HOOGHLY COCHIN SHIPYARD LIMITED

(A WHOLLY-OWNED SUBSIDIARY OF COCHIN SHIPYARD LTD)

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

TENDER NO: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

NOTICE INVITING TENDER (NIT)

Dated: 01 November 2022

Due Date of Submission: 15.00 Hrs on 30 November 2022

Date & Time of Opening of Technical bid: 15.30 Hrs on 30 November 2022

To,

The Prospective Bidders

Sub: **Development of Ship Repair Facility at Pandu, Guwahati, Assam – Package I Tender for Civil Works**

Dear Sir,

1. On behalf of Inland Waterways Authority of India (IWAI), (HCSL) is inviting the bids for Development of Ship Repair Facility at Pandu, Guwahati, Assam – Package I Tender for Civil Works. IWAI shall therefore be the owner of the entire facility and HCSL is the Nodal agency for execution commissioning of the project.

2. We have noted that you have applied for issue of bid document for the subject work. As requested, the bid document is enclosed.

3. You are strongly advised to read the whole document carefully and submit your tender/bid strictly meeting with the requirements spelt out in the bid document. HCSL is not obliged to call for any shortfall documents, if it is not attached along with the bid and HCSL, at its discretion, may take appropriate decision based on the documents made available without reverting to the bidder. The decision of the HCSL in this regard is final and no claim shall be entertained for any reasons.

4. Please note that you must submit independent documentary evidence to establish that "MINIMUM QUALIFICATION CRITERIA" as spelt out in the Tender Call Notice and bid document are fully met, irrespective of the fact that you might have submitted similar evidence to Hooghly Cochin Shipyard Ltd (HCSL) in respect of some other works.

5. Please note that if your submission is found deficient with reference to the requirements spelt out in the bid document, it may be rejected.

6. Please note that you must read instruction to bidders and submit all relevant information required strictly. Avoid submission of irrelevant papers and vague information. All the required information shall be self-explainable.

7. Please note that if you are furnishing experience certificate of works executed in private agencies to qualify for the work, you should submit TDS Certificate along with work order and completion certificate.

Thanking you,

Yours faithfully,
For Hooghly Cochin Shipyard Ltd

CHIEF EXECUTIVE OFFICER (CEO)

शेखर चक्रवर्ती
Shekhar Chakravarty
मुख्य कार्यकारी अधिकारी
Chief Executive Officer
हुगली कोचीन शिपयार्ड लिमिटेड
Hooghly Cochin Shipyard Ltd.
हावड़ा/Howrah-711109

HOOGHLY COCHIN SHIPYARD LTD

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

Tender Documents Issued to:

CHIEF EXECUTIVE OFFICER
HOOGHLY COCHIN SHIPYARD LTD
Administrative Building,
HCSL Premises, Satyen Bose Road,
P.O.- Danesh Shaikh Lane,
Nazirgunge,
Howrah,
West Bengal - 711109,
India,
Tel No. – 033-29558283 / 033-26888282

CONTENTS OF PACKAGE I TENDER FOR CIVIL WORKS

HOOGHLY COCHIN SHIPYARD LTD

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

COVER A TECHNICAL & COMMERCIAL BID

HOOGHLY COCHIN SHIPYARD LTD

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

NOTICE INVITING TENDER

NOTICE INVITING TENDER (NIT)

Sealed bids in the prescribed proforma are invited by Hooghly Cochin Shipyard Ltd for development of Ship repair facility at Pandu, Guwahati, Assam Package I Tender for Civil works in single stage two cover system (Cover A: Technical& Commercial Bid and Cover B : Financial Bid) from experienced, resourceful and bonafide contractors with proven technical and financial capabilities of executing the work, for the mentioned work so as to reach the undersigned on or before the date and time mentioned below.

Tender No:	HCSL/PANDU/TEN/002/2022-23 dated 01 November 2022
Name of the work	**Development of Ship repair facility at Pandu, Guwahati, Assam, Package I Tender for Civil works**
Estimated value of work put to tender (in INR)	Rs 144,24,68,576 /- (Including applicable GST of 18%)
Type of Tender	Open Tender with Single Stage Two Cover System
Cost of Tender Document (non-refundable)	Rs 5000/- (Including 12 % GST)
Period of contract	18 months from the 30th day from the date of work order or site handing over whichever is later
Bid Security / EMD	Rs 1,54,00,000/-
Time slot for site visit	9 AM to 5 PM on 14 and 15 Nov 2022
Pre-bid Meeting, time and Place	11.00 Hours on 16 November 2022 at IWAI Office, Pandu Port Terminal, Assam
Last date & time for submission of Bid	30 Nov 2022 on 1500 Hrs.
Date, time and Place of opening of Technical Bid	30 Nov 2022 , 1530 Hrs at HCSL Administrative Building, HCSL Premises, Satyen Bose Road, P.O.- Danesh Shaikh Lane, Nazirgunge, Howrah, West Bengal - 711109,
Date, Time, and Place of opening of Price Bid	Shall be intimated separately to the bidders who are technically qualified.

2. The Scope of work of Package I – "Tender for Civil Works" involves are listed below but not limited to;

The development of ship repair facility consisting of two phases. In the present tender Phase I development only considered and the details are as follows.

Water side development

The phase-I development consist of open piled structure of ship repair facility having length of 128m and width of 70m. The facility consist of boat hoist jetty of 60m length and width of 10m parallel to the river and the transfer bay consist of berthing jetty provisions along the river side. The transfer bay has length of 68m and width of 37.5m. The repair yard length is 68m and width is 32.5m. In phase-I, 60m length of vessesls can be handled in ship repair facility.

Land side development

The Phase development consists of construction of substation building of 42 sqm, security plus admin block of 560 sqm, store for paint, electrical goods, carpentry/outfitting shop of 252 sqm, shop for pipe, engine machine shop, fabrication shop of 330 sqm and driveway of 354 sqm.

3. The project site is located at the western side of the IWAI Port Terminal, Pandu ,

Guwahati, Assam.

4. Intending bidder can collect bid papers from the office of the Chief Executive office, Hooghly Cochin Shipyard Ltd on payment of a non-refundable sum of Rs 5,000/- Plus GST @12% towards the cost of Bid document through Demand Draft/ Banker's Cheque from any Nationalised Bank/ Scheduled Bank in India drawn in favour of the Hooghly Cochin Shipyard Ltd payable at Kolkata, on any working day between 1000 Hrs IST to 16 00 Hrs IST from 01 Nov 2022 to 29 Nov 2022

5. Bid document is also available at the Hooghly Cochin Shipyard Ltd (HCSL) and Cochin shipyard Ltd websites www.hooghlycsl.com, www.cochinshipyard.in and

www.tenders.gov.in from 01 Nov 2022. Interested contractors/firms may download the bid documents from the website and submit their offer. To avoid any discrepancy between the downloaded bid document and hard copy of the bid document duly filled in, bidders qualified for opening of Price Bid shall have to sign the hard copy of the bid documents which would form part of the Agreement. The downloaded bid document signed and submitted by the bidder shall only be used for bid evaluation and shall be retained by HCSL for future guidance/ reference.

6. Bidders submitting the bid after downloading from the website shall have to furnish the cost of the bid documents through Banker's Cheque/ Demand Draft from any Nationalized Bank/Scheduled Bank in India drawn in favour of HCSL, payable at for the amount indicated in the NIT, and enclose the same in a separate sealed cover super scribing "cost of the bid document" for the work of "Development of Ship Repair Facility at Pandu, Guwahati, Assam – Package I Tender for Civil Works" failing which his/ their bid(s) shall be returned unopened.

7. Bidders should submit their offer in duplicate in two envelopes clearly super scribing the name of work and the 1st envelope (Cover –A) should contain the Technical & Commercial bid document duly completed and filled in except prices, Blank Proforma of Schedule of Quantities (Prices not to be filled), experience certificate of similar work executed, works in hand, annual turnover, equipments available, history of litigation, if any and all details sought below along with any additional information to be furnished by the bidder. The EMD in a separate envelope should be attached with the 1st Envelope (Technical & Commercial Bid) (Cover –A). Bid not accompanied by required EMD shall be liable for rejection. Previous dues / deposits with HCSL shall not be counted / adjusted towards EMD. The 2nd envelope (Cover- B) should contain the Schedule of Quantities (Price /Financial Bid) duly filled in.

8.0 MINIMUM QUALIFICATION CRITERIA

8.1 FINANCIAL TURN OVER:

Average annual financial turnover on construction works should be at least 50% of the estimated cost put to tender during the immediate last three consecutive financial years ending 31st March 2022. The value of annual turnover figures shall be brought to current value by enhancing the actual turnover figures at simple rate of 7% per annum. An attested / notarized copy of audited balance sheet and profit & loss Account for the preceding 3 years has to be submitted in proof of financial turn over.

8.2 EXPERIENCE:

Experience of having successfully completed similar works during last 7 year (ending last day of month previous to the one in which tender applications are invited) should be either of the following:

(i) Three similar works, each work either costing not less than Rs. 58 Crs

OR

(ii) Two similar works, each work either costing not less than Rs 86 Crs

OR

(iii) One similar work either costing not less than Rs. 115 Crs

Explanatory Notes:

a) Similar works means development of marine structures or structures developed in the river and other water bodies viz., structures like Shiplift/ shipyard, slipway, dry dock, jetties, berths, off shore port facilities, offshore bridges etc. Work order and Completion certificate issued by the client/employer shall be enclosed for each eligible project.

b) The value of similar works completed by the Tenderer will be brought to current cost level by enhancing the actual value of work with the multiplication factor as detailed below for assessing the eligibility of the Tenderer under experience. The base year shall be taken as 2021-22.

Year	Multiplication factor
FY 2021-22	1.00
FY 2020-21	1.07
FY 2019-20	1.14
FY 2018-19	1.21
FY 2017-18	1.28
FY 2016-17	1.35
FY 2015-16	1.41

Note:1. Bidder should indicate actual figures of costs and amount for the works executed by them in the schedule without accounting for the above-mentioned factors. In case the financial figure and the value of completed works are in foreign currency, the above enhancement factors will not be applied. Instead , the foreign currency will be converted into equivalent Indian Rupees (INR) at the State Bank of India BC selling rate prevailing 28 days prior to bid due date.

e) The bidder should not have incurred any loss (profit after tax should be positive) in more than two years during available last five consecutive balance sheet (balance sheet in case of private/public limited company means its standalone financial statement and consolidated financial statement both), duly audited and certified by the Chartered Accountant.

8.3 FINANCIAL CAPABILITY FOR EXECUTING THE WORK:

Banker's Certificate from a Commercial Bank or Net worth Certificate:

Banker's Certificate of the amount equal to or minimum 40% of the Estimated Cost put to tender (ECPT), OR

Networth certificate of minimum 10% of the estimated cost put to tender issued by certified Chartered Accountant with UDIN

8.4 PERSONNEL CAPABILITY AND EQUIPMENTS /MACHINERY FOR EXECUTING THE WORK:

The tenderer shall furnish details of technically qualified personnel in their employment to be deployed for the above work, if awarded, as per the proforma at Annexure 4 & 5. The tenderer shall also furnish the details of equipments/machinery to be deployed for the above work, if awarded, as per the proforma at Annexure 6.

8.5 EVALUATION CRITERIA

The details submitted by the bidders will be evaluated by scoring method in the following manner:

(a) Financial strength - Maximum 30 marks

(b) Experience in similar nature of work during last 7 years - Maximum 30 marks

(c) Personnel and Establishment - Maximum 20 marks

(d) Plant & Equipment/survey equipment - Maximum 20 marks

Total 100 marks

To become eligible for short listing, the bidder must secure at least fifty percent marks in category (a), (b), (d) of Annexure-7 and seventy percent marks in aggregate. The marking system for evaluation will be as given in Annexure-7. During the evaluation of tender CEO may at his discretion ask the bidders for clarifications. Request for clarification will be given in writing and no change in prices or substance of the bid shall be sought, offered or permitted. No post-bid clarification on the initiative of the bidder will be entertained.

9 The tenderer should keep open the validity of the tender normally for 90 days from the date fixed for its opening. However, it is also obligatory for the tenderer to extend the validity for further period of 60 days on request in writing/email/fax by the CEO , before the expiry of the original validity, would be intimated. The receipt of the intimation of the CEO should be acknowledged. Should any tenderer withdraw his tender before this period, or makes any modifications in the terms and conditions of the tender which are not acceptable to HCSL, the earnest money deposited by the tenderers shall be forfeited.

10. Tenders received after the stipulated last date and time for receipt of bids, due to any reasons will not be considered.

11. HCSL reserves the right to reject any or all the bids without assigning any reason thereof.

12. Integrity Pact (IP) shall cover this tender throughout its various phases, and IP would be deemed as a part of the contact though an appropriate provision. The bidders should sign and submit an "Integrity Pact" to be executed between the bidder and HCSL along with the bid in a separate envelope (Cover 'A1') super scribed "Integrity Pact" in Cover-A. Bids not accompanied by a duly signed "Integrity Pact" shall be liable for rejection. For full details of the scheme of IP, you may visit the website of Central Vigilance Commission, New Delhi.

CHIEF EXECUTIVE OFFICER

HCSL

हावड़ा-०९ HOWRAH-09 Hooghly Cochin Shipyard Limited

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शेखर चक्रवर्ती
Shekhar Chakravarty
मुख्य कार्यकारी अधिकारी
Chief Executive Officer
हुगली कोचीन शिपयार्ड लिमिटेड
Hooghly Cochin Shipyard Ltd.
हावड़ा/Howrah-711109

HOOGHLY COCHIN SHIPYARD LIMITED

(A WHOLLY-OWNED SUBSIDIARY OF COCHIN SHIPYARD LTD)

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

TENDER NO: HCSL/PANDU/TEN/002/2022-23, Dt.- 01.11.2022

COVER-A

SECTION- I

INSTRUCTION TO BIDDERS (ITB)

SECTION- I INSTRUCTION TO BIDDERS (ITB)

Contents

SECTION I INSTRUCTION TO BIDDERS

1 GENERAL INFORMATION

1.1 Owner

Name	Inland Waterways Authority of India (IWAI)
Address	Pandu Port Complex Pandu Guwahati 781 012 Assam India
Phone	Tel No.: 0361-2676925, 2676927, 2676929, 2570109

1.2 Nodal Agency

Name	Hooghly Cochin Shipyard Limited (HCSL)
Address	HCSL Premises, Satyen Bose Road, P.O.- Danesh Shaikh Lane, Nazirgunge, Howrah, West Bengal - 711109, India,
Phone	033-29558283 / 033-26888282
Website	www.hooghlycsl.com

1.3 The Inland Waterways Authority of India (IWAI)

IWAI came into existence on 27th October 1986 for development and regulation of inland waterways for shipping and navigation. The Authority primarily undertakes projects for development and maintenance of IWT infrastructure on national waterways through grant received from Ministry of Shipping.

The river Brahmaputra having a length of 891 Km between Bangladesh Border and Sadiya was declared as National Waterway no. 2 (NW-2) on 1st September, 1988. IWAI is carrying out various developmental works on the waterway for improving its navigability. At present the waterway is being used by vessels of Govt. of Assam, Army Border Security Forces, Tourism organization and other private operators. Long cruise tourist vessels are making voyages between Pandu and Majuli island near Neamah regularly. From October to May, over dimensional cargo (ODC) is also transported through the waterway from time to time.

1.4 Cochin Shipyard Limited (CSL)

CSL, a "Mini Ratna Company" under the Ministry of Ports, Shipping and Waterways is the largest Ship Building and Ship Repair facility in India. The firm incorporated in 1972 as a Government of India company. As part of business expansion strategy CSL formed a joint venture company with M/s. Hooghly Dock & Port Engineers Limited (HDPEL), Kolkata one of the oldest shipyards in India established in 1819. The JV Company registered in October, 2017 as per companies' act 2013 is called "Hooghly Cochin Shipyard Limited (HCSL)". HCSL became a wholly owned subsidiary of Cochin Shipyard Limited (CSL) with effect from November 01, 2019.

1.5 Proposed Project site.

The proposed project of development of ship repair facilities is located at Pandu, Assam. Pandu Multimodal IWT Terminal is a riverine Terminal in the Indian state of Assam, serving North Eastern states in general and Assam and Guwahati in particular. This Terminal has been developed on the bank of the Brahmaputra River. The ship repair facility is proposed on the eastern side of existing jetty at Pandu Multimodal IWT Terminal at a distance of about 350m. The latitude and longitude of the ship repair facility is 26°10'15.01"N and 91°40'59.87"E. The location of the proposed site is shown in Figure 1.1 and the Ariel view of the Pandu site is shown in Figure 1.2.

FIG1.1 LOCATION OF PROPOSED SITE

FIG 1.2 ARIAL VIEW OF PANDU

Development of ship repair facility consisting of two phases. In the present tender Phase I development only considered. The layout of proposed ship repair facility Phase I is shown in Figure 1.4

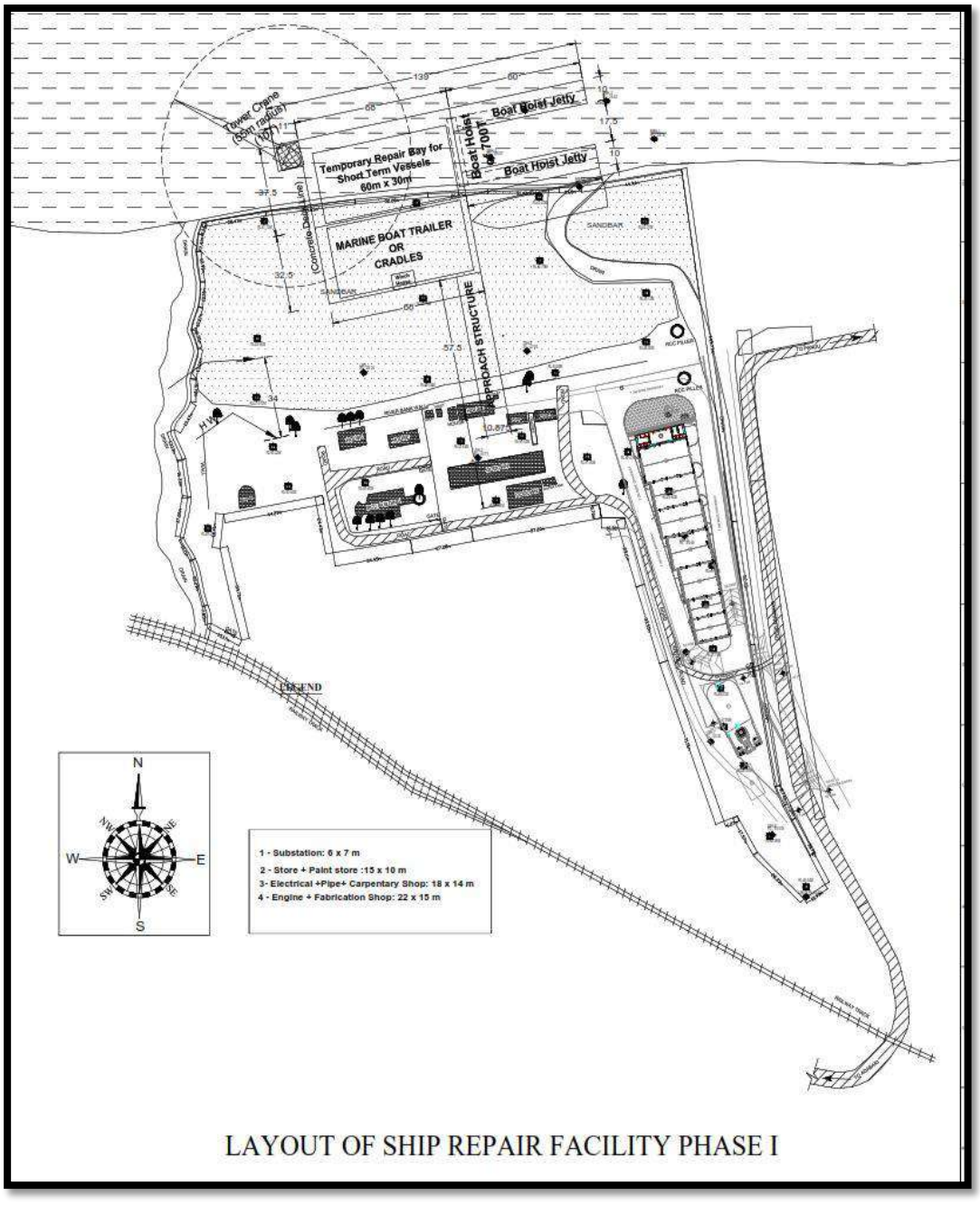

FIG1.4 LAYOUT OF SHIP REPAIR FACILITY PHASE I

1.6 BACKGROUND OF PROJECT

The works shall, inter alia, include the following, as specified or as directed

Water side development

The Phase I of ship repair facility consist of boat hoist jetty, transfer bay and repair bay. The proposed boat hoist jetty length is 60m and width is 10m parallel to the river. The transfer bay length is 68m and width is 37.5m. The repair bay length is 68m and width is 32.5m.

Boat Hoist jetty

The proposed cross section of boat hoist jetty consists of open piled type of jetty and the pile diameter is 1.3m. The length of jetty is 60m and width is 10m. The transverse and longitudinal beam dimensions are 1.75m x 2m and 1.5m x 2m. The centre to centre pile spacing is 6.16m in longitudinal direction and 8.25m in transvers direction. The adopted thickness of deck slab is 700mm and the wearing coat of 100mm is provided. The deck level of jetty is +53.50m. The founding level of pile is +10m. The plan view and cross-section of the typical jetty is shown in **Fig. 1.5** and **1.6** respectively.

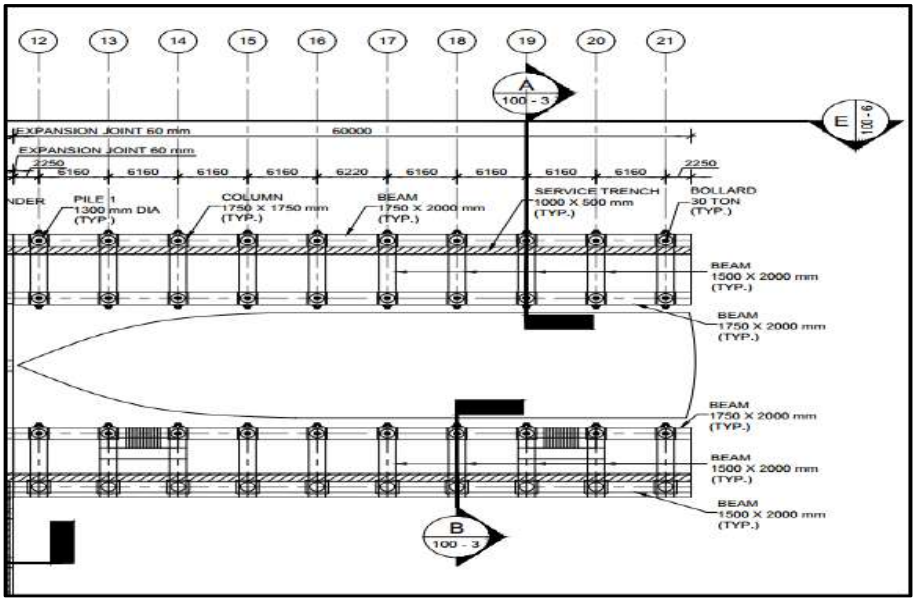

FIG. 1.5: PLAN VIEW OF BOAT HOIST JETTY

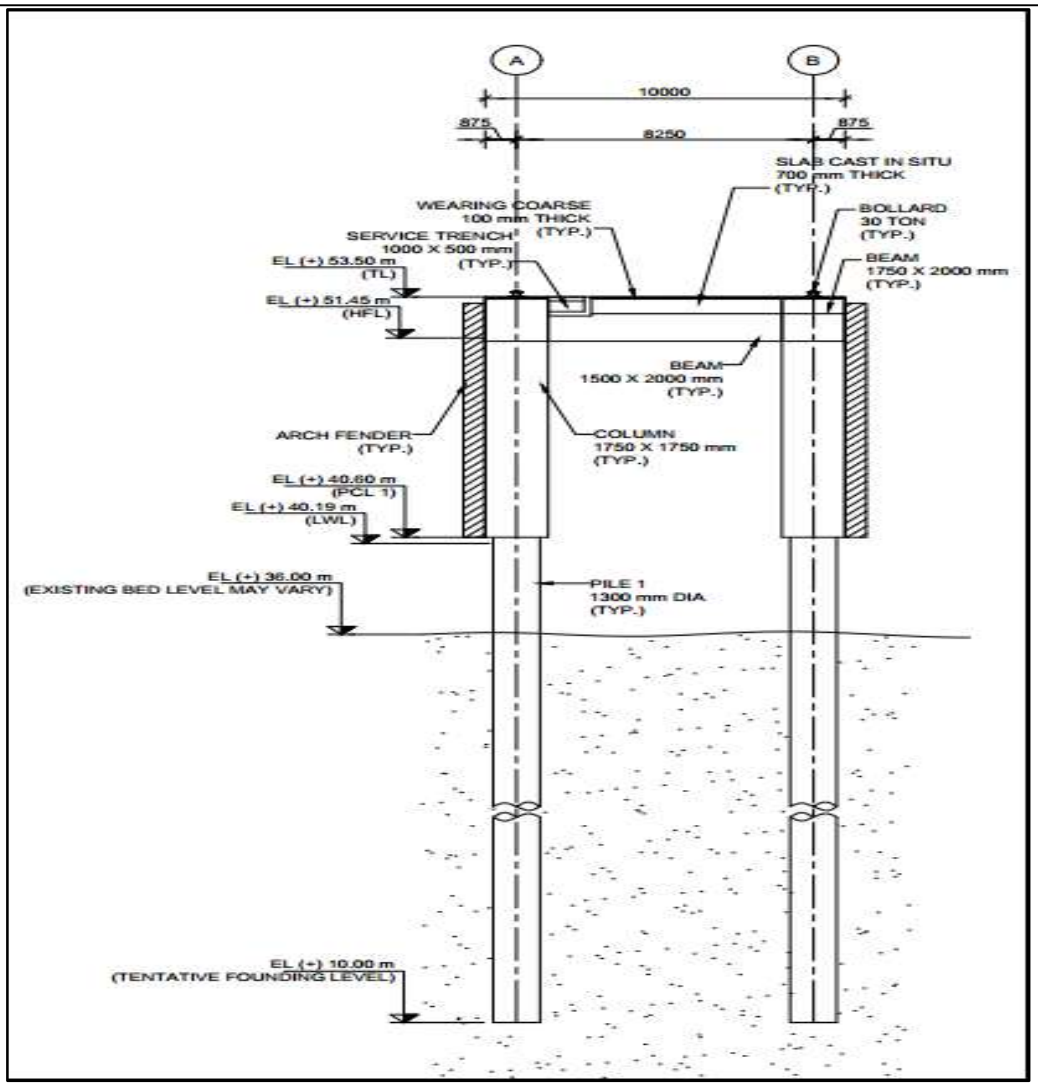

FIG. 1.6: CROSS-SECTION OF BOAT HOIST JETTY

Transfer Bay

The proposed cross section of transfer bay consists of open piled type of jetty and the pile diameter is 1.3m. The length of jetty is 68m and width is 37.5m. The transvers and longitudinal beam dimension is 1.5m x 2.5m and 1.75m x 2m. The centre to centre pile spacing is 6.375m in longitudinal direction and 7.625m and 9.625m in transvers direction .The adopted thickness of deck slab is 800mm and the wearing coat of 100mm is provided. The deck level of jetty is +53.50m. The founding level of pile is +10m . The plan view and cross-section of the typical jetty is shown in **Fig. 1.7** and **1.8** respectively.

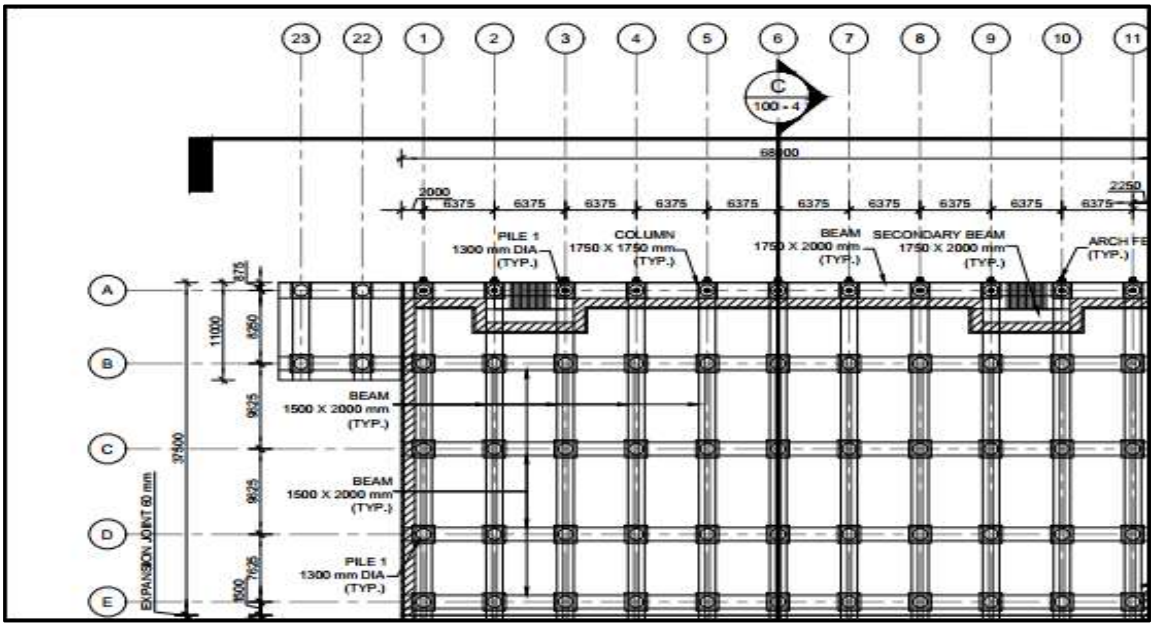

FIG. 1.7: PLAN VIEW OF THE TRANSFER BAY

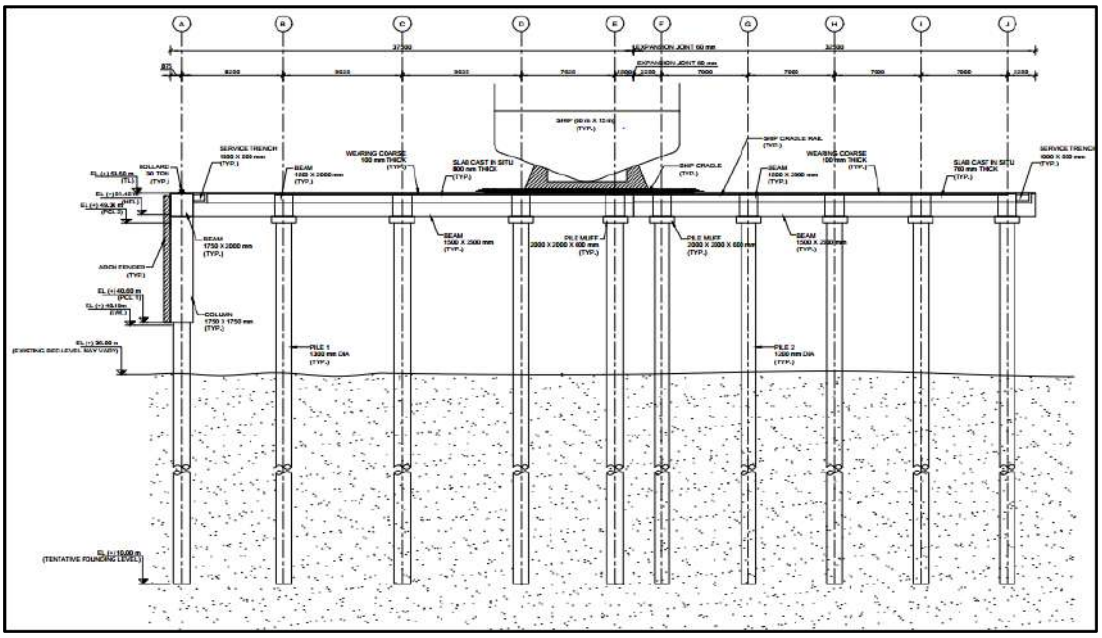

FIG. 1.8: CROSS-SECTION OF TRANSFER BAY

Repair Bay

The proposed cross section of repair bay consists of open piled type of jetty and the pile diameter is 1.2m. The length of jetty is 68m and width is 32.5m. The transvers and longitudinal beam dimension is 1.5m x 2m. The centre to centre pile spacing is 6.375m in longitudinal direction and 7.0m in transvers direction. The adopted thickness of deck slab is 700mm and the wearing coat of 100mm is provided. The deck level of jetty is +53.50m . The founding level of pile is +10m . The plan view and cross-section of the typical jetty is shown in **Figure. 1.9** and **1.10** respectively.

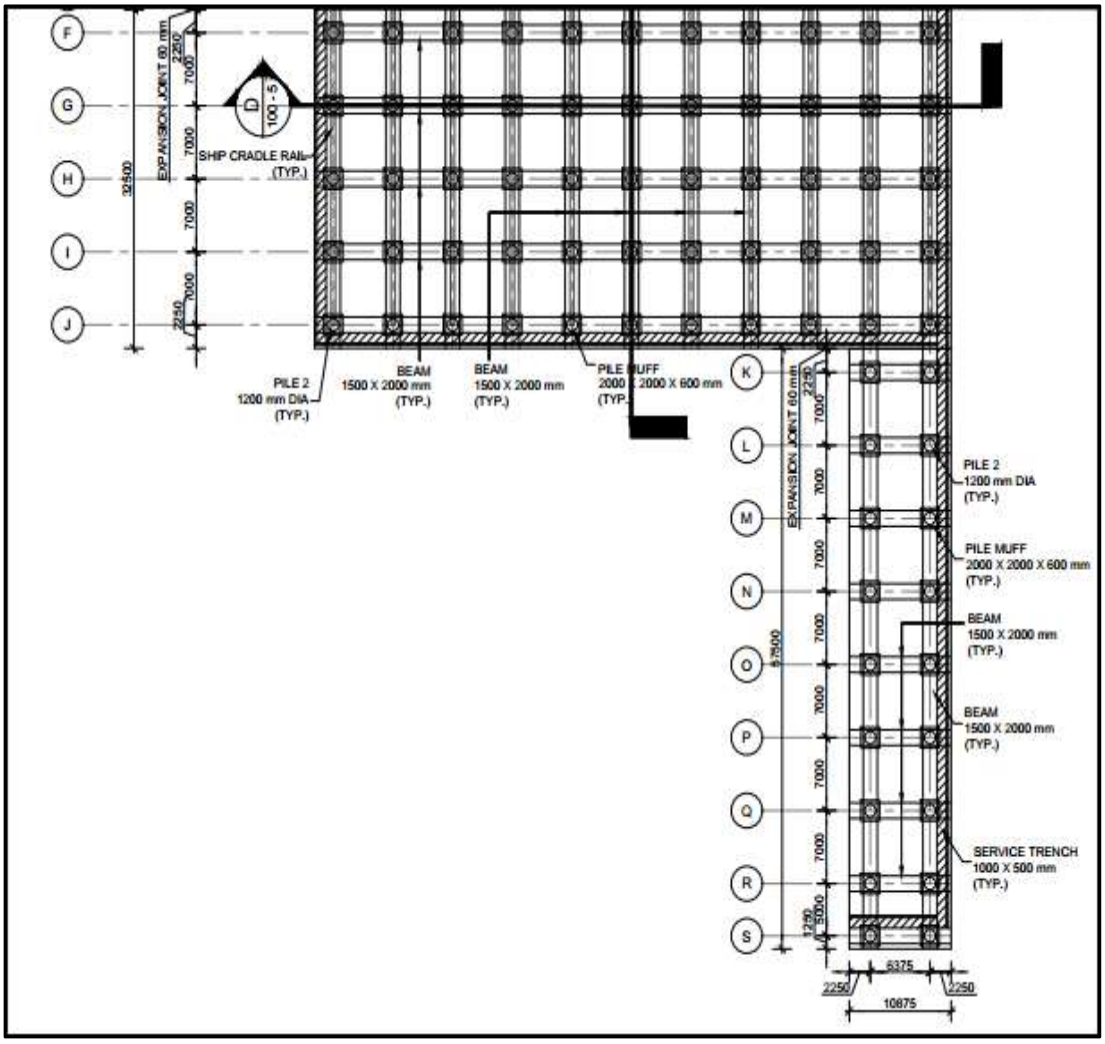

FIG. 1.9: PLAN VIEW OF THE SHIP REPAIR BAY

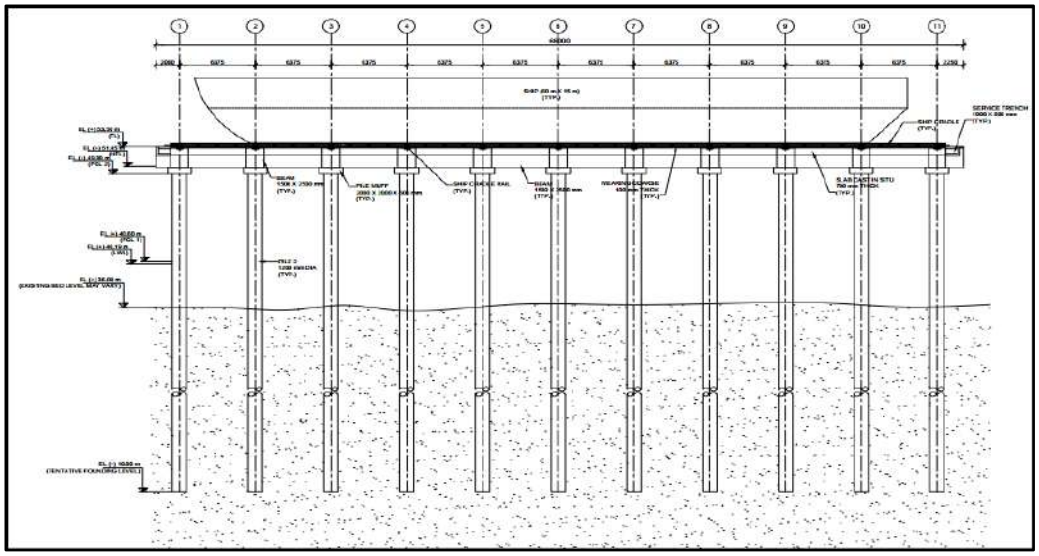

FIG. 1.10 : FRONT-SECTION OF SHIP REPAIR BAY

Land side development

The ship repair facility at Pandu in Guwahati has a sprawling space consisting of PEB shed divided into Fabrication yard, electrical and outfitting shops, Store and scrap yard. Further the land side developments includes admin block, Canteen & substation building , Store, Carpentry shop, Pipe shop , Fire and safety building/Rest Room , Drive way and landscape etc. The overall view of the Land side facility shown in Figure 1.11.

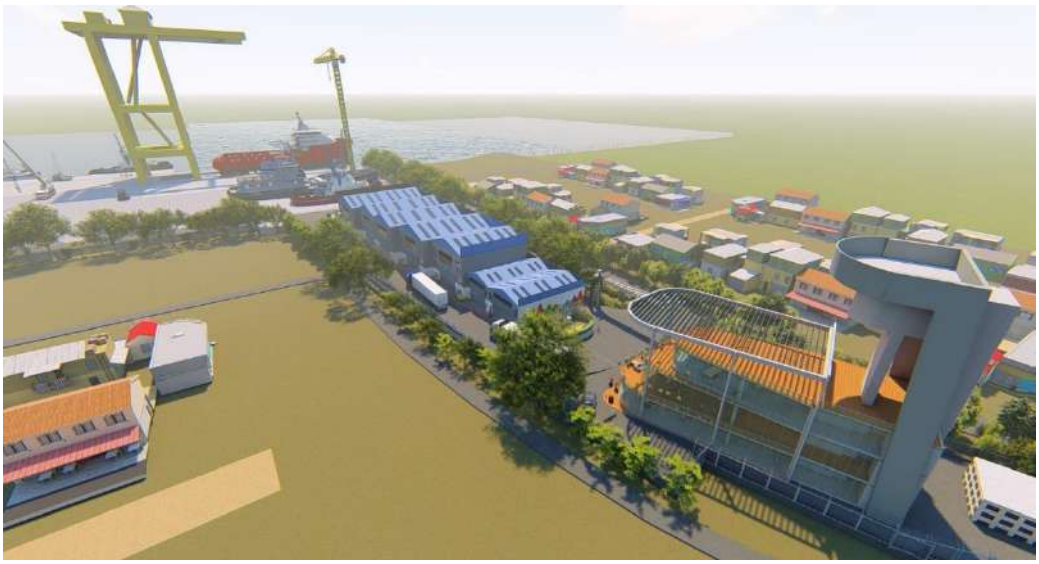

FIG 1.11 OVERALL VIEW OF THE LAND SIDE FACILITY

1.7 TENDER PROCEDURE

The Tender procedure will be executed as a 02 (two) envelope system.

a) The Bidders have to submit their Tender according to Clause 2 and shall comprise of 2 parts- Techno-commercial Tender & Financial Tender.

b) The Financial Tenders shall be retained in the custody of the Employer without being opened.

c) The Employer shall invite those bidders who have submitted responsive Technical Tenders and who have been determined as techno-commercially qualified, for attending the opening of Financial Tender.

d) The Employer will inform bidder who have not submitted substantially responsive Technical Tenders and who have been determined as being not post-qualified.

e) The tenderer should familiarize themselves with the local conditions, and take them into account in preparing their Tender including site visits, attending pre-bid meeting etc. Bidders are expected to independently assess the site conditions, scope and nature of work and the circumstances under which work is awarded. Attending any such site visit, pre-bid meeting is purely at the risk and cost of the bidder.

1.8 EVALUATION CRITERIA

The Bids received and opened will be evaluated by employer to ascertain the relative position of the best Bid in the interest of employer, for the complete work covered up by Bid Documents.

The details submitted by the bidders will be evaluated by scoring method in the followingmanner:

(a) Financial parameters - Maximum 30 marks

(b) Experience in similar nature of work during last 7 years - Maximum 30marks

(c) Personnel and Establishment - Maximum 20 marks

(d) Plant & Equipment - Maximum 20 marks

Total 100 marks

1.9 MINIMUM QUALIFICATION CRITERIA

1.9.1 Financial Turn Over

Average annual financial turnover on construction works should be at least 50% of the estimated cost put to tender during the immediate last three consecutive financial years ending 31st March 2022. The value of annual turnover figures shall be brought to current value by enhancing the actual turnover figures at simple rate of 7% per annum. An attested / notarized copy of audited balance sheet and profit & loss Account for the preceding 3 years has to be submitted in proof of financial turn over.

1.9.2 Financial capability for executing the work

Banker's Certificate from a Commercial Bank or Net worth Certificate:

Banker's Certificate of the amount equal to or minimum 40% of the Estimated Cost put to tender (ECPT) ie Rs 58 crs , OR

Networth certificate of minimum 10% of the estimated cost put to tender issued by certified Chartered Accountant with UDIN

The bidder should not have incurred any loss (profit after tax should be positive) in more than two years during available last five consecutive balance sheet (balance sheet in case of private/public limited company means its standalone financial statement and consolidated financial statement both), duly audited and certified by the Chartered Accountant.

1.9.3 Experience

Experience of having successfully completed similar works during last 7 years (ending last day of month previous to the one in which tender applications are invited) should be either of the following:

- Three similar works, each work costing not less than Rs. 58 Crs

OR

- Two similar works, each work costing not less than Rs. 86 Crs

OR

- One similar work costing not less than Rs. 115 Crs

Explanatory Notes:

a. Similar works means development of marine structures or structures developed in the river and other water bodies viz., structures like Shiplift/ shipyard, slipway, dry dock, jetties, berths, off shore port facilities, offshore bridges etc. Work order and Completion certificate issued by the client/employer shall be enclosed for each eligible project.

b. The value of similar works completed by the Tenderer will be brought to current cost level by enhancing the actual value of work with the multiplication factor as detailed below for assessing the eligibility of the Tenderer under experience. The base year shall be taken as 2021-22.

Year	Multiplication factor
FY 2021-22	1.00
FY 2020-21	1.07
FY 2019-20	1.14
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FY 2015-16	1.41

Note:1. Bidder should indicate actual figures of costs and amount for the works executed by them in the schedule without accounting for the above-mentioned factors. In case the financial figure and the value of completed works are in foreign currency, the above enhancement factors will not be applied. Instead , the foreign currency will be converted into equivalent Indian Rupees (INR) at the State Bank of India BC selling rate prevailing 28 days prior to bid due date.

1.9.4 Personnel and Establishment

The tenderer shall furnish details of proposed organizational structure and technically qualified personnel in their employment to be deployed for the above work, if awarded, as per the proforma at Annexure-12. Technically qualified personnel should fulfil minimum

criteria specified in clause No: 105.1 of General conditions of contract.

1.9.5 Plant and Equipment

The tenderer shall furnish the details of equipment/machinery to be deployed for the above work, if awarded, as per the proforma at Annexure-11. The tenderer shall own plant, equipment(s) and other resources of adequate capacity at least in minimum numbers specified in Annexure-11 to carry out the scope of works within the time period specified in the bid.

1.9.6 Other Eligibility Criteria

a) The Applicant shall not be under a declaration of ineligibility or put on holiday or blacklisted or terminated by HCSL/CSL or Govt. of India / Any State in India / Other public Sector undertakings etc.

b) Bidders are also required to furnish an undertaking clearly stating that the bidder has not applied or is not applying for Corporate Debt Restructuring (CDR) in last 5 years (FY 2017-2018, 2018-2019, 2019- 2020, 2020-2021, 2021-2022 and till the date of submission of the bid.

c) Only bidders with valid Permanent account number (PAN), GST Registration, EPF/ESI registration need to participate in this tender. GST Registration number, PAN, EPF/ESI details etc. is to be clearly mentioned in the tender. The tenderer shall furnish documentary evidence in support of above requirements.

d) The Applicant and its vendor subsidiaries / affiliates should not be involved as consultant for the services for the project.

e) Bidder shall not be under liquidation, court receivership or similar proceedings.

f) **Bid Capacity**

The Applicants who meet the minimum qualification criteria will be qualified only if their available bid capacity at the expected time of bidding is more than the total Estimated Cost of the works. The available bid capacity will be calculated as under.

Assessed Available Bid Capacity = (A x N x 1.5 -B)

Where

A = Maximum value of Construction works executed in any one year during the last five years with enhancement factor as given below, which will take into account the completed as well as works in progress.

B =Value of the existing commitments and ongoing works to be completed during the next **18** months (period of completion of works for which bids are invited), and

N =number of years prescribed for completion of the works for which the bids are invited, i.e., 18 months in the present case.

Note: Item 'B' stated above should be substantiated with proper records & evidences.

Escalation:

The base year is 2021-22**.**The following enhancement factors will be used for the costs of works executed and the financial figures to a common base value for works completed in India.

Year	Multiplication factor
FY 2021-22	1.00
FY 2020-21	1.07
FY 2019-20	1.14
FY 2018-19	1.21
FY 2017-18	1.28
FY 2016-17	1.35
FY 2015-16	1.41

In case the financial figure and the value of completed works are in foreign currency, the above enhancement factors will not be applied. Instead , the foreign currency will be converted into equivalent Indian Rupees (INR) at the State Bank of

India BC selling rate prevailing 28 days prior to bid due date.

Note:

- ✓ Copies of the documentary evidences to be furnished in support of the pre-qualification requirements should be submitted with due attestation by the competent authority.
- ✓ The tenderers should furnish the original documents is called for at the time of tender evaluation to verify the copies of documentary evidences furnished along with the pre-qualification documents.
- ✓ The tenderer should furnish self-sworn affidavit about the fresh tenders and the tenders, which are now being processed in various Wings/Departments in their favor.
- ✓ The audited balance sheet/profit and loss account etc. to be furnished by the tenderer should be properly endorsed by the auditors as verified with reference to the particulars furnished by the individuals and found to be correct

g Disqualification

Even though the Applicants meet the above criteria, they are subject to be disqualified if they have:

- ➢ Made misleading or false representation in the form, statements and attachment submitted and / or
- ➢ Records of poor performance such as abandoning the work, rescinding of contract for which the reasons are attribute to the non-performance of the contractor, consistent history of litigation awarded against the applicant or financial failure due to bankruptcy.

1.10 CONFIDENTIALLY

The Bidder is committed and fully expected to handle all information in relation to the project confidentially, including but not limited to the project name, name and logo of

Employer or one of its shareholders furnished by the Employer to the Bidder.

Information relating to the evaluation of Tenders, and recommendation for post-qualification, shall not be disclosed to any Bidder or any other persons not officially concerned with such process until the notification of post-qualification is made to all Bidders.

1.11 PERIOD OF CONTRACT

The time of completion of work of 18 months shall be reckoned from the 30th day of the date of the work order or the date of handing over the site whichever is later. The time allowed for carrying out the work as mentioned above shall be strictly observed by the contractor. The work throughout the time period shall be proceed with diligence keeping in view that time being deemed to be the essence of the contract.

Bidders shall categorically consider the schedule of the project and stages of work and should have a strategy to execute the Civil works in proper schedule exactly in agreement with the stages of work and completion schedule. Procurement of materials /systems shall be commenced and completed exactly in tandem with the execution schedule.

1.12 COSTS

The Bidder shall bear all costs associated with the preparation and submission of the Tender, Pre-Bid Meeting and contract negotiations, including visits to the Employer and project site. The Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

1.13 BIDDING DOCUMENT, CLARIFICATION AND AMENDMENT

1.13.4 Bidding Document

The Bidding Document shall be read in conjunction with any amendment issued subsequently.

The Bidder is fully expected to examine the Bidding Document, including all instructions, terms, specifications and drawings in the Bidding Document. Failure to

furnish all information required as per the Bidding Document or submission of a bid not responsive to the Bidding Document in every respect could result in rejection of the Bid.

Bidding documents are non-transferable in other name and shall at all times remain the exclusive property of Employer. However, Bidder can use the Bidding Documents for a limited purpose of bid submission.

1.13.5 Clarification Requests by Bidder

The Bidder is fully expected to have inspected and assessed the site conditions, read and clearly understood the bidding documents. It is the responsibility of the Bidder to ensure that all documents are included in the bid as per the checklist. Bidder shall examine the Bidding Document thoroughly in all respects and if any conflict, discrepancy, error or omission is observed, Bidder may request clarification up to 2 days prior to Pre-Bid Meeting date as per format in Annexure-21. Such clarification requests shall be directed to the emails mentioned in the NIT.

Bidders are expected to resolve all their clarifications / queries to the Bidding Document and submit their bid in total compliance to Bidding Document without any deviation. Any failure by Bidder to comply with the aforesaid requirement shall not excuse the Bidder, after subsequent award of Contract, from performing the work in accordance with the Contract.

1.13.6 Amendment of Bidding Document

Employer may, for any reason whether at his own initiative or in response to the clarification requested by the prospective bidder(s), issue amendment in the form of Corrigendum/Addendum during the bidding period or subsequent to receiving the

bids. Any Amendment thus issued shall become part of Bidding Document. The Bidder or Contractor as the case may be, shall be bound by the amendment carried out.

1.14 PRE-BID MEETING

a) Only single pre-bid meeting is envisaged and the same will be held on the date and at the location mentioned in the Summary.

b) Bidders are expected to visit the site and understand the site conditions prior to pre-bid meeting. Every clarification in connection with Civil works shall be addressed to HCSL prior to the pre-bid meeting.

c) The purpose of the meeting is to clarify any doubts, suggestions, modifications and other queries, if any, on the tender document.

d) All Bidders are fully expected to study the tender documents thoroughly and come prepared to the meeting.

e) The meeting shall be attended by duly authorized competent representative(s) of the Bidder. Duly filled authorization letters are required for attending the pre-bid meeting. The same shall be submitted on the venue of the pre-bid meeting. HCSL prefers domain experts in Civil of the tenderer shall also participate in the pre-bid meeting in order to have explicit clarity as regards to the works to be executed, specifications and stages of work to be achieved.

f) All the clarification/queries have to be cleared in this meeting and no further clarifications shall be entertained after the Pre-bid meeting

g) Bidder requiring any clarifications must send a written request to the Employer in the pre-bid questionnaire attached as Annexure-21 by courier/e-mail to reach HCSL at least 2 days prior to Pre-bid meeting. These queries shall be replied during the Pre-bid meeting. Any request should be sent by the time and to the address mentioned in the summary.

h) The compilation of all queries discussed during the pre-bid meeting together with replies shall be uploaded in HCSL website www.hooghlycsl.com and CSL website www.cochinshipyard.in.

i) Any modification of the tender document which may become necessary as a result of the pre-bid meeting shall be made by the Employer through the issuance of a corrigendum/addendum (Refer Clause 2.3) which shall be published in HCSL website www.hooghlycsl.com and CSL web site www.cochinshipyard.in.

j) Non-attendance of the pre-bid meeting will not be a cause for disqualification of a

bidder. In case any bidder does not attend the pre bid meeting, it shall be understood that the bidder has a clear understanding of the scope, terms & conditions of the tender document and does not have any comments/ deviations to the requirements of the tender Document. Any clarification raised by the non-attending bidder shall not be entertained later.

k) Considering the nature of the works to be executed, please take note that not visiting the site prior to submission of bid shall be a cause for rejection of bids.

l) Record Notes of Pre-bid Meeting/Reply to Pre-bid Queries, Bidders authorization letter and shall be considered as part of tender document.

1.15 SITE VISIT

Considering the nature of the works to be executed, Site visit by prospective bidders is a mandatory requirement for submission of bid. Bidders have to submit a declaration along with technical bid stating that detailed site visit was carried out and site conditions and present status of works were examined and assessed and balance scope of works are fully understood by bidders.

Pre and post pre-bid meeting, Bidder is advised to visit and examine the site and its surroundings multiple times and familiarize himself with the existing facilities and environment, present status of progress of various works, materials available at site etc. and collect all other information including applicable laws, which he may require for preparing and submitting the bid and entering into the Contract. Bidder shall depute domain experts in Civil works to imbibe full clarity on the site conditions , surface and subsurface strata, climatological, oceanographic data given in the tender documents are only intended as a general guidance for the Contractor and no warranty is given for the correctness of the same. Claims and objections due to ignorance of existing site conditions or inadequacy of information will not be considered after submission of the bid and during implementation.

The Bidder and any of his personnel or agents will be granted permission by the Employer to enter upon his premises and land for the purpose of such inspection, but only upon the explicit condition that the Bidder, his personnel or agents will release and indemnify the Employer and his personnel and agents from and against all liability in

respect thereof and will be responsible for personnel injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, cost and expenses incurred as result thereof.

The contact for requests for the site visit is mentioned in the summary.

1.16 ONE TENDER PER BIDDER

Each Bidder shall submit only one Tender.

1.17 ALTERATION OF SUBMITTED TENDERS

Any alterations, modifications or change in the submitted proposals can be made at any time prior to the tender submission date. Under such scenario, the latest offer received by HCSL shall only be considered for evaluation. Date of submission of revised offer should be clearly mentioned in such cases.

Subsequent to the due date and time, Bidders are not allowed to change the price or substance of the Bid i.e. scope of work, specifications, delivery schedule, completion period, etc. Unsolicited clarifications to the offer and / or change in the prices during the validity period would render the bid liable for rejection.

1.18 EMPLOYER'S RIGHT TO ACCEPT OR REJECT TENDER

Notwithstanding anything contained in this Tender Document, the Employer reserves the right to accept or reject any Tender and to annul the tender process and reject all

Tenders, at any time without any liability or any obligation for such acceptance, rejection or annulment, without assigning any reasons.

The Employer reserves the right to invite revised Technical Tenders and / or revised Financial Tenders from Bidder(s) with or without amendment of the Tender document at any stage, without liability or any obligation for such invitation and without assigning any reason. Such decisions by Employer shall bear no liability whatsoever consequent upon such decisions.

1.19 SUBCONTRACTOR

The successful bidder (contractor) shall not subcontract, transfer or assign the entire work to any other Agency or entity or person nor shall transfers be made by the 'Power of Attorney' authorizing others to carry out the work or receive payment on behalf of the Contractor.

However, if the Contractor is required to engage a Sub-Contractor for any specialized part of work then such Sub-Contractors shall have prior proven experience of undertaken such similar work and shall require prior specific approval by employer after award of work. If such cases are envisaged, bidder shall depute the subcontractor also for the site evaluation in order to understand the scope, stages of work, and completion schedule in all respects.

They have to have substantial information and a solid plan about the procurement and positioning of required materials at site in tune with the milestones /stages as per contract and to execute the work hand in hand with the progressing civil works. Please take specific note that no claims or variation shall be accepted either in terms of time or cost once the bid is opened or later during execution. So, it shall be the obligation of the contractor /subcontractor to work exactly as per the scope, terms and conditions of the contract and strictly in compliance with the milestones/ stages and completion schedule. Please take note that the liabilities of those works, in all its entirety shall also lie with the principal Contractor. The principal contractor shall be liable for complying with all the applicable law in force, in respect of the sub- contractor engaged by him.

For specialized works, all documentary evidence substantiating the credentials of the subcontractor shall be submitted during approval stage after award of work.

Notwithstanding any sub-letting with such approval as aforesaid and notwithstanding that the Engineer-in-charge shall have received copies of any sub-contracts, the contractor shall be and shall remain solely responsible for the quality and proper and expeditious execution of the works and the performance of all the conditions of the contract in all respects as if such sub-letting or sub-contracting had not taken place and as if such work had been done directly by the contractor.

If any sub-contractor engaged upon the works at the site executes any work which in the opinion of the Engineer-in-charge is not in accordance with the Contract documents in all respects including the execution in compliance with HSE scheme, the employer may issue notice to the contractor requesting him to terminate such sub- contractors and the contractor upon the receipt of such notice shall terminate such sub-contractors and the latter shall forthwith leave the works, failing which the employer shall have right to remove such sub-contractors from the site in respect of the contract awarded. In such cases bidder shall have alternate option to rectify the defects and complete the works exactly as per the specification, mile stones and completion schedule.

Any action taken by the employer under this clause shall not relieve the contractor of any of his liabilities under the contract or give rise to any right to compensation, extension of time.

1.20 CORRUPT OR FRAUDULENT PRACTICES

No Bidder shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the Tender evaluation result is announced by the Employer.

The Employer fully expects that Bidder / Contractors observe the highest standard of ethics during all stages of post-qualification, tendering, planning and construction.

In pursuance of this policy, the Employer:

a) defines, for the purposes of this provision, the terms set forth below as follows:

i. "Corrupt practice" means the offering, giving, receiving or soliciting of anything of value (in cash or in kind) to influence the action of a public official/HCSL official during prequalification or tendering process or contract execution; and

ii. "Fraudulent practice" means a misrepresentation of facts in order to influence a prequalification or tendering process or the execution of a contract to the detriment of the Employer and includes collusive practice among Applicants / Contractors (prior to or after tender submission)

designed to establish tender prices at artificial non-competitive levels and to deprive the Employer of the benefit of free and open competition.

b) Will reject a proposal for award if it determines that the bidder/ Contractor recommended for award has engaged in corrupt and / or fraudulent practices in competing for the Contract in question.

Submission of Duly filled Integrity Pact in HCSL approved format (Annexure-7 of Standard Forms & Formats) along with the Techno-Commercial tender is mandatory and any offer submitted without duly filled Integrity Pact in HCSL approved format will summarily be rejected.

2.0 PREPARATION OF TENDER DOCUMENT

2.1 GENERAL CONSIDERATIONS

The Bidder should read all terms and instructions included in the document. Failure to provide all requested information will be at Bidder's own risk and may result in rejection of the proposal. Bidding Document is non-transferable. Bids received from Bidders in whose name Bidding Document Fee has been submitted shall only be considered.

In case any Bidder is found to be involved in cartel formation, his Bid will not be considered for evaluation / placement of order. Such Bidder will also be debarred from bidding in future.

Canvassing in any other form by the Bidder or by any other agency on their behalf may lead to disqualification of their Bid.

Integrity Pact (in original), duly signed & stamped on each page, shall be submitted along with the Original EMD and Bidding Document Fee

Bids received after stipulated bid due date and time i.e. late/delayed bids due to any reasons whatsoever will not be considered. Bids sent through Fax/E-mail/CD/Pen Drive shall not be accepted. Such bidders cannot have any claim what so ever arising out of the non- accepted bids.

2.2 VALIDITY OF TENDERS

2.2.1 The Tender shall be valid for a period of 90 days from the date of opening of tender

2.2.2 If it becomes necessary, the Employer may in writing request the parties to extend the Tender validity. The request and responses thereto shall be made in written form. In case a party extends the validity then it shall also extend the validity of its EMD for corresponding period.

In case the Bidder refuses to extend the validity of the Bid, EMD shall be forfeited and the Bidder shall be disqualified from further bidding process.

The Employer may extend the Tender Due Date by issuing an Addendum

2.3 AMENDMENT OF TENDER DOCUMENTS

2.3.1 At any time before the submission of Tender, Employer may, for any reasons, whether at its own initiative or in response to a clarification requested by an invited Bidder, modify the documents by amendment. The amendment will be circulated by uploading in HCSL website www.hooghlycsl.com and CSL Website www.cochinshipyard.in . It is the responsibility of the Bidder to check for any amendments prior to bidding.

2.3.2 Employer may at its discretion extend the deadlines for the submission of Tender.

2.3.3 Prospective Bidder shall acknowledge receipt of each addendum in writing to the Employer. The Bidder shall also confirm in the Form of Tender that the information contained in such amendment/addendum have been considered in preparing its Tender.

2.3.4 If the amendment is major, the tender submission deadline might be postponed.

2.4 LANGUAGE

The Tender and all related correspondence and documents should be written in English.

2.5 BID PRICES

Bidder shall quote price after careful analysis of cost involved for the performance of the work considering all parts of the Bidding Document. In case any activity though specifically not covered in description of item under Schedule of Rates (SOR)/Schedule of Price (SOP) but is required to complete the work as per scope of work, scope of supply, specifications, standards, drawings, General Conditions of Contract (GCC), Special Conditions of Contract (SCC), Employer's requirement or any other part of Bidding Document, the prices quoted shall be deemed to be inclusive of cost incurred for such activity.

The quoted prices shall remain firm, fixed and valid until completion of the Contract performance and will not be subject to variation on any account except as otherwise specifically provided in the tender document and contract signed.

