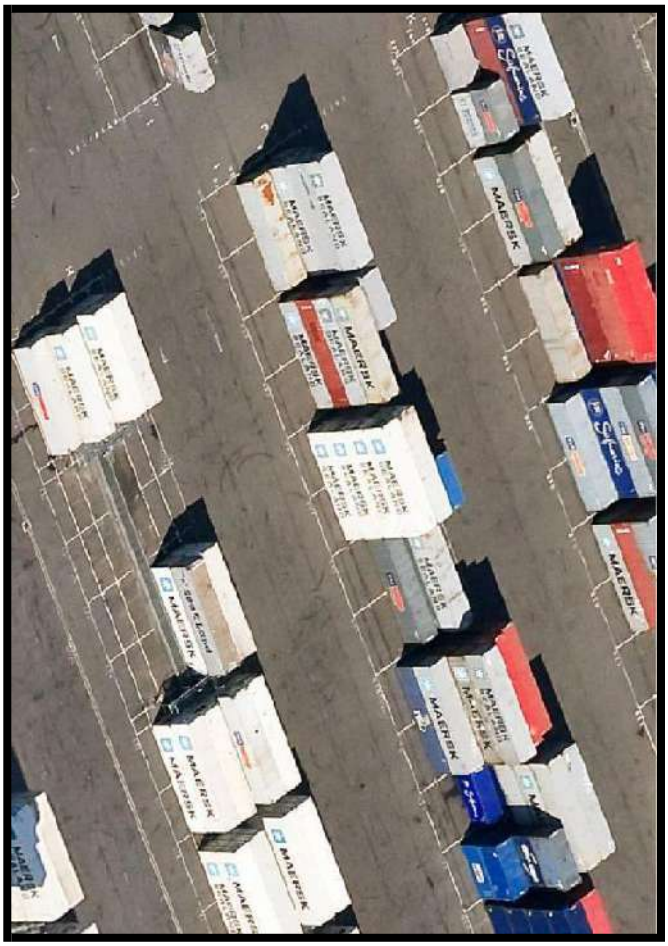
However, with the transit sheds at the berths in place, the available area is in odd shape and is not conducive for efficient operation of the terminal equipment. With the fact that almost all the sheds are presently not in use, it is suggested that the sheds at the berths nos. 4,6,8 & 10 be removed and the entire area developed in modular shape to ensure efficient operation. Such an option is marked in the figure hereunder.

The transit sheds at berths nos. 2 and 12 are retained for handling other cargo through barges such as pulses and fertilisers.

DEVELOPMENT OF INTEGRATED MODULAR PARKING YARD

A typical modular yard block for Reach Stacker operations is given hereunder. The block will contain three rows of containers on either side of a central passage which comprises a trailer passage and an aisle for a reach stacker handling a 40’ container. The three rows of containers are 4 high on the last row, 3 high on the second row and two high on the first row.

Such developed yard will, in reality, look like this.



TYPICAL REACH STACKER CONTAINER PARKING YARD

If we take the length of one TEU ground slot of 6.1 M, the area of the block works out to 202.15 sq.m. In this area 6 TEU ground slots are available which gives the area requirement of one TEU ground slot as 33.14 sq.m. rounded to 34 sq.m.

The total area to be handed over during both the phases, excluding the area of sheds at berths 2 & 12 works out to (67,761+3,198+2,619+54,705+2,475+3,521) = 134,279

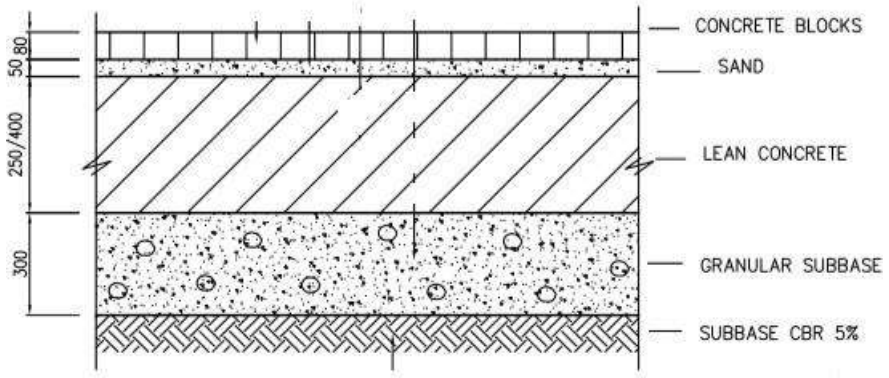
sq.m. Taking only 70% of this area for operational purposes, the available area works out to 93,995 sq. m which will be able to accommodate 2,764 TEU ground slots.

Assuming an average stack height of 2.5 and a dwell time of 6 days, this can handle an annual container traffic of 4.52 lakh TEUs which is much more than the projected traffic.

Hence it may be sufficient to develop only 50% of the available total area for the container parking yard i.e. 67,140 sq.m only. This will accommodate 1,974 TEU ground slots. With an average height of 2.5 and a dwell time of 6 days this can handle an annual container traffic of 3.00 lakh TEUs.

During the first phase of development, an area of 33,570 sq.m will be developed which will be able to handle the first phase traffic of 1.2 lakh TEUs of containers per annum.

A typical cross section of the heavy-duty pavement for the container parking yard is given hereunder.



HEAVY DUTY PAVEMENT WITH
PRECAST CONCRETE BLOCK

STORAGE AREA FOR OTHER CARGO

As of the current year, the traffic in the traditional cargo of pulses and fertilisers has been has undergone a drastic reduction. However, there has been a sudden spurt in the traffic of limestone. As indicated under Traffic Study, there is every possibility for the reversal of traffic growth in pulses and fertilisers in the years to come. This implies that the facilities to handle and store such cargo should be flexible to accommodate all types.

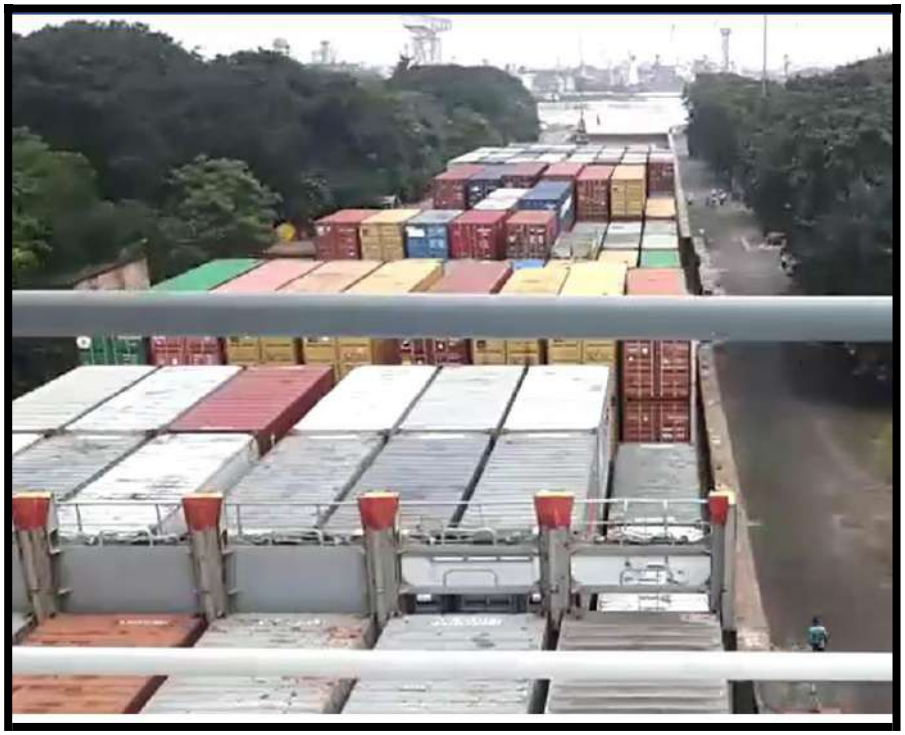
As indicated in the earlier section on Planning Parameters, the existing transit sheds at berths nos. 2 & 12 will be able to handle Pulses or Fertilisers in bagged condition for the projected traffic of 3.0 lakh tons and 3.5 lakh tons.

7.5 CARGO HANDLING EQUIPMENT

7.5.1 SHIP-SHORE TRANSFER – CONTAINERS

There is a requirement of one MHC for each of the two phases of development.

It has been indicated that KPD will be able to receive ships of size LOA: 157 M and beam 21.3 M. A typical vessel of this size which calls at KDS is presented hereunder.



MV MASTERY D INSIDE NSD LOCK BARREL

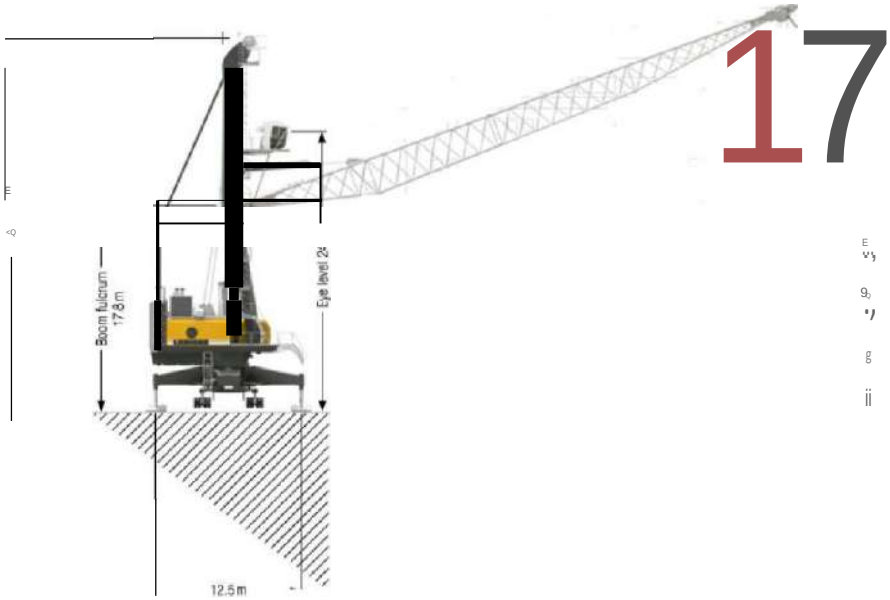
MASTERY D (IMO: 9301201) is a **Container Ship** registered and sailing under the flag of **Liberia**. Her gross tonnage is **8971** and deadweight is **10744**. MASTERY D was built in **2006** by **VOLHARDING SHIPYARD**. MASTERY D length overall (LOA) is **154.57** m, beam is **21.83** m and maximum draught is **6.97** m. Her container capacity is **900** TEU. The ship is operated by **DREVIN BEREEDERUNGS**.

