



PARADIP PORT AUTHORITY

Augmentation of Iron Ore Berth (IOB) and construction of South Quay-II (SQ-II) Berth on BOT basis – Replies to Pre-Bid Queries

CORRIGENDUM-I

(Tender Id: 2026_MoS_900764_1)

No. ENG/CE/1607/IOB/2025/522, dt.08.04.2026

**AUGMENTATION OF IRON ORE BERTH (IOB) AND CONSTRUCTION OF SOUTH QUAY-II (SQ-II) BERTH ON BOT
BASIS – REPLIES TO PRE-BID QUERIES**

Sl. No.	Clause/ Reference	Queries	PPA Clarifications
1.	TEFR/ Clause 3.3	Export Cargo Handling IOB Berth - Can bidder handle other export bulk commodities e.g. (Thermal Coal, Lumps etc) with Iron Ore and Pellets.	The permitted cargo in the Terminal is dry bulk cargo, both exports and/or imports. As such, Bidders, based on type of cargo and nature of handling, can design the Terminal facilities to the tune of 13 MTPA capacity.
2.	TEFR/ Clause 4.1	Export Cargo Handling SQ II Berth - Can bidder handle other export bulk commodities e.g. (Thermal Coal, Lumps etc) with Iron Ore and Pellets	Please refer to the reply at Sl. No. 1.
3.	TEFR/ Clause 7.2	Estimate of Earnings- Will berth hire be applicable for new berth or existing Iron Ore Berth	For estimate of earnings, Bidders to note that the selected Concessionaire shall fix the Cargo Handling Charges/Tariff based on market conditions and on such other conditions, if any, and shall be entitled to collect the same from the users of the Project Facilities and Services. The Concessionaire will collect the berth hire charges for IOB and SQ-II from the vessel owners. The Concessioning Authority will collect the other vessel related charges from vessel owners like Port dues, Pilotage & Towage etc., as per Tariff Notification as revised from time to time. The Concessionaire shall pay to the Concessioning Authority Royalty per Month in the manner as provided in the Concession Agreement.
4.	RFQ	The project site will be to the tune of 1,47,000 Sqm for cargo storage and other operational usages for the project. Is it planned for both the berths.	Project site is to the tune of 1,47,000 Sqm, of which stack yard area is ~1.00 lakh Sqm. The back up/stock pile area and tipplers are common to both the existing IOB & SQ-II berth. Accordingly, the stack yard is intended to serve as a common facility for integrated operations of both the existing Iron Ore Berth and the SQ-II Berth.

AUGMENTATION OF IRON ORE BERTH (IOB) AND CONSTRUCTION OF SOUTH QUAY-II (SQ-II) BERTH ON BOT BASIS – REPLIES TO PRE-BID QUERIES

Sl. No.	Clause/ Reference	Queries	PPA Clarifications
5.	DCA/ Appendix 5	The implementation schedule is estimated as 24 months, which is very optimistic. Request the implementation schedule is kept as 48 months.	Bidders to note that within 24 months construction of SQ-II berth along with allied facilities is only required to be completed and operations to be commenced in the SQ-II berth. The overall duration of the construction phase for completion of the project viz. “Augmentation of Iron ore Berth (IOB) and construction of South Quay-II (SQ-II) Berth” is 48 months.
6.	DCA	Kindly clarify that the MGC mentioned here is the sum of both the berths (IOB + new SQ-II Berth).	Yes. MGC specified in the DCA pertains to the combined capacity of both the berths, namely the existing Iron Ore Berth (IOB) and the new SQ-II Berth.
7.	DCA/ Appendix 8	Whether the EC is being sought for specific commodities mainly for export handling or under a generic bulk cargo category.	Environmental Clearance (EC) will be for handling dry bulk cargo in the Terminal.
8.	General	Kindly let us know the rail connectivity i.e. after tripling of inward rakes, rake hauling towards which terminal in PPA.	Bidders to note that after tripling of inward rakes, no specific destination terminal is designated and it shall be kept open to be decided on a case to case as per requirement.
9.	General	Request confirmation whether the proposed rail track layout has been reviewed and approved by Indian Railways. Further, please confirm whether the Detailed Project Report (DPR) for the same is available and can be shared for our reference.	Rail connectivity to the Wagon Tiplers is in place and upgradation will be carried out by the Concessionaire. The Railway DPR covering the Railway facilities, layout, Rail sidings etc. will be prepared and approval taken from the Competent Authority by the Concessionaire for upgradation of the Rail facilities for the Terminal.
10.	General	What will be the distance from SQ II berth to back up yard?	The backup yard is located adjacent to the new SQ-II Berth and existing IOB berth. It will serve as intended to serve as a common facility for integrated operations of both the existing iron ore berth and the SQ-II Berth.

AUGMENTATION OF IRON ORE BERTH (IOB) AND CONSTRUCTION OF SOUTH QUAY-II (SQ-II) BERTH ON BOT BASIS – REPLIES TO PRE-BID QUERIES

Sl. No.	Clause/ Reference	Queries	PPA Clarifications
11.	DCA/ Appendix 1	Project Site: Request you to kindly provide a clear demarcated area of the project site mentioned in 1,47,000 Sqm, of which stack yard area is 1,00,235 Sqm. Request Authority to share the CAD drawings for assessment of Cost. Boundaries and coordinates of the total allocated area (1,47,000 sqm) • Segregation of stack yard area (1,00,235 sqm) and balance land • Existing vs proposed infrastructure within the boundary • Stack yard layout and levels • Berth alignment and connectivity corridors • Rail and road alignment drawings • Existing utility corridors (power, water, drainage, etc.)	Project site is to the tune of 1,47,000 Sqm, of which stack yard area is ~1 lakh Sqm. The back up/stock pile area and tippers are common to both the existing IOB & SQ-II berth. The project back up area is indicated in the TEFR and broadly comprises of the following: • Stackyard/Storage Area: The stack yard is equipped with two (02) Stacker-cum-Reclaimers, two (02) Reclaimers, and one (01) Ship loader for efficient material handling. • Berth Infrastructure: The existing Iron Ore Berth (IOB) has a length of 210 m, with a dolphin-to-dolphin distance of 320 m. • Rail Handling Facilities: The site includes two (02) Rotary Wagon Tippers (WT-149 & WT-150) along with associated auxiliary systems and supporting rail connectivity infrastructure. • Conveyor System & Ancillaries: The conveyor network comprises two (02) tunnel conveyors (1A & 1B), two (02) reversible/cross conveyors (2A & 2B), two (02) yard conveyors (3A & 3B), and two (02) shipping conveyors (IV & VI), along with junction houses, operational buildings, and other ancillary facilities. The Terminal to be equipped with capacity to handle 13 MTPA of permitted cargo and the salient equipment are as under: (a) Ship Loaders on SQ-II - 2 nos. (b) Stacker cum Reclaimer - 3 nos. Bidders are however, also advised to visit the project site and independently assess the condition by conducting their own surveys and investigations.

AUGMENTATION OF IRON ORE BERTH (IOB) AND CONSTRUCTION OF SOUTH QUAY-II (SQ-II) BERTH ON BOT BASIS – REPLIES TO PRE-BID QUERIES

Sl. No.	Clause/ Reference	Queries	PPA Clarifications
12.	DCA/ Appendix 2	Port Assets: Request the authorities to share the detailed Condition Survey of the existing equipment as mentioned in Appendix 2 (A).	Please refer to Annexure-I for the Condition Survey of Iron Ore Berth. The equipment mentioned in Appendix 2(A) of DCA are currently operational and in working condition. Bidders are however, also advised to visit the project site and independently conduct their own surveys and investigations.
13.	DCA/ Appendix 4	Scope of Work: Kindly clarify if the project facility capacity of 13 MTPA is the sum of existing IOB and new SQ-II Berth. If yes, please advise the breakup.	Yes. Bidders to assume that the capacity of each Berth/Quay is to the tune of 50% of the Terminal Capacity. Bidders may also note that the total cargo handled at both the IOB & SQ-II Berths will be considered towards fulfilment of MGC.
14.	DCA/ Appendix 5	Project Schedule: Considering the extensive work to be carried out to make the new SQ-II berth the schedule time of operation commencement of 24 months is very short. Is the authority willing to consider shifting the milestone of SQ-II Berth to 48 th month?	Please refer to reply at Sl. No. 5.
15.	DCA/ Appendix 13	Minimum Guaranteed Cargo: Please kindly clarify that the MGC mentioned here is the sum of both the berths (IOB + new SQ-II Berth). If yes, the calculation shall be basis 50:50 for both berths or sum of total cargo volume irrespective of the % contribution of each berth.	Yes. The total cargo handled at the Terminal will be considered towards fulfilment of MGC, irrespective of the % contribution of each berth.