Rates shall be furnished both in figures and words. Rates quoted should be basic rates including all taxes, cess and duties but excluding goods and service tax (GST) and should be in Indian Rupees. The rate and amounts including Goods and service tax, have to be mentioned at the end of the schedule of rates/price bid. The GST applicable as per the law can be billed on the Hooghly Cochin Shipyard Limited (HCSL) , which will be paid to the Contractor by the Employer along with the bills. The Contractor in

turn shall remit the GST to the concerned department as provided by law, within 20th day of next month and proof of remittance shall be submitted to the employer prior to submission of next bill claim.

Price Bids shall be evaluated based on overall total amount (Landed cost of HCSL). The overall total amount is arrived from the sum of the total amount of individual items and total amount of all taxes quoted by the contractor.

In the event that no rate has been quoted for any item(s), then the rate for such item(s) will be considered as zero and tender evaluated accordingly. If the bidder becomes L-1 during such evaluation, then non- quoted item(s) of work have to be executed with zero rates.

2.6 CURRENCIES OF BID & PAYMENT

Bidders shall quote the rates/prices in Indian Rupees (INR) only. All payment to be made by Employer shall be made in Indian Rupees (INR) only.

2.7 EARNEST MONEY DEPOSIT AND BIDDING DOCUMENT FEE

Cost of Bidding Document for an amount of Rs 5000/- plus GST at the rate of 12% shall be submitted in the form of Demand Draft/Bankers Cheque/NEFT, in favour of HCSL Ltd., payable at Kolkata.

Bidder shall deposit an amount of Rs. 1,54,00,000/-as Earnest Money Deposit (EMD) along with the tender.

The EMD can be remitted in the form of Demand Draft (DD)/ Banker's Cheque/NEFT or RTGS/Bank Guarantee drawn in favour of 'Hooghly Cochin Shipyard Ltd.' payable at Kolkata and shall be valid for a period of 6 (Six) months from the due date of opening of Techno commercial Bids from any Nationalized/ Scheduled Bank or paid online through e-gateway during the period of bid submission:

EMD furnished by all un-successful Bidders will be released after acceptance of the Work Order to whom the Works are awarded.

a) EMD of the successful Bidder will be refunded after remittance of the performance security as stated under conditions of contract.

b) EMD deposited with the Employer will be forfeited;

i. If a bidder withdraws or modifies his Tender during the period of validity specified, or

ii If the successful Bidder fails within the time limit to sign the Contract Agreement or fails to furnish the required Performance Security.

iii Request for enhancement in the quoted rates or bringing in new conditions after tender opening or unnecessary delayed acceptance of the work order/ Commencement of work / submission of Performance Security / executing the agreement.

iv. In the event of bidder withdrawing his Tender before the expiry of 90 days from the due date of submission of proposal or such extended period sought by the employer.

c) The relevant documents pertaining to the EMD & Cost of tender form should be enclosed in a

separate sealed cover, super scribing the Bidder name, Tender Notice No. and Date in the Technical Tender.

d) Tenders received without EMD, cost of tender form or EMD/cost of tender form not furnished as per HCSL approved format shall be summarily rejected.

2.8. ZERO DEVIATION BIDDING

Bid shall be submitted as "Zero deviation Basis". Accordingly offer is to be submitted in complete compliance to Bidding Document terms & conditions without any deviation. Offer with deviation shall be liable for rejection without any further correspondence. In view of this, Bidder shall ensure submission of complete bid without any deviation as per requirement of bidding document in first instance itself.

2.9 SIGNING OF TENDER

a) An authorized representative of the Bidder shall sign the original Tender submission letters and shall initial all other pages of the Tender.

b) The signing representative of the Bidder must be authorized by an officially certified power of attorney in the form at (Annexure – 4 of Standard Forms & Formats). The power of attorney shall be enclosed to the Technical Tender.

c) The proposal shall not contain interlineations or overwriting except as necessary to correct errors made by the bidder itself. In such cases the corrections must be initialed by a person who is authorized to sign the Tender.

d) The tender shall contain complete address of the company making the tender followed by the name and designation of the person signing with company round seal and designation seal.

e) Tender by Company or Corporation registered under the relevant Companies Act shall be signed by the authorized representative and a power of attorney in that behalf shall accompany the tender.

2.10 ELEMENTS OF TENDER

2.10.1. Technical Tender

a) The Technical Tender shall not include any financial information. A Technical Tender containing material financial information shall be declared non-responsive and will not be considered.

b) The Technical Tender shall comprise the documents and forms listed in the Summary. As regards to mechanical & Electrical items, all required information shall be furnished along with make /model if any applicable shall be provided The Employer reserves the right to reject any Tender that is not in the specified formats.

2.10.2. Financial Tender

a) The Financial Tender shall comprise the documents and forms listed in the summary. The Employer reserves the right to reject any tender that is not in the specified formats.

b) The Bidder is deemed to have included all prices in the Financial Tender, so neither arithmetical corrections nor price adjustments shall be made subsequently.

c) If there are discrepancies between the PDF versions of price bid issued by the Employer and signed printout of price bid submitted by the Tenderer, the PDF version issued by the Employer shall prevail.

2.11. PRINTING OF TENDER

The Proposal shall be prepared with indelible ink.

2.12. TENDER COPIES

a) The Tender must be submitted in hard (1 Original & 2 Duplicates). Soft copy of tender document scanned from the original document in CD/DVD shall be submitted along with the hard copy. In case of any discrepancy between the two, original signed document will be considered as final.

b) All duplicates shall be made from the signed original. If there are discrepancies between the original and the copies, the original shall

prevail.

2.13. SEALING OF TENDER

a) The Bidder shall seal the Technical Tender and the Financial Tender in two separate envelopes. Both of these envelopes shall then be sealed and placed in an outer envelope.

b) The envelope of the Technical Tender shall be clearly marked with "TECHNICAL TENDER", "[Name of the Work] ", reference number, name, address, e-mail of the bidder, and with the warning "DO NOT OPEN BEFORE [INSERT THE DATE AND THE TIME OF THE TECHNICAL PROPOSAL SUBMISSION DEADLINE]" and sealed.

Within the envelope of the Technical Tender the relevant documents pertaining to the EMD (Refer Clause 2.7) & cost of tender form should be enclosed in a separate sealed cover, super scribing the Bidder name, Tender Notice No. and Date in the Technical Tender.

c) The envelope of the Financial Tender shall be clearly marked with "FINANCIAL TENDER", "[Name of the work] ", reference number, name, address, e-mail of the Bidder, and with the warning "DO NOT OPEN BEFORE NOTIFICATION FOR POST- QUALIFIED BIDDER IS ISSUED" and sealed.

d) Technical and Financial Tender envelopes shall be placed in an outer envelope and sealed. The outer envelope shall indicate the submission address, reference number, name of the work, reference number, name and address of the Bidder, and with the warning "DO NOT OPEN BEFORE [INSERT THE DATE AND THE TIME OF THE TECHNICAL PROPOSAL SUBMISSION DEADLINE]"

e) If the envelopes are not sealed and marked as instructed above, the Tender may be deemed to be non-responsive and would be rejected. The Employer takes no responsibility for the misplacement or premature

opening of suchTender.

2.14. SUBMISSIONOFTENDERS

a) Tenders shall be submitted at the address and not later than the time mentioned in the summary

b) Any Tender submitted after the submission date mentioned in the summary will not be considered and will automatically stands rejected.

c) Proposals submitted by facsimile transmission, telex or email will not be accepted.

d) Late tenders and delayed tenders shall be summarily rejected.

3 TENDER OPENING

3.11. TECHNICAL TENDER

a) The Techno Commercial Tender shall be opened in the premises of the employer in the presence of the bidders, if present : the following shall be checked:

- Name, address, e-mail of Bidder
- Cost of tender form
- Presence of Techno-commercial & Financial Tender in separate duly filledsealed envelopes.
- Presence of EMD.
- Presence of Integrity Pact.
- Presence of Unpriced Bill of Quantities
- Any modifications of Tender submitted prior to proposal submission deadline.
- Declaration regarding site visit and awareness of present site conditions
- Undertaking regarding compliance of qualifying criterion
- Undertaking regarding unconditional rates, illegal gratification
- Undertaking regarding acceptance of Terms & conditions
- Attestation by authorized representative of bidder in all pages of tender document

- Information about any current litigation / arbitration, if any, in which bidder isinvolved.
- Fresh Solvency Certificate from Bidder's Banker. The date of issue of this certificate should not be earlier than 1 month from the date of opening of techno-commercial Un-priced Bid
- Details of current commitments as per **Annexure-8** of Formats & Schedules, which include all work under execution with percentage of completion. The percentage of completion should indicate updated progress as on due date of bid
- Submission Declaration by bidder regarding black listing / holiday listing as per (**Annexure –2** of Formats & Schedules)
- Check list duly filled in as per **Annexure -1** of Formats & Schedules
- Self-certificate that the bidder is not under liquidation, court receivership orsimilar proceedings
- Details of Annual Turnover Statement along with Audited Balance Sheet andProfit & Loss account of bidding entity for preceding financial years.
- Undertaking regarding CDR.
- Authorization letter/Power of attorney as per approved Employer format
- Details of organizational structure and key personnel proposed for the project along with CV.
- Details of major plant and machinery as per Annexure-11
- Detailed work methodology and construction schedule
- Details of sub-contractors(If any)
- Experience credentials of executing works of similar nature in last 7 years
- NEFT payment details

b) The technical content of bids shall be examined in detail. In case of any clarification, the Employer shall intimate the bidder regarding the clarifications/query and bidder is bound to furnish required clarifications within stipulated time period.

c) The envelope with the Financial Tender shall remain sealed and shall be securely stored until the technical evaluation (post-qualification) is completed. The

evaluators of the Techno Commercial Tenders shall have no access to the Financial Tenders until the technical evaluation (post-qualification) is completed.

d) During technical evaluation, in case the firms were asked to comply with certain additional requirements that has commercial implications then technically qualified bidders may be given an opportunity to submit their most competitive addendum price bid before opening the price bids.

3.2 FINANCIAL TENDER

i. The Financial Tender shall be opened by the Employer on a later date which willbe intimated to the responsive Bidders

ii. Financial bids shall be opened in presence of the representatives of those Bidder whose Techno-commercial Tender has passed the post-qualification, which will be intimated to those bidders whose techno-commercial bid is determined as qualified.

iii. At the time of opening, the name of Bidder shall be read aloud. Before opening, the Financial Tenders will be inspected to confirm that they have remained sealed and unopened. These Financial Tenders shall then opened, and the total prices read aloud and recorded

4. TENDER TECHNO-COMMERCIAL EVALUATION

4.1. QUERIES BY EMPLOYER

The Bidder shall in writing intimate to the Employer an official e-mail address, in case queries arise during Tender evaluation by the Employer.

During evaluation stage, the Employer or his representatives may, at its own discretion,ask the Bidder for clarifications The Bidder is required to respond within the time frameprescribed by the Employer.

In case these are not submitted within stipulated time, offer of bidder will be evaluatedbased on available details. If the available details are found to be adequate, the same will be considered. Otherwise, it will be rejected.

During the course of evaluation, Bidder may be asked to visit the Employer for

discussion, if required. Bidder shall depute his authorized representative(s) for attending the discussions. The representative attending the discussions shall produceauthorization from his organization to attend the discussions and sign the minutes of meeting on behalf of his organization. The authorized representatives must be competent and empowered to settle all technical and commercial issues with the exception of Price implications, wherever applicable. Bidders will be asked to submit price implication in sealed envelopes, if considered necessary by CSL, due to change in the scope of work or conditions of contract.

4.2. PRELIMINARY SCRUTINY

Submission of Techno-commercial, financial tenders in separate sealed envelopes and in turn placed in an outer envelope as mentioned in Clause No: 2.13- Sealing of Tenders is mandatory. In case a Tender is received without the requisite and proper EMD and cost of tender form, it shall be summarily rejected and the second envelope of such Tender containing Financial Proposal will not be opened. Delayed offers and late offers shall be summarily rejected

4.3. RESPONSIVENESS OF TENDER

Tenders received on time with the requisite tender document fee and proper EMD shallthereafter be examined for responsiveness. A substantially responsive bid is one, which conforms to the terms, conditions and specification of the bidding documents without deviation.

The following provisions of the bidding document must be adhered to without any deviation, failing which the bid shall be considered to be non-responsive and rejected.

a) Bid validity

b) Cost of Bid document & Bid Security/Earnest Money Deposit, wherever applicable

c) Mandatory participation - Site visit and pre-bid meeting

d) Tender document signed and sealed in accordance.

c) Time Schedule

d) Schedule of Rates/Prices

e) Defects Liability Period

f) Mobilization Advance

g) Compensation for Delay

h) Arbitration

i) Scope of Work / Scope of Supply

j) Security Deposit/Performance Bank Guarantee

k) Suspension & Termination

l) Force Majeure

m) Integrity Pact

n) Submission of relevant undertakings

o) Positive Profit after tax for financial years 2020-2021, 2021-2022& 2022-2023 (provisional)

p) Undertaking regarding not applied/applying for CDR

q) Fresh solvency certificate for an amount of Rs 58 crores

4.4. POST-QUALIFICATION OF BIDDER

All Bidders whose Tender have been determined to be substantially responsive to the requirements and who have met or exceeded the specified criteria's shall be determined as post-qualified by the Employer.

4.5. NOTIFICATION OF POST-QUALIFICATION

Once the Employer has completed the evaluation of the Technical Tenders, it shall notify all Bidders (bidders determined as post qualified) in writing regarding their status of post-qualification, including the date, time and venue for opening of the financial tenders.

4.6. OPENING AND EVALUATION OF FINANCIAL TENDER

Promptly after the notification of the results of the post-qualification, the Employer shallinvite the post-qualified Bidder for the opening of the Financial Tender.

After opening of the Financial Tenders, Employer will execute an evaluation of Financial Tenders regarding their completeness, soundness, significant variations and

or inconsistency (ies).

4.6.1 Evaluation of Financial Tender

Price bids shall be evaluated based on the lowest offer on the total overall amount obtained.

The prices quoted by the Bidders shall be checked for arithmetic correction, if any, based on rate and amount filled by the Bidder in the Schedule of rates/Schedule of prices formats. If some discrepancies are found between the rate / amount given in figures, the total amount shall be corrected as per the following procedure, which shall be binding upon the Bidder:

- When there is a difference between the rate in figures and in words for an item, the rate which corresponds to the amount worked out by the Bidder for the item based on the notional quantity specified, shall be taken as correct.

- When the rate quoted by the Bidder in figures and words tallies but the amount is incorrect, the rate quoted by the Bidder shall be taken as correct.
- When it is not possible to ascertain the correct rate as detailed above, the rate quoted for the item in words shall be adopted as the quoted rate.
- If the total amount written against an item does not correspond to the rate written in figures and if the rate in words is not written by the Bidder, then the higher of the rates, i.e. higher of the rate worked out by dividing the amount by the notional quantity or the rate quoted, shall be considered for evaluation. In the event that such a bid is determined as the lowest bid, the lower of the rates shall be considered for award of works.
- When there is a difference between the rate in figures and in words for an item and if the rate which corresponds to the amount worked out by the bidder for the item based on the notional quantity specified is also different, then the higher of the rates, i.e. higher of the rate worked out by dividing the amount by the notional quantity or the rate quoted in figures or the rate quoted in words, shall be considered for evaluation. In the event that such a bid is determined as the lowest bid,

the lower of the rates shall be considered for award of works.

Optional items, if any, shall not be considered for the purpose of arriving at the total cost.

Conditional discount, if offered, shall not be considered for evaluation.

While arriving at the final evaluated prices of all the Bidders, any suo-moto /lump sum percentage or adhoc reduction by the Bidders after submission of the priced bid shall not be considered for evaluation. However, if such bidder happens to be lowest after evaluation, such rebate shall be taken into account for award of work.

In case the lowest tendered amount (worked out on the basis of quoted rate of Individual items) of two or more contractors is same, then such lowest contractors may

be asked to submit sealed revised offer quoting rate of each item of the schedule of quantity for all sub sections/sub heads as the case may be, but the revised quoted rate of each item of schedule of quantity for all sub sections/sub heads should not be higher than their respective original rate quoted already at the time of submission of tender. The lowest tender shall be decided on the basis of revised offer.

If the revised tendered amount (worked out on the basis of quoted rate of individual items) of two or more contractors received in revised offer is again found to be equal, then the lowest tender, among such contractors, shall be decided by draw of lots in the presence of Engineer in-charge and the lowest contractors those have quoted equal amount of their tenders.

In case of any such lowest contractor in his revised offer quotes rate of any item more than their respective original rate quoted already at the time of submission of tender, then such revised offer shall be treated invalid. Such case of revised offer of the lowest contractor or case of refusal to submit revised offer by the lowest contractor shall be treated as withdrawal of his tender before acceptance and 50% of his earnest money shall be forfeited.

In case all the lowest contractors those have same tendered amount (as a result of their

quoted rate of individual items), refuse to submit revised offers, then tenders are to be recalled after forfeiting 50% of EMD of each lowest contractors.

Contractor, whose earnest money is forfeited because of non-submission of revised offer, or quoting higher revised rate(s) of any item(s) than their respective original rate quoted already at the time of submission of his bid shall not be allowed to participate in the retendering process of the work.

4.7. BID EVALUATION PROCESS TO BE CONFIDENTIAL

Information related to the examination, clarification, evaluation and comparison of bidsand recommendations for award of contract shall not be disclosed to Bidder or other person not officially concerned with such process. Any effort by Bidder to influence Owner's processing of bidding or award decisions may result in rejection of such Bidder's bid.

4.8. OWNER'S RIGHT TO ACCEPT OR REJECT A BID

Owner reserves the right to accept a bid other than the lowest and to accept or reject any bid in whole or part, to annul the bidding process or to reject all bids with or without notice or reasons. Such decisions by Owner shall bear no liability whatsoever consequent upon such decisions.

4.9. NEGOTIATION

Normally HCSL will award the contract to the Bidder whose bid has been substantially responsive to the bidding documents and who has offered lowest evaluated total amount. However, if in the opinion of HCSL, the total price or certain item rates quoted by the lowest evaluated bidder are considered high, HCSL may invite such bidder for price negotiation. Lowest quoted bidder shall attend such negotiation meetings and if requested by HCSL shall provide the analysis of rates/ break-up of amount quoted by him for any or all items of Schedule of Rates/ Prices to demonstrate the reasonability. As a result of negotiation, bidder may offer rebate on his earlier quoted Price.

5. AWARD OF CONTRACT

5.1 Notification of Contract Award

a) Prior to expiration of the Tender validity and successful Contract Negotiations under Clause 4.10, the Employer should inform the successful Bidder with issuing the "Work Order" about the acceptance of his Tender. The "Work Order" shall be send by fax or emailing a scan following by registered letter for signature of the Contractor. Bidder shall confirm acceptance by returning a signed copy of the work order.

b) The "Work Order" must specify the sum the Employer will pay to the Contractor in consideration of the execution of the Services.

c) Owner shall not be obliged to furnish any information/ clarification/explanation

to the unsuccessful bidders as regards non-acceptance of their bids. Except for refund of EMD to unsuccessful bidders, Owner shall correspond only with the successful bidder(s).

5.2. SIGNING OF CONTRACT AGREEMENT

The successful Bidder shall be required to execute a formal Agreement as per the Form of Contract, with Owner within the specified period. For execution of the Agreement, the successful bidder shall provide Stamp Paper of appropriate value. Thecost of non-judicial stamp paper shall be borne by the Contractor.

The Contract document shall consist of the following:

a) Agreement (Form of Contract) signed on non-judicial stamp paper by employerand Contractor.

b) Work order

c) All correspondences till the award of work.

d) The Bidding Document along with bidding drawings, approved Schedule of prices

e) Amendments to Bidding Document, if any.

f) Any other documents as deemed necessary.

After receiving the duly signed Contract Agreement the Performance Security have to be submitted within the period stated in the "General Terms and Conditions of Contract" (see Volume II, Part -1)

Contract agreement should be signed and returned by the successful bidder within 7 days from the date of work order.

The Contract Agreement shall be signed by both parties. All other pages of the Contract shall be initialed by both parties.

5.3. PERFORMANCE SECURITY

a) The successful Bidder should furnish 3% of contract value as Performance Security in accordance with the "General Terms and Conditions of Contract" (see Volume II-Part 1). The Performance Security has to be furnished in the form attached at (**Annexure – 5** of Formats & Schedules). Failure to comply with these requirements constitutes a breach of Contract and may lead to the annulment of award and forfeiture of EMD.

b) The Performance Security is to be provided not later than 14 days after issue of work order, in the form of irrevocable bank guarantee issued by Nationalized/ Scheduled Indian bank encashable at Kolkata.

6 SUMMARY

ITB Clause	Description
1.1	Country of the Employer Republic of India
1.9	Pre-Bid Meeting The Pre-Bid meeting will be held at the Employers premises given under Clause 1.11 at 10:00 Hrs (IST) on 16 Nov 2022. Request for clarification by Bidder shall be submitted not later than 2 days prior to the scheduled date of Pre-Tender meeting
1.10/1.11/1.12	Contact person **CHIEF EXECUTIVE OFFICER** HOOGHLY COCHIN SHIPYARD LTD

	Administrative Building, HCSL Premises, Satyen Bose Road, P.O.- Danesh Shaikh Lane, Nazirgunge, Howrah, West Bengal - 711109, India, Tel No. - 033-26888282
2.2	Validity of Tender Tender validity period is 90 days from the date of opening of Tender/offer
2.4	Language of CommunicationEnglish
2.6	Currency Indian Rupees(INR)
3.1	The following documents have to be submitted in standard formats placed atVol-II . along with the Techno-commercial Tender: a) Cost of Tender form & EMD in a separate sealed cover b) Annexure 1: CHECK LIST c) Annexure 2: APPLICATION LETTER d) Annexure 3: PROFORMA OF POWER OF ATTORNEY e) Annexure 4: FORM OF BG TOWARDS EMD f) Annexure 5: PROFORMA OF BG FOR PERFORMANCE GURANTEE g) Annexure 6 : PROFORMA OF BG FOR MOBILISATION ADVANCE h) Annexure 7 : DETAILED METHODOLOGY AND WORKPROGRAMME SCHEDULE i) Annexure 8 : CURRENT COMMITMENTS OF CONTRACTOR j) Annexure 9 : FINANCIAL DETAILS OF CONTRACTOR

	k) Annexure 10 : LIST OF SUBCONTRACTORS PROPOSED FOR THE PROJECT l) Annexure 11 : LIST OF KEY PERSONNEL FOR THE EXECUTION OF WORK m) Annexure 12 : LIST OF PLANT, EQUIPMENTS/ MACHINERIES / LAB TESTING EQUIPMENST OWNED BY THE COMPANY AND TO BE USED IN THIS WORK n) Annexure 13: PROFORMA OF INTEGRITY PACT o) Annexure 14 : DECLARATION BY CONTRACTOR p) Annexure 15 : NEFT DETAILS OF CONTRACTOR q) Annexure 16 : PRE-BID QUESTIONNAIRE r) Annexure 17 : FORMAT OF CONTRACT AGREEMENT s) Pre-bid site visit format t) Site awareness format
3.2	The following documents have to be submitted within the Financial Tender: a) Schedule of Prices b) Summary of Tender Price Lump Sum Cost Breakdown for Major Items
2.12	<u>Tender copy</u> Each Tender part (Technical and Financial) in hard has to be submitted as one (01) original and two (02) duplicates
2.14	<u>Submission of Tender</u> The Employer must receive the Tender in the address mentioned above not later than: 15:00 Hrs. (IST) on 30 Nov 2022
3.1	<u>Opening of Techno-commercial Tender</u> Opening of the Technical Tender will be conducted at Conference room of Infra Projects department, CSL Administrative building at 15:30 Hrs. (IST) on 30 Nov 2022
5.2	<u>Signing of Contract</u>

	Contract signing within 7 days from the date of work order
5.3	Performance Security 3% of contract value within 14 days from date of work order

HOOGHLY COCHIN SHIPYARD LIMITED

(A WHOLLY-OWNED SUBSIDIARY OF COCHIN SHIPYARD LTD)

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

TENDER NO: HCSL/PANDU/TEN/002/2022-23, Dt.- 01.11.2022

COVER-A

SECTION II

STANDARD FORMS AND FORMATS

ANNEXURE - 1

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

LETTER OF BID

To

The CEO
HCSL

I/We hereby bid for the execution of the work specified in the underwritten memorandum within the time specified in the schedule attached hereto and in accordance in all respects with the specifications, drawings and instructions in accordance with such conditions so far as applicable.

M E M O R A N D U M

a) General description: Development of Ship Repair Facility at Pandu, Guwahati, Assam. **Package I Tender for Civil works**

b) Tendered cost:

c) Earnest Money Deposit: Rs. 1,54,00,000/- in DD/ Banker's cheque/NEFT payment receipt.

d) Performance Security: 3 % of the Accepted Contract Amount

e) Total Security Deposit : 8% of the executed contract value (3% of the Performance security as stated "d" above and 5 % of retention money.)

f) Contract Period: 18 months specified in Clause 2.3 of Special Conditions of Contract

Should this bid be accepted, I/We hereby agree to abide by and fulfill all the terms and provisions of the said conditions of contract annexed hereto or in default thereof forfeit and pay to Hooghly Cochin Shipyard Ltd the sum of money mentioned in the said conditions. I/We further agree to execute an agreement with Hooghly Cochin Shipyard Ltd in the prescribed form or in default thereof to forfeit the earnest money deposited by me/us.

The sum of Rs 1,54,00,000/-in DD/ Banker's cheque/NEFT/BG, as required is enclosed in cover 'A2' as earnest money, the full value of which is to be absolutely forfeited to Hooghly Cochin Shipyard Ltd , should I/We withdraw the offer or revise or go back upon the terms of the bid; or fail to commence the work specified in the memorandum or should I/We not furnish the Performance Security specified in the above memorandum, otherwise the said sum of Rs 1,54,00,000/-in DD/ Banker's cheque/NEFT/BG shall be retained by Cochin Shipyard Ltd on account of and towards such security deposit as aforesaid.

Dated……..the…… day of 2022

Signature of Bidder

Address

Witness
Address
Occupation

The above bid is hereby accepted by me on behalf of Hooghly Cochin Shipyard Ltd

Dated……..the……. day of 2022

CEO
HCSL

ANNEXURE - 2

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt.- 01.11.2022

CHECK LIST

Bidder should compulsorily fill this check list and ensure that all details / documents as mentioned in the Tender Document is submitted along with their bid. Please Put Yes or No (Y/N) in the box and ensure compliance and specify the page no. of bid submitted.

Sl.No	Item	Check Box (Y/N)	Page No of Bid Document
1	Submitted cost of tender form in DD/Cheque/NEFT mode		
2	Submitted EMD for an amount of Rs. 1,54,00,000/- in DD/Cheque/NEFT/BG mode		
3	Submitted Duly filled power of attorney in favour of signatory of bid documents		
4	Submitted techno-commercial tender & Financial tender in separate closed envelopes		
5	Attestation by authorized representative of bidder in all pages of tender document		
6	Submitted un-priced Bill of Quantities in techno-commercial bid		
7	Submitted duly filled pre-contract integrity pact		
8	Submitted Undertaking regarding unconditional rates & illegal gratification – Annexure 3A		
9	Submitted Undertaking regarding acceptance of terms & conditions mentioned in the tender documents – Annexure 3B		
10	Submitted Undertaking regarding not blacklisted/put on holiday/terminated by any Govt. dept.		

11	Submitted Details of Annual Turnover Statement along with Audited Balance Sheet and Profit & Loss account for financial years 2020-2021, 2021-2022 & 2022-2023		
12	Positive Profit after tax(PAT) during financial years 2020-2021, 2021-2022 & 2022-2023.		
13	Submitted fresh solvency certificate for an amount equal to 40% of the Tendered value		
14	Submitted Undertaking regarding not applied/applying for CDR		
15	Submitted self-declaration regarding not under liquidation, court receivership or similar proceedings		
16	Submitted details of present commitments, works under execution with percentage of completion		
17	Submitted details of current litigation/arbitration if any		
18	Submitted Detailed methodology for execution of works & Proposed works programme schedule		
19	Submitted list of contractor's personnel proposed for the project along with CV		
20	Submitted list of equipment's & machinery available with the contractor		
21	Submitted list of subcontractor's/sub vendor's proposed for the project		
22	Submitted NEFT details in relevant format		
23	Submitted letter of bid		
24	Submitted details of similar works executed		
25	Submitted PAN, GST , EPF, ESI details		

26	Submitted undertaking regarding conducted detailed site visit and evaluation and accordingly all required information and data have been collected.		

ANNEXURE - 3A

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

Development of Ship Repair Facility at Pandu, Guwahati, Assam- Package-I- Tender for Civil Work

UNDERTAKING BY CONTRACTOR

1. "I / WE COMPLY WITH ALL CONDITIONS OF TENDER BY HCSL AND CONFIRM THAT RATES QUOTED IN THE PRICE BID ARE INCLUSIVE OF ALL TAXES, ALL CESS AND DUTIES BUT EXCLUDING GOODS AND SERVICES TAX. I / WE ALSO CONFIRM THAT COVER B (PRICE BID) DO NOT CONTAIN ANY CONDITIONS"

2. "I / WE HAVE NOT MADE ANY PAYMENT OR ILLEGAL GRATIFICATION TO ANY PERSON/AUTHORITY CONNECTED WITH THE BID PROCESS SO AS TO INFLUENCE THE BID PROCESS AND HAVE NOT COMMITTED ANY OFFENCE UNDER THE PC ACT IN CONNECTION WITH THE BID."

Date & Signature:

Name & address of the contractor:

ANNEXURE - 3B

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

Development of Ship Repair Facility at Pandu, Guwahati, Assam- Package-I- Tender for Civil Work

UNDERTAKING BY CONTRACTOR

1) All information provided in the Tender and in the Annexures is true and correct.

2) We have thoroughly read the tender conditions and have inspected the site and have independently assessed the site conditions, scope and nature of work and the circumstances under which work is awarded and hereby undertake to execute the work on ''As is where is'' basis at our own risk.

3) We shall make available to HCSL any additional information it may find necessary or require to supplement or authenticate the Tender.

4) We are not under a declaration of ineligibility issued by HCSL or Govt. of India or any State Govt. in India or any Public Sector Undertakings.

5) We have not applied/applying for CDR in last five years 2017-2018, 2018-2019, 2019-2020, 2020-2021 and 2021-2022/2022-2023 and till the time of submission of the bid and are not under liquidation, court receivership or similar proceedings.

6) We agree and undertake to abide by all the terms and conditions of the tender document.

7) We do hereby confirm that no changes have been made in the tender document downloaded and submitted by us for the above bid. Tender document will be treated as authentic tender and if any discrepancy is noticed at any stage between HCSL tender document and the one submitted by the tenderer, the HCSL document shall prevail.

Date & Signature:

Name & address of the contractor:

ANNEXURE - 4

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

PROFORMA OF POWER-OF-ATTORNEY (NOTARISED)

To
Chief Executive Officer
Hooghly Cochin Shipyard Limited
Administrative Building,
HCSL Premises, Satyen Bose Road,
P.O.- Danesh Shaikh Lane,
Nazirgunge,
Howrah,
West Bengal - 711109,
India,

Dear Sir,

We_____

_____

Do here by confirm that Mr./Ms./Messrs_____

_____ (Name and Address) is /are authorized to represent us to bid, negotiate and conclude the agreement on our behalf with you against Tender No.

We confirm that we shall be bound by all and whatsoever our said agents shall commit.

Yours faithfully,

Signature:

Name & Designation:
For & on behalf of: Signature, name and seal of the certifying authority

ANNEXURE - 5

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

PROFORMA OF BANK GUARANTEE FOR

PERFORMANCE SECURITY

(On stamp paper of value Rs.200/-)

Guarantee No……..

Amount of Guarantee Rs.…….

Guarantee Cover From……

Last Date of Lodgement of Claim……

1. In consideration of the Hooghly Cochin Shipyard Limited (hereinafter called HCSL) having agreed to exempt……(hereinafter called "The said Contractor(s)" from the demand, under the terms and condition of an Agreement between HCSL and …….for the execution of the work of ……..as per work order No……dated…… (hereinafter called "the said agreement") of Performance Security/ Security Deposit for the due fulfillment by the said contractor(s) of the terms and conditions contained in the said agreement, on production of a Bank Guarantee forRs.……(Rupees only)

   We……(Name of Bank) (Hereinafter referred to as "the Bank) at the request of ……contractor(s)do hereby undertake to pay to HCSL an amount not exceeding Rs. (Rupees……..Only) on demand.

2. We (name of bank)……..do hereby unconditionally and irrevocably undertake to pay the Employer to the extent of Rs……/- (Rs……. Only) without any demur merely on a demand from

the Employer stating that the amount claimed is due by way of loss or damage caused to or suffered by the Employer by reason of breach by the Contractor of any of the terms and conditions contained in the said contract. Any such demand made on the (name of bank)……..shall be conclusive as regards to the amount due payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs……../-(Rs Only)

3. Our liability under this present guarantee is absolute and unequivocal and we undertake to pay the Employer the amount so demanded without seeking the consent of the Contractor and notwithstanding the raising any dispute and/or disputes or filling any suit or proceeding before any court or tribunal Authority. The payment so made by us under this guarantee shall be a valid discharge of our liability for payment here under and the Contractor shall have no claim against us for making such payment.

4. Notwithstanding anything to the contrary, Employer's decision as to whether the Contractor has made any default or defaults and the amounts to which Employer is entitled by reason therefore shall be binding on us and we shall not be entitled to ask the Employer to establish the claims under the guarantee but will pay the same on demand without objection.

5. We, (Name of bank),……,further agree that the guarantee herein contained shall remain in full force and effect during the periods that would be taken for the performance of the said contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said contract have been fully paid and its claims satisfied or discharged and till the Employer certifies that the terms and conditions of the said contract have been fully and properly carried out by the said contractor and accordingly discharges this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before…… we shall be discharged from all liability under this guarantee thereafter.

6. This guarantee shall not be recoverable by us except with the written consent of the Employer and shall continue to be enforceable till……. should it be necessary to extend this guarantee beyond the said date. We undertake to extend the

validity of this guarantee for such further period as maybe required by the Employer, subject to the Employer giving in writing to Contractor the request for extension, and such extension shall be given before the expiry of the forthwith become payable to the Employer, notwithstanding that the contract is continuing and/or the Employer has or has not terminated the contract or preferred any claim against the Contractor.

7. We (name of bank)……, further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting any manner our obligations here under to vary any of the terms and conditions of the said contractor to extend the time of guarantee by the said Contractor from time to time or to postpone for any time or from time to time exercise any of the powers exercisable by the Employer against the said Contractor and to forebear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor or any indulgence which under the law relating to sureties, would but for this provision, have effect of so relieving us.

8. This guarantee shall not in any way be affected due to change in our constitution or by your taking or varying or giving up any securities from the Contractor or any other person, firm or Employer on its behalf or by change in the constitution, winding up, dissolution, insolvency or death as the case may be of the contractor.

9. In order to give full effect to the Guarantee herein contained you shall been titled to act as if we are your principal debtors in respect of all your claims against the contractor hereby guaranteed by us as aforesaid and we hereby expressly waive all our right of surety ship and other rights if any which are in any way inconsistent with the above or any other provisions of this guarantee.

10. We, (name of bank)……. also undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

11. Notwithstanding anything contained herein above:

a. Our Liability under this guarantee shall not exceed Rs……/- (Rs…….. Only).

b. This Bank Guarantee shall be valid up to and including……. and

c. We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if you serve upon us a written claim or demand on or before the expiry of this Guarantee.

Dated the ……day of……..

SIGNATURE AND SEAL OF BANK

FULL ADDRESS OF THE BANK

ANNEXURE - 6

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

PROFORMA OF BANK GUARANTEE FOR MOBILIZATION ADVANCE

(To be submitted on Stamp Paper of Rs.200/-)

Guarantee No……..

Amount of Guarantee Rs.…….

Guarantee Cover From……

Last Date of Lodgement of Claim……

1. In consideration of Hooghly Cochin Shipyard Limited (hereinafter called "HCSL") which expression shall include all their successors and assignees having agreed to pay Mobilization advance of Rs……. Rupees …….....only repayable with interest 8.5 % per annum to …….. (Name & Address of contractor) (hereinafter called the "CONTRACTOR") which expression shall include their successors and assignees for the contract for the work of……Name of work) evidenced by the offer of the contract No:……. dated ……..and accepted by HCSL and the formal stamped agreement to be entered into between parties in the above, the said amount and interest being recoverable from the running bills of the contractor on pro-rata basis as per terms of agreement, we (Name of Bank) having our Head office at……..(hereinafter referred to as "the Bank") do hereby undertake to pay an amount of Rs……(Rupees …….only) with interest against any loss or damage caused to or would be caused to or suffered by HCSL by reason of any breach by the said contractor of any of the terms or conditions contained in the said agreement, making it impossible or difficult to recover the said mobilization advance of Rs……(Rupees only) or part there of or interest thereon.

2. We (name of bank)……, do here by unconditionally and irrevocably undertake to pay the Awarder to the extent of Rs…….. (Rs…….. Only) without any demur merely on a demand from the Awarder stating that the amount claimed is due by way of loss or damage caused to or suffered by the Awarder by reason of breach by the Contractor of any of the terms and conditions contained in the said contract. Any such demand made on the (name of bank)…. shall be conclusive as regards to the amount due payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs…….. (Rs……Only)

3. Our liability under this present guarantee is absolute and unequivocal and we undertake to pay the Awarder the amount so demanded without seeking the consent of the Contractor and notwithstanding the raising any dispute and/or disputes or filing any suit or proceeding before any court or tribunal Authority. The payment so made by us under this guarantee shall be a valid discharge of our liability for payment here under and the Contractor shall have no claim against us for making such payment.

4. Notwithstanding anything to the contrary, decision of HCSL (Awarder) as to whether the Contractor has made any default or defaults and the amounts to which HCSL is entitled to ask the Contractor to establish the claims under the guarantee but will pay the same on demand without objection.

5. We,(name of bank)……,further agree that the guarantee herein contained shall remain in full force and effect during the periods that would be taken for the performance of the said contract and that it shall continue to be enforceable till all the dues of the Awarder under or by virtue of the said contract have been fully paid and its claims satisfied or discharged and till the Awarder certifies that the terms and conditions of the said contract have been fully and properly carried out by the said contractor and accordingly discharge this guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before……. we shall be discharged from all liability under this guarantee thereafter.

6. This guarantee shall not be recoverable by us except with the written consent of the Awarder and shall continue to be enforceable till…… should it be necessary to extend this guarantee beyond the said date, we undertake to extend the validity of this guarantee beyond the said date, for such further period as may be required by the Awarder, subject to the Awarder giving in writing to Contractor the request for extension, and such extension shall be before the expiry of the forthwith become payable to the Awarder, notwithstanding that the contract is continuing and/or the Awarder has or has not terminated the contract or preferred any claim against the Contractor.

7. We, (name of bank)…….., further agree with the Awarder that the Awarder shall have the fullest liberty without our consent and without affecting any manner our obligations here under to vary any of the terms and conditions of the said contractor to extend the time of guarantee by the said Contractor from time or to postpone for any time or from time to time exercise any of the powers exercisable by the HCSL (Awarder) against the said Contractor and to forebear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor or any indulgence which under the law relating to sureties, would butfor this provision, have effect of so relieving us.

8. This guarantee shall not in any way be affected due to change in our constitution or by your taking or varying or given up any securities from the Contractor or any other person, firm or Awarder on its behalf or by change in the constitution, winding up, dissolution, insolvency or death as the case may be of the contractor.

9. In order to give full effect to the Guarantee herein contained you shall be entitled to act as if we are your principal debtors in respect of all your claims against the contractor hereby guaranteed by us as aforesaid and we here by expressly waive all our right of surety ship and other rights if any which are in any way inconsistent with the above or any other provisions of this guarantee.

10. We, (name of bank)……, also undertake not to revoke this guarantee during its currency except with the previous consent of

the HCSL (Awarder) in writing.

11.Notwithstanding anything contained hereinabove:

(i) Our Liability under this guarantee shall not exceed Rs……/-(Rs……only).

(ii) This Bank Guarantee shall be valid upto and including……..
…….and

(iii) We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if you serve upon us a written claim or demand on or before the expiry of this Guarantee.

Dated the …….day of……..

SIGNATURE AND SEAL OF BANK

FULL ADDRESS OF THE BANK

ANNEXURE -7

PROFORMA OF INTEGRITY PACT

(On stamp paper of value Rs.200/-)

GENERAL

This pre-contract Agreement (hereinafter called the Integrity pact) is made on……. day of month of ……..2022, between, on one hand, the President of India acting through Shri, ……Designation of the officer, Hooghly Cochin Shipyard Ltd (hereinafter called the "BUYER", which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns) of the first part and M/s……. represented by Shri…..……., Chief Executive Officer (hereinafter called the "BIDDER/Seller" which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second part.

WHEREAS the BUYER proposes to produce (Name of the Stores/Equipment/Item) and the BIDDER/Seller is willing to offer/has offered the stores and

WHEREAS the BIDDER is a private company/public company/Government undertaking/partnership/registered export agency, constituted in accordance with the relevant law in the matter and the BUYER is a Ministry/Department of the Government of India/PSU performing its functions on behalf of the President of India.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

Enabling the BUYER to obtain the desired said stores/equipment at a competitive price in conformity with defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement,and

Enabling BIDDERs to abstain from bribing and other corrupt practices in order to secure the contract by proving assurance to them that their competitors will also abstain from bribing and other corrupt practices and the BUYER will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

Commitments of the BUYER

1.1 The BUYER undertakes that no official of the BUYER, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person organization or third party related to the contract in exchange for any advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

1.2 The BUYER will, during the pre-contract stage, treat all BIDDERs alike and will provide to all BIDDERs the same information and will not provide to all BIDDERs the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERs.

1.3 All the officials of the BUYER will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

2. In case any such preceding misconduct on the part of such officials is reported by the BIDDER to the BUYER with full and verifiable facts and the same is prima facie found to be correct by the BUYER, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings maybe initiated by the BUYER and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the BUYER the proceedings under the contract would not bestalled.

Commitments of BIDDERs

3. The BIDDER commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following:-

3.1 The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BUYER, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

3.2 The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or any other advantage, commission, fees, brokerage or inducement to any official of the BUYER or otherwise in procuring the contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the government for showing or forbearing to show favour or disfavour to any person in relation to the contract or any other contract with the Government.

3.3 BIDDERs shall disclose the name and address of agents and representatives and Indian BIDDERs shall disclose their foreign principals or associates.

3.4 BIDDERs shall disclose the payments to be made by them to agents/brokers or any other intermediary, in connection with this bid/contract.

3.5 The BIDDER further confirms and declares to the BUYER that the BIDDER is the original manufacturer /integrator /authorized government sponsored export entity of the defence stores and has not engaged any individual or firm or company whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount been paid, promised or intended to be paid to anysuch individual, firm or company in respect of any such intercession, facilitation or recommendation.

3.6 The BIDDER either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the BUYER or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

3.7 The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

3.8 The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

3.9 The BIDDER shall not use improperly, for purposes of completion or personal

gain, or pass on to others, any information provided by the BUYER as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

3.10 The BIDDER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

3.11 The BIDDER shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.

3.12 If the BIDDER or any employee of the BIDDER or any person acting on behalf of the BIDDER, either directly or indirectly, is a relative of any of the officers of the BUYER, or alternatively, if any relative of an officer of the BUYER has financial interest/stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filling of tender.

3.13 The BIDDER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the BUYER.

4. Previous Transgression

4.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify BIDDER's exclusion from the tender process.

4.2 The BIDDER agrees that if it makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

5. Earnest Money (Security Deposit)

5.1 While submitting commercial bid, the BIDDER shall deposit anamount…… (to be specified in RFP) as Earnest Money/Security Deposit, with the BUYER through any of the following instruments:

(i) DD/ Banker's cheque/NEFT payment in favour of…….

(ii) A confirmed guarantee by an Indian Nationalized Bank, promising

payment of the guaranteed sum to the BUYER on demand within three working days without any demur whatsoever and without seeking any reasons whatsoever. The demand for payment by the BUYER shall be treated as conclusive proof of payment.

[

(iii) Any other mode or through any other instrument (to be specified in the RFP)

5.2 The Earnest Money/Security Deposit shall be valid up to a period of Three years or complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and the BUYER, including warranty period, whichever islater.

5.3 In case of the successful BIDDER a clause would also be incorporated in the article pertaining to Performance Bond in the Purchase Contract that the provisions of sanctions for violation shall be applicable for forfeiture of Performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

5.4 In case of the successful BIDDER a clause would also be incorporated in the article pertaining No interest shall be payable by the BUYER to the BIDDER on Earnest Money/Security Deposit for the period of its currency.

6. Sanctions for violations

6.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the buyer to take all or any one of the following actions, wherever required:-

(i) To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.

(ii) The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bond (after the contract is signed) shall stand forfeited either fully or partially, as decided by the BUYER and the BUYER shall not be required to assign any reason therefore.

(iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.

(iv) To recover all sums already paid by the BUYER, and in case of an Indian BIDDER with interest thereon at 2% higher than the prevailing Prime Lending Rate of State Bank of India, while in case of a BIDDER from a country other than India with interest thereon at 2% higher than the LIBOR.

If any outstanding payment is due to the BIDDER from the BUYER in connection with any other contract for any other stores, such outstanding payment could also be utilized to recover the aforesaid sum and interest.

(v) To encase the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the BUYER, along withinterest.

(vi) To cancel all or any other contracts with the BIDDER. The BIDDER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such cancelation/rescission and the BUYER shall been titled to deduct the amount so payable from the money(s) due to the BIDDER.

(vii) To debar the BIDDER from participating in future bidding processes of the Government of India for a minimum period of five years, which may be further extended at the discretion of the BUYER.

(viii) To recover all sums paid in violation of this Pact by BIDDER(s) to any middleman or agent or broker with a view to securing thecontract.

(ix) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the BUYER with the BIDDER, the same shall not be opened.

(x) Forfeiture OF performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

6.2 The BUYER will be entitled to take all or any of the actions mentioned at para 6.1 (i) to (x) of this Pact also on the Commission by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

6.3 The decision of the BUYER to the effect that a breach of the provisions of this Pact has been committed by the BIDDER shall be final and conclusive on the BIDDER. However, the BIDDER can approach the Independent Monitor(s) appointed for the purposes of this Pact.

7. Fall Clause

7.1 The BIDDER undertakes that it has not supplied/is not supplying similar product/systems or subsystems at a price lower than that offered in the present bid in respect of any other Ministry/Department of the Government of India or PSU and if it is found at any stage that similar product/systems or sub systems was supplied by the BIDDER to any Ministry/Department of the Government of India or a PSU at a lower price, then that very price, with due allowance foe elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the BIDDER to the BUYER, if the contract has already been concluded.

8. IndependentMonitors

8.1 The BUYER has appointed

(i) Shri. Om Prakash Singh, IPS (Retd.),

Flat No. D-801, PrateekStylome,

Sector-45, Noida,

Uttar Pradesh – 201301

Mob: 9818564455

Email: Ops2020@rediffmail.com

&

(ii) Shri. Jagadip Narayan Singh, IAS (Retd.),

C-54, BharatenduHarischandra Marg,

Anand Vihar, Delhi – 110092.

Mobile: 9978405930

Email: jagadipsingh@yahoo.com

as Independent Monitors (hereinafter referred as Monitors) for this Pact in constitution with Central Vigilance Commission (Names and Addresses of the Monitors to be given).

8.2 The task of the Monitors shall be to review independently and objectively, whether and to what extend the parties comply with the obligations under this

Pact.

8.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.

8.4 Both the parties accept that the monitors have the right to access all the documents relating to the project/procurement including minutes of meetings.

8.5 As soon as the Monitor notices, or has reason to believe, a violation of this Pact, he will so inform the Authority designated by the BUYER.

8.6 The BIDDER(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the BUYER including that provided by the BIDDER. The BIDDER will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to subcontractors. The Monitors shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with confidentiality.

8.7 The BUYER will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.

8.8 The Monitor will submit a written report to the designated Authority of BUYER/Secretary in the Department/ within 8 to 10 week from the date of reference or intimation to him by the BUYER / BIDDER and should the occasion arise, submit proposals for correcting problematic situations.

9. Facilitation of Investigation

In case of any allegation of violation of any provisions of this Pact or payment of commission, the BUYER or its agencies shall be entitled to examine all the documents including the Books of Account of the BIDDER and the BIDDER shall provide necessary information and documents in English and shall extend all possible help for the purpose of such examination.

10. Lawand Place Jurisdiction

This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the BUYER.

11. Other LegalActions

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.

12. Validity

12.1 The validity of this Integrity Pact shall be from date of its signing and extend up to 5 years or the complete execution of the contract to the satisfaction of both the BUYER and the BIDDER/Seller, including warranty period, whichever is later. In case BIDDER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract.

12.2 Shouldoneorseveralprovisionsofthispactturnouttobeinvalid;theremainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

12.3 The parties hereby sign this integrity pact at ……on ……

BUYER BIDDER

Name ofthe Officer CHIEF EXECUTIVEOFFICER

Designation

Dept./MINISTRY/PSU

Witness

1…… 1……

2…… 2……

*Provisions of these clauses would need to be amended /deleted in line with

the policy of the BUYER in regard to involvement of Indian agents of foreign suppliers.

ANNEXURE - 8

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

FORMAT OF CONTRACT AGREEMENT

PROFORMA OF CONTRACT AGREEMENT

(On west Bengal or Assam state stamp paper of suitable value)

THIS AGREEMENT MADE ON ……. 2022 BETWEEN THE CHIEF EXECUTIVE OFFICER, HOOGHLY COCHIN SHIPYARD LIMITED,KOLKATA on behalf of Hoohly Cochin Shipyard Limited (hereinafter called the "Engineer") which expression shall, unless excluded by or repugnant to the context, be deemed to include their successors in office on one part of and……..(hereinafter called "CONTRACTOR") on the other part. WHEREAS THE ENGINEER is desirous that certain work should be done viz. "Development of Ship Repair Facility at Pandu, Guwahati, Assam, Package-I-Tender for Civil Works" and had accepted the tender by the Contractor for the construction, completion & guarantee of such work, NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this agreement words & expression shall have the same meaning as respectively assigned to them in the General & Special conditions of contract hereinafter referred to.

2. The following documents shall be deemed to form part and be read and construed as part of this agreement viz.

   a) The said tender.
   b) The conditions of contract (General & Special).
   c) The tender schedule.
   d) All letters from contractor
   e) All letters by HCSL.
   f) HCSL letter of acceptance

3. In consideration of the payment to be made by the CEO, HCSL to the contractor (hereinafter called the contractor) hereby covenants with the CEO, HCSL to construct, complete and guarantee the work in conformity in all respects, with the provisions of contract.

4. The CEO, HCSL hereby covenants to pay the contractor the contract price, in consideration of the construction, completion & guarantee of the work at the time and in the manner prescribed by the contract.

5. In witness where of the parties here to have caused their respective common seals to be hereunto affixed (or have hereunto set their respective hand & seals) the day and year first above written.

6. The common seal of the CEO, Hooghly Cochin Shipyard Limited, Kolkata affixed and CEO, HCSL has signed.

For Hooghly Cochin Shipyard Limited,

Signed & Sealed by Contractor: -

In the presence of:-

1.

2.

ANNEXURE- 9

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

FINANCIAL DETAILS OF CONTRACTOR (NOTARISED)

Sl. No.	Financial Year	Annual Turnover	Net worth	Profit After Tax (PAT)
1	2021-22			
2	2020-21			
3	2019-20			
4	2018-19			
5	2017-18			

Certificate from the Statutory Auditors:

Name of Authorized Signatory :

Designation :

Name of firm :

(Signature of the Authorized Signatory)

Seal of firm

ANNEXURE- 10

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

CURRENT COMMITMENTS OF CONTRACTOR

Sl. No	Name of work	Total Contract value	Scheduled date of completion	Percentage completion as on date	Expected date of completion

Signature:

Name & Designation:

Company seal:

Date:

ANNEXURE -11

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

LIST OF PLANT, EQUIPMENTS/ MACHINERIES OWNED BY THE COMPANY AND TO BE USED IN THIS WORK

The Tenderer shall furnish the list of Plant cum equipment/machineries proposed for the work in the format prescribed below:

SL. No	Description of Equipment/Machinery	Make	Year of Manufacture	Capacity
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Signature:

Name & Designation:

Company seal:

Date:

ANNEXURE- 12

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

LIST OF KEY PERSONNEL FOR THE EXECUTION OF WORK

The Tenderer shall furnish the list of Key personnel proposed for the work (as per GCC) in the format prescribed below:

SI No	Name	Designation	Qualification	Experience

Note: CV, qualification certificate, experience certificate of personnel listed in the annex should be included along with this annexure

Signature:

Name & Designation:

Company seal:

Date:

ANNEXURE-13

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

DETAILS OF LITIGATION

Name of Applicant:……..

Applicants should provide information on any history of litigation or arbitration resulting from contracts executed in the last five years or currently under execution.

Year	Award FOR or AGAINST applicant	Name of client	Cause of litigation, and matter in dispute	Disputed amount (current value, Rupee equivalent)

Signature of the Authorized Representative:

(Name and designation of the Authorized Representative):

(Name of the Applicant):

Date:

ANNEXURE -14

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

DETAILED METHODOLOGY & WORK PROGRAMME SCHEDULE

Bidder shall furnish a detailed method statement (Technical Note) for carrying out of the works, along with a programme schedule and proposed organizational structure showing sequence of operation and the time frame for various stages of temporary and permanent works.

Signature:

Name & Designation:

Company Seal:

Date:

ANNEXURE -15

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

SOLVENCY CERTIFICATE

To,

Hooghly Cochin Shipyard Limited
Administrative Building,
HCSL Premises, Satyen Bose Road,
P.O.- Danesh Shaikh Lane,
Nazirgunge,
Howrah,
West Bengal - 711109,
India,

Name of Work: "**Development of Ship Repair Facility at Pandu, Guwahati, Assam-Package-I-Tender for Civil works"**

This is to state that to the best of our Knowledge and information that,……(Name of the company) having registered office address…… is customer of bank and has been maintaining his accounts with our branch since …… As per records available with the bank, Name of the company can be treated as solvent up to a limit of Rs. 58 Crores.

It is clarified that this information is furnished without any risk and responsibility on our part in any respect whatsoever more particularly either as guarantor or otherwise. This certificate is issued at the specific request of the customer.

Signature:

Name & Designation of the officer:

Bank seal:

Date:

Note: This certificate shall be issued on the letter head of the bank

ANNEXURE - 16

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

LIST OF SUBCONTRACTORS PROPOSED FOR THE PROJECT

Sl.No	Scope of work	Name of subcontractor	Experience details

Signature:

Name & Designation:

Company Seal:

Date:

ANNEXURE - 17

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

CRITERIA FOR EVALUATION OF MINIMUM ELIGIBILITY CRITERIA

	ATTRIBUTES	EVALUATION	
(a)	Financial strength (30 marks)		
	(i) Average annual turnover- 10marks (ii) Financial Capability- 10marks (iii) Net worth - 5marks	(i) 50% marks for minimum eligibility criteria (ii) 100% marks for twice the minimum eligibility criteria or more In between (i) & (ii) on prorata basis	
	(iv) Profit After tax - 5marks	(i) 100% marks for positive profit after tax	
(b)	Experience in similar Class of work (30 marks)	(i) 50% marks for minimum eligibility criteria (ii) 100% marks for twice the minimum eligibility criteria or more In between (i) & (ii) on prorata basis	
(c)	Personnel and Establishment (Max. 20 marks)		
	Personnel	Minimum Requirement (Nos)	Marks per person
	(i) Project Manager	1	3 marks
	(ii) Deputy Project manager	2	1 marks each up to maximum 2 marks
	(iii) Planning Engineer	1	1 marks each up to maximum 1 marks
	(iv) Site Engineer Civil	12	1/2 marks each up to maximum 6 marks

	(vii) Quality Engineer	2	1 marks each up to maximum 2 marks
	(viii) Safety Office	2	1 marks each up to maximum 2 marks
	(ix) Surveyor	2	1marks each up to maximum 2 marks
	(x)Planning Engineer	1	2 marks
(d)	Plant & Equipments (Max. 20 marks)		
	Equipments	Minimum Requirement (Nos)	Marks Per Person
	(i) Piling Rig equipment	2	2 marks each up to maximum 4 marks
	(ii) Pontoon	2	1/2 marks each up to maximum 1 marks
	(iii) Vibro Hammer	2	1/2 marks each up to maximum 1 marks
	(iv) Concrete pumps & associated fittings	4	1/2 marks each up to maximum 2 marks
	(v) Boom Placer	2	1/2 marks each up to maximum 1 marks
	(vi) Concrete Miller	4	1/4 marks each up to maximum 2 marks
	(vii)Batching Plant	2	1 marks each up to maximum 2 marks
	(viii) Plate Compactor	2	1/2 marks each up to 1

			maximum 1 marks
	(ix) Vibro Roller	2	1/2 marks each up to maximum 1 marks
	(x) Excavator	2	1/4 marks each up to maximum 1 marks
	(xi) Crawler crane, Hydra, Tyre mounted crane	4	1/4 marks each up to maximum 2 marks
	(xii) Trailor	1	1/2 marks each up to maximum 1 marks
	(xiii) Motor grader with blade and ripper	1	1/2 marks each up to maximum 1 marks

ANNEXURE - 18

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

NEFT/RTGS PAYMENT FORMAT

Electronic Payment Mandate Form

(Mandate for receiving payments through NEFT Cochin Shipyard Ltd)

1) Vendor/Contractor Name
2) Vendor/Contractor Address

3) Vendor Code
4) Permanent Account Number(PAN)
5) Particulars of Bank Account
   a. Name of the Bank
   b. Name of the Branch
   c. NEFT/IFS Code of the Bank
   d. Branch Code
   e. City Name
   f. Branch Location
   g. Branch Telephone No.
   h. 9-Digit MICR Code

(where MICR is starting with "0". Please take the correct code from your bank for proper identification of city, bank,branch)

   i. Type of the Account(S.B,Current or Cash Credit) with code (010/011/013)
   j. Account Number (as appearing on the cheque book)
6) Email Address of Vendor
7) Date of Effect of RTGS/NEFT in your Bank

(Please enclose a cancelled un-signed cheque leaf to enable us to verify the details mentioned above)

We hereby declare that the particulars given above are correct and complete. If the transaction is delayed or lost because of incomplete or incorrect information, we would not hold the company responsible.

(.....)
Signature of vendor

Bank Certificate

We certify that_____ has an Account No._____ with us and we confirm that the details given above are correct as per our records.

Date:
Place:

(.....)
Authorized official of Bank

ANNEXURE - 19

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

DETAILS OF COMPLETED SIMILAR WORKS DURING THE LAST SEVEN YEARS ENDING 31st MARCH, 2022(NOTARIZED)

Sl. No	Name and Location of the project	Owner's complete address including Telex/Fax no. with contact person	Value of contract	Scope of work including major items of work	Duration of contract			Name of consulting engineer responsible for supervision	Reference No & Date of letter of Acceptance & Completion certificate enclosed
					Commencement date	Scheduled completion date	Actual completion date		
1	2	3	4	5	6	7	8	9	10

Note: Bidder to enclose letter of Acceptance and completion certificate issued by owner, certified by a Notary public or equivalent certifying authority.

ANNEXURE -20

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

FORM OF BANK GUARANTEE TOWARDS EMD

(On stamp paper of value Rs.200/-)

This deed of GURANTEE made on …….day of ……Two thousand twenty-two…….……

Between HCSL on the one part and ……..

(Name and address of the bank) of the other part is as follows:-

In consideration of the HCSL having allowed M/s……..…….. …… (Herein after referred to as 'the Contractor') to submit Tender No……. to them without Earnest Money according to the conditions of such Tender Notification, We……...……(here enter the name of 'the Bank') a Company incorporated under the ……..Act and having its registered office at ……(hereinafter referred to as 'the bank') undertake to pay to HCSL on demand at Kolkata the sum of money payable as Earnest Money in respect of the Tender No……made by the Contractor in case the Contractor withdraws the tender before the date of firmness stipulated or when the tender is accepted by or on behalf of the HCSL the Contractor makes default in furnishing the Security Deposit or in entering into an agreement as required by the HCSL or otherwise commits any breach of the terms and conditions of the tender.

We, ……Bank Guarantee to pay the amount due and payable under this guarantee without any demur merely on demand from the HCSL. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. The liability of the surety shall be restricted to Rs ……..…….

(Rs……only)

This guarantee shall not be avoided, released or affected by any variation in the terms of the tender, acceptance or the contract between the Contractor and the HCSL or any neglect indulgence or forbearance by the HCSL.

This guarantee shall remain in full force and effect during the period that would be taken for the finalization of the tender and till the HCSL certifies that the terms and conditions of the said tender have been fully and properly carried out by the said contractor and accordingly discharges this guarantee or for Six Months from the date of issue of this guarantee whichever is earlier. A notice of the claim under this guarantee may be served on the Bank within Six Months after the said period in which case the same shall be enforceable against the Bank notwithstanding the fact that the same is enforced after the expiry of the said period.

The decision of the CEO, HCSL as to whether the occasion or the ground has arisen for the demand of the surety form Bank shall be final. The HCSL shall be at liberty to act as though the Bank were the principal debtor.

We, the said Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the HCSL in writing and agree that any change in the constitution of the said contractor or the said Bank shall not discharge our liability hereunder.

In witness where of we have here unto set our hand and seal this. ……..……day of…….. . ……Two thousand and ……..

Place:

Date:

Witnesses: 1.

2.

ANNEXURE - 21

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

PRE-BID QUESTIONNAIRE

SL.NO	Reference clause	Page No	Description	Tenderer Suggestion/Query	HCSL Reply

ANNEXURE - 22

Tender No: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

SITE VISIT DECLARATION FORMAT

‘’I/WE …… (NAME OF FIRM) HAVE inspected the project site thoroughly and have examined the present site conditions and have assessed and understood the scope of works thoroughly and willing to carry out and complete the work.