Such vessels will carry 8 containers across the beam. It has been indicated by the Civil Engineering Department of the port that a clear width of 3.4m from quay wall should be left for the presence of service duct in the Berths. As such, the outer edge of the pad of MHC can be placed keeping a clear width of 3.4m from quay wall.

The placement of a MHC as per this requirement is shown in the figure hereunder.

OUTREACH OF THE MHC SHOULD BE 30.05 M FROM CRANE CENTRE (19.3 M + 4.5 M + 6.25 M)

Two cranes, one Liebherr LHM 425 and another Italgru IMHC 2120 E are considered. Key Technical details of Liebherr LHM 425 are given hereunder.



Technical Data

Capacity and Classification

	Capacity	Classification
EOA" rope 1211b operation	:5:521	AB
EOA" rope grab operation	:5:601	*Ai*
Motor grab operation	:5:521	AB
Container operation	:5:571	*Ai*
Heavy lift operation	:5: 1241	A3

Main Dimensions

Min. to max. outreach	11- 48m
Height of boom fulcrum	17.5m
Tower cabin height (eye level)	24.0m
Overall height (top of tower)	32.5m
Overall length of undercarriage	20.0m
Overall width of undercarriage	6.0m

	Bulk	Container
Number of axle sets (standard)	14	16
Number of axle sets (optional)	24	24

Working Speeds

Hoisting/ lowering	0- 120 m/min
Slewing	0- 1.6rpm
Luffing (average horizontal speed)	0- 55m/min
Travelling	0 - 5km/h

Propping Arrangements

Standard pad dimension	12.5m x 12.5m
Standard pad dimension	6.5mx 1.8m
Standard pad area of pads	9.9m²

Optional size of supporting pads for basic configuration

Quay Load Arrangements

	Bulk	Container
Uniformly distributed load	1 .9t/m²	1.9t/m²
Max. load per axle	6.01	5.8t

Due to a unique undercarriage design the Quay loads specified above can ..... be reduced. Pad sizes, supporting base and the number of axle sets can easily be adapted to comply with the most stringent quay load restrictions.

Weight

	Bulk	Container
Total weight of crane LHM 425	approx. 342t	approx. 371t

Hoisting Heights

Above Quay at minimum radius	45.0m
Above Quay at maximum radius	29.0m
Below Quay level (approx)	12.0m

)

LIFTING CAPACITIES
for container operations

Maximum crane capacity 84 t

Outreach	Spreader operation under		Hook operation on the ropes
	Single lift	Twin lift	Heavy lift
(m)	(t)	(t)	(t)
11	41.0	50.0	84.0
12	41.0	50.0	84.0
13	41.0	50.0	84.0
14	41.0	50.0	84.0
16	41.0	50.0	84.0
18	41.0	50.0	84.0
20	41.0	50.0	84.0
23	41.0	50.0	84.0
24	41.0	50.0	83.8
26	41.0	50.0	76.2
28	41.0	50.0	69.7
30	41.0	50.0	64.1
32	41.0	46.0	59.2

Weight rotator 2.5 t
Weight fully automatic (telescopic) spreader 9 t
Weight twin lift spreader 10.7 t

ITALGRU IMHC 2120 E

LIFTING CAPACITIES
for container operations

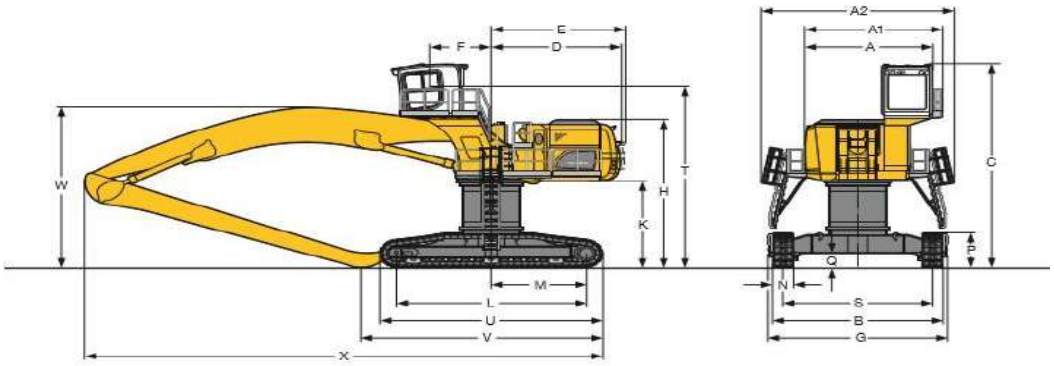
OPERATIONAL DATA	CAPACITIES FOR DIFFERENT USES			
RADIUS L (m)	HEAVY (t)	STANDARD or TWIN LIFT (t)	SINGLE LIFT (t)	GRAB (t)
11.0	125.0	65.0	50.0	50.0
12.0	125.0	65.0	50.0	50.0
14.0	125.0	65.0	50.0	50.0
16.0	125.0	65.0	50.0	50.0
18.0	125.0	65.0	50.0	50.0
20.0	125.0	65.0	50.0	50.0
22.0	112.5	65.0	50.0	50.0
24.0	102.5	65.0	50.0	50.0
26.0	93.0	65.0	50.0	50.0
28.0	84.5	65.0	50.0	50.0
30.0	80.0	65.0	50.0	50.0
32.0	71.5	65.0	50.0	50.0

NOTE
- Radius "L" is intended from slewing centre to C/L of suspended load (ropes).
- Shown capacities are effective working capacities under hook.
- The grab and spreader weight are included in shown capacities.
- Capacities on wheels are prohibited.

7.5.2 SHIP-SHORE TRANSFER – OTHER CARGO

For ship-shore transfer of other cargo, it has been indicated under Planning Parameters that one grab unloader with two hoppers will be required for each of the two phases of development.

Key technical features are presented hereunder.

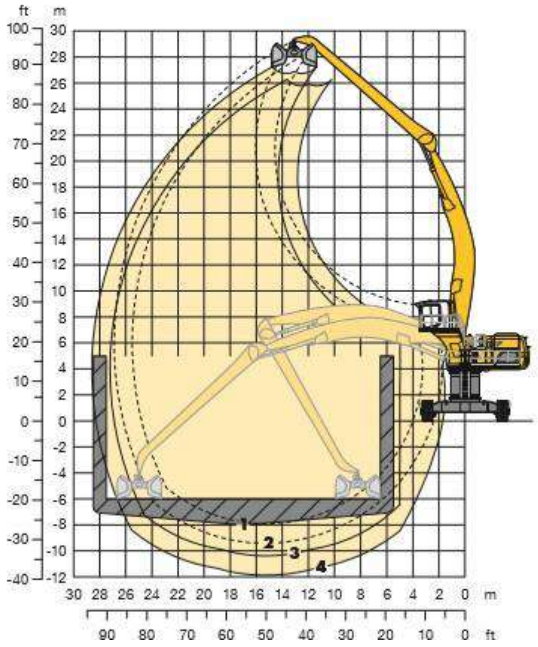


	without turret	mm	with turret 2.00 m	mm
A		4,815		4,815
A1		5,200		5,200
A2		6,180		7,310
B		6,450		6,450
C		7,290		9,290
D		4,970		4,970
E		5,020		5,020
F		2,340		2,340
G		6,860		6,860
H		4,725		6,725
K		1,970		3,970
L		7,270		7,270
M		3,635		3,635
N		750		750
P		1,545		1,545
Q		670		670
S		5,700		5,700
T		6,260		8,260
U		8,480		8,480

E = Tail radius

with turret 2,00 m Industrial-Type Gooseneck Boom 15.00 m and Industrial Stick	m	12.00	13.50
V	mm	9,950	8,350
W	mm	7,500	7,500
X	mm	20,850	20,850

Industrial-Type Gooseneck Boom 15.00 m



Attachment Envelope

Kinematic variant 3D

1 with industrial stick 12.00 m
2 with industrial stick 13.50 m
3 with industrial stick 12.00 m and grapple model GMZ 50
4 with industrial stick 13.50 m and grapple model GMZ 50

Operating Weight and Ground Pressure

The operating weight includes basic machine with turret 2.00 m, rigid cab elevation, industrial-type gooseneck boom 15.00 m and grapple model GMZ 50/6.00 m³.

Industrial stick	m	12.00	13.50
Pad width	mm	750	750
Weight	kg	143,500	144,100
Ground pressure		on request	

APRON IN FRONT OF THE SHED

The minimum apron width at berths nos. 2 and 12 is 15.24 M.

As in the case of MHCs, here also the outer edge of the pad shall be placed keeping a clear width of 3.4m from quay wall. Keeping this in view, the grab unloader will be placed. Considering the dimensions given earlier, its disposition on the apron is given hereunder.

Farthest edge of grab from berthing face = Quay wall clearance 3.4 M + G/2: 3.4 M + E: 5 M = 11.8 M. This means there will be a clearance of 3.44 M from the wall of the transit shed.

7.5.3 STORAGE YARD TRANSFER – CONTAINERS

Under the section on Planning Parameters, it has been indicated that a fleet of 10 tractor trailer units will be required for transferring the containers unloaded from the ship for each MHC. This means that for each phase of development, there will be requirement of 10 tractor trailer units.