AUGMENTATION OF IRON ORE BERTH (IOB) AND CONSTRUCTION OF SOUTH QUAY-II (SQ-II) BERTH ON BOT BASIS – REPLIES TO PRE-BID QUERIES

Sl. No.	Clause/ Reference	Queries	PPA Clarifications
16.	DCA/ Appendix 8	Whether the EC is being sought for specific commodities or under a generic bulk cargo category allowing flexibility to handle multiple commodities without amendment. Kindly confirm whether the Environmental Clearance being obtained/ proposed by the Authority includes marine components, specifically: • Berth construction • Dredging & Reclamation (if any) And other associated work related to Construction and development of SQ II & IOB.	Environmental Clearance (EC) will be for handling dry bulk cargo in the Terminal. Further, the EC will cover the required construction works including dredging & reclamation.
17.	General	Please kindly provide current berth wise volume and utilization rate for current IOB.	Cargo handled at IOB in FY-25 is to the tune of 5.77 Million Tones.
18.	TEFR	What % of Iron ore volume growth does the authority assume for coastal vs Exports?	Please refer to Chapter-3 of the TEFR for “Traffic Scenario and Forecast”.
19.	TEFR	Cargo Flexibility: Will the Selected Bidder be permitted to handle additional/ alternative commodities at SQ-II and IOB in future, beyond those explicitly specified in the TEFR document? If yes, kindly provide: •List of pre-approved/ permissible commodities by the Authority •Process and timeline for approval of new commodities	Please refer to the reply at Sl. No. 1 Bidders are advised to submit their bids considering that the permitted Cargo in the Terminal will be Dry Bulk Cargo.

AUGMENTATION OF IRON ORE BERTH (IOB) AND CONSTRUCTION OF SOUTH QUAY-II (SQ-II) BERTH ON BOT BASIS – REPLIES TO PRE-BID QUERIES

Sl. No.	Clause/ Reference	Queries	PPA Clarifications
20.	TEFR	Equipment Configuration Flexibility: In case of diversification of cargo mix (including non-coal commodities), will the Bidder be allowed to adopt alternate handling configurations (e.g., use of Harbour Mobile Cranes (HMCs), mobile hoppers, or multipurpose systems) in lieu of fixed systems like ship loaders, subject to achieving prescribed performance standards?	Based on the cargo to be handled, the Concessionaire can propose to reconfigure equipment capacity/number/type and submit their proposal with supporting documents to the Independent Engineer. Such proposal may be reviewed and approved by the Independent Engineer if the equipment configuration is capable of handling 13 MTPA of cargo adhering to the prescribed performance standards. Bidders to note that use of Harbour Mobile Cranes (HMCs) is not envisaged in the Terminal.
21.	TEFR	Import/Export Handling Flexibility: Will the Bidder be permitted to handle both import and export cargo using flexible equipment configurations (such as HMC-based systems), provided that the guaranteed performance parameters (throughput, turnaround time, etc.) are met?	Please refer to the replies at Sl. No. 1 & 20.
22.	TEFR	Proposed berth size indicated as 210 m (L) × 26 m (W) Whether the bidder is required to strictly adhere to the berth dimensions (210 m × 26 m) as specified in the TEFR, or will flexibility be permitted to optimize the berth dimensions based on the selected equipment configuration, vessel mix, and operational philosophy, subject to approval of the Authority? In case of alternate berth dimensions proposed by the bidder, what will be the approval mechanism and evaluation criteria by the Authority? Will such deviations have any impact on bid evaluation or only be reviewed at detailed engineering stage?	The Concessionaire shall design & construct the SQ-II Berth such that the distance between berth edge on JSWPTPL side to dolphin center on IOB side shall not be less than 260 m. The width of the berth has been indicated as 26 m considering practical operational requirements.

AUGMENTATION OF IRON ORE BERTH (IOB) AND CONSTRUCTION OF SOUTH QUAY-II (SQ-II) BERTH ON BOT BASIS – REPLIES TO PRE-BID QUERIES

Sl. No.	Clause/ Reference	Queries	PPA Clarifications
23.	TEFR	Kindly confirm whether the following studies/reports are available and can be shared with bidders prior to bid submission: • Detailed feasibility report/ TEFR backup studies • Bathymetric and hydrographic survey data • Geotechnical investigation reports (bore logs, soil parameters) • Berth alignment and layout finalization studies • Any previous DPR/ engineering consultant reports, drawings etc.	The TEFR has been shared as part of the Bidding Documents. The indicative layout of the project site is given in the TEFR. The exact design layouts and construction drawings will be prepared by the selected Concessionaire as part of Detailed Engineering. Available bore log data is enclosed as Annexure-II. Bidders may note that the soil conditions within the project site comprises of sand, silt, clay or a mixture of above and there are no rock strata. Bidders are also advised to visit the Project site and ascertain the site conditions including carrying out their own surveys & investigations prior to submission of Bids. The bathymetry chart is enclosed as Annexure-III.
24.	TEFR/ Chapter 4 & DCA	Kindly clarify the basis for considering 3000 TPH conveyor capacity in TEFR, against 2 × 3200 TPH Ship Loaders (SLs) specified in the DCA. Whether the conveyor system is intended to feed both SLs simultaneously or operate under a different philosophy?	The equipment configuration given in the TEFR is indicative. Based on the cargo/commodity to be actually handled, the Concessionaire can design the terminal facilities, reconfigure equipment capacity/number/type and submit their proposal with supporting documents to the Independent Engineer. Such proposal may be reviewed and approved by the Independent Engineer if the terminal facilities and equipment configuration is capable of handling 13 MTPA of permitted cargo in fully mechanized manner adhering to the prescribed performance standards.

AUGMENTATION OF IRON ORE BERTH (IOB) AND CONSTRUCTION OF SOUTH QUAY-II (SQ-II) BERTH ON BOT BASIS – REPLIES TO PRE-BID QUERIES

Sl. No.	Clause/ Reference	Queries	PPA Clarifications
25.	DCA & TEFR	Kindly confirm whether any conceptual/ detailed layout plan has been developed by the Authority (or its consultants) for sharing of equipment between IOB and SQ-II (including routing, transfer points, stockyard interface, and evacuation systems). If available, the same may please be shared with bidders. Or will the bidder be allowed to reconfigure/ deviate from any indicative layout (if provided), including equipment type, routing philosophy, and interface arrangements between IOB and SQ-II, based on the bidder's design and operational approach, subject to meeting prescribed performance parameters? Are there any constraints on simultaneous operations at IOB and SQ-II while using shared equipment (e.g., priority rules, operational restrictions, or minimum guaranteed capacity allocation)?	Please refer to the reply at Sl. No. 24.
26.	TEFR & DCA	Kindly provide the latest health assessment/ condition report of the existing Wagon Tippers, including: • Mechanical and structural condition • Residual life assessment • Availability and reliability data (uptime, breakdown history) • Current rated vs achievable throughput In case the bidder is required to rely on existing Wagon Tippers, kindly confirm whether performance risk (meeting guaranteed throughput/ turnaround) attributable to these assets will be borne by the Authority.	Please refer to the reply at Sl. No. 12. Any issues arising out of tippers' performance etc. shall not be attributable to the Authority. The Concessionaire is required to construct the project facilities including any upgradation of the assets handed over under Appendix 2 of DCA so that the Terminal is capable of handling 13 MTPA of permitted cargo in accordance with the Performance Standards.