Name & Designation:
Signature of authorized representative
Company Seal:
Date:

HOOGHLY COCHIN SHIPYARD LIMITED

(A WHOLLY-OWNED SUBSIDIARY OF COCHIN SHIPYARD LTD)

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

TENDER NO: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

COVER-A

SECTION-III

GENERAL CONDITIONS OF CONTRACT (GCC)

CONTENTS OF GENERAL CONDITIONS OF CONTRACT

GENERALCONDITIONS OF THE CONTRACT (GCC)

1 SCOPE OF CONTRACT

1.1 The scope of the contract shall be the DEVELOPMENT SHIP REPAIR FACILITY (CIVIL WORKS) AT PANDU, GUWAHATI, ASSAM, in accordance with the specifications, terms and conditions of the contract within the contract period. All rates quoted in BoQ includes work shall be executed as per specifications, drawings and BoQ. The Scope of work includes Waterside development and Landside development are detailed in Section VI and the brief details are provided hereunder:

Water side development

The Phase I of ship repair facility consist of boat hoist jetty, transfer bay and repair bay. The proposed boat hoist jetty length is 60m and width is 10m parallel to the river. The transfer bay length is 68m and width is 37.5m. The repair bay length is 68m and width is 32.5m.

Land side development

The ship repair facility at Pandu in Guwahati has a sprawling space consisting of PEB shed divided into Fabrication yard, electrical and outfitting shops, Store and scrap yard. Further the land side developments includes admin block, Canteen & substation building , Store, Carpentry shop, Pipe shop , Fire and safety building/Rest Room , Drive way and landscape etc

1.2 The General Terms and Conditions contained herein shall form part of the specification and documents, of the contract.

2 CONTRACT DOCUMENTS

2.1 The term of Contract Documents shall mean and include the following which shall be deemed to form an integral part of the contract:

a. Contract Agreement & Work order,

b. Notice Inviting Tender & Instructions to Bidders (Vol I), General terms &

Conditions of the Contract (GCC) - Vol 2 Part1, Special Conditions of the Contract (SCC)- Vol 2 Part 2, Vol 3 – Employer's requirement etc.

c. Tender drawings and technical Specifications of the Civil & Structural works which are to be constructed.

d. Vendor's/ Contractor's bid proposals including the letters of clarifications thereto between the Vendor/ Contractor and Employer prior to the award of "Contract", duly accepted.

e. All required details of materials, literature, data and information of any sort given by the Vendor/ Contractor along with his bid, subject to the approval of the Employer.

f. All required forms, undertakings, certificates duly filled and signed by the authorized representative of the contractor and affixed with company stamp as mentioned in the tender documents.

g. Accepted schedule of Rate/price

h. All documents & correspondence submitted till award of work including all annexures etc.

i. Any agreed variations to the conditions in the documents and specifications and special terms and conditions of the "Contract", including amendments, if any

2.2 The several documents forming the 'Contract' are to be taken as mutually explanatory of one another but in case of ambiguities or discrepancies, the same shall be explained and adjusted by the Employer, who shall there-upon issue to the Vendor/ Contractor instructions directing in what manner the 'Works' are to be carried out.

2.3 In the event of any discrepancies between the documents constituting the contract, the documents defining the contract shall take the following order of precedence.

- Contract Agreement as per *pro-forma* vide **Annexure-XX.**
- Work order

- Any agreed variation between the Employer and the Contractor including but not limited to minutes of negotiation, amendments of specifications and/ or specifications
- Accepted Schedule of Rates/ prices
- Drawings
- Technical specifications
- Special Conditions of the Contract (SCC)
- General terms and Conditions of the Contract (GCC)
- Employers Requirements
- Instruction to Bidders & Notice inviting tender
- All materials, literature, drawings, data, duly filled forms and formats and information of any sort given by the Contractor and approved by Employer as well as the one given by the Employer to the contractor.
- Any other documents as may be required.

Decisions taken by the Employer for the successful completion of the works shall be final and binding on the parties.

3. DEFINITION OF TERMS

3.1 In the Contract (as hereinafter defined) the following words and expressions will have the meanings hereby assigned to them.

"Abnormally Bad Weather" means maximum temperature at project site at any particular day during the contract period exceeding 40 degree Celsius or occurrence of a cyclone/depression at project site notified by Indian meteorological department or rainfall amount realized in a day exceeding an intensity of 124.5mm or wind velocity at project site exceeding 61kmph.

"Applicable Law" means the laws, rules, regulations, and any other instruments having the force of law in the Employer's country, India

"CMD'' means Chairman & Managing Director of Cochin Shipyard Limited

"CEO'' means Chief Executive Officer of Hooghly Cochin Shipyard Limited

"Consultant" means appointed by the employer that may provide or provides the Project Management Consultancy Services to the Client under the Contract.

"Contract" means the formal agreement signed by both parties which includes Contract agreement, work order, schedule of accepted rates, General Conditions of Contract (GCC), Special Conditions of the Contract (SCC), employers requirements, Technical specifications and drawings, Notice inviting tender & instructions to bidders including all attachments and appendices thereto and all documents incorporated by reference therein and all correspondences (including Pre-Bid) up to the date of signing of Agreement

"Contractor'' shall mean the individual, firm, company or corporation, who enters into the Contract with the Employer, and shall include his heirs, his executors, administrators, successors, legal representatives, as the case may be. "Contractor" is interchangeable with "Supplier" or ''Vendor'' or "Manufacturer".

"Day" means a calendar day.

"Employer" shall mean Hooghly Cochin Shipyard Limited (HCSL), having registered office at Howrah, on whose behalf the enquiry is issued by its representative, the Employer and shall include his successors and assignees, as well as his authorized officers/ representatives. "Employer" is interchangeable with "Client".

"Engineer –in – Charge'' shall mean CEO or the authorized representatives appointed by the Employer for purposes of supervision & inspection of Works, Materials & Equipment. "Engineer-in-charge" is interchangeable with "Engineer".

"Experts" means, collectively, Key Experts, Non-Key Experts, or any other personnel of the Employer, Consultant, Contractor or Subcontractor.

"Government" means the government of India – and/ or respective states

"ITB" mean the Instructions to Bidder that provides the Contractors with all information needed to prepare their Tender.

"Key Expert(s)" means an individual professional whose skills, qualifications, knowledge and experience are critical to the performance of the Services under the Contract and whose CV is taken into account in the technical evaluation of the tender.

"Work Order" means the letter send by the Employer notifying the contractor that his proposal has been accepted and that the Vendor/ Contractor is required to sign the Contract Agreement.

"Non-Key Expert(s)" means an individual professional provided by the Contractor or its Sub-consultant and who is assigned to perform the Services or any part thereof under the Contract.

"Services" means the permanent and temporary works to be performed by the Contractor pursuant to the Contract. "Services" is interchangeable with "Works".

"Sub-Contractor/Sub-vendor/Sub-Fabricator" means the individual, Firm Company, Corporation, having direct contract with the Contractor and to whom any part of the Work has been sublet by the Contractor, with prior permission of the Employer and shall include his heirs, his executors, administrators, successors, legal representatives, as the case may be.

"Tendering" is interchangeable with "Bidding".

"Approved/Approval" means approved in writing including subsequent written confirmation of previous verbal approval.

"Accepted Delivery Schedule'' means the delivery schedule as per contract and any authorized extension issued by HCSL.

"Tender'' shall mean the offer made by individual, Firm, Company or corporation for the execution of the works. Tender includes the Technical Tender and the Financial Tender of the Bidder. "Tender" is interchangeable with "Offer", "Bid" and "Proposal".

"Bidder'' shall mean the individual, firm, Company, Corporation submitting a bid / tender. **"**Bidder" is interchangeable with "Tenderer".

"Correspondence'' shall mean any e-mail, letter, fax, site orders or other written communication related to the `Contract'.

"Contract Price" or "Contract Value" means the sum stated in the work order for the execution & completion of entire scope of the Works including Defects Liability Period subject to such additions thereto or deductions there from as may be made under the provisions of the Contract.

"Contract Period'' shall mean the period during which the work shall be executed as agreed between the Vendor/ Contractor and the Employer in the 'Contract' including approved extensions granted.

"Contract Master Schedule'' shall mean the schedule detailing how the principal elements of the work shall be completed. This schedule will reflect the key dates as shown on the Contract Master Bar Chart (CMB), and shall be revised by Contractor as necessary with the approval of Employer to reflect how the Work will proceed.

"Change in Work'' shall mean any addition to, deletion from, suspension of or other modification, within the scope of the work, to the quantity, quality, function or intent of the Project as delineated in the Contract, including any such addition, deletion, suspension or other modification which requires change in one or more of the Project Variables.

"Change Order'' shall mean a written order to Contractor issued authorizing a change in Work and, if appropriate, an adjustment in one or more of the Project variables.

"Codes'' shall unless otherwise specified in these contract documents mean the applicable codes or standards of the country of origin of materials. This shall mean the following, including the latest amendments and/ or replacements, if any; The Codes shall be in English version and should not be inferior than the equivalent Indian Codes.

- CEA Regulations and Indian Standards

- Marine Environment Protection Committee (MARPOL) Convention73/78
- Indian Factory Act, 1948, and Rules and Regulations made there under.
- Labour Organization- (ILO) code of practice on safety and health in ports
- ASME Test Codes, AIEE Test Codes, IEEE Codes, IEC Codes
- American Society of Materials Testing Codes.
- European Standards (EC), German Industrial Standards (DIN), British Standards (BS, CP) and American Standards (ASTM, ACI)
- All Standards of the Bureau of Indian Standards applicable to this work
- Other Internationally approved Standards and / or Rules and Regulations related to the subject matter of the Contract.
- Any other code/ standard published by Government of India/ other agencies and Institutions having a bearing over the performance of the Contract.
- Construction & Demolition Rules
- Any other Act as that is covered in the Specification.
- Any other applicable statutory rules and regulations even though not specifically mentioned
- Latest revisions and amendments shall be considered.

"Commissioning/ Commissioning work'' shall mean activity covered under 'Trial Operation' and putting the systems in service. Date of successful completion of commissioning works, will be the Date of Commissioning of the entire works as per the Contract.

"Commercial Operation'' shall mean the Conditions of Operation in which the complete work covered under the Contract is officially declared by the Employer to be available for continuous operation at different loads up to and including rated capacity at specified modes of

operation. Such declaration by the Employer, however, shall not relieve or prejudice any of the Contractor's obligations under the Contract.

"Commercial Use'' shall mean the use of the equipment/ system/ material or work, which the 'Contract' contemplates or that for which equipment or work is commercially capable.

"CIF'' shall mean Cost, Insurance and Freight.

"Date of Contract" shall mean the calendar date on which Employer and the Vendor/ Contractor have signed the 'Contract'. Date of work order precedes the date of contract & 14th day of work Order or site handing over whichever is later will be the zero date for commencement of project.

"Drawings" means maps, drawings, plans, sketches, tracings or prints thereof, calculations and technical information of a like nature provided by the Consultant to the Contractor or annexed to the Contract, and any modifications of such drawings and further drawings that may be issued by the consultant from time to time or approved by the Employer in writing. It includes such other drawings that are made from time to time and furnished by the contractor and approved by the Engineer-in-charge.

"Destination'' means the location where the item is specified to be delivered and where it will be accepted by the Employer.

"Equipment'' shall mean all the plants, stores & materials, the goods including equipment/ components/ parts specified in the contract which the contractor has agreed to supply under the contract.

"Equipment Portion'' of the 'Contract Price' shall mean the CIF value of the equipment and FOR value of the equipment in case of domestic Bidders.

"Erection Portion'' of the 'Contract Price' shall mean the value of field activities of the 'works' including port clearance, if any, inland transportation, handling and storage, erection, testing and putting into satisfactory operation including successful completion of performance tests to be performed at site by the Vendor/Contractor and cost of insurance.

"Extra work'' shall mean all 'labour', 'equipment', 'materials', 'services' in addition to those required by the 'Contract' document & scope.

"Consultant Instruction'' shall mean any drawings and/or instructions, oral and/ or in writing, details, directions and explanations issued by the Employer or consultant from time to time during the 'Contract Period'.

"Consultant Representative'' means any Resident Engineer/ Project Manager or representative of the Employer / Consultant duly authorized and appointed from time to time by the Employer to exercise the powers, discretion, functions, and authorities vested in him.

"Equipment'' and "Work'' or "Works" shall mean respectively the goods to be supplied and service to be provided by the Vendor/ Contractor under the 'Contract'. 'Works' shall include design, engineering, construction, manufacturing, supply of equipment, labour, services & complete erection, testing, commissioning equipment including all transportation, handling, unloading, storage etc as per contract.

"Final Acceptance'' shall mean the Employer's written acceptance of the works performed under the contract after successful completion of performance guarantee or acceptance test and fulfillment of all contractual obligations.

"Guarantee period'' shall mean the period during which the works, system /equipment shall give the same performance as guaranteed by the Vendor/Contractor, which will be reckoned from date of taking over of whole project.

"Taking Over" shall mean the Employer's written acceptance of the works performed under the Contract, after successful commissioning of the whole project and fulfillment of contractual obligations including statutory approvals.

"Inspectors'' shall mean the Employer or any person nominated by the Employer from time to time, to inspect the works, equipment of works under the Contract and/ or the duly authorized representative of the Employer.

"Items'' means the all equipment, components, fittings and other materials including raw materials required to execute and complete the work.

"Manufacturer's works" or "Contractor's works" shall mean the place used by the manufacturer, the Contractor, their Collaborators, / partners or Sub-Contractors for the performance of the Works.

"Defects Liability Period/Maintenance Period" means the specified period of guarantee or maintenance from the date of completion of the whole work as certified by the Engineer-in-charge and specified in the Contract

"Month" shall mean the calendar month. 'Day' or 'days' unless herein otherwise expressly defined shall mean calendar day or days of 24 hours each. A 'week' shall mean continuous period of seven (7) days.

''Net amount payable'' shall mean amount eligible to the contractor after deducting all applicable statutory recoveries like Income tax, cess etc. and all other recoveries such as principal and interest on mobilization advance, secured advance, and other recoveries applicable under ambit of the contract as the case may be.

"Project" shall mean the Civil portion of the works for the Development of Ship Repair Facility more so detailed under relevant portion of this document.

"Ruling Percentage" shall mean the percentage by which the amount of the works actually awarded is higher or lower than the corresponding departmental estimated amount of the works.

"Schedule of Rates/ Schedule of Price" means the priced and completed Bill of Quantities forming part of the Bid.

"Scope" shall means execution of all the works covered in the contract in prescribed quantities, qualities & in a prescribed manner inclusive of those not explicitly mentioned but required for completion and intended performance of works.

"Specification" shall mean collectively all the terms and stipulations contained in those portions of the 'Contract' known as Conditions of Contract, the technical Specifications and such Amendments, revisions, Deletions or Additions, as may be made in the agreement and all written agreements made or to be made pertaining to the method and manner of performing the 'Work' or to the quantities and qualities of the materials & services to be furnished under this 'Contract' as well as the manner or method of performing the Contract.

"Site" shall mean the lands and/or other places on, under, in or through which the work is to be executed under the contract including any other lands or places which may be allotted by the Employer or used for the purposes of the Contract.

"Substituted items" are items that are taken up with partial modification or in lieu of items of works in the contract.

"Writing" or "Written Notice" shall mean any manuscript, a notice in written, type-written or printed statement under or over signature and/or seal as the case may be sent (unless delivered personally or otherwise proved to have been received) by registered post to the last known private or business address or registered office of the addressee and shall be deemed to have been received when in the ordinary course or post it would have been delivered.

Terms and expressions not herein defined shall have the same meaning as are assigned to them in the Indian Sale of Goods Act (1930), falling that in the Indian Contract Act (1872) and falling that in the General Clauses Act (1897). The various Acts and regulations are normally available for sale from the following address. Deputy Controller, Publication Department/ Govt. of India, Civil Lines, New Delhi -110006.

4 INTERPRETATIONS OF TERMS

4.1 Words importing Person shall include firms, companies, and corporations and associated or body of individuals, whether incorporated or not. Words have their normal meaning under the language of the Contract unless specifically defined.

4.2 Words importing the singular only shall also include the plural and vice-versa where the context so requires. Similarly, words importing masculine gender also include the feminine

gender.

4.3 The headings and subheadings in these general conditions are solely for the purpose of facilitating reference and shall not be deemed to be part thereof or to be taken into consideration in the interpretation or construction thereof or of the contract.

4.4 When the words "approved", “Subject to Approval", “Satisfactory", "Equal to", " Proper", "Requested", "As Directed", "Where Directed", "when Directed", "Determined by", "Accepted", "Permitted", or words and phrases of like importance are used, the approval, judgment, direction, etc is understood to be a function of the Employer.

4.5 “Written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

5 VENDOR/CONTRACTOR TO INFORM HIMSELF FULLY

5.1 The tenderers are expected to have inspected the site, before quoting, read the conditions thoroughly and understand the works in all respect and satisfy themselves on the actual site conditions, progress of work, materials available at site, meteorological and oceanographic data, and soil/subsoil strata before tendering. Whatever information regarding surface and subsurface strata, climatological, oceanographic data given in the tender documents are only intended as a general guidance for the Contractor and no warranty is given for the correctness of the same. The contractor is expected to acquaint himself with the site conditions, progress of works in various work fronts, labour situation, wage and benefits applicable to labour, working hours, out turn of work by labour and the fluctuations which are likely to happen till the work is completed on all the above aspects prior to quoting the rates. The submission of a tender by tenderer implies that he has made himself aware of all the above situations and conditions. Any extra claim on this account will not be entertained by employer.

5.2 The Vendor/Contractor shall be deemed to have carefully examined all Contract Document to his entire satisfaction. If he shall have any doubt as to the meaning of any portion of the Contract Documents, he shall, before signing the ‘Contract’ set forth the particulars thereof, and submit them to the Employer in writing, in order that such doubt may be removed. The

Employer will provide such clarifications as may be necessary in writing to the Vendor/Contractor. Any information otherwise obtained from the Employer shall not in any way relieve the Vendor/ Contractor of his responsibility to fulfill his obligations under the 'Contract'.

6 LANGUAGES AND MEASURES

6.1 All documents pertaining to the Contract including specifications, schedules, notices, correspondence, operating and maintenance instructions, drawings or any other writing shall be written in English language only.

6.2 The metric system of weights and measurements shall exclusively be used in the contract.

7 NOTICE

7.1 Any notice to be given to the contractor under the terms of this contract shall be served by sending the same by the registered post and/or by leaving the same at the contractor's notified site office against a receipt voucher. Proof of issue of any such notice could be conclusive regarding the intimation of all the contents in the notice.

8 STATUTORY REQUIREMENTS & RULES

Contractor at own risk and cost has to meticulously follow the following statutory rules prevailing in India during the entire period of contract. Contractor shall take note that owner is no way liable or responsible for any of its omissions, non compliances and contractor should implement the same scrupulously. All disputes , or noncompliances shall immediately be addressed and settled by the contractor at his risk and cost. It is also expressily informed that owner is no way responsible or liable for any liable in respect of any consequential damages or payments or remittances arising out of or in relation, including but not limited to the statutes mentioned below:

a. Contract Labour (Regulation and Abolition Act)

b. Employees Compensation Act.

c. ESI Act

d. EPF Act

e. Minimum Wages Act

f. Payment of Gratuity act.

g. Any other acts/ rules stipulated by Govt. Authority during contract period

However, if employer incurs any cost or expense on account of inaction or non-compliance of statutory requirements and rules by the contractor or their sub-contractors, the expense incurred by the employer shall be deducted from any payment due to the contractor or from security deposit or by actions of law.

9 CONTRACT AGREEMENT

9.1 The Contractor on receipt of the work Order shall return the duly signed copy of the work order, signed by the authorized representative of the owner and affixing the company seal on each page of the work order within seven days from the date of the work order. The contractor shall enter into a contract agreement in prescribed form at **Annexure – 17** with the Owner/ Purchaser within 7 days(seven) from the date of P.O/Work order or within such extended time as may be granted by the Purchaser.

9.2 The agreement shall be executed at the Office of the Purchaser on a date and time to be mutually agreed. All charges for preparing the contract agreement including the legal fees, stamp fees, other stationery expenses etc., shall be borne by the contractor. Till the signing of contract agreement, the work order/Letter of acceptance together with all tender documents shall constitute a binding contract between the successful bidder and employer.

10 MANNER OF EXECUTION OF CONTRACT

10.1 The agreement shall be signed on a date and time to be mutually agreed within the specified period. The authorized representative of Vendor/ Contractor will present himself for signing the 'Contract' with proper power of Attorney and other requisite materials.

10.2 The agreement (in original) will be retained by the the Owner and a copy shall be handed over to the Contractor.

10.3 The Vendor/ Contractor shall provide free of cost to the Owner/ Purchaser all the engineering data, drawings and descriptive materials, as applicable submitted with the bid, in at least three copies to form a part of the 'Contract' immediately after the issue of the 'Work Order".

11 EFFECT AND JURISDICTION OF CONTRACT

11.1 The time of completion of work of 18 months shall be reckoned from the 30th day of the date of the work order or the date of handing over the site whichever is later. The time allowed for carrying out the work as mentioned above shall be strictly observed by the contractor. The work throughout the time period shall be proceed with diligence keeping in view that time being deemed to be the essence of the contract.

11.2 The laws applicable to this contract shall be the prevailing laws in force for time being in India. No suit or other proceedings relating to the contract shall be filed or taken by the contractor in any Court of Law, except the courts at Kolkata. The courts at Kolkata only shall have exclusive jurisdiction to try / entertain the disputes / claims arising between the parties, in relation to this contract.

12 EMPLOYER'S AND CONTRACTOR'S RISK

12.1 The Employers risks under this contract are:

(a) Loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract;

(b) loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible; and

(c) Any operation of the forces of nature (in so far as it occurs on the Site) which an experienced Contractor:

(i) Could not have reasonably foreseen, or

(ii) Could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:

(iii) Prevent loss or damage to physical property from occurring by taking appropriate measures, or

(iv) Insure against.

12.2 The contractor's risks under this contract are:

All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

Excepted risks are riot (in so far as it is uninsurable) war, invasion, act of foreign enemies, hostilities (whether war be declared or not), civil war, rebellion, revolution, insurrection or military usurped power or a cause solely due to use of occupation by the Employer of any portion of the work, any operation of the forces of nature that the Contractor could not have foreseen or reasonably provided against. (All of such are herein collectively referred to as the excepted risks)

13 ASSIGNMENT AND SUBLETTING OF CONTRACT

13.1 The Contractor shall not assign the Contract or any part thereof or any benefit or interest therein or thereunder (otherwise than by a change) in favour of the Contractor's Banker of any money due to or to become due under this Contract without the prior written consent of the Employer.

13.2 The Vendor/Contractor shall not sublet the whole of the 'Contract'. Except where otherwise provided by the contract, the Vendor/Contractor shall not sublet any part of the 'Contract' without the prior written consent of the Owner/Purchaser, which shall not be unreasonably withheld and such consent if given, shall not relieve the Vendor/Contractor, from any liability or obligation under the 'Contract' and he shall be responsible for the acts, defaults and neglects of any Sub-Vendor/Sub-Contractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Vendor/Contractor, his agents, servants, or workmen. Specialized works can be sub-contracted to agencies having proven experience with prior written approval of engineer-in-charge.

13.3 In the event of the contractor failing to accomplish the works sublet through the subcontractor, he shall with the prior approval of employer, engage a competetnt subcontractor meeting the Prequalification criteria, at the Contractors risk & cost meeting the agreed schedule. Contractor shall submit all required information and supporting documents pertaining to the sub-contractor for evaluating his capability and competency as per the prequalification criteria of this project and accepted by the contractor. All the risk including the technical , financial and which are related to statutory rules in terms of government or to their labours or statutory bodies are not in the scope of owner and contractor shall take note on this and implement the same at contractor's risk and cost

13.4 The Vendor/Contractor shall be responsible for transmitting pertinent data of all contract terms and conditions to the Sub-Vendors/Sub-contractors. The

Vendor/Contractor shall furnish to the Owner/Purchaser copy of un-priced sub-orders showing promised delivery dates/places/work program.

13.5 If any Sub-Contractor engaged upon the works at the site executes any work, which in the opinion of the Engineer or his nominee is not in accordance with the Contract condition, written notice may be given to the Contractor requesting him to terminate such sub contract and the Contractor, upon receipt of such notice shall terminate such sub contract and the said Sub Contractor shall forthwith leave the works, failing which the Employer shall have right to remove such Sub Contractors from site. Any action taken by the Employer under this clause shall not relieve the Contractor of any of his liabilities under the contract or give

rise to any compensation, extension of time or otherwise.

13.6 For components/equipment procured by the Contractor for the purpose of the contract after obtaining the written approval of the Owner, the Contractors specification shall call for quality plans to be submitted by the suppliers along with their proposals. The quality plan called for from the suppliers shall set out, during the various stages of manufacture and installation, quality practices and procedures followed by the supplier's quality control organization, the relevant reference documents/standards used, acceptance level, inspection of documentation raised etc. Such quality plans of the selected supplier shall be discussed and finalized in consultation with the Engineer and shall form a part of purchase order of Contractor on that supplier. Un-priced copied of such order or orders are to be submitted to the Owner within 15 days after placement of the order by the Contractor showing promised delivery dates/places/work programme.

14. PATENT RIGHTS AND ROYALTIES

14.1 Royalties and fees for patents covering materials, articles, apparatus, devices, equipments or processes used in the works shall be deemed to have been included in the contract price. The contractor shall satisfy all demands that may be made at any time for such royalties or fees and he alone shall be liable for any damages or claims of infringement of any patent rights, design, trademark or name or other protected rights in respect of any construction plant, machine/equipment, work or material used for in connection with the works or associated temporary works and shall keep the Purchaser, his officers and employees indemnified from and agianst all claims and proceedings in that regard.

14.2 The contractor shall, at his own cost and expense, defend all units or proceedings that may be instituted for alleged infringement of any patents involved in the works and in case of an award of damages, the contractor shall pay for such award. In the event of any suit or other proceedings instituted against the Purchaser, the same shall be defended at the cost and expenses of the contractor who shall also satisfy/comply any decree, order or award made against Purchaser. But it shall be understood that no such machine, systems work material or thing has been used by the Purchaser for any purpose or any manner other than that for which they have been furnished and installed by the Contractor and specified under these

specification, final payment to the Contractor by the Purchaser will not be made while any such suit or claim remains unsettled. In the event of any apparatus or equipment, or any part thereof furnished by the contractor is in such suit or proceedings held to constitute infringement and its use is enjoined, the contractor shall, at his option, the right to continue use of said apparatus, equipment, or part thereof, replaces it with non-infringing apparatus or remove the equipment and refund the purchase price plus transportation and installation cost thereof.

14.3 The Contractor shall pay all royalties, rent and other payments or compensation if any to obtain necessary permits from local authorities for getting stone, sand, gravel, clay or any other materials required for the works.

15 DELAY AND EXTENSIONS OF TIME

The time and the date of completion of the works as per the Contract Agreement and so incorporated in the Work Order, shall be deemed to be the essence of the contract. The CONTRACTOR shall be allowed admittance to the Site on the "Date of Commencement" and he shall thereupon and forthwith begin the work and shall proceed with the work with due deference. The Contractor shall so organise his resources and perform his work as to complete it not later than the date agreed to. If the Contractor commits default in commencing the execution of the work as aforesaid, the Employer shall without prejudice to any other right for remedy available in law, be at absoute liberty to forfeit the performance guarantee forthwith and terminate the Contrcat / Work Order forthwith without any further notice or intimation to the Contractor.

As soon as possible after the Contract is concluded and not later than 15 days from the date of issue of work order, the Contractor shall submit a Time and Progress Chart for each mile stone in Project Evaluation & Review Techniques (PERT) and get it approved by the Engineer-in-charge. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the Contract documents.

The Contractor shall also prepare an integrated programme chart for the execution of work, showing clearly all activities from the start of work to completion, with details of manpower, equipment and machinery required for the fulfilment of the programme within the stipulated period or earlier and submit the same for approval to the Engineer-in- Charge within fifteen days from the date of issue of work order. In addition to above, to achieve the progress of Work as per programme, the contractor must bring at site adequate shuttering material required for cement concrete and

R.C.C. works etc. within one month from the date of start of work till the completion of RCC work as per requirement of work.

The above PERT network shall be reviewed and periodic review reports shall be submitted by the Contractor as directed by the Engineer-in-charge During performance of the contract, if in the opinion of the Engineer-in-charge proper progress is not maintained, suitable changes shall be made in the contractor's operations to ensure proper progress, as per PERT NETWORK. The CONTRACTOR agrees that the work shall be commenced and carried on at such points and in the order of precedence and at such times and seasons as may be directed by the OWNER in accordance with the schedule for completion of the work as outlined elsewhere. The CONTRACTOR declares that he has familiarized himself with the site and rights-of-way, with all the local conditions, and with all the circumstances, which may, or are likely to affect the performance and completion of the work, and that he has accounted for such conditions. However, if a time schedule is submitted by the CONTRACTOR so as to keep the phasing of work generally in line with the time schedule drawn up and to keep the components unchanged, such time schedule after approval from the ENGINEER-IN-CHARGE, shall be accepted and complied by the CONTRACTOR and it shall form a part of the Contract. The progress of work will be checked at regular weekly intervals and the percentage progress achieved shall be commensurate with the time elapsed after the award of the Contract.

The submission for approval by the Engineer-in-Charge of any such programme or such particulars shall not relieve the contractor of any of the duties or responsibilities under the contract. This is without any prejudice to the right of Engineer-in-Charge to take action against the contractor as per terms and conditions of the agreement.

If the CONTRACTOR shall desire an extension of time for completion of work on the grounds of his having been unavoidably hindered in its execution not because of his acts or failure or any other ground which is beyond his control and functions, he shall apply in writing to the OWNER within 15 days of the date of hindrance on account of which he desires such extension as aforesaid. This application shall invariably be accompanied by sufficient valid documentation (including hindrance register) giving reasons for seeking such extension. No application for such extension shall be entertained if it is not received well in time to allow the OWNER to consider it on the basis of the genuity of the supporting documents and the decision of the employer shall be final and the CONTRACTOR shall be responsible for the consequence arising out of such negligence.

If the work(s) be delayed by:-

(i) Force majeure, or

(ii) Abnormally bad weather, or

(iii) Serious loss or damage by fire, or

(iv) Civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or

(v) Delay on the part of other contractors or tradesmen engaged by Engineer-in-

Charge in executing work not forming part of the Contract, or

(vi) Any other cause which, in the absolute discretion of the Engineer-in-Charge is beyond the Contractor's control.

Force majeure due to abnormally bad weather shall be granted subject to declaration of the occurrence of the event defined as abnormally bad weather at project site at Guwahati by Indian Meteorological department.

Then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the engineer-in-charge as indicated above but shall

nevertheless use constantly his best endeavors to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

Under above circumstances, only extension of time may be granted but the contractor will not be entitled to any additional compensation.

The OWNER shall have the right to require the discontinuance of the work, in whole or in part, for such time as may be necessary, should the condition of the weather or of flood or other contingencies make it desirable to do so in order that the works shall be well and properly executed. The CONTRACTOR shall have no claim for idle time etc. However, the Employer will grant such extension of time for completion of the Contract, as he may think proper and sufficient in consequence of such delay.

The Employer, if not satisfied with the progress of the contract and in the event of failure of the Contractor to recoup the delays in the mutually agreed time frame, shall be entitled to terminate the contract.

16 DEDUCTIONS FROM CONTRACT PRICE

All costs, damages or expenses which the Employer may have paid for which under the 'Contract', the contractor is liable, will be claimed by the Employer from the Contractor and shall be paid by the Contractor from any money due or becoming due to the Contractor under the 'Contract' and balance if any, may be recovered by actions of law or otherwise, if the Contractor fails to satisfy the Employer of such claims. Such deductions shall be made only with sufficient proper reasons.

In addition to the provision of Clause above, which relates to the recovery by the Employer of any amounts that the Employer may have paid for which the Contractor is liable under the Contract, the Employer shall also be entitled to recover all dues in terms of the Contract including Liquidated Damages(not the way of penalty) for delay, penalties for shortfall in the guaranteed performance parameters, penalties for shortfall in quality of work, repeated safety violations etc. by way of deductions from the payments due to the Contractor or that may

become due to the Contractor in future or from any securities/guarantees under the Contract and / or otherwise.

17 TERMS OF DELIVERY

NOT APPLICABLE

18 PACKING, FORWARDING AND SHIPMENT & PACKAGING

NOT APPLICABLE

19 SHIPPING NOTES & DOCUMENTS

NOT APPLICABLE

20 DEMURRAGE, WHARFAGE, ETC.

NOT APPLICABLE

21 INSURANCE

21.1 The Contractor shall provide in the joint names of the Employer and the Contractor, insurance cover in the form of contractor's all risk policy from the Start Date to the end of the Defects Liability Period for the following events which are due to the Contractors risks.

a) loss of or damage to the Works, Plant and Materials ,equipments etc for an amount of contract value of work executed for time being plus 10% thereon to allow for any additional costs and professional fees resulting from the loss or damage.

b) loss of or damage to contractor's Equipment brought on to site by the contractor for a sum sufficient to provide for their replacement at site; This includes all imported materials, machinery and other equipments.

c) loss of or damage of property (except the Works, Plant, Materials and Equipment) in connection with the Contract; and

d) personal injury or death.

e) Compensation to be paid to currencies needed to cover the loss or damage incurred.

Policies and certificates for insurance shall be delivered by the Contractor to the Owner or his nominee for approval before the start date. All such insurances shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred. If the Contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from any payments due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

Alterations to the terms of insurance shall not be made without the prior- approval of the Owner or his nominee.

Both parties shall comply with all conditions of the insurance policies.It shall be the responsibility of the contractor to ensure the adequacy of the insurance cover at all times in accordance with the provisions of this clause

If the Contractor receives instructions from the Employer to insure against war risks, such insurance if normally available shall be effected, at the cost of the Employer, with the Insurance Company acceptable to the Employer and shall be in the joint names of the Employer and Contractor.

21.2 The Goods supplied under the contract shall be properly and fully insured by the contractor in a freely convertible currency against loss or damage incidental to manufacture or acquisition, risks to be covered from his works to port of discharge, marine transportation, clearing forwarding and handling at port of entry, inland transportation up to project site (warehouse to warehouse) storage, handling and transportation at site and erection, testing and commissioning and up to defect liability

period in the manner specified in this bid documents.

21.3. Contractor's all risk policy shall be arranged by the contractor from nationalized insurance companies.

21.4 The Contractor at his cost shall arrange, secure and maintain all insurance as may be pertinent to the works and obligatory in terms of law to protect his interest and interests of the Purchaser against all perils detailed herein. The form and the limit of such insurance as defined herein together with the underwriter in each case shall be acceptable such as may be to the Purchaser. However, irrespective of such acceptance the responsibility to maintain adequate insurance coverage at all times during the period of Contract shall be of the Contractor alone. The Contractor's failure in this regard shall not relieve him of any of his Contractual responsibilities and obligations. The Insurance covers to be taken by the Contractor shall show the Owner as Co-Insured for the Contract Value and the policy shall be submitted to the Owner. The Contractor shall, however, be authorized to deal directly with insurance Company or Companies and shall be responsible in regard to maintenance of all insurance covers. Details of each & every claim and its result and correspondence in this regard with insurance company shall be intimated to the Owner/Purchaser at each stage.

21.5 Any loss or damage to the equipment during handling, transportation, storage, erection, putting into satisfactory operation and all activities to be performed till the successful completion of performance test run, shall be to the account of the Contractor. The Contractor shall be responsible for preference of all claims and make good for the damage or loss by way of repairs and/ or replacement of the equipment, damaged or lost. The transfer of title shall not in any way relieve the Contractor of the above responsibilities during the period of Contract. The Contractor shall provide the Purchaser with copy of all insurance policies and documents taken out by him in pursuance of the Contract. Such copies of documents shall be submitted to the Purchaser immediately after such insurance coverage. The Contractor shall also inform the Purchaser in writing at least sixty (60) days in advance regarding the

expiry/ cancellation and / or change, in any of such documents and ensure revalidation, renewal, etc. as may be necessary well in time.

21.6 Licenses/ port clearances in respect of supplies to be made by the Contractor from outside India required for purposes of replacement of equipment lost in transit and/ or during erection and / or during storage shall be made available by the contractor. Contractor shall however, be required to follow the procedure as may be laid down by the Purchaser to facilitate him arranging such licenses/ clearances. The perils required to be covered under the insurance shall include, but not be limited to fire and allied risks, miscellaneous accidents (erection risks), workman compensation risks, loss or damage in transit, theft, pilferage, riot and strike and malicious damages, civil commotion, weather conditions, accidents of all kinds, war risks (during ocean transportation only) etc. The scope of such insurance shall be adequate to cover the replacement / reinstatement cost of the equipment for all risks up to and including delivery of goods on CIF Indian Port basis and shall also cover custom duty and inland transportation and other costs till the equipment is delivered at site. The Insurance policies to be taken should be on replacement value basis.

21.7 Notwithstanding the extent of insurance cover and the amount of claim available from the underwriters, the Contractor shall be fully liable and responsible to make good the full replacement/ rectification value of all equipment/ materials and to ensure their availability as per project specifications and requirements.

21.8 All costs on account of insurance liabilities covered under the Contract shall be to the Contractor's account and shall be included in Contract price. However, the Purchaser may from time to time, during the pendency of the Contract, asks the Contractor in writing to limit the insurance coverage, risks and in such a case, the parties to the Contract shall agree for a mutual settlement, for reduction in Contract Price to the extent of reduced premium amount. The Contractor, while arranging the insurance, shall ensure to obtain all discounts on premium which may be available for higher volume or for reason of financing arrangement of the Project.

21.9 The Clause entitled "Insurance" under the Section named “Erection Conditions of

Contract" of this Volume-II, Section 3, covers the additional insurance requirements for the portion of the works to be performed at the site and shall be fully complied by the contractor.

21.10 Bidders shall ensure that for activities to be performed at the project site, which inter-alia include storage, local handling and transportation,erection, testing, commissioning etc. till the successful completion of performance tests of the plant, the insurance cover shall only be taken from Indian Insurance companies.

21.11 In respect of insurance proceeds/ claim settlements relating to claims preferred by the Contractor, the Purchaser may give, from time to time, written authorization to the underwriters to directly pay such proceeds/ settlements to the Contractor as are in accordance with the provisions here under: Wherever total damage/ loss of equipment/ material, would occur, the Contractor will be entitled to payment of all payments received from the underwriters except the following amounts: The amount paid to the Contractor under the Contract in respect of equipment/ material damaged/ lost, already paid to the Contractor.

21.12 Customs duties and taxes which have already been paid by the Purchaser, Subsequent payments, if any, due under the Contract shall be regulated by the relevant terms of payment, provided the claim money settled by the underwriters is more than the total of the amount as above. In the event of the claim money settled is less than the total of the amount as above, then the entire claim money settled will be retained by the Purchaser and the Contractor will forthwith pay the Purchaser, the shortfall amount between the claim money and the total of amounts as per mentioned above.

21.13 In case of damage to any equipment/ material during any stage, the Contractor upon rectification of the damaged equipment to the satisfaction of the Purchaser shall be paid to the extent of full claims settled by the underwriters. Subsequent payments, if any, due under the Contract shall be regulated by the relevant terms of payment.

22 TROPICAL SERVICEABILITY

22.1 All equipment furnished under the Contract shall be suitable and whenever necessary treated and processed for delivery, storage and use under tropical conditions including high temperature, high humidity, saline atmosphere, mild dew and fungus conducive environment. All equipment shall be specially protected with protective coating and other measures to ensure prevention of rusting of the equipment/material. An approved drying agent such as 'silica gel' shall be packed in containers or packages holding parts which should not be adversely affected by moisture or excessive humidity.

23 INSPECTION, TESTING AND INSPECTION CERTIFICATE

23.1 All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Engineer-in-charges instructions and shall be subjected from time to time to such tests as the Engineer may direct at the place of manufacture or fabrication, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places. The Contractor shall provide such assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples of materials before incorporation in the Works for testing as may be selected and required by the Engineer-in-charge. Sources of materials being supplied shall be intimated to the Engineer-in-charge and are subject to his approval. Materials that are not specified in the Contract document shall conform to the relevant Indian Standards. If Indian Standards are not available, they shall conform to any International Standard approved by the Engineer-in-charge.

23.2. The Owner and/or his duly authorized representative shall have at all reasonable times access to the contractor premises or works or subcontractor works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture and if part of works is being manufactured or assembled on other's premises of works, the contractor shall obtain for the Owner/Purchaser and for his duly authorized representative, permission to

inspect, as if the works were manufactured or assembled on the contractors own premises.

23.3 The Contractor shall furnish in English translation of the standards to which shop tests on equipment shall conform. He shall finalize the test methodology, test set up furnish list of tests and their approximate time and place of tests to the Owner/Purchaser. Moreover, all tests mentioned in the technical specification shall be carried out by the contractor.

23.4 The Contractor shall give the Owner/Purchaser/Inspector fifteen (15) days notice by telex or Fax or email followed by hardcopy confirmation of any material being ready for testing. Such tests shall be to the contractor's account including the expenses of the Contractor's Third party Inspector towards all local transport, living and other incidental expenses including the cost of international passage to and fro. In the case of inspections to be carried out by the Owner, travelling & lodging expenses shall be borne by the Owner and entire expenditure on arranging testing shall be under the scope of Contractor. The Owner/Purchaser/Inspector, unless the inspection of the tests is virtually waived, shall attend such tests within thirty (30) days from the date on which the equipment is notified as being ready for inspection/witnessing of test, failing which, the Contractor may proceed with the tests which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of the test results in triplicate. The Contractor shall assemble equipment and carry out shop test in the works in the presence of one Engineer from HCSL for each unit.

23.5 The Owner/Purchaser or Inspector shall within seven (7) days from the date of inspection as defined herein give notice in writing to the Contractor of any objection to any drawings unless already approved earlier testing procedure and testing facilities and all or any equipment and workmanship which in his opinion is not in accordance with the contract. The Contractor shall give due consideration to such objection and shall either make the modifications that may be necessary to meet the said objections or

shall confirm in writing to the Owner/ Purchaser/ Inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

23.6 When the factory tests have been completed at the contractors or sub-contractors works, the Owner/Purchaser/Inspector shall issue a certificate to this effect within seven (7) days after completion of tests but if the tests are not witnessed by the Owner/Purchaser/Inspector to issue such a certificate shall not prevent the contractor from proceeding with the contract. The completion of these tests or the issue of the certificate shall not bind the Owner/Purchaser to accept the equipment should it, on further tests after erection, can be found not to comply with the contract. In such cases, Contractor is liable to carry out required remedial steps complying to the Contract specification to the satisfaction of the Owner. Any defects pointed out by Owner/Third party inspection agency shall be rectified prior to the dispatch of the equipment/item.

23.7 In all cases where the contract provides for tests whether at the premises of works of the contractor or any sub-contractor the Contractor where otherwise specified, shall provide free of charge such items as labour, materials, electricity, fuel, water stores, apparatus and instruments, as may reasonably be demanded by the Owner/Purchaser/Inspector or his authorized representative(s) to carry out effectively, such tests of the equipment in accordance with the contract and shall give facilities to the Owner/Purchaser/Inspector or to his authorized representative to accomplish testing.

23.8 The approval of drawings, inspection by the Owner/Purchaser and issue of inspection certificate thereon shall in no way limit liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the contract, including its guarantee period.

23.9 Final acceptance letter after witnessing the test by the Owner/Purchaser's

representative shall be issued by the office awarding this contract. The contractor shall dispatch the equipment after receipt of the letter of consent from the office awarding the contract.

23.10 Final acceptance letter for the test certificates will be approved by the Owner/Purchaser within 10 (Ten) days from the date of receipt of test reports. The documents shall be negotiated for payment as per the terms of the Contract along with the approval of test certificate.

24 LIABILITY FOR ACCIDENTS TO PERSONS

24.1 The Contractor shall indemnify and save harm to the Purchaser fully against all sections, suits, claims, demands, cost of expenses arising in connection with injuries suffered, prior to the date when the works or plant shall have been taken over, by the Purchaser by person employed by the Contractor or his sub-contractor on the works whether under the general law or under the workmen's compensation Act, 1923, or any other statute in force on the date of the contract, dealing with question of liability of employer for injuries suffered by employees and to have taken steps properly to insure against any claims there under.

24.2 On the occurrence of an accident which results in the death of the workmen employed by the Contractor or which is due to the contract work and of so serious as to be likely to result in the death of any such workmen, the Contractor within 24 hours of happening of such accident intimate in writing to the Owner and such concerned officers required by the provision of the workmen's compensation Act the fact of such accident. The Contractor shall indemnify the Purchaser against all loss or damage sustained by the Purchaser resulting directly or indirectly from his failure to give intimation the manner aforesaid including the penalties or fines, if any payable by the Purchaser as a consequence, of the Purchaser's failure to give notice under the workmen's Compensation Act or otherwise to conform to the provisions of the said Act in regard to such accident.

24.3 In the event of any claim being made, or action brought against the Purchaser involving the Contractor and arising out of the matters referred to and in respect of which the Contractor is liable under Clause, the Contractor shall be immediately notified thereof, and he shall with the assistance, if he so requires, of the Purchaser but at the sole expense of the Contractor, conducts all negotiations for the settlement of the same or any litigation that may arise there from. In such cases, the Purchaser shall, at the expense of the Contractor, afford all available assistance for any such purpose.

24.4 In the event of an accident in respect of which compensation may become payable under workmen's Compensation Act VII of 1923 and any subsequent amendment thereof whether by the Contractor, or by the Purchaser, as principal it shall be lawful for the Owner to retain out of money due and payable to the Contractor such sum or sums of money as may be in the opinion of the said Owner be sufficient to meet such liability. The opinion of the Owner shall be final in regard to all matters arising under this Clause and will not be subject to any arbitration.

24.5 Liability for damage or loss to third party including inspection officers due to act of the Contractor or his sub-contractor connected with the execution of the contract shall be fully borne by the Contractor. The Contractor shall maintain such detailed records to furnish information regarding entertainment and discharge of all workmen employed under this contract as to be adequate for the timely and full settlement of claims under the Workmen's compensation Act. All cases of accidents or injuries shall be reported to the Engineer with all the full details required for the settlement under the workmen's compensation Act.

24.6 The Contractor should report about all accidents within 24 hours to the Owner/Purchaser in the preliminary accident report form. He should furnish other particulars such as medical certificates, wage particulars, fitness, etc., in due course without delay. In the case of any fatality or serious accident, the Contractor shall, in

addition, notify the local police authorities, factories & boilers dept. immediately by the available means. The compensation for affected Workers or their relatives shall be paid by the Contractor in such cases with utmost expeditious in accordance with the Workmen's Compensation Act.

25 LIQUIDATED DAMAGES FOR DELAY IN COMPLETION (Delay compensation)

25.1 Time is the essence of contract. In case the contractor fails to complete the whole work including statutory approvals within the stipulated period including all extensions granted, he shall be liable to pay liquidated damages(not by the way of penalty) at the rate of 0.25% of the value of contract per week and when the delay is not a full week or in multiples of a week and involves a fraction of week, the compensation payable for that fraction shall be proportional to the number of days involved subject to a maximum of 7.5% of the value of the executed contract value. The parties agree that this is a genuine pre-estimate of the loss or damage which will be suffered by the owner on account of delay on the part of the contractor and said amount will be payable on demand without there being any proof of the actual loss or damages having been caused by such delay or breach. The owner shall be at liberty to adjust or deduct the said amount of liquidated damages (not the way of penalty) from any amount due to the contractor including Security Deposit.

25.2 The owner shall be at liberty to deduct or retain from any amount payable to the contractor periodically, the proportionate or full amount of liquidated damages as the case may be for the delay periodically caused by the contractor.

25.3 Sum payable by way of compensation is to be considered as reasonable compensation without actual reference to actual loss.

~~26~~ INCENTIVE FOR EARLY COMPLETION OF WORK

NOT APPLICABLE

27 VENDOR'S/CONTRACTOR'S DEFAULT

27.1 If the Contractor shall neglect to execute the works with due diligence and expedition or stoppage of works without any reasons or stoppage has not been authorized by Engineer-in-charge or shall refuse or neglect to comply with any reasonable orders given to him in writing by the Owner/Purchaser in connection with the works or shall neglect to mobilize required manpower, materials, machinery, equipment's etc. or shall contravene the provisions of the Contract, the Owner/Purchaser may give notice in writing to the Contractor to make good the failure, neglect or contravention complained of. Should the Contractor fail to comply with the notice within thirty (30) days from the date of service thereof, then and in such case the Owner/Purchaser shall be at liberty to execute such part of the work as the Contractor may have neglected or if the Owner/Purchaser shall think fit, it shall be lawful for him,for the successfull completion of the project as per approved specifications without prejudice to any other right he may have under the Contract to take the works wholly or in part out of the Contractor's hands and re-contract with any other person or persons to complete the works or any part thereof and in that event the Owner/Purchaser shall have free use of all Contractors equipments/ resources that may have been at the time on the site in connection with the works without being responsible to the Contractor for wear and tear thereof and to the exclusion of any right of the Contractor over the same and the Owner/Purchaser shall be entitled to retain and apply any balance which may otherwise be due on the Contractor by him to the Contractor or such part there-of as may be necessary, to the payment of the cost of executing a part thereof as aforesaid shall exceed the balance due to the Contractor, the Contractor shall pay such excess. Such payment of excess amount shall be independent of the liquidated damages for delay which the Contractor shall have to pay if the completion of works is delayed.

27.2 In addition, such action by the Owner/Purchaser as aforesaid shall not relieve the Contractor of his liability to pay Liquidated Damages for delay in completion of works as defined in Clause above of this section. The termination of the Contract under this Clause shall not entitle the Contractor to reduce the value of the Performance Bond/Guarantee nor the time thereof. Contractor shall take note that the

Performance Bond/Guarantee shall be valid for the full value and for the full period of the Contract including guarantee period.

28 OUTBREAK OF WAR

28.1 If during the currency of the Contract there shall be an outbreak of war, whether declared or not, in any part of the World, which whether financially or otherwise materially affect the execution of the 'Works', the Vendor/Contractor shall, unless and until the 'Contract' is terminated under the provisions in this Clause continue to use his best endeavour to complete the execution of the 'Works', provided always that the Purchaser shall be entitled, at any time after such outbreak of war to terminate the 'Contract' by giving notice in writing to the Vendor/Contractor, and upon such notice being given, the 'Contract' shall save as to the rights of the parties under this Clause and to the operation of clauses titled 'Settlement of Dispute' be terminated but without prejudice to the rights of either party in respect of any antecedent breach thereof.

28.2 If the 'Contract' shall be terminated under the provisions of the above Clause, the vendor/Contractor shall with all reasonable diligence remove from the 'Site' all the Vendor's/Contractor's equipment and shall give similar facilities of his sub-vendors/sub-Contractors to do so

28.3 The Contractor shall leave the Site and stop work as quickly as possible after receiving the written notice from the employer and shall be paid for all work carried out before receiving the written notice.

29 FORCEMAJEURE

29.1 Definition of Force Majeure

Force Majeure is herein defined as any cause which is beyond the control of the Contractor/ Supplier/ or Owner/Purchaser as the case may be which they could not foresee or with a reasonable amount of diligence could not have been foreseen and which substantially affect the performance of the "Contract" such as:

a. Acts of God, War, natural calamities, including but not limited to floods, droughts, earthquakes, famines and epidemic/ pandemic;

b. Acts of any Govt., domestic or foreign, including but not limited to war, declared or undeclared priorities, lockdown, quarantines, embargoes;

c. Acts of public enemy, accidents and disruptions, including but not limited to explosions,;

d. Transportation delay due to force majeure

e. Strikes, Hartal, Lockouts and sabotages by persons other than contractors & subcontractors personnel and other employees of the contractor

f. Riots and civil commotion

h. Fire caused otherwise than by any act or omission on the part of the contractor or its agents, servants or employees or its subcontractor

The Contractor or the Owner/Purchaser shall not be liable for delays in performing his obligations resulting from any force majeure cause as referred to and/or defined above.

29.2 Notice for Force Majuere

Either party shall within fifteen (15) days from the occurrence of such a cause notify the other in writing with necessary supporting documents of such causes. If neither party issues notice regarding the event within 15 days of its occurrence, the said event shall be deemed not have occurred and the Contract will continue to have effect as such. In case of doubt or dispute, whether a particular occurrence should be considered an "event" as defined under this clause, the decision of the Engineer-in-charge shall be final and binding.

29.3 Consequence of Force Majuere

The obligation under the Contract shall be resumed as soon as practicable after the event has come to an end or ceased to exist. If the contractor suffers delay in due execution of the contractual obligation due to delays caused by force majeure as defined above, the agreed time of completion of the job covered by this contract or the obligations of the contractor shall be extended by a period of time equal to actual period of delay, i.e, from start date of hindrance to end date of hindrance provided that on the occurrence of any such contingency, the contractor immediately should report in writing to HCSL.

For the purpose of assessing delay due to force majeure, fraction of a day shall be treated as full day. If the delay due to force majeure at any instance exceeds 7 days in a stretch, then extension of time to the tune of actual period of delay plus 25%(twenty five percent) shall be granted. Only extension of time shall be considered for Force Majeure conditions as accepted by the Employer and no additional cost on account of force majeure shall be admissible.

If the Contract is terminated under this Clause, the Contractor shall be paid fully for the work done including completed supply part under the Contract, but not for any defective work or rejected material or work done which has been destroyed or damaged before its measurement. Works that have already been measured shall be paid for by the Employer even if the same is subsequently destroyed or damaged as a result of the event. The Employer shall have the option to take over any plant and material lying at site, at rates provided for in the Contract.

If the performance in whole or part by the Vendor/Contractor or any obligations under the Contract is prevented or delayed by "Force Majeure" condition for the continued or aggregated period exceeding 120 days, the Employer/Purchaser may at his option terminate the Contract by issuing notice in writing.

29.4 Force Majeure affecting Sub-Contractor

Authorized sub-contractors executing works under the scope of this contract are also entitled for extension in time due to delays caused by Force Majeure events listed above.

30 LIABILITY FOR DAMAGE TO SYSTEMS OR WORKS

30.1 The Contractor shall be responsible for all risks to the materials, construction works & equipments and for trespass and shall make good, at his own expense, all loss or damage to the works themselves or to any other property of the Employer or the lives, persons and property of others from whatsoever cause in connection with works until they are taken over by the Employer.

30.2 The Contractor shall during the progress of the work properly cover up and protect the work and systems/ equipments from theft, pilferage injury by exposure to the weather or other detrimental works/elements in the nearby area and shall take every reasonable, proper, timely and useful precaution against accident or injury to the same from any cause and shall be and remain answerable and liable for all accidents or injuries there to which until the same, be or be occasioned by the acts or omissions of the Contractor or his workmen or his sub-Contractors, and all losses and damages to the works or systems/ equipments arising from such accidents or injuries as aforesaid shall be made good in the most complete and substantial manner by and at the sole cost of the Contractor and to the reasonable satisfaction of the Engineer. Should such loss or damage happen to units of works or systems/ equipments or materials failing outside the scope of this contract and due to the contract, those shall be replaced or compensated for by the Contractor to the satisfaction of Engineer.

30.3 In the case of loss or damage to any portion of the work or properties of owner which are not related to the work occasioned by other causes, the same shall, if required by the Purchaser, be made good by the Contractor in like manner but at the cost of the Purchaser at a price to be agreed between the Contractor and the Purchaser and the Purchaser shall pay to the Contractor the contract value of the portion of the work so

lost or damaged or any balance of such contract value remaining unpaid as the case may be.

30.4 Until the work shall be deemed to be taken over as aforesaid, the Contractor shall also be liable for and shall indemnify the Purchaser in respect of all damage or injury to any person or to any property of the Purchaser or of others occasioned by Act of the Contractor or his work men or his sub-Contractors or by defective design, work or material but not due to cause beyond his reasonable control. Provided that the Contractor shall not be eligible under the contract for any loss of profit or loss of contracts or any claims made against the Purchaser not already provided for in the contract, nor for any damage or injury caused by or arising from acts of the Purchaser or of others (same as to damage by fire, as hereinafter provided) due to the circumstances over which the Contractor has no control nor shall his total liability for loss, damage or injury exceed the total value of the contract.

31 SUSPENSION OF WORK

31.1 The Owner/Purchaser reserve the right to suspend and reinstate execution of the whole or any part of the work for such time, and in such manner, as the Engineer-in- charge may consider necessary without invalidating the provisions of the Contract. Orders for suspension or reinstatement of the work will be issued by the Owner to the Contractor in writing. Contractor / vendor shall during such suspension, properly protect and secure the Works so far as it is necessary in the opinion of the Engineer- in-charge.

31.2 The time for completion of the work will be extended for a period equal to duration of the suspension and no financial compensation shall be paid for the above suspension. For the purpose of assessing delay due to suspension, fraction of a day shall be treated as full day. If the delay due to suspension of work at any instance exceeds 7 days in a stretch, then extension of time to the tune of actual period of suspension plus 25% (twenty five percent) shall be granted. Contractor shall not be entitled for idle labour, plant & machinery charges on this account.

31.3 The Contractor shall not be entitled for extension of time if the suspension or delay is due to some default on the part of the Contractor or his subcontractor or any agencies outside the control of the Owner.

32 TERMINATION OF CONTRACT BY THE OWNER/ PURCHASER

32.1 Termination of contract due to reasons not attributable to the contractor

The Owner / Purchaser reserves the right to foreclose & terminate the Contract either in part or full due to reasons other than those mentioned under clause ,'Contractor's Default'', at any time, should, in the Employer's opinion, the cessation of works becomes necessary, owing to any cause whatsoever The Owner/Purchaser shall in such an event give fifteen (15) days notice in writing to the Contractor of his decision to do so.

The Contractor upon receipt of such notice shall discontinue the work on the date and to the extent specified in the notice, make all reasonable efforts to obtain cancellation of all orders and contracts to the extent they are related to the work terminated and upon terms satisfactory to the Owner/Purchaser, stop all further sub-contracting or purchasing activity related to the work terminated and assist the Owner/Purchaser in maintenance, protection and disposition of the works required under the Contract by the Owner/Purchaser.

In the event of such termination the Contractor shall be paid compensation for the value of approved materials actually brought to the site and reasonably required to execute the Works as per approved programme, and of Work done up-to-date by the Contractor, shall be paid for in full by the Employer, at rates specified in the Contract. Decision of engineer-in-charge in this regard shall be final and binding

32.2 Termination of contract due to contractor's default

Subject to other provisions contained in this clause, the Engineer-in-Charge may, without prejudice to his any other rights or remedy against the contractor in respect of any delay, inferior workmanship, any claims for damages and/or any other provisions of this contract or

otherwise, and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:

- If the contractor having been given by the Engineer-in-Charge a notice in writing to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or unworkman like manner shall omit to comply with the requirement of such notice for a period of fifteen days thereafter.

- If the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence so that in the opinion of the Engineer-in-Charge (which shall be final and binding) he will be unable to secure completion of the work by the date for completion and continues to do so after a notice in writing of 15 days from the Engineer-in- Charge.

- If the contractor fails to complete the work within the stipulated date or items of work with individual date of completion, if any stipulated, on or before such date(s) of completion and does not complete them within the period specified in a notice given in writing in that behalf by the Engineer-in-Charge.

- If the contractor persistently neglects to carry out his obligations under the contract and/ or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 15 days after a notice in writing is given to him in that behalf by the Engineer-in-Charge.

- If the contractor shall offer or give or agree to give to any person of employer or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any act in relation to the obtaining or execution of this or any other contract for employer

- If the contractor shall enter into a contract with Employer in connection with which commission has been paid or agreed to be paid by him or to his knowledge, unless the particulars of any such commission and the terms of payment thereof have been previously disclosed in writing to the Engineer-in- Charge.

- If the contractor had secured the contract with Employer as a result of wrong tendering or other non-bonafide methods of competitive tendering or commits breach of Integrity Agreement.

- If the contractor being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport so to do, or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors.

- If the contractor being a company shall pass a resolution or the court shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the court or the creditor to appoint a receiver or a manager or which entitle the court to make a winding up order.

- If the contractor assigns, transfers, sublets (engagement of labour on a piece- work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Engineer-in-Charge.

When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer-in-Charge shall have powers:

a) To determine the contract as aforesaid (of which termination notice in writing to the contractor under the hand of the Engineer-in-Charge shall be conclusive evidence). Upon such determination, the retention money already recovered and Performance Guarantee or any other guarantee(s) available with Employer under the

contract shall be liable to be forfeited and shall be absolutely at the disposal of the Employer

b) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof, as shall be un- executed out of his hands and to give it to another contractor to complete the work at the risk and cost of the previous terminated contractor. The contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work.

All costs, damages or expenses which the Employer may have paid for which under the 'Contract' the contractor is liable, will be claimed by the Employer from the Contractor and shall be paid by the Contractor from any money due or becoming due to the Contractor under the 'Contract' and balance if any may be recovered by actions of law or otherwise. In the event of above courses being adopted by the Engineer-in-Charge, the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer-in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified. Terminated contractor shall dismantle and demobilize all plant and machinery, equipments, other temporary site establishments belonging to him within two months of termination of contract failing which Employer shall be at full liberty to take possession of those items and liquidate the same at the risk and cost of the terminated contractor.

32.3 Termination of contract by the contractor

If the suspension of the whole of the Works, or any part or group of the Works by the employer or due to Force Majeure defined above exceeds 120 days without any reasonable update, the Contractor shall have the option to ask for closure of the Contract, or deletion from the

Contract of that part of Works which has been suspended. In case contractor wants to close the contract, he shall give notice to the employer stating the failure on the part of employer to restart the work.In that event, the Contractor shall not be entitled to any compensation for damage or loss, alleged or actual and for loss of any profits anticipated, but the Contractor shall be eligible for only for payment of actual work executed at site. In such eventuality, the Performance Guarantee of the contractor shall be refunded within 30 days from the date of closure of the contract.

33. NO WAIVER OF RIGHTS

Neither the inspection by the Owner/Purchaser or any of their officials, employees or agents nor any order by the Owner/Purchaser or the Engineer-in-charge for payment of money or any payment for or acceptance of the whole or any part of the works by the Owner/Purchaser nor any extension of time nor any possession taken by the Owner shall operate as a waiver of any provision of the Contract, or of any power herein reserved to the Owner/ Purchaser, or any right to withhold herein provided nor shall waiver of any breach in the Contract be held to be a waiver of any other or subsequent breach.

34. SETTLEMENT OF CLAIMS, DISPUTES, ARBITRATION

34.1 Claims by the contractor

If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give notice to the Employer, describing the event or circumstance giving rise to the claim with all supporting documents certified by relevant authorities as applicable. The notice shall be given as soon as practicable, and not later than 14 days after the Contractor became aware; or should have become aware, of the event or circumstance. The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

If the Contractor fails to give notice of a claim within such period of 14 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim.

Within 28 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Engineer-in-charge, the Engineer-in-charge shall respond with approval, or with disapproval and detailed comments. He may also request any further particulars, which are necessary, from the contractor, who will then be bound to provide the same within the time stipulated by the Engineer-in-charge.