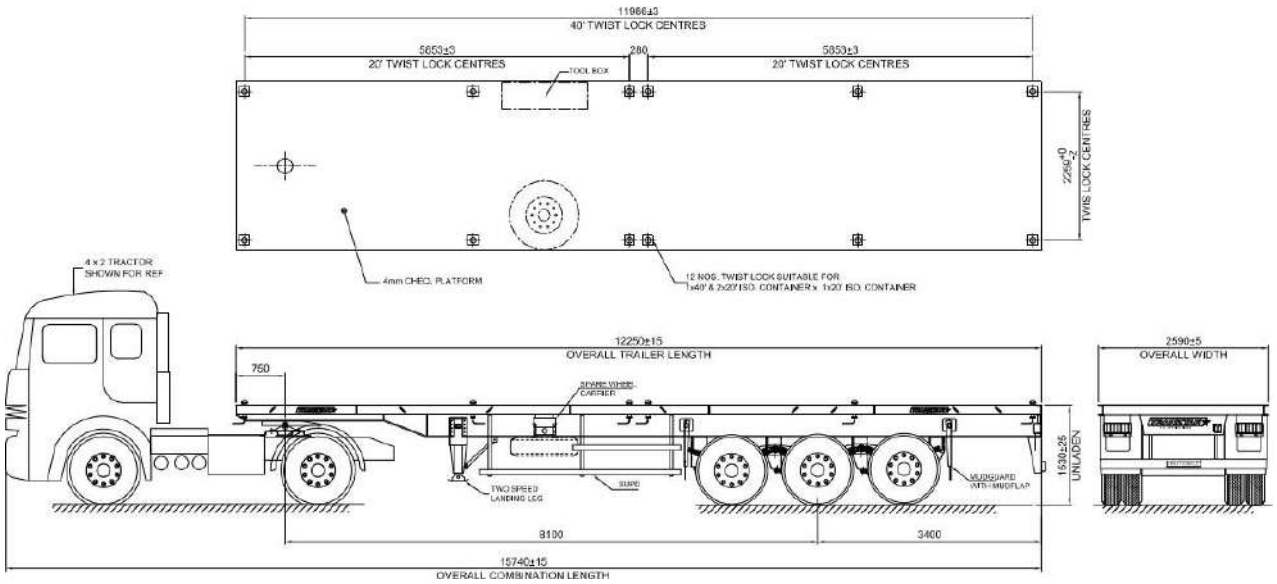
The tractor head shall be capable of hauling a container trailer with a fully loaded 40 ft. container. It shall be fitted with a fifth wheel for attaching the trailer. It shall be powered by diesel engine and provided with automatic power transmission. The engine shall conform to the pollution norms of the relevant Euro standards.

Key technical features of a typical 40’ flatbed tridem axle semi-trailer are presented hereunder.

Overall dimensions: Length: 12250 mm x Width: 2500 mm x Height: 1530 mm.
Weight: ~ 7500 kg

Chassis is constructed using two numbers fabricated beam of appropriate size, running along the full length of the trailer with cross members of folded sections. 4 mm thick MS chequered platform. 12 numbers twist locks (2 nos. 20’ container/ 1 no. 20’ container application/ 1 no. 40’ container application)

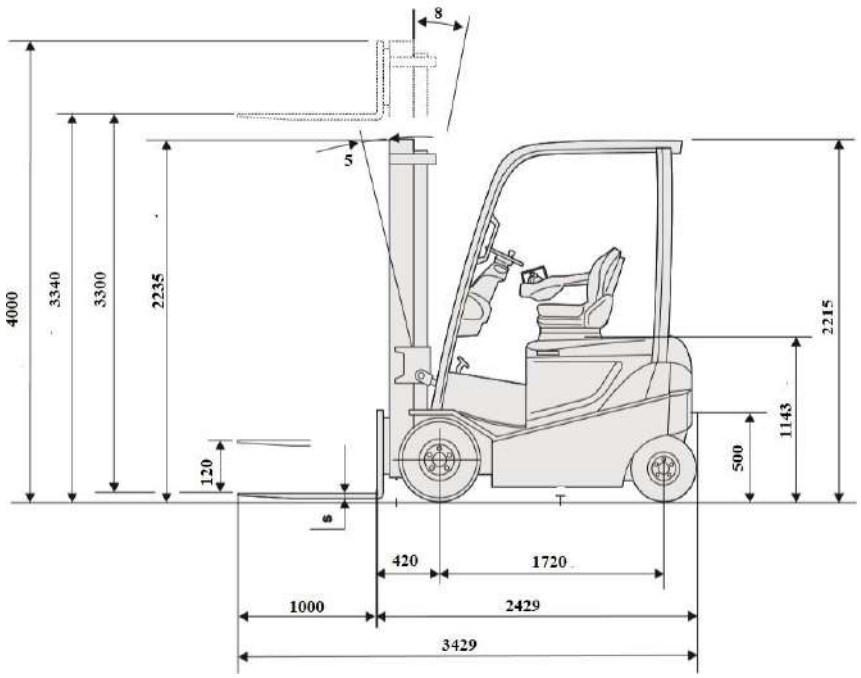
Axle assembly: 3 nos. 13 T capacity heavy duty axles.

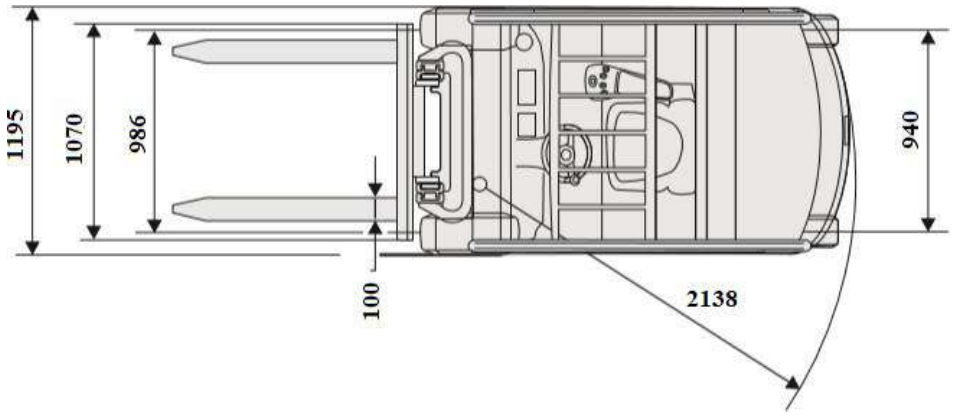


7.5.4 STORAGE YARD TRANSFER – PULSES / FERTILISERS

Under the section on Planning Parameters, it has been indicated that a fleet of 9 forklift trucks will be required for transferring the bagged pulses / fertilisers unloaded from the barges for each unloader during each phase.

Key features of a typical electric powered forklift truck of 2.5-ton capacity are presented hereunder.



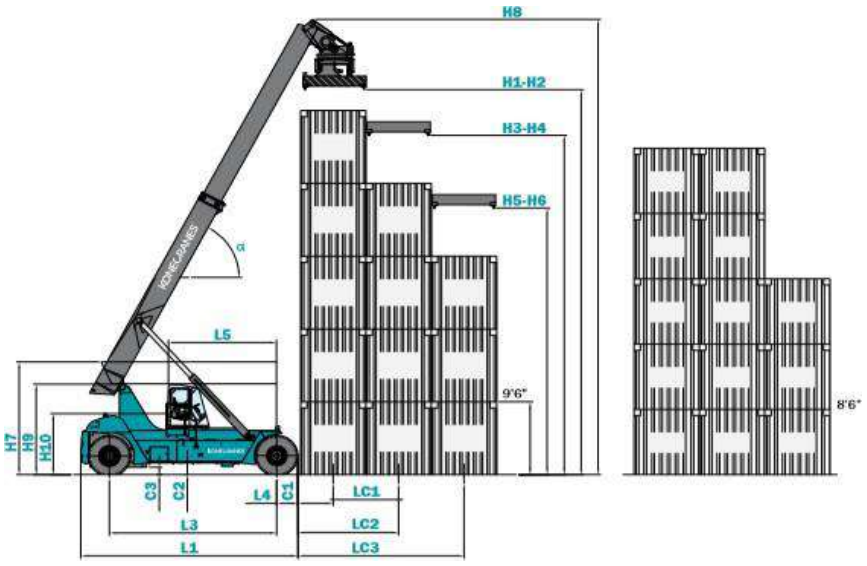


Travel speed: 19 kmph with load and 20 kmph without load.

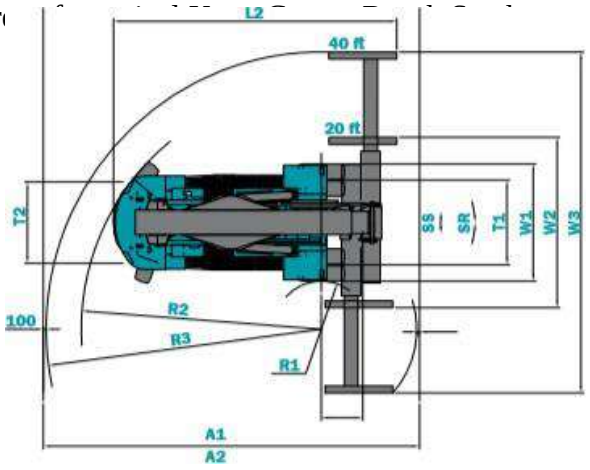
Drive motor rating: 20 kW

7.5.5 CONTAINER PARKING YARD EQUIPMENT

As indicated under section Planning Parameters, the container parking yard will be served by Reach Stackers and 2 numbers will be required for serving one MHC and one more will be required for receipt and despatch of containers. On the whole 3 Reach Stackers will be required for the first phase. The same number of Reach Stackers will have to be repeated for the second phase of development.



Key featur



	MODEL			SMV 4545 CB5 (CBX5)
LIFTING DATA	**Dimensions**	**Identifier**	**Units**	
	Lifting capacity at load center LC1 / LC2 / LC3 (no jacks)		tons	45 / 45 / 33
	Lifting capacity at load center LC1 / LC2 / LC3 (with jacks)		tons	45 / 45 / 45
	Load centers in row 1 / 2 / 3	LC1 / LC2 / LC3	mm	2275 / 3850 / 6350
	Stacking height in row 1 (9'6" / 8'6")			5 x 9'6" / 5 x 8'6"
	Spreader type, telescopic, locking			
	Lost load center to face of tires / jacks	L4	mm	1025
	Wheelbase	L3	mm	8000
WEIGHT	Service weight		kg	110000
	Axle pressure front LC1 (unloaded / rated load)		kg	54000 / 117600
	Axle pressure rear LC1 (unloaded / rated load)		kg	58400 / 131000
	Axle pressure front LC2 (unloaded / rated load)		kg	56000 / 37400
	Axle pressure rear LC2 (unloaded / rated load)		kg	51600 / 24000
WHEELS	Tire type			Pneumatic
	Tire dimension / ply rating, front & rear		inch	21.00 x 35"/PR40
	Rim dimensions, front & rear		inch	15.00 x 35"
	Tire pressure, front / rear		MPa	1.0 / 1.0
	Number of wheels, front / rear (X = driven)			4X / 2
	Track width, front / rear	T1 / T2	mm	3227 / 3420
DIMENSIONS	Boom angle, min - max	α	deg	0 - 55
	Lifting height in twistlocks, min - max at LC1	H1 - H2	mm	1300 - 15000
	Lifting height in twistlocks, min - max at LC2	H3 - H4	mm	1300 - 14100
	Lifting height in twistlocks, min - max at LC3	H5 - H6	mm	1300 - 11100
	Boom height, min - max	H7 - H8	mm	5100 - 18800
	Truck height over cabin / seat height	H9 - H10	mm	4050 - 2900
	Sliding cabin stroke (manual / hydraulic)	L5	mm	2900
	Overall length, with - without spreader	L1 - L2	mm	14150 - 10600
	Drive axle width	W1	mm	4600
	Spreader width, min - max	W2 - W3	mm	6050 - 12175
	Spreader sideshift	SS	mm	± 800
	Spreader rotation	SR	deg	-105 / 195
	Mechanical Pile Slope (side tilt / no power)	PS	deg	± 6
	Ground clearance, front / mid / steering axle	C1 / C2 / C3	mm	300 / 300 / 500
	Aisle width (with 20 ft / 40 ft container)	A1 / A2	mm	15200 / 15400
	Turning radius, inner	R1	mm	2800
	Turning radius, outer 20 ft / outer 40 ft	R2 / R3	mm	11300 / 11300
PERFORMANCE	Drive speed forward, unloaded / at rated load		km/h	25 / 20
	Drive speed reverse, unloaded / at rated load		km/h	25 / 20
	Lifting speed, unloaded / at 40% load / at rated load		m/s	0.35 / 0.33 / 0.17
	Lowering speed, unloaded / at rated load		m/s	0.25 / 0.35
	Gradeability, at rated load, 0/2 km/h		% / %	22 / 16
	Towing power, at rated load, 0/2 km/h		kN / kN	260 / 214
IVELINE	Engine power (min - max)	EU2 / EU3b	kW	256 - 294
	Engine torque (min - max)	EU2 / EU3b	Nm	1640 - 2172
	Transmission, gears forward + reverse			DANA 3+3 / ZF 4+3
	Transmission type, function, shifting			Automatic transmission, to
	Drive axle model			Kessler D81