AUGMENTATION OF IRON ORE BERTH (IOB) AND CONSTRUCTION OF SOUTH QUAY-II (SQ-II) BERTH ON BOT BASIS – REPLIES TO PRE-BID QUERIES

Sl. No.	Clause/ Reference	Queries	PPA Clarifications
27.	General, DCA	Kindly provide details of insurance policies currently in place for existing assets, including IOB, covering: • Type of policies • Validity period and insurer details Please clarify whether existing insurance policies will continue under Authority's scope or need to be taken over/ replaced by the Bidder upon commencement of the concession.	The Concessionaire shall effect and maintain at its own cost, during the Concession Period insurances as may be required under the Financing Agreements Applicable Laws, and in accordance with Good Industry Practice.
28.	DCA	Kindly confirm whether the Berth Hire Charges for vessels calling at the newly developed SQ-II berth and existing IOB shall be levied and collected by the Concessionaire or retained by the Authority.	Please refer to the reply at Sl. No. 3.
29.	General	Kindly confirm whether any railway line augmentation/ additional siding/ connectivity enhancement is envisaged by the Authority to support the projected cargo capacity at SQ-II and IOB. If such augmentation is planned, request the Authority to share the Detailed Project Report (DPR)/ Feasibility Study, including: • Alignment and layout drawings • Capacity (rakes per day) and design assumptions • Phasing and implementation timeline	Please refer to the reply at Sl. No. 9. The Railway DPR covering the Railway facilities, layout, Rail sidings etc. will be prepared and approval taken from the Competent Authority by the Concessionaire for up-gradation of the Rail facilities for the Terminal.
30.	TEFR	Kindly confirm whether a formal agreement/ consent from JSW has been obtained for use of their berth bollards for mooring operations. If yes, request sharing of the relevant agreement/ MoU. In case of non-availability/ withdrawal of access by JSW, kindly clarify whether the same will be treated as Authority risk, including any impact on vessel handling performance.	The access to JSW bollards is not assured and shall not form part of the committed project scope. Use of the same may be considered on mutual consent basis Any associated risks, including potential impact on vessel handling performance arising from non-availability of such facilities, shall not be attributable to the Authority.



CHAPTER-14 HEALTH AUDIT OF IRON ORE BERTH

1.0 Introduction

The Condition Assessment of concrete in the Reinforced Concrete (RC) structural elements of the Iron Ore Berth of Paradip Port, which is being utilised for berthing of Bulk carriers. The assignment includes (i) Qualitative assessment of all berths using underwater visual inspection and (ii) Quantitative assessment of the condition of concrete of the RC piled structure of various berths through visual inspection, rebound hammer, UPV& core tests etc. This chapter outlines the details of the site investigation carried out to assess the quality of concrete, analysis of data obtained during the site investigation for the distressed structural elements of Iron Ore Berth.

2.0 Structure Investigated

The Iron ore berth is one of the oldest berths of Paradip Port and is located in the eastern dock. It has a dredged depth of 13.5 m and the length of 210 m. It is a fixed jetty having a R.C.C. deck supported on steel tubular piles and connecting shore arms. The berth is equipped with a mechanised ore loading system with twin wagon tippers, conveyor system, stackers, reclaimers and one ship loader. The layout of Iron Ore Berth is shown in **Fig 2.1**

The Iron Ore Berth was one of the berths investigated. The present investigation covers the deck elements above the water level on the Berthing side of the Iron Ore Berth through Quantitative assessment. In case of below water level, the investigation was through Qualitative assessment by underwater videography.

3.0 Summary of Findings

3.1 Quantitative Assessment

After carrying out various Quantitative investigations during the period from (19/02/2019) to (24/02/2019), the results and findings under the relevant tests covered under the scope of work are summarized below;

- Visual Inspection
- Rebound Hammer Test
- Ultrasonic Pulse Velocity (UPV) Test
- Core Test

- Carbonation Test
- Half Cell Potential Test
- Determination of chlorides and pH
- Profoscope Survey

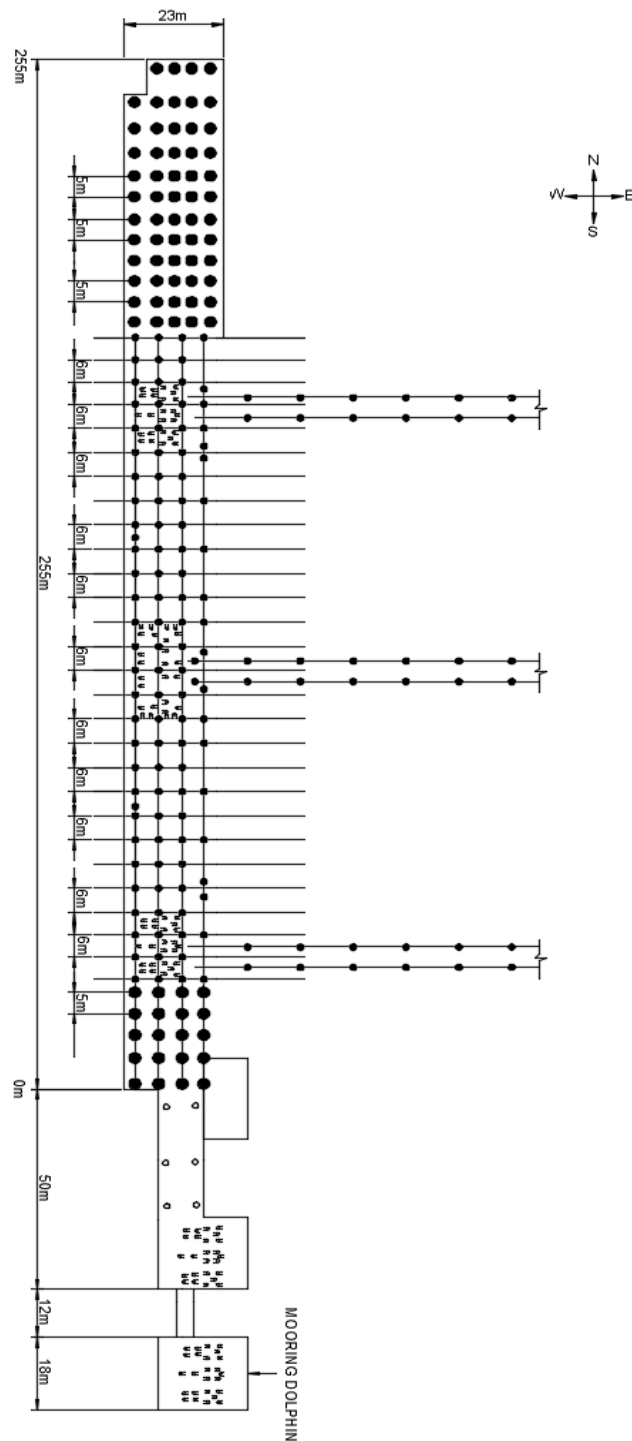


Fig 2.1 Layout of Iron ore berth



3.1.1 Visual Inspection

During the inspection, the following kinds of distress were typically noticed in the Iron Ore Berth of PPT.

- Major distress/ spalling of concrete and exposure of rebar was noticed in most of the Piles of the Iron Ore Berth (**Figure 3.1**). It was observed that concrete jacketing has already been carried out in the Piles.
- Cracks were noticed in some of the RC structural elements, viz., RC Pile caps, RC beams and RC deck slab (**Figure 3.2 & 3.3**). Guniting has already been carried out in the RC beams and the RC Deck slab as well as in the Group Pile caps.
- Leaching was observed in some of the locations in the bottom of the RC deck slab (**Figure 3.4**).
- Major spalling of concrete and exposure of rebar was noticed in some of the locations of the RC structural elements, viz., RC Pile caps, RC beams and RC deck slab on the berthing side (**Figure 3.5,3.6 & 3.7**).



Fig 3.1: A view of the spalling of concrete and exposure of rebar noticed in the Piles



Fig 3.2: A view of the cracks noticed in the bottom of the RC group pile cap



Fig 3.3: A view of the cracking noticed in the RC Beam between the Piles



Fig 3.4: A view of the leaching noticed in the bottom of the RC deck slab



Fig 3.5: A view of the spalling of concrete and exposure of rebar noticed in RC Deck slab on the berthing side



Fig 3.6: A view of the spalling of concrete and exposure of rebar noticed in RC cantilever beam on the berthing side



Fig 3.7: A view of the cracking/spalling of concrete and exposure of rebar noticed in RC Pile cap in the berthing side



3.1.2 Rebound Hammer Test Results

Table 3.1 Summary of the Rebound Hammer Test Results

Sl. No	Identification	No of Points	Rebound Number “R”			Condition of concrete Surface
			Maximum	Minimum	Average	
1	Mooring Dolphin - South	24	46	32	38	Good
2	Fender @ 20m	18	44	30	35	Good
3	Deck Slab @ 60m	24	42	20	33	Good
4	Deck Slab @ 100m	18	30	22	26	Satisfactory
5	Fender @ 140m	24	40	22	34	Good
6	Fender @ 200m	24	46	28	36	Good
Total No. of Points		132 Points				