34.2 Stages of dispute settlement

a) **Amicable dispute settlement**

Any dispute(s) or differences arising out of or in connection with the Contract shall, to the extent possible, be settled amicably between HCSL and the contractor. Any grievance in connection with the work/Contract can be addressed to the Grievance Redressal Committee of Hooghly Cochin shipyard Ltd/Cochin Shipyard Ltd. All representations to the Grievance Redressal Committee should be submitted to the nodal officer nominated by Hooghly Cochin Shipyard Ltd in the specified format. The name and contact No: of Grievance Redressal committee members can be had from the Engineer-in- charge.

If any dispute arises out of or in connection with this contract, representatives of the employer and contractor with authority to settle the dispute will, within 30 days of a receipt of written request from one Party to the other, meet in good faith and take all efforts in good faith to resolve the dispute. If the dispute is not resolved at that meeting, the Parties will attempt to settle it by Arbitration.

b) Arbitration

Unless settled amicably under mediation, disputes shall be settled by arbitration under the provisions of Indian Arbitration and Conciliation Act 1996. The seat of arbitration / arbitrator shall be at Kolkata.

c) Court of law

No suit or other proceedings relating to the contract shall be filed or taken by the contractor in any Court of Law, except the courts of Kolkata

35. RIGHT TO USE UNSATISFACTORY EQUIPMENT OR MATERIALS

If after delivery, acceptance and installation and within the guarantee period the operation or use of an item proves to be unsatisfactory to the Owner/Purchaser and fails to meet the requirements of specifications under which it was purchased, the Owner shall have the right to continue to operate or use such items until correction of defects by repair or replacement can be made by the contractor without interfering with the Owner/Purchaser's operations. Contractors shall be responsible for all sort of rectifications / corrective actions prior to the release of Performance guarantee. If the contractor fails to clear the defects and prove the system to the satisfaction of owner, the same can be rectified by owner to his satisfaction as per contract specifications at the cost and risk of contractors.

36. ENFORCEMENT OF RIGHTS

The failure of either party to enforce at any time any of the provisions of this Contract or any rights in respect thereto or to exercise any option therein provided, shall in no way be construed to be a waiver of such provisions, rights or options or in any way to affect the validity of the Contract. The exercise by either party of any of its rights herein shall not preclude or prejudice either party from exercising the same or any other right it may have under the contract.

37. BRIBE, GIFTS AND COMMISSIONS, ETC.

Any graft, commission gift or advantage given, promised or offered by or on behalf of the Contractor or his partner, agent, officer, director, employee or servant or sub- contractor or any one of his on their behalf in relation to the obtaining or to the execution of this or any other Contract with the Owner/Purchaser, shall in addition to any criminal liability which it may incur, subject the Contractor to the cancellation of this and all other Contracts and also to

payment of any loss or damage to the Owner/Purchaser resulting from any cancellation. The Owner/Purchaser shall then be entitled to deduct the amounts so payable from any moneys otherwise due to the Contractor under this contract.

The Contractor shall not lend or borrow money from, or enter into any monetary dealings or transactions directly or indirectly, with any employee of the Employer, and if he does so, the Employer shall be entitled forthwith to rescind the Contract and all other Contracts with the Employer. The Contractor shall be liable to pay compensation for any loss or damage to the Employer resulting from such rescission and the Employer shall be entitled to deduct the amounts so payable from the money (s) due to the Contractor

In the event of rescission of Contract, the Contractor shall not be entitled to any compensation whatsoever, except for the work done up to the date of rescission.

38. RELEASE OF INFORMATION

38.1 The Contractor shall not communicate or use in advertising, publicity, sales releases or in any other medium photo-graphs or other reproduction of the works under this contract or description of the site, dimensions, quality or other information, concerning the work unless prior written permission has been obtained from the Owner/Purchaser. Contractor shall also ensure the usage of drawings / design /information /data in any form either in hard copy or in electronic mode pertaining to this contract strictly for its execution and shall not share the same with any other party /agency pertinent to this project except its Subcontractors and/or Equipment/system/material manufacturer/suppliers involved in the Project

38.2 All specifications and drawings shall remain the property of the Employer and shall not be used on any other works and shall be returned by the Contractor to the Employer on completion of the works or on termination of the Contract.

39. CERTIFICATE NOT TO AFFECT RIGHT OF OWNER/ PURCHASER AND LIABILITY OF VENDOR/ CONTRACTOR

No interim payment certificate of the Owner/Purchaser, nor any sum paid on account by the Owner/Purchaser, nor any extension of time for execution of the 'Works' granted by the

Owner/Purchaser shall affect or prejudice the rights of the Owner/Purchaser against the Vendor/Contractor or relieve the Vendor/Contractor of his obligations for the due performance of the 'Contract' or be interpreted as approval of the 'Works' done or of the equipment furnished and no certificate shall create liability in the owner/Purchaser to pay for alterations, amendments, variations or additional 'Works' not ordered, in writing, by the Owner/Purchaser or discharge the liability of the vendor/Contractor for the payment of damages whether due, ascertained, or certified or not or any sum against the payment of which the contractor is bound to indemnity the Owner/Purchaser nor shall any such certificate nor the acceptance by the contractor of any such paid on account or otherwise affect or prejudice the rights of the Vendor/Contractor against the Owner/Purchaser.

40. OWNER'S/PURCHASER'S DECISION

40.1 In respect of all matters which are left to the decision of the Owner including the granting or withholding of the certificates, the Owner shall, if required to do so by the Contractor, give in writing a decision thereon.

40.2 If in the opinion of the Contractor, a decision made by the Owner is not in accordance with the meaning and intent of the Contract, the Contractor may file with the Owner within fifteen (15) days after receipt of the decision, a written objection to the decision giving his reasons for so doing. Failure to file an objection within the allotted time shall be considered as acceptance of the Owner decision and the decision shall become final and binding.

40.3 It shall be accepted as an inseparable part of the Contract with any matters regarding material, workmanship, removal of improper work, interpretation of the Contract drawings and Contract Specifications, the decision of the Owner which would be given in writing shall prevail.

.4 The contractor shall proceed with the works in accordance with the decisions, instructions and orders given by the Owner accordance with these conditions.

41. TRAINING OF OWNER'S/PURCHASER'S PERSONNEL

NOT APPLICABLE

42. POWER TO VARY OR OMIT WORK

Civil works

The Engineer-in-charge shall make any Variation of the form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be appropriate, he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following:

i. Increase or decrease the quantity of any work included in the Contract

ii. Omit any such work

iii. Change the character or quality or kind of any such work

iv. Change the levels, lines, position and dimension of any part of the Works

v. Execute additional work of any kind necessary for the completion of the Works

vi. Change any specified sequence or timing of construction of any part of the Works.

The quantities given under the respective of Bill of Quantities are those upon which the approximate estimated cost of work are based but they are subject to alterations, omissions, deduction and additions and not necessarily show the actual quantities of work to be done and can be increased or decreased at the discretion of the Engineer. In general, the rates quoted shall be firm for such variation up to the limit of (+)25% in respect of individual items (except those items specified in Appendix-I for which separate variation provisions as specified thereon) and upto (+)10 % of the total awarded contract value. Contractor is bound to execute the variation if any within the permitted variation for individual item as per his quoted schedule of rates/prices.

In case the variation results in the total awarded contract value exceeding the prescribed percentage, the revision of rates for respective individual items, if any, shall be applicable only for that portion of work carried out in excess of the permissible percentage.`

No such Variation shall in any way vitiate or invalidate the Contract, by the effect, if any, of all such Variations shall be valued in accordance with clause ,'Payment for variations'', provided that where the issue of an instruction to vary the works is necessitated by some default of or breach of

contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor. All Variations shall be included in updated Programme produced by the Contractor.

If the contractor refuses to carryout variation item works or fails to commence such work within a reasonable period of time, then Engineer-in-charge shall be entitled to execute such work through other agencies at the risk and cost of the contractor and no claim from contractor shall be admissible on this account.

Instruction for Variations

The Contractor shall not make any such Variation without an instruction of the Engineer -in-charge. Provided that no instruction shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities.

Payment for Variations

Within 14 days of the date of instruction for executing varied work, extra work or substitution, and before the commencement of such work, notice shall be given by the Contractor to the Employer of his intention to claim extra payment or a varied rate or price.

For items in the Bill of Quantities but where quantities have increased beyond the variation limits, the rate payable for quantity in excess of the quantity in the Bill of Quantity plus the permissible variation shall be as determined by methods given below:

(i) Rates and prices in the Delhi Schedule of Rates (inclusive of Guwahati cost index) applicable to the Contract plus or minus Ruling percentage.

(ii) Market rates of material and labour, hire charges of plant and machinery used plus 15% for overheads and profits of Contractor.

Whichever is lower, but not less than the rate in the Bill of quantities.

For items not existing in the Bill of Quantities (extra item) rate payable should be determined by methods given below and in the order given below and whichever is lower shall be paid;

i) Rates and prices of relevant item in the Delhi Schedule of Rates 2021 plus cost index plus/minus ruling percentage

ii) Market rates of materials and labour, hire charges of plant and machinery used, plus 15% for overheads and profits of Contractor. Contractor has to furnish site observed data jointly certified by contractor, employer and consultant for computing local market rates along with supporting documents such as tax invoice of materials procured, labour deployment log book, work order/purchase order showing hire charges of plant and machinery, work order showing labour rates etc. to employer

But for items not listed in the bill of quantities, but can be considered as substitute item, rate payable shall be detemined as below:

i) Rates and prices derived from the accepted rate of similar items in Contract.

If there is delay in the Employer and the Contractor coming to an agreement on the rate of an extra item, rates as proposed by the Employer shall be payable provisionally till such time as the rates are finally determined or till date mutually agreed.

43. GUARANTEE

43.1 The Contractor shall be responsible for the rectification of defects in all civil works/structures for a period of twenty four months from the date of taking over of the entire works by the Owner/ Employer. Any defects discovered and brought to the notice of the Contractor forthwith shall be attended to and rectified by him at his own cost and expense. In case the Contractor fails to carry out these rectifications within 14 (fourteen) days from the date of notifying the defect, the same may without prejudice to any other right or remedy available, be got rectified by the Employer at the risk and cost of the Contractor.

43.2 In addition to defect liability period of twenty four months, Contractor shall also furnish guarantee bond in employer approved format for following civil works/items covering periods specified below which shall be reckoned from the date of final taking over of the project by the employer;

Anti-termite treatment – 5 Years

Water proofing treatment – 5 Years

Decorative paint – 5 Years

Road works(Thermo plastic paint, Reflector studs, Sign boards) – 3 Years

43.3 If during the said guarantee period, the Owner/Purchaser Employer finds any materials/ works to be containing manufacturing defects or defect in workmanship, the Contractor would be required to replace such defective equipment/ work free of charge. The above guarantee shall also apply to defects noticed upto end of defect liability period. The Contractor shall bear all the expenses incurred in connection with replacement against such defective equipment /component /module inclusive of all freight both inland and overseas, insurance, customs levies, forwarding and clearing all demurrage and other incidental charges involved in delivering the said equipment to the Owner/Purchaser's specified destination including its loading and unloading charges. The charges for erection of such replacement shall not be paid by the Owner/Purchaser. The decision whether correction of the defects would be by repair or by replacement shall be mutually discussed and decided to the satisfaction of the Purchaser.

43.4 The Contractor shall take all necessary steps for expediting clearance and delivery of the replacement which may be required to be made by him under this Clause.

43.5 The Owner/Purchaser and the Contractor shall mutually agree to programme of replacement, renewal or repair which will minimize any interruption in the commercial use of the equipment.

43.6 In the event, the Contractor fails to undertake necessary steps to repair or replace defective materials as stipulated above after receiving notice from the Owner/Purchaser Employer of any

defect in the materials or failure of any material to conform to the specifications, the Owner/Purchaser Employer may proceed to undertake the repair replacement of such defective equipment at Contractors risk and expense but without prejudice to any other rights which the Owner/Purchaser Employer may have against the Contractor in respect of such defects.

43.7 Provision of this Clause shall also apply to all materials repaired or replaced under the provision of this until the expiration of period of twenty four (24) months from the date of such replacement.

43.8 The cost of any special or general overhaul rendered necessary during the guarantee period due to defects in the systems/ equipments or defective work carried out by the Contractor shall be borne by Contractor.

43.9 If the replacements or renewals are of such a character as may affect the efficiency or output of the equipment supplied or any portion thereof, then the Owner may, within one month of such replacement or renewal, give to the contractor a notice in writing requiring that tests on completion be made in which case such tests shall be carried out in accordance with the provisions made in this contract. All costs for testing shall be borne by the contractor.

43.10 The acceptance or taking over of the equipments by the Owner/Purchaser shall in no way relieve the Contractor of his obligation under this Clause.

43.11 At the end of the guarantee period, the Contractor's liability ceases except for latent defects. In respect of goods supplied by sub-contractors to the Contractor, where sub-contractor provides a longer guarantee than the one indicated in this contract, the Owner should be entitled to the benefit of such longer guarantees.

44. REPLACEMENT OF PARTS AND MATERIALS DEFECTIVE/ DAMAGED/ LOST DURING TRANSIT

44.1 The Employer shall have the authority to order in writing from time to time:

i. The removal from site within such time, as the Engineer-in-charge may specify, any material, equipment which in his opinion, is not in accordance with the Specifications and Conditions of the Contract.

ii. the substitution of defective material by proper and suitable material

iii. The removal and proper re-execution, notwithstanding any previous decision or interim payment thereof, of any work which in respect of materials or workmanship is not, in the opinion of the Engineer-in-charge, in accordance with the Contract.

44.2 If during the progress of the works the as part of quality assurance Owner shall decide and inform in writing to the Contractor that the Contractor has manufactured any systems/ equipments or part of the systems/ equipments unsound or imperfect or has furnished any systems/ equipment inferior to that the quality specified the Contract~~or~~ and on receiving details of such defects or deficiencies, contractor shall at his own expense within seven (7) days of his receiving the notice or communication, or otherwise and within such time as may be reasonable necessary for making it good proceed to alter, reconstruct or remove such work and furnish fresh equipment up to the standards of the Specifications. In case the Contractor fails to do so, as per the nature and requirement of the defect, the Owner may on giving the Contractor seven (7) days, notice in writing or communicating of his intentions to do so and proceed to rectify or remove the portion of the works so complained of and at the cost and risk of the Contractor.

44.3 The Contractor's full and extreme liabilities under this Clause shall be satisfied by the payments to the Owner/Purchaser of the extra cost of such replacement procured including extra cost of erection as provided for in the Contract, such extra cost being the ascertained difference between the price paid by the Owner/Purchaser for such replacements and the Contract price portion for such defective systems/ equipments and repayments of any sum paid by the Owner/Purchaser under the Contract for such defective systems/ equipments.

45 DEFENSE OF SUITS

45.1 If any action in courts is brought against the Owner/Purchaser or an officer or agent of the Owner/Purchaser, for the failure or neglect on the part of the Contractor to perform any acts, matters, covenants or things under the Contract or for damage or injury caused by the alleged

omission or negligence on the part of the Contractor or in connection with any claim based on lawful demands of sub-contractors, workmen, suppliers or employees, the Contractor shall be the sole agency to meet the risk and cost fully and in all such cases contractor shall indemnify and keep the Owner/Purchaser and the consultant and or his representative(s) harmless from all losses, damages, expenses or decrees arising such action.

46 LIMITATIONS OF LIABILITIES

46.1 Under the contract, the contractor shall be responsible for any loss or damage to the systems/ equipments /works until the systems/ equipments/works is taken over by the Owner in accordance with the contract. The contractor shall be responsible for making good repair /rectify the damage or loss by way of repairs and or replacement of the portion or full of the works damaged or lost. The transfer of title shall not in any way relieve the contractor of the above responsibilities.

46.2 Except in respect of latent defects, liability, the long terms availability of spares and other specific liabilities identified in the Contract, the Contractor shall be released from his liabilities under the Contract at the end of the warranty period /defect liability period. The Contractor shall be released from his liability in respect of latent defects on expiry of Twenty four (24) months after successful completion of performance test of the respective unit/ systems/ equipments / taking over of the project in full whichever is later.

46.3 The final payment by the Owner in pursuance of the contract shall mean the release of the Contractor from all his liabilities under the contract. Such final payment shall be made only at the completion of the guarantee/defect liability period. All the contractual liabilities of the Contractor shall prevail up to the end of guarantee period/defect liability period. In the event the final payment is made prior to the completion of guarantee period on agreement between the Owner & the Contractor or under any other Clause of the contract, the contractual liabilities of the Contractor shall prevail up to the end of guarantee period / defect liability period.

46.4 The aggregate total liability of the Contractor to Owner under the Contract shall not exceed the total

Contract Price, except that this Clause shall not limit the liability of the Contractor for following:

(a) In the event of breach of any Applicable Law;

(b) In the event of fraud, willful misconduct or illegal or unlawful acts, or gross negligence of the Contractor or any person acting on behalf of the Contractor; or

(c) In the event of acts or omissions of the Contractor which are contrary to the most elementary rules of diligence which a conscientious Contractor would have followed in similar circumstances; or

(d) In the event of any claim or loss or damage arising out of infringement of Intellectual Property; or

(e) For any damage to any third party, including death or injury of any third party caused by the Contractor or any person or firm acting on behalf of the Contractor in executing the Works.

46.5 Neither Party shall be liable to the other Party for any kind of indirect nor consequential loss or damage like, loss of use, loss of profit, loss of production or business interruption which is connected with any claim arising under the Contract.

47 FOREIGN FIELD PERSONNEL

47.1 The Contractor shall submit to the Engineer-in-charge, a complete list of foreign field personnel (including necessary data as may be required by Engineer-in-charge), required for the performance of the works in India. He shall also intimate the programme of their visit to India and departure from India during the pendency of the Contract. The Engineer will have the right to review the list of such personnel and ask for increase in the strength or reschedule the visits of such personnel if in the opinion of the Engineer-in-charge, the list of personnel mentioned is not sufficient for effective performance of the Contract.

48 HEADINGS AND MARGINAL NOTES

48.1 The headings and marginal notes to any Clause of the Contract shall not affect or control the construction of such Clause.

49 COMPLETION OF CONTRACT

49.1 Unless otherwise terminated under the provisions of any other relevant Clause, this contract shall be deemed to have been completed at the conclusion of the guarantee period/ defect

liability period as provided for under the Clause 'Guarantee' in this section and completion of all the contractual obligations.

50 DUTIES OF THE CONSULTANT

The scope of the duties of the Consultant pursuant to the 'Contract' will include but not limited to the following:

50.1 Conusltant shall undertake all activities related to the technical site supervision, contract management, cost checking/controls, quality assurance/quality control, monitoring safety related issues, equipment trial, booking of work done measurements, finalization/certification of bills and overall coordination, and providing, comprehensive contract administration services to administer the construction contract, issuing site instructions, managing progress with respect to program, valuing progress claims and assessing variations and claims for the extensions of time and cost as required.

50.2 Consultants site team shall be headed by a Resident Project Manager and supported by Assistant Resident Managers, Site Engineers, Quantity Surveyors, and HSE Engineers as required to maintain full control over the works, and protect the interests of HCSL.

50.3 Preparation of bar chart and master construction schedule, review of contractor's construction schedule, identifying critical activities etc. and periodic review of project status to the employer.

50.4 Consultant shall carry out the design and detailed engineering and shall provide Good for

Construction drawings(GFC) for the all the structures except for the PEB works. Front End Engineering Design (FEED) shall be provided by the Consultant for Pre Engineered Buildings (PEB) structures and contractor has to do the detailed engineering.

50.5 Review Contractor's Drawings:

PEB drawings to be submitted by the contractors and should be checked for adequacy and compliance with the terms and conditions of the Contract. Copies of contractor's submissions, comments and the finally accepted documents should be maintained in permanent file until completion and final acceptance of all construction undertaken by the contractors. Archiving should

then be carried out in accordance with the Quality Plan with the transfer of appropriate document records to HCSL.

50.6 Interpretation of all the terms and conditions of contract documents and specifications, Resolving technical issues at site, Review and interpretation of all consulatant's drawings and specifications, Vendor's/Contractor's/Sub-Contractor's drawings engineering data, etc. as applicable. Checking compliance of quality of works executed and its conformity with the standards, specifications prescribed in the contract etc.

50.7 Attending management meeting, preparation and distribution of minutes to all parties concerned.

50.8 Review and suggest modifications and improvements in completion of physical and financial schedules from time to time and supervise/verify the Quality Assurance/Quality control Programme implementation at all stages of the 'Works', Ensuring compliance with HSE policies and procedures, ISO & OHSAS standards promoting safety awareness & accident prevention measures, conducting risk assessment and recommending corrective actions.

50.9 Review of Contractors Methodology and Procedures: Provide completion schedule by developing

Project Execution plan and Master Project Implementation schedule in appropriate software in line with the Target Project Completion date and its continuous review &updation and advice HCSL for timely corrective action of any delay. The schedules should be monitoring against the works to check progress, quality and compliance to HCSL requirements.

50.10 Technical clarification and site resolution: Technical issues arising during construction shall be

resolved by the consultant on immediate basis. The consultant shall be required to assemble suitable staff on site during the work execution stage for proper site supervision/ contact administration stage so that design queries can be addressed quickly and any design related proposals from the contractor can be efficiently handled, without delay. This includes proactively investigating possible cost savings due to design modifications throughout the construction stage, in conjuction with the contractor.

50.11 Review Test Reports, QC Reports, Registers, Measurements, Bills, QAPs document, Witness Tests,

Other documents: All Test Reports, QC Reports, Registers, Measurements, Bills, QAPs document, Witness Tests and Other documents will be reviewed and attested by Consultant for approval. At various points in the progress ofthe job, as required in the Contract Documents that specific materials orequipment shall be tested. The objective of such tests is to monitor adherence by the contractors to the requirements of the Contract Documents and to check that the materials and equipment comply with the appropriate contract specifications.

50.12 Progress Monitoring and Review Meeting:

a) The consultant will review the program network submitted by contractor which is based on Critical Path Method using precedence diagram method to complete the work with in stipulated time schedule.

b) The consultant will review contractors month/week wise details of manpower and machinery to be deployed in project along with material procurement schedule for completion of work with in stipulated period based on program networking. The progress will be reviewed monthly/weekly with respect to the program/Net Work chart submitted by contractor. If required a daily meeting can be held at site to take up any urgent activity as required on priority.

50.13 Evaluate and certify the works/bills submitted by the contractor and recommend payment to HCSL.

50.14 Advising the employer regarding taking over the completed works after issue of completion certificate by the consultant .

50.15 Preparation and submission of Ás-built drawings at the end of construction, Inspection of performance of works during defect liability period.

50.16 Prepare ‘As-Built’ Drawings and O&M Manuals: On completion of the construction, the ‘as-built’/ 'as installed’ modifications should be recorded on CD ROMs by the contractors. These digital records should be reviewed by the Resident Project Manager and submitted to HCSL as

permanent records of the As- constructed /As-installed works within 3 months of the completion of the contract to which they relate. One set of hard copy shall also be furnished to HCSL.

50.17 All site registers like Daily work history, Hindrance register, Cement Register, Steel Register, Site order register, Material/Equipment receipt Register; Measurement Book/register etc. shall be maintained and certified by the consultant and HCSL. The registers shall be jointly signed by Consultant and contractor wherever applicable.

50.18 Issue of final completion certificate:

On completion of the remedial snag works, a "Final Completion Certificate" shall be issued by the consultant as appropriate for all works associated with the project and taking over date mentioned in the Final Completion Certificate shall be deemed to be start date of defect liability period.

50.19 Defects Liability Period:

Once the Final Completion Certificate is issued, the consultant shall be under an obligation to inspect the above system infrequency of six months during the defect notification period of Twenty Four months regardless of the defects noticed.

The Contractor based on the instructions and orders given by the consultant shall execute all works under the contract. To eliminate delays and avoid disputes and litigation, all matters and questions shall be referred to the Employer/Engineer in change and his decision shall be final.

51 CO-OPERATION WITH OTHER CONTRACTORS

51.1 The Contractor shall co-operate with the Owner/Purchaser's other Contractors & Consultants and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts.

Contractor has to execute the work causing minimum disturbance and interference with works beingcarried out by other contractors/vendors.

51.2 It is envisaged that there will be number of areas where there would be interface between equipments to be supplied under this Contract and equipments proposed to be purchased under other enquiries by the owner.

51.3 In such cases the Contractors may, if applicable communicate directly with each other put two copies of such communications, all drawings referred to therein. And records of all discussions or conferences between them shall be sent at the same time to the Owner/Purchaser by the originating party.

51.4 Receipt of such copies by the Owner/Purchaser shall not imply approval of the contents thereof unless such approval is given in writing and shall not relieve the respective Contractors of the obligation of supplying between them everything within the scope of their contract necessary for the proper operation of the systems/ equipments .

51.5 Neither Contractor shall submit to Owner/Purchaser for approval any drawings or proposals which affect the other Contractor unless he has obtained prior written agreement from the other Contractor.

51.6 Should the occasion arise that either Contractor considers that the other has failed or will fail to supply any necessary information the lack of which will prejudice the former's obligations; he may seek Owner/Purchaser's assistance in having such information provided.

51.7 Subject to the rights under the Contract, the decision of the Owner/Purchaser shall be final in the event of any disagreement between the Contractors which cannot be resolved mutually.

52 PROGRESS REPORTS AND PHOTOGRAPHS

52.1 Daily reports

The Contractor shall submit daily report indicating daily activities, weather condition, actual manpower, equipment and the materials arriving on site, breakdown of machinery, hindrances if any etc.

52.2 Weekly Reports

The Contractor shall submit to the Engineer-in-charge on the first day of each week or such longer period as the Engineer-in-charge may from time to time direct, a progress report in an approved format showing up-to-date total progress, progress achieved against planned progress, during the previous week and progress forecast for the following week for all important items in each section or portion of the Works, in relation with the approved Programme

52.3 Monthly Report

Monthly progress reports shall be prepared by the Contractor and submitted to the Employer in triplicate. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7days after the last day of the period to which it relates. Reporting shall continue until the Contractor has completed all work, which is known to be outstanding at the completion date, stated in the Taking-Over Certificate for the Works. Each report shall include:

a. Charts and detailed descriptions of physical & financial progress, including each stage of design (if any), Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection and testing; and including these stages for work by each Sub-Contractor,

b. Photographs in hardcopy & digital copy and videography in two sets showing the various stages of progress on the Site monthly;

c. Status of labour deployed shift wise, plant and machinery status, breakdown of plant and machinery, hindrances if any etc

d. For the supply of manufactured items, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of:

i. Commencement of manufacture,

ii. Contractor's/ Engineer's inspections,

iii. Tests,

iv. Shipment and arrival at the Site;

e. Copies of quality assurance documents, test results and certificates of Materials;

f. Safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and

g. Quality statistics such as observations/NCR issued, closed etc.

Comparisons of actual and planned progress, with details of any events or circumstances which may jeopardise the completion In accordance with the Contract, and the measures being (or to be) adopted to overcome delays. The progress achieved on various fronts like engineering, manufacture, procurement of sub-vendor items, supply etc, as compared to schedules shall be presented on the progress report. The reasons for variance, actual progress & corrective measures wherever necessary shall be brought out. Photographs shall be taken as & when indicated by the Engineer-in- charge. Photographs shall be adequate in size and number and shall have proper orientation to reveal actual status of works.

53 SPARES

CLAUSE DELETED

54 SECRECY

54.1 The contract involves an obligation of secrecy and the contractor, his agents, servants or sub-contractor or their agents or servants shall observe and comply with the requirements of the Indian Official Secrets Act 1923, and the rules there under or any statutory modifications or re-

enactments thereof. Any breach of this clause shall constitute a breach of the contract.

54.2 The Site of Work is a protected area. The contractor is obliged to comply with the provisions of the Port Facility Security (ISPS) code in force and as amended from time to time. Entry to the work site shall be regulated by photo entry passes issued by the contractor at his risk and cost. Contractor shall strictly abide by the rules and regulations of HCSL regarding entry and exit of vehicles, materials, equipments & contractor's workmen. No photographs of the work site area shall be taken or permitted by the contractor to be taken by any of his employees without the approval of the engineer-in-charge and no such photographs shall be published, or otherwise circulated without the approval of the employer.

54.3 The technical information, drawings, specifications and other related documents forming part of the 'Contract' are property of the Owner/Purchaser and shall not be used for any other purpose, except for execution of the `Contract'. All rights, including rights in the event of grant of a patent and registration of designs are reserved. The technical information, drawings, specifications, records and other documents shall not be copied, transacted, traced or reproduced in any other form or communication in any media or otherwise in whole and/or duplicated, modified, divulged and/or disclosed to a third party nor misused in any other form whatsoever, without the Owner's/Purchaser's previous consent in writing, except to the extent required for the execution of this 'Contract'. The technical information, drawings, specifications and other related documents shall be returned to the Owner/Purchaser with all approved copies and duplicates, if any, immediately after they have been used for the agreed purpose. Contractor shall ensure the confidentiality nature of documents / installations either in the project site or other part of the premise of the owner having direct interaction for the execution of this project.

54.4 In the event of any breach of this provision, the Vendor/Contractor shall indemnify the Owner/Purchaser from any loss, cost or damage or any other claim whatsoever from any parties claiming from or through them in respect of such breach.

55 BANKRUPTCY

55.1 If the Contractor commits any act of Bankruptcy or goes into liquidation except for reconstruction purpose or if its business carried on by a receiver such receiver liquidates or any

person in whom the contract may become vested shall forthwith give notice thereof in writing to the Owner/Purchaser and shall for one month, during which he shall take all reasonable steps to prevent stoppage of performance of the contract, have the option of carrying out the contract subject to his or their providing such guarantees as may be required by the Owner/Purchaser but not exceeding value of work for the time being which remain un-executed.

55.2 In the event of stoppage of performance under the contract, the period of option under this Clause shall be 14 days only, provided that should be the above option not exercised, the contract may be terminated by the Owner/Purchaser by notice in writing to the Contractor/ Consortium partners. The power and provision so reserved to Owner/Purchaser on taking work out of Contractor's hands shall apply as far as they may be when the contract is so terminated.

55.3 After termination, the Employer may complete the Works and/or arrange for any other entities to do so at the risk and cost of the Contractor.

56 MEMBER OF OWNER'S STAFF ETC. NOT PERSONALLY LIABLE

56.1 Neither any member of the owner's staff nor the Owner shall in any way be personally liable for the acts or obligations under the contract or answerable for any nor omission on the part of the owner in the observance or performance of any of the acts, matters or things which are concerning the contract.

57 LIMITATION OF CONTRACT SPECIFICATION FOR EQUIPMENTS, COMPONENTS & SYSTEMS

Clause deleted

58 EQUIPMENT PERFORMANCE GUARANTEE

Clause deleted

59 ENGINEERING DATA

59.1 The furnishing of engineering data and calculations by the Vendor/Contractor, as applicable wherever they have to carry out design, shall be in accordance with the schedule as per specifications. The review of these data by the Employer or his parties will cover only general conformance of the data to the specifications and documents interfaces with the equipment provided under 'Specification', external connections and of the dimensions which might affect systems/ equipments layout. This review by the Engineer may not indicate a thorough review of all dimensions, quantities and details of the equipment, materials, any devices or items indicated or the accuracy of the information submitted. This review and/or approval by the Engineer shall not be construed by the Vendor/Contractor, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

59.2 All engineering data submitted by the Vendor/Contractor after final process including review and approval by the Engineer-in-charge shall form part of the Contract and the entire 'Works' covered under these specifications shall be performed in strict conformity.

60 DRAWINGS

60.1 General details of the works are shown on the drawings accompanying the tender document in the case of civil works. The Engineer-in-charge will supply to the Contractor from time to time during the progress of the works such further working drawings as will be necessary in his opinion for the proper and adequate execution and maintenance of the Works in accordance with the Engineer-in-charge's designs and/or any modification thereof as decided by the Engineer-in-charge and the Contractor shall carry out the work in accordance with the said working drawings. Two sets of such working drawings will be issued. If the Contractor requires more sets he will have to make his own arrangement at his cost.

60.2 The consultant to the project has done the detailed design and engineering for the subject tender. During execution of the work the residual design, detailing and engineering, if needed, is to be carried out by the contractor at no extra cost to the Employer. However, if any other alternate form of construction is adopted in the permanent works, the successful contractor shall

be responsible for detailed design & drawings. Such design, detailing & engineering shall be got approved by the contractor from the Employer. For equipment's/ Installations detailed drawings need to be produced by the contractor at no extra cost to the Employer. Such detailing & engineering shall be got approved by the contractor from the Employer.

60.3 Detailed working drawings for the designs executed by the contractor on the basis of which actual execution of the work is to proceed will be furnished by the contractor from time to time during the progress of the work. The contractor shall be deemed to have gone through the drawings supplied to him thoroughly and carefully and in conjunction with all other connected drawings and bring to the notice of the Engineer- in-Charge, discrepancies, if any, therein before actually carrying out the work. It shall be contractor's responsibility to have these drawings prepared as per the directions of Engineer-in-Charge and got approved before proceeding with manufacture construction / fabrication, as the case may be. Any changes that may have become necessary in these drawings during the execution of the work shall have to be carried out by the contractor to the satisfaction of Engineer-in-Charge at no extra co. All final drawings shall bear the certification stamps duly signed by both the contractor and the Engineer-in-Charge. In addition, as applicable, the Vendor/Contractor shall furnish the 'Soft copy' of all essential drawings in addition to full size prints. Drawings shall be submitted in adequate number of copies as indicated in Volume IV,V & VI

60.4 The Contractor shall keep at site in good order one copy of latest approved Specifications and Drawings and also such other contract documents as may be necessary and make them available to the Engineer or his Representative. All specifications and drawings shall remain the property of the Employer and shall not be used on other works and shall be returned by the Contractor to the Employer on completion of the works or on termination of the Contract.

60.5 If any ambiguity arises as to the meaning and intent of any portion of the specifications and drawings or as to execution or quality of any work or material or as to the measurement of the Works, the decision of the Engineer-in-charge shall be final and binding.

The Vendor/Contractor shall be responsible for any discrepancies, errors or omissions in the drawings and other particulars supplied by him, whether such drawings and particulars have been approved by Engineer-in-charge or not provided that such discrepancies, errors, or omissions be

not due to inaccurate information or particulars furnished in writing to the Vendor/Contractor by the Owner/Purchaser.

61 INSTRUCTION MANUALS

Not applicable

62 FIRST FILL OF OILS, LUBRICANTS, ETC.

Not Applicable

63 WORK/ PROGRAM SCHEDULE

63.1 The Contractor shall, on receipt of work order of his tender, or as soon as thereafter as possible, but not later than 15 days from the date of receipt of work order, submit to the Engineer-in-charge and the consultant for his approval, a detailed programme, showing the general methods, procedure, arrangements, order, and timing for all the activities in the works along with monthly cash flow forecast in which he proposes to carry out the work within the "Time for Completion" stipulated in "Instruction to Tenderers". Any requirement for completion of any part or parts of the Works before completion of the whole of the Works should be reflected in the programme. Such schedules shall be reviewed, updated and submitted to the Engineer once in a month thereafter by the Contractor to ensure contracted schedule of works. The Contractor shall, whenever required by the Engineer-in-charge or his Representative, also provide in writing for their information, a general description of the arrangements and method of deployment of labour and machinery which the Contractor proposes to adopt for the execution of the Works.

63.2 If at any time it should appear to the consultant that the actual progress of work does not conform to the approved programme, referred to above, the Contractor shall produce at the request of the consultant, a revised programme showing modifications to the approved programme, necessary to ensure completion of the work within the time for completion stipulated in the Contract. The submission to and approval by the consultant of such programme or the furnishing of such particulars shall not relieve the Contractor of any of his

duties or responsibilities or obligations under the Contract. The consultant shall have full power and authority during progress of work, to issue such instructions as may be necessary for the proper and adequate execution and maintenance of the Work. The Contractor shall carry out and be bound by the same. The programme finally approved by the Engineer-in-charge shall supersede the one submitted earlier with the Tender.

64 REFERENCE STANDARDS

64.1 The Codes, and/or standards referred to in the 'Specification' shall govern, in all the cases wherever such references are made. In case of a conflict between such codes and/or standards and the specifications Such codes and/or standards referred to shall mean the latest revisions, amendments/changes adopted and published by the relevant agencies. In case of any further conflict in the matter, the same shall be referred to the Engineer-in-charge whose decision shall be final and binding.

64.2 If the bidder wants to follow standards other than those specified in the specification, then he must mention the same in the deviation list expressly during pre-bid discussion and get specific confirmation from the to follow these standards. No request on this shall be permitted unless and otherwise a superior code /rule / regulation is confirmed.

64.3 In the case of any class of work for which there are no such specifications as referred, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications or other mentioned standards. In case there is no such specifications in Bureau of Indian Standards, the work shall be carried out as per specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Engineer-in-charge or his nominee. Electrical works shall be carried out as per CEA regulations & Indian Electricity Act amended date.

64.4 If the Contractor does any work or part of work in a manner contrary to the specifications or drawings without the approval of the Engineer, he shall bear all the costs arising there from including dismantling and reconstruction strictly in accordance with the specifications and drawings and shall be responsible for all loss to the Employer.

65 DESIGN IMPROVEMENTS

65.1 The employer or the Vendor/Contractor may propose changes in the 'Specification' of the equipment or quality thereof and if the parties agree upon any such changes in the 'Specification' shall be modified accordingly.

65.2 If any such agreed upon change, is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any change in the price and/or schedule of completion before the Vendor/Contactor proceeds with the change. Following such, agreement the provision thereof shall be deemed to have been amended accordingly.

66 QUALITY ASSURANCE PROGRAMME

66.1 To ensure that the works, equipment and services under the scope of this 'Contract' whether manufactured or performed within the Vendor's/Contractors works or at his sub-vendor's/sub-contractors premises or at the 's 'Site' or any other place of works are in accordance with the 'Specification', the Vendor/Contractor shall adopt suitable Quality Assurance Programme to control such activities at all points necessary. The Contractor shall prepare and finalize such Quality Assurance Programme within 30 days from the date of issue of Work order programme shall be outlined by the Vendor/Contractor and shall be finally accepted by the Consultant after discussions.. Employer shall also carryout quality surveillance of systems and procedures of Contractor's quality control activities A quality assurance programme of the Vendor/Contractor shall generally cover the following:

- Detailed work methodology for all major works – Detailed work methodology should be submitted by the contractor at least 14 days prior to date of commencement of respective work and contractor should ensure that no work is commenced without an approved method statement.
- His organisation structure for the management and implementation of the proposed Quality Assurance Programme.
- The procedure for procurement of materials, parts, source inspection,.

- Control of non-conforming items and systems for corrective actions,
- Inspection and test procedure both for manufactured and field activities.
- Control of calibration and testing of measuring and testing equipment.
- System for indication and appraisal of inspection status.
- System for handling, storage, packaging and delivery, and
- System for maintenance or records.
- A quality plan detailing out quality practices and procedures, relevant standards and acceptance levels for all types of work under the scope of this contract.

66.2 Acceptance of the Tenderer's quality assurance programme does not relieve the Tenderer's obligation to comply with the requirement of the contract document. If the programme is found to be ineffective, then the consultant reserves the right to request for necessary revisions of the programme. All the quality reports shall be submitted by the Contractors in the formats approved by consultant. All the costs associated with printing of Formats and testing of materials required as per technical specifications or by Engineer-In-Charge shall deemed to be included in the Contractor's quoted rates of various items of work in the Schedule/ Bill of Quantities.

66.3 In case works are found to be executed in a defective manner with snag list/punch list, non-conformity reports (NCR) shall be raised by Employer and consultants and same shall be rectified within a reasonable timeframe as per the repair methodology approved by Employer and consultants at the risk and cost of the contractor. Closing of NCR is mandatory for considering that portion of work(s) in running account bill. In case of non-compliances and also for repeated failure in implementation of any of the quality provisions, Employer may impose stoppage of work without any cost & time implication to the Employer and/or impose a suitable penalty. Repeated quality violations shall result in a penalty of Rs 10,000/- per incident reported and decision of Engineer-in-charge on levy of penalty against

quality violation shall be final and binding on the contractor. Imposition of penalty does not make the Contractor eligible to continue the work in an inefficient or otherwise improper or unworkman like manner. If non- conformities persists and work is not found to be executed with due diligence and good quality, Employer reserves the right to terminate the contract and same shall be totally binding on the contractor.

67 TESTS FOR CIVIL WORKS

67.1 Tests shall be carried out and documented as stipulated in the bid documents. Entire expenditure for tests and its arrangements shall be in the scope of the contractor fully at his risk and cost. Samples approved by engineer-in-charge shall be retained under the custody of Emplyer. Lodging and travelling expenditure of Owner would on HCSL account.

67.2 All the tests necessary in connection with the execution of the work as decided by Owner shall be carried out at the field testing laboratory of the contractor from time to time. The Contractor shall provide such assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples of materials before incorporation in the Works for testing as may be selected and required by the Engineer. In case of non-availability of test facility with the contractor at site, the required test shall be carried out outside at the cost of contractor at government or any other NABL approved testing laboratory as directed by Owner.

68 PROTECTIVE GUARDS

68.1 Suitable guards, for supply items and for equipment or machinery used for site works including electrical protections as per statutory regulations, rules shall be provided for protection of Personnel on all exposed rotating and/or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purposes.

69 DESIGN COORDINATION

69.1 The Vendor/ Contractor shall be responsible for the selection and design of appropriate equipment to provide the best coordinated performance of the entire system. The basic design requirements are detailed out in the 'Specification'. The design of various components, sub-assemblies and assemblies shall also be done, so that it facilitates easy field assembly and maintenance, and the natural frequency of the complete unit is not critical at or close to the operating range of the unit.

70 DESIGN COORDINATION MEETINGS

70.1 The Vendor/Contractor will be called upon to attend design coordination meetings for as applicable with the Owner/Purchaser along with consultant, other Vendors/Contractors and the Engineers during the period of the 'Contract'. The vendor/Contractor shall attend such meetings as and when required and fully co- operate with such persons and agencies involved during those discussions.

71 TOOLS AND TACKLES

NA

72 TAKING OVER

72.1 Notice by Contractor regarding completion of work

As soon as the work is completed, the Contractor shall give notice of such comple- tion, whether of the whole of the Works, or of any part of the work, for which a separate date of completion is stipulated in the Contract, to the consultant , and the consultant within 14 days of receipt of such notice, shall inspect the work and also arrange for carrying out of such tests as may be prescribed under the . If the consultant notices any incomplete item of work or any defect which is to be rectified by the Contractor, or if any part of or whole of the work fails to pass the specified tests, the consultant shall furnish to the Contractor, the list of all such incomplete items of work, deficiencies, defects failure to pass tests, etc., and may refuse to issue a Certificate of Completion to the Contractor. Provided, how- ever, that such certificate shall not be refused only on grounds of any minor defect in the work, which can be rectified by the Contractor during defect liability period.

No final certificate of completion shall be issued, nor shall the project be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor(s) and cleaned off the dirt from all wood work, doors, windows, walls, floor or other parts of the building, in, upon, or about which the work is to be executed or of which he may have had possession for the purpose of the execution; thereof, and not until the work shall have been measured by the consultant. If the contractor shall fail to comply with the requirements of this Clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the consultant may at the expense of the contractor remove such scaffolding, surplus materials and rubbish etc., and dispose off the same as he thinks fit and clean off such dirt as aforesaid, and the contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

Completion certificate shall be issued on completion of entire works including all statutory approvals as per contract.

72.2 Completion Certificate not to Absolve

The Certificate of Completion of works referred above, shall not absolve the Contrac- tor from his liability to make good defects, imperfections and shrinkages or faults, which may appear during the defect liability period specified in the Contract, arising in the opinion of the Employer from materials or workmanship being not in accordance with Drawings or Specifications or instructions of the consultant. These shall be amended and made good by the Contractor at his own cost. In case of default on the part of the Contractor, to so make good the defects or deficiencies, the Engineer- in-charge may employ labour, plant and machinery and materials or appoint another agency or Contractor, to amend and make good such defects, imperfections, shrink- ages and faults, and all expenses consequent thereto and incidental thereto, shall be borne by the Contractor and shall be recoverable from any moneys due to the Con- tractor under the Contract including the Performance Guarantee amount or from any moneys payable to the Contractor by the Employer, under any other Contract, or as a debt due.

73 STATUTORY OBLIGATIONS INCLUDING EMP

73.1 All statutory obligations (IF ANY) not limited to Central Electricity Authority, Power supply Licensee, Factories and Boilers Department, Labour Inspectorate, Chief Controller of Explosives, Pollution Control Board (PCB), MoEFCC, clearance from Port Authorities/ Ministry of Transport, local bodies and other Govt. agencies shall be scrupulously complied with in all respect by the contractor duly. Any pior approvals as applicable shall also be obtained. Notwithstanding any approval given by Employer to any of the drawings/calculations, Contractor at his cost shall comply with all the recommendations insisted by statutory bodies during the statutory clearance stage. Contractor on behalf of HCSL shall submit all applications for getting statutory approvals.

74 CUSTOMS DUTY

74.1 The customs clearance at the port of entry in India, if any, and transportation to site from the said port of entry shall be made by the Contractor. All custom duties, taxes, port charges, etc., if any, shall be paid by the Contractor directly to the authorities concerned. Concessional customs duty, if any, availed by the contractor, shall duly be intimated to the owner for required actions, the same shall be passed on to owner fully

74.2 The Employer may assist by way of issue of letters to the Contractor, where required, in obtaining clearance through the Customs of Constructional Plant, materials and other things required for the Works. This shall not in any way dilute the Contractor's obligations and responsibilities under the Contract.

75 TAXES, PERMITS, LICENSES AND OTHER CHARGES

75.1 The Contractor shall be liable and pay duly all non-Indian taxes, duties, levies, lawfully assessed against the Owner/Purchaser or the Contractor in pursuance of the Contract as per Terms and Conditions of the Contract. In addition the Contractor shall be responsible and liable for the payment of all Indian duties, levies, and taxes lawfully assessed against the Contractor. This Clause shall be read in conjunction with relevant Clause of Instruction to Bidder.

75.2 All tariffs, duties, taxes and other charges levied on the goods by the country of origin if any shall be borne by the Contractor for Foreign supplies.

75.3 The Contractor shall be solely responsible for all taxes that may be levied on the Contractor or on the earnings of any of his employees or personnel engaged by him and shall hold the Owner/Purchaser indemnified and harmless against any claims that may be against the Owner/Purchaser in this behalf. The Owner/Purchaser does not undertake any responsibility whatsoever regarding taxes under Indian Income Tax Act of the Contractor or his personnel. If it is obligatory under the provision under the Indian Income Tax deduction of Income Tax at source shall be done by the Owner/Purchaser.

75.4 The quoted Contract Price shall include all taxes, duties, octroi, labour cess, excise duty etc.,

75.5 Cess as per Building and other Construction Workers Welfare Cess Act (Act 28 of 1996) at the rate of one percent or at the rates prevailing in force at the time of payment of bills, of the cost of construction should be borne by the contractor and the same will be deducted from contractor‘s bills while making payment or when crediting amount to contractor’s account.

76. CONTRACT DOCUMENT AND MATTERS TO BE TREATED AS CONFIDENTIAL

76.1 All documents, correspondence, decisions and orders concerning the contract shall be considered as confidential and/or restricted in nature by Contractor or his employees / partners /sub-contractors /OEMs and be shall not divulge or allow access to them by any unauthorized persons. It is the duty and obligation of the contractor to comply this in all respect. The liability of the Contractor to maintain the confidentiality of the documents / correspondence / decisions / orders / drawings / designs etc provided by the Owner / Contractor shall survive the expiry / termination of the work order / contract.

77. STATUTORY VARIATION IN TAXES & DUTIES

77.1. All tendered rates shall be inclusive of any tax, levy or cess applicable on last stipulated date of receipt of tender including extension if any except Goods and services tax (GST). No adjustments i.e.

increase or decrease shall be made for any variation in the rate of GST, Building and Other Construction Workers Welfare cess or any tax, levy or cess applicable on inputs.

77.2. However, effect of variation in rates of GST or Building and Other Construction Workers Welfare Cess or imposition or repeal of any other tax, levy or cess applicable on output of the works contract shall be adjusted on either side, increase or decrease;

a) Provided further that for Building and Other Construction Workers Welfare Cess or any tax (other than GST), levy or cess varied or imposed after the last date of receipt of tender including extension if any, any increase shall be reimbursed to the contractor only if the contractor necessarily and properly pays such increased amount of taxes/ levies/cess.

b) Provided further that such increase including GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time.

78. SOFT COPIES OF DRAWINGS, DIAGRAMS, DOCUMENTS, MANUALS ETC.

78.1 Notwithstanding anything stated elsewhere in this Tender Specification Volumes, Soft copies in the form of Compact Disc (CD) are to be supplied by the Tenderer for the drawings, documents, diagrams, manuals etc., for all the works and equipments covered under the Contract in addition to the Hard copies as stipulated in Volume IV,V,VI and Volume VIII, General Technical Specification.

79 WORKS TO THE SATISFACTION OF THE OWNER

79.1 The Contractor shall execute, complete and maintain the works including statutory requirements strictly in accordance with the Contract to the satisfaction of the Owner and shall comply with and adhere strictly to the consultant‘s instructions and directions on any matter connected with or concerning the works. The Contractor shall take instructions and directions only from the Purchaser/ Owner their representative.

79.2 The contractor shall execute the whole and every part of the work in the most substantial and workmanlike manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly, fully and faithfully to the

approved design, drawings and instructions in writing in respect of the work signed by the Engineer-in-charge. The contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labour and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

79.3 The detailed programme should show the order of procedure and method in which he proposes to carry out the works. The Contractor shall whenever required by the Engineer-in-charge, consultant or his authorized representative, furnish for his information particulars in writing of the Contractor's agreement for the carrying out of the works and of the construction and Temporary works which the Contractor intends to supply, use or construct as the case may be, the submission to and approval by the consultant's representative of such programme or the furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the Contract, particularly for the quality and timely completion of the works, as contemplated in the work order and provided in the price schedule & delivery period of contract agreement.

80 TELECOMMUNICATIONS

80.1 The Contractor shall make his own arrangements for suitable telephone/internet connections / wireless communication system for intercommunication between base office, dredging vessels and transport barges and even in the project site. Owner is no way responsible for the right of this communication and not liable for any misuse or unauthorised use of frequencies or communication sets and which are fully under the cost and risk of Contractor.All applicable licenses shall be obtained by the contractor

80.2 In addition, the Contractor shall provide a radio room at Contractor's base office and adequate radio communication sets on the vessels, dredgers, survey and inspection boats, and shore control points. An adequate number of walkie-talkie sets are to be provided for key personnel to be contacted on VHF channel.

81 USE OF EXPLOSIVES

81.1 Except as may be provided in the Contract or authorized by the Engineer-in-charge in writing, the Contractor shall not use explosives. Where the use of explosives is so provided or ordered or authorized the Contractor shall comply with the following requirements:

81.2 The Contractor shall at all times take every possible precaution in and shall comply with the appropriate laws and regulations relating to the importation, handling, transportation, storage and use of explosives and shall at all times when engaged in blasting operations post sufficient warning flagmen to the full satisfaction of the Engineer.

81.3 The Contractor shall at all times make full liaison with and inform well in advance and obtain such permission as is required from all Government authorities, public bodies and private parties whosoever concerned or affected or likely to be concerned or affected by blasting operations.

81.4 The Contractor shall pay all license fees and charges which may be required for storage or in respect of any other matter whatsoever.

81.5 All operations in which or for which explosives are employed shall be at the sole risk and responsibility of the Contractor and the Contractor shall indemnify the Employer in respect thereof

81.6 The contractor shall only permit handling and use of explosives to be carried by men fully qualified and experienced in the storage, handling and issues of the types of explosives to be used. He shall comply with the provisions of Indian Explosives Act

82 COMPLIANCE WITH IMO AND OTHER STATUTORY REGULATIONS

Not Applicable

83 ADVERTISEMENT

83.1 No advertisement shall be placed on any hoarding, fencing, building or scaffolding erected in connection with this Contract without the written permission of the Employer.

84 ACTION WHERE NO SPECIFICATIONS ARE SPECIFIED

84.1 In the case of any class of work for which there are no such specifications, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications or equivalent foreign standards. In case there is no such specifications in Bureau of Indian Standards, the work shall be carried out as per manufacturer's specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Engineer-in-charge or his authorized representative.

85 CONTRACTOR'S USE OF EMPLOYER'S DOCUMENTS

85.1 As between the Parties, the Employer shall retain the copyright and other intellectual property rights in the Specification, the Drawings and other documents made by (or on behalf of) the Employer. The Contractor may, at his cost, copy, use, and obtain communication of these documents for the purposes of the Contract. They shall not, without the Employer's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

86 EMPLOYER'S USE OF CONTRACTOR'S DOCUMENTS

86.1 As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor. The Contractor shall be deemed (by signing the Contract) to give to the Employer a non-terminable transferable non-exclusive royalty- free to copy, use and Communicate the Contractor's Documents, including making and using modifications of them. This shall:

a) Apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,

b) Entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing,

operating, maintaining, altering, adjusting, repairing and demolishing the Works, and

c) In the case of Contractor's Documents, which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

87 DELAYED DRAWINGS OR INSTRUCTIONS

87.1 The Contractor shall give notice to the consultant with a copy to the Engineer-in-charge whenever the works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and details of the nature and amount of the delay or disruption likely to be suffered if it is late.Notice in such cases should be issued as early as possible but not later than 15 days prior to the scheduled execution of that part of work for which working drawings are not issued.

87.2 Employer on his part shall issue Working drawings within in 15 days from the date of request of the Contractor for such part of work. If the Contractor suffers delay as a result of a failure of the Employer to issue the notified drawing or instruction within this time , the Contractor shall be entitled to an extension of time for any such delay, if completion is or will be delayed. However, if and to the extent that the Employer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time.

88 DIVING WORK

88.1 All diving work shall be carried out in accordance with the requirements of the Employer and Statutory Authorities. If divers are employed, the Contractor shall arrange for competent

linemen to be in attendance at all times during the diving operations. Before any diving is undertaken, the Contractor shall supply the Engineer- in-charge with two copies of the Diving Code prominently displayed on the craft or structure from which the diving operations take place. Complete diving equipment and a standby diver must be ready for use whenever operations by a single diver are in progress.

88.2 If divers are employed, the Contractor shall make available at such times as the consultant may direct, a diving boat with all necessary equipment and attendance to enable inspection of underwater work to be made by the consultant. The Contractor shall provide a standby diver with independent equipment during the period of inspection. All the above shall be provided at the risk and cost of the Contractor.

89 SAMPLES

89.1 The Contractor shall submit the following samples of Materials, and relevant information, to the consultant for consent prior to using the Materials, in or for the Works:

- Manufacturer's standard samples of Materials and samples specified in the Contract, all at the Contractor's cost, and
- Additional samples instructed by the Engineer-in-charge as a variation.

Each sample shall be labelled as to origin and intended use in the Works. Samples tested shall be kept in the safe custody of the employer.

90 NOISE AND DISTURBANCE

90.1 All Works shall be carried out without unreasonable noise and disturbance to the public. The lighting shall be restricted to project site only. The Contractor shall indemnify the Employer from and against any liability for damages on account of noise or other disturbance created while or in carrying out the work and from and against all claims ,demands, proceedings ,damages ,costs charges and expenses whatsoever in regard or in relation to such liability.

91 POLLUTION

91.1 Subject and without prejudice to any other provision of the Contract, the Contractor shall take all reasonable precautions:

a) In connection with the sea or any port, docks, rivers, streams, waterways, drains, water courses, and the like to prevent:

i) Pollution of the water so as to affect adversely the quality of appearance thereof or cause injury or death to animal and plant life.

ii) Open dumping of concrete debris /demolition waste (C&D waste) and earth in to channel

iii) Oil spillage

b) In connection with underground water resources (including percolating water) to prevent:

i) Any interference with the supply to or obstruction from such sources

ii) Pollution of the water so as to affect adversely the quality thereof.

92 REMOVAL OF CRAFT OR PLANT THAT HAS SUNK

92.1 The Contractor shall forthwith and with dispatch at his own cost raise and remove any craft or plant (floating or otherwise) belonging to him or to any Sub-Contractor employed by him (including also any plant which is held by the Contractor or any Sub- Contractor under agreement for charter, hire or hire purchase) which may be sunk in the course of the construction and completion of the Works or otherwise deal with the same as the Engineer-in-charge may direct until the same shall be raised and removed at his own cost. The Contractor at his own cost shall set all such buoys and display at night such lights and do all such things for the safety of navigation as may be required by the Employer. In the event of the Contractor not carrying out his obligation imposed upon him by this Clause, the Employer may buoy and light such sunken craft or plant and raise and remove the same (without prejudice to the right of the Employer to hold the Contractor liable) and the Contractor shall refund to the employer all

costs incurred in connection therewith.

92.2 Sunken craft or any other such obstruction encountered during the course of the work but not belonging to the contractor shall also be salvaged/ removed by the contractor as mentioned in Vol-II,Part –II ,Special conditions of contract, Clause No:- 24.

93. UNDER WATER WORKS

93.1 Underwater works envisaged under this contract such as should be executed by deploying diving experts with having valid registrations & permits. All underwater, machinery required for execution such as underwater cutting tools, floating crafts etc. should be arranged by the contractor at own risk and cost. Contractor should take this in to account while quoting rates for these items.

94. RELICS AND TREASURES

94.1 All gold, silver, coins, oil and other minerals of any description, and all precious stones of all kinds, treasures, antiques, fossils and other similar things of geological or archaeological interest, which shall be found in or at site during excavation / dredging shall be the sole property of the Employer and shall be placed under the authority and care of the employer.

95. EXCAVATED MATERIALS

95.1 The Contractor shall not sell or otherwise dispose off, or remove, sand, stone, clay, ballast, earth, rock or any other substance or materials, which may be obtained from any excavation made for the purpose of the works, or any building or produce existing at the site at the time of delivery of possession thereof. All such substances, materials, buildings and produce, shall be the property of the Employer.

96. MANAGEMENT MEETING

96.1 Either the Engineer-in-charge or his nominee or the Contractor or the consultant may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and assess the arrangements for future work.

96.2 The nominee of the consultant shall record the business of management meetings and shall provide copies of his record to those attending the meeting. The responsibility of the parties for actions to be taken is to be decided by the Engineer-in-charge or his nominee either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

97 PROTECTION OF ENVIROMENT

97.1 The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations. The Contractor shall ensure that emissions, surface discharges and effluent from the Contractor's activities shall not exceed the values prescribed by applicable laws. They shall follow the Environment Management Plan, EMP if any issued by the HCSL.

98 SITE FACILITIES

98.1 The Contractor shall provide all services, amenities, Hygeine facilities for workmen, water supply, power supply, sanitation facilities, temporary structures including security fencing and storage sheds, machinery, buildings and construction equipment necessary for the proper execution of the Works at Site at his own cost. The Contractor shall also provide and maintain upon the Works sufficient proper and efficient life saving appliances and first aid equipment to the approval of the Engineer- in-charge. The appliances and equipments shall be available for use at all times. Services of ambulance shall be available round the clock to cater to any medical emergencies. Contractor should collaborate with health facility centres available in the vicinity of the site and arrange for the services of practising medical staff on the site at all times throughout the period of the contract at his own cost to attend any medical emergencies. Contractor shall also make proper arrangements for prevention of epidemics and necessary welfare and hygiene requirements at site.

99 SECURITY AT THE SITE

99.1 The Contractor shall be responsible for keeping unauthorized persons off the Site. Authorized persons shall be limited to the Contractor's Personnel and the Employer's Personnel;

Consultant's personnel and to any other personnel notified to the Contractor permitted by the employer., The contractor has to arrange for watch and ward at work site at no extra cost to the employer.

100 CONTRACTOR'S OPERATION AT SITE

100.1 The Contractor shall confine his operations to the Site, and to any additional areas, which may be obtained by the Contractor and agreed by the Engineer in charge as working areas. The Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the site and these additional areas, and to keep them off adjacent land.

100.2 During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any Contractor"s Equipment or surplus materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works, which are no longer required.

100.3 Upon the issue of a Taking-Over Certificate, the Contractor shall clear away and remove, from that part of the Site and Works to which the Taking-Over Certificate refers, all Contractor"s Equipment, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave that part of the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Liability Period, such Goods as are required for the Contractor to fulfil obligations under the Contract.

101 PERFORMANCE SECURITY

101.1 The successful Bidder should furnish 3% of contract value as Performance Security within 14 days from the date of issue of Letter of Award (LOA). Performance guarantee should be furnished in the form of an irrevocable Bank Guarantee (BG) enforceable and encashable at Kolkatta, drawn from any scheduled bank operating in India. The BG furnished towards the Performance Security shall be valid for a period until a date 30 days from the day of expiry of the defect liability period stipulated as per the terms of the contract. Performance security shall not accrue any interest. Performance Security will be released / refunded to the Contractor not later than 30 days from the date of completion of Defect Liability / warranty period of the

work. Bank guarantee should be submitted only in the format enclosed at Annexure – 5.

102 INTEREST FREE SECURED ADVANCE FOR CIVIL WORKS

102.1 The contractor, on signing an indenture in the format to be specified by the Engineer- in-Charge, shall be entitled to be paid during the progress of the execution of the work up to 75% of Market Value of the accepted materials or the cost of accepted materials as derived from the tendered item rate of the Contractor (75% of BoQ Item quoted rate), whichever is less or which are in accordance with the contract and which have been brought on the site in connection therewith and are adequately stored and/or protected against damage by weather or other causes but which have not at the time of advance been incorporated in the works. Interest free secured advance up-to a maximum of 75 % shall be given for non-perishable materials to the contractor on submission of claim with documentary proof of vouchers of materials procured under the scope of the contract along with proof for its ownership. Cement, Sand and different grades of hard granite broken stones will not considered as a non-perishable item. Similarly interest free secured advance, shall not be paid on high-risk materials such as ordinary glass, petrol, diesel etc. The decision of the Engineer- in-Charge shall be final and binding on the contractor in this matter

102.2 When materials on account of which an advance has been made under this clause are incorporated in the work, the amount of such advance shall be recovered/deducted from next payment made under any of the clause or clauses of this contract. For non-perishable items which are used for fabrication in the fabricators's site, Interest free Secured advance shall be paid against an irrevocable Bank Guarantee(BG) valid for a period up to 6 months enforceable and encashable at Kolkata, drawn from any scheduled bank operating in India for an amount equal to 75% of the Market Value of the materials or the cost of materials as derived from the tendered item rate of the Contractor (75% of BoQ Item quoted rate),, whichever is less.