7.6 ELECTRICAL FACILITIES

The berths and the yards at KPD I are already in operation, of course, to a limited extent. With the proposed development in two phases, the yards will be expanded to provide additional operational area. Hence the lighting in the area has to upgraded by providing additional Flood light masts. This may need augmenting with transformers and additional cables.

7.7 PROJECT IMPLEMENTATION SCHEDULE

The Project Implementation Schedule has been for both the phases of development has been prepared and is presented hereunder. It is expected that the Licensee will be selected by September, 2020. Thereafter the Port will complete its enabling works within the next 6 months. The Licensee is expected to take another 6 months for preparatory works such as preparation of DPR, soil investigation, formalities such as submission of BGs, arranging funds for the project and the Financial closure and fulfilling Conditions Precedent as per Concession Agreement.

The actual physical project execution is expected to take 18 months.

IMPLEMENTATION SCHEDULE FOR REJUVENATION OF KIDDERPORE DOCKS I

PHASE I DEVELOPMENT

S.No.	Item of work	2020									2021												2022												2023		
		A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
	PORT ACTIVITIES																																				
1	Application to SFC, RFQ, RFP till the signing of Concession Agreement																																				
2	Dismantling of transit sheds at berths 4 & 6																																				
3	Installation of capstans in Tidal Basin																																				
4	Shifting of Gate No. 2																																				
5	New peripheral road																																				
	ACTIVITIES OF LICENSEE																																				
6	Field investigations and preparation of DPR																																				
7	Development of Container Parking Yard																																				
8	Control building, workshop, canteen etc.																																				
9	Mobile Harbour Cranes																																				
10	Grab unloaders with hoppers																																				
11	Reach Stackers																																				
12	Tractor - Trailer units																																				
13	Forklift Trucks																																				
14	Upgrading electrical facilities																																				

Fixing up agency for execution

Field execution / Fabrication and supply

Testing and commissioning

IMPLEMENTATION SCHEDULE FOR REJUVENATION OF KIDDERPORE DOCKS I

PHASE II DEVELOPMENT

S.No.	Item of work	2028												2029												2030		
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
	ACTIVITIES OF LICENSEE																											
5	Field investigations and preparation of DPR																											
6	Development of Container Parking Yard																											
7	Control building, workshop, canteen etc.																											
8	New peripheral road																											
9	Mobile Harbour Cranes																											
10	Grab unloaders with hoppers																											
11	Reach Stackers																											
12	Tractor - Trailer units																											
13	Forklift Trucks																											
14	Upgrading electrical facilities																											

Fixing up agency for execution

Field execution / Fabrication and supply

Testing and commissioning

Page left blank purposefully

SECTION 8
CAPITAL COST ESTIMATION & IMPLEMENTATION SCHEDULE

8.1 Capital Cost

The total capital cost of the project is estimated at Rs. 91.21 Crores for Phase-1 and Rs. 82.16 crores for Phase -2. The cost estimates are based on the prevailing market rates. The detailed estimates are attached as ***Annexure 8.01 & 8.02.*** The summary break-up of the estimate is given as under:

First Phase

(Rs. in crores)

S.No	Particulars	Estimated Capital Cost
1	Civil Works	23.50
2	Mechanical Equipment	54.20
3	Electrical Works	1.00
	Sub Total	**78.70**
4	Detailed Engineering & Project Supervision @ 2%	1.57
5	Contingencies @ 3%	2.37
6	**TOTAL CAP-EX**	**82.64**
7	GST @ 18% (on Civil Cost)	4.44
8	Miscellaneous Cost @ 5% of project cost as per TAMP	4.13
9	**GRAND TOTAL**	**91.21**

Second Phase (Rs. in crores)

S.No	Particulars	Estimated Capital Cost
1	Civil Works	17.35
2	Mechanical Equipment	54.20
	Sub Total	**71.55**
3	Detailed Engineering & Project Supervision @ 2%	1.43
4	Contingencies @ 3%	2.15
5	**TOTAL CAP-EX**	**75.13**
6	GST @ 18% (on Civil Cost)	3.27
7	Miscellaneous Cost @ 5% of project cost as per TAMP	3.76
8	**GRAND TOTAL**	**82.16**

8.2 Implementation Schedule

The project implementation period including detailed engineering for the above from the date of grant of concession is estimated at 24 months for each phase. The phasing of expenditure is given as under:

First Phase (Rs. In Cr)

Year	Percent of Expenditure	Amount
1	40 %	36.48
2	60 %	54.73
TOTAL	**100 %**	**91.21**

Second Phase (Rs. In Cr)

Year	Percent of Expenditure	Amount
8	40 %	32.86
9	60 %	49.30
TOTAL	**100 %**	**82.16**

8.3 Interest During Construction

The Total Cap-ex is going to be spent in 24 months' time for each phase as indicated above and is proposed to be entirely from PPP operator. The Interest During Construction (IDC) is calculated to arrive at the impact of it on the cash flows considering the cost of capital as 10% and the amounts are going to be spent uniformly over the period. Accordingly, the IDC works out to Rs. 8.59 crores for Phase-1 and Rs. 7.74 crores for Phase-2. However as per TAMP Guidelines, IDC is calculated at 5% of Cap-ex at Rs. 4.13 cr and Rs. 3.76cr for Phase-1 and Phase-2 respectively. Hence the balance of Rs. 4.46 cr and Rs. 3.98cr is additionally to be added to the Cap-ex. Accordingly, the Cap-ex together with the actual IDC totals to **Rs. 95.66** crores for Phase-1 and **Rs. 86.15** crores for Phase-2.

Annexure 8.01

Detailed Capital Expenditure of the Project (Phase-1)
(Civil works)

S.No	Description	Amount (Rs. Crore)
A. Civil Works		
1	Pre-Project Activities - site survey, Soil investigations, Preparation of Detailed Project Reports etc	1.50
2	Providing hard standing for container parking yard of total area of 33, 570 m2	20.00
3	New office building with control center & IT infrastructure	1.00
4	Maintenance workshop with canteen	1.00
	Civil Works Cost (Total A)	**23.50**

B. Mechanical equipment				
S.No	**Description**	**Nos.**	**Rate (Rs. In Cr)**	**Amount (Rs. in Crores)**
1	Mobile Harbour Cranes	1	33.00	33.00
2	Reach Stackers	3	4.00	12.00
3	Tractor Trailer units	10	0.40	4.00
4	Grab Unloaders	1	2.00	2.00
5	Hoppers	2	0.75	1.50
6	Fork Lift Trucks	10	0.17	1.70
	Mechanical Equipment Cost (Total B)			**54.20**

B. Electrical Works		
1	Electrical facilities for illuminating the berth area & Sheds	1.00
	Electrical Works Cost (Total C)	**1.00**
	Total Capital Cost (A + B+C)	**78.70**

Annexure 8.02

Detailed Capital Expenditure of the Project (Phase-2)
(Civil works)

S.No	Description	Amount (Rs. Crore)
A. Civil Works		
1	Pre-Project Activities - site survey, Soil investigations, Preparation of Detailed Project Reports etc	1.00
2	Providing hard standing for container parking yard of total area of 27400 (33570-6170)	16.35
	Civil Works Cost (Total A)	**17.35**

Note :The area of 6170 m2 developed by the port will be handed over to Licensee.

B. Mechanical equipment				
S.No	**Description**	**Nos.**	**Rate (Rs. In Cr)**	**Amount (Rs. in Crores)**
1	Mobile Harbour Cranes	1	33.00	33.00
2	Reach Stackers	3	4.00	12.00
3	Tractor Trailer units	10	0.40	4.00
4	Grab Unloaders	1	2.00	2.00
5	Hoppers	2	0.75	1.50
6	Fork Lift Trucks	10	0.17	1.70
	Mechanical Equipment Cost (Total B)			**54.20**

	Total Capital Cost (A + B)	**71.55**

SECTION 9
FINANCIAL VIABILITY

The Financial Viability is worked out based on the Capital expenditure, its phasing, Traffic available for the project, Operating & Maintenance expenditure, the revenue that can be generated with reference to the investment and traffic etc.

9.1 Capital Cost

The total capital cost of the project as estimated in Section 8, i.e. Rs. 91.21 Crores for Phase-1 and Rs. 82.16 crores for Phase -2 is considered for further analysis. The Total cost estimate of Rs. 173.37 cr is further apportioned to the respective cargo handling heads to work out the O&M expenses and to derive the approximate tariff that can be charged to get the ROCE of 16% as prescribed by TAMP in the Guidelines.

Apportionment of Cap-ex

S.No	Particulars	Amount (Rs. in crore)
A	**Phase-1**	
1	Container Handling	85.48
2	Other cargo Handling (Pulses)	5.73
	Total	**91.21**
B	**Phase-2**	
1	Container Handling	76.43
2	Other cargo Handling (Fertiliser etc)	5.73
	Total	**82.16**
C	**Grand Total**	**173.37**

The Phase-1 is assumed to start from the FY 2021-22 and the commercial operations start in the year 2023-24. Similarly, the phase-2 development is assumed to take effect from the FY 2028-29 and the commercial operations will start in the year 2030-31.