3.1.3 Ultrasonic Pulse Velocity Test Results

Table 3.2 Summary of the UPV Test Results

Sl. No	Identification	No of Points	Maximum UPV in km/s	Minimum UPV in km/s	Average UPV in km/s	Condition of concrete
1	Moring Dolphin - South	20	4.63	3.51	3.92	Good
2	Fender @ 20m	15	4.69	3.79	4.25	Good
3	Deck Slab @ 60m	20	4.71	1.69	3.48	Medium
4	Deck Slab @ 100m	15	4.36	2.85	3.49	Medium
5	Fender @ 140m	20	4.58	3.17	4.05	Good
6	Fender @ 200m	20	4.74	3.39	4.22	Good
Total No. of Points		110 points				



3.1.4 Core Sampling of Concrete and Carbonation Test

Table 3.3 Detailed Results of the Core & Carbonation Test

Sl. No.	Location of the core sample	Diameter of the core sample in mm	Length of the core sample in mm	Carbonation depth in mm	UPV in km/s	Equivalent Cube Compressive Strength in (MPa)	Average Equivalent Cube Compressive Strength in (MPa)
1	RC Beam @ 10m	69	110	Nil	4.40	34.3	34.3
2	Pile Cap @ 30m	69	138	Nil	4.56	29.9	27.0
3	Pile Cap @ 180m	69	138	Nil	4.52	24.1	
4	Fender @ 100m	69	138	Nil	4.38	31.5	31.1
5	Fender @ 130m	69	138	Nil	4.47	33.5	
6	Fender @ 160m	69	138	Nil	4.60	28.3	

3.1.5 Half-cell Potential Test

Table 3.4 Half-cell Potential Test results

Sl. No	Member Identification	Half Cell Potential Readings in mV
1	Pile Cap @ 30m Visually Good	-371, -369, -348, -339, -368, -371, -389, -370, -369, -361
2	Fender @ 100m Visually Moderate	-404, -426, -489, -440, -448, -429, -436, -439, -409, -421
3	Deck Slab @ 100m Visually Distressed	-602, -628, -599, -636, -637, -634, -589, -629, 634, -619
4	Fender @ 130m Visually Good	-380, -369, -371, -390, -366, -374, -390, -372, -366, -374
5	Fender @ 160m Visually Good	-394, -438, -460, -424, -432, -440, -438, -440, -438, -452
6	Pile Cap @ 180m Visually Distressed	-498, -509, -524, -489, -466, -474, -460, -471, -469, -480



3.1.6 Evaluation of Chlorides and pH

Table 3.5 Results of Chlorides and pH Results

Sl. No.	Member Identification	Chloride Content in (kg/m ³)	pH	Stipulation
1	Pile Cap @ 30m Visually Good	2.62	11.28	Maximum Chloride content in concrete shall not exceed 0.6 kg/m ³ by weight of concrete at the time of placing as per IS: 456-2000.
2	Fender @ 100m Visually Moderate	2.01	11.26	
3	Deck Slab @ 100m Visually Distressed	3.63	11.09	
4	Fender @ 130m Visually Good	3.01	11.60	
5	Fender @ 160m Visually Good	2.88	10.84	
6	Pile Cap @ 180m Visually Distressed	5.31	11.12	

3.1.7 Profoscope Survey

In order to obtain the reinforcement details of the Iron Ore Berth, a Profoscope survey was conducted to obtain a fair idea about the provision of reinforcement. However, it is to be noted that as per the manufacturers of the equipment (Profoscope) an error of $\pm 25\%$ can be expected in the diameter of the rebar. It is also to be noted that Profoscope can detect the rebar only in the first layer if they are situated within 70 mm from the face of the concrete. In case the cover to the reinforcement is more than 70 mm or second layer of reinforcement is provided, the Profoscope will not be able to detect the reinforcing bars.

Since the cover to the reinforcement was more than 70 mm, the Profoscope could not detect the rebar in all the 6 locations where the reinforcement scanning was carried out. This is due to the limitation of the equipment as already pointed out earlier



3.2 Qualitative Assessment

The assessment was made by carrying out underwater visual inspection which was conducted during the period from 21/02/2019 to 22/02/2019 by expert divers who also filmed the condition of the structure using underwater video camera.

3.2.1 Under water Inspection

During the Underwater inspection, the following distresses were typically noticed in the Iron Ore Berth of PPT.

Two piles were visual observation was conducted

Pile 1 - 1.3 m Diameter

- Date & time of observations 21-02-2019 & 11.45 am
- Deck Slab to top of Water level – 3.40 m
- Total Depth of Water – 14.00 m
- The pile cleaning and observation was taken by three different locations at a height of 600mm all-round pile diameter.
- Visually pile liner was good.
- A few representative snap shots taken from video footage at different underwater location of the Pile of Iron Ore berth are shown in below,



Fig 3.8: A view of pile-1 Before cleaning



Fig 3.9: A view of pile-1 after cleaning

Pile 2 - 0.75 m diameter

- Date & time of observations 22-02-2019 & 12.00 pm
- Deck Slab to top of Water level – 3.00 m
- Total Depth of Water – 7.00 m
- The pile cleaning and observation was taken by two different locations at a height of 600 mm all-round pile diameter.
- Minor distress was noticed in the pile liner below the water.
- A few representative snap shots taken from video footage at different underwater location of the Pile of Iron Ore berth are shown in below,



Fig 3.10: A view of exposure of reinforcement in a pile



Fig 3.8: A view of distress in a pile-2



Fig 3.11: A view of exposure of reinforcement in a pile-2

BORE HOLE NO. : MBH-01

LOCATION : EQ Berth

SHEET NO. : 1 OF 4

CO-ORDINATE : E 465778.515 N 2241904.660

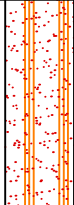
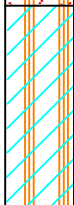
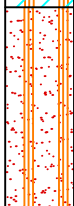
DATE : 01/07/2016 to 04/07/2016

GROUND R. L. : -14.53 m

METHOD : ROTARY DRILLING

GROUND W. T. : MARINE BORE HOLE

CASING : 100 mm Ø Nx Upto 25.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
1.00	100 Ø MM		Grayish fine grained medium silty SAND	0.00	DS1								
				0.50									
2.00				1.50	SPT1	15 04	30 05	45 07	60 06	N 12			
				2.10									
3.00			Yellowish very stiff silty CLAY	3.00	DS2								
				3.50									
4.00				3.50	UDS1								
				4.10									
5.00				5.00	DS3								
				5.50									
6.00				5.50	SPT2	15 06	30 07	45 09	60 11	N 16			
				6.10									
7.00			Yellowish fine grained medium silty SAND	7.00	DS4								
				7.50									
8.00				7.50	SPT3	15 08	30 12	45 16	60 20	N 28			
				8.10									
9.00				9.00	DS5								
				9.50									
10.00				9.50	SPT4	15 06	30 09	45 13	60 15	N 22			
				10.10									

SPT N = STANDARD PENETRATION TEST VALUE

RQD = ROCK QUALITY DESIGNATION

UDS = UNDISTURBED SOIL SAMPLE

SCALE : 1: 50

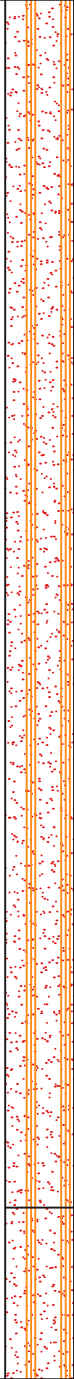
CR = CORE RECOVERY

DS = DISTURBED SOIL SAMPLE

VST = VANE SHEAR TEST

JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port			
BORE HOLE NO. : MBH-01			
LOCATION : EQ Berth		SHEET NO. : 2 OF 4	
CO-ORDINATE : E 465778.515 N 2241904.660		DATE : 01/07/2016 to 04/07/2016	
GROUND R. L. : -14.53 m		METHOD : ROTARY DRILLING	
GROUND W. T. : MARINE BORE HOLE		CASING : 100 mm Ø Nx Upto 25.00m Below G.L.	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
11.00	100 Ø MM		Yellowish fine grained dense silty SAND	11.00	DS6								
				11.50									
				11.50	SPT5	15	30	45	60	N			
				12.10		10	15	17	20	32			
12.00													
				13.00	DS7								
				13.50									
				13.50	SPT6	15	30	45	60	N			
				14.10		09	14	18	21	32			
14.00													
				15.00	DS8								
				15.50									
				15.50	SPT7	15	30	45	60	N			
				16.10		11	14	17	20	31			
16.00													
				17.00	DS9								
				17.50									
				17.50	SPT8	15	30	45	60	N			
				18.10		09	13	14	23	32			
18.00													
			Yellowish fine grained medium silty SAND	19.00	DS10								
				19.50									
				19.50	SPT9	15	30	45	60	N			
				20.10		08	11	14	17	25			
20.00													