101.4. Contractor shall ensure that materials against which secured advance has been released shall be used only for permanent works.

101.5. Contractor shall submit material statement along with each running account bill showing status of total materials claimed under secured advance, total consumed and work in progress. Necessary

identification tags shall be provided to each consignment of materials received at site to ensure easy traceability. Engineer-in-charge or consultant shall carryout frequent stock staking/reconciliation of such materials and contractor shall provide all assistance to Engineer-in-charge/consultant in carrying out reconciliation of materials. Based on reconciliation statement, Engineer-in-charge/consultant retains the right to recover outstanding material advances from running account bills of the contractor.

101.6 If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination of contract as the case may be, the whole of the balance amount then outstanding shall be recovered from the contractor.

103 MOBILIZATION ADVANCE

103.1 Mobilization advance to the tune of 10% of the accepted contract value will be paid, on production of an irrevocable Bank Guarantee from a scheduled/Nationalized bank in India valid for the contract period, after issuing the work order and execution of contract agreement. The BG towards mobilization advance should be 110% of the advance amount paid. The form of Bank Guarantee to be executed exactly as per proforma at Annexure - 6. The mobilization advance shall be paid in two equal installments. Utilization certificate, along with supporting documents, of the mobilization advance paid is to be submitted by the contractor. Second installment will be paid only after getting utilization certificate of the first installment. Part/Split 'Bank Guarantees' (BGs) against mobilization advance is permitted.

103.2 An interest rate of 8.5 % per annum shall be charged on the mobilization advance paid. The mobilization advance paid will not be more than 10% of the contract value and shall be recovered from each running account bill on pro rata basis. Along with the recovery towards the mobilization advance, the interest accrued on the advance will also be recovered from each running account bill. The interest charges shall be levied on the outstanding amount. For calculating interest, the period shall be reckoned up to the date of settlement for payment of the bill by HCSL. The recovery of Mobilization advance shall commence once the contractor's progress of work reaches 10% of the awarded contract value and the recovery of entire mobilization advance should be complete by the time works for 80% of the original contract price is executed. BG will be returned to contractor after 100% recovery of mobilization

advance.

103.3 The Contractor shall ensure that the bank guarantee is valid and enforceable until the advance payment has been repaid, but its amount may be progressively reduced by the amount repaid by the Contractor. If the terms of the bank guarantee specify its expiry date, and the advance payment has not been repaid by the date, 28 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been fully repaid. If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination of contract (as the case may be) then the whole of the balance and interest then outstanding shall be recovered immediately from the Contractor .

104 SECURITY DEPOSIT

104.1 Security Deposit (SD) shall be at 8% of the contract value or value of the work done whichever is higher and it shall consist of two parts:

- Performance Security to be submitted at award of the work (3%)
- Retention Money to be recovered from Running Bills. (5%)

104.2 The total amount thus deposited towards SD will be retained as security for the due and proper fulfillment of the contract and will not carry any interest. Such deposit shall be forfeited on failure to perform or non-fulfillment by the Contractor of the terms and conditions of the contract. The contractor has to make good all defects during the defect liability period at his own cost. 3% of security deposit deposited shall be released on satisfactory completion of 1 year of defect liability period and remaining 5% shall be released after satisfactory elapsing of defect liability period/guarantee period. Security deposit can released against irrevocable bank guarantee furnished by the contractor for an amount equal to security period valid up to defect liability period.

105 STAFF AND LABOUR

105.1 Contractor's technical staff requirements

The contractor's technical staff requirement for the project is as follows. The contractor shall provide all necessary superintendence during execution of the work and all along thereafter as may be necessary for proper fulfilling of the obligations under the contract. The contractor shall immediately after receiving letter of acceptance of the tender and before commencement of the work, intimate in writing to the Engineer-in-Charge the name(s), qualifications, experience, age, address(s) and other particulars along with certificates of the principal technical representatives to be in charge of the work and other technical representative(s) who will be supervising the work. Minimum requirement of such technical representative(s) and their qualifications and experience shall not be lower than specified below. Recovery as per Table below will be effected from the contractor in the event of not maintaining minimum technical staff. The Engineer-in-charge or his authorized representative will approve any proposed replacement of key personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the schedule.

Designation	**Number (Minimum)**	**Qualification**	**Minimum Experience (Years)**	**Rate at which recovery shall be made from**
Project manager	1	Graduate Engineer	20 (Experience in similar nature of work)	Rs 1,00,000/- per month
Deputy project manager	1	Graduate Engineer	12 (Experience in similar nature of work)	Rs 60,000/- per month /person
Site Engineer		Graduate Engineer Or Diploma	5	Rs 40,000/-

Civil	6	Engineer	Or 10	per / person
Quality Engineer	1	Graduate Engineer	8	Rs 40000/- per month / person
Safety Officer	2	Graduate Engineer Or Diploma Engineer	4 or 8	Rs 40000/- per month / person
Surveyor	1	Diploma Engineer	8	Rs 15000/- per month / person
Billing Engineer	1	Graduate Engineer	6	Rs 40000/- per month / person
Planning Engineer	1	Graduate Engineer	6	Rs 40000/- per month / person

The principal technical representative and other technical representative(s) shall be present at the site of work for supervision at all times when any construction activity is in progress and also present himself/themselves, as required, to the Engineer-in- Charge and/or his designated

representative to take instructions. Instructions given to the principal technical representative or other technical representative(s) shall be deemed to have the same force as if these have been given to the contractor. The principal technical representative and other technical representative(s) shall be actually available at site fully during all stages of execution of work, during recording/checking/test checking of measurements of works and whenever so required by the Engineer-in-Charge and shall also note down instructions conveyed by the Engineer-in-Charge or his designated representative(s) in the site order book and shall affix his/their signature in token of noting down the instructions and in token of acceptance of measurements/ checked measurements/ test checked measurements. The representative(s) shall not look after any other work. Substitutes, duly approved by Engineer-in-Charge of the work in similar manner as aforesaid shall be provided in event of absence of any of the representative(s) by more than two days

Further if the contractor fails to appoint suitable technical Principal technical representative and/or other technical representative(s) and if such appointed persons are not effectively present or are absent by more than 2 days without duly approved substitute or do not discharge their responsibilities satisfactorily, the Engineer-in- Charge shall have full powers to Recovery the amount as per table above and suspend the execution of the work until such date as suitable other technical representative(s) is/are appointed and the contractor shall be held responsible for the delay so caused to the work.

The contractor shall provide and employ on the site only such technical assistants as are skilled and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work. The contractor shall provide and employ skilled, semiskilled and unskilled labour as is necessary for proper and timely execution of the work. The Engineer-in-Charge shall be at liberty to object to and require the contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Engineer-in-Charge to be undesirable. Such person shall not be employed again at works site without the written permission of the Engineer-in-Charge and the persons so removed shall be replaced as soon as possible by competent substitutes.

Contractor shall submit attendance details of all key personnel on a monthly basis (with date wise attendance) on a monthly basis along with each running account bill.

105.2 Obligations of contractor

Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labour, local or otherwise, and for their payment, housing, feeding, drinking water,hygiene & sanitation facilities and transportation facilities etc.The Contractor shall ensure that the employees deployed by him in the project siteare physically , mentally fit , skilled and do not have any criminal record. The Contractor shall maintain records of his employees deployed to carry out the job on daily basis. The Contractor will provide employment card/Identity card with photograph duly attested by him to his employees. The Contractor will be responsible for the good conduct of his employees. In case of any misconduct / misbehavior by any employee, contractor shall replace such employee immediately.

Contractor shall submit their HSE policy to the owner for approval. Any reasonable changes proposed by the owner for ensuring better safety of man and machinery shall be implemented by the contractor at his cost. Contractor shall liable to provided all sorts of Personal Protective Equipment to each labour or staff and shall ensure its usage meticulously. Contractor shall deploy HSE officers / Safety officer adequate in numbers as per rules and requirement of this project site. Contractor shall ensure all sorts of work permit as per the prevailing rules or regulations issued by the statutory authorities solely at his cost and risk.

The Contractor shall provide to his employees all special tools, tools, tackles and equipment and measuring equipment etc. required to carry out the job under the contract at his own cost.

The Contractor shall pay rates of wages, and observe conditions of labour, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions, which are not lower than the general level of wages, and conditions observed locally by employers whose trade or industry is similar to that of the Contractor. Contractor shall make PF, ESI contributions as per applicable rules. ESI Cards should be arranged to

contract labour and their wards by the contractor. These records need to be preserved for a period of at least 3 years and made available even after the contract is over for any verification by the statutory authorities.The Contractor shall be solely responsible for non payment/delayed payment of wages, contributions under Minimum wages Act, EPF, ESI Act etc and owner will not be responsible or liable for any sort of non-compliances.

The Contractor shall comply with all the relevant labour laws applicable to the Contractor's Personnel, including laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights. The Contractor shall require his employees to obey all applicable laws, including those concerning safety at work. Vehicles/craft deployed by the contractor should possess all necessary permits, insurance and should satisfy other statutory requirements. Similarly Driver's arranged by the contractor/sub-contractor should possess valid driving licenses.

The Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.

No work shall be carried out on the Site on 3 National holidays (26th January, & 15th August, 2nd October) and on 1st May, unless:

- The Engineer-in-charge gives consent, or
- The work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer-in-charge

Round the clock working will be allowed. Successful bidder (Contractor) shall obtain all necessary permissions, give weekly off to employees and keep regard to the labour laws.

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's

Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send to the Engineer and the Employer details of any accident at the site immediately to forward the name to the competent authority within 24 hours. The Contractor shall maintain records and make Reports concerning health, safety and welfare of persons, and damage to property, as, the Engineer and the Employer may reasonably require.

In case the Contractor does not carry out the Contractual/Statutory obligations or the services rendered by him are found to be unsatisfactory, HCSL shall bring the same to his notice and he shall be obliged to discharge the obligations and rectify the efficiency/anomaly within three days time failing which, HCSL reserves the right to terminate the contract without assigning any reason whatsoever. In such an event, no damages will be payable for short closure of the contract

106 EXECUTION OF WORK BY THE CONTRCTOR

The Contractor shall be required to execute the work in such a way so as not to cause any damage, hindrance or interference with ship repair activities going on in the nearby area. He should not also deposit the materials at such places which may cause inconvenience to the public and the work going on in the nearby area. The Contractor shall have to make good all damages done by him to the structures nearby while executing the work and no extra payment shall be made to him on that account.

All the materials required to be used in the work shall have to be got approved from the Engineer-in-Charge before stacking at the site of work.

Barricading, including proper lighting arrangement in the night at the required places shall have to be provided by the Contractor at his own cost, including necessary arrangements for proper movement of traffic by carefully maintained approaches and road diversions with suitable sign boards for indications of road signs etc. as directed by the Engineer-in-Charge

The contractor shall keep his work place clean and safe to avoid injuries to men and damage to finished products / equipment. All scrap / rubbish / waste, balance materials etc as it accumulates shall be removed from the site on a dialy basis by the contractor at no extra cost

107 MEASUREMENT AND EVALUATION

107.1 Measurements for civil works

a) Consultant shall, except as otherwise provided, ascertain and determine by measurement the value of work done in accordance with the contract. All measurements of all items having financial value shall be entered by the contractor and compiled in the shape of the Computerized Measurement Book having pages of A-4 size as per the format of the department so that a complete record is obtained of all the items of works performed under the contract.

b) All such measurements and levels recorded by the contractor or his authorized representative from time to time, during the progress of the work, shall be got checked by the contractor from the consultant or his authorized representative as per interval or program fixed in consultation with the consultant. After the necessary corrections made by the consultant, the measurement sheets shall be returned to the contractor for incorporating the corrections and for resubmission to the consultant for the dated signatures by the consultant and the contractor or their representatives in token of their acceptance.

c) Whenever bill is due for payment, the contractor would initially submit draft computerized measurement sheets and these measurements would be got checked/test checked from the consultant and/or his authorized representative. The contractor will, thereafter, incorporate such changes as may be done during these checks/test checks in his draft computerized measurements, and submit to the department a computerized measurement book, duly bound, and with its pages machine numbered. The consultant and/or his authorized

representative would thereafter check this MB, and record the necessary certificates for their checks/test checks. The final, fair, computerized measurement book (2 nos) given by the contractor, duly bound, with its pages machine numbered, should be 100% correct, and no cutting or over-writing in the measurements would thereafter be allowed. If at all any error is noticed, the contractor shall have to submit a fresh computerized MB with its pages duly machine numbered and bound, after getting the earlier MB cancelled by the consultant or his authorized representative.The contractor shall, without extra charge, provide all assistance with every appliance, labour and other things necessary for checking of measurements /levels by the Engineer-in- Charge , consultants or their representatives.

d) Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available then a mutually agreed method shall be followed.

e) The contractor shall give not less than seven days' notice to the Engineer-in-Charge/consultant or his authorized representative in charge of the work before covering up or otherwise placing beyond the reach of checking and/or test checking the measurement of any work in order that the same may be checked and/or test checked and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of checking and/or test checking measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Engineer-in-Charge/consultant or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of checking and/or test checking measurements without such notice having been given or the Engineer-in- Charge's consent being obtained in writing the same shall be uncovered at the Contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.

f) It is also a term of this contract that checking and/or test checking the measurements of any item of work in the measurement book and/or its payment in the interim, on account of final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

g) No Running Account Bill shall be paid for the work till the applicable valid statutory documents, Insurance policy, attendance register, wage register, labour licenses, registration with EPFO, ESIC and BOCW, Welfare Board, migrant workers certificate whatever applicable are submitted by the contractor to the Engineer-in-charge/consultant.

h) No Running Account Bill shall be paid for the work till the quality related documents, plant and machinery permits and calibration certificates, procurement and consumption statements of the applicable items whatever applicable, workmen attendance register/wage register, EPF/ESIC remittance details, key personnel attendance statement etc. are submitted by the contractor to the Engineer-in-charge/consultant.

i) The final bill shall be submitted by the contractor in the same manner as specified in interim bills within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer-in-charge/consultant whichever is earlier. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Engineer-in Charge/consultant, will, as far as possible be made within the period of four months the period being reckoned from the date of receipt of the bill by the Engineer-in-charge /consultant or his authorized representative.

108 COMPLETION DOCUMENTS

108.1 For processing the final payment , the following documents also needs to be furnished by the contractor :

i) The Technical documents according to which the work was carried out.

ii) The set of construction drawings showing therein the modifications and corrections made during the course of execution signed by the Engineer-in-charge

iii) Certificates of final levels and dimensions as set out for various works.

iv) Certificates of tests performed for various works

v) All manuals and as-built drawings mentioned in the technical specifications

109 POST PAYMENT AUDIT

109.1 It is an agreed term of the Contract, that the Employer reserves to himself the right to carry out a post payment audit and / or technical examination of the Works, and the Final bill including all supporting vouchers, abstracts, etc., and to make a claim on the Contractor for the refund of any excess amount paid to him, if as a result of such examination, any over-payment to him is discovered to have been made in respect of any work done or alleged to have been done by the Contractor, under the contract. If any under-payment is discovered, the same shall be paid by the Employer to the Contractor. Such payments or recoveries, however, shall not carry any interest.

110 ACTION IN CASE WORKS NOT DONE AS PER SPECIFICATIONS

110.1 All works under or in course of execution or executed in pursuance of the contract, shall at all times be open and accessible to the inspection and supervision of the Engineer-in-charge/consultant, his authorized subordinates in charge of the work and all the superior officers, officer of the Quality Assurance Unit of the Department or any organization engaged by the employer or the Chief Technical Examiner's Office, and the contractor shall, at all times, during the usual working hours and at all other times at which reasonable notice of the visit of such officers has been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing, present for that purpose.

110.2 Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

If it shall appear to the Engineer-in-charge/consultant or his authorized representatives in charge of the work the officials engaged by the Employer for Quality Assurance or to the Chief Technical Examiner or his subordinate officers, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract, the contractor shall, on demand in writing which shall be made within twenty four months of the completion of the work from the Engineer-in-charge/consultant specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing to do so within a period specified by the Engineer-in-Charge/consultant in his demand aforesaid, then the contractor shall be liable to pay compensation to the employer.

110.3 In such case the Engineer-in-charge/consultant may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates as the authority specified in Appropriate Schedule may consider reasonable during the preparation of on account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure or he may reject the work outright without any payment and/or get it and other connected and incidental items rectified, or removed and re-executed at the risk and cost of the contractor. Decision of the Engineer-in-Charge to be conveyed in writing in respect of the same will be final and binding on the contractor.

111 CONTRACTOR LIABLE FOR DAMAGES, DEFECTS LIABILITY PERIOD

If the contractor or his working people or servants shall break, deface, injure or destroy any part of infrastructure /building in which they may be working, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or

telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within twenty four months after a certificate final or otherwise of its completion shall have been given by the Engineer in-Charge/consultant as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense or in default the Engineer-in-Charge cause the same to be made good by other contractor and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit. The security deposit of the contractor shall not be refunded before the expiry of twenty four months after the issue of the certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later. Provided that in the case of road work, if in the opinion of the Engineer-in-Charge, half of the security deposit is sufficient, to meet all liabilities of the contractor under this contract, half of the security deposit will be refundable after twelve months and the remaining half after twelve months of the issue of the said certificate of completion or till the final bill has been prepared and passed whichever is later.

112. RECOVERY OF COMPENSATION PAID TO THE WORKER

112.1. In every case in which by virtue of the provisions sub- section (1) of section 12 of the Workmen's Compensation Act. 1923, HCSL is obliged to pay compensation to a workman employed by the contractor, in execution of the works, HCSL will recover from the contractor, the amount of the compensation so paid by deducting it from the security deposit or from any sum due by HCSL to the contractor.

113. LEVY/TAXES PAYABLE BY CONTRACTOR

113.1. GST, Building and other Construction Workers Welfare Cess or any other tax, levy or Cess in respect of input for or output by this contract shall be payable by the contractor. The contractor shall deposit royalty and obtain necessary permit for supply of the red bajri, stone, kankar, etc. from local authorities. If pursuant to or under any law, notification or order any royalty, cess or the like becomes payable by the Government of India and does not any time become payable by the contractor to the State Government, Local authorities in respect of any

material used by the contractor in the works, then in such a case, it shall be lawful to the Government of India and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor.

114. ENSURING PAYMENT AND AMENITIES TO WORKERS IF CONTRACTOR FAILS

114.1. In every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and of the Contract Labour (Regulation and Abolition) Central Rules, 1971, HCSL is obliged to pay any amounts of wages to a workman employed by the contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act or under the Rules framed by Government from time to time for the protection of health and sanitary arrangements for workers HCSL will recover from the contractor, the amount of wages so paid or the amount of expenditure so incurred; by deducting it from the security deposit or from any sum due by HCSL to the contractor.

115. LABOUR LAW TO BE COMPLIED BY THE CONTRACTOR

115.1. The contractor shall obtain a valid license under the Contract Labour (R&A) Act, 1970, and the Contract Labour (Regulation and Abolition) Central Rules, 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. The contractor shall also comply with provisions of the Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979. The contractor shall also abide by the provisions of the Child Labour (Prohibition and Regulation) Act, 1986. The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996. Any failure to fulfill these requirements shall attract the penal provisions of this contract arising out of the resultant non-execution of the work.

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HOOGHLY COCHIN SHIPYARD LIMITED

(A WHOLLY-OWNED SUBSIDIARY OF COCHIN SHIPYARD LTD)

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

TENDER NO: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

COVER-A

SECTION –IV

SPECIAL CONDITIONS OF CONTRACT (SCC)

TABLE OF CONTENTS FOR SPECIAL CONDITIONS OF CONTRACT

SPECIAL CONDITIONS OF CONTRACT (SCC)

1. GENERAL

1.1. Special Conditions shall be read in conjunction with the General Conditions of Contract, Specification, Bill of quantities, Drawings and any other documents forming part of this Contract wherever the Context so requires.

1.2. Notwithstanding the Sub-division of the documents in to these separate section and volume, every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the Contract so far as it may be practicable to do so.

1.3. Where any portion of the General Conditions of Contract is repugnant to or at variance with any provisions of the Special Conditions, the provisions of the Special Conditions shall be deemed to over-ride the provisions of the General Conditions of Contract and shall to the extent of such repugnancy of variations, prevail.

1.4. Wherever it is mentioned in the Specifications that the Contractor shall perform certain Work or provide certain facilities, it is understood that the Contractor shall do so at his own Cost.

1.5. The materials, design and workmanship shall satisfy the relevant Indian Standard, the Specification and conditioned herein referred to. Where the Specifications stipulate requirement in addition to those contained in the Standard codes and Specifications, these additional requirements shall also be satisfied.

1.6. It is mandatory for the bidders to inspect the site, before attending pre-bid meeting and quoting, read the conditions thoroughly and understand the works in all respect and satisfy themselves on the actual site conditions, meteorological and oceanographic data, and soil/subsoil strata before bidding. Whatever information regarding surface and subsurface strata, climatological, oceanographic data given in the tender documents are only intended as a general guidance for the Contractor and no warranty is given for the correctness of the same.

2. AMENDMENTS IN TENDER DOCUMENTS

2.1. All corrigenda, addenda, amendments and clarifications to Tender Specifications shall be uploaded in the website of HCSL. Bidders shall keep themselves updated with all such information till the last date and time of submission of tender.

3. SITE CONDITIONS

3.1. The intending tenderers are expected to visit the site and satisfy themselves on the actual site conditions, weather conditions, meteorological and oceanographic data, and soil/subsoil strata, approach roads, time restrictions for movement of construction vehicles/ material trucks (if any), stacking grounds, dumping grounds, availability of land for temporary works and labour camps , labour situation, wage and benefits applicable to labourers, working hours, out turn of work by labour and the fluctuations which are likely to happen till the work is completed etc before tendering. Before bidding. Whatever information regarding progress of work, materials available at site, surface and subsurface strata, climatological, oceanographic data given in the tender documents are only intended as a general guidance for the Contractor and no warranty is given for the correctness of the same.

3.2. Pandu Multimodal IWT Terminal is a riverine Terminal in the Indian state of Assam, serving North Eastern states in general and Assam and Guwahati in particular. This Terminal has been developed on the bank of the Brahmaputra River. The ship repair facility is proposed on the eastern side of existing jetty at Pandu Multimodal IWT Terminal at a distance of about 350m. The latitude and longitude of the ship repair facility is 26°10’15.01”N and 91°40’59.87”E. The site will be released at the earliest once the Contract Agreement signed by the successful bidder. The contractor is expected to acquaint himself with the site conditions, labour situation, wage and benefits applicable to labourers, working hours, out turn of work by labour and the fluctuations which are likely to happen till the work is completed on all the above aspects prior to quoting the rates. The submission of a tender by tenderer implies that he has made himself aware of all the above situations and conditions. Any extra claim on this account will not be entertained.

4. PRE-BID MEETING

4.1. A Pre-bid meeting is scheduled on16 Nov 2022 as specified in Vol-1, Instructions to Bidders. Only one pre-bid meeting shall be arranged by the employer and bidders are expected to clear all doubts/clarifications regarding the tender in this meeting.

5. SUBMISSION OF TENDERS

5.1. The tender for the work will be based on single bid two cover system as detailed in Clause No: 2 of Vol-1, INSTRUCTIONS TO BIDDERS. The tenderers should note that the tender is strictly on the item rate basis and their attention is drawn to the fact that the rates for each and every item should be correct, workable, reasonable and self-supporting. If called upon by the HCSL, detailed analysis of any or all the rates shall be submitted. However, HCSL shall not be bound to recognize/accept the contractor's analysis. The rates quoted by bidder shall remain firm till completion of all works even during the extended period, if any, on any account whatsoever. The rates quoted by the contractor shall be for finished items of works including supplying appropriate materials, labour, equipment/tools, systems, modules, conveyance, testing, installation and commissioning etc. all complete, unless otherwise specified in the tender schedule.

5.2. Late tenders, Delayed tenders and tenders with conditions & conditional rebates shall be summarily rejected.

6. EARNEST MONEY DEPOSIT

6.1. Please refer Clause No: 2.7 of Instructions to Bidders (ITB)

7. EVALUATION OF TENDERS

7.1. During the evaluation of techno-commercial tender, Engineer-in-charge, at his discretion may ask the bidders for clarifications. Request for clarification will be given in writing and no change in prices or substance of the bid shall be sought, offered or permitted. Financial bid of post-qualified bidders shall be opened on a later date after giving notice to the qualified bidders.

7.2. Price Bids shall be evaluated based on total overall amount. HCSL will award the contract to the Bidder whose bid has been substantially responsive to the bidding documents and

who has offered lowest evaluated total amount. However, if in the opinion of HCSL, the total price or certain item rates quoted by the lowest evaluated bidder are considered high, HCSL may invite such bidder for price negotiation. Lowest quoted bidder shall attend such negotiation meetings and if requested by HCSL shall provide the analysis of rates/break – up of amount quoted by him for any or all items of Schedule of Rates/ prices to demonstrate the reasonability. As a result of negotiation, bidder may offer rebate on his earlier quoted price.

7.3. The acceptance of tender will rest with Chairman or his authorized officer who does not bind himself to accept the lowest tender and reserves to himself the authority to reject any or all of the tenders received without assigning any reason.

8. VALIDITY OF TENDERS

8.1. The tenderer should keep open the validity of the tender normally for 90 days from the date fixed for its opening of Technical bid. However, it is also obligatory for the tenderer to keep the validity open for another 60 days for which request in writing/email by Engineer-in-charge, before the expiry of the original validity, would be intimated. The receipt of the intimation of the Engineer-in-charge, should be acknowledged. Should any tenderer withdraw his tender before this period, or makes any modifications in the terms and conditions of the tender which are not acceptable to HCSL, the earnest money deposited by the tenderers shall be forfeited.

9. CONTRACT AGREEMENT

9.1. Duly Signed and stamped copy of the work order issued shall be returned to the employer within 7 days from the date of work order. The successful tenderer will be required to execute an agreement at his expense on proper value West Bengal/ Assam State non-judicial Stamp Paper in the prescribed format of the employer. Contract Agreement should be signed within seven days from the date of issue of work order or within such extended time as may be granted by the employer. Till signing of the agreement, the tender together with the work order shall constitute a binding contract between the Contractor and Hooghly Cochin Shipyard Ltd.

9.2. In the event of the tenderer, after the issue of work order by HCSL, failing / refusing to execute the agreement, the tenderer shall be deemed to have abandoned the contract and

such an act shall amount to and be construed as the contractors calculated and the wilful breach of the contract, the cost and consequence of which shall be to the sole account of the tenderer and upon such an event HCSL shall have full right to claim damages therefore either together with or in addition to the forfeiture of Earnest Money Deposit.

10. CONTRACT PRICE

10.1. The price for the entire scope of work as covered under the contract shall be treated as total contract price which includes the product of Quantity and rate quoted against each item summarizing to total price plus GST rate.

10.2. The Contractor shall be paid for the theoretical quantity or actual quantity of the work done whichever is lower-at the quoted approved rates in the Bill of Quantities for each item.

10.3 All tendered rates shall be inclusive of any tax, levy or cess, duties applicable on last stipulated date of receipt of tender including extension if any. No adjustments i.e. increase or decrease shall be made for any variation in the rate of GST, Building and Other Construction Workers Welfare Cess or any tax, levy or cess applicable on inputs.

However, effect of variation in rates of GST or Building and Other Construction Workers Welfare Cess or imposition or repeal of any other tax, levy or cess applicable on output of the works contract shall be adjusted on either side, increase or decrease;

a) Provided further that for Building and Other Construction Workers Welfare Cess or any tax (other than GST), levy or cess varied or imposed after the last date of receipt of tender including extension if any, any increase shall be reimbursed to the contractor only if the contractor necessarily and properly pays such increased amount of taxes/ levies/cess.

b) Provided further that such increase including GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time.

11. PERIOD OF CONTRACT

11.1. The time of completion of work of 18 months shall be reckoned from the 30th day of the date of the work order or the date of handing over the site whichever is later. The time allowed for carrying out the work as mentioned above shall be strictly observed by the

contractor. The work throughout the time period shall be proceed with diligence keeping in view that time being deemed to be the essence of the contract.

11.2. The contractor shall submit a detailed works schedule with resource planning(manpower, machinery, materials etc,) in Microsoft Projects in conformity with the completion time and Indicative milestones stipulated hereunder from the date of issuance of letter for commencement of the work. Time schedule submitted by the contractor should be such as to achieve the milestones listed within their respective scheduled completion dates. The obligations and performances under this contract service shall commence from the effective date of the contract.

Indicative Milestone

Sl. No.	Milestone	Time Allowed in days(from commencement date)
	Waterside	
1	Completion of 20% of piles.	90
2	Completion of the 100% of piles	270
3	Commencement of Deck Structure work.	180
4	Completion of the Deck Structure	510
5	Completion of the Berth accessories	540
	Landside	
1	Completion of 50% of piles.	120
2	Completion of 100% of piles	270
3`	Commencement of Super Structure work.	150
4	Completion of the Super Structure	360
5	Completion of Water supply, sewerage and rain water system	450
6	Completion of the Site development works	540

12. PERFORMANCE SECURITY

Please refer Clause No: 101 of General Terms and conditions of contract (GCC)

13. MOBILIZATION ADVANCE

Please refer Clause No: 103 of General Terms and conditions of contract (GCC)

14. ENTRY ON PRIVATE OR OTHER PROPERTY

14.1. The Contractor shall not enter upon or commence any work in or upon, across or through any land, building or place being private property until authorised in writing by the Employer.

15. SITE HANDING OVER

15.1. For the construction purpose, the entire site will be handed over in ‘’As is where is’’ basis. If this is not possible due to reasons, which cannot be anticipated now, the site will be handed over in parts in ‘’As is where is’’ basis. Proportionate extra time will be granted if found necessary by the Engineer in Charge and the decision of Engineer in Charge shall be final. Employer shall issue a site handing over letter to the contractor and in return a site taking over certificate has to be furnished by the contractor.

16. NOTICE OF OPERATIONS

16.1. The normal working time of HCSL is from 8.00 am to 5.00 pm on all weekdays. All Sundays, second Saturday and fourth Saturday are holidays. But the Contractor may have to work round the clock including holidays, if required to complete the work in time without any extra cost. Over time work is permitted however the employer shall not compensate the same. Shift working at 2 or 3 shift per day may become necessary and the contractor should take this aspect into consideration for formulating the rates. No extra claims on this account shall be entertained. If the Contractor wishes to carry out the work beyond normal working hours and or on holidays, he should get specific approval from the Engineer-in-charge for the same. The charges for supervision arranged by the employer during such overtime work (2 or 3 shift work) including on Sunday and holidays will be borne by the employer.

16.2. The contractor must arrange for the placement of workers in such a way that the delayed completion of the works of any part thereof for any reason whatsoever will not affect their proper employment. Employer shall not entertain any claim for idle time payment whatsoever.

16.3. Similarly No important operations shall be commenced without the consent of the Engineer-in-charge/consultant or his authorized representative in writing.

17. PRELIMINARY SURVEY

17.1. Before the works of any part thereof begin, the Contractor's authorized representative and the Engineer-in-charge's representative and consultant's representative shall together carryout topographic survey and take levels of the site of the works both above and below water level / Chart Datum level and agree all particulars on which the measurements of the works are to be based. Topography survey shall be carried out for 5m x 5m grid spacing intervals. Such particulars shall be plotted by the Contractor. The Contractor shall be entirely responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify any errors or imperfection therein. Such rectification shall be carried out by the Contractor, at his own cost.

17.2. Before commencement of the work the contractor shall establish at suitable points, (as directed by Engineer in charge) reference benchmarks based on the standard benchmark approved by the Engineer in charge. Reference benchmarks shall be established on stainless steel plates and embedded on to permanent structures. The construction and maintenance of these benchmarks shall be responsibility of the contractor at his cost and risk. These reference benchmarks established by the contractor shall be got checked and approved by the Engineer in charge at suitable intervals of time. Stamped and certified Topography survey layout drawing (In AutoCAD & PDF) and field level book in triplicate has to be submitted by the contractor and got approved from engineer-in-charge prior to commencement of permanent works. All costs involved in topography survey including preparation of field level book and layout drawing shall be borne by the contractor without any additional cost to employer.

18. SETTING OUT OF WORKS

18.1. The contractor shall be responsible for the true and proper setting out of the works and for the correctness of the position, lines, levels, dimensions, and alignment of all parts of the works and for the provision of all necessary instruments (including Total Station survey equipment), appliances and labour in connection therewith. If at any time during the progress of the work any error shall appear or arise in the position, level, dimension or alignment of any part of the work, the contractor on being required to do so by the Engineer in charge, shall at his cost rectify such errors to the satisfaction of the Engineer in charge. The checking of any setting out or of any line or level by the Engineer in charge shall not in any way relieve the contractor of his responsibility for the correctness thereof. The contractor shall provide all necessary instruments, appliances and labour required for the Engineer in charge for checking, if any, of the setting out. The contractor shall carefully protect and observe all benchmarks, site levels, pegs and other things used in setting out the works.

19. ORDER OF WORKS

19.1. The order in which the works are to be carried out shall be to the approval of the Engineer-in-charge/consultants and shall be such as to suit the detailed method of construction, adopted by the Contractor as per the approved programme schedule and milestones specified in the tender and notified by engineer-in-charge from time to time. The works shall be carried out in such a manner so as to enable the other Contractors to work concurrently so that the entire project may be brought into use immediately after the completion of works.

20. OBTAINING ALL LICENSES, PERMITS ETC.

20.1. The contractor shall make his own arrangements for obtaining all necessary Licenses, permits, etc. for his plant, labour, equipment, materials, floating craft, machinery, material handling devices including ropes, DG , power supplies, power distribution inside the construction site etc. and procurement of any spares that may be required for the execution of the Works. A ‘permit to operate’ the batching plant(s) at work site (if any) has to be

obtained from Assam state Pollution control board. All equipment, MHEs used at site shall have valid Pollution under Control (PUC) certificate. Any local approvals , if any, required from statutory bodies such as Assam State Pollution Control Board, Factories and Boilers Department, State Electrical Inspectorate, IWAI (Licensee), Central Electricity Authority, Assam State Electricity Board, Local Authorities for construction, Revenue department, Labour inspectorate, EPFO/ESIC, Legal metrology, Mining and Geology, Chief Controller of Explosives, Wireless communication – Ministry of telecommunication, Customs Department etc. shall be obtained by the contractor in connection with the construction works. All vehicles, craft, and other machinery deployed by the contractor should possess valid registration certificate, permits, fitness certificate & insurance. Similarly, drivers employed by contractors should have valid driving license. A copy of such licenses, permits etc. obtained shall be submitted to employer. Delays in the procurement of such licenses, permits etc. will not be acceptable reasons for delays in the progress of the works.-

20.2. The damages caused by deviation if any, besides attracting penalty under different statutes may also lead to work stoppage which will be purely on Contractor's account.

20.3. The Contractor shall provide himself from the very beginning with adequate supply of materials, manpower, stock control items, spare parts etc. so as to ensure that these delays or hold-ups do not occur in the commencement and execution of the works. Buffer stock for critical construction items such as reinforcement steel, structural steel, cement, admixtures, aggregates etc. sufficient to carry out at least two months of work shall be ensured by the contractor for smooth progress of work.

21. IMPORT LICENSE

21.1. The domestic bidders should note that Import license for importing any components or assemblies of raw materials or finished products from any country of any foreign collaborator or associate or sub-vendor etc. will have to be arranged by the bidder/ contractor himself. The Employer will only issue essentiality certificate for availing concessional tariff. The foreign bidder should note that they will complete all the formalities to import the material on Employer's behalf according to the laws prevalent at that time without any financial liabilities to the Employer.

21.2. The bidder is required to quote his price considering the concessional duty after due confirmation of availability of such concessional custom duty. To avail the concessional custom duty the Employer shall issue certificate, at the request of the Contractor. For issue of such certificate, the Contractor shall give advance notice. It shall be the responsibility of the Contractor to get approval of the appropriate authority for the list of imported items and avail concessional custom duty. In case the Contractor fails to avail the concessional custom duty (which he might have considered while submitting his bid) for any reason, whatsoever, then the bidder shall not have any claim on the Employer on this account. It should be clearly mentioned in approach methodology, whether concessional or regular custom duty is considered for pricing.

22. CO-ORDINATION, REVIEW AND INSPECTION OF WORKS

22.1. The Co-ordination and inspection of the day-to-day work under the Contract shall be carried out by the authorized representative of the Engineer-in-Charge. The written instructions regarding any particular work will be normally passed by the authorized representative of the Engineer-in-charge. A site order book will be maintained by the Employer on which aforesaid written instructions will be entered. These will be signed by the Contractor or his authorised representative by way of acknowledgment within 12hours.

22.2. The Contractor shall allow the Engineer-in-charge or his authorized representative's unhindered and safe access to the Site or to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured, fabricated and/or assembled for the works.

23. INTEREST FREE SECURED ADVANCE FOR CIVIL WORKS

Please refer Clause No: 102 of General Terms and conditions of contract (GCC)

24. WORKING IN MONSOON

24.1. The timely completion of Works may entail working in the monsoon period also. The Contractor must take such an eventuality into consideration while formulating his rates for quotation. The Contractor must maintain sufficient labour force as may be required for the work and Plan and execute the construction and erection according to the prescribed schedule. No extension of time or extra rate will be considered for such work in monsoon.

During monsoon and other period, it shall be responsibility of the Contractor to keep the portion of Construction site on land accessible, free from water by providing suitable drainage arrangements at his own cost to ensure proper inspection by engineer-in-charge.

25. TEMPORARY STRUCTURES

25.1. The Contractor shall submit to the Engineer-in-charge for his approval, drawings and proposals for any temporary works such as Batching plant, storage yard, temporary office, toilet facility, stores, false work and temporary platforms, pre-casting yard, field laboratory, workshop, Weighbridge, erection gantries etc. which the contractor intends to construct for the execution of the Contract and no such work shall be constructed before obtaining the written approval of the Engineer- in-charge. Materials for permanent works shall not be used for temporary works unless otherwise approved in writing by the Employer. The Contractor shall obtain permission for any temporary work and should ensure that during execution of works all statutory requirements would be compiled with. Temporary structures should not be constructed in areas where permanent works are scheduled as per master plan layout and relevant drawings without prior written approval from engineer-in-charge.

25.2. The furnishing to the Engineer any design for any temporary works and staging shall not relieve the Contractor of any liability or obligation under the Contract in respect of such temporary works and staging. All temporary works shall remain the property of the Contractor which the contractor has to remove away & clear the site of all debris, scrap, balance materials etc. on completion of the work or on termination of the contract or when directed by engineer –in-charge at no extra cost to employer within the period of two months

26. QUALITY PLAN FOR MANUFACTURE OF EQUIPMENT

26.1. The Quality plan for manufacture is a document, which presents in a tabular form, the Quality Control checks to be exercised by the Contractor during the various stages of manufacture and dispatch in order to meet the requirements of this Contract. This plan shall detail the components manufactured, characteristics being controlled and acceptance norms for this characteristic and the agency responsible for performance and witnessing the checks.

26.2. After issuance of Letter of Intent (LOI), the contractor shall submit to the Employer, the detailed quality plans to be followed during manufacture of all major equipment's. These quality plans shall be discussed mutually and updated by the Contractor taking into consideration the requirement of the Employer. The quality plan when approved shall form a part of the contract. This document shall be followed for inspection of the concerned equipment.

26.3. The details of the quality assurance/ quality checks envisaged by the Contractor during manufacturing of the equipment supplied by him or procured through his sub- vendors/ sub-contractors shall be detailed out in the quality plans to be submitted by the Contractor. The contractor may also furnish any additional information regarding quality assurance/ quality checks in the additional sheets, if required. Quality plans for major equipment's manufactured by the Contractor or procured through his sub-vendors/sub-contractors shall be submitted during engineering. After approval of the Employer is accorded various quality plans shall be bound as a booklet and shall be submitted to the Employer as soon as possible. The contractor shall ensure that the approved quality plans are followed scrupulously by him and by his sub-vendors/ sub-contractors and manufacturing of the items covered under the quality plans shall be taken up only after Employer has approved the quality plan.

27. OPERATION AND MAINTENANCE MANUALS- Not Applicable

28. ERECTION DRAWINGS AND MANUALS

28.1. In order to enable the engineers of the Employer to supervise the works properly, Contractor shall furnish three copies of erection drawings/manuals depicting there in the erection procedure, special precautions to be taken, various clearance to be maintained, erection checks and tests to be carried out before the commencement of the erection of equipment.

29. TEST REPORTS OF EQUIPMENTS

29.1. On completion of tests of equipment at manufacturer's works, the Contractor shall furnish four copies of test certificates to the Employer for approval and subsequent dispatch clearance. The test report shall invariably indicate identification data, including model no.,

sl.no. etc. of the equipment, method of application and duration of test along with test results. Only on approval of these test results by the Employer or Employer's representative, dispatch clearance will be issued for dispatch of material to site. Traceability certificate in original of testing equipment shall be submitted to the Employer or his representative attending tests and a copy of the same shall be attached with the reports.

30. LIST OF APPROVED MAKES

30.1. List of approved makes is placed as Annexure-X. It will be deemed that the contractor has priced the respective items on the basis of the approved makes.

30.2. Where a particular brand or make is specified in Bill of Quantities or Technical specification, such brand or make of material shall only be used in the works.

30.3. Whenever equivalent is specified in the list of approved makes, permission for use of equivalent make shall be subject to contractor submitting proof of non-availability by way of valid regret letters from the makes listed along with the comparison table of properties of proposed make w.r.t specified make. Also contractor shall submit sample of equivalent material along with test certificates and other documentary evidences to the engineer- in – charge for approval. Decision of engineer-in-charge on approving equivalent makes shall be final and binding on the contractor.

31. SITE FACILITIES TO BE ARRANGED BY THE CONTRACTOR

31.1. The Contractor will not be permitted to establish his labour camp and residential accommodation for his staff on the Employer's land. But contractor can construct temporary site offices, workers change/rest room, dining area, material storage room/godowns, fabrication yard, field laboratory etc. after getting prior approval from employer. Services of ambulance, medical staff, lifesaving appliances should be arranged at site by contractor at own cost.

31.2 Contractor at own cost has to make his own arrangements for water supply, electricity, facility of watch and ward, sanitation, transportation facilities for employees, supply of gases required at site such as oxygen, compressed air, acetylene, CO2, argon, other amenities material handing equipments such as cranes, hydra, trailers etc etc. during the

entire duration of the contract. Storage, handling and disposal of such items as applicable shall be done exactly in compliance with the prevailing rules and regulations. In case of any violation, Contractor will solely be responsible and to ensure a resolution immediately at his cost and risk.

31.3 The Contractor shall make his own arrangement for all his communication needs such as Fax, Internet, and telephone at his site office.

32. CONTRACTOR'S STAFF AND LABOUR

32.1. Workers above 60 years of age and below 18 years of age shall not be deployed by the contractor. All labour, skilled or unskilled shall be provided by the contractor. Settling any dispute with the labour/ subcontractor will be contractor's responsibility and risk. The workers engaged for works should have sufficient knowledge and experience in the respective fields. This shall be proved to the Engineer-in-charge. The Employer may at any time request the contractor to remove from the Work/Site contractor's / sub- contractor's supervisor or any other authorized representative including any employee of the Contractor or his Sub-contractor(s) or any person(s) deployed by Contractor for professional incompetence or negligence or for being deployed for work for which he is not suited.

32.2. The Employer may at any time object to and require the Contractor/sub-contractor to remove forthwith from the Site a supervisor or any other authorized representative or employee of the Contractor's /sub-contractor(s) or any person(s), if in the opinion of the Employer, the person in question has mis-conducted himself or his deployment is otherwise considered undesirable by the employer, the contractor/sub-contractor shall forthwith remove and shall not again deploy the person in question of the Work Site without the written consent of the Employer.

32.3. The workmen deployed by the contractor are strictly banned from use of any kind of Narcotics drugs / Alcohol / smoking etc. at site and any illegal activity by the work men should be reported to Engineer-in-charge without delay and the contractor shall remove such persons from the work site forthwith.

32.4. Entire staff of the contractor at site has to wear PPE's and reflective jackets meticulously.

33. COMPLIANCE WITH LABOUR REGULATIONS

33.1 The Contractor shall adhere to the provisions Statute, Ordinance or Law of the labour regulations of State/Central Government

34. COMPLIANCE WITH STATUTORY REGULATIONS

34.1 The Contractor shall conform in all respects with the provisions of Statute, Ordinance or Law such as EPF Act, ESI Act, BOCW Act, Indian Contracts Act, Minimum wages Act, Contract labour (Regulation & abolition) Act, Employees compensation Act, IMO regulations, PCB norms, construction & demolition rules etc. and the Regulations or Bye-laws of any local or other duly constituted authority which may be applicable to the Work or to any Temporary Work and with such rules and regulations of public bodies and Companies as aforesaid and shall keep the EMPLOYER indemnified against all penalties and liability of every kind for breach of any such Statute, Ordinance or Law, Regulation or Bye-laws. Contractor shall take note that employer is no way liable or responsible for omissions, non compliances of aforesaid statutes and contractor should implement the same scrupulously. All disputes or non-compliances shall immediately be addressed and settled by the contractor at his risk and cost. It is also expressly informed that employer is no way responsible or liable in respect of any consequential damages or payments or remittances arising out of or in relation, including but not limited to the statutes mentioned above.

34.2 Contractor has to furnish statutory documents such as workmen attendance register, wage register, EPF/ESIC remittance details, HCSL welfare department declaration format etc. along with each running account bill and has to ensure compliance to statutes in all respects. Similarly, contractor has to ensure that all applicable permits and licenses such as Contractor's all risk policy, labour/migrant labour license, workmen compensation policy, BOCW license etc. is kept valid throughout the period of contract. Submission and compliance of above statutory provisions is mandatory for processing of running account bill.

34.3 The contractor shall ensure valid fitness /test /calibration certificates/PUC certificates as applicable for cranes, materials handling equipment, tools & tackles, weighing systems, and all other vehicle positioned inside the project site.

35. SAFETY AND SECURITY AT WORK SITE

34.1. The Site of Work is a protected area. . Entry to the work site shall be regulated by photo entry passes issued by the contractor at his risk and cost. Contractor shall strictly abide by the rules and regulations of HCSL/IWAI regarding entry and exit of vehicles, materials, equipments & contractor's workmen. No photographs of the work site area shall be taken or permitted by the contractor to be taken by any of his employees without the approval of the engineer-in-charge and no such photographs shall be published, or otherwise circulated without the approval of the employer.

34.2. It is the responsibility of the contractor to follow all safety rules and regulations in force, during the currency of contract in HCSL/IWAI, and any violation of the same during the course of work will be at the risk and cost of the contractor and will attract penal action. Upon any violation of Safety rules by the contractor, safety department will impose penalty of Rs 10,000/- per violation. Action for debarring the contractor also will be taken in case of repeated violations. Any accident caused due to safety violation and any damage to the Employer property suitable penalty will be imposed by HCSL including termination of contract, if required.

34.3. The contractor shall submit a HSE plan /scheme to the Employer within 14 days of signing of contract. Contractor is bound to accept the changes as promulgated by the employer without any objection /procrastination and shall liable to implement such changes. Employer and his consultant will ensure the pragmatic implementation of the HSE scheme in all respects. Any violation on HSE scheme will be dealt strictly by issuing warning notice and or charging a fine of Rs 10,000/- per case.

34.4. HCSL shall not be liable for, or in respect of, any damages or compensation payable as per law in respect or in consequence of any accident or injury to any workmen or other person in the employment of the contractor or any sub-contractor. The contractor shall indemnify and keep HCSL indemnified against all such damages and compensation and against all claims, demands, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

34.5. The Contractor shall take all possible precaution to prevent outbreaks of fire on the site and in all offices, stores, camps and other places and things connected there with and especially with respect to the safe storage of petroleum products, explosives and all other dangerous

or hazardous goods. He shall comply with all rules, regulations and orders of any Statutory Authority and of the Engineer-in-charge at no extra cost to the Employer.

34.6. The Contractor shall ensure the safety of all the workmen, materials and equipment either belonging to him or to others working at Site. The Contractor will notify the Engineer-in-charge of his intention to bring on to site any equipment or any container, with liquid or gaseous fuel or other substance which may create hazard. The Employer shall have the right to prescribe the conditions under which such equipment or container may be handled and used, during the performance of the works and the Contractor shall strictly adhere to such instructions. The Employer shall have the right to inspect any erection plant for fabricated item and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition shall be entertained by the Employer.

34.7. Where it is necessary to provide and/or store petroleum products or petroleum mixture and explosive, the Contractor shall be, responsible for carrying out such provisions and/or storage in accordance with the rules and regulations laid down in Petroleum Act 1934, Explosive Act 1948, and Petroleum and Carbide of Calcium manual published by the Chief Inspector of Explosives of India. All such storage shall have prior approvals of the Engineer. In case any approvals are necessary from the Chief Inspector of Explosive or any statutory authorities, the Contractor shall be responsible for obtaining the same.

34.8. The Contractor shall be responsible for provision of all safety notices and safety equipment required both by the relevant legislations and the Employer as he may deem necessary. The Contractor shall be responsible for the same storage of his and his Sub-Contractor's radioactive sources, if any.

34.9. Power supply required for the work including required lighting shall be arranged by the contractor at own risk and cost. In no circumstances will the Contractor interfere with fuses and electrical equipment belonging to the Employer. Any approvals required from local statutory bodies and Central Electricity Authority related to power supply shall be obtained by the contractor. HCSL reserves the right to inspect the construction facilities used by the contractor at any time. Suggestions by HCSL in this regard shall be implemented. Any prior approvals required for using material handling equipment and power supply shall be obtained from HCSL and Statutory Authorities.

34.10. No electric cable in use by the Employer shall be disturbed without prior permission. No weight of any description shall be imposed on any such cable and no ladder or similar equipment shall rest against or be attached to it. Only double PVC insulated cables shall be used. Armoured cables, Flash back arresters shall be used wherever required. ELCBs and MCBs as per statutory regulations shall be used for all plug boards/distribution boards. Bare cables shall not be connected to plug boards, it shall be connected using suitable plug tops. Safety relay and isolation device shall be provided for welding sets. Hand lamps used shall be of 24V. Contractors shall use outdoor duty plugs and sockets for availing power supply for the work.

34.11. No work shall be carried out on any live equipment. Necessary shutdown of power supply shall be obtained. The equipment must be made safe. Double earthing shall be ensured for electrics. The Contractor shall employ the necessary number of qualified, full time electricians to maintain his temporary electrical installation.

34.12. All lifting tools and tackles shall have valid statutory load test certificate and same shall be renewed on expiry of the Validity. All electrical panels, control gears, motors and such other devices shall be properly dried by heating before they are installed and energized. All the electrical equipment/accessories, such as motors, cables, etc. shall be tested for insulation resistance at least once in three months during the contract period. Such records shall be open for inspection by the Employer.

34.13. Any additional safety requirement intimated by Employer or his authorized representative per statutory norms shall be complied without any additional cost to the Employer.

36. AMBIQUITY

35.1. The drawings given in the tender documents are indicative only and issued for tendering purpose. Final detailed drawings shall be issued during execution of works at site. There may be changes in drawing as per the requirement of the employer and the quantities may vary on execution of works and no extra claim on rates will be entertained on this account

35.2. The contractor shall thoroughly study the specifications and drawings and errors/omissions/modifications if any shall be brought to the notice of the Engineer-in-Charge/consultant well in advance so that a final decision in the matter could be given in time. Contractor has to analyse the specifications, drawings issued by the Engineer-in-

charge/consultant and errors/omissions/modifications if any noticed should be brought to the notice of Engineer-in-charge within 14 days of issuance of specifications, drawings etc. Claims of whatsoever nature shall not be entertained for clarifications sought by the contractor post elapsing of aforesaid 14 days period. If any ambiguity arises as to the meaning and intent of any of portion of the specifications and drawings or as to execution or quality of any work or material or as to measurement of the works the decision of the Engineer-in-Charge shall be final and binding on the Contractor.

37. FORCE MAJEURE

36.1. Please Refer Clause No-29 of General Terms and conditions of contract (GCC)

38. PRICE ADJUSTMENT FOR CIVIL WORKS

37.1. The amounts payable to the contractor shall be adjusted in respect of the rise or fall in the cost of materials like Cement, Reinforcement Steel, Structural Steel (which includes angles, channels, other sections, steel plates, etc.) & Rails by the addition or subtraction of the amounts as determined by the formulae prescribed in the following paragraphs. If the prices of above materials required for execution of the work increase/ decrease, such increase/ decrease shall be paid/ recovered to/from the contractor, as the case may be as per provisions detailed below and the amount of the contract shall accordingly be varied subject to the condition that such increase/ decrease due to variation in prices shall be applicable only for the work done up to the date of completion as specified in the contract. Escalation during the extended period if granted for the reasons attributable to the contractor shall not be payable. Such increase/decrease due to variation in prices of above materials when due shall be worked out based on the following provisions and formulae.

37.2. Price Adjustment for Cement

Price adjustment on account of increase or decrease of cement price shall be paid/recovered as per the following formulae.

Cement Price adjustment = X x V x (I – Io)/Io

Where:

X = 35% =Cement component

V = 75% of the value of work done as per relevant items of concrete for land and marine side of tender schedule, during the period for which escalation is under consideration.

I = All India wholesale price index for cement as published by the Economic Adviser to Govt. of India, Ministry of Industry & Commerce for the period for which escalation is payable.

Io = All India wholesale index for cement as published by the Economic Advisor to Govt. of India, ministry of Industry and Commerce as on the month of receipt of price bid.

37.3. Price Adjustment for Reinforcement Steel

Price adjustment on account of increase or decrease of Reinforcement steel price shall be paid as per the following formulae.

Reinforcement Steel price adjustment = X x V x (I – Io)/Io

Where:

X = 80% = Reinforcement steel component

V = 75% of the value of work done as per relevant items of steel for land and marine side works of tender schedule, during the period for which escalation is under consideration.

I = All India wholesale price index for MS Long products as published by the Economic Adviser to Govt. of India, Ministry of Industry & Commerce for the period for which escalation is payable.

Io = All India wholesale index for MS Long products as published by the Economic Advisor to Govt. of India, ministry of Industry and Commerce as on the month of receipt of Price bid

37.4. Price Adjustment for Structural Steel

Price adjustment on account of increase or decrease of Structural steel (which includes angles, channels, other sections, steel plates) price shall be paid as per the following formulae.

Structural Steel price adjustment = X x V x (I – Io)/Io

Where V = 75% of the value of works done, as per relevant item which involves use of Structural steel (which Includes angles, channels, other sections, steel plates, Tie Rod etc), during the period for which escalation is under consideration.

X = Structural Steel component = 70 %

I = All India wholesale price index for Angles, Channels & Sections as published by the Economic Adviser to Govt. of India, Ministry of Industry & Commerce for the period for which escalation is payable.

Io = All India wholesale index for Angles, Channels & Sections as published by the Economic Advisor to Govt. of India, ministry of Industry and Commerce as on the month of receipt of price bid

37.5. Price Adjustment for Crane Rail

Price adjustment on account of increase or decrease of CR100 Rail price shall be paid as per the following formulae.

Rail price adjustment = X x V x (I – Io)/Io

Where: V = 75% of the value of works done, as per relevant item of tender schedule marine side , during the period for which escalation is under Consideration.

X = A100 Rail component = 70 %

I = All India wholesale price index for rails as published by the Economic Adviser to Govt. of India, Ministry of Industry & Commerce for the period for which escalation is payable.

Io = All India wholesale index for rails as published by the Economic Advisor to Govt. of India, ministry of Industry and Commerce as on the month of receipt of price bid.

37.6. **No other escalation whatsoever, except as stated above shall be paid.** Any deviation to this clause shall render the offer liable for rejection.

37.7. **"I" shall be All India wholesale price index prevailing on the month of consumption of the respective material for the permanent works**

38. 8 Price adjustment shall not be applicable for any lumpsum items in the BoQ

38.9. The following principles shall be followed while working out increase/decrease due to variation in prices of materials like cement, tor Steel and structural steel (which includes angles, channels, other sections, steel plates, sheet piles etc)

a) The increase/ decrease due to variation in cost of materials like cement, tor Steel, structural steel (which includes angles, channels, other sections, steel plates, etc) shall be worked out at quarterly intervals and shall be with respect to the cost of work done during the three calendar months of the said work. The first such payment/ recovery shall be made at the end of three months after the month (including) in which the work commenced and thereafter at three months intervals. At the times of completion of work, the last period for payment might become less than three months depending on the date of completion specified in the contract.

b) The indices (I) relevant to any quarter for which such increase/ decrease is paid or recovered shall be the arithmetical average of the indices relevant to the three calendar months. If the period up to date of

completion specified in the contract after the quarter covered by the last such instalment or payment is less than three months for indices (I) shall be the average of indices for the month falling within that period.

c) The base indices (Io) shall be the one relating to the month in which price bid is received.

d) Every quarter from the date of award of the contract, the contractor shall submit to the Engineer-in-charge/consultant a written statement accompanied by authentic documentary evidences of the changes, if any, that have occurred in the specified indices of materials to substantiate the claim for variation in prices.

39. TESTING OF MATERIALS FOR CIVIL WORKS

38.1. All materials to be used in the work will have to be got approved by the Engineer-in-charge before use. Unless otherwise decided by the Engineer-in-charge all the materials are to be procured by the contractor. The contractor shall at his risk and cost make all arrangements and shall provide all facilities as the Engineer-in-charge may require for collection, preparing, forwarding and testing the required number of samples for test (or for analysis) to places as may be directed by the Engineer-in- charge. The charges for testing is to be borne by the contractor. Samples tested shall be retained by the employer for future references.

38.2. The contractor shall be required to establish complete field testing laboratory at no extra cost and arrange all the relevant Codes and Standards under the scope of this contract at the site office. The contractor shall also provide the minimum staff, as specified in the staff requirement appendix, for quality assurance. He shall also provide for a temporary shed, of required size and specifications, at the allotted space at site, for housing the testing laboratory.

38.3. The equipment /testing machines including batching plant, etc. shall be maintained in good working condition and calibrated at regular intervals as specified in approved project quality plan to maintain accuracy of testing. In addition to these equipments, contractor shall bring all equipments required for all tests as per approved ITP and relevant Indian standards.

38.4. Sampling and testing of the material supplied by the contractor for use on the work shall be done as per the provisions of the relevant IS codes/specifications. In the absence of IS specification in a particular case, the sampling and testing shall be done as directed by the Engineer in charge as sound engineering practice. Material conforming to the specifications and approved by the Engineer in Charge/Third party inspection agency shall only be used by the contractor.

38.5. In case of non-availability of any testing facility with the contractor at site, the required tests shall be carried out at contractor's cost at any of the government laboratories or NABL approved laboratory testing facility as directed by the Engineer-in charge. In the case of the following materials, the contractor has to get the materials tested, approved and material test certificate stamped by the industrial wing of any approved classification society/agency (list given below) at source. The cost for the same has to be included in the quoted price. It is the contractor's responsibility to get approvals from classification society in time and employer will not entertain any request for extra time on this account.

38.6. Contractor shall handover master samples of all relevant approved materials to employer for maintaining as master sample at no additional cost to employer. Contractor has to furnish material procurement, testing and consumption statement in employer approved

format for all major items used in permanent works and included under approved inspection and testing protocol (ITP) such as but not limited to cement, reinforcement steel, structural steel, bitumen, grouting materials, aggregates, admixtures and other construction chemicals, construction water, other major bought out items etc. along with every running account bill. Materials which require approval from classification agency is as follows:

1. Fenders (Arch & DD) & its fixtures
2. Bollards & its fixtures
3. All Structural steel items (Plates, Flats, Angles, channels, I-Beams, pipes, tubular sections, sheet materials, Barbed/concertina wire coil, chain link fencing etc.)
4. MS Chequered plate item
5. CR 100 Rail & its accessories(Transfer/Crane rail system components)
6. Bolts, Stud, Nuts, washers & screws
7. Major bought out items –rubber curb, Guard rail, Handrails, Gratings, ladders etc.
8. Grouting materials
9. Anchor fasteners
10. DI/CI/FRP Covers and frames
11. Road studs, Delineator, Road marking thermoplastic paint
12. Hume pipes

a. List of approved classification societies/agency is as follows:

1) Bureau Veritas (BV)
2) Det Norske Veritas (DNV)
3) Lloyd's Register(LR)
4) Indian Register of Shipping(IRS)
5) American Bureau of Shipping(ABS)
6) Class NK Japan
7) TUV SUD

MIR (Material Inspection Record) shall be generated by contractor on receipt of major construction items at work site. MIR shall be raised by Quality manager of the contractor and representatives of Employer, consultant shall inspect the materials received at site and verify the compliance to quality assurance plan/Inspection and testing protocol. Approved MIR shall be furnished along with secured advance/Running account bills on a regular basis by the contractor failing which payment against the respective item shall not be considered by the Employer

In addition, Employer or Employer's representative reserves the right to carry out the inspection at manufactures works. Lodging and travelling expenses of the Employer/Employers representative shall be borne by the Employer. However all the testing facilities shall be arranged by the contractor at manufacturer's works.

All rejected materials shall be removed within 7days from the date of written order to that effect. In case the rejected materials are not removed within the specified period mentioned above the same will be removed by HCSL at the cost and risk of the contractor.

40. ADHERENCE TO MANUFACTURER'S INSTRUCTION

Adherence to instructions of the Manufacturer's supervisory engineers, where provided, is compulsory. The Contractor shall work under the guidance of the Manufacturer's supervisors to ensure that erection procedure adopted by the Contractor as well as completed erection of equipment is such as not to interfere with or prevent equipment from functioning as intended, as well as to the entire satisfaction of the Manufacturer's supervisor/Employer.

The Contractor shall also permit and provide all facilities for the Manufacturer's erection supervisors to carry out all checks that they may wish to and approve any erection procedure and / or final setting and alignment of component, in order to satisfy themselves that erection has been carried out as intended by them. This shall, however, in no way relieve the Contractor of his responsibility for providing adequate and competent supervision and quality workmanship. In case of any dispute, the decision of the Employer/ Engineer/ Manufacturer's erection supervisor shall be final.

41. MODIFICATIONS

Employer retains the right to carryout necessary modifications to drawings, technical specifications, scope of works etc. as deemed fit to complete the project, works or sections of works in quickest possible time. The Contractor shall carry out all modifications at site as directed by the Employer/Engineer to complete the work covered in this Contract. It is the responsibility of the Contractor to get the prior approval for such modifications from the Employer/ Engineer before such works are taken final. No claim of whatsoever nature is admissible on account of modifications incorporated by Employer.