The detailed breakup is given in ***Annexure 9.01***

9.2 Traffic Projections

The Traffic projections given in Section -4 are considered for evaluation. However the same are pegged to the optimum capacity of the terminal calculated as under.

Optimal Capacity of the Container Terminal as per TAMP guidelines :

a) Optimal Quay Capacity	
1. Number of HMCs deployed	2
2. Number of working hours per crane in a year (365 days x 24 hrs)	8760
3. Average number of moves per crane	20
4. TEU ratio	1.3
5. Maximum operable capacity	70%
6. Optimal quay capacity = (1x2x3x4x5) in TEUs	**3,18,864**
b) Optimal Yard Capacity	
1. Total area allotted in hectares	13.4279
2. Area available for operations = 70%	9.3995 Ha
3.Total ground slots (TEUs) per Hectare	350
4.Average Stack height ratio	2.5
5.Period in Number of days	365
6.Surge factor ratio	1.3
7. Average Dwell time in days	6
8. Optimal Yard Capacity = (2x3x4x5x70%)/)6x7) in TEUs	**3,84,888**

Therefore, the Optimal capacity of the Terminal is limited to 3,18,864 TEUS

In view of above, the Traffic projections of the Container terminal are frozen at 3,30,000 TEUs (considering marginal possible increase)**.** However, if the operator desires to invest in the 3rd HMC and the stream of equipments, the traffic as given in the Section-4 to the tune of 3.65 lakh TEUs can be handled in view of the availability of the Ground Slots.

In view of restricting cargo to the optimum capacity and the fact that the storage area is available for other cargoes, the pulses traffic of 3.0 Lakh Tons is considered for all the years of project life of phase-1 and the Fertiliser/other traffic of 3.5 Lakhs during the entire Phase-2.

The year wise Traffic considered is given at ***Annexure- 9.02***

9.3. Operation & Maintenance Cost

For calculation of Operation and maintenance cost, the TAMP guidelines for fixation of upfront Tariff are considered as far as possible. The Broad assumptions for calculating O&M costs are as under.

9.3.1 Repairs & Maintenance Cost:

As per norms specified in Upfront Tariff guidelines 2008, the Repairs & Maintenance cost is estimated at 1% of Civil assets, 2% for Container handling equipment and 5% for other cargo handling equipment.

9.3.2. Insurance

As per Upfront Tariff guidelines, Insurance cost is estimated @ 1% of the gross value of assets.

9.3.3 Other Expenses

As per norms specified in Upfront Tariff guidelines, other expenses are to be estimated at the rate of 15% of Gross value of assets for container operations and at 5% for other cargo operations Multipurpose Terminal which include the following:

a. Salaries and wages of operating and maintenance staff including welfare and other expenses towards them.
b. Management and general overheads and other miscellaneous cost.

9.3.4. License Fee

The License fee for the area proposed to be allotted in each Phase is considered in the respective years.

Phase-1

The area proposed to be allotted to the operator for Phase-1 is 67761 m2 of open area, 3109 m2 of Shed2, 3198 m2 of Shed 4 and 2619 m2 of shed 6. The Sheds 4 and 6 are proposed to be demolished for creating stack yard. Hence the total open area works out to 73578 m2. The Present License fee for open area is 48.38 per sq. meter notified on 31st May 2017. Since the area is going to be allotted in 2021, escalation @ 2% for 4 years is considered to arrive at the LF at the time of handing over. Since Shed No.2 is proposed to be retained for storing pulses etc. the LF of Rs. 104.37 per sq meter for the covered sheds as on 31st May 2017, escalated at 2% for 4 years is considered.

Phase-2

The area proposed to be allotted to the operator for Phase-2 is 48535 m2 of open area, 6170 m2 of Paved area, 2475 m2 of Shed 8, 3521 m2 of Shed 10 and 4988 m2 of shed 12. The Sheds 8 and 10 are proposed to be demolished for creating stack yard. Hence the total open/paved area works out to 60701 m2. The Present License fee for open area is Rs. 48.38 per sq. meter and Rs. 63.88 per sq. meter for paved area notified on 31st May 2017. Since the area is going to be allotted in 2028-29, escalation @ 2% for 12 years is considered to arrive at the LF at the time of handing over. Since Shed No.12 is proposed to be retained for storing pulses etc. the LF of Rs. 104.37 per sq meter for the covered sheds as on 31st May 2017, escalated at 2% for 12 years is considered for the purpose of IRR.

9.3.5. Depreciation

As per Upfront Tariff guidelines, Depreciation is calculated at 3.17% on Civil Assets and at 6.33% for Mechanical assets and at 9.50% for Electrical on Straight line method as per the Companies Act 2013. However, the same is not considered in the cash flows being non-cash expenditure for calculating IRR.

9.3.6. Power cost for Illumination of berth area:

As per norms specified in Upfront Tariff guidelines, the power consumption for illumination of the Liquid Terminal is considered in the absence of any other guidelines for the area illumination. Accordingly, 2.4 lakh units per annum per hectare consumption is considered for the illumination purpose for the entire area of operation. The cost per unit is taken as Rs. 10/- which includes fixed demand charges etc.

9.3.7. Variable operating expenditure

Cost of Fuel etc.

The fuel consumption varies from equipment to equipment based on the usage etc. The fuel consumption of various equipment proposed to be installed is assumed as under.

i)	Mobile Harbour Crane (100T)	- 70 Ltrs per hour
ii)	Reach Stacker	- 14 Ltrs per hour
iii)	Tractor Trailers	- 4 Ltrs per hour
iv)	Grab Unloader	- 15 Ltrs per hour
v)	Fork Lift Trucks (2.5 T)	- 3 Ltrs Per hour

Diesel rate at Rs. 65.62 per litre as per IOCL website on 20th May 2020 prevailing in Kolkata is considered for working out the cost.

The following assumptions are considered for calculating the per TEU cost or Per Ton of cargo handling cost of fuel.

i) Mobile Harbour crane (100 T)

20 Moves per hour with a TEU ratio of 1.3, the TEUs that can be handled per hour are 26 Nos. The Fuel cost per hour is divided by the Number of TEUs to arrive at per TEU cost of fuel.

ii) Reach Stacker

3 Numbers of Reach Stackers are considered to support one MHC operation. Thus one reach stacker can handle 8.67 TEUs (both stacking and delivery). Accordingly, the Fuel cost per hour is divided by the Number of TEUs to arrive at per TEU cost of Fuel.

iii) Tractor Trailers

Each tractor trailer is expected to take 25 minutes per trip to make a round movement and with waiting assumed at 5 mts per trip can handle 2 moves per hour. With the TEU ratio of 1.3, the TEUs that can be transported by a Tractor Trailer per hour works out to 2.60. The Fuel cost per hour is divided by the Number of TEUs to arrive at per TEU cost of fuel.

iv) Grab Unloader

Each Grab unloader is expected to unload 100 tph. An extra time of 20% is assumed for positioning etc. It means in 1.20 hrs, the estimated cargo handling is 100 tons. Accordingly, the Fuel cost per hour is divided by the Number of Tons to arrive at fuel cost per ton.

v) Fork Lift Trucks

Each FLT is expected to handle 12 tph. An extra time of 20% is assumed for positioning etc. It means in 1.20 hrs, the estimated cargo handling is 12 tons. Accordingly, the Fuel cost per hour is divided by the Number of Tons to arrive at fuel cost per ton.

9.3.8. Escalation

The operating expenditure given above is escalated at 2% p.a (compounded) to account for the increase in costs for all the components except at 1% for Insurance. This is due to the fact that the insurance as per market practice is less on Civil assets and more on Mechanical / Electrical assets.

The above assumptions are tabulated below.

Operation & Maintenance Cost

Sl. No.	Particulars	Assumption	Basis
1.	**Repairs & Maintenance Cost**		
a)	Civil Works	1% of Capital Cost	TAMP Guidelines
b)	Mechanical Works	2% for Container Equipment 5% for other cargo Equipment	TAMP Guidelines
c)	Electrical Works	2% of Capital Cost	TAMP Guidelines
2.	**Insurance**	1% of Gross value of assets	TAMP Guidelines
3.	**Other Expenses** This caters to the Salaries & wages and other overheads)	15% of Gross value of assets for container 5% of Gross value of assets – other cargo	TAMP Guidelines
4.	**Lease rentals**	Rs. 48.38/m2 for Open area Rs. 63.88/m2 for Paved area Rs. 104.37 / m2 for Sheds escalated @ 2% p.a.	As per KoPT SOR as on 31-5-2017 escalated up to 2021 for Ph-1 & 2028 for Ph-2 (handing yr)
5.	**Depreciation (SLM)**		
a)	Civil Works	3.17% of Capital Cost	TAMP Guidelines
b)	Mechanical Works	6.33% of Capital Cost	TAMP Guidelines
c)	Electrical Works	9.50% of Capital Cost	TAMP Guidelines

6.	**Power and Fuel cost**		
	Power for illuminating berth and immediate back up area	2.4 lakh units per hectare per annum x Rs.10 per unit	TAMP Guidelines Unit rate as at KoPT
7.	**Fuel Cost**	Rs. 65.62 per Ltr	(Diesel rate on 20-5-20 from IOC at Kolkata)
a)	Mobile Harbour Crane	70 Ltr / hr	TAMP Guidelines Unit rate at Kolkata
b)	Reach Stacker	14 Ltr / hr	Market Practice
c)	Tractor Trailer	4 Ltr / hr	Market Practice
d)	Grab Unloader	15 Ltr / hr	Market Practice
e)	FLT (2.5 ton)	3 Ltr / hr	Market Practice
8.	**Escalation**	1% p.a on Insurance & 2% p.a on other costs	
9.	**Berth Hire**	Not considered	The Berth continues to be with KoPT

The detailed operating cost is given for each phase in ***Annexure 9.03 (a) and 9.03 (b).*** Total Operating and Maintenance cost based on Fixed Cost and Variable cost (for the Fuel) concept for the respective years considering the traffic projections for each year and escalated at 2% p.a is summarized and given at ***Annexure-9.03 (c)***

9.4. Revenue Estimates

9.4.1. The Project is planned to be taken up through PPP mode for Cargo handling operations only. Since the Berth is already constructed by the Port and is going to be maintained by the port, the Vessel related income is going to be earned by the Port. The PPP operator has to invest in constructing the storage yard and procuring the equipment for Container and other cargo operations. Hence the operator can earn Cargo related Charges only at the notified Tariff. The

Upfront Tariff / Reference Tariff needs to be approved by TAMP based on the proposal sent by the port. In order to work out the Feasibility of the Project, the approximate Revenue requirement per TEU or per Ton is worked out based on the TAMP guidelines and the restrictions of Traffic. The key factors considered are :

a) Operating cost + ROCE @ 16% of Capital Cost / Optimal Capacity for Containers

b) Operating cost + ROCE @ 16% of Capital Cost / Possible traffic handling for Other cargo.