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-01	
LOCATION : EQ Berth	SHEET NO. : 3 OF 4
CO-ORDINATE : E 465778.515 N 2241904.660	DATE : 01/07/2016 to 04/07/2016
GROUND R. L. : -14.53 m	METHOD : ROTARY DRILLING
GROUND W. T. : MARINE BORE HOLE	CASING : 100 mm Ø Nx Upto 25.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
21.00	100 Ø MM		Yellowish fine grained dense silty SAND	21.00	DS11								
				21.50									
				21.50	SPT10	15	30	45	60	N			
				22.10		10	12	18	29	30			
22.00													
				23.00	DS12								
				23.50									
				23.50	SPT11	15	30	45	60	N			
				24.10		13	17	21	24	38			
24.00													
				25.00	DS13								
				25.50									
			Yellowish fine grained medium silty SAND	25.50	SPT12	15	30	45	60	N			
				26.10		09	11	13	14	24			
26.00													
				27.00	DS14								
				27.50									
				27.50	SPT13	15	30	45	60	N			
				28.10		07	10	13	18	23			
28.00													
				29.00	DS15								
				29.50									
				29.50	SPT14	15	30	45	60	N			
				30.10		06	08	11	14	19			
30.00													

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-01	
LOCATION : EQ Berth	SHEET NO. : 4 OF 4
CO-ORDINATE : E 465778.515 N 2241904.660	DATE : 01/07/2016 to 04/07/2016
GROUND R. L. : -14.53 m	METHOD : ROTARY DRILLING
GROUND W. T. : MARINE BORE HOLE	CASING : 100 mm Ø Nx Upto 25.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
31.00	100 Ø MM		Yellowish fine grained dense silty SAND	31.00	DS16								
				31.50									
				31.50	SPT15	15	30	45	60	N			
				32.10		11	14	18	23	32			
32.00													
				33.00	DS17								
				33.50									
			Yellowish fine grained medium silty SAND	33.50	SPT16	15	30	45	60	N			
				34.10		08	11	13	16	24			
34.00													
				35.00	DS18								
				35.50									
				35.50	SPT17	15	30	45	60	N			
				36.10		08	10	13	15	23			
36.00													
				37.00	DS18								
				37.50									
				37.50	SPT18	15	30	45	60	N			
				38.10		07	10	13	15	23			
38.00													
				39.00	DS20								
				39.50									
				39.50	SPT19	15	30	45	60	N			
				40.10		08	10	13	15	23			
40.00													

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port			
BORE HOLE NO. : MBH-03			
LOCATION : EQ Berth		SHEET NO. : 1 OF 5	
CO-ORDINATE : E 465853.522 N 2242057.217		DATE : 26/06/2016 to 29/06/2016	
GROUND R. L. : -12.907 m		METHOD : ROTARY DRILLING	
GROUND W. T. : MARINE BORE HOLE		CASING : 100 mm Ø Nx Upto 30.00m Below G.L.	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	15	15	15					
1.00	100 Ø MM		Grayish stiff silty CLAY	0.00	DS1									
				0.50										
				1.50		SPT1	15	30	45	60	N			
2.10				03	05		07	07	12					
3.00				DS2										
3.50														
3.50					UDS1									
4.00														
5.00					Grayish fine grained medium silty SAND	5.00	DS3							
5.50														
5.50		SPT2	15			30	45	60	N					
6.10			08			10	12	20	27					
7.00			DS4											
7.00														
7.50														
8.00			Grayish fine grained dense silty SAND			7.50	SPT3	15	30	45	60	N		
8.10	07					13		20	21	33				
9.00	DS5													
9.00														
9.50				SPT4	15	30	45	60	N					
9.50	10				12	19	23	31						
10.10														
10.00														

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-03	
LOCATION : EQ Berth	SHEET NO. : 2 OF 5
CO-ORDINATE : E 465853.522 N 2242057.217	DATE : 26/06/2016 to 29/06/2016
GROUND R. L. : -12.907 m	METHOD : ROTARY DRILLING
GROUND W. T. : MARINE BORE HOLE	CASING : 100 mm Ø Nx Upto 30.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
11.00	100 Ø MM		Grayish fine grained dense silty SAND	11.00	DS6								
				11.50									
				11.50	SPT5	15	30	45	60	N			
				12.10		09	14	16	20	30			
12.00													
				13.00	DS7								
				13.50									
				13.50	SPT6	15	30	45	60	N			
				14.10		14	20	24	31	44			
14.00													
				15.00	DS8								
				15.50									
			Yellowish fine grained very dense silty SAND	15.50	SPT7	15	30	45	60	N			
				16.10		16	22	28	36	50			
16.00													
				17.00	DS9								
				17.50									
				17.50	SPT8	15	30	45	60	N			
				18.10		17	20	25	31	45			
18.00													
				19.00	DS10								
				19.50									
				19.50	SPT9	15	30	45	60	N			
				20.10		15	25	30	35	55			
20.00													

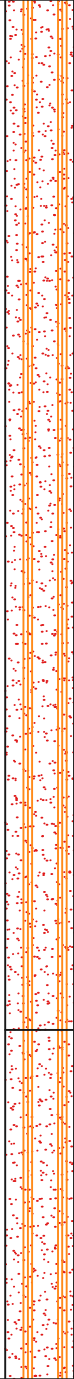
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-03	
LOCATION : EQ Berth	SHEET NO. : 3 OF 5
CO-ORDINATE : E 465853.522 N 2242057.217	DATE : 26/06/2016 to 29/06/2016
GROUND R. L. : -12.907 m	METHOD : ROTARY DRILLING
GROUND W. T. : MARINE BORE HOLE	CASING : 100 mm Ø Nx Upto 30.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
21.00	100 Ø MM		Grayish fine grained dense silty SAND	21.00	DS11								
				21.50									
				21.50	SPT10	15	30	45	60	N			
				22.10		12	18	20	26	38			
22.00													
				23.00	DS12								
				23.50									
				23.50	SPT11	15	30	45	60	N			
				24.10		08	15	19	20	33			
24.00													
				25.00	DS13								
				25.50									
				25.50	SPT12	15	30	45	60	N			
				26.10		07	14	18	20	32			
26.00													
				27.00	DS14								
				27.50									
				27.50	SPT13	15	30	45	60	N			
				28.10		09	15	19	22	34			
28.00			Grayish fine grained medium silty SAND										
				29.00	DS15								
				29.50									
				29.50	SPT14	15	30	45	60	N			
				30.10		08	08	12	28	20			
30.00													

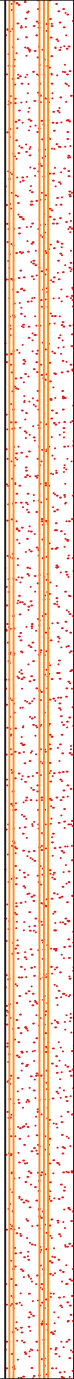
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-03	
LOCATION : EQ Berth	SHEET NO. : 4 OF 5
CO-ORDINATE : E 465853.522 N 2242057.217	DATE : 26/06/2016 to 29/06/2016
GROUND R. L. : -12.907 m	METHOD : ROTARY DRILLING
GROUND W. T. : MARINE BORE HOLE	CASING : 100 mm Ø Nx Upto 30.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
31.00	100 Ø MM		Grayish fine grained medium silty SAND	31.00	DS16								
				31.50									
				31.50	SPT15	15	30	45	60	N			
				32.10		08	10	14	16	24			
32.00													
				33.00	DS17								
				33.50									
				33.50	SPT16	15	30	45	60	N			
				34.10		07	09	12	24	21			
34.00													
				35.00	DS18								
				35.50									
				35.50	SPT17	15	30	45	60	N			
				36.10		09	14	18	19	32			
36.00													
				37.00	DS19								
				37.50									
				37.50	SPT18	15	30	45	60	N			
				38.10		08	12	13	16	25			
38.00													
				39.00	DS20								
				39.50									
				39.50	SPT19	15	30	45	60	N			
				40.10		07	11	15	17	26			
40.00													

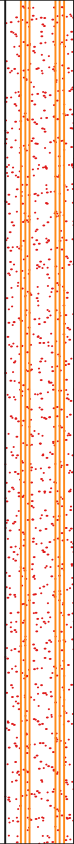
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