42. INCIDENTAL WORKS

42.1All the works such as cleaning, checking, levelling, assembling, temporary erection for alignment, dismantling of certain equipment's for checking and cleaning, preparation, fabrication of plates/ sheets, tubes and pipes as per general engineering practice at site, cutting, gauging, grinding, straightening, filling, chipping, drilling, reaming, lapping, shaping, fitting, heat treatment cable laying, etc. and other such minor civil works incidental in nature and necessary to complete the works satisfactorily shall be carried out by the Contractor's workers at no extra cost, to the employer.

43. COMMISSIONING AND HANDING OVER OF EQUIPMENTS

43.1 DEFECTIVE WORKS

If the works or any portion there of shall be damaged in any way except by the acts of the Employer, or if defects not readily detected by prior inspection shall develop before the final completion and acceptance of the whole work, the Contractor shall forthwith make good, without compensation, such damage or defects in a manner satisfactory to the Employer/Engineer. In no case shall defective or imperfect work be retained.

~~43.2INITIAL TRAIL~~

~~Not applicable~~

~~**43.3INITIAL OPERATION**~~

~~Not applicable~~

~~**43.4TRIAL OPERATION / PERFORMANCE GUARANTEE TEST**~~

~~**Not Applicable**~~

43.5 FINAL ACCEPTANCE

Final acceptance of the works is after obtaining statutory approvals from all statutory authorities as applicable. Necessary documents shall be submitted in this regard and defects list pointed out by employer, statutory authorities as per statutory norms shall be rectified by the contractor without any additional cost to the Employer. Statutory Authorities (if applicable) includes but not limited to Assam State Pollution Control Board, Inland Waterways Authority of India (IWAI), Central Pollution Control Board, Factories and Boilers Department, labour department, Central Electricity Authority(CEA), Petroleum and Explosives Safety Explosives Department, Load Testing Authorities, Legal Metrology Department, etc.

44 DELAY/EARLY COMPLETION OF WORK PERIOD

44.1 Delay compensation, reward for early completion of work shall be in accordance with clause No-25 (Liquidated Damages for Delay in Completion) and clause 26 (stating that Early completion of work is not applicable) of General terms and conditions of contract.(GCC)

45 MEASUREMENTS

CIVIL WORKS

Measurement shall be as per relevant IS code 1200. In the absence of any code dealing with a particular aspect, sound engineering practice shall prevail. Decision of Engineer in charge in this aspect will be final. In case there is discrepancy between Indian Standard code and CPWD specifications, the former shall prevail.

The quantities set out in the Schedule of quantities (Price Bid) are the estimated quantities of the work for tendering purpose, but they are not to be taken as the actual and exact quantities of the work to be executed by the Contractor. The Contractor shall be paid for the theoretical quantity or actual quantity of the work done whichever is lower at the approved rates in the Bill of Quantities for each item.

46 POSSESSION PRIOR TO COMPLETION

The Employer shall have the right to take possession of or use any completed or partially completed work or part of the work. Such possession or use shall not deem to be acceptance of any work completion in accordance with the Contract agreement. If such prior possession or use by the Engineer-in charge delays the progress of work, suitable adjustment in the time of completion will made and contract agreement shall be deemed to be modified accordingly.

47 SECURITY DEPOSIT

Please refer Clause No:104 of General Terms and conditions of contract (GCC)

48. PAYMENT OF BILL

48.1 CIVIL WORKS

The monthly payment shall be based on the bill submitted by the contractor. The bill for previous month along with detailed measurements and all relevant supporting documents such as RFI, pour card, approved BBS, batch sheets, post pour, survey documents, erection checklist, and all other applicable checklists/site documents etc. without omissions, arithmetic errors and complete in all respects and complying with provisions of contract shall be prepared and submitted to Engineer-in-charge/consultant on or before 7th working day of the current month by the contractor and payment shall be released within one month from the date of submission of corrected fair bill and measurement book and its acceptance of the bill by Engineer-in-charge. The contractor shall submit running account bills in two copies along with joint measurements. The contractor shall inform the Engineer-in-charge/consultant or his representative well in advance for recording the joint measurement. The contractor shall raise only one bill in a month and shall submit the bill after satisfactory completion of joint measurement.

For the completed items of the works (where measurements are certified by contractor and authorized representative of the Engineer-in-charge and specifically noted in the computerized

measurement book), 75% of the net amount payable on each bill can be paid as an advance within 10 working days from the date of receipt of bill by Engineer-in-charge, on receipt of specific request from the contractor, provided bill submitted and supporting site records/documents is found prima facie in order. Balance amount of 25% will be paid after scrutiny and cross-checking of the bill is completed by Employer and final measurement book (as final measurements and as such have been signed and accepted by the contractor and the employer) incorporating all necessary modifications/corrections is submitted by the contractor within 20 working days from the date of submission of final measurement book with all supporting documents including all quality and statutory documents complete in all respects. Finalization and submission of measurement book (final after incorporating all modifications/corrections) is mandatory for considering advance payment of subsequent running account bill. Non submission of bill on time by the contractor or submission of incomplete/erroneous bills by the contractor and resultant delay in processing of bill is fully attributable to the contractor and no claim on this account shall be entertained by the Employer.

No Running Account Bill shall be paid for the work till the applicable valid statutory documents such as Insurance policy/CAR policy, labour licenses, registration with EPFO, ESIC and BOCW, Welfare Board, workmen compensation policy, migrant workers certificate etc. are submitted by the contractor to the Engineer-in-charge.

Contractor shall furnish valid workmen statutory documents – Attendance register, wage register, EPF/ESIC remittance details, CSL welfare department declaration form, key personnel attendance statement, quality testing compliance report in approved employer format, details of plant, machinery and equipments permits and calibration status in approved employer format, procurement and consumption statement of construction items in employer format as directed by Engineer-in-charge etc. complete in all respects to the Engineer-in-charge along with each monthly running bill for scrutiny and processing of running account bills by the Employer.

All payments due to the contractor under this contract will be made in Indian Rupees only. All statutory taxes and cess (Such as IT, TDS on GST, labour cess etc.) as per the rules prevailing in force at the time of payment of bills, principal and interest applicable against advances (Such as

secured advance, mobilization advance etc.) availed by the contractor will be deducted while making payment or when crediting the amount to the account.

After completion of all the works/termination of contract, the contractor has to dismantle and demobilize plant & machinery, other site establishments etc. and clear all the debris and make the area neat and tidy and handover the entire site in good condition to Employer within a period of two months.

The final bill shall be paid only after compliance of above and after obtaining all applicable statutory approvals and no objection certificates/No dues certificate from statutory agencies like labour department, EPFO, ESIC, IWAI, Mining and geology, PCB, Legal metrology etc. to this effect. The final bill shall be paid within four months from the date of submission of claim (bill) by the contractor or completion of all the items of work or date of acceptance of the bill by both parties whichever is later.

49 PROCUREMENT OF MATERIALS AND BOUGHT OUT ITEMS

49.1 The Contractor shall arrange from the very beginning adequate supply of materials, manpower, stock control items, spare parts etc. so as to ensure that delays or hold-ups do not occur in the commencement and execution of the works. Advance planning for procurement shall be ensured and buffer stock for critical construction items such as reinforcement steel, structural steel, cement, admixtures, aggregates etc. sufficient to carry out at least one month of work shall be ensured by the contractor for smooth progress of work.

49.2 All the materials to be used in construction shall be subjected to the approval of engineer-in-charge. The contractor shall apply sufficiently in advance with the samples of materials including the supporting test results from the government/NABL accredited laboratory and other documentary evidence from the manufacturer wherever applicable indicating the types of materials and their respective sources. The engineer-in-charge also reserves the right to conduct additional tests at government laboratories or NABL accredited laboratory at his discretion. The cost of all such tests shall be borne by the contractor. The delivery of material at the site shall be carried out only after the approval of quality, grading and source of materials by engineer–in-charge. The quality of all material once approved shall be maintained throughout the period of construction and periodic tests shall be carried out to ensure that it is maintained.

The guarantees/warranty certificates for all major bought out items, fittings /fixtures are to be handed over to HCSL prior to use in permanent works.

50 COMPLIANCE OF QUALITY ASSURANCE PROGRAMME

Contractor shall adopt sound engineering practices and ensure high degree of quality assurance/control and compliance to approved quality assurance plan during the tenure of the contract. In case works are found to be executed in a defective manner with snag list/punch list, non-conformity reports (NCR) shall be raised by Employer and consultants and same shall be rectified within a reasonable timeframe as per the repair methodology approved by employer and consultants at the risk and cost of the contractor. Closing of NCR is mandatory for considering that portion of work(s) in running account bill. In case of non-compliances and also for repeated failure in implementation of any of the quality provisions, Employer may impose stoppage of work without any cost & time implication to the employer and/or impose a suitable penalty. Repeated quality violations shall result in a penalty of Rs 10,000/- per incident reported and decision of Engineer-in-charge on levy of penalty against quality violation shall be final and binding on the contractor. Imposition of penalty does not make the Contractor eligible to continue the work in an inefficient or otherwise improper or unworkman like manner. If non-conformities persists and work is not found to be executed with due diligence and good quality, Employer reserves the right to terminate the contract and same shall be totally binding on the contractor.

51 TERMINATION/OFFLOADING

51.1.The contractor fully understands that timely completion of the work as per the schedule is of paramount necessity as otherwise it would lead to adversely affecting the schedules of other works/project with resultant financial and other losses to the Employer. Contractor shall take specific notice that stages of work are defined with a view to the scheduled installations and commissioning of Boat lift. Any slippages to the installation and commissioning of above will impart huge financial loss to the Employer. Contractor shall strictly plan and control the execution strictly so as to meet the defined stages/milestones considered by the employer without any slippages. Close control and monitoring shall be implanted in the execution to catch-up immediately if any slippage occurred. In view of this, the contractor unconditionally agrees and binds himself to be liable for all the consequences for non-completion of the work within the stipulated time.

51.2 In case a situation is brought about by the contractor warranting termination/off-loading of the whole or any part of the work for any reason whatsoever, the Employer shall have the liberty and right to entrust/engage/award the work so terminated/off loaded at the risk and cost of the contractor to any other agency/contractor by adopting any mode of inviting tenders, i.e. open/limited/single party/negotiation basis etc. in order to ensure completion of the work as per the schedule or at the quickest possible time. The contractor shall take specific notice that by signing the contract, Contractor declares and agree to Employer that he is fully aware about the Conditions and Schedules of the contract expressly in its entirety including the specific requirements of the Employer in all respects and solemnly agree that in case of an action as aforesaid, the contractor will not make any stoppage or even any hindrance to the progress of the works awarded to another arty or parties as desired by the employer at his sole liberty for the earliest completion of the project, keeping the best interest of the project in the backdrop.

52 FORFEITURE OF SECURITY DEPOSIT

52.1 Whenever any claim against the Contractor for the payment of a sum of money arises out of or under the contract, the Employer shall be entitled to recover such sum by appropriating in part or whole, security deposit of the contractor, forming whole or part of such security being insufficient or if no security has been taken from the Contractor then the balance or the total sum recoverable, as the case may be, shall be deducted from any sum then due or which at any time thereafter may become due to the Contractor. The contractor shall pay to the Employer on demand any balance remaining due.

53 ACTION WHEN WHOLE OF SECURITY DEPOSIT IS FORFEITED

53.1In any case in which, under any clause or clauses of this contract, the contractor shall have forfeited the whole of his security deposit (whether paid in one sum or deducted by installment) or have committed a breach of any of the

terms contained in this contract and circumstances leading to forfeiture of security deposit, the Employer shall have power to adopt any of the following courses as he may deem best suited to his interest:

a) To rescind the contract (of which rescission notice in writing to the contractor under the hand of the Employer shall be conclusive evidence) in which case the security deposit of the contractor shall stand forfeited and be absolutely at the disposal of the Employer.

b) To employ labour paid by the Employer and to supply materials to carry out the work any part of the work, debiting contractor with the labour cost of tools and plants and equipment charges, the cost of the materials for which a certificate of the Engineer-in-charge shall be final and conclusive against the Contractor and 10% of costs as above to cover all departmental charges and crediting him with the value of the work done in all respects in the manner and at the same rates as if it had been carried out by the Contractor under the term of his contract. The certificate of Engineer-in-charge as to the value of the work done shall be final and conclusive against the contractor.

c) To measure up the work of the contractor and to take such part thereof as shall be unexecuted out of his hand to give it to another contractor to complete in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (of the amount of which excess, the certificate in writing of the Engineer-in-charge shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any money due to him by the Employer under the contract or otherwise or from his security deposit or from the proceeds of sale thereof, of a sufficient part thereof.

54.2 In the event of any of the above course being adopted by the Employer, the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any agreements or made any advances on account of or with a view to the execution of the work of the performance of the contract. In such a case, the Contractor shall not be entitled to recover or paid be paid any sum for any work actually performed under this contract unless the Engineer-in- charge will certify in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

54 CONTRACTOR REMAINS LIABLE TO PAY COMPENSATION

In any case of determination of the contract, in which any of the powers conferred upon the Employer by clause 53 thereof shall have become exercisable and the same had not been exercised, the non exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercised in the event of any further case of default by the contractor for which any clause of hereof he is declared liable to pay compensation amounting to the whole of his security deposit and the liability of the contractor for past and future compensation shall remain unaffected.

In the event of the Employer putting in force the power under sub-clause (a),

(b) or (c) above vested in him under the preceeding clause he may, if he so desires takes possession of all or any tools and plants materials and stores in or upon the works or the site thereof belonging to the contractor or procured by him and intended to be used for the execution of the work or any part thereof paying or allowing for the same in account at the contract rates or in case of these not being applicable at current market rates to be certified by the Engineer-in-charge whose certificate thereof shall be final otherwise the Engineer-in-charge may give notice in writing to the contractor or his clerk of the works, supervisor or other authorized agent, requiring him to remove such tools, plant, materials or stores from the premises (within a time to be specified in such notice) and in the event of the contractor failing to comply with any such requisition, the Engineer-in-charge may remove them at the contractors expense or sell them by auction or private sale on account of the contractor and at his risk in, all respects without any further notice as to the date, time or place of sale and the certificate of the Engineer- in-charge as to the expense of any such removal and the amount of proceeds and any expenses of any such sale shall be final and conclusive against the contractor.

55 NO COMPENSATION FOR ALTERATION IN OR RESTRICTION OF WORK

If at any time from the commencement of the work the Employer shall for any reasons whatsoever, not require the whole or part thereof as specified in the tender to be carried out, the Engineer-in-Charge shall give notice in writing of the fact to the contractor, who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full, but which he did not derive in consequence of the full amount of the work not having been carried out, neither shall he have any claim for compensation by reason of any alterations having been made in the original specifications, drawings, designs and instructions which shall involve any curtailment of the work as originally contemplated.

56 POWER OF ENTRY

56.1. If the contractor shall not commence the work in the manner previously described in the contract document or if he shall, at any time in the opinion of the Engineer-in-charge.

a) Fail to carry out the works in conformity with the contract documents, or
b) Fail to carry out the works in accordance with the time schedule, or
c) Substantially suspend work or the works for a period of Fourteen days without authority from the Engineer-in-charge, or
d) Fail to carry out carry out and execute the works to the satisfactions of the Engineer-in-charge, or
e) Fail to supply sufficient or suitable constructional equipment, temporary works, labour materials or things, or
f) Commit or suffer or permit any other breach of any of the provisions of the contract on his part to be performed or observed or persist in any of the above mentioned above-mentioned breaches of the contract for the fourteen days, after notice in writing shall have been given to the Contractor by the Engineer-in-charge requiring such breach to be remedied, or
g) Abandon the works, or
h) During the continuance of the contract, become bankrupt, make any arrangement or composition with his creditors, or permit any execution to be levied or go into liquidation whether compulsory or voluntary not being merely a voluntary liquidation for the purpose of amalgamation or reconstruction.

Then in any such case, the Employer shall have the power to enter upon the works and take possession thereof and of the materials, temporary works, constructional equipment, and stock thereon, and to revoke the contractor's license to use the same, and to complete the works, by his agents, other contractor or workmen, or to re-let the same upon any terms and to such other person firm or corporation as the Employer in his absolute discretion may think proper to employ and for the purpose aforesaid to use or authorize the use of any materials, temporary works constructional equipment, and
stock as aforesaid without making payment or allowances to the contractor for the said materials other than such as may be certified in writing by the Engineer-in-charge to be reasonable, and without making any payment or allowance to the contractor for the use of the temporary said works,

constructional equipments and stock or being liable for any loss of damage thereto, and if the Employer shall by reason of his taking possession of the works or of the works being completed by other contractors (due account being taken of any such extra work or works which may be omitted) then the
amount of such excess as certified by the Engineer-in-charge shall be deducted from any money which may be due for work done by the contractor under the contract and not paid for. Any deficiency shall forthwith be made good and paid to the Employer by the contractor and the Employer shall have power to sell in such manner and for such price as he may think fit all or any of the constructional equipment, materials etc. belonging to and to recoup and retain the said deficiency or any part thereof out of the proceeds of the sale.

57. OTHER AGENTS AT SITE

57.1. The contractor shall have to execute the work in such place and condition where other agencies might also be engaged for other works such as E&M, firefighting , Boatlift fabrication , erection, installation and commissioning works , installation and commissioning of cranes etc. No claim shall be entertained to works being executed in the above circumstances.

58. RIGHTS OF VARIOUS INTERESTS

58.1. The Employer reserves the right to distribute the work between more than one contractor. The contractor shall co-operate and ensure afford other contractor's reasonable opportunity for access to the works for the carriage and storage of materials and execution of their works.
58.2. Whenever the work being done by any department of the Employer or by other contractors employed by the Employer is contingent upon work covered by the contract, the respective rights of the various interests involved shall be determined by the Engineer-in-charge to secure the completion of the various portions of the work in general harmony.

59. RIGHT OF EMPLOYER TO DETERMINE / TERMINATE CONTRACT

59.1 Employer shall, at any time be entitled to determine and terminate the contract, if in the opinion of the Employer the cessation of the work becomes necessary owing to paucity of funds or for any other cause whatsoever, in which case, the cost of approved materials at the site at current market rates as verified and approved by Engineer-in-charge and of the value of the work done to date by the contractor shall be paid for in full at the rates specified in the contract. A notice in writing from the Employer to the contractor of such determination and termination and the reason thereof, shall be the conclusive proof of the fact that the contract has been so determined and terminated by the Employer.

59.2 Should the contract be determined under above sub-clause and the contractor claims payments to compensate expenditure incurred by him in the expectation of completing the whole of the work, the Employer shall consider and admit such claim as are deemed fair and reasonable and are supported by vouchers to the satisfaction of the Engineer-in-charge. The Employer's decision on the necessity and propriety of any such expenditure shall be final and conclusive and binding on the contractor

60. LIENS

60.1. If, at any time, there should be evidence or any lien or claim for which the Employer might have become liable and which is chargeable to the contractor, the Employer shall have the right

to retain out of any payment then due or thereafter to become due, an amount sufficient to completely indemnify the Employer against such lien or claim and if such lien or claim be valid, the Employer may pay and discharge the same and deduct the amount so paid from any money which may be or may become due and payable to the Contractor. If any lien or claim remain unsettled after all payments are made, the contractor shall refund or pay to the Employer all moneys that the latter may be compelled to pay in discharging such lien or claim including all costs and reasonable expenses.

60.2. Contractor will not disclose details of the work to any person or persons except those engaged in its performance, and only to the extent required for the particular portion of the work being done. Contractor will not give any items concerning details of the work to the press or a news disseminating agency without prior written approval from Engineer-in-charge. Contractor shall not take any pictures on site without written approval of Engineer-in- Charge

61. OFFICIAL SECRETS

61.1. Contractor will not disclose details of the work to any person or persons except those engaged in its performance, and only to the extent required for the particular portion of the work being done.

61.2. Contractor will not give any items concerning details of the work to the press or a news disseminating agency without prior written approval from Engineer-in-charge. Contractor shall not take any pictures on site without written approval of Engineer-in-charge.

62. NON-WAIVER OF DEFAULT

62.1. Any failure by the Employer or Contractor at any time, or from time to time, to enforce or require the strict keeping and performance of any of the terms or conditions of this agreement, or to exercise a right hereunder, shall not constitute a waiver of such terms, conditions or rights, and shall not affect or impair same, or the right of the Employer or the Contractor, as the case may be at any time to avail itself of same.

63. MATERIALS PROCURED WITH ASSISTANCE OF EMPLOYER

63.1. Notwithstanding anything contained to the contrary in any or all the clause of this document where any materials for the execution of the contract are procured with the assistance of Employer either by issue from Employer's stock or purchase made under orders or permits or licences issued by

Government, the contractor shall hold the said materials as trustee for the Employer and use such materials economically and solely for the purpose of the contract and not dispose them off without the permission of the Employer and return, if required by the Engineer-in-charge, all surplus or unserviceable materials that may be left with him after the completion of the contract or at its termination for any reason, whatsoever on his being paid or credited such prices as the Engineer in-charge shall determine having due regard to the condition of the materials. The price allowed to the contractor however, shall not exceed the amount charged to him excluding the storage charges if any. The decision of the Engineer-in-charge shall be final and conclusive in such matters. In the event of breach of the aforesaid condition, the contractor shall in terms of the licenses or permits, and/or for criminal breach of trust, be liable to compensate the Employer a double rate or high rate, in the event of those materials at that time having higher rate or not

being available in the market, then any other rate to be determined by the Engineer-in-charge and his decision shall be final and conclusive.

64. SUSPENSION OF WORKS

The contractor shall, if ordered in writing by the Engineer-in-charge or his representative, temporarily suspend the works or any part thereof for such period and such time as so ordered and shall not, after receiving such written order, proceed with the work therein ordered to be suspended, until he shall have received a written order to proceed therewith. The contractor shall not be entitled to claim/ compensation for any loss or damage sustained by him by reason of temporary suspension of the works aforesaid. An extension of time for completion, corresponding with the delay caused by any such suspension of the works as aforesaid will be granted to thecontractor, should he apply for the same, provided that suspension was not consequent to any default or failure on the part of the contractor.

65. EMPLOYER MAY DO PART OF WORK

65.1. Upon failure of the contractor to comply with any instructions given in accordance with the provisions of the contract, or due to any potential slippage occurring from the side of the contractor in executing the works as per schedule, the Employer has the alternative right, instead of assuming charge for entire work to place additional labour force, tools, equipments and materials on such parts of the work, as the Employer may designate or also engage another contractor to carry out the work. In such cases, the Employer shall deduct from the amount which otherwise might become due to the contractor, the cost of such work and materials with ten percent added to cover all departmental charges and should the total amount thereof exceed the amount due to the contractor, the contractor shall pay the difference to the Employer.

66. ACTION TO RESCIND THE CONTRACT

In the event of failure on the part of the contractor to complete work even after the expiry of the extended period or due to other causes of non- performance on-performance, Employer HCSL shall be entitled to rescind the contract with a notice period of 14 days and take the following action:

- Levy of Lliquidated damages
- Forfeit performance Bank guarantee and Security Deposit
- Banning of business with the contractor
- Forfeit any other bank guarantees of contractor available withEmployer

67. DEFECTIVE WORK / MATERIALS

If the work done by the Contractor or any part there of shall be found defective in workmanship or by reason of bad or inferior materials used, then in such case he shall at his own risk and cost without delay, demolish all such defective work and rebuild or replace the same in a satisfactory manner. The Employer may, if necessary, at the cost and risk of the Contractor, temporarily stop all other activities by the Contractor in connection with the work until such time as the defective work has been rebuilt or replaced at the Contractor's cost. In case of default on the part of the contractor to remove defectives work and rebuild or replace the same without delay and in a manner satisfactory to the Employer, the Employer shall be entitled to employ another Contractor or its own workman to carry out the removal and rebuilding or replacing at the risk and cost of the contractor.

68. SUBSTITUTION OF CONTRACTOR

68.1. If the Company finds it necessary to employ a person or persons for the purposes of determining/terminating the contract, then the Employer may deduct and retain from out of the sums due to the contractor all such amounts as they may require to pay or to reimburse themselves there from in respect of the costs and expenses which they have incurred in completing the work and or in removing defective work and rebuilding or replacing the same in a manner satisfactory to the Employer and if such amounts be more than the sums due or thereafter becoming due to the Contractor, and the balance, shall be a debt recoverable from the Contractor by the Employer. The Contractor shall not in any manner do or cause to be done any act, matter or things whatsoever to prevent the person or persons so employed by the Employer from removing defective work and re-building or replacing the same in a manner satisfactory to the Employer and/or from, completing the work in the manner aforesaid.

69. REMOVAL OF MATERIAL

69.1. On the Determination of the contract Agreement, the Contractor shall at his own risk and cost remove from site within two months all his plant and machinery, materials, equipment and tools. It is agreed that in case of such determination the Employer shall be entitled to purchase from the Contractor such materials as will be approved by the Authorized Engineer of the Employer at the prices then current. If the Contractor does not remove the other materials, equipment and tools which he has been asked to remove within the time prescribed as aforesaid, the Employer may remove and sell the same holding the proceeds less the cost of storage, removal and sale to the credit of the Contractor. Should Employer incur any loss in respect of the sale, it shall be entitled to recover same from the Contractor.

70. CANCELLATION

70.1. The Employer shall at any and all times during the period stipulated for the work, has the right forthwith to cancel this agreement by giving written notice thereof to the Contractor and in such case the Contractor shall be paid for such part of the work as has been executed by him up to the date of cancellation, on the basis of schedule of rates as per Purchase order/Contract and shall be reimbursed by the Employer for the cost and expenses incurred by him but which would now be wasted as a direct consequence of the cancellation of the Agreement.

70.2. It is specifically and distinctly understood and agreed between the HCSL and the Contractor that contractor shall have no right, title or interest in the Site made available by the CSL for the Contract work or in the work executed on the said site by the Contractor or in the goods, articles, materials etc. brought on the said site (unless the same actually belongs to the Contractor) and the Contractor shall not have nor deemed to have any lien whatsoever or charge for unpaid bills nor shall be entitled to assume or retain possession or control of the Site or structures under any circumstances whatsoever and the HCSL shall have an absolute and unfettered right to take full possession of the Site and structures and to remove the Contractor, his servants, agents and materials belonging to the Contractor and lying on the Site.. The Contractor shall be allowed to enter upon the site for execution of the works only as a licensee simpliciter and shall not have any claim, right, title or interest in the Site made available by the Board for execution of the Works. The Contractor shall use such site allotted by the HCSL only and exclusively for the Contract Work. On termination of the Contract, the Contractor shall forthwith hand over vacant and peaceful possession of the Site whenever called upon to do so by the Engineer-in-charge or any of his representative(s) of HCSL without any let or hindrance or demur whatsoever.

71. BASIC RATES FOR CIVIL WORKS

71.1. In case of materials where ‘Basic Price’ has been indicated in the Bill of Quantities (BOQ), the Contractor must necessarily submit copy(s) of challan and invoice of all such materials used in the works immediately on receipt of the materials at site. In case, the basic rate of the material procured is less than that indicated against the respective item, the difference in the amount of basic rate of the material procured and the Basic Price indicated in the respective item in the Contract shall be deducted from the running account bill invoices.

71.2. In case, CSL desires to adopt certain material in lieu of the material mentioned in the item in Bill of Quantities wherein the basic rate is indicated, the difference in the amount of basic rate of the material to be procured and the Basic Price indicated in the respective item in the Contract shall be paid extra over and above the quoted/ negotiated price of the item. In such cases, the Contractor must necessarily submit copy(s) of challan and invoice of all such materials used in the works immediately on receipt of the materials at site.

72. INCONVENIENCE TO PUBLIC/ NEARBY OFFICES

72.1. The contractors shall not deposit materials on any site or on access roads, which will seriously cause inconvenience the public/nearby offices. The Engineer-in-charge retains the right to instruct may required the contractor to remove any materials which are considered by him to be dangerous or inconvenience to the pubic/nearby offices or cause to be removed at the contractor's cost.

72.2. Waste materials are to be cleared from site on a day-to-day basis. Each area of working is to be cordoned off with necessary signboards and barriers/barrication to ensure safe transportation of men and material as directed by the Engineer-in-charge. Measures for dust control such as frequent sprinkling of water shall be ensured by the contractor at no extra cost to employer.

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HOOGHLY COCHIN SHIPYARD LIMITED

(A WHOLLY-OWNED SUBSIDIARY OF COCHIN SHIPYARD LTD)

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

TENDER NO: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

COVER-A

SECTION V

ERECTION & COMMISSIONING

CONDITIONS OF CONTRACT (ECC)

TABLE OF CONTENTS FOR ERECTION& COMMISSINING CONDITIONS OF CONTRACT (ECC)

SECTION – III

ERECTION & COMMISSIONING CONDITIONS OF THE CONTRACT (ECC)

1.0 GENERAL

1.1 Erection Conditions shall be read in conjunction with the General Conditions of Contract, Specification, Drawings and any other documents forming part of this Contract wherever the Context so requires.

1.2 The following shall supplement the conditions already contained in the other parts of the specifications and documents governing the scope of contract related to erection.

1.3 The Contractor shall nominate one of the responsible officers as their residential representative suitably designated for the purposes of overall responsibility and coordination of the services to be performed in respect of erection etc. at site. Such person shall function from the site office established by the Contractor, during the pendency of Contract.

2.0 SCOPE OF SERVICES

The scope of work and duties and responsibilities of the Contractor shall broadly include the following, though not restricted to them.

2.1 Assisting the Engineer, whenever required by him in checking and verification of equipment and materials supplied by the Contractor.

2.2 Erection, Technical supervision of erection including disassembly, preassembly etc., adjustments of the equipment supplied by the Contractor and performing trial and pre-commissioning tests.

2.3 Foundation works for the equipment and cranes supplied by HCSL shall be done by the contractor as per drawings provided by the HCSL on payment basis.

2.4 Technical supervision of the work of repairs, modifications and alterations, etc., of equipment, wherever necessary.

2.5 Rendering technical assistance, clarifications and guidance on technical problems and drawing/documents relating to equipment supplied by the Contractor.

2.6 To conduct performance guarantee tests. All the inputs required for the tests shall be arranged by the Contractor.

2.7 Any other related services though not specifically mentioned herein before but necessary for proper execution of the work, as stipulated.

3.0 REGULATION OF LOCAL AUTHORITIES AND STATUTES

3.1 The Contractor shall comply with all the rules and regulations of local authorities during the performance of his field activities. He shall also comply with the Minimum Wages Act. 1948, Payment of Wages Act and Contractor Labour (Regulation and Abolition Act) or any other law and the rules made there under in respect of any employee or workman employed or engaged by him or his sub-Contractor.

4.0 ACCESS TO SITE AND WORKS ON SITE

4.1 Necessary access to the site shall be made by the contractor after handing over of the site to the contractor by the Owner within one week from the date of receipt of work order.

4.2 The works so far as it is carried out on the Owner's premises, shall be carried out at such time as the Owner/Owner's representative may approve.

4.3 In the execution of works, no persons other than the Contractor or his duly appointed representative, Sub-Contractor and workmen, shall be allowed to do work on the site, except by the special permission, in writing, of the Owner or his representative.

5.0 CONTRACTOR'S SITE OFFICE ESTABLISHMENT

5.1 The Contractor shall establish a site office at the site as required in the foregoing paras. Any order or instruction of the Engineer or his duly authorized representative shall be communicated to the aforesaid authorized representative at the site office via writing, email, etc and same shall be deemed to have been communicated to the Contractor at his legal address & head office. The contractor shall employ a competent representative as required above to deal with work schedules & negotiations at site. He shall be assigned with authority & responsibility towards the above and he shall always be present at site during working hours.

6.0 COOPERATION WITH OTHER CONTRACTORS

6.1 The Contractor shall co-operate with all other Contractors or tradesmen and staff of the Engineer/Owner/Purchaser, who may be performing other services on behalf of the Owner/Purchaser and the workmen who may be employed by the Owner/Purchaser and doing work in the vicinity of the works under the contract. The Contractor shall also so arrange to perform his work as to minimize, to the maximum extent possible, interference

with the work of other contractors and his workmen. Any injury or damage that may be sustained by the employees of the other Contractors and the Owner due to the Contractor's work shall promptly be made good at his own expense. The Engineer shall determine the resolution of any difference or conflict that may arise between the Contractor and the other contractors or between the Contractor and the workmen of the Owner in this regard to their work. If the works of the Contractor is so delayed because of any acts or omission of another contractor, the Contractor shall have no claim against the Owner.

6.2 The Engineer shall be notified promptly by the Contractor of any defects in the other contractor's work that could affect the contractor's work. The Engineer shall determine the corrective measures, if any, required rectifying this situation after inspection of the works and such decisions by the Engineer shall be binding on the Contractor.

7.0 DISCIPLINE OF WORKMEN

7.1 The Contractor shall adhere to the disciplinary procedure set by the Purchaser/ Engineer in respect of his employees and workmen at site. The Engineer shall be at liberty to object to the presence of any representative or employee of the Contractor at the site, if in the opinion of the Engineer such employee has misconduct himself or be incompetent or negligent or otherwise undesirable and then the Contractor shall remove such a person objected to and provide in his place a competent replacement.

7.2 The Contractor at all time shall take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his employees and for preservation of peace and protection of persons and property at and in the neighborhood of works.

8.0 CONTRACTOR'S ASSISTANCE IN WORK PLAN FOR FIELD OPERATION

8.1 Erection network submitted by the Contractor and discussed with the Owner/Purchaser and finalised with necessary modifications form a part of contract documents & will be the essence for planning erection activities. The Contractor will furnish the detailed working schedules in respect of each of the activities.

8.2 The Contractor shall keep the Engineer informed in advance regarding his field activity plans and schedule for carrying out each part of the work. Any review of such plan or schedule or method of work by the Engineer shall not relieve the Contractor of any of his responsibility towards the field activities. Such reviews shall also not be considered as an assumption of any risk or liability by the Engineer or the Purchaser or any of his

representatives and no claim of the Contractor will be entertained because of the failure of inefficiency of any such plan or schedule or method of work reviewed. The Contractor shall be solely responsible for the safety, adequacy and efficiency of plants and equipment, his erection methods.

8.3 The Contractor shall have the complete responsibility for the conditions of the work site including the safety of all persons employed by him or his Sub-Contractor and all the properties under his custody during the performance of the work. The requirement shall apply continuously till the completion of the Contract and shall not be limited to normal working hours. The erections reviewed by the Engineer is not intended to include review of Contractor's safety measures in, on or near the works site, and their adequacy or otherwise.

8.4 The first preparation of such erection plan will cover erection activities to be performed for the whole period of erection. Every subsequent plan in the last week of every month will contain updated report for reflecting progress achieved up to 20th day of the month (hereinafter reporting month) a firm programme for the first ensuing month and tentative programme for the second ensuing month. The firm erection programme for the first ensuing month will reflect the progress of the reporting month, erectable equipment and material available at site, resources at the immediate disposal and the inputs to be provided by the Owner/Purchaser. The firm work plan shall be broken down by the Contractor in week wise erection plan. The tentative work plan must set target for the complete month based on progress achieved through firm work plan of first ensuing month and identify constraints.

8.5 The erection work plan will be reviewed by the Owner with the assistance of the Contractor and Consultants where ever necessary

8.6 WORK TO BE OPEN FOR INSPECTION AND CONTRACTOR TO BE PRESENT: All works under or in course of execution or executed under the contract shall at all times be open to the inspection & supervision by engineer. Contractor shall at all times during the working hours and at other times with notice of Engineer's visit to works shall have responsible representative available to receive instructions from the Engineer, orders/instructions given to authorized representative shall be considered as if they are given to the Contractor himself.

8.7 NOTICE BEFORE WORK IS COVERED UP: The Contractor shall give adequate notice (normally seven days) to Engineer in writing before covering up or otherwise placing beyond the reach of inspection and measurement any work in order that the same may be measured & correct dimension thereof recorded. If contractor covers such works without notice; then Engineer reserves the right to get the same uncovered at the risk & cost of the Contractor.

9.0 MANPOWER REPORT

9.1 The Contractor shall submit to the Engineer, on the first day of every month, a man power schedule for the next month, detailing the man power scheduled for the month, skill wise and area wise.

9.2 The Contractor shall also submit to the Engineer on the first day of every month, a man power report of the previous month detailing the number of persons scheduled to have been employed and actually employed, skill-wise and the areas of employment of such labour.

9.3 The Contractor shall decide mutually with the Owner/Purchaser, from time to time, in regard to Contractor's manpower deployment, plan and schedules for providing the services under the contract to match the erection programme.

9.4 The Contractor shall also intimate the programme of the visit of his personnel to site and departure from site. The Engineer will have the right to review the list of such personnel and ask for increase in the strength or reschedule the visits of such personnel, if in the opinion of the Engineer, the list of personnel furnished by the Contractor is not sufficient for effective performance of the Contract.

10.0 PROTECTION OF WORK

10.1 The Contractor shall have total responsibility for protecting his work till it is finally taken over by the Engineer. No claim will be entertained by the Purchaser or the Engineer for any damage or loss to the Contractor's works and the Contractor shall be responsible for the complete restoration of the damaged works to its original condition to comply with the Specifications and Drawings. If required as instructed by the Engineer a temporary barricade or fencing of 2m high may be provided by the contractor at no extra cost. Should any such damage to the Contractor's works occur because of other party not under his supervision or control, the Contractor shall make his claim directly with the party concerned. If disagreement or conflict or dispute develops between the Contractor and the

other party or parties concerned regarding the responsibility for damage to the Contractor's Works, the same shall be resolved as per the provision of the clause: 50 of GCC, `Co-operation with other Contractors'. The Contractor shall not cause any delay in the repair of such damaged works because of any delay in the resolution of such disputes. The Contractor shall proceed to repair the work immediately and no cause thereof will be assigned pending resolution of such dispute.

11.0 SECURITY

11.1 The Contractor shall have total responsibility for all equipment and materials in his custody stored, loose, semi-assembled and/or erected by him at site. The Contractor shall make suitable security arrangements including employment of security personnel to ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss. All materials of the Contractor shall enter and leave the project site with the written permission of the Engineer in the prescribed manner. Inadequate provision in this regard will result in Owner making security arrangements at Contractor's cost.

12.0 EMPLOYMENT OF LABOUR

12.1 The Contractor shall employ on the work only his skilled employees with experience of his particular work.

12.2 Contractor's employees shall wear identification badges, safety helmets and applicable protective gear while on work at site.

12.3 In case the Owner becomes liable to pay any wages or dues to the labour or to any Government agency under any of the provisions of the Minimum Wages Act, Workmen Compensation Act, Contract Labour Regulation and Abolition Act or any other law due to act of omission of the Contractor, the Owner may make such payments and shall recover the same from the Contractor's bills.

12.4 As far as possible unskilled labour shall be engaged from local area of site.

12.5 The Contractor shall at all time have due regard to the local religious, festivals & customs.

12.6 Contractor shall comply with all the provisions of labour, civil, State & Central laws, statutory rules, regulations under the law. In case of his non-compliance with any provision, he will indemnify the Owner from and against all liabilities, damages, penalties, demand etc.

12.7 The Contractor in the event of his engaging 20 (twenty) or more workmen at site shall

obtain independent license under contract labour (Regulation and abolition act) from the concerned state labour authorities for which necessary certificate shall be issued by the concerned department.

12.8 Contractor's Employees: The Contractor shall provide and employ on the site in connection with the execution and maintenance of the works the following: a) Technical personnel, skilled and experienced in their respective trades and are competent to give proper supervision to the work they are required to supervise and execute. The regular skilled employees with experience of the particular work are expected to be employed by the Contractor. b) Such skilled, semi-skilled labour as is necessary for the proper work strictly as per Specification and timely execution and maintenance of the works. No female labour shall be employed after darkness. No person below the age of 18 Years (eighteen years) and above the age of 60 years (sixty years)shall be employed. c) Where required by Law Regulation of Local or other authority, such personnel shall be duly licensed by the Competent Authority to practice their trades, professions and callings. d) The same technical personnel of the Contractor shall continue till completion of work and if at all it is necessary to withdraw any of the technical personnel of the Contractor to any other site, the same shall be done with written approval of Engineer or Purchaser unless it is a case of resignation. e) If any of the personnel is not found to be performing his services in a manner as expected of him, under the contract, the Contractor on advice from the Engineer shall replace such person(s) at his cost with those acceptable to the Engineer, by mutual agreement.

12.9 The Contractor shall be responsible for payment of salaries to the said labour/ employees. The Contractor shall also be liable to extend/ provide all the benefits admissible to said labour/ employee under various laws in force.

12.10 All travelling expenses including provisions of all necessary transport to and fro from site, lodging allowances and other payments to the Contractor's employees shall be sole responsibility of the Contractor.

12.11 The normal working hours on the Site shall be in accordance with the applicable labour laws of India.

13.0 FIRST AID AND LIFE SAVING APPLIANCES

13.1 The Contractor shall provide necessary first aid facilities for all his employees, representatives and workmen working at the site. Sufficient number of Contractor's

personnel shall be trained in administering first-aid. The contractor shall arrange transport facilities needed for emergency treatment at hospitals.

13.2 The Contractor shall provide and maintain upon the Works sufficient proper and efficient first aid equipments to the approval of the Engineer. The equipment shall be available for use at all times.

14.0 CLEANLINESS

14.1 The Contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc., during the period of Contract. The Contractor shall employ enough number of special personnel to thoroughly clean his work-area at least once in a day. All such rubbish and scrap material shall be stacked or disposed as instructed by the Engineer. Materials and stores shall be so arranged by the contractor to permit easy cleaning of the area. In areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect the floor from such damage.

14.2 Similarly the offices of the Contractor shall be kept clean and neat to the entire satisfaction of the Engineer. Proper sanitary arrangements shall be provided by the Contractor, in the work-areas and office of the Contractor.

14.3 In the event Contractor fails to keep his work area clean, the Engineer shall be free to engage alternate labour, after serving written notice to that effect to the Contractor, to clean up the Contractor's work area and realize the amount spent on this account from the Contractor.

14.4 To prevent dust emission, the contractor shall arrange watering facility in work site and roads

15.0 LINES AND GRADES

15.1 All the works shall be performed to the lines, grades and elevation indicated on the drawings. The Contractor shall be responsible to locate the layout of the works. Basic horizontal and vertical control points will be established and marked by the Engineer at site at suitable points. The Contractor shall inform the Engineer well in advance of the time and places at which he wishes to do work in the area allotted to him so that suitable datum points may be established and checked by the Engineer to enable the Contractor to proceed with his works. Any work done without being properly located may be removed and/ or dismantled by the Engineer at Contractor's expense.

16.0 FIRE PROTECTION

16.1 The work procedures that are to be used during the erection shall be those which minimize fire hazards to the extent practicable. Combustible materials, combustible waste and rubbish shall be collected and removed from the site at least once each day. Fuels, oils and volatile or flammable materials shall be stored away from the erection equipment and materials storage areas in safe containers. Untreated canvas paper, plastic or other flammable flexible materials shall not at all be used at site for any other purposes unless otherwise specified. If any such materials are received with the equipment at the site, the same shall be removed and replaced with acceptable materials before moving into the erection area or storage.

16.2 Similarly corrugated paper fabricated cartons, etc shall not be permitted in the erection area either for storage or for handling of materials. All such materials used shall be water proof and flame resistant type. All the other materials such as working drawings, plans etc., which are combustible but essential shall be protected against combustion resulting from welding sparks, cutting flames and other similar fire sources.

16.3 All the Contractor's supervisory personnel and sufficient number of workers shall be trained for fire fighting and shall be assigned specific fire protection duties. Enough No. of such trained personnel must be available at the site during the entire period of the Contract.

16.4 The Contractor shall provide enough fire protection equipment of the types and number for the warehouses, office, temporary structures, labour colony area, etc. Access to such fire protection equipment shall be easy and kept open at all times. The compliance of the above requirements under fire protection shall in no way relieve the Contractor of any of his responsibilities and liabilities due to fire accidents occurring either to his materials and equipments or to those of others working in the area.

17.0 CONTRACTOR'S AREA LIMITS

17.1 The contractor based on discussion with Engineer will mark out the boundary limits of access roads, parking spaces, storage and erections area for the Contractor and the Contractor shall not tress-pass the areas not so marked out for him. The Contractor shall be responsible to ensure that none of his personnel move out of the areas marked out for his operations. In case of such a need for the Contractor's personnel to work, out of the areas marked out for him, the same shall be done only with the written permission of the

Engineer.

18.0 CONTRACTOR'S COOPERATION WITH THE OWNER/ PURCHASER

18.1 In cases where the performance of the erection work by the Contractor affects the operation of the system facilities of the Purchaser, such erection work of the Contractor shall be scheduled to be performed only in the manner stipulated by the Engineer and the same shall be acceptable at all times to the Contractor. The Engineer may impose such restrictions on the facilities provided to the Contractor as he may think fit in the interest of the Purchaser and the Contractor shall strictly adhere to such restrictions and cooperate with the Engineer. It shall be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and operation of the equipment systems which are erected by him.

19.0 PRE-COMMISSIONING TRIALS & INITIAL OPERATIONS & PG TEST

Not Applicable

20.0 MATERIALS HANDLING AND STORAGE

20.1 All the materials, equipments furnished under the Contract and arriving at site shall be promptly received, unloaded and transported and stored in the storage spaces by the Contractor including re-handling re-transporting to erection works.

20.2 Contractor shall be responsible for examining all the consignments and notify the Engineer immediately of any damages, shortage, discrepancy etc for the purpose of Engineer's information only. The Contractor shall submit to the Engineer every week a report detailing all the receipts during the week. However, the Contractor shall be solely responsible for any shortages or damage in transit, handling and/ or in storage and erection of the equipments at the site. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc., shall be to the account of the Contractor.

20.3 All the equipment shall be handled very carefully to prevent any damage or loss. No bare wire rope slings, etc shall be used for unloading and/or handling of the equipment without the specific written permission of the Engineer. The equipment stored shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the storage shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at site. All lifting tools and tackles shall have valid statutory load test certificate and same shall be renewed on expiry of the validity.

20.4 The Contractor shall ensure that all the packing materials, and protection devices used for the various equipment during transit and storage are removed before the equipment are installed. The packing materials and protection devices shall remain the property of the Purchaser and those packing materials and protection devices which are required by the purchaser shall be handed over to him by the Contractor. Those packing materials and protection devices which are not required by the purchaser shall be disposed by the contractor as per the norms of the statutory body. HCSL shall not be responsible for non-adherence to statutory norms for the disposal.

20.5 The consumable and other supplies likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality by storage.

20.6 All the materials stored in the open or dusty location must be covered with suitable weather proof and flame proof covering material wherever applicable.

20.7 If the materials belonging to the Contractor are stored in areas other than those earmarked for him, the Engineer will have the right to get it moved to the area earmarked for the Contractor at the Contractor's cost.

20.8 Dismantling work should be done with due diligence so as not to damage the equipment. The dismantled materials / equipment should be handed over to the Owner at the storage place & site indicated by the Owner.

21.0 CONSTRUCTION/ERECTION MANAGEMENT

21.1 The field activities of the contractors working at site will be coordinated by the Engineer and the Engineer's decision shall be final in resolving any disputes or conflicts between the Contractor and other contractors and tradesmen of the Owner regarding scheduling and coordination of work. Such decision by the Engineer shall not be a cause for extra compensation or extension of time for the Contractor.

21.2 The Engineer shall hold weekly meetings of all the Contractors working at Site, at a time and a place to be designated by the Engineer. The Contractor shall attend meetings and take notes of discussions during the meeting and the decisions of the Owner and shall strictly adhere to that decision in performing his works. In addition to the above weekly meetings, the Owner may call for other meetings either with individual contractors or with selected number of contractors and in such a case the Contractor, if called, will also attend such meetings.

21.3 Time is the essence of the Contract and the Contractor shall be responsible for performance of his works in accordance with the specified erection schedule. If at any time, the Contractor is falling behind the schedule, he shall take necessary action to make good for such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate, such actions in writing to the Engineer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

21.4 The Engineer shall, however, not be responsible for provision of additional labour and/ or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.

22.0 FIELD OFFICE RECORDS

22.1 The Contractor shall maintain at his site office up to date copies of all drawings, Specification and other Contract Document and any other supplementary data complete with all the latest revisions there to. The Contractor shall also maintain in addition the continuous record of all changes to the above Contract documents, drawings, Specification, supplementary data, etc effected at the field and on completion of his total assignment under the Contract shall incorporate all such changes on the drawings and other engineering data to indicate as installed conditions of the equipment furnished and erected under the Contract. Such drawings and Engineering data shall be submitted to the Engineer in required number of copies.

23.0 CONTRACTOR'S MATERIALS BROUGHT ON TO SITE

23.1 The Contractor shall bring to site all equipment component, parts, materials, including erection equipment, tools and tackles for the purpose of the works under intimation to the Engineer. The right on all such goods shall, from the time of their being brought shall rest with the Purchaser but may be used for the purpose of the works only and shall not on any account be removed or taken away by the Contractor without the written permission of the Engineer. The Contractor shall be solely liable and responsible for any loss or destruction thereof and damage thereto.

23.2 The Owner shall have a lien on such goods throughout the period of contract for any sum or sums which may at any time be due or owing to him by the Contractor, under, in respect of or by reasons of the contract. After giving a 15 (fifteen) days notice in writing of his intention to do so, the Owner shall be at liberty to sell and dispose of any such

goods, in such manner as he shall think fit including public auction or private treaty and to apply the proceeds in or towards the satisfaction of such sum or sums due as aforesaid.

23.3 After the completion of the works, the Contractor shall remove under the direction of the Engineer, the materials such as construction/ erection tools and tackles, erection equipment, scaffolding, etc. from the site after written permission of the Engineer. If the Contractor fails to remove such materials, within fifteen (15) days of a notice by the Engineer to do so, then the engineer shall have the liberty to dispose of such materials as detailed in above clause and credit the proceeds thereof to the account of the Contractor.

24.0 PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY

24.1 The Contractor shall be responsible for any damage resulting from his operation. He shall also be responsible for protection of all persons including members of public and employees of the Purchaser and Engineer and the employees of the Contractors and Sub-Contractors and all public and private property including structures, buildings, other plants and equipments and utilities either above or below the ground.

24.2 The Contractor shall ensure provision of necessary safety equipment such as barriers, sign boards, warning lights and alarms, etc to provide adequate protection to persons and property. The Contractor shall be responsible to give reasonable notice to the Engineer, Owner of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his works and shall make all necessary arrangements with such Owners, related to removal and/ or replacement or protection of such property and utilities.

25.0 PAINTING

25.1 Wherever the structures are required to be identified even in low visibility, like railings, edges of structures, etc, shall be painted with reflective paints of approved make and color.

25.2 All exposed metal parts of the equipment including piping, structures, railings etc. wherever applicable, after installation unless otherwise surface protected, shall be first painted with at least one coat of suitable primer which matches the shop primer paint used, after thoroughly cleaning all such parts of all dirt, rust, scales, greases, oils and other foreign materials by wire brushing, scraping or sand blasting, and the same being inspected and approved by the engineer for painting. Afterwards, the above parts shall be finished with two coats of alloyed resin machinery epoxy paints. The quality of the finish

paint shall be as per the Indian Standards or equivalent and to be of the colour as approved by the Engineer.

26.0 UNFAVOURABLE WORKING CONDITIONS

26.1 The Contractor shall confine all his field operations to those works which can be performed without subjecting the equipment and materials/ works to adverse effects during inclement weather conditions, like monsoon, storms etc. and during other unfavourable working/ erection conditions. No field activities shall be performed by the Contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precautions or measures are taken by Contractor in a proper and satisfactory manner in the performance of such works and with the concurrence of the Engineer. Such unfavourable working/ erection conditions will in no way relieve the Contractor of his responsibility to perform the works as per the schedule.

27.0 PROTECTION OF MONUMENTS & REFERENCE POINTS

27.1 The Contractor shall ensure that any finds such as relic, antiquity, coins, fossils, etc which he may come across during the course of performance of his works either during excavation or elsewhere, are properly protected and handed over to the Engineer. Similarly the Contractor shall ensure that the bench marks, reference points etc which are marked out either with the help of Owner or by the Owner shall not be disturbed in any way during the performance of his works. If any work is to be performed which may disturb such references, the same shall be done only after these are transferred to other suitable location under the direction of the Engineer. The Contractor shall provide all necessary materials and assistance for such relocation of reference points etc.

28.0 WORK & SAFETY REGULATIONS

28.1 The Contractor shall ensure the safety of all the workmen, materials and equipments either belonging to him or to others working at site.

28.2 The Contractor will notify the Engineer of his intention to bring on to site any equipment or any container, with liquid or gaseous fuel or other substance which may create hazard. The Engineer shall have the right to prescribe the conditions under which such equipment or container may be handled and used, during the performance of the works and the Contractor shall strictly adhere to such instructions. The Engineer shall have the right to inspect any erection plant for fabricated item and to forbid its use, if in his opinion it is unsafe. No claim due to such prohibition shall be entertained by the Purchaser.

28.3 Where it is necessary to provide and/or store petroleum products or petroleum mixture and explosive, the Contractor shall be, responsible for carrying out such provisions and/or storage in accordance with the rules and regulations laid down in Petroleum Act 1934, Explosive Act 1948, and Petroleum and Carbide of Calcium manual published by the Chief Inspector of Explosives of India. All such storage shall have prior approvals of the Engineer. In case any approvals are necessary from the Chief Inspector of Explosive or any statutory authorities, the Contractor shall be responsible for obtaining the same.

28.4 The Contractor shall be responsible for provision of all safety notices and safety equipment required both by the relevant legislations and the Engineer as he may deem necessary.

28.5 The Contractor shall be responsible for the same storage of his and his Sub-Contractor's radioactive sources, if any.

29.0 ELECTRICAL SAFETY REGULATIONS

29.1 Power supply required for the work shall be arranged by the contractor. In no circumstances will the Contractor interfere with fuses and electrical equipment belonging to the Purchaser. Any approvals required from local statutory bodies shall be obtained by the contractor.

29.2 No electric cable in use by the Contractor/Purchaser shall be disturbed without prior permission. No weight of any description shall be imposed on any such cable and no ladder or similar equipment shall rest against or be attached to it. Only double PVC insulated cables shall be used. ELCBs and MCBs shall be used for all plug boards/distribution boards. Bare cables shall not be connected to plug boards; it shall be connected using suitable plug tops. Safety relay and isolation device shall be provided for welding sets. Hand lamps used shall be of 24V.

29.3 No work shall be carried out on any live equipment. Necessary shutdown of power supply shall be obtained. The equipment must be made safe and a permit to work issued by the Engineer should be obtained before any work is carried out. Double earthing shall be ensured for electrics.

29.4 The Contractor shall employ the necessary number of qualified, full time electricians to maintain his temporary electrical installation.

29.5 The major equipments & plants erection, testing & commissioning shall be as per IER 1956 & Central Electricity Authority clearance and approval shall be obtained by the

contractor at his cost.

30.0 FACILITIES TO BE PROVIDED BY THE OWNER/ PURCHASER

30.1 The following facilities alone shall be provided by the Owner to the Contractor for execution of this work. Any other facility, whatsoever required to complete the works shall be arranged by the Contractor within the contract price.

30.2 **SPACE**

30.2.1 Available open space shall be provided to the Contractor for storage of materials during the period of storage and erection. The bidder shall visit the site and if required shall make his own arrangement for extra space if required at his cost.

30.2.2 No space will be provided by the Purchaser for the Contractor's labour. All facilities for labour housing shall be the sole responsibility of the Contractor. The balance requirement of space over and above what is allotted by HCSL shall be met by the Contractors through his own means.

30.2.3 The Contractor shall make proper arrangement for safe storage and protection of the equipment/materials during storage and erection till commissioning. Any other facility required for the work shall be arranged by the contractor.

31.0 CLOSING OF SITE OFFICE

31.1 After completing the works at site, the contractor shall remove all temporary works constructed by him as identified by the Owner and hand over back to the Owner the balance clear space & un-dismantled closed space as constructed. No cost shall be paid for the sheds handed over to the Owner after closing of the office / storage yard.

31.2 The contractor shall remove all erection equipment brought by him to site for execution of the contract as well as all left out material of supplies,

31.3 All the balance supplies left over after completing the erection works & belonging to the Owner shall be deposited and stacked in the stores as instructed by the Owner.

31.4 Unless all material are removed and clear space is handed over back to the Owner, the final bill payment as well as release of contract performance security shall not be considered by the Owner.

31.5 On completion of the erection activities the contractor shall return the labour license to the Labour Commissioner and submit a proof of having cancelled the labour license to the Owner.

32.0 DEFECTIVE WORKS

32.1 If the works or any portion thereof shall be damaged in any way excepting by the acts of the Purchaser, or if defects not readily detected by prior inspection shall develop before the final completion and acceptance of the whole work, the Contractor shall forthwith make good, without compensation, such damage or defects in a manner satisfactory to the Purchaser/Engineer. In no case shall defective or imperfect work be retained.

33.0 FACILITIES TO BE PROVIDED BY THE CONTRACTOR

33.1 ELECTRICITY

33.1.1 Power supply required for the work shall be arranged by the contractor.

33.1.2 All temporary wiring must comply with safety erection regulations and shall be subjected to approval of statutory authorities as applicable before connection to supply. Purchaser shall not be responsible for any interruption in power supply. The non-availability of supply or its quality shall not be cited as hindrance of work execution.

33.2 WATER

33.2.1 The Contractor shall make his own arrangement for water for erection & drinking purposes.

33.3 TOOLS, TACKLES AND SCAFFOLDINGS

33.3.1 The Contractor shall provide at his own expense, all the erection equipments, erection tools, machine tools, power tools, tackles, hoists cranes, derricks, cables sling, skids, scaffolding, work benches, tools for rigging, cribbing and blocking, welding machines, appliances, materials and supplies required for unloading, transporting, storing, erection, testing and commissioning that may be required to accomplish the work under the Contract unless otherwise to final determination of the Purchaser/ Engineer. He shall submit a list of all such material to the Purchaser/ Engineer before the commencement of preassembly at ‘site’. These tools and tackles shall not be removed from the ‘site’ without the written permission of the Purchaser/ Engineer.

33.3.2 The Contractor shall also furnish all necessary expandable devices like anchors, grinding and abrasive wheels, hacksaw blades, taps, dies, drills, reamers, chisels, files, carborundum stones, wire brushes, necessary scaffolding, ladders, wooden planks, timbers, sleepers and consumable materials like oxygen, acetylene, argon, lubricating oils, greases, cleaning fluids, graphite powder and flakes, fasteners, gaskets, temporary supports, stainless steel shims of various thickness as required, cotton waste, cheese cloth

and all other miscellaneous supplies of every kind required for carrying out the work under the 'Contract'.

33.3.3 The Contractor shall provide all reasonable facilities including tools, personnel, etc., and ensure co-ordination with the Purchaser/ Engineer and the Manufacturer's erection supervisors to enable them to carry out all supervision, measurements, checks etc., in a satisfactory manner.

33.3.4 The Contractor shall inform the Engineer about arrival of all tools, tackles and scaffoldings. The Contractor shall not dispose or transport or withdraw any tools, tackles, equipment and material provided by him for the 'Contract' without taking prior written approval from the Purchaser/Engineer, and the Purchaser/ Owner at all times shall have right to refuse permission for disposal, transport or withdrawal of tools, tackles, equipment and materials, if in his opinion, the same will adversely affect the efficient and expeditious completion of the 'Project'.

34.0 INSURANCE

34.1 In addition to the conditions covered under the clause entitled "Insurance", the following provisions shall also apply to the portion of the works to be done beyond the Contractor's own or his Sub-Contractor's manufacturing works. Comprehensive insurance of equipment during erection and commissioning, workmen's Compensation Insurance, comprehensive Automobile insurance and Comprehensive General Liability Insurance shall be the responsibility of the Contractor. Contractor shall generally take the insurance from nationalized insurance companies

34.2 WORKMEN'S COMPENSATION INSURANCE: The insurance shall protect the Contractor against all claims applicable under the workmen's compensation Act 1948 (Government of India). This policy shall also cover the Contractor against claims for injury, disability, disease or death of his or his Sub-Contractor's employees, which for any reason are not covered under the workmen's compensation Act, 1948. The liabilities shall not be less than: Workmen's compensation: As per statutory provisions Employee's liability : As per statutory provisions Recoveries will be made from Contractor's bills for any liability for the accident and refund shall be considered later after the claim is fully settled by the insurance authorities.

34.3 COMPREHENSIVE AUTOMOBILE INSURANCE The insurance shall be in such a form to protect the Contractor against all claims for injuries, disability, disease and death

to members of public including the Purchaser's men and damage to the property of others arising from the use of motor vehicles during on or off the site operations, irrespective of the ownership of such vehicles. The liability covered shall be as per Motor Vehicles Act.

34.4 COMPREHENSIVE GENERAL LIABILITY INSURANCE

34.4.1 This insurance shall protect the Contractor against all claims arising from injuries, disabilities, diseases or death of members of public or damage to property of others, due to any act or omission on the part of the Contractor, his agents, his employees, his representative and Sub-Contractors or from riots, strikes and civil commotion. This insurance shall also cover all the liabilities of the Contractor arising out of the Clause 45.0 "Defense of Suits" under Section -1 General Terms and Conditions of Contract.

34.4.2 The hazards to be covered will pertain to all the works and areas where, the Contractor, his Sub-Contractors, his agents and his employees have to perform work pursuant to the Contract.

34.5 FIRE INSURANCE: Unless otherwise instructed by the Purchaser/ Engineer, the Contractor shall, on signing the 'Contract', insure the works and keep them insured until the completion of the 'Contract' against loss or damage by fire, with the Company to be approved by the Purchaser/Engineer, in the joint names of the Purchaser and the Contractor for such amount and for any further sum, if called upon to do so by the Purchaser/Engineer, the premium of such further sum being allowed to the Contractor as an authorized extra. Such policy shall cover the property of the Purchaser only and shall not cover any property of the Contractor or any SubContractor, or his employees. The Contractor shall deposit the policy receipts for the premium with the Purchaser/Engineer within twenty one (21) days from the date of signing the 'Contract' unless otherwise instructed by the Purchaser/Engineer. In default of the Contract insuring as provided above, the Purchaser may so insure and may deduct the premiums paid from any money due, or which may become due to the Contractor. The Contractor shall, as soon as the claim under the policy is settled, or the work reinstated by the Insurance Office should they elect to do so, proceed with all due diligence with the completion of the works in the same manner as though the fire had not occurred and in all respects under the same conditions of 'Contract'. The Contractor will arrange all the replacement material damaged during fire accident if any without waiting for finalization of his claim with insurance Company. The claim received if any will be passed on to the Contractor.