The Tariff is escalated at 3% p.a. based on the average Escalation factor notified by TAMP during the past 3 years. The Container traffic is frozen at 3.30 MMT.

9.4.2. The tentative Tariff arrived at based on the Annual Revenue Requirement as per the TAMP guidelines is as under.

i) Container - Rs. 2733.27 per TEU

ii) Pulses - Rs. 112.30 per ton

iii) Fertiliser - Rs. 106.07 per ton

The above tariff together with the applicable escalation is applied to the Projected Traffic of respective years to arrive at the cargo related income of that year. The year wise cargo related income calculated is given in Annexure 9.04.

9.5. Financial Viability and Sensitive Analysis

9.5.1. The Financial viability of the project is analyzed considering 30 years' life period from the date of starting of the construction. For arriving at FIRR, the Current Tariff is increased by 3% every year as stated above and all the O&M expenses are escalated at 2% (except insurance cost at 1%). The Operating income and the O&M expenditure are calculated based on the Cargo handled in the respective years till it reaches the optimal capacity of 3.30 Lakh TEUs in the case of Containers, 3.00 Lakh tons of Pulses and 3.50 lakh tons of Fertilizer etc..

9.5.2. Replacement cost of the Outlived mechanical equipment during the license period is considered as per the life norms below. The present value of the cost of equipment is escalated at 2% for working out the replacement cost in the relevant year of replacement.

The life of various mechanical equipments is considered based on the market practice and the DPR for Balagarh prepared by Tata Consulting Engineers.

i)	Mobile Harbour Crane (100T)	- 20 years
ii)	Reach Stacker	- 15 years
iii)	Tractor Trailers	- 10 years
iv)	Grab Unloader	- 20 years
v)	Fork Lift Trucks (2.5 T)	- 10 years
vi)	Hoppers	- 10 years

9.5.3. Scrap Value of Assets sold within the 30 yrs period is taken as credit and the Realizable value of the asset at the end of Concession Period of 30 years is considered as the obligation to transfer to port account for the purpose of calculating the IRR etc.

Sensitivity analysis has been carried out to gauge the impact of increase in cost and reduction of revenue earnings on the viability of the proposal. The results of the analysis are presented below. The detailed Cash flow statement is given at ***Annexure-9.05 (a) below.***

Table 9.5 (a) (Considering IDC as per TAMP Guidelines)

S.No.	Pre-Tax Project IRR	IRR (%)	NPV @ 9% (in Rs. cr)
1	Base case	16.11%	172.16
2	Capital Cost up by 10%	15.21%	157.65
3	Revenue down by 10%	13.03%	92.55
4	Annual O&M Cost up by 10%	14.12%	124.27

9.5.4 From the above, it is evident that the FIRR of the Project at Base case is 16.13% and in all the other cases of adversity also gives more than 13%. Hence the Project is Financially viable for taking up through PPP in view of interest rates being much lower for investment of funds. The Payback in absolute net revenues works out to be between 13 to 14 years.

9.5.5. TAMP recognizes IDC by permitting 5% as Miscellaneous cost irrespective of the implementation schedule and the market rate of interest. The above IRR calculations are accordingly worked out. *However, Ministry of Shipping vide their letter dated 1st Feb 2017 issued directions to provide second set of numbers calculating the IDC as per prevalent interest rate*, implementation schedule etc while arriving at the cost of project along with IRR and project cost in case of PPP projects. Since this project is on PPP, the IDC is calculated at 10% (Cost of Capital including processing charges etc). Thus, IDC at current cap-ex estimate for both the phases works out to Rs. 16.33 crores based on the implementation schedule given in section 8. However, the Cap-ex already includes Rs. 7.89 cr by way of 5% Misc cost. Hence the net IDC to be considered extra is Rs. 8.44 crores and hence the total project cost including additional IDC works out to Rs.181.81 crores (95.66 cr Ph-1 and Rs. 86.15 cr ph-2). With the same assumptions given in paras above, the Financial viability and Sensitivity analysis are as under. However escalated cost applicable for the year 8 and 9 is taken in the IRR calculation. The detailed Cash flow statement is given ***Annexure-9.05 (b) below.***

Table 9.5 (b) (Considering IDC as per Market Practice)

S.No.	Pre-Tax Project IRR	IRR (%)	NPV @ 9% (in Rs. cr)
1	Base case	15.69%	166.09
2	Capital Cost up by 10%	14.80%	150.97
3	Revenue down by 10%	12.68%	86.48
4	Annual O&M Cost up by 10%	13.75%	118.21

9.5.6. From the above, it is evident that the FIRR of the Project at Base case is 15.69% and in all the other cases of adversity also gives more than 12.60%. Hence the Project is Financially viable for taking up through PPP in view of interest rates are being much lower for investment of funds. The Payback in absolute net revenues works out to be between 13 to 14 years.

9.5.7 The PPP operator is permitted to increase the Tariff upto 15% on achieving the Performance Standards from the 2nd year onwards. But the effect of increase may take place from 3rd year onwards. In such case the IRR for the base case works out to 19.36% with a payback of 12 to 13 years.

9.5.8. The Project is not only attractive it has great economic impact in the region there by much economic benefits for the EXIM trade of the country. The Port may increase their throughput and can earn an incremental revenue not only by Revenue share but also through increased vessel related income besides the Lease rent.

Annexure - 9.01

Apportioned Capital estimates

Phase-1 Rs.Cr

S.No	Item of work	Container operation				Pulses	G.Total
		Civil	Mech	Elect	Total	Mech	
1	Cost estimate	23.50	49.00	1.00	73.50	5.20	**78.70**
2	Detailed Engineering@2%	0.47	0.98	0.02	1.47	0.10	**1.57**
3	Contingencies @ 3%	0.71	1.47	0.03	2.21	0.16	**2.36**
	Sub Total	**24.68**	**51.45**	**1.05**	**77.18**	**5.46**	**82.64**
4	GST at 18% (Excl on Mech/Elec	4.44			4.44		**4.44**
5	Misc cost @ 5% of Project cost	1.23	2.57	0.05	3.86	0.27	**4.13**
	Total Cost	**30.35**	**54.02**	**1.10**	**85.48**	**5.73**	**91.21**

Phase-2 Rs.Cr

S.No	Item of work	Container operation				Fert	G.Total
		Civil	Mech	Elect	Total	Mech	
1	Cost estimate	17.35	49.00		66.35	5.20	**71.55**
2	Detailed Engineering@2%	0.35	0.98	-	1.33	0.10	**1.43**
3	Contingencies @ 3%	0.52	1.47	-	1.99	0.16	**2.15**
	Sub Total	**18.22**	**51.45**	**-**	**69.67**	**5.46**	**75.13**
4	GST at 18% (Excl on Mech/Elec	3.28			3.28		**3.28**
5	Misc cost @ 5% of Project cost	0.91	2.57	-	3.48	0.27	**3.76**
	Total Cost	**22.41**	**54.02**	**-**	**76.43**	**5.73**	**82.16**
		52.76	108.05	1.10	161.91	11.47	173.37

Annexure-9.02

Traffic Projections considered for Financial Calculations - KPD-1

Year of Opn	F Y			AGR	Container TEUs Ph-1	AGR	Container TEUs Ph-2	Container Total	Pulses MTs Ph-1	Fertilizer etc Ph-2
1	2				3		4	5	6	7
1	2021	-	2022		1,00,000					
2	2022	-	2023	2.0%	1,02,000					
3	2023	-	2024	2.0%	1,04,040			1,04,040	3,00,000	
4	2024	-	2025	2.0%	1,06,121			1,06,121	3,00,000	
5	2025	-	2026	2.0%	1,08,243			1,08,243	3,00,000	
6	2026	-	2027	2.0%	1,10,408			1,10,408	3,00,000	
7	2027	-	2028	2.0%	1,12,616			1,12,616	3,00,000	
8	2028	-	2029	2.0%	1,14,869			1,14,869	3,00,000	
9	2029	-	2030	2.0%	1,17,166			1,17,166	3,00,000	
10	2030	-	2031	2.5%	1,20,095	2.5%	1,20,000	2,40,095	3,00,000	3,50,000
11	2031	-	2032	2.5%	1,23,097	2.5%	1,23,000	2,46,097	3,00,000	3,50,000
12	2032	-	2033	3.0%	1,26,790	3.0%	1,26,690	2,53,480	3,00,000	3,50,000
13	2033	-	2034	3.0%	1,30,594	3.0%	1,30,491	2,61,085	3,00,000	3,50,000
14	2034	-	2035	3.0%	1,34,512	3.5%	1,35,058	2,69,570	3,00,000	3,50,000
15	2035	-	2036	3.5%	1,39,220	3.5%	1,39,785	2,79,005	3,00,000	3,50,000
16	2036	-	2037	3.5%	1,44,093	4.00%	1,45,376	2,89,469	3,00,000	3,50,000
17	2037	-	2038	3.5%	1,49,136	4.0%	1,51,191	3,00,327	3,00,000	3,50,000
18	2038	-	2039	3.5%	1,54,356	4.0%	1,57,239	3,11,595	3,00,000	3,50,000
19	2039	-	2040	3.5%	1,59,758	4.0%	1,63,529	3,23,287	3,00,000	3,50,000
20	2040	-	2041	3.5%	1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
21	2041	-	2042	3.5%	1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
22	2042	-	2043	3.5%	1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
23	2043	-	2044	3.5%	1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
24	2044	-	2045	3.5%	1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
25	2045	-	2046	3.5%	1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
26	2046	-	2047		1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
27	2047	-	2048		1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
28	2048	-	2049		1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
29	2049	-	2050		1,65,000		1,65,000	3,30,000	3,00,000	3,50,000
30	2050	-	2051		1,65,000		1,65,000	3,30,000	3,00,000	3,50,000

Annexure-9.03 (a)