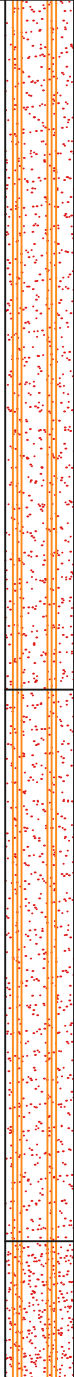
SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-03	
LOCATION : EQ Berth	SHEET NO. : 5 OF 5
CO-ORDINATE : E 465853.522 N 2242057.217	DATE : 26/06/2016 to 29/06/2016
GROUND R. L. : -12.907 m	METHOD : ROTARY DRILLING
GROUND W. T. : MARINE BORE HOLE	CASING : 100 mm Ø Nx Upto 30.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
41.00	100 Ø MM		Grayish fine grained medium silty SAND	41.00	DS21								
				41.50									
				41.50	SPT20	15	30	45	60	N			
				42.10		06	11	13	17	24			
42.00													
				43.00	DS22								
				43.50									
				43.50	SPT21	15	30	45	60	N			
				44.10		08	13	15	19	28			
44.00													
				45.00	DS23								
				45.50									
46.00				45.50	SPT22	15	30	45	60	N			
				46.10		09	12	14	17	26			
47.00													
48.00													
49.00													
40.00													

SPT N =STANDARD PENETRATION TEST VALUE	RQD = ROCK QUALITY DESIGNATION	UDS = UNDISTURBED SOIL SAMPLE	SCALE : 1: 50 JOB NO. : 172
CR = CORE RECOVERY	DS = DISTURBED SOIL SAMPLE	VST = VANE SHEAR TEST	

PROJECT : Geotechnical Investigation Study at Paradip Port			
BORE HOLE NO. : MBH-04			
LOCATION : EQ Berth		SHEET NO. : 1 OF 4	
CO-ORDINATE : E 465891.058 N 2242133.480		DATE : 05/07/2016 to 08/07/2016	
GROUND R. L. : -12.67 m		METHOD : ROTARY DRILLING	
GROUND W. T. : MARINE BORE HOLE		CASING : 100 mm Ø Nx Upto 30.00m Below G.L.	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
1.00	100 Ø MM		Yellowish fine grained loose silty SAND	0.00	DS1								
				0.50									
2.00				1.50	SPT1	15	30	45	60	N			
				2.10		02	03	03	05	06			
3.00				3.00	DS2								
				3.50									
4.00			Yellowish fine grained medium silty SAND	3.50	SPT2	15	30	45	60	N			
				4.10		02	04	05	08	09			
5.00				5.00	DS3								
				5.50									
6.00				5.50	SPT3	15	30	45	60	N			
				6.10		06	08	11	13	19			
7.00			Yellowish fine grained dense silty SAND	7.00	DS4								
				7.50									
8.00				7.50	SPT4	15	30	45	60	N			
				8.10		09	10	13	15	23			
9.00			Yellowish fine grained dense silty SAND	9.00	DS5								
				9.50									
10.00				9.50	SPT5	15	30	45	60	N			
				10.10		10	14	17	23	31			

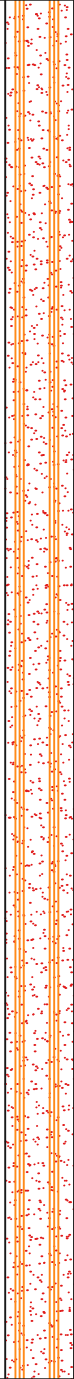
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-04	
LOCATION : EQ Berth	SHEET NO. : 2 OF 4
CO-ORDINATE : E 465891.058 N 2242133.480	DATE : 05/07/2016 to 08/07/2016
GROUND R. L. : -12.67 m	METHOD : ROTARY DRILLING
GROUND W. T. : MARINE BORE HOLE	CASING : 100 mm Ø Nx Upto 30.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
11.00	100 Ø MM		Grayish fine grained dense silty SAND	11.00	DS6								
				11.50									
				11.50	SPT6	15	30	45	60	N			
				12.10		12	16	18	23	34			
12.00													
				13.00	DS7								
				13.50									
				13.50	SPT7	15	30	45	60	N			
				14.10		13	16	21	26	37			
14.00													
				15.00	DS8								
				15.50									
				15.50	SPT8	15	30	45	60	N			
				16.10		14	17	21	28	38			
16.00													
				17.00	DS9								
				17.50									
				17.50	SPT9	15	30	45	60	N			
				18.10		14	18	23	29	41			
18.00													
				19.00	DS10								
				19.50									
				19.50	SPT10	15	30	45	60	N			
				20.10		14	19	26	34	45			
20.00													

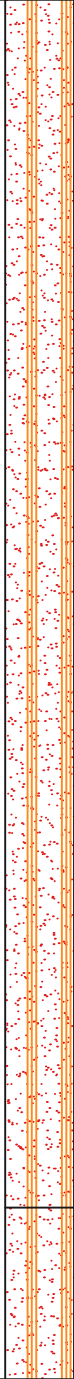
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-04	
LOCATION : EQ Berth	SHEET NO. : 3 OF 4
CO-ORDINATE : E 465891.058 N 2242133.480	DATE : 05/07/2016 to 08/07/2016
GROUND R. L. : -12.67 m	METHOD : ROTARY DRILLING
GROUND W. T. : MARINE BORE HOLE	CASING : 100 mm Ø Nx Upto 30.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
21.00	100 Ø MM		Grayish fine grained dense silty SAND	21.00	DS11								
				21.50									
				21.50	SPT11	15	30	45	60	N			
				22.10		16	22	26	33	48			
22.00													
				23.00	DS12								
				23.50									
				23.50	SPT12	15	30	45	60	N			
				24.10		16	20	26	34	46			
24.00													
				25.00	DS13								
				25.50									
				25.50	SPT13	15	30	45	60	N			
				26.10		18	23	25	36	48			
26.00													
				27.00	DS14								
				27.50									
				27.50	SPT14	15	30	45	60	N			
				28.10		08	13	18	24	31			
28.00													
			Grayish fine grained medium silty SAND	29.00	DS15								
				29.50									
				29.50	SPT15	15	30	45	60	N			
				30.10		08	13	15	21	28			
30.00													

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-04	
LOCATION : EQ Berth	SHEET NO. : 4 OF 4
CO-ORDINATE : E 465891.058 N 2242133.480	DATE : 05/07/2016 to 08/07/2016
GROUND R. L. : -12.67 m	METHOD : ROTARY DRILLING
GROUND W. T. : MARINE BORE HOLE	CASING : 100 mm Ø Nx Upto 30.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
31.00	100 Ø MM		Grayish fine grained medium silty SAND	31.00	DS16								
				31.50									
				31.50	SPT16	15	30	45	60	N			
				32.10		03	11	16	30	27			
32.00													
				33.00	DS17								
				33.50									
				33.50	SPT17	15	30	45	60	N			
				34.10		09	13	16	21	29			
34.00													
				35.00	DS18								
				35.50									
				35.50	SPT18	15	30	45	60	N			
				36.10		11	14	16	20	30			
36.00													
				37.00	DS19								
				37.50									
				37.50	SPT19	15	30	45	60	N			
				38.10		10	10	14	21	24			
38.00													
				39.00	DS20								
				39.50									
				39.50	SPT20	15	30	45	60	N			
				40.10		10	12	14	24	26			
40.00													

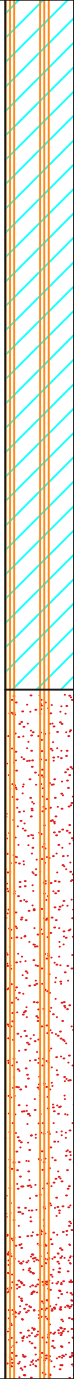
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port			
BORE HOLE NO. : MBH-05			
LOCATION : EQ Berth		SHEET NO. : 1 OF 4	
CO-ORDINATE : E 465928.584 N 2242209.748		DATE : 10/07/2016 to 12/07/2016	
GROUND R. L. : -12.84 m		METHOD : ROTARY DRILLING	
GROUND W. T. : Marine Bore Hole m.BGL		CASING : 100 mm Ø Nx Upto 35.00m Below G.L.	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
1.00	100 Ø MM		Yellowish stiff silty CLAY	0.00	DS1								
				0.50									
				1.50	SPT1	15	30	45	60	N			
2.00				2.10		02	02	03	05	05			
				3.00	DS2								
3.00				3.50									
				3.50	UDS1								
4.00				4.00									
				5.00	DS3								
5.00				5.50									
			Yellowish fine grained medium silty SAND	5.50	SPT3	15	30	45	60	N			
6.00				6.10		06	09	11	15	20			
				7.00	DS4								
7.00				7.50									
				7.50	SPT3	15	30	45	60	N			
8.00				8.10		09	12	16	21	28			
				9.00	DS5								
9.00				9.50									
				9.50	SPT4	15	30	45	60	N			
10.00				10.10		10	13	18	24	31			