34.6 The above are only illustrative list of insurance covers normally required and it shall be the responsibility of the Contractor to maintain all necessary insurance coverage to the extent both in time and amount to take care of all his liabilities either direct or indirect, in pursuance of the Contract.

34.7 Fire insurance is required either separately or under CAR.

35.0 ADHERENCE TO MANUFACTURER'S INSTRUCTION

35.1 Adherence to instructions of the Manufacturer's supervisory engineers, where provided, is compulsory. The Contractor shall ensure presence of manufacturers supervisor at site whenever required and work under the guidance of the Manufacturer's supervisors to ensure that erection procedure adopted by the Contractor as well as completed erection of equipment is such as not to interfere with or prevent equipment from functioning as intended, as well as to the entire satisfaction of the Manufacturer's supervisor/ Purchaser/ Engineer. The Contractor shall also permit and provide all facilities for the Manufacturer's erection supervisors to carry out all checks that they may wish to and approve any erection procedure and / or final setting and alignment of component, in order to satisfy themselves that erection has been carried out as intended by them. This shall, however, in no way relieve the Contractor of his responsibility for providing adequate and competent supervision and quality workmanship. In case of any dispute, the decision of the Engineer or his authorized representative shall be final.

36.0 MODIFICATIONS

36.1 The Contractor shall carry out all modifications at site as directed by the Purchaser/Engineer to complete the work covered in this Contract. It is the responsibility of the Contractor to get the prior approval for such modifications from the Purchaser/ Owner before such works are taken final.

37.0 HANDING OVER

37.1 In the event of the Contractor being prevented by causes not attributable to him from proceeding with erection or from completing erection before he withdraws from the site he shall hand over to the Purchaser for safe keeping during his absence such Contract material that is usable to erect, and the Purchaser will furnish a receipt for material so handed over. Also if particular equipment is handed over before the start of the defect liability period of the plant, then the same can be used by the owner. However responsibility of performance of that equipment shall be with the contractor from the date

of handing over of equipment till the date of completion of defect liability period of plant.

37.2 If the executions of Performance Guarantee Tests (PG tests) are delayed for reasons beyond the control of the Contractor, the plant may be handed over to the Purchaser. However, the Contractor has to complete the PG tests at the appropriate time and establish the Guaranteed Parameters. The Guarantee cover for equipment and spares etc., will take effect only from the date of satisfactory completion of PG tests, and written acceptance of the results by the Purchaser. However the maximum delay shall be limited to 6 months beyond the stipulated dated or a mutually agreed period. During delayed period after handing over, till PG tests, the responsibility of the plant shall be with the contractor. .

38.0 WASTE MATERIALS & DEMOBILISATION

38.1 All waste materials (including waste oil, grease packing material, etc) as decided by the site Engineer should be safely let out of the premises at Contractor's cost and the Contractor should keep the site always clean during progress of work.

38.2 On Completion of work, the Contractor shall promptly demobilize from the site and leave the place within two months from the date of handing over of site to HCSL, in a manner, as directed by the Owner/ Engineer.

39.0 INCIDENTAL WORKS

39.1 All the works such as cleaning, checking, leveling, assembling, temporary erection for alignment, dismantling of certain equipments for checking and cleaning, preparation, fabrication of plates/ sheets, tubes and pipes as per general engineering practice at site, cutting, welding, gauging, grinding, straightening, filling, chipping, drilling, reaming, lapping, shaping, fitting, heat treatment cable laying, etc. and minor civil works as incidental to the erection and necessary to complete the work satisfactorily shall be carried out by the Contractor's workers at no extra cost, to the Owner.

40.0 LIABILITY FOR ACCIDENTS AND DAMAGE

40.1 In this contract the contractor shall be entirely responsible for all loss, damage or depreciation to the plant until the plant has been delivered at the site on the plinth/ structure or as decided by the Engineers.

40.2 The Contractor shall, during the progress of the work, properly cover up and protect the plant from injury by exposure to the weather, and shall take every reasonable, proper, timely and useful precaution against accident or injury to the same from any cause and shall be and remain answerable and liable for all accidents or injuries thereto which until

the same be, occasioned by the acts or omissions of the Contractor or his workmen or Sub-Contractors and all losses and damages to the plant arising from such accidents or injuries as aforesaid shall be made good in the most complete and substantial manner by and at the sole cost of the Contractor and to the reasonable satisfaction of the Engineer.

40.3 Until the plant shall be or deemed to be taken over as aforesaid, the Contractor shall also be liable for and shall be deemed to have indemnified the Purchaser in respect of all damage or injury to any person or to any property of the Purchaser or of others occasioned by the negligence of the Contractor or his workmen or SubContractors or by defective design, work or material, but not otherwise.

40.4 Provided that the Contractor shall not be liable under the Contract for any loss or profit or loss of Contracts or any claims made against the Purchaser not already provided for in the Contract, nor for any damage or injury caused by or arising from the acts of the Purchaser or of others, or (save as to damage by fire as hereinafter provided) due to circumstances over which the Contractor has no control, nor shall his total liability for loss, damage or injury exceed the total value of the Contract.

40.5 The Contractor shall be deemed to have indemnified and save harmless to the Purchaser against all actions, suits, claims, demands, costs or expenses arising in connection with injuries suffered prior to the date when the plant shall have been taken over by person employed by the Contractor or his Sub-Contractor on the works whether under the general law or under the Workmen's Compensation Act VIII of 1923, or any other statute in force on the date of the Contract dealing with the question of the liability of employers for injuries suffered by employees and to have taken steps properly to insure against any claims there under.

40.6 On the occurrence of an accident which results in the death of any of the workmen employed by the Contractor or which is so serious as to be likely to result in the death of any such workmen, the Contractor shall, within 24 hours of the happening of such accident intimate in writing to the Engineer, the fact of such accident. The Contractor shall indemnify the HCSL against all loss or damage sustained by the HCSL resulting directly or indirectly from his failure to give intimation in the manner aforesaid including the penalties or fines if any payable by the HCSL as a consequence of the HCSL's failure to give notice under the workmen's Compensation Act or otherwise, to conform to the provision of the said act in regard to such accident.

40.7 In the event of any claim being made or action brought against the Purchaser involving the Contractor and arising out of the matters referred to and in respect of which the Contractor is liable under this clause, the Contractor shall be immediately notified thereof and he shall, with the assistance if he so requires of the Purchaser, but at the sole expense of the Contractor conduct all negotiations for the settlement of the same or of any litigation that may arise there from. In such case, the Purchaser shall, at the expense of the Contractor, afford all available assistance for any such purpose.

40.8 In the event of an accident in respect of which compensation may become payable under the Workmen's Compensation Act VIII of 1923, whether by the Contractor or by the Government as Principal, it shall be lawful for the Owner to retain out of money due and payable to the Contractor such sum or sums of money as may, in the opinion of the Engineer, but sufficient to meet such liability. The opinion of the Owner shall be final in regard to all matters arising under this clause.

41.0 NIGHT WORK

41.1 The Contractor may work during the night hours to complete the work. Engineer may consider granting permission for working during night hours. Night work shall not entitle the Contractor to any extra payment. Where night work is in progress sufficient lights shall be provided by the Contractor at his cost, to safeguard the workmen and the public and he shall take suitable precautions to prevent accidents. Excavated areas shall be barricaded and provided with red lights/ glow signs as a caution to prevent accidental falls.

42.0 SUBLETTING OF CONTRACT

42.1 The contract is not transferable. No part of the contract shall be sublet without the written permission of the Owner.

43.0 CONTRACT QUALITY ASSURANCE

43.1 The Contractor shall submit immediately after the issue of LOA/Work order, the Quality Assurance Programme (QAP) containing the overall quality management and procedures which he proposes to follow in the performance of the works during various phases as detailed in relevant clauses of the "Technical Specification and Scope of supply and Work" covered in this Specification and this QAP will be reviewed and approved by the OWNER/Owner's Representative.

44.0 PENALTY FOR THE VIOLATION OF FACTORY ACT & RULES

44.1 The contract is liable for termination, if any of the provisions of the factory act and the rules there-under is violated or if the Contractors obligations to ensure security for the project are not complied with.

45.0 FIELD ENGINEERING CLARIFICATIONS

45.1 The Contractor shall provide all necessary field engineering clarifications to the Owner/Purchaser for the overall engineering/startup of equipment supplied by the Contractor.

46.0 CLEANING AND SERVICING

46.1 Upon completion of the work, the Contractor shall remove from the vicinity of the work all plant, buildings, oil, grease, rubbish, unused materials, concrete forms and other materials, belonging to him or used under his discretion, during construction and in the event of his failure to do so, the same will be removed by the Purchaser and the relevant expenditure recovered from the Contractor.

46.2 The Contractor shall ensure that all the equipments shall be free from dirt and loose scales by thoroughly blowing and/or flushing or servicing before being erected.

47.0 IMPLEMENTATION AND FIELD QUALITY PLANS

47.1 It will be the responsibility of the Contractor to ensure that the erection of the equipment supplied by the Contractor is being carried out according to the quality plans and standard manufacturing practice/instructions as given by the manufacturer. In case of any deviations noticed in performing the erection in accordance with such quality plan etc., the Contractor shall forthwith inform the Owner/Purchaser of such deviations. However the Contractor shall be fully responsible for any consequential liability.

47.2 The contractor shall ensure quality norms in welding/heating as per the codal requirements.

48.0 ENTRY PASS FOR LABOUR

48.1 The Contractor shall obtain entry pass for his workers in the prescribed form from the Employer. The Contractor must maintain details of the men employed by him for each work in a separate register. This register must be produced for inspection by HCSL's officers as and when required.

48.2 The Contractor will be held responsible for the theft of any materials belonging to the HCSL if found detected in the Contractor's Lorries plying within the Project premises.

51.0 PHOTOGRAPHS AND PROGRESS REPORT

51.1 The monthly progress report detailing out the progress achieved on all erection activities as compared to the schedules to be submitted by the contractor. The report shall also indicate the reasons for the variance between the schedule and actual progress and the action proposed for correction wherever necessary.

51.2 The Contractor shall furnish two (2) prints each; of photographs showing milestone activity at site to the Owner. Photographs shall be taken as and when required and shall be submitted quarterly for progress review. Photographs shall be adequate in size and number to indicate various stages of erection. Each photograph shall contain the date, the name of the Contractor and the title of the photograph.

51.3 In addition to the above, the erection of critical equipment/ work as directed by Engineer/Owner is to be video-graphed and provided to the Purchaser in the Compact Disc (CD) form for future reference.

52.0 ADHERANCE TO SPECIFICATIONS

52.1 A written statement by the Contractor stating that they will fully meet the requirements of the specification shall be given in the agreement signed by the Contractor.

52.2 The Contractor shall submit the following before the commencement of work:

52.2.1 To furnish details of special precautions and instructions to be followed and checklist for erection, testing and commissioning of the plant.

52.2.2 To furnish all required drawings, documentation for assembly, erection, testing and commissioning of the plant. Instructions regarding storage, handling, precautions, etc. and checklists at various stages till the plant is installed.

52.2.3 Time schedule for design, manufacture, testing and shipment is to be furnished, taking into account the time schedule given by HCSL.

53.0 SAFETY AND SECURITY OF MATERIALS

53.1 Safety and security of material and equipment etc is bidder's responsibility.

54.0 SAFETY, SECURITY AND PROTECTION OF ENVIRONMENT

Subject and without prejudice to any other provision of the Contract, the Contractor shall take all reasonable precautions:

a) In connection with underground water resources (including percolating water) to prevent

(i) Any interference with the supply to or abstraction from such sources

(ii) Pollution of the water so as to affect adversely the quality thereof.

(b) All works shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify the Employer from and against any liability for damages on account of noise or other disturbance created while or in carrying out the work and from and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in regard or in relation to such liability.

(c) The Contractor at his own cost shall make such provisions for lighting of Works, Temporary Works, Materials and Plant and shall provide all such marks and lights as may be required by the Employer or the Engineer or any other authority having jurisdiction over the Site together with all labour stores and services required for their efficient working and use at any time, day or night. The Contractor shall also provide at his own cost every description of watching and maintenance required in connection with the foregoing, and all other services for protecting and securing all places dangerous whether to Contractor's workmen or to other persons until the Works are handed over to the Employer, or till such time when the Engineer decides that such services are no longer required. All lights provided by the Contractor shall be placed or screened such as not to interfere with any navigation lights or with any traffic or signal lights of any local or other authority or disturbance to public.

55.0 ALCOHOLIC LIQUOR OR DRUGS

55.1 The Contractor shall not, otherwise than in accordance with the Statues, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor, or drugs or permit or suffer any such importation, sale, gift, barter disposal by his sub-contractors agents or employees.

56.0 ARMS AND AMMUNITION

56.1 The Contractor shall not give, barter or otherwise dispose of to any persons or person, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

57.0 DIVING OPERATIONS

57.1 Any diving work shall be carried out in accordance with the Diving Operations Regulations of the Government of India.

58.0 PORT OPERATION RULES

58.1 The Contractor shall observe the Conservancy Rules relating to the harbour and shall

always take such necessary additional steps to keep the harbour waters free of noxious or unhygienic matters coming from his works as are required by the Employer. Under no circumstances shall inflammable materials be allowed to spill into the harbour waters.

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APPENDIX-I

The quantities given under the below items may vary to suit the site conditions and this such variations shall not cover in the ambit of variation limit specified for individual items as per clause no 42 of GCC. However, overall increase in contract value mentioned shall be applicable irrespective of variation of quantities mentioned in financial bid.

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI				
BILL OF QUANTITIES FOR LAND SIDE FACILITIES				
LIST OF PROVISIONAL ITEMS				
Sl.No	**BOQ Item No**	**Description**	**Unit**	**Qty**
1	1.01	Earth work in excavation by mechanical means using JCB, in all types of soils in foundations trenches, rafts, column pits, pile caps etc. including dressing of sides and ramming of bottom, disposing surplus earth within the premises in a manner as directed by the Project Manager including side/ back fills upto existing G.L. in layers not exceeding 150mm thick (compacted) including watering, ramming, consolidating and dressing etc. including all and lead upto 100 metres. (For Pile cap)	Cu.m	710.00
2	1.02	Filling in plinth (compacted) including watering, ramming, consolidating and dressing etc.		
3	a)	With selected excavated earth available within the compound including all lead & lift.	Cu.m	710.00
4	b)	with quarry dust brought form outside	Cu.m	270.00
5	3.01	Providing and laying in position cement concrete of specified grade including the cost of centering and shuttering - all work in foundations and in Super Structure.		

6	a)	M10	Cum	900.00
7	b)	M15	Cum	80.00
8	3.05	Providing & laying cinder filling / AAC block in sunken slab or wherever called for, including consolidating/ ramming.	Cu.m	7.50
9	4.01	Providing and laying Brick work with Ist class bricks in foundations & plinth in cement mortar 1:4 (1 cement : 4 coarse sand). The rate shall include curing etc. complete.	Cu.m	65.00
10	7.01(c)	Extra over above the screed concrete floor by providing highly abrasion resistant non-metallic floor hardener by applying NITOFLOR HARDTOP of FOSROC / SIKA CHAPDUR of SIKA / MATERTOP 100 of BASF/STP for a minimum of 3.5 kgs / sqm under dry shake method as directed by EIC	KG	2820.00
11	7.01(d)	**SAW CUTTING OF JOINTS -** Initial Cutting of Contraction Joints in concrete not less than 3 mm and not more than 5mm in width and 1/3 of the thickness of Pavement Quality Concrete layer but not less than 100mm with saw cutting machine as per MORTH Pavement Quality Concrete specification clause and approved design drawings including Quality Control testing, maintenance and protection as directed by and to the satisfaction of Engineer-in-Charge.	RM.	120.00
12	7.01	**SEALING OF JOINTS -** Priming and Sealing of joints in position with polysulphide sealant or polyurethane sealant conforming to B.S.5212 of approved brand applied in expansion/ contraction/construction joints including painting contact surface of the joints with primer of approved brand, over and including a polyethylene rod in	RM.	120.00

		expansion/contraction/construction joints etc., complete by approved mechanical means, tools and tackles etc., as per MORTH Pavement Quality Concrete specification clause and approved design drawings including Quality Control testing, maintenance and protection as directed by and to the satisfaction of Engineer-in-Charge. A closed cell polyethylene foam backing rod shall be inserted in the groove to arrest sealant leakage.		
13	7.03	Soft lanscape preparation with necessary fertilised sub-soil	Sqm	255.00
14	9.04	**PRECAST DRAIN/TRENCH COVER** - Providing and fixing factory made precast RCC perforated drain covers, having concrete of strength not less than M-25, of size 1000 x450x50 mm, reinforced with 8 mm dia four no longitudinal & 9 nos cross sectional T.M.T. hoop bars, including providing 50 mm dia perforations @ 100 to 125 mm c/c, including providing edge binding with M.S. flats of size 50 mm x 1.6 mm complete, all as per direction of Engineer-in-charge. (Size should be changed as per site requirement).	Cu.m	210.00
15	9.05	**MANHOLE/CHAMBER** - Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 coarse sand) R.C.C. top slab with 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), foundation concrete 1:4:8 mix (1 cement : 4 coarse sand : 8 graded stone aggregate 40mm nominal size) inside plastering 12mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm size) finished with a		

		floating coat of neat cement complete as per nominal standard design :		
		Inside size 90x80 cm and up to 90 cm deep including C.I. cover with frame (light duty) 455x610 mm internal dimensions total weight of cover and frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg)		
	a)	With F.P.S. bricks with class designation 75	Each	6.00
16	9.06	Laying , fabricating, and fixing in position steel reinforcement in all reinforced concrete work, including straightening, cutting, removal of loose rust by wire brush and coating with cement slurry, bending, hoisting, laying in position to the shape and profile required at all levels and heights as per drawing & design and/or as directed, binding with 18 gauge MS annealed wire etc. complete. (quoted rate also to include providing & fixing the binding wire, cement mortar, spacer blocks etc.)		
		Thermomechanically treated reinforcement (TMT and/or high yield strength deformed Tor Steel) bars of all grades.	M.T.	42.00
17	9.07	**BRICK WORK** - Brick work with common burnt clay non modular bricks of class designation 7.5 in foundation and plinth.Cement mortar 1:4 (1 cement : 4 coarse sand)	Cum	116.00

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI			
BILL OF QUANTITIES -GROUND FLOOR WATER SUPPLY, SEWAGE AND STROM WATER DRAIN SYSTEM			
-	**LIST OF PROVISIONAL ITEMS**		
S.No	**Description of item**	**Unit**	**Total Quantity**
	INTERNAL		
A-2	Providing and fixing uPVC (Poly Vinyl Chloride) water supply pipes of SCH 80 as per ASTM D 1785 of approved make as per list of makes, using solvent welded uPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2467 with only uPVC solvent cement conforming to ASTM D-2564 with fabricated & sub sequently GI clamps excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including cutting chases and fitting the same with brick masonary as required, All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings. (Inside Duct and Terrace Piping)		
f	65 mm nominal bore	Rm	2.00
g	80 mm nominal bore	Rm	2.00
h	100 mm nominal bore	Rm	2.00

A-4	Disinfecting of water mains with 50ppm of chlorine solution and then flushing the entire pipeline with water etc. all complete as per standard specifications and directed by Engineer-in-charge		
f	65 mm nominal bore	Rm	2.00
g	80 mm nominal bore	Rm	2.00
h	100 mm nominal bore	Rm	2.00
A-6	Providing and fixing CP brass ball valves of model and make as specified in list of make and as per IS all complete as per specifications and as directed by the engineer in charge.		
e	50mm nominal bore	Nos	1.00
A-7	Providing and fixing pressurized float valve (ball cock) PN 10 of SS 304 Ball, Body, piston, Lever and PTEF seat of approved make as specified etc. complete as per specifications and as directed by the engineer in charge.		
b	50mm nominal dia	Nos	1.00
A-8	Supplying and fixing in position water meter with direct meter dial in KL of approved make of required dia. with all integral parts of gunmetal of brass with necessary fittings such as threaded pipes, unions, including necessary fittings and accessories etc. all complete.		
a	40mm nominal dia	Nos	1.00
b	32mm nominal dia	Nos	1.00
A-16	Providing and fixing in RCC tank GI / MS galvanized insert with flanged ends 450mm to 750mm long including puddle flange required, no of companion flanges, bolts, nuts, rubber gaskets, a thick coat of non-setting mastic or plastic cement etc complete.		
c	65mm nominal bore	Nos	1.00
d	80mm nominal bore	Nos	1.00
e	100mm nominal bore	Nos	1.00

f	150mm nominal bore	Nos	1.00
B-1	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with solvent joints laid on wall face, Suspended to ceiling / under sunken areas in toilet, in ground including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection with sanitary fittings and taking the pipelines outside the building into the ducts / crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. excluding erecting necessary temporary scaffolding, civil works etc. all complete as per specifications and as directed by the engineer in charge. (INTERNAL TOILET PIPING)		
a	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	3.00
B2	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with rubber ring joints laid on wall face, vertical in duct, including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection fittings and inspection chambers \ gully traps crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. Excluding MS support as required, erecting necessary temporary scaffolding and make good the walls, ceiling etc, Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.(DUCT)		
a	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	

C	**INTERNAL RAIN WATER SYSTEM**		
C-1	Providing and fixing uPVC pipes, as per IS 4985 of approved make for rain water pipes with rubber ring joints laid on wall face, vertical in duct, Suspended to ceiling including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, erecting necessary temporary scaffolding and make good the walls, ceiling etc., making connection fittings and inspection chambers crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.		
a	160mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	3.00
D.2	Supplying Installing, testing and commissioning of approved make white vitreous china glazed floor mounted pattern European water closet of P/S trap with WC connector etc. with flush tank and angle valves with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make etc., including Supplying and fixing medium grade 40 mm dia. PVC heavy grade 8Kg/sqm pipe of required length for flush pipe Including cutting & making good the walls, floors, slab wherever required etc complete and or as directed by Engineer-in-charge. **(OTHER Toilets)**	Nos	1.00
D.3	Supplying Installing, testing and commissioning of approved make white vitreous china glazed wall hung pattern European water closet of P/S trap with WC connector etc. with concealed 6/3 Dual Flush metropolitan flush valve with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make etc., including Supplying	Nos	1.00

	and fixing medium grade 40 mm dia. PVC heavy grade 8 Kg/sqm pipe of required length for flush pipe Including cutting & making good the walls, floors, slab wherever required etc complete and or as directed by Engineer-in-charge. **(Common Area Toilets)**		
D.5	Supply, Installing, testing and commissioning of wall hung wash basin from approved make white Wash basin including cutting and making good the walls/ floors wherever necessary all complete as per specifications with CP brass bottle trap 1no; CP inlet connection pipe 8mm dia of required length; CP waste half threaded coupling 32mm dia; and CP wall flanges rate shall include 40mm PVC waste pipe of 8kg/sq.cm with necessary pipe fittings of required length of approved make. etc., complete as per specifications and as directed by the engineer in charge.**(Other Toilets)**	Nos	0.00
D.6	Providing, fixing, testing and commissioning of vitreous china **below counter oval wash basin (Size 550 x 400 mm)** with CP brass waste assembly, CP cast brass bottle trap with extension piece, wall flanges and rubber adapters for waste connection complete including CI / MS brackets duly painted, cutting and making good the walls floors wherever required as per specifications and as directed by the engineer in charge.	Nos	1.00
E.2	Supplying and fixing of wash basin Pillar cock of approved make with all flexible pipes of required length & all accessories etc. complete and or as directed by Engineer-in-charge. **(Other Toilets)**	Nos	1.00
E.4.	Supplying and fixing of shower head, concealed Single lever Shower Mixer divertor of approved make with plate with wall flanges including CP overhead shower arm with wall flange and CP shower rose with CP spout of approved make all accessories etc. The work shall include cutting, chasing the walls and making good the walls etc complete and as directed by Engineer-in-	Nos	1.00

	charge. **(for other Bed toilets)** of model and make as specified in the list of makes etc all complete.		
E.6	Supply, installing, testing and commissioning of 15mm CP of Concealed stop cock with wall flanges etc. complete and or as directed by Engineer-in-charge.	Nos	1.00
E.8	Supplying and fixing of BIB COCK (FOR SERVENT/Driver TOILET/Common) etc. complete and or as directed by Engineer-in-charge.	Nos	1.00
E.9	Supplying and fixing of 15mm nominal bore C.P brass long body bibcock with flange of Model and make etc. complete and or as directed by Engineer-in-charge. **(UTILITY AREA)**	Nos	1.00
E.11	Installing, testing and commissioning of approved make SS kitchen sink with single bowl & single drain board made of Stainless steel 18 Gage 1 No.40mm dia CP bottle trap with extension pipe, CP wall flange, CP waste coupling, C.I.brackets.etc. complete and or as directed by Engineer-in-charge.	Nos	1.00
F-2	Make core cutting in RCC beams, slabs, floors etc of one dia higher size than the pipe/trap to be provided excluding filling the annular space with EPOXY based water proofing compound for sealing the joints around the pipes by pressure grouting to make it water tight making good the same after pipes have been duly laid and testing complete etc all complete as per specifications and as directed by the engineer in charge.		
a	25mm dia upto 50 mm dia.	Nos	1.00
b	50mm dia upto 110 mm dia.	Nos	1.00
c	110mm dia. upto 160 mm dia.	Nos	1.00

F-3	Providing & Fixing in position UPVC sleeves with 4Kg/sqcm in RCC slab & Beams excluding filling the annular space with EPOXY based water proofing compound for sealing the joints around the pipes. by pressure grouting to make it water tight including making good the same after pipes have been duly laid and testing complete etc all complete as per specifications and as directed by the engineer in charge.		
a	75mm dia	Nos	1.00
b	110mm dia	Nos	1.00
c	160mm dia	Nos	1.00
d	200 mm dia	Nos	1.00
	EXTERNAL		
G.1	Providing and fixing uPVC (Poly Vinyl Chloride) water supply pipes of SCH 80 as per ASTM D 1785 of approved make as per list of makes, using solvent welded uPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2467 with only uPVC solvent cement conforming to ASTM D-2564 with fabricated & sub sequently GI clamps excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including cutting chases and fitting the same with brick masonary as required, All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings.. **(PIPING FROM UG SUMP TO OHT and Pump room Drain Sump + Irrigation)**		
e	65mm dia	Rm	2.00
f	80mm dia	Rm	3.00
g	100mm dia	Rm	2.00

G.2	Providing, laying, jointing and testing in position the following medium class GI pipes for under ground piping conforming to IS:1239 including all necessary fittings (conforming to IS : 1879) such as elbow, coupler & tee etc. Cost shall be inclusive of excavation, dewatering, backfilling, ramming surrounding the pipe all-round with minimum 150 mm thick compacted silver sand and providing thrust block at distance 2 M C/C. (Pipe shall be provided with anti corrosive protective treatment as per BIS / manufacturer specifications). All work complete as per specification and satisfaction of the Project Manager. **(Main Connection to UG sump + River well pipe to UG sump)**		
d	100 mm dia	RM	3.00
G.3	Supply, installation in position, testing and commissioning of electrically driven horizontal Monobloc pumps of approved equivalent make capable of discharging as indicated below, shall be automatic in operation with control panel, low and high level sensors of approved make provided in the overhead tank of the building, with necessary cables upto the control panel in the pump house near the sump, accessories like pressure guages, footvalves,termination of cables, earthing leads, excluding civil works etc. all complete.		
a	21 cum/hr at 45m head (1 Working + 1 Stand by) - Domestic Transfer Pumps	Nos	1.00
b	10 cum/hr at 45m head (1 Working + 1 Stand by) - Drinking Transfer Pumps	Nos	1.00
G.5	Providing and fixing cast iron wafer type Butterfly valve of the following size complete with bolts, nuts, washers and neoprene gaskets as per specifications.		
c	100mm dia	Nos	1.00
d	150mm dia	Nos	1.00

G.6	Supply, erection, testing and commissioning of CI non- return valve with flanged ends conforming IS 5312		
d	100mm dia	Nos	1.00
G.7	Supplying and fixing of motorised valves of model and make as specified in the list of makes PN 1.0 suitable for 240 Volts, with suitable motorised rotor 3 nos of float type sensors and control panel, to shut and close valve when water level is low / high in water tanks including necessary cabling from terrace OHT to sump pump and control panel etc all complete		
b	40mm dia	Nos	1.00
G.10	Constructing masonry chamber with 75 class designation brick work in cement mortar 1:3 (1 cement : 3 coarse sand) for butterfly valve/ scour valve with RCC top slab 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size), necessary excavation, foundation concrete 1:3:6 (1 sand : 3 coarse sand : 6 graded stone aggregate 20mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3coarse sand) 12mm thick finished with a floating coat of neat cement complete as per standard design.		
a	600x600x600 MM clear inside	No	1.00
b	450x450x600 MM clear inside	No	1.00
H-2	All as in item B-1 above but for the depth upto 2.5M		
a	All types of soils		
i)	Exceeding 80mm dia but not exceeding 300mm dia	Rm	2.00
H-3	Providing and laying plain cement concrete bedding in 1:5:10 below the pipes 100mm thick, projecting 100mm on either side of pipe at all depths etc. all complete		
c	200mm dia	Rm	2.00

H-4	Providing and fixing grade "A" P type 150mm square mouth stoneware gully trap with 100mm dia. Outlet of approved make with cast iron grating housed in 200mm thick brick masonry chamber and water tight cast iron cover 12 Kg with frame of 300x300mm size (inside) as per standard design and drawing including necessary excavation and back filling all complete as per specifications and as directed by the engineer in charge.	Nos	1.00
H-6	Providing, fixing and jointing uPVC as per IS 4985 with solvent joints laid at required slope , with available fittings including cutting and making good masonry or concrete walls wherever necessary and make good the walls, retaining wall etc., making connection fittings and inspection chambers\gully traps etc. complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.		
a	75 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	2
H-8	Providing and fixing SWR PVC P trap with 110mm dia outlet of approved make including connection to PVC Soil pipe, providing and fixing top tail piece with with necessary cement concrete. (For Internal toilets) etc complete as per specifications and as directed by the engineer in charge.	Nos	2.00
H-9	Construction brick masonry inspection chamber as per standard design in cement mortar 1:4, foundation concrete 1:2:4, 150mm thick, inside and outside plastering 12mm thick with cement mortar 1:3 finished with a floating coat of neat cement and making channels in cement concrete M15 neatly finished, top RCC/SFRC cover for medium loads, polypropylene steps, earthwork excavation, getting out the excavated soil and returning the suitable soil as required for refilling, consolidating and disposal of surplus excavated soil within a lead of 50m etc. all complete including manhole cover and frame as per IS etc all		

	complete as per specifications and as directed by the engineer in charge.		
c	1200 x 800 x 1500 mm inside dimension with 100mm thick RCC slab M20 grade with 200 mm thick side walls	Nos	1.00
d	1500 mm dia inside dimension circular manhole with 200 mm thick walls upto 2000 mm depth	Nos	1
e	1500mm dia inside dimension circular manhole with 230 mm thick walls above 2000 mm depth upto 3000 mm depth	Nos	1.00
I.1	Supplying, installing, testing and commissioning of R.C.C NP2 class pipe conforming to IS:458 laid laid to correct levels below ground in trenches upto required depth and grade including collars joining made of spun yarn and stiff mixture of cement mortar 1:1 and curing the joints, testing the joints as per specifications and rectifying any leakages etc and filling the excavated trench with approved quality saturated sand on sides, bottom and top surface of pipe with all leads and lifts, making necessary connections as required etc.,complete as required. (UNDERGROUND)		
d	300mm dia	Rm	2.00
I.1.1	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with solvent joints laid on wall face, Suspended to ceiling / under sunken areas in toilet, in ground including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection with sanitary fittings and taking the pipelines outside the building into the ducts / crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. excluding erecting necessary temporary		

	scaffolding, civil works etc. all complete as per specifications and as directed by the engineer in charge..		
a	200mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	2.00
b	160mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	3.00
I.3	Excavation in trenches all kind of soils (other than in rock requiring chiselling and blasting) for sockets and dressing of sides, ramming of bottoms, including getting out the soil as required and refilling, and refilling of trenches after pipes are laid in layers not exceeding 20 cm watering and consolidation and disposing off surplus earth within a lead of 100M or as directed by the Engineer in charge, providing necessary Shoring & Strutting while excavating etc., complete		
b	Depth of excavation up to 2.5m	Cum.	2.00
I.4	Providing and laying plain cement concrete bedding in 1:5:10 below the pipes 100 mm thick, projecting 100mm on either side of pipe at all depths and haunches upto the center of pipe including shuttering & timbering etc. all complete		
d	300mm dia	Rm	2.00
I.5	Construction of Catch Basin of size mentioned below for external storm water drainage with 230mm thick walls in well burnt table moulded bricks in CM 1:4 over a bed of 100 mm thick PCC 1:4:8 internal walls plastered smooth in CM 1:3 and external walls plastered in1:3 with sponge finish with Fixing perforated Pre-cast RCC covers, capable of taking Medium Duty Vehicular loads manhole cover on top surface flushed to the finished floor level with necessary excavation, back filling the selected		

	excavated earth withall leads and lifts etc., complete as per specifications and as directed by the engineer in charge.		
a	300mm x 300mm (clear internal dimension) upto 450 mm depth	Nos	2
I.7	Providing, fixing and commissioning non clog type mono block submersible drainage pumps suitable for handling solids of 12 mm size with totally water and dust proof motor as specified complete including suitable starter, required relays along with control panel and float switch, inclusive of all terminations and earthing required all complete as per specifications. (STP ROOM+PUMP ROOM)		
a	Capacity 200 lpm & Head 12 m (1 W + 1 SB)	Set	1.00
I.9=8	Providing, fixing and commissioning non clog type mono block submersible drainage pumps suitable for handling solids of 12 mm size with totally water and dust proof motor as specified complete including suitable starter, required relays along with control panel and float switch, inclusive of all terminations and earthing required all complete as per specifications. (BASEMENT STORM WATER SUMP)		
a	Capacity 200 lpm & Head 12 m (1 W + 1 SB)	Set	1
J-3	Providing and fixing 125 mm dia dial pressure gauge to read upto 10kg/sq.cm, to be fixed on delivery main of pump sets with isolation cock.	Nos	1.00
J-4	Providing and fixing in position 125mm dia flanged Cast Iron dirt box Y-Type Strainer having body fabricated in Cast Iron and strainer made of SS perforated sheet having perforations of suitable size.	Nos	1.00

J-5	Supply, delivery and fixing of approved make reflux valve (non return valve) on delivery side of pumps of sizes as mentioned below.		
b	65 mm dia.	Nos	1.00
c	50 mm dia.	Nos	1.00
J-6	Providing and fixing in RCC tank GI / MS galvanized insert with flanged ends 450mm to 750mm long including puddle flange required, no of companion flanges, bolts, nuts, rubber gaskets, a thick coat of non-setting mastic or plastic cement etc complete.		
a	40mm nominal bore	Nos	1.00
f	150mm nominal bore	Nos	1.00
g	200mm nominal bore	Nos	1.00

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI			
BILL OF QUANTITIES -FIRST FLOOR WATER SUPPLY, SEWAGE AND STROM WATER DRAIN SYSTEM			
LIST OF PROVISIONAL ITEMS			
Sl.No	**Description of item**	**Unit**	**Total Quantity**
	INTERNAL		
A-2	Providing and fixing uPVC (Poly Vinyl Chloride) water supply pipes of SCH 80 as per ASTM D 1785 of approved make as per list of makes, using solvent welded uPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2467 with only uPVC solvent cement conforming to ASTM D-2564 with fabricated & sub sequently GI clamps		

	excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including cutting chases and fitting the same with brick masonary as required, All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings. (Inside Duct and Terrace Piping)		
f	65 mm nominal bore	Rm	2.00
g	80 mm nominal bore	Rm	2.00
h	100 mm nominal bore	Rm	2.00
A-4	Disinfecting of water mains with 50ppm of chlorine solution and then flushing the entire pipeline with water etc. all complete as per standard specifications and directed by Engineer-in-charge		
f	65 mm nominal bore	Rm	2.00
g	80 mm nominal bore	Rm	2.00
h	100 mm nominal bore	Rm	2.00
A-6	Providing and fixing CP brass ball valves of model and make as specified in list of make and as per IS all complete as per specifications and as directed by the engineer in charge.		
e	50mm nominal bore	Nos	1.00
A-7	Providing and fixing pressurized float valve (ball cock) PN 10 of SS 304 Ball, Body, piston, Lever and PTEF seat of approved make as specified etc. complete as per specifications and as directed by the engineer in charge.		
b	50mm nominal dia	Nos	1.00
A-8	Supplying and fixing in position water meter with direct meter dial in KL of approved make of required dia. with all integral parts of gunmetal of brass with necessary fittings such as threaded		

	pipes, unions, including necessary fittings and accessories etc. all complete.		
a	40mm nominal dia	Nos	1.00
b	32mm nominal dia	Nos	1.00
A-16	Providing and fixing in RCC tank GI / MS galvanized insert with flanged ends 450mm to 750mm long including puddle flange required, no of companion flanges, bolts, nuts, rubber gaskets, a thick coat of non-setting mastic or plastic cement etc complete.		
c	65mm nominal bore	Nos	1.00
d	80mm nominal bore	Nos	1.00
e	100mm nominal bore	Nos	1.00
f	150mm nominal bore	Nos	1.00
A-19	Providing and fixing electronic type level indicator for water tanks with low voltage Relays and Seamless Steel probes and PVC shroud, including necessary wiring and conduiting from probes to display panel/motor control panels, mounting in panel with following features, level display, alarm when water level is low or high, full range from one level to 3 level display and manual reset from alarm, etc with electrical wiring conduit supports from wall & ceiling probs and other accessories complete as required.	Set	1.00
A-20	Providing and fixing heavy duty Polypropylene pvc rungs in RCC wall of water tanks etc. including cutting, chasing the RCC work and making good the same complete as required.		
a	Polypropylene PVC Rungs	Nos	1.00
A-21	Providing and fixing 600 mm x 600mm dia cast iron (Medium duty) Overhead water tank cover with frame CI seat and lock complete in all regards (Total WT of cover and frame to be not less than 21 kg). (OHT)	Nos	1.00

B-1	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with solvent joints laid on wall face, Suspended to ceiling / under sunken areas in toilet, in ground including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection with sanitary fittings and taking the pipelines outside the building into the ducts / crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. excluding erecting necessary temporary scaffolding, civil works etc. all complete as per specifications and as directed by the engineer in charge. (INTERNAL TOILET PIPING)		
a	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	2.00
B-2	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with rubber ring joints laid on wall face, vertical in duct, including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection fittings and inspection chambers \ gully traps crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. Excluding MS support as required, erecting necessary temporary scaffolding and make good the walls, ceiling etc, Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.(DUCT)		
a	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	1.00

C-1	Providing and fixing uPVC pipes, as per IS 4985 of approved make for rain water pipes with rubber ring joints laid on wall face, vertical in duct, Suspended to ceiling including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, erecting necessary temporary scaffolding and make good the walls, ceiling etc., making connection fittings and inspection chambers crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.		
a	160mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	1.00
D.2	Supplying Installing, testing and commissioning of approved make white vitreous china glazed floor mounted pattern European water closet of P/S trap with WC connector etc. with flush tank and angle valves with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make etc., including Supplying and fixing medium grade 40 mm dia. PVC heavy grade 8Kg/sqm pipe of required length for flush pipe Including cutting & making good the walls, floors, slab wherever required etc complete and or as directed by Engineer-in-charge. **(OTHER Toilets)**	Nos	1.00
D.3	Supplying Installing, testing and commissioning of approved make white vitreous china glazed wall hung pattern European water closet of P/S trap with WC connector etc. with concealed 6/3 Dual Flush metropolitan flush valve with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make etc., including Supplying and fixing medium grade 40 mm dia. PVC heavy grade 8 Kg/sqm	Nos	1.00

	pipe of required length for flush pipe Including cutting & making good the walls, floors, slab wherever required etc complete and or as directed by Engineer-in-charge. **(Common Area Toilets)**		
D.5	Supply, Installing, testing and commissioning of wall hung wash basin from approved make white Wash basin including cutting and making good the walls/ floors wherever necessary all complete as per specifications with CP brass bottle trap 1no; CP inlet connection pipe 8mm dia of required length; CP waste half threaded coupling 32mm dia; and CP wall flanges rate shall include 40mm PVC waste pipe of 8kg/sq.cm with necessary pipe fittings of required length of approved make. etc., complete as per specifications and as directed by the engineer in charge.**(Other Toilets)**	Nos	1.00
D.6	Providing, fixing, testing and commissioning of vitreous china **below counter oval wash basin (Size 550 x 400 mm)** with CP brass waste assembly, CP cast brass bottle trap with extension piece, wall flanges and rubber adapters for waste connection complete including CI / MS brackets duly painted, cutting and making good the walls floors wherever required as per specifications and as directed by the engineer in charge.	Nos	1.00
E.2	Supplying and fixing of wash basin Pillar cock of approved make with all flexible pipes of required length & all accessories etc. complete and or as directed by Engineer-in-charge. **(Other Toilets)**	Nos	2.00
E.4.	Supplying and fixing of shower head, concealed Single lever Shower Mixer divertor of approved make with plate with wall flanges including CP overhead shower arm with wall flange and CP shower rose with CP spout of approved make all accessories etc. The work shall include cutting, chasing the walls and making	Nos	1.00

	good the walls etc complete and as directed by Engineer-in-charge. of model and make as specified in the list of makes etc all complete.		
E.6	Supply, installing, testing and commissioning of 15mm CP of Concealed stop cock with wall flanges etc. complete and or as directed by Engineer-in-charge.	Nos	1.00
E.8	Supplying and fixing of BIB COCK (FOR SERVENT/Driver TOILET/Common) etc. complete and or as directed by Engineer-in-charge.	Nos	1.00
E.9	Supplying and fixing of 15mm nominal bore C.P brass long body bibcock with flange of Model and make etc. complete and or as directed by Engineer-in-charge. **(UTILITY AREA)**	Nos	1.00
E.11	Installing, testing and commissioning of approved make SS kitchen sink with single bowl & single drain board made of Stainless steel 18 Gage 1 No.40mm dia CP bottle trap with extension pipe, CP wall flange, CP waste coupling, C.I.brackets.etc. complete and or as directed by Engineer-in-charge.	Nos	1.00
F-2	Make core cutting in RCC beams, slabs, floors etc of one dia higher size than the pipe/trap to be provided excluding filling the annular space with EPOXY based water proofing compound for sealing the joints around the pipes by pressure grouting to make it water tight making good the same after pipes have been duly laid and testing complete etc all complete as per specifications and as directed by the engineer in charge.		
a	25mm dia upto 50 mm dia.	Nos	1.00
b	50mm dia upto 110 mm dia.	Nos	1.00
c	110mm dia. upto 160 mm dia.	Nos	1.00

F-3	Providing & Fixing in position UPVC sleeves with 4Kg/sqcm in RCC slab & Beams excluding filling the annular space with EPOXY based water proofing compound for sealing the joints around the pipes. by pressure grouting to make it water tight including making good the same after pipes have been duly laid and testing complete etc all complete as per specifications and as directed by the engineer in charge.		
a	75mm dia	Nos	1.00
b	110mm dia	Nos	1.00
c	160mm dia	Nos	1.00
d	200 mm dia	Nos	1.00
	EXTERNAL		
G.1	Providing and fixing uPVC (Poly Vinyl Chloride) water supply pipes of SCH 80 as per ASTM D 1785 of approved make as per list of makes, using solvent welded uPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2467 with only uPVC solvent cement conforming to ASTM D-2564 with fabricated & sub sequently GI clamps excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including cutting chases and fitting the same with brick masonary as required, All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings.. **(PIPING FROM UG SUMP TO OHT and Pump room Drain Sump + Irrigation)**		
e	65mm dia	Rm	2
f	80mm dia	Rm	2
g	100mm dia	Rm	2

G.2	Providing, laying, jointing and testing in position the following medium class GI pipes for under ground piping conforming to IS:1239 including all necessary fittings (conforming to IS : 1879) such as elbow, coupler & tee etc. Cost shall be inclusive of excavation, dewatering, backfilling, ramming surrounding the pipe all-round with minimum 150 mm thick compacted silver sand and providing thrust block at distance 2 M C/C. (Pipe shall be provided with anti corrosive protective treatment as per BIS / manufacturer specifications). All work complete as per specification and satisfaction of the Project Manager. **(Main Connection to UG sump + River Well pipe to UG sump)**		
d	100 mm dia	RM	2.00
G.3	Supply, installation in position, testing and commissioning of electrically driven horizontal Monobloc pumps of approved equivalent make capable of discharging as indicated below, shall be automatic in operation with control panel, low and high level sensors of approved make provided in the overhead tank of the building, with necessary cables upto the control panel in the pump house near the sump, accessories like pressure guages, footvalves,termination of cables, earthing leads, excluding civil works etc. all complete.		
a	21 cum/hr at 45m head (1 Working + 1 Stand by) - Domestic Transfer Pumps	Nos	1
b	10 cum/hr at 45m head (1 Working + 1 Stand by) - Drinking Transfer Pumps	Nos	1
G.5	Providing and fixing cast iron wafer type Butterfly valve of the following size complete with bolts, nuts, washers and neoprene gaskets as per specifications.		
c	100mm dia	Nos	1.00
d	150mm dia	Nos	1.00

G.6	Supply, erection, testing and commissioning of CI non- return valve with flanged ends conforming IS 5312		
d	100mm dia	Nos	1.00
G.7	Supplying and fixing of motorised valves of model and make as specified in the list of makes PN 1.0 suitable for 240 Volts, with suitable motorised rotor 3 nos of float type sensors and control panel, to shut and close valve when water level is low / high in water tanks including necessary cabling from terrace OHT to sump pump and control panel etc all complete		
b	40mm dia	Nos	1
G.9	Construction of water meter chamber 1200x900x800 mm inside with brick masonry in CM (1:4), 230mm thick, inside and outside plastering in CM (1:4), for water meter with 100 mm THK RCC top slab 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominalsize), 150mm thick, necessary reinforcement, excavation, foundation concrete 1:3:6 (1 sand : 3 coarse sand : 6 graded stone aggregate 40mm nominal size), 100mm thick, inside and outside plastering with cement mortar 1:3 (1 cement : 3coarse sand) 12mm thick finished with a floating coat of neat cement complete as per standard design. etc all complete as per specifications and as directed by the engineer in charge.		
	1200mm x 900mm x 800mm clear inside	Nos	1.00
G.10	Constructing masonry chamber with 75 class designation brick work in cement mortar 1:3 (1 cement : 3 coarse sand) for butterfly valve/ scour valve with RCC top slab 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size), necessary excavation, foundation concrete 1:3:6 (1 sand : 3 coarse sand : 6 graded stone aggregate 20mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3coarse		

	sand) 12mm thick finished with a floating coat of neat cement complete as per standard design.		
a	600x600x600 MM clear inside	No	1.00
b	450x450x600 MM clear inside	No	1.00
H-2	All as in item B-1 above but for the depth upto 2.5M		
a	All types of soils		
i)	Exceeding 80mm dia but not exceeding 300mm dia	Rm	1
H-3	Providing and laying plain cement concrete bedding in 1:5:10 below the pipes 100mm thick, projecting 100mm on either side of pipe at all depths etc. all complete		
c	200mm dia	Rm	1
H-4	Providing and fixing grade "A" P type 150mm square mouth stoneware gully trap with 100mm dia. Outlet of approved make with cast iron grating housed in 200mm thick brick masonry chamber and water tight cast iron cover 12 Kg with frame of 300x300mm size (inside) as per standard design and drawing including necessary excavation and back filling all complete as per specifications and as directed by the engineer in charge.	Nos	1
H-6	Providing, fixing and jointing uPVC as per IS 4985 with solvent joints laid at required slope , with available fittings including cutting and making good masonry or concrete walls wherever necessary and make good the walls, retaining wall etc., making connection fittings and inspection chambers\gully traps etc. complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.		

a	75 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	1
H-8	Providing and fixing SWR PVC P trap with 110mm dia outlet of approved make including connection to PVC Soil pipe, providing and fixing top tail piece with with necessary cement concrete. (For Internal toilets) etc complete as per specifications and as directed by the engineer in charge.	Nos	1
H-9	Construction brick masonry inspection chamber as per standard design in cement mortar 1:4, foundation concrete 1:2:4, 150mm thick, inside and outside plastering 12mm thick with cement mortar 1:3 finished with a floating coat of neat cement and making channels in cement concrete M15 neatly finished, top RCC/SFRC cover for medium loads, polypropylene steps, earthwork excavation, getting out the excavated soil and returning the suitable soil as required for refilling, consolidating and disposal of surplus excavated soil within a lead of 50m etc. all complete including manhole cover and frame as per IS etc all complete as per specifications and as directed by the engineer in charge.		
a	600 x 600 x up to 900 mm inside dimension with100mm thick RCC slab M20 grade with 200 thick side walls	Nos	1
b	800 x 800 x 1200 mm inside dimension with 100mm thick RCC slab M20 grade with 200 mm thick side walls	Nos	1
c	1200 x 800 x 1500 mm inside dimension with 100mm thick RCC slab M20 grade with 200 mm thick side walls	Nos	1
d	1500 mm dia inside dimension circular manhole with 200 mm thick walls upto 2000 mm depth	Nos	1
e	1500mm dia inside dimension circular manhole with 230 mm thick walls above 2000 mm depth upto 3000 mm depth	Nos	1

I.1	Supplying, installing, testing and commissioning of R.C.C NP2 class pipe conforming to IS:458 laid laid to correct levels below ground in trenches upto required depth and grade including collars joining made of spun yarn and stiff mixture of cement mortar 1:1 and curing the joints, testing the joints as per specifications and rectifying any leakages etc and filling the excavated trench with approved quality saturated sand on sides, bottom and top surface of pipe with all leads and lifts, making necessary connections as required etc.,complete as required. (UNDERGROUND)		
d	300mm dia	Rm	2
I.1.1	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with solvent joints laid on wall face, Suspended to ceiling / under sunken areas in toilet, in ground including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection with sanitary fittings and taking the pipelines outside the building into the ducts / crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. excluding erecting necessary temporary scaffolding, civil works etc. all complete as per specifications and as directed by the engineer in charge..		
a	200mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	1
b	160mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	1
I.3	Excavation in trenches all kind of soils (other than in rock requiring chiselling and blasting) for sockets and dressing of sides, ramming of bottoms, including getting out the soil as required and refilling, and refilling of trenches after pipes are laid in layers not exceeding 20 cm watering and consolidation and disposing off surplus earth within a lead of 100M or as directed		

	by the Engineer in charge, providing necessary Shoring & Strutting while excavating etc., complete		
b	Depth of excavation up to 2.5m	Cum.	0
I.4	Providing and laying plain cement concrete bedding in 1:5:10 below the pipes 100 mm thick, projecting 100mm on either side of pipe at all depths and haunches upto the center of pipe including shuttering & timbering etc. all complete		
d	300mm dia	Rm	2
I.5	Construction of Catch Basin of size mentioned below for external storm water drainage with 230mm thick walls in well burnt table moulded bricks in CM 1:4 over a bed of 100 mm thick PCC 1:4:8 internal walls plastered smooth in CM 1:3 and external walls plastered in1:3 with sponge finish with Fixing perforated Pre-cast RCC covers, capable of taking Medium Duty Vehicular loads manhole cover on top surface flushed to the finished floor level with necessary excavation, back filling the selected excavated earth withall leads and lifts etc., complete as per specifications and as directed by the engineer in charge.		
a	300mm x 300mm (clear internal dimension) upto 450 mm depth	Nos	1
I.6	Providing and constructing Rain water recharge pits the clear dimensions mentioned as per drawing and filling the normal aggreate gelly up to 300 mm, coarse sand 300mm, 40mm size aggregate gelly up to 400mm and brick bat up to 500mm depth with precast SFRC cover with frame and recessed top cover of 600 x 600mm, 110 mm IS 4985 6kg PVC pipe upto 3M and perforated IS 4985 6kg PVC pipe with Geo filter fabric upto 6M, inlet and outlet arrangements, and including excavation, backfilling, curing with all leads and lifts as per the detailed drawings, disposing the surplus earth according to site condition		

	as directed by site in charge. etc,complete as per specifications and as directed by the engineer in charge.		
a	Size : 3000mm X1500mm X 1500mm effective depth	Nos	1
I.7	Providing, fixing and commissioning non clog type mono block submersible drainage pumps suitable for handling solids of 12 mm size with totally water and dust proof motor as specified complete including suitable starter, required relays along with control panel and float switch, inclusive of all terminations and earthing required all complete as per specifications. (STP ROOM+PUMP ROOM)		
a	Capacity 200 lpm & Head 12 m (1 W + 1 SB)	Set	1
I.9=8	Providing, fixing and commissioning non clog type mono block submersible drainage pumps suitable for handling solids of 12 mm size with totally water and dust proof motor as specified complete including suitable starter, required relays along with control panel and float switch, inclusive of all terminations and earthing required all complete as per specifications. (BASEMENT STORM WATER SUMP)		
a	Capacity 200 lpm & Head 12 m (1 W + 1 SB)	Set	1
J-3	Providing and fixing 125 mm dia dial pressure gauge to read upto 10kg/sq.cm, to be fixed on delivery main of pump sets with isolation cock.	Nos	1
J-4	Providing and fixing in position 125mm dia flanged Cast Iron dirt box Y-Type Strainer having body fabricated in Cast Iron and strainer made of SS perforated sheet having perforations of suitable size.	Nos	1

J-5	Supply, delivery and fixing of approved make reflux valve (non return valve) on delivery side of pumps of sizes as mentioned below.		
b	65 mm dia.	Nos	1
c	50 mm dia.	Nos	1
J-6	Providing and fixing in RCC tank GI / MS galvanized insert with flanged ends 450mm to 750mm long including puddle flange required, no of companion flanges, bolts, nuts, rubber gaskets, a thick coat of non-setting mastic or plastic cement etc complete.		
a	40mm nominal bore	Nos	1
f	150mm nominal bore	Nos	1
g	200mm nominal bore	Nos	1

HOOGHLY COCHIN SHIPYARD LIMITED

(A WHOLLY-OWNED SUBSIDIARY OF COCHIN SHIPYARD LTD)

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

TENDER NO: HCSL/PANDU/TEN/002/2022-23, Dt.- 01.11.2022

COVER A

SECTION –VI

EMPLOYERS REQUIREMENT

CONTENTS OF EMPLOYERS REQUIRMENT

HOOGHLY COCHIN SHIPYARD LIMITED

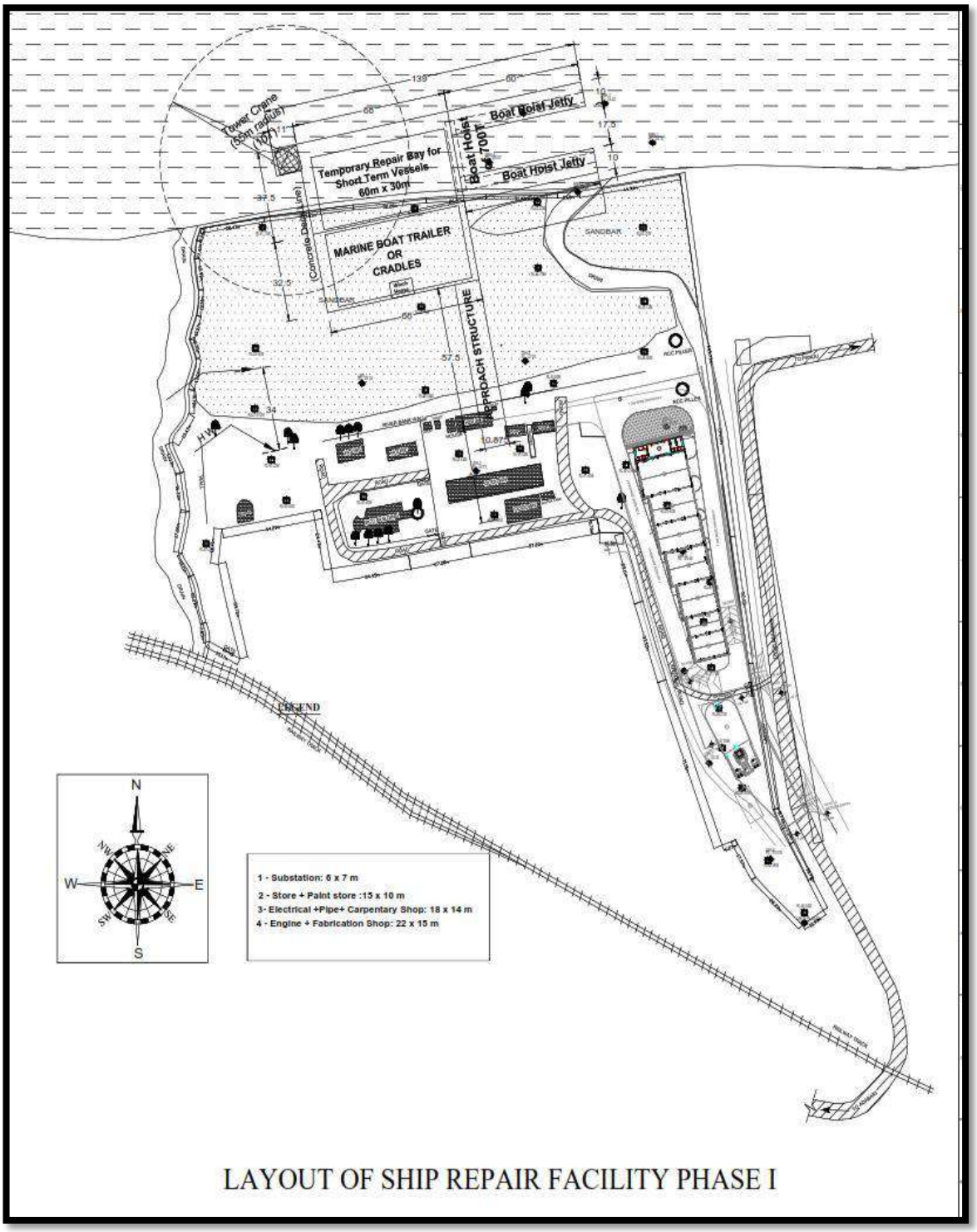
EMPLOYERS REQUIREMENT

1. INTRODUCTION AND OBJECTIVE

The proposed project of HSCL located at Pandu, Assam. Pandu Multimodal IWT Terminal is a riverine Terminal in the Indian state of Assam, serving North Eastern states in general and Assam and Guwahati in particular. This Terminal has been developed on the bank of the Brahmaputra River. The ship repair facility is proposed on the eastern side of existing jetty at Pandu Multimodal IWT Terminal at a distance of about 350m. The latitude and longitude of the ship repair facility is 26°10'15.01"N and 91°40'59.87"E.

Development of ship repair facility consisting of two phases. In the present tender Phase I development only considered. The location and details of proposed ship repair facilities are shown in enclosed drawings in **Fig 1.1**

Figure 1-1: View of Pandu



LAYOUT OF SHIP REPAIR FACILITY PHASE I

2 SCOPE OF WORK

The Contract for the ship repair facility with support facilities shall have the detailed scope of work as mentioned, but not limited to the following.

Water side development

The Phase I of ship repair facility consist of boat hoist jetty, transfer bay and repair bay. The proposed boat hoist jetty length is 60m and width is 10m parallel to the river. The transfer bay length is 68m and width is 37.5m. The repair bay length is 68m and width is 32.5m.

Boat Hoist jetty

The proposed cross section of boat hoist jetty consists of open piled type of jetty and the pile diameter is 1.3m. The length of jetty is 60m and width is 10m. The transverse and longitudinal beam dimensions are 1.75m x 2m and 1.5m x 2m. The centre to centre pile spacing is 6.16m in longitudinal direction and 8.25m in transvers direction. The adopted thickness of deck slab is 700mm and the wearing coat of 100mm is provided. The deck level of jetty is +53.50m.

Transfer Bay

The proposed cross section of transfer bay consists of open piled type of jetty and the pile diameter is 1.3m. The length of jetty is 68m and width is 37.5m. The transvers and longitudinal beam dimension is 1.5m x 2.5m and 1.75m x 2m. The centre to centre pile spacing is 6.375m in longitudinal direction and 7.625m and 9.625m in transvers direction .The adopted thickness of deck slab is 800mm and the wearing coat of 100mm is provided. The deck level of jetty is +53.50m.

Repair Bay

The proposed cross section of repair bay consists of open piled type of jetty and the pile diameter is 1.2m. The length of jetty is 68m and width is 32.5m. The transvers and longitudinal beam dimension is 1.5m x 2m. The centre to centre pile spacing is 6.375m in longitudinal direction and 7.0m in transvers direction. The adopted thickness of deck slab is 700mm and the wearing coat of 100mm is provided. The deck level of jetty is +53.50m.

Land side development

The ship repair facility at Pandu in Guwahati has a sprawling space consisting of PEB shed divided into Fabrication yard, electrical and outfitting shops, Store and scrap yard. Further the land side developments includes admin block, Canteen & substation building , Store, Carpentry shop, Pipe shop , Fire and safety building/Rest Room , Drive way and landscape etc

2.1 The detailed scope of work covered in this contract are as follows.

2.1.1 Water side development

- Providing RCC bored piles of 1300mm and 1200mm which includes positioning & setting up, erection of cylindrical Liners, Boring, M 40 concreting of piles etc
- Trimming of pile heads
- Testing of piles – Dynamic pile load Test, Integrity test & Routine and Initial Vertical load test.
- Providing pile muff with M40 Concrete
- Providing Column with M40 Concrete
- Providing precast and cast in situ Beams with M40 Concrete
- Providing precast and cast in situ slabs with M40 Concrete
- Supplying, fabricating and placing of TMT, Fe500D grade steel for reinforcement works
- Providing wearing coat with M30 Concrete
- Supplying, handling, transporting and fixing in position of Arc fender(800)
- Supplying, handling, transporting and fixing in position of Bollard (30 ton capacity)

2.1.2 Land side development

- Earth work excavation
- Providing pre constructional anti termite treatment.
- Providing RCC bored piles of 800 mm dia which includes positioning & setting up, , Boring, M 35 concreting of piles etc
- Testing of piles –Integrity test & Routine and Initial Vertical load test.