Rejuvination of KPD 1

OPERATING COST

		Phase-1				
S.No	**Particulars**		**Rate**	**Container**	**Pulses etc**	**Total Rs lakh**
A	**Fixed Cost**					
1	**Repairs & Maintenance Cost**					
a	Civil works	3,035.03	1%	30.35		30.35
b	Mechanical Equipment for CT	5,402.25	2%	108.05		108.05
c	Mechanical Equipment for Other cargo	573.30	5%		28.67	28.67
d	Electrical works	110.25	2%	2.21		2.21
	Sub Total	**9,120.83**		**140.60**	**28.67**	**169.27**
2	**Insurance for CT equipment**	8,547.53	1%	85.48		85.48
	Insurance for other equipment	573.30	1%		5.73	5.73
	Sub Total	**9,120.83**		**85.48**	**5.73**	**91.21**
3	**Other expenses**					
a	For terminals having capacity less than	8,547.53	15%	1,282.13		1,282.13
	5 Laksh TEUs @ 15% of Gross F Assets					-
b	5% of GFA for Other cargo	573.30	5%		28.67	28.67
	Sub Total	**9,120.83**		**1,282.13**	**28.67**	**1,310.79**
4	**Licence fee**					
	Since the berth is owned by the port, no LF					
	LF for the area to be handed over					
	Ph-1 = 67761+3198+2619= 73578 m2	73578	52.37	462.38		462.38
	Transit Shed 2 = 3109 m2	3109	112.97		42.15	42.15
	(48.38 /m2 as on 31-5-2017)	52.37				
	(104.37 /m2 as on 31-5-2017)	112.97				
	Sub Total			**462.38**	**42.15**	**504.52**
5	**Depreciation**					
a	Civil works	3,035.03	3.17%	96.21		96.21
b	Mechanical Equipjment for CT	5,402.25	6.33%	341.96		341.96
	Mechanical Equipjment for other cargo	573.30	6.33%		36.29	36.29
c	Electrical works	110.25	9.50%	10.47		10.47
	Sub Total	**9,120.83**		**448.65**	**36.29**	**484.94**
6	**Power cost**					
a	For illumination of the entire area					
	LF for the area to be handed over	per sq m	24			
	Ph-1 = 67761+3198+2619 sq m	73578	10	176.59		176.59
	Transit Shed 2 = 3109 m2	3109			7.46	7.46
	Total Area in Sq Mtrs					
	(At 2.4 lakh units p.a per hectare)					
	Sub Total			**176.59**	**7.46**	**184.05**
	Total Fixed Cost			**2,595.81**	**148.96**	**2,744.78**
B	**VARIABLE COST**					
1	**Fuel Cost**	Cons /Hr	Rate/Lt	Moves	TEU/hr	Rs/TEU
a	Mobile Harbour cranes - 1 Nos	70	65.62	20	26.00	176.67
b	Reach stackers 3 Nos	14	65.62		8.67	106.00
c	Tractor - Trailers 10 Nos	4	65.62	2	2.60	100.95
	Total Cost of Fuel per TEU					**383.62**
				Ton/Hr	Factor for Moven	Rs/Ton
d	Grab Unloader 1 No for Pulses Handling	15	65.62	100.00	1.20	11.81
e	FLTs 2.5 ton - 10 Nos for Pulses Handling	3	65.62	12.00	1.20	19.69
	Total Cost per Ton Pulses Handling					**31.50**

Annexure-9.03 (b)

Rejuvination of KPD 1

OPERATING COST

		Phase-2				
S.No	**Particulars**		**Rate**	**Container**	**Fert Cargo**	**Total Rs lakh**
A	**Fixed Cost**					
1	**Repairs & Maintenance Cost**					
a	Civil works	2,240.75	1%	22.41		22.41
b	Mechanical Equipment for CT	5,402.25	2%	108.05		108.05
c	Mechanical Equipment for Fertiliser	573.30	5%		28.67	28.67
d	Electrical works		2%	-		-
	Sub Total	**8,216.30**		**130.45**	**28.67**	**159.12**
2	**Insurance for CT equipment**	7,643.00	1%	76.43		76.43
a	Insurance for equipment-Fertiliser	573.30	1%		5.73	5.73
b	**Sub Total**	**8,216.30**		**76.43**	**5.73**	**82.16**
3	**Other expenses**					
a	For terminals having capacity less than	7,643.00	15%	1,146.45		1,146.45
	5 Laksh TEUs @ 15% of Gross F Assets					-
b	5% of GFA for Fertiliser cargo	573.30	5%		28.67	28.67
	Sub Total	**8,216.30**		**1,146.45**	**28.67**	**1,175.12**
4	**Licence fee**					
	Since the berth is owned by the port, no LF					
	LF for the area to be handed over					
	Ph-2 = 48535+2475+3521	54531	52.37	342.68		393.88
	Paved area = 6170 m2	6170	69.15	51.20		
	Transit Shed 12 = 4988 m2	4988	112.97		67.62	67.62
	(48.38 /m2 as on 31-5-2017)	52.37				-
	(63.88 /m2 as on 31-5-2017)	69.15				
	(104.37 /m2 as on 31-5-2017)	112.97				-
	Sub Total			**393.88**	**67.62**	**461.50**
5	**Depreciation**					
a	Civil works	2,240.75	3.17%	71.03		71.03
b	Mechanical Equipment for CT	5,402.25	6.33%	341.96		341.96
c	Mechanical Equipment for Fertiliser	573.30	6.33%		36.29	36.29
d	Electrical works	-	9.50%	-		-
	Sub Total	**8,216.30**		**412.99**	**36.29**	**449.28**
6	**Power cost**					
a	For illumination of the entire area					
	LF for the area to be handed over		24			
	Ph-2 = 54705+2475+3521-6170	54531	10	130.87		145.68
	6170 m2 of developed area	6170		14.81		
	Transit Shed 12 = 4988 m2	4988			11.97	11.97
	Total Area in Sq Mtrs					-
	(At 2.4 lakh units p.a per hectare)					-
	Sub Total			**145.68**	**11.97**	**157.65**
	Total Fixed Cost			**2,305.89**	**178.95**	**2,484.83**
B	**VARIABLE COST**					
1	**Fuel Cost**	Cons /Hr	Rate/Lt	Moves	TEU/hr	Rs/TEU
a	Mobile Harbour cranes - 1 Nos	70	65.62	20	26.00	176.67
b	Reach stackers 3 Nos	14	65.62		8.67	106.00
c	Tractor - Trailers 10 Nos	4	65.62	2.00	2.60	100.95
	Total Cost of Fuel per TEU					**383.62**
				Ton/Hr	Factor for moven	Rs/Ton
f	Grab Unloader 1 Nos for Fertiliser etc	15	65.62	100.00	1.20	11.81
g	FLTs 2.5 ton - 10 Nos for Fertiliser etc	3	65.62	12.00	1.20	19.69
	(Diesel rate as per IOCL website on 20th May 20)					
	Total Cost per ton of Fertliser Handling					**31.50**

Annexure - 9.03 (c)

REJUVINATION OF KPD 1

Operating Expenses

Rs. Cr

Yr of Opn	F Y			R&M	Insu-rance	Other Exps	LF	Power	Fuel	Total Cash Cost P.a	Depn	Total O&M Exps
				Esc 2%	Esc 1%	Esc 2%	Esc 2%	Esc 2%	Esc 2%			
	Escn											
1	2			3	4	5	6	7	8	9	10	11
1	2021	-	2022				5.05	1.84		6.89		6.89
2	2022	-	2023				5.15	1.88		7.02		7.02
3	2023	-	2024	1.76	0.93	13.64	5.25	1.91	5.14	28.63	9.34	37.97
4	2024	-	2025	1.80	0.94	13.91	5.35	1.95	5.32	29.28	9.34	38.62
5	2025	-	2026	1.83	0.95	14.19	5.46	1.99	5.52	29.94	9.34	39.28
6	2026	-	2027	1.87	0.96	14.47	5.57	2.03	5.72	30.62	9.34	39.96
7	2027	-	2028	1.91	0.97	14.76	5.68	2.07	5.93	31.32	9.34	40.66
8	2028	-	2029	1.94	0.98	15.06	11.10	3.93	6.15	39.15	9.34	48.49
9	2029	-	2030	1.98	0.99	15.36	11.32	4.00	6.37	40.02	9.34	49.37
10	2030	-	2031	3.92	1.90	29.71	11.54	4.08	13.45	64.61	9.34	73.95
11	2031	-	2032	4.00	1.92	30.30	11.78	4.17	14.00	66.17	9.34	75.51
12	2032	-	2033	4.08	1.93	30.91	12.01	4.25	14.64	67.82	9.34	77.16
13	2033	-	2034	4.16	1.95	31.53	12.25	4.33	15.30	69.53	9.34	78.87
14	2034	-	2035	4.25	1.97	32.16	12.50	4.42	16.03	71.32	9.34	80.66
15	2035	-	2036	4.33	1.99	32.80	12.75	4.51	16.82	73.21	9.34	82.55
16	2036	-	2037	4.42	2.01	33.46	13.00	4.60	17.70	75.19	9.34	84.53
17	2037	-	2038	4.51	2.03	34.13	13.26	4.69	18.63	77.25	9.34	86.59
18	2038	-	2039	4.60	2.05	34.81	13.53	4.78	19.60	79.38	9.34	88.72
19	2039	-	2040	4.69	2.07	35.50	13.80	4.88	20.64	81.58	9.34	90.93
20	2040	-	2041	4.78	2.09	36.22	14.07	4.98	21.43	83.57	9.34	92.91
21	2041	-	2042	4.88	2.12	36.94	14.35	5.08	21.85	85.22	9.34	94.56
22	2042	-	2043	4.98	2.14	37.68	14.64	5.18	22.29	86.90	9.34	96.25
23	2043	-	2044	5.08	2.16	38.43	14.93	5.28	22.74	88.62	9.34	97.96
24	2044	-	2045	5.18	2.18	39.20	15.23	5.39	23.19	90.37	9.34	99.71
25	2045	-	2046	5.28	2.20	39.98	15.54	5.50	23.66	92.16	9.34	101.50
26	2046	-	2047	5.39	2.22	40.78	15.85	5.61	24.13	93.98	9.34	103.32
27	2047	-	2048	5.50	2.25	41.60	16.17	5.72	24.61	95.84	9.34	105.18
28	2048	-	2049	5.61	2.27	42.43	16.49	5.83	25.10	97.73	9.34	107.07
29	2049	-	2050	5.72	2.29	43.28	16.82	5.95	25.61	99.66	9.34	109.00
30	2050	-	2051	5.83	2.31	44.15	17.16	6.07	26.12	101.63	9.34	110.97
	Total			114.28	50.78	867.38	357.59	126.90	467.68	1,984.60	261.58	2,246.18