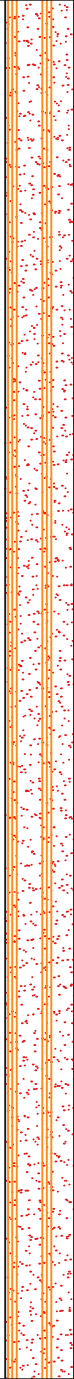
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-05	
LOCATION : EQ Berth	SHEET NO. : 2 OF 4
CO-ORDINATE : E 465928.584 N 2242209.748	DATE : 10/07/2016 to 12/07/2016
GROUND R. L. : -12.84 m	METHOD : ROTARY DRILLING
GROUND W. T. : Marine Bore Hole m.BGL	CASING : 100 mm Ø Nx Upto 35.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
11.00	100 Ø MM		Yellowish fine grained dense silty SAND	11.00	DS6								
				11.50									
				11.50	SPT5	15	30	45	60	N			
				12.10		11	14	18	23	32			
12.00													
13.00													
				13.00	DS7								
				13.50									
				13.50	SPT6	15	30	45	60	N			
				14.10		12	16	19	22	35			
14.00													
15.00													
				15.00	DS8								
				15.50									
				15.50	SPT7	15	30	45	60	N			
				16.10		13	17	20	26	37			
16.00													
17.00													
				17.00	DS9								
				17.50									
				17.50	SPT9	15	30	45	60	N			
				18.10		15	18	22	27	40			
18.00													
19.00													
				19.00	DS10								
				19.50									
				19.50	SPT10	15	30	45	60	N			
				20.10		15	22	26	32	48			
20.00													

SPT N =STANDARD PENETRATION TEST VALUE	RQD = ROCK QUALITY DESIGNATION	UDS = UNDISTURBED SOIL SAMPLE	SCALE : 1: 50 JOB NO. : 172
CR = CORE RECOVERY	DS = DISTURBED SOIL SAMPLE	VST = VANE SHEAR TEST	

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-05	
LOCATION : EQ Berth	SHEET NO. : 3 OF 4
CO-ORDINATE : E 465928.584 N 2242209.748	DATE : 10/07/2016 to 12/07/2016
GROUND R. L. : -12.84 m	METHOD : ROTARY DRILLING
GROUND W. T. : Marine Bore Hole m.BGL	CASING : 100 mm Ø Nx Upto 35.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
21.00	100 Ø MM		Yellowish fine grained very dense silty SAND	21.00	DS11								
				21.50									
				21.50	SPT10	15	30	45	60	N			
				22.10		16	24	26	33	50			
22.00													
				23.00	DS12								
				23.50									
				23.50	SPT11	15	30	45	60	N			
				24.10		17	25	28	34	52			
24.00													
				25.00	DS13								
				25.50									
				25.50	SPT12	15	30	45	60	N			
				26.10		08	12	14	20	26			
26.00			Yellowish fine grained dense silty SAND										
				27.00	DS14								
				27.50									
				27.50	SPT13	15	30	45	60	N			
				28.10		09	13	19	22	32			
28.00													
				29.00	DS15								
				29.50									
				29.50	SPT14	15	30	45	60	N			
				30.10		10	14	19	24	33			
30.00													

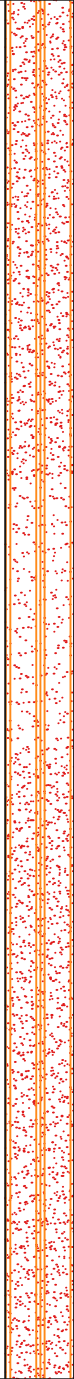
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-05	
LOCATION : EQ Berth	SHEET NO. : 4 OF 4
CO-ORDINATE : E 465928.584 N 2242209.748	DATE : 10/07/2016 to 12/07/2016
GROUND R. L. : -12.84 m	METHOD : ROTARY DRILLING
GROUND W. T. : Marine Bore Hole m.BGL	CASING : 100 mm Ø Nx Upto 35.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
31.00	100 Ø MM		Yellowish fine grained dense silty SAND	31.00	DS16								
				31.50									
				31.50	SPT15	15	30	45	60	N			
				32.10		09	13	19	24	32			
32.00													
				33.00	DS17								
				33.50									
				33.50	SPT16	15	30	45	60	N			
				34.10		10	14	19	27	33			
34.00													
				35.00	DS18								
				35.50									
				35.50	SPT17	15	30	45	60	N			
				36.10		11	16	19	27	35			
36.00													
				37.00	DS19								
				37.50									
				37.50	SPT18	15	30	45	60	N			
				38.10		12	17	21	26	38			
38.00													
				39.00	DS20								
				39.50									
				39.50	SPT19	15	30	45	60	N			
				40.10		13	19	21	24	40			
40.00													

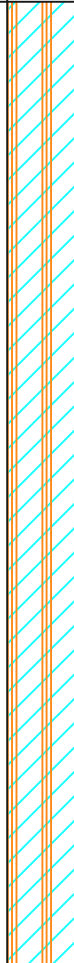
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

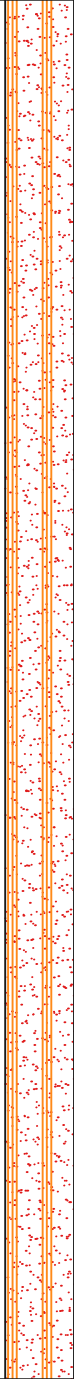
SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port			
BORE HOLE NO. : MBH-07			
LOCATION : EQ Berth		SHEET NO. : 1 OF 4	
CO-ORDINATE : E 466003.635 N 2242362.285		DATE : 13/07/2016 to 14/07/2016	
GROUND R. L. : -12.38 m		METHOD : ROTARY DRILLING	
GROUND W. T. : Marine Bore Hole m.BGL		CASING : 100 mm Ø Nx Upto 36.00m Below G.L.	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
1.00	100 Ø MM		Yellowish stiff silty CLAY	0.00	DS1								
				0.50									
1.50				SPT1	15	30	45	60	N 05				
2.10					02	02	03	05					
3.00				DS2									
3.50													
3.50				UDS1									
4.10													
5.00				DS3									
5.50													
5.50				SPT2	15	30	45	60	N 08				
6.10					02	03	05	07					
7.00				DS4									
7.50													
7.50	SPT3	15	30	45	60	N 13							
8.10		03	05	08	13								
9.00	DS5												
9.50													
9.50	SPT4	15	30	45	60	N 23							
10.10		06	11	18	21								

SPT N =STANDARD PENETRATION TEST VALUE	RQD = ROCK QUALITY DESIGNATION	UDS = UNDISTURBED SOIL SAMPLE	SCALE : 1: 50 JOB NO. : 172
CR = CORE RECOVERY	DS = DISTURBED SOIL SAMPLE	VST = VANE SHEAR TEST	

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-07	
LOCATION : EQ Berth	SHEET NO. : 2 OF 4
CO-ORDINATE : E 466003.635 N 2242362.285	DATE : 13/07/2016 to 14/07/2016
GROUND R. L. : -12.38 m	METHOD : ROTARY DRILLING
GROUND W. T. : Marine Bore Hole m.BGL	CASING : 100 mm Ø Nx Upto 36.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
11.00	100 Ø MM		Yellowish fine grained dense silty SAND	11.00	DS6								
				11.50									
				11.50	SPT5	15	30	45	60	N			
				12.10		07	12	19	22	31			
12.00													
				13.00	DS7								
				13.50									
				13.50	SPT6	15	30	45	60	N			
				14.10		08	13	21	23	34			
14.00													
				15.00	DS8								
				15.50									
				15.50	SPT7	15	30	45	60	N			
				16.10		09	13	21	23	36			
16.00													
				17.00	DS9								
				17.50									
				17.50	SPT8	15	30	45	60	N			
				18.10		10	14	24	26	38			
18.00													
				19.00	DS10								
				19.50									
				19.50	SPT9	15	30	45	60	N			
				20.10		11	18	21	26	39			
20.00													