- Providing and laying M35 RCC works for Footings, pile cap, columns, beams, slabs, retaining wall etc
- Supplying, fabricating and placing of TMT 500 D grade steel for reinforcement works
- Brick work in CM 1:4 for walls
- Plastering with CM1:4/1:3 for wall /ceiling
- Painting the exposed surfaces
- Providing and fixing MS Perforated rolling shutter
- P/F 40 mm thk Commercial Flush shutter with 1mm thick laminate on both sides/one side.
- Providing and fixing UPVC glazed openable windows/ ventilators and sliding window
- Providing and fixing Aluminum Composite Panel of Eurobond/Aludecor make, cladding in combination of Metallic / Solid colours for elevation works.
- Providing & laying 80 mm thick reflective type interlocking paver block
- Providing and fixing factory made precast RCC drain covers
- Constructing brick masonry manhole
- Providing structural steel members for columns, truss members etc
- Providing and fixing Bare Galvalume sheets of 0.47mm thk
- Providing site development works
- Providing water proofing works.
- Providing internal and External water supply and sanitary arrangements works

All other miscellaneous works for proper completion of works. Further any other buildings, structures and works necessary and not specifically mentioned here but required for construction, operation and maintenance of the ship repair facility conforming to other sections of this tender document are deemed to be included in the scope of the Contractor.

The work under this tender should complement with the other tenders hence the contractor to carry out the construction activity in synchronizing with other contractor.

3 HSE COMPLIANCES

The Contractor shall be ensured in a significant manner for compliance of HSE issued by the Employer /Engineer during the entire execution period.

4 GENERAL SCOPE OF SUPPLY AND SERVICES

- Intermediate site storage, transport to erection area, Receipt of material at site including unloading from carriers at site, handling, storage & preservation at site and intra site transport.
- Inspection, testing, cleaning, painting, marking, etc. at the contractor's and/or sub- contractors' workshops, delivery and transportation to the site, including insurance, unloading, etc
- Overall Project management, project control, quality assurance, site management and coordination for all technical matters, interconnections, connection to off-site facilities, scheduling, contractual matters and obligations, etc. with suppliers, sub- suppliers, subcontractors, vendors, the Employer, authorities as required for the implementation, construction and putting into commercial operation of the whole project under the overall and sole responsibility of the contractor.
- Carry out all necessary civil and construction works at site as specified.
- Supply of all information, documents, calculations, drawings, reports, etc. which are required for Employer's approval and to obtain all necessary permits, clearances, from the Government authorities.
- Apply for all permits and get the authorities approval for all actions, which require approval or permit from local government and statutory authorities for execution of project works such as insurance, labour license, EPF/ESIC, NOC from government agencies such as PCB, Legal metrology, mining and geology etc. All fees shall be paid by the Contractor.
- Provision of all labor, necessary construction and erection equipment, temporary site facilities, contractor staff welfare facilities, temporary connections for power supply, water supply, etc. for construction, erection and

commissioning required for the fulfillment of the Contractor's duties in connection with the works and for completion of the entire project in time.

- Provision of all accommodation, transport, canteen facility, social facilities, etc. for the Contractor's personnel employed at site. Labour accommodation at site shall notbe allowed.
- Co-ordination with other agencies for this project engaged by Employer
- Cleaning and application of corrosion protection during erection as required by the Employer and apply final & touch up painting in accordance with the specification.
- Tentative list of required approvals if any are as mentioned below. However, contractor shall consider all other necessary approvals, wherever essential for completion and handing over of project / system.
    - Local Authorities for construction Pollution Control Board
    - Revenue department Labour inspectorate EPFO/ESIC
    - Legal metrology Mining and Geology
    - Chief Controller ofExplosive
    - Wireless communication – Ministry of telecommunication Customs Department
    - Chief Electrical Inspector to Government Factories & boilers dept.
    - Central Electricity Authority,

5. PERIOD OF CONTRACT

The time of completion of work of 18 months shall be reckoned from the 30th day of the date of the work order or the date of handing over the site whichever is later. The time allowed for carrying out the work as mentioned above shall be strictly observed by the contractor. The work throughout the time period shall be proceed with diligence keeping in view that time being deemed to be the essence of the contract.

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COVER A

SECTION-VII

TECHNICAL SPECIFICATIONS

SECTION VII

TECHNICAL SPECIFICATIONS – CIVIL WORKS

TABLE OF CONTENTS

VOLUME IV

TECHNICAL SPECIFICATIONS – CIVIL WORKS

i. The following technical specification, code of practice etc. referred herein is form a part of the Item Specification and work shall be executed accordingly. Items which are not covered under Technical Specification shall be carried out as per relevant IS Specification or as per manufactures specification or as directed by Engineer.

ii. In case of discrepancy between technical specification and item specification provided along with Bill of Quantities, the Item Specification shall prevail.

iii. All the measurements shall be as per latest edition of B.I.S.

iv. Contractor is required to submit a methodology of work in conforming to BoQ, technical specification, conditions of contract and sound engineering practices and get it approved by Engineer before the commencement of any new work.

v. The existing ground level at site varies from (+) 7.3mCD to (+) 8.00mCD. CD (0.0 Chart Datum is 0.0 KODS).

1 EARTH WORK

1.1 Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

IS - 4081 Safety code for blasting and related drilling operation.

IS - 1200 Method of measurement of building works.

IS - 3764 Safety code for excavation work.

IS - 3385 Code of practice for measurement of Civil works.

IS - 2720 Part II Determination of moisture content.

- Part VIII Determination of moisture content dry density relation using light compaction.
- Part XXVIII Determination of dry density of soils, in-place by the sand replacement method.

- Part XXIX Determination of dry density of soils, in-place, by the core cutter method.

1.2 General

Contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels for various works such as earthwork in excavation for levelling, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines, etc. It is necessary to establish permanent bench mark at such point which will not be affected by subsequent work. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to establish reference/grid lines at 5 m intervals or nearer as determined by Engineer based on ground profile.

The area to be excavated/ filled shall be cleared of fences, trees, plants, logs, slumps, bush, vegetations, rubbish slush, etc., and other objectionable matter. If any roots or stumps of trees are found during excavation, they shall also be removed. The material so removed shall be disposed off as directed by Engineer. Where earth fill is intended, the area shall be stripped of all loose/soft patches, top soil containing deleterious matter/materials before fill commences.

In firm soil if the excavation is deeper than 2 m and in loose, soft or slushy soil, the width of the step shall be suitably increased or the sides sloped or shoring and strutting may be done as per the Engineer's instructions without any extra cost.

For excavation in trenches for pipes nothing extra shall be payable for the lift irrespective of the depth unless specifically mentioned otherwise in the Schedule of Quantities.

The trenches which are ready for concreting shall be got approved by the Engineer.

The excavated stacked earth shall be refilled in the trenches and sides of foundation in 200 mm layers and the balance surplus shall be first filled in layers in plinth and the remaining surplus shall be disposed off by uniform spreading within the site/outside the site as directed by the Engineer.

Adequate protective measures shall be taken by the Contractor to see that the excavation for the building foundation does not affect the adjoining structure's stability and safety. Contractor will be responsible if he has not taken precaution for the safety of the people,

workers property or neighbor's property caused by his negligence during the constructional operations.

1.3 Lead

Lead for disposal of excavated material inside the site and at convenient places in the surrounding areas have been specified in the respective items of work and no other extra lead is intended.

1.4 Classification

Any earthwork will be classified under any of the following categories:

1.5 All kinds of soils

These shall include all kinds containing kankar, sand, silt, moorum and/or shingle, gravel, clay, loam peat, ash, shale, etc., which can generally be excavated by spade, pick-axe and shovel and which is not classified under ordinary rock, and hard rock defined below. This shall also include excavation in macadam and tarred roads and pavements. This shall also include rock boulders up to 200 dm^3. Rubble masonry to be dismantled below ground level will also be measured under this item.

1.6 Dewatering

If water is met with in the excavations due to springs, seepage, rain or other causes, it shall be removed by suitable diversions, pumping or bailing out and the excavation kept dry whenever so required or directed by the Engineer. Care shall be taken to discharge the drained water into suitable outlets as not to cause damage to the works, crops or any other property. Due to any negligence on the part of the Contractor, if any such damage is caused, it shall be the sole responsibility of the Contractor to repair/restore to the original condition at his own cost or compensate for the damage.

1.7 Measurements

The length and breadth of excavation or filling shall be measured with a steel tape correct to the nearest cm. The depth of cutting or height of filling shall be measured, correct to 5 mm, by recording levels before the start of the work and after the completion of the work. The cubical contents shall be worked out to the nearest two places of decimal in cubic metres.

2 SAND FILLING IN PLINTH

2.1 Sand

Sand (Silver sand) of filling sand type shall be clean and free from dust organic and foreign matter**.**

2.2 Filling

Sand filling shall be done in a manner similar to earth filling in plinth specified in 2.23.3.2 of CPWD specifications. Except that consolidation shall be done by flooding with water. The surface of the consolidated sand filling shall be dressed to the required level or slope and shall not be covered till the Engineer has inspected and approved the sand filling.

2.3 Measurements

The length, breadth and depth of consolidated sand shall be measured with steel tape correct to the nearest cm and cubical contents worked out in cubic metres correct to two places of decimal.

2.4 Rates

The rates include the cost of material and labour involved in all the operations described above

3 PILE WORKS

3.1 Bored Cast-in-situ Pile Foundation

The tenderer has to acquaint himself with the site condition before tendering for the work.

The contractor shall be responsible for the correctness of location of pile points as given with the pile layout drawing which will be supplied to the contractor. If any lateral shift or tilt of the pile is noticed, the contractor will have to drive alternate pile at his own cost as directed by the Engineer whose decision shall be final. Any excess quantity of RCC pile cap if necessitated due to driving such alternate pile will have to be done by the contractor, at his own cost.

Contractor is required to concrete above cutoff level as per IS 2911 and chip it off subsequently to get sound concrete. Cost of this concrete and chipping off is not payable separately.

Main steel of piles shall be kept projecting from the cutoff level top to the extent of 50 times the diameter of the bar for use as dowels in pile cap/grade beam.

Cement and steel to be used on the work shall conform to prevailing IS standards.

Any ground with high water table or in soft soil having unstable pile bores, boring and under ream may be carried out with suitable drilling works.

For land side piles temporary mild steel liner of minimum 6mm thk shall be provided for minimum 6m depth from cut off level/ground level or as required to suit the site condition and remaining depth shall be provided with Bentonite/polymer fluid stabilizing method. The temporary casing shall be removed after casting of the piles.

The bentonite suspension used in bore holes is basically a clay of montmorillonite group having exchangeable sodium cations.

The bentonite suspension/polymer used for piling work shall satisfy the requirements as per IS: 2911 (Part IV) latest.

Concreting shall be done as soon as possible after completing the pile bore. The bore hole full of drilling mud should not be left unconcreted for more than 12 to 24 hours depending upon the stability of bore hole.

The work shall be done as per IS: 2911 (Part I/Section II) 2010/ latest edition and CPWD Specification for Pile works.

3.2 Pile Construction

Piles are constructed by sinking a permanent bore casing/steel liners with a nominal diameter equal to the designed diameter of the pile. The soil inside the temporary bore casing is removed by means of appropriate boring tools, while bore casing/liner is simultaneously rotated or driven, and advanced into the ground. After the bore casing/liner is sunk to the desired depth the borehole must be cleaned, a reinforcing cage is installed and the empty space is concreted.

In the following, the term "diameter" will always be construed as the outer diameter of the bore casing/liner.

The following has to be considered by the Contractor:

The method of construction of piles in water area shall be suitably selected by the Contractor and submitted for the approval of Engineer.

i. Only firms/sub-contractors that possesses a thorough knowledge and extensive experience in this special field shall be entrusted with the construction of bored piles.

ii. The responsible construction superintendent must be thoroughly acquainted with the type of bored pile construction and its execution.

iii. Pile works shall be supervised only by experienced and reliable foremen, who have already successfully executed such work.

iv. Piece-work will not be tolerated by the Engineer because of the therewith connected sources of danger for the quality of the bore pile construction. The same holds good for night work, which will be approved by the Engineer only in exceptional cases.

Permanent steel liner for Piles

Permanent steel casings are to be installed from the bottom level of the beams/pilecap to a depth, where the casing is embedded at least 1.00 m in the competent soil stratum (medium stiff clay or medium dense sand). In the BoQ, the average liner toe level is assumed at -15 m CD. Any extension and/or cutting which may be required is deemed to be included in the unit rates.

The inside diameter of the permanent steel casings shall be equal to the outer diameter of the bored pile and the wall thickness of the permanent steel casings shall be at least 8 mm. The Contractor has to state the chosen inside diameter for the permanent steel casing, which he considers suitable for each pile diameter.

The permanent steel casings are lost formwork and the Contractor is allowed to choose the steel grade. The Contractor has to insure the stability of the permanent steel casings during the entirety of the construction phase.

Contractor shall provide temporary bracings for the installed permanent steel casing to keep them in correct position for the subsequent works.

3.3 Load Test on Piles

General

The bearing capacity of a single or group of piles shall be determined from test loading. It is most direct method for determining safe load on pile and it is more reliable on account of its being in-situ test. The load test on a concrete pile shall not be carried out earlier than 28 days of its casting. Initial test shall be carried on test pile which is not used as working pile and Routine tests shall be carried out as a check on working pile. Load Test shall generally conform to provision made in IS 2911(Part IV) which provides guidelines for determination of safe loads and conducting of different types of tests.

Types of loadings/tests

(i) Vertical Load Test (Compression)

3.3.1 Vertical Load Test

General: Compression load shall be applied to the pile top by means of a hydraulic jack against suitable load frame which is capable of providing reaction and settlement is recorded by suitable dial gauges. The contractor shall apprise of Engineer before test is conducted.

Preparation of Pile Head: Pile head shall be chipped off to horizontal plane, projecting steel shall be cut or bent and top finished smooth and leveled with plaster of Paris or similar synthetic material as specified to give a plane surface which is normal to the axis of the pile. A bearing plate with a hole at the centers shall be placed on the head of pile for the jacks to rest.

Loading Platform: A proper loading platform is installed as specified. Contractor shall ensure that when the hydraulic jack and load measuring devices are mounted on pile head the whole system will be stable on the maximum specified load. For single pile two dial gauges shall be fixed to the pile and bear on surfaces on reference frame. The dial gauges shall be placed in diametrically opposite positions and be equidistant from the pile axis. Four dial gauges are used for groups, having 0.01 mm sensitivity. The arrangement shall be approved by the Engineer. ***Application of Load:*** The test is carried out as per

IS:2911 (Part IV) in maintained load method. The contractor is required to submit the methodology of testing to Engineer which will be approved before testing.

Measurement: Each completed test shall be enumerated for initial test, routine test separately. Cost for the casting of initial test pile shall be paid separately.

Rate: The rate includes the cost of labour, material and all the operations described above such as preparatory work including installation of loading platform, applying load, preparing pile head for load test, trimming of pile head etc. complete. If contractor wants to carry out the testing through reaction pile system, no separate payment will be allowed for reaction pile.

3.3.2 Integrity Tests for Piles

Non-destructive integrity testing of on all working bored piles done as per IS: 2911 (Part IV), shall be conducted using the low strain sonic diagnostic system consisting of hammer, low 'g' accelerometer with amplifier, pile integrity tester, portable computer system, graphics printer etc. all complete. Number and frequency of testing shall be as per codal provisions. The test shall be conducted by the qualified and experienced specialists in this field. Engineer's decision shall be final regarding approval of piles passing integrity test but of questionable workmanship.

The Engineer reserves the right to give due weightage and consideration to results of these tests which will affect the integrity of the installed piles. In case of questionable test results, the same pile shall be tested for working (routine) compressive load test. If the results of such tests are found satisfactory, the pile shall be approved, otherwise the pile shall be treated as defective and corrective action shall be taken with no extra cost.

5% of the final payment for the piling works will be released only after the successful completion of pile integrity test for each working piles.

3.4 Measurement & Payment

Measurement for payment of the Works shall be in accordance with the Bill of Quantities. Additional length of pile to chip off for good concrete as per IS 2911 is not payable. 5% of final payment for pile works will be released only after the successful completion of pile integrity test.

The procurement and installation of the permanent steel casings will be paid according to the Drawings and as stated in the Bill of Quantities. Procurement and installation of the permanent steel casings, provision and operating all required equipment, surveys, costs for oxy-cuts, butt-welds, waste lengths (at least +0.50 m above the cut-off level), temporary bracing, etc. shall be included in the relevant unit rate for its procurement and installation. Temporary steel casings are not payable.

4 CONCRETE AND RCC WORKS

4.1 Applicable Codes

The following codes and standards are made a part of the Specifications. All standards, codes of practices referred to herein shall be the latest edition including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall prevail materials

1) IS 269 : Specification for ordinary, rapid hardening and low heat Portland cement
2) IS 455 : Specification for Portland blast furnace slag.
3) IS 1489: Specification for Portland-pozzolana cement
4) IS 4031: Methods of physical tests for hydraulic cement
5) IS 650 : Specification for standard sand for testing of cement
6) IS 383: Specification for coarse and fine aggregates from natural sources for concrete
7) IS 2386 (Parts I to VIII) : Methods of test for aggregates for concrete
8) IS 516 : Methods of test for strength of concrete
9) IS 1199 : Methods of sampling and analysis of concrete
10) IS 2396 (I) IS 5640: Flakiness Index of aggregates
11) IS 3025: Methods of sampling and test (physical and chemical water used in industry)
12) IS 432(Part I & II): Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement

13) IS 1139m: Specification for hot rolled mild steel and medium tensile steel deformed bars for concrete reinforcement

14) IS 1566: Specification for plain hard drawn steel wire fabric for concrete reinforcement

15) IS 1785: Specification for plain hard drawn (Part I) steel wire for pre-stressed concrete

16) IS 1786: Specification for cold twisted steel bars for concrete reinforcemen

17) IS 2090: Specification for high tensile steel bars used in pre-stressed concrete

18) IS 4990: Specification for plywood for concrete shuttering work.

19) IS 2645: Specification for integral cement water-proofing compounds

Equipment

1) IS 1791: Specification for batch type concrete mixers

2) IS 2438: Specification for roller pan mixer

3) IS 2505: Specification for concrete vibrators immersion type

4) IS 2506: Specification for screed board concrete vibrators

5) IS 2514: Specification for concrete vibrating tables

6) IS 3366: Specification for pan vibrators

7) IS 4656: Specification for form vibrators for concrete

8) IS 2722: Specification for portable swing weigh-batchers for concrete (single and double bucket type)

9) IS 2750: Specification for steel scaffoldings

Codes of Practice

1) IS 456: Code of practice for plain and reinforced concrete

2) IS 1343: Code of practice for pre-stressed concrete

3) IS 457: Code of practice for general construction of plain and reinforced concrete for dams and other massive structures

4) IS 3370 (Part I to IV): Code of practice for concrete structures for storage of liquids.

5) IS 3935: Code of practice for composite construction

6) IS 3201: Criteria for design and construction of precast concrete trusses

7) IS 2204: Code of practice for construction of reinforced concrete shell roof

8) IS 2210: Criteria for the design of RC shell structures and folded plates

9) IS 2751: Code of practice for welding of mild steel bars used for reinforced concrete construction

10 IS 2502: Code of practice for bending and fixing of bars for concrete Reinforcement

11) IS 3558: Code of practice for use of immersion vibrators for consolidating concrete

12) IS 3414: Code of practice for design and installation of joints in buildings

13) IS 4014 (Part I&II): Code of practice for steel tubular, scaffolding

14) IS 2571: Code of practice for laying in-situ - cement concrete flooring

15) IS 4926: Code of Practice for Ready Mixed Concrete

16) IS 3696: Safety code for scaffolds and ladders Construction Safety

17) IS 3696 : Safety code for scaffolds and ladders

Measurement

1) IS 1200: Method of measurement of building works
2) IS 3385: Code of practice for measurement of civil engineering works

4.2 General

The quality of materials, method and control of manufacture and transportation of all concrete work irrespective of mix, whether reinforced or otherwise shall conform to the applicable portions of this specification.

4.3 Materials

The ingredients to be used in the manufacture of standard concrete shall consist solely of standard type Portland cement, clean sand, natural coarse aggregate, clean water and admixtures.

4.3.1 Cement

While supplying Cement Contractor shall follow the points provided below:

a. The cement to be used shall be Grade OPC/PPC/PSC of approved grade 43 & 53 conforming to IS: 8112-1989/IS: 1489 part I / IS 455 respectively unless otherwise mentioned. As far as possible, all the cement shall be obtained from a single source

throughout the contract. Cement of different types shall not be mixed together. Different brands of cements or same brand of cement from different sources shall not be used without prior approval of the Engineer.

The cement shall be delivered at site in original sealed bags which shall be labelled with the weight, date of manufacture, brand and type. Cement received in torn or hand-stitched bags shall not be used. For volumetric batching of, concrete, cement should be mixed only by box measurement. All cement should be fresh when delivered and shall be stored in an approved manner in stores built by the Contractor at his own cost. Set cement shall not be allowed to be used for any work. Site blending of the cement is not permitted.

b. A certified report attesting to the conformance of the cement to IS specifications by the cement manufacturer's chemist shall be furnished to engineer if demanded.

c. Cement held in storage for a period of sixty (60) days or longer shall be tested. Should at any time Engineer have reasons to consider that any cement is defective, then irrespective of its origin, and/or manufacturers test certificate, such cement shall be tested immediately at contractor's cost at an approved laboratory and until the results of such tests are found satisfactory, it shall not be used in any work. Contractor shall not be entitled to any claim of any nature on this account.

d. Contractor will have to make his own arrangements for storage of adequate quantity of cement.

e. The Engineer shall be regularly notified when supplies of cement are made to the site store. Copies of invoices shall be made available to the site engineer and a common cement register shall be kept at his office showing the supply stock and issue on a daily basis.

Minimum cement content for different grade of concrete shall be on the basis of relevant exposure conditions.

For land area exposure is to be assumed as “severe”

For marine area exposure is to be assumed as “very severe”

4.3.2 Aggregates

Aggregate in general designates both fine and coarse inert materials used in the manufacture of concrete. Fine aggregate is aggregate all of which passes through 4.75 mm IS sieve. Coarse aggregate is aggregate most of which is retained on 4.75 mm sieve. Specification mentioned against various item of work may also be followed.

All fine and coarse aggregates proposed for use in the work shall be subject to Engineer’s approval and after specific materials have been accepted the source of supply of such materials should not be changed without prior approval of Engineer.

Aggregates shall, except as noted above, consist of natural sands, crushed stone and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, durable against weathering, of limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength and/or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the mix design and preliminary tests on concrete specified later.

Sampling and testing

Samples of the aggregates for mix design and determination of suitability shall be taken under the supervision of Engineer and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to Engineer in advance of the work for use in determining aggregate suitability. The costs of all such tests, sampling, etc., shall be borne by contractor.

Storage of Aggregates

All coarse and fine aggregates shall be stacked in stock separately in stock piles in the materials yard near the work site or if instructed in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign materials and with earth during storage and while heaping the materials shall be avoided.

The aggregate must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer.

Screening and Washing

a) Sand shall be prepared for use for such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fractions.

b) Natural gravel and crushed rock shall be screened and/or washed for the removal of dirt or dust coating, if so demanded by Engineer

Water

Water used for both mixing and curing shall be free from injurious amounts of deleterious materials. Potable waters are generally satisfactory for mixing and curing concrete.

The suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS-456. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

4.4 General Requirements of RMC

The contractor is allowed to use RMC instead of batching plant, but without any extra cost.

Ready Mixed Concrete shall conform to IS 4926 and technical specifications as stipulated in CPWD latest edition shall be strictly followed.

Basis of Supply: Ready-mixed concrete shall be supplied having the quality and the quantity in accordance with the requirement agreed with the purchaser or his agent. Notwithstanding this, the concrete supplied shall generally comply with requirements of IS 456. All concrete will be supplied and invoiced in terms of cubic metres (full or part) of compacted fresh concrete. All proportioning is to be carried out by mass except water and admixture, which may be measured by volume.

Transport of Concrete*:* Ready-mixed concrete shall be transported from the mixer to the point of placing as rapidly as practicable by methods that will maintain the required workability and will prevent segregation, loss of any constituents or ingress of foreign matter or water. The concrete shall be placed as soon as possible after delivery, as close as is practicable to its final position to avoid re-handling or moving the concrete horizontally by vibration. If required by the purchaser the producer can utilize admixtures to slow down the rate of workability loss, however this does not remove the need for the purchaser to place the concrete as rapidly as possible. The purchaser should plan his arrangements so as to enable a full load of concrete to be discharged within 120 minutes of arrival on site. Concrete

shall be transported in a truck-mixer unless the purchaser agrees to the use of non-agitating vehicles.

Batching Plants and Batching Equipment: Hoppers for weighing cement, mineral admixtures, aggregates and water and chemical admixture (if measured by mass) shall consist of suitable container freely suspended from a scale or other suitable load-measuring device and equipped with a suitable discharging mechanism. The method of control of the loading mechanism shall be such that, as the quantity required in the weighing hopper is approached the material may be added at controllable rate and shut off precisely within the weighing tolerances specified in Annex C of CPWD specifications. The weighing hoppers for cement, mineral admixtures aggregate shall be capable of receiving their rated load, without the weighed material coming into contact with the loading mechanism. Where the rated capacity of a batching plant mixing cycle is less than 2.0 m3, additional precautions shall be taken to ensure that the correct number of batches are loaded into the truck mixer. The weighing hoppers shall be constructed so as to discharge efficiently and prevent the buildup of materials. Dust seals shall be provided on cement hoppers between the loading mechanism and the weigh hopper, and shall be fitted so as to prevent the emission of cement dust and not affect weighing accuracy. The hopper shall be vented to permit escape of air without emission of cement dust.

Vibrator or other attachment, where fitted, shall not affect the accuracy of weighing. There shall be sufficient protection to cement and aggregate weigh hoppers and weighing mechanisms to prevent interference with weighing accuracy by weather conditions or

external build-up of materials. Where chemical admixture dispensers are used, they shall be capable of measurement within the tolerance in annex C and calibrated container or weigh scales shall be provided to check the accuracy of measurement at least once a month.

Each control on the batching console and weigh-dial or display shall be clearly labeled with its function and where concerned with the batching of materials, the materials type. When more than one type or grade of cement is being used, the weighing device and discharge screw or other parts of the transfer system shall be empty before changing from on type of cement to another. When more than one type or grade of cement is being used, the weighing devised and discharge screw or other parts of the transfer system shall be empty before changing from on type of cement to another.

When pulverized fuel ash and other mineral admixtures are batched through the cement weigh system, the weighing device and discharge screw or other parts of the transfer system shall be empty when the weighing system has returned to zero reading or completed the batch.

Where a back weigh system is utilized to weigh materials a system shall be in place so as to prevent materials being loaded during the process of weighing.

4.5 Mix Design

Classification

In case of concrete works, mix design may be necessary as per IS:456 and Mix design Code (IS 10262 latest) for certain items as directed by Engineer. All concrete in the works shall be of design mix as defined in IS 456, unless it is a nominal mix concrete such as 1:3:6, 1:4:8, 1:5:10. Whether reinforced or otherwise, all design mix concrete works to be carried out under this specification shall be divided into the following classifications.

Class	Specified Characteristic Compressive Strength of 15cm Cube at 28 Days in	Assumed Standard Deviation as per table no.8 of IS 456	Max. size of Aggregate mm

M 40	40.0	5.0	20
M 35	35.0	5.0	20
M 30	30.0	5.0	20
M 25	25.0	4.0	20
M 20	20.0	4.0	20
M 15	15.0	3.5	20

It shall be very clearly understood that whenever the class of concrete such as M 20 is specified it shall be the Contractor's responsibility to ensure that minimum crushing strength stipulated for the respective class of concrete is obtained at works. The maximum total quantity of aggregate by weight per 50 kg of cement shall not exceed 250 kg except when otherwise specifically permitted by Engineer.

To fix the grading of aggregates, water cement ratio, workability and the quantity of cement required to give preliminary and works cubes of the minimum strength specified, the proportions of the mix shall be determined by weight. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Mix proportioning shall be carried out according to Indian Standard Specifications.

Whenever there is a change either in required strength of concrete or water cement ratio or workability or the source of aggregates and/or cement, preliminary tests shall be repeated to determine the revised proportions, of the mix to suit the altered conditions. While fixing the value for water cement ratio for preliminary mixes, assistance may be derived from the graph (appendix IS 456) showing the relationship between the 28 day compressive strengths of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with IS 269.

Preliminary tests

Test specimens shall be prepared with at least two different water/cement ratios for each class of concrete, consistent with workability required for the nature of the work. The materials and proportions used in making preliminary tests shall be similar in all respects to those to be actually employed in the works as the object of these tests is to determine the proportions of cement, aggregates and water necessary to produce concrete of required

consistency and to give the specified strength. It will be the Contractor's sole responsibility to carry out these tests and he shall therefore furnish to Engineer a statement of proportions proposed to be used for the various concrete mixes.

Materials shall be brought to the room temperature and all materials shall be in a dry condition. The quantities of water, cement and aggregates for each mix shall be determined by weight/volume to an accuracy of 1 part in 1000 parts.

Mixing shall be done by a batching plant in such a manner as to avoid loss of water. The cement and fine aggregate shall first be mixed dry until the mixture is uniform in colour. The coarse aggregate shall then be added, mixed and water added and mixed thoroughly for a period of not less than 3 minutes until the resulting concrete is uniform in appearance. Each mix of concrete shall be of such a quantity as to leave about 10% excess concrete after moulding the desired number of test specimens.

The consistency of each mix of concrete shall be measured immediately after mixing, by the slump test in accordance with IS 1199. If in the slump test, care is taken to ensure that no water or other materials is lost, the materials used for the slump test may be remixed with the reminder of the concrete for making the specimen test cubes. The period of remixing shall be as short as possible yet sufficient to produce a homogeneous mass.

Compression tests of concrete cubes shall be made as per IS 516 on 15 cm cubes. Each mould shall be provided with a metal base having a plane surface so as to support the mould during filling without leakage. The base plate shall be preferably attached to the mould by springs or screws. The parts of the mould when assembled shall be positively and rigidly held together. Before placing concrete the mould and base plate shall be cleaned and oiled. The dimensions and internal faces of the mould shall be accurate within the following limits:

Height and distance between the opposite faces of the mould shall be of specified size plus or minus 0.2 mm. The angle between the adjacent internal faces and between internal faces and top and bottom planes of mould shall be 90 Deg. plus or minus 5 Deg. The interior faces of the mould shall be plane surfaces with a permissible variation 0.03 mm.

Concrete test cubes shall be moulded by placing fresh concrete in the mould and compacted as specified in IS 516.

Curing shall be as specified in IS 516. The cubes shall be kept in moist air of at least 90% relative humidity at a temp. Of 27 Deg. Cent. Plus or minus 2 Deg. Cent. For 24 hours plus or minus half hour from the time of adding water to the dry ingredients. Thereafter they shall be removed from the moulds and kept immersed in clean, fresh water and kept at 27 Deg. Cent. Plus or minus 2 Deg. Cent. Temp. Until required for test. Curing water shall be renewed every seven days. A record of maximum and minimum temperatures at the place of storage of the cubes shall be maintained during the period they remain in storage.

Testing of specimens

The strength shall be determined based on not less than five cubes test specimens for each age and each water cement ratio. All these laboratory test results shall be tabulated and furnished to Engineer. The test result shall be accepted by Engineer if the average compressive strengths of the specimens are tested subject to the condition that only one out of the five consecutive test may give a value less than the specified strength for that age. The Engineer may direct the Contractor to repeat the tests if the results are not satisfactory and also to make such changes as he considers necessary to meet the requirements specified. All these preliminary tests shall be conducted by the Contractor at his own cost in an approved laboratory.

4.6 Proportioning, consistency, batching and mixing of concrete

4.6.1 Aggregate

The proportions which shall be decided by conducting preliminary test shall be by volume. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete mixing. The supply of properly graded aggregate of uniform quality shall be maintained over the period of work, the grading of aggregates shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stocked in separate stock piles. The grading of coarse and fine aggregate shall be checked as frequently as possible as determined by

Engineer, to ensure maintaining of grading in accordance with the samples used in preliminary mix design. The material shall be stock piled well in advance of use.

4.6.2 Cement

The cement shall be measured by weight.

4.6.3 Water

Only such quantity of water shall be added to the cement and aggregates in the concrete mix as to ensure dense concrete, specified surface finish, satisfactory workability, consistent with the strength stipulated for each class of concrete as per approved mix design. The water added to the mix shall be such as not to cause segregation of material or the collection of excessive free water on the surface of the concrete.

The W/C ratio specified for use by Engineer shall be maintained. The Contractor shall determine the water content of the aggregates as frequently as directed by Engineer as the work progress and as specified in IS 2386 (Part-III) and the amount of water added at the mixer shall be adjusted as directed by Engineer so as to maintain the specified W/C ratio. To allow for the variation in volume of aggregates due to variation in their moisture content suitable adjustments in the volume of aggregates shall also be made.

4.6.4 Consistency and slump

Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of water required is determined, the consistency of the mix shall be maintained throughout the progress of the corresponding parts of the work and approved tests e.g. slump tests, compacting factor tests, in accordance with IS 1199 shall be conducted from time to time to ensure the maintenance of such consistency.

4.6.5 Slumps for Various Types of Construction

Only sufficient quantity of water shall be added to concrete during the mixing to produce a mix of sufficient workability to enable it to be well consolidated, to be worked into the corners of the shuttering and around the reinforcement, to give the specified surface finish, and to have the specified surface strength. The following slumps shall be adopted for different kinds of works:

Placing Conditions	Degree of Workability	Slump (mm)

[1]	[2]	[3]
Blinding concrete:	Very low	
Shallow sections;		
Pavements using pavers Mass concrete:	Low	25-75
Lightly reinforced sections in slabs, beams, walls, columns:		
Floors;		
Hand placed pavements; Canal lining;		
Strip footings Heavily reinforced sections in slabs,	Medium	50-100
beams, walls, columns; Slip form work; Pumped concrete		75-100
Trench fill; *In-situ pilling*	High	100-150
Tremie concrete	Very high	150-180

4.6.6 Sampling and testing concrete in the field

Facilities required for sampling materials and concrete in the field shall be provided by the Contractor at no extra cost. The following equipment with operator shall be made available at Engineer's request (all must be in serviceable condition):

a) One concrete cube testing machine suitable for 15 cm cubes of 100 tonnes capacity with proving calibration ring.

b) Twelve cast iron cube moulds of 15 cm size

c) One Lab. balance to weigh up to 5 kg with sensitivity of 10 gm.

d) One set of sieves for coarse and fine aggregates

e) One set of slump cone complete with tamping rod

f) A set of measures from 5 litre to 0.1 litre

g) One electric oven with thermostat up to 120 Deg. Cent.

h) One flakiness gauge

i) One elongation index gauge

j) One sedimentation pipette

k) One Pyconometer

l) Two calibrated glass jar of 1 litre capacity

Arrangement can be made by the contractor to have the cubes tested in an approved laboratory in lieu of a testing machine at site at his expense, with the prior consent of the Engineer.

At least 6 test cubes of each class of concrete shall be made for every 15.0 cu.m. of concrete or part thereof. Such samples shall be drawn on each day for each type of concrete. Of each set of 6 cubes, three shall be tested at 7 days age and three at 28 days age. The laboratory test results shall be tabulated and furnished to Engineer. Engineer will pass the concrete if average strength of the specimens tested is not less than the strength specified, subject to the condition that only one out of three consecutive tests may give a value less than the specified strength but this shall not be less than 90% of the specified strength. The cubes shall be tested on 7th and 28th day from the day of casting of the cubes.

4.6.7 Admixtures

Admixtures may be used in concrete only with the approval of Engineer based upon evidence that, with the passage of time, neither the compressive strength nor its durability reduced. Calcium chloride shall not be used for accelerating setting of the cement for any concrete containing reinforcement, or embedded steel parts. When calcium chloride is permitted to be used, such as in mass concrete works, it shall be dissolved in water and added to the mixing water in an amount not to exceed 1.5% of the volume of the cement in concrete. When admixtures are used, the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer's instructions and in the manner and with the control specified by Engineer.

4.6.8 Retarding admixtures

Where specified and approved by Engineer-in-charge retarding agents shall be added to the concrete mix in quantities specified by Engineer.

4.6.9 Optional tests

Engineer may order tests to be carried out on cement, sand, coarse aggregate and water in accordance with the relevant Indian Standards. Tests on cement shall include (i) fineness test (ii) test for normal consistency (iii) test for setting time (iv) test for soundness (v) test for tensile strength (vi) test for compressive strength (vii) test for heat of hydration by experiment and by calculations in accordance with IS 269. Tests on sand shall include (i) sieve test (ii) test for organic impurities (iii) decantation test for determining clay and silt content (iv) specific gravity test (v) test for unit weight and bulkage factor. Tests on coarsed aggregate shall include (i) test for sieve analysis (ii) specific gravity and unit weight of dry loose and rodded aggregate (iii) soundness and alkali aggregate reactivity (iv) pertrographic examination (v) deleterious materials and organic impurities (vi) test for

aggregate crushing value. Any or all these tests would normally be ordered to be carried out only if Engineer feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be performed by contractor at site or at an approved test laboratory.

If the work cubes do not give the stipulated strengths Engineer reserves the right to ask contractor to dismantle such portions of the work which in his opinion are unacceptable and re-do the work to the standard stipulated at contractor's cost.

4.6.10 Preparation prior to concrete placement

Before the concrete is actually placed in position, the insides of the form work shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection, especially at bottom of columns and walls forms to permit removal of saw dust, wood shavings, and binding wire, rubbish dirt, etc. Openings shall be placed or holes drilled so that these materials and water can be removed easily. Such openings/holes shall be later suitably plugged.

The various agencies shall be permitted ample time to install drainage and plumbing lines in floor and treech drains, conduits, hangers, anchors, inserts, sleeves, bolts, frames and

other miscellaneous embedment's to be cast in the concrete as indicated on the drawings or as is necessary for the proper execution of the work. Contractor shall cooperate fully with all such agencies and shall permit the use of scaffolding form work, etc., by other agencies at no extra cost.

All embedded parts, inserts, etc., supplied by Contractor shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete including suitable grouting as per Instruction of Engineer.

Anchor bolts shall be positioned and kept in place with the help of properly manufactured templates. The use of all such templates, fixture, etc., shall be deemed to be included in the rates.

Slots, openings, holes, pockets, etc., shall be provided in the concrete work in the positions indicated in the drawings or as directed by Engineer.

Prior to concrete placement all work shall be inspected and approved by Engineer and if found unsatisfactory, concrete shall not be poured until after all defects have been corrected

at Contractor's cost. Cat ladders shall be provided on the reinforcement to facilitate labour movement.

Approval by Engineer for all materials and work as required herein shall not relieve contractor from his obligation to produce finished concrete in accordance with the drawings and specifications.

No concrete shall be placed in wet weather or on water covered surface. Any concrete that has been washed by heavy rains, the work shall be entirely removed, if there is any sign of cement and having been washed from the concrete mixture. To guard against damage which may be caused by rains, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over/around freshly placed concrete, suitably drains and sumps shall be provided. Immediately before concrete placement begins, proposed surfaces except framework, which will come in contact with the concrete to be placed, shall be covered with a bonding mortar.

4.6.11 Transportation

All buckets, containers or conveyors used for transporting concrete shall be mortar tight. Irrespective of the method of transportation adopted, concrete shall be delivered with the required consistency and plasticity without segregation or loss of slump. However, chutes shall not be used for transport of concrete without the written permission of Engineer and concrete shall not be rehandled before placing.

Concrete must be placed in its final position before it becomes too stiff to work. On no account, water shall be added after the initial mixing concrete which has become stiff or has been contaminated with foreign materials shall be rejected and disposed off as directed by Engineer.

All equipment used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans, buckets, hoppers, chutes, pipelines and other equipment shall be thoroughly cleaned after each period of placement.

4.6.12 Procedure for placing of concrete

Before any concrete is placed, the entire placing programme, consisting of equipment, layout proposed procedures and methods shall be submitted to engineer for approval if so demanded by Engineer and no concrete shall be placed until Engineer's approval has been received. Conveyor for conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete during depositing without segregation of materials, considering the size of the job and placement location.

Concrete shall be placed in its final position before the cement shall normally be compacted in its final position within 2hours of leaving the mixer and once compacted it shall not be disturbed.

Concrete, in all cases, be deposited as nearly as practicable directly in its final position, and shall not be rehandled or caused to flow in a manner which will cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible, and in narrow forms, contractor shall provide suitable drop and elephant trunks to confine the movement of concrete. Special care shall be taken when concrete is dropped from a height especially if reinforcement is in the way, particularly in columns and thin walls. Except when

otherwise approved by Engineer, concrete shall be placed in shovels or other approved implements and shall not be dropped from a height more than 1 M or handled in a manner which will cause segregation.

The following specification shall apply when placing of concrete by use of mechanical equipment is specifically called for while inviting bids or is warranted considering the nature of work involved. The control of placing shall begin at the mixer discharger, concrete shall be discharged by a vertical drop into the middle of the bucket or hopper and this principle of a vertical discharge of concrete shall be adhered to thoroughly all stages of delivery until the concrete comes to rest in its final position.

Central bottom dump buckets of a type that provides for positive regulation of the amount and rate of deposition of concrete in all dumping position, shall be employed.

In placing concrete in large open areas, the bucket shall be spotted directly over the position designated and then lowered for dumping. The open bucket shall clear the concrete already in place and the height of drop shall not exceed 1 M. The bucket shall be opened slowly to

avoid high vertical bounce. Dumping of buckets on the swing or in any manner which results in separation of ingredients or disturbance of previously placed concrete will not be permitted.

Concrete placed in restricted forms by wheel barrows, buggies, cars, short chutes or hand shoveling shall be subject to the requirement for vertical delivery of limited height to avoid segregation and shall be deposited as nearly as practicable in its final position.

Where it is necessary to use transfer chutes, specific approval of Engineer must be obtained to the type, length, slopes, baffles, vertical terminals and timing of operations, the discharge and without segregation. To allow for the loss of mortar against the sides of the chutes, the first mix shall have less coarse aggregate. During cleaning of chutes the waste water shall be kept clear of the forms. Concrete shall not be permitted to fall from the end of the chutes by more than 1 M. Chutes when approved for use shall have slopes not flatter than 1:2 chutes shall be of metal or metal lined and of rounded cross section. The slopes of all chutes sections shall be approximately the same. The discharge end of the chutes shall be maintained above the surface of the concrete in the forms. Concrete may be

conveyed and placed by mechanically operated equipment e.g. pumps or pneumatic placers only with the written permission of Engineer. The slump shall be held to the minimum, necessary for conveying concrete by this method.

When pumping is adopted, before pumping of concrete is started, the pipeline shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. The concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

When pneumatic placer is used, the manufacturer's advice on layout of pipeline shall be followed to avoid blockages and excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at this end. Manufacturer's advice shall be followed regarding concrete quality and all other related matters when pumping or pneumatic placing equipment are used.

Concreting, once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15 to 90 mm as directed by Engineer. These shall be placed as rapidly practicable to prevent the formation of cold joints or planes of weakness between each succeeding layer within the pour.

The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit shall be spotted progressively along the face of the layer with such overlap as well facilitate spreading the layer to uniform depth and texture with a minimum of shovelling. Any tendency to segregation shall be corrected by shovelling stones into mortar rather than mortar on to stones. Such a condition shall be corrected by redesign of mix or other means, as directed by Engineer.

The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed.

4.6.13 Compaction

Concrete shall be compacted during placing with approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, is free of pockets of coarse aggregate and fits tightly against all form surfaces, reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the

forms faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution exercised not to over-vibrate the concrete to the point that segregation results. Vibrators shall conform to IS specifications. Type of vibrator to be used shall depend on the structure where concrete is to be placed. Shutter vibrators to be effective, shall be firmly secured to the formwork which must be sufficiently rigid to transmit the vibration and strong enough not to be damaged by it. Immersion vibrators shall have no load frequency, amplitude and acceleration as per IS 2505 depending on the size of vibrator. Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or external vibrating of forms by hand tools or immersion vibrators will not be permitted.

The exact manner of application and the most suitable machines for the purpose must be carefully considered and operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn when air bubbles cease to come to the surface. Immersion vibrators shall be withdrawn very slowly. In no case shall immersion vibrators be used to transport concrete inside the forms. Particular attention shall be paid to vibration at the top of a lift e.g. in a column or wall.

When placing concrete in layers, which are advancing horizontally as the work progresses, great care shall be exercised to ensure adequate vibration, blending and mixing of the concrete between the succeeding layers.

The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below with the under layer is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.

Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall also not be allowed to come in contact with forms or finished surfaces.

Form attached vibrators shall be used only with specific authorization of Engineer.

The surface vibrators will not be permitted under normal conditions. However for thin slabs vibration by specially designed vibrators may be permitted upon approval of Engineer.

The formation of stone pockets or mortar bondages in corner and against faces of forms shall not be permitted. Should these occur, they shall be dug out, reformed and refilled to sufficient depth and shape for through bonding, as directed by Engineer.

4.6.14 Placement interval

Except when placing with slip forms each placement of concrete in multiple lift work, shall be allowed to set for atleast 24 hours after the final set of concrete and before the start of a subsequent placement.

4.6.15 Special provision in placing

When placing concrete in walls with openings and in floors of integral slab and beam construction and other similar conditions, the placing shall stop when the concrete reaches the top of the opening in walls and bottom horizontal surface of the slab, as the case may be placing shall be resumed before the concrete in place takes initial set, but not until it has time to settle as determined by Engineer.

4.6.16 Placing concrete through reinforcement steel

When placing concrete through reinforced steel, care shall be taken to prevent segregation of the coarse aggregate. When the congestion of steel makes placing difficult it may be

necessary to temporarily move the top steel aside to get proper placement and restore reinforcing steel to design position.

4.6.17 Bleeding

Bleeding of free water, on top of concrete being deposited, in to the forms shall be caused to stop the concrete pour. The conditions causing this defect corrected before any further concreting is resumed.

4.6.18 Curing, protecting, repairing and finishing

Curing

All concrete shall be cured by keeping it continuously damp for the period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or ponded water continuously saturated covering of sacks, canvas, hessian, polythene sheets or other absorbent materials, or approved effective curing

compounds applied with spraying equipment capable of producing a smooth, even textured coat. Extra precautions shall be exercised in curing concrete during cold and hot water as outlined hereinafter. The quality of curing water shall be the same as that used for mixing concrete.

Certain types of finish or preparation for overlaying concrete must be done at certain stage of the curing process and special treatment may be required for specific concrete surface finish.

Curing of concrete made of high alumina cement and supersulphated cement shall be carried out as directed by Engineer.

Fresh concrete shall be kept continuously wet for a minimum period of 15 days from the date of placing of concrete following a lapse of 12 to 14 hours after laying of concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin immediately the concrete has hardened. Water shall be applied uniformly to concrete surfaces within 1 hour after concrete has set. Water shall be applied to formed surfaces immediately upon removal of forms. Quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

Curing shall be assured by use of an ample water supply under pressure in pipes with all necessary appliance of hose, sprinklers and spraying devices. Continuous fine mist spraying

or sprinkling shall be used, unless otherwise specified or approved by Engineer. Whenever, by the judgement of Engineer, it may be necessary to omit the continuous spray method, a covering of clean sand or other approved means such as wet gunny bags which will prevent loss of moisture from the concrete, may be used. No type of covering will be approved which would stain or damage the concrete during or after the curing period. Covering shall be kept continuously wet during the curing period.

For curing of concrete in pavements, side-walks floors, flat roofs or other level surfaces, the ponding method of curing is preferred. The method of containing the ponded water shall be approved by Engineer. Special attention shall be given to edges and corners of the slabs to ensure proper protection to these area. The ponded area shall be kept continuously filled with water during the curing period.

Surface coating type compounds shall be used only by special permission of Engineer, curing compounds shall be liquid type white pigmented. Other curing compounds shall be used on surfaces where future blending with concrete, water or acid proof membrane or painting is specified.

All equipment and materials required for curing shall be on hand and ready for use before concrete is placed.

Protecting fresh concrete

Fresh concrete shall be protected from defacements and damage due to construction operation by leaving forms in place for an ample period as specified later in this specifications. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by Engineer shall also be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion or contact with other materials, etc., that may impair the strength and/or durability of the concrete. Workmen shall be warned against and prevented from disturbing green concrete during its setting period. If it is necessary that workmen enter the area of freshly placed concrete, Engineer may require that bridges be placed over the area.

Repair and replacement of unsatisfactory concrete

Immediately after the shuttering is removed, the surface of concrete shall be very carefully inspected and all defective areas called to the attention of Engineer who may permit patching of the defective areas or also reject the concrete unit either partially or entirely. Rejected concrete shall be removed and replaced by contractor at no additional expense to owner. Holes left by form bolts, etc., shall be filled up and made good with mortar composed of one part of cement to one and half parts of sand passing 2.36 mm IS sieve after removing any loose stones adhering to the concrete shall be finished as described under the particular items of work.

Superficial honeycombed surfaces and rough patches shall be similarly made good immediately after removal of shuttering in the presence of Engineer and superficial water and air holes shall be filled in. The mortar shall be well worked into the surface with a wooden float. Excess water shall be avoided. Unless instructed otherwise by Engineer the surface of the exposed concrete placed against shuttering shall be rubbed down

immediately on removal of shuttering to remove fine or other irregularities and necessary care being taken to avoid damage to the surface. Surface irregularities shall be removed by grinding.

If reinforcement is exposed or the honey combing occurs at vulnerable positions eg. ends of beams or columns it may be necessary to cut out the member completely or in part and reconstruct. The decision of Engineer shall be final in this regard. If only patching is necessary, the defective concrete shall be cut out till solid concrete is reached (or to a minimum depth of 25 mm) the edges being cut perpendicular to the affected surface or with small undercut if possible. Achors, tees or dovetail slots shall be provided whenever necessary to attach the new concrete securely in place an area extending several centimetres beyond the edges and the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

The use of epoxy for bonding fresh concrete used for repairs will be permitted upon written approval of Engineer. Epoxy shall be applied in strict accordance with the instructions of the manufacturer.

Small size holes having surface dimensions about equal to the depth of the hole, holes left after removal of form bottom, grout insert holes and slots cut for repair of cracks shall be repaired as follows. The hole to be patched shall be roughened and thoroughly soaked with clean water until absorption stops.

A 5 mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched, followed immediately by the patching concrete which shall be well consolidated with a wooden float. The concrete patch shall be built up in 10 mm thick layers. After an hour or more, depending upon weather conditions, it shall be worked off flush with a wooden float and smooth finish obtained by wiping with hessian, a steel trowel shall be used for this purpose. The mix for patching shall be of same materials and in the same proportions as that used in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible.

Mortar filling by air pressure (guniting) shall be used for repairing of areas too large and/or too shallow for patching with mortar. Patched surfaces shall be given a final treatment to match the colour and texture of the surrounding concrete. While cement shall be substituted for ordinary cement, if so directed by Engineer, to match the shade of the patch with original concrete.

The patched area shall be covered immediately with an approved non-staining water saturated material such as gunny bag which shall be kept continuously wet and protected against sun and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by fine spray of sprinkling for not less than 10 days.

All materials, procedures and preparation used in the repairing of concrete and also the finished repair work shall be subject to the approval of Engineer. All fillings shall be tightly bonded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured and finished.

Finishing

The type of finish for formed concrete surface shall be as follows, unless, otherwise specified by the Engineer.

For surfaces against which backfill or concrete is to be placed, no treatment is required except repairing of defective area.

For surface below grade which will receive waterproofing treatment the concrete shall be free of surface irregularities which would interfere with proper application of the waterproofing material which is specified for use.

Unless specified, surfaces which will be exposed when the structure is in service shall receive no special finish, except repairing of damage or defective concrete removal of fins and abrupt irregularities, fillings of holes let by form ties and rods and clean-up of loose or adhering debris.

Surfaces which will be exposed to the weather and which would normally be level, shall be sloped for drainage. Unless the drawing specifies such as stair treads, walls shall be sloped across the width approximately 1 in 30 broader surface such as walkways, roads, parking areas and platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete subfloors to be covered either concrete topping, terrazzo or quarry tile and

similar surfaces shall be smooth screeded and levelled to produce even surfaces. Surface irregularities shall not exceed 6 mm. Surfaces which will not be covered by backfill, concrete or tile toppings such as outside decks, floors of galleries and sumps, parapets, gutters, sidewall floors and slabs shall be consolidated, screeded and floated. Excess water and laitance shall be removed before finishing. Floating may be done with hand or power tools and started as the screeded surface has attained a stiffness to permit finishing operation and these shall be the minimum required to produce a surface uniform in texture and free from screed marks or other imperfections.

Joints edges panels and forms linings shall be of uniform size and be as large as practicable and installed with closed joints. Upon removal of forms the joint marks shall be smoothed off and all blemishes, projections etc., removed leaving the surfaces reasonably smooth and unmarked.

Integral cement concrete finish

When specified on the drawings and integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded as specified on the drawing as per IS 2571. The surface shall be compacted and then floated with a wood float or power floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated. Floating or trowelling of finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

Exposed Concrete finish/Rendering

A rubbed finish shall be provided only on exposed concrete surfaces as specified on the drawings. Upon removal of forms, all fins and other projections on the surfaces shall be carefully removed, off-sets levelled and voids and damaged sections be immediately saturated with water and repaired by filling with a concrete or mortar of the same composition as was used in the surface. Then surface shall be thoroughly wetted and rubbed with carborundum or other abrasive. Cement mortar may be used in the rubbing, but the finished surface shall be brush coated with either cement grout after rubbing. The finished surfaces shall present a uniform and smooth appearance.

4.7 Form Work

The formwork shall consist of shores, bracings, sides of beams and columns, bottom of slabs, etc., including ties anchors, hangers inserts, etc., complete which shall be properly designed and planned for the work. False work shall be so constructed that necessary adjustment can be made to compensate for take up and settlements. Wedge may be used at the top or bottom of timber shores but not at both ends to facilitate vertical adjustment or dismantling of the formwork.

4.7.1 Design of formwork

The design of the formwork as well as its construction shall be the responsibility of Contractor. If so instructed, the drawings and/or calculation for the design for the formwork shall be submitted to Engineer for approval before proceeding with work, at no extra cost. Engineer's approval shall not however relieve Contractor of the full responsibility for the design and construction of the formwork. The design shall take into account all the load vertical and lateral that the forms will be carrying live and vibration loadings.

4.7.2 Type of formwork

Formwork may be of timber, plywood, metal, plastic or concrete. For special finishes the formwork may be lined with plywood, steel, sheets, oil, tempered hard board, etc. Sliding forms and slip forms may be used with the approval of Engineer.

4.7.3 Form work requirements

Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, braces, ties, straps, etc., shall be

used to hold the forms in proper position without any distortion whatsoever until the concrete is set sufficiently to permit removal of forms. Forms shall be strong enough to permit the use of immersion vibrators. In special cases form vibrators may also be used. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps or other surface defects in contact with concrete. Faces coming in contact with the concrete shall be free from adhering grout, plaster, paint, projecting nails, splits or other defects. Joints shall be sufficiently tight splits or other defects. Joints shall be sufficiently tight to prevent loss of water or any fine material from concrete.

Plywood shall be used for exposed concrete surfaces; where called for Sawn and wrought timber may be used for unexposed surfaces. Inside faces of forms for concrete surfaces which are to be rubbed finished shall be planned to remove irregularities or unevenness in the face. Formwork with linings shall be permitted.

All new and used form timber shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness and cleanliness of surfaces. Form timber unsatisfactory in any respect shall not be used and if rejected by Engineer shall be removed from the site.

Shores supporting successive members shall be placed directly over those below or be so designed and placed that the load will be transmitted directly to them. Trussed supports shall be provided for shores that cannot be secured on adequate foundations.

Formwork, during any stage of construction showing signs of distortion or distored to such a degree that the intended concrete work will not conform to the exact contours indicated on the drawings, shall be repositioned and strengthened. Poured concrete affected by the faulty formwork, shall be removed completely and the formwork be corrected prior to placing of new concrete.

Excessive construction camber to compensate for shrinkage, settlement may impair the structural strength of members and shall not be permitted.

Forms shall be so designed that their removal will not damage the concrete. Face formwork shall provide true vertical and horizontal joints, conform to the architectural features of the structure as to location of joints and be as directed by engineer.

Where exposed smooth or rendered concrete finishes are required the forms shall be constructed with special care so that the resulting concrete surfaces require a minimum finish.

4.7.4 Formwork for Slope Surfaces

Forms for sloped surfaces shall be built so that the formwork can be placed board-by- board immediately ahead of concrete placement so as to enable ready access for placement, vibration inspection and repair of the concrete.

The formwork shall also be built so that the boards can be removed one by one from the bottom up as soon as the concrete has attained sufficient stiffness to prevent sagging. Surfaces of construction joints and finished surfaces with slopes steeper than 4 horizontal: 1 vertical shall be formed as required herein.

4.7.5 Formwork for Curved Surfaces

The contractor shall interpolate intermediate sections as necessary and shall construct the forms so that the curvature will be continuous between sections. Where necessary to meet requirements for curvature, the form timber shall be built up of laminated splines cut to make tight, smooth form surfaces.

After the forms have been constructed, all surface imperfections shall be corrected and all surface irregularities at matching faces of form material shall be dressed to the specified curvature.

4.7.6 Formwork for Exposed Concrete Surfaces

Where it is desired, directed or shown on the drawings to have original fair face finish of concrete surface without any rendering or plastering, formwork shall be carried out by using wood planks, plywood or steel plates of approved quality and as per direction of the Engineer.

The contractor shall use one type of material for all such exposed concrete faces and the forms shall be constructed so as to produce uniform and consistent texture and pattern on the face of the concrete. Patches or forms for these surfaces will not be permitted. The formwork shall be placed so that all horizontal formworks are continuous across the entire surface.

To achieve a finish which shall be free of board marks, the formwork shall be faced with plywood or equivalent material in large sheets. The sheets shall be arranged in an approved pattern. Wherever possible, joints between sheets shall be arranged to coincide with architectural features, chills, window heads or change in direction of the surface. All joints between shuttering plates or panels shall be vertical or horizontal unless otherwise directed. Suitable joints shall be provided between sheets. The joints shall be arranged and fitted so that no blemish or mark is imparted to the finished surfaces.

To achieve a finish which shall give the rough appearance of concrete cast against sawn boards, formwork boards unless otherwise stated shall be of 150 mm wide, securely jointed with tonge and grooved joints if required to prevent grout loss with tie rod positions and direction of boards carefully controlled. Sawn boards shall be set horizontally, vertically or at an inclination shown in the drawings. All bolt holes shall be accurately aligned horizontally and vertically and shall be filled with matching mortar recessed 5 mm back from the surrounding concrete face.

Forms for exposed concrete surfaces shall be constructed with grade strips (the underside of which indicated top of pour) at horizontal construction joints, unless the use of groove strips is specified on the drawings. Such forms shall be removed and reset from lift to lift, they shall not be continuous from lift to lift. Sheeting of reset forms shall be tightened against the concrete so that the forms will not be spread and permit abrupting irregularities or loss of mortar. Supplementary form ties shall be used as necessary to hold the reset forms tight against the concrete.

For fair faced concrete, the position of through bolts will be restricted and generally indicated on the drawings.

Chamfer strips shall be placed in the corners of forms for exposed exterior corners so as to produce 20 mm beveled edges except where otherwise shown in the drawings.

Interior corners and edges at formed joints shall not be beveled unless shown on the drugs. Mouldings for grooves, drip courses and bands shall be made in the form itself.

The wood planks, plywood and steel plates used in formwork for obtaining exposed surfaces shall not be used for more than 3 times in case of wood planks, 6 times for plywood and 10 times for steel plates respectively. However, no forms will be allowed for reuse, if in the opinion of the Engineer it is doubtful to produce desired texture of exposed concrete.

In order to obtain exposed concrete work of uniform colour it shall be necessary to ensure that the sand used for all exposed concrete work shall be of approved uniform colour. Moreover the cement used in the concrete for any complete element shall be from single consignment.

No exposed concrete surface shall be rendered or painted with cement or otherwise. Plastering of defective concrete as a means of achieving the required finish shall not be permitted, except in the case of minor porosity on the surface, the Engineer may allow a surface treatment by rubbing down with cement and sand mortar of the same richness and colour as for the concrete. This treatment shall be made immediately after removing the formwork.

The contractor shall also take all precautionary measures to prevent breaking and chipping of corners and edges of completed work until the building is handed over.

4.7.7 Bracings struts and props

Shuttering shall be braced, strutted, propped and so supported that it shall not deform underweight and pressure of the concrete and also due to the movement of men and other materials. Bamboos shall not be used as props or cross bearers.

The shuttering for beams and slabs shall be so erected that the shuttering on the sides of the beams and under the soffit of slabs can be removed without disturbing the beam bottoms. Repropping of beams shall not be done except when props have to be reinstated to take care of construction loads anticipated to be in excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be generally lowered vertically while striking the shuttering. If the shuttering for a column, is erected for the full height of the column, one side shall be left open and built up in sections as placing of concrete from the sides to limit the drop of concrete to 3 M or as directed by Engineer.

4.7.8 Mould Oil

Care shall be taken to see that the faces of form work coming in contact with concrete are perfectly cleaned and two coats of mould oil or any other approved material applied before fixing reinforcement and placing concrete. Such coating shall be insoluble in water, non-staining and not injurious to the concrete. It shall not become flaky or be removed by rain or wash water. Reinforcement and/or other items to be cast in the concrete shall not be placed until coating of the forms is complete, adjoining concrete surface shall also be protected against contamination from the coating material.

Chamfers and fillets

All corners and angles exposed in the finished structure shall be formed with moulding to form chamfers or fillets on the finished concrete. The standard dimension of chamfers and fillers, unless otherwise specified shall be 20 mm x 20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the mouldings shall be planned or surfaced to the same texture as the forms to which it is attached.

4.7.9 Wall ties

Wire ties passing through the walls shall not be allowed. In their place bolts through sleeves be used.

4.7.10 Reuse of forms

Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes that may leak suitably plugged and joints examined and when necessary, repaired and the inside retreated to prevent adhesion, to the satisfaction of Engineer. Warped timber shall be resized. Contractor shall equip himself with enough shuttering material to complete the job in the stipulated time.

4.7.11 Removal of forms

Contractor shall record on the drawings and in a special register the date upon which the concrete is placed in each part of the work and the date on which the shuttering is removed there from. The Contractor shall remove the shuttering after obtaining the approval of the Engineer

In no circumstances shall forms be struck until the concrete reaches a strength of at least twice the stress due to self-weight and any construction/erection loading to which the concrete may be subjected at the time of striking formwork.

In normal circumstances