Annexure - 9.04

Cargo related revenue based on Traffic Projections - KPD 1

Rs. Crores

Year of Opn	F Y			Containers			Pulses	Fertiliser		Total	Total	Grand
				Ph-1	Ph-2	Total	Ph-1	Ph-2		Ph-1	Ph-2	Total
1	2			3	4	5	6	7		8	9	10
	Rate			2,733.27	2,733.27		112.30	106.07				
	Esc		3%									
1	2021	-	2022	-	-	-	-			-	-	-
2	2022	-	2023	-	-	-	-			-	-	-
3	2023	-	2024	31.07	-	31.07	3.68	-		34.76	-	34.76
4	2024	-	2025	32.65	-	32.65	3.79	-		36.44	-	36.44
5	2025	-	2026	34.30	-	34.30	3.91	-		38.20	-	38.20
6	2026	-	2027	36.03	-	36.03	4.02	-		40.06	-	40.06
7	2027	-	2028	37.86	-	37.86	4.14	-		42.00	-	42.00
8	2028	-	2029	39.77	-	39.77	4.27	-		44.04	-	44.04
9	2029	-	2030	41.78	-	41.78	4.40	-		46.18	-	46.18
10	2030	-	2031	44.11	44.08	88.19	4.53	4.99		48.64	49.07	97.71
11	2031	-	2032	46.57	46.54	93.11	4.66	5.14		51.24	51.68	102.91
12	2032	-	2033	49.41	49.37	98.78	4.80	5.29		54.21	54.66	108.88
13	2033	-	2034	52.42	52.38	104.80	4.95	5.45		57.37	57.83	115.20
14	2034	-	2035	55.61	55.84	111.45	5.10	5.62		60.71	61.45	122.16
15	2035	-	2036	59.28	59.53	118.81	5.25	5.78		64.53	65.31	129.84
16	2036	-	2037	63.20	63.76	126.96	5.41	5.96		68.61	69.72	138.33
17	2037	-	2038	67.37	68.30	135.68	5.57	6.14		72.94	74.44	147.38
18	2038	-	2039	71.82	73.17	144.99	5.74	6.32		77.56	79.49	157.05
19	2039	-	2040	76.57	78.38	154.94	5.91	6.51		82.48	84.89	167.36
20	2040	-	2041	81.45	81.45	162.91	6.08	6.71		87.54	88.16	175.70
21	2041	-	2042	83.90	83.90	167.79	6.27	6.91		90.16	90.80	180.97
22	2042	-	2043	86.41	86.41	172.83	6.46	7.11		92.87	93.53	186.40
23	2043	-	2044	89.01	89.01	178.01	6.65	7.33		95.66	96.33	191.99
24	2044	-	2045	91.68	91.68	183.35	6.85	7.55		98.53	99.22	197.75
25	2045	-	2046	94.43	94.43	188.85	7.05	7.77		101.48	102.20	203.68
26	2046	-	2047	97.26	97.26	194.52	7.27	8.01		104.53	105.27	209.79
27	2047	-	2048	100.18	100.18	200.36	7.48	8.25		107.66	108.42	216.09
28	2048	-	2049	103.18	103.18	206.37	7.71	8.49		110.89	111.68	222.57
29	2049	-	2050	106.28	106.28	212.56	7.94	8.75		114.22	115.03	229.25
30	2050	-	2051	109.47	109.47	218.93	8.18	9.01		117.64	118.48	236.12
				1,883.09	**1,634.58**	**3,517.67**	**158.05**	**143.07**		**2,041.14**	**1,777.65**	**3,818.79**

Annexure - 9.05 (a)

REJUVINATION OF KPD-1

FINANCIAL FEASIBILITY - PROJECT IRR (Considering IDC as per TAMP Guidelines)

						Rs. Cr	16.11%	15.21%	13.03%	14.12%
Year of Opn	F Y			Cap-ex	Total Revenue	O&M Exps Excl depn	Net Operation Cashflows	Sensitivity Analysis		
								Cap-ex +10%	Revenue -10%	O&M +10%
1		2		3	4	5	6	7	8	9
1	2021	-	2022	36.48	-	6.89	-43.37	-47.01	-43.37	-44.05
2	2022	-	2023	54.72	-	7.02	-61.74	-67.22	-61.74	-62.45
3	2023	-	2024		34.76	28.63	6.13	6.13	2.65	3.26
4	2024	-	2025		36.44	29.28	7.16	7.16	3.52	4.23
5	2025	-	2026		38.20	29.94	8.26	8.26	4.44	5.27
6	2026	-	2027		40.06	30.62	9.43	9.43	5.43	6.37
7	2027	-	2028		42.00	31.32	10.68	10.68	6.48	7.55
8	2028	-	2029	37.75	44.04	39.15	-32.86	-36.63	-37.26	-36.77
9	2029	-	2030	56.63	46.18	40.02	-50.47	-56.14	-55.09	-54.48
10	2030	-	2031		97.71	64.61	33.10	33.10	23.33	26.64
11	2031	-	2032		102.91	66.17	36.75	36.75	26.46	30.13
12	2032	-	2033	8.95	108.88	67.82	32.10	31.21	21.21	25.32
13	2033	-	2034	-0.45	115.20	69.53	46.12	46.16	34.60	39.16
14	2034	-	2035		122.16	71.32	50.84	50.84	38.62	43.71
15	2035	-	2036		129.84	73.21	56.64	56.64	43.65	49.32
16	2036	-	2037		138.33	75.19	63.14	63.14	49.30	55.62
17	2037	-	2038	16.47	147.38	77.25	53.66	52.02	38.92	45.94
18	2038	-	2039		157.05	79.38	77.67	77.67	61.97	69.73
19	2039	-	2040		167.36	81.58	85.78	85.78	69.04	77.62
20	2040	-	2041	10.49	175.70	83.57	81.64	80.59	64.07	73.28
21	2041	-	2042		180.97	85.22	95.75	95.75	77.65	87.23
22	2042	-	2043	63.96	186.40	86.90	35.53	29.14	16.89	26.84
23	2043	-	2044	-	191.99	88.62	103.37	103.37	84.17	94.51
24	2044	-	2045		197.75	90.37	107.38	107.38	87.60	98.34
25	2045	-	2046	19.30	203.68	92.16	92.22	90.29	71.86	83.01
26	2046	-	2047		209.79	93.98	115.81	115.81	94.83	106.42
27	2047	-	2048		216.09	95.84	120.25	120.25	98.64	110.67
28	2048	-	2049		222.57	97.73	124.84	124.84	102.58	115.07
29	2049	-	2050		229.25	99.66	129.58	129.58	106.66	119.62
30	2050	-	2051		236.12	101.63	134.49	134.49	110.88	124.33
	Total			**304.31**	**3,818.79**	**1,984.60**	**1,529.88**	**1,499.45**	**1,148.00**	**1,331.42**
	Note:	*Capex escalated at 2% p.a.*								
		Scrap value of equipement sold is taken in year 12. Reaslisable value of equpt at the end of 30 yrs is to port								
						FIRR	16.11%	15.21%	13.03%	14.12%
						NPV@9%	₹ 172.16	₹ 157.65	₹ 92.55	₹ 124.27

Annexure - 9.05 (b)

REJUVINATION OF KPD-1

FINANCIAL FEASIBILITY - PROJECT IRR considering IDC as per market practice

						Rs. Cr	15.69%	14.80%	12.68%	13.75%
Year of Opn	F Y			Cap-ex	Total Revenue	O&M Exps Excl depn	Net Operation Cashflows	Sensitivity Analysis		
								Cap-ex +10%	Revenue -10%	O&M +10%
1		2		3	4	5	6	7	8	9
1	2021	-	2022	38.26	-	6.89	-45.15	-48.97	-45.15	-45.84
2	2022	-	2023	57.39	-	7.02	-64.42	-70.16	-64.42	-65.12
3	2023	-	2024		34.76	28.63	6.13	6.13	2.65	3.26
4	2024	-	2025		36.44	29.28	7.16	7.16	3.52	4.23
5	2025	-	2026		38.20	29.94	8.26	8.26	4.44	5.27
6	2026	-	2027		40.06	30.62	9.43	9.43	5.43	6.37
7	2027	-	2028		42.00	31.32	10.68	10.68	6.48	7.55
8	2028	-	2029	39.58	44.04	39.15	-34.69	-38.65	-39.09	-38.60
9	2029	-	2030	59.37	46.18	40.02	-53.22	-59.15	-57.83	-57.22
10	2030	-	2031		97.71	64.61	33.10	33.10	23.33	26.64
11	2031	-	2032		102.91	66.17	36.75	36.75	26.46	30.13
12	2032	-	2033	8.95	108.88	67.82	32.10	31.21	21.21	25.32
13	2033	-	2034	-0.45	115.20	69.53	46.11	46.16	34.59	39.16
14	2034	-	2035		122.16	71.32	50.84	50.84	38.62	43.71
15	2035	-	2036		129.84	73.21	56.64	56.64	43.65	49.32
16	2036	-	2037		138.33	75.19	63.14	63.14	49.30	55.62
17	2037	-	2038	16.47	147.38	77.25	53.66	52.02	38.92	45.94
18	2038	-	2039		157.05	79.38	77.67	77.67	61.97	69.73
19	2039	-	2040		167.36	81.58	85.78	85.78	69.04	77.62
20	2040	-	2041	10.49	175.70	83.57	81.64	80.59	64.07	73.28
21	2041	-	2042		180.97	85.22	95.75	95.75	77.65	87.23
22	2042	-	2043	63.96	186.40	86.90	35.53	29.14	16.89	26.84
23	2043	-	2044	-	191.99	88.62	103.37	103.37	84.17	94.51
24	2044	-	2045		197.75	90.37	107.38	107.38	87.60	98.34
25	2045	-	2046	19.30	203.68	92.16	92.22	90.29	71.86	83.01
26	2046	-	2047		209.79	93.98	115.81	115.81	94.83	106.42
27	2047	-	2048		216.09	95.84	120.25	120.25	98.64	110.67
28	2048	-	2049		222.57	97.73	124.84	124.84	102.58	115.07
29	2049	-	2050		229.25	99.66	129.58	129.58	106.66	119.62
30	2050	-	2051		236.12	101.63	134.49	134.49	110.88	124.33
	Total			**313.34**	**3,818.79**	**1,984.60**	**1,520.85**	**1,489.52**	**1,138.97**	**1,322.39**
	Note:	*Capex escalated at 2% p.a. for the phase-2*								
		Scrap value of equipement sold is taken in year 12. Reaslisable value of equpt at the end of 30 yrs is to port								
						FIRR	15.69%	14.80%	12.68%	13.75%
						NPV@9%	₹ 166.09	₹ 150.97	₹ 86.48	₹ 118.21