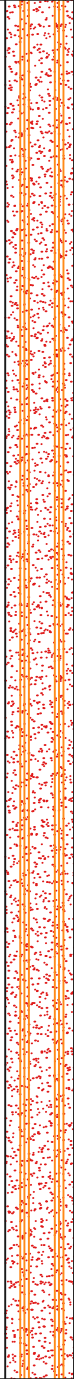
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-07	
LOCATION : EQ Berth	SHEET NO. : 3 OF 4
CO-ORDINATE : E 466003.635 N 2242362.285	DATE : 13/07/2016 to 14/07/2016
GROUND R. L. : -12.38 m	METHOD : ROTARY DRILLING
GROUND W. T. : Marine Bore Hole m.BGL	CASING : 100 mm Ø Nx Upto 36.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
21.00	100 Ø MM		Yellowish fine grained medium silty SAND	21.00	DS11								
				21.50									
				21.50	SPT10	15	30	45	60	N			
				22.10		08	09	11	13	21			
22.00													
				23.00	DS12								
				23.50									
				23.50	SPT11	15	30	45	60	N			
				24.10		09	10	13	15	23			
24.00													
				25.00	DS13								
				25.50									
				25.50	SPT12	15	30	45	60	N			
				26.10		07	10	14	18	24			
26.00													
				27.00	DS14								
				27.50									
				27.50	SPT13	15	30	45	60	N			
				28.10		08	11	14	18	25			
28.00													
				29.00	DS15								
				29.50									
				29.50	SPT14	15	30	45	60	N			
				30.00		08	12	12	15	24			
30.00													

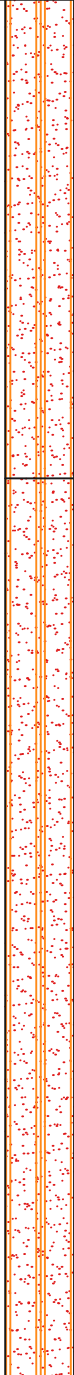
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-07	
LOCATION : EQ Berth	SHEET NO. : 4 OF 4
CO-ORDINATE : E 466003.635 N 2242362.285	DATE : 13/07/2016 to 14/07/2016
GROUND R. L. : -12.38 m	METHOD : ROTARY DRILLING
GROUND W. T. : Marine Bore Hole m.BGL	CASING : 100 mm Ø Nx Upto 36.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
31.00	100 Ø MM		Yellowish fine grained medium silty SAND	31.00	DS16								
				31.50									
				31.50	SPT15	15	30	45	60	N			
				32.10		09	12	14	19	26			
32.00													
33.00			Yellowish fine grained dense silty SAND	33.00	DS17								
				33.50									
				33.50	SPT16	15	30	45	60	N			
				34.10		08	13	15	21	28			
34.00													
35.00				35.00	DS18								
				35.50									
				35.50	SPT17	15	30	45	60	N			
				36.10		10	15	18	24	31			
36.00													
37.00				37.00	DS19								
				37.50									
				37.00	SPT18	15	30	45	60	N			
				38.10		12	16	17	28	33			
38.00													
39.00				39.00	DS20								
				39.50									
				39.00	SPT19	15	30	45	60	N			
				39.50		12	17	18	29	35			
40.00													

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port			
BORE HOLE NO. : MBH-08			
LOCATION : EQ Berth		SHEET NO. : 1 OF 4	
CO-ORDINATE : E 466041.161 N 2242438.553		DATE : 23/06/2016 to 25/06/2016	
GROUND R. L. : -5.673 m		METHOD : ROTARY DRILLING	
GROUND W. T. : Marine Bore Hole m.BGL		CASING : 100 mm Ø Nx Upto 20.00m Below G.L.	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
1.00	100 Ø MM		Grayish fine grained dense silty SAND	0.00	DS1								
				0.50									
2.00				1.50	SPT1	15	30	45	60	N			
				2.10		05	14	14	21	28			
3.00				3.00	DS2								
				3.50									
4.00				3.50	SPT2	15	30	45	60	N			
				4.10		10	16	19	20	35			
5.00				5.00	DS3								
				5.50									
6.00				5.50	SPT3	15	30	45	60	N			
				6.10		09	15	17	17	32			
7.00				7.00	DS4								
				7.50									
8.00				7.50	SPT4	15	30	45	60	N			
				8.10		08	13	20	21	33			
9.00				9.00	DS5								
				9.50									
10.00				9.50	SPT5	15	30	45	60	N			
				10.10		09	16	21	24	37			

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port			
BORE HOLE NO. : MBH-08			
LOCATION : EQ Berth		SHEET NO. : 2 OF 4	
CO-ORDINATE : E 466041.161 N 2242438.553		DATE : 23/06/2016 to 25/06/2016	
GROUND R. L. : -5.673 m		METHOD : ROTARY DRILLING	
GROUND W. T. : Marine Bore Hole m.BGL		CASING : 100 mm Ø Nx Upto 20.00m Below G.L.	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
11.00	100 Ø MM		Grayish fine grained dense silty SAND	11.00	DS6								
				11.50									
				11.50	SPT6	15	30	45	60	N			
12.00				12.10		10	20	20	32	40			
13.00			Yellowish fine grained very dense silty SAND	13.00	DS7								
				13.50									
				13.50	SPT7	15	30	45	60	N			
14.00				14.10		17	25	27	36	52			
15.00				15.00	DS8								
				15.50									
				15.50	SPT8	15	30	45	60	N			
16.00				16.10		16	20	30	46	50			
17.00				17.00	DS9								
				17.50									
				17.50	SPT9	15	30	45	60	N			
18.00				18.10		18	24	28	29	52			
19.00				19.00	DS10								
				19.50									
				19.50	SPT10	15	30	45	60	N			
20.00				20.10		10	25	30	30	55			

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-08	
LOCATION : EQ Berth	SHEET NO. : 3 OF 4
CO-ORDINATE : E 466041.161 N 2242438.553	DATE : 23/06/2016 to 25/06/2016
GROUND R. L. : -5.673 m	METHOD : ROTARY DRILLING
GROUND W. T. : Marine Bore Hole m.BGL	CASING : 100 mm Ø Nx Upto 20.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
21.00	100 Ø MM		Yellowish fine grained very dense silty SAND	21.00	DS11								
				21.50									
				21.50	SPT11	15	30	45	60	N			
				22.10		20	30	36	42	66			
22.00													
				23.00	DS12								
				23.50									
				23.50	SPT12	15	30	45	60	N			
				24.10		18	26	30	36	56			
24.00													
				25.00	DS13								
				25.50									
				25.50	SPT13	15	30	45	60	N			
				26.10		15	20	26	30	46			
26.00			Yellowish fine grained medium silty SAND										
				27.00	DS14								
				27.50									
				27.50	SPT14	15	30	45	60	N			
				28.10		06	08	10	10	18			
28.00													
				29.00	DS15								
				29.50									
29.00													
				29.50	UDS1								
				30.00									
30.00													

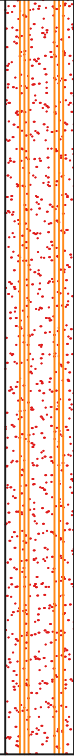
SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

SCALE : 1: 50
JOB NO. : 172

PROJECT : Geotechnical Investigation Study at Paradip Port	
BORE HOLE NO. : MBH-08	
LOCATION : EQ Berth	SHEET NO. : 4 OF 4
CO-ORDINATE : E 466041.161 N 2242438.553	DATE : 23/06/2016 to 25/06/2016
GROUND R. L. : -5.673 m	METHOD : ROTARY DRILLING
GROUND W. T. : Marine Bore Hole m.BGL	CASING : 100 mm Ø Nx Upto 20.00m Below G.L.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	15	15	15				
31.00	100 Ø MM		Grayish fine grained medium silty SAND	31.00	DS16								
				31.50									
				31.50	SPT15	15	30	45	60	N			
				32.10		08	10	12	10	22			
32.00													
				33.00	DS17								
				33.50									
				33.50	SPT16	15	30	45	60	N			
				34.10		06	09	11	13	20			
34.00													
				35.00	DS18								
				35.50									
				35.50	SPT17	15	30	45	60	N			
				36.10		09	11	14	14	25			
36.00													
37.00													
38.00													
39.00													
40.00													

SPT N =STANDARD PENETRATION TEST VALUE	RQD = ROCK QUALITY DESIGNATION	UDS = UNDISTURBED SOIL SAMPLE	SCALE : 1: 50 JOB NO. : 172
CR = CORE RECOVERY	DS = DISTURBED SOIL SAMPLE	VST = VANE SHEAR TEST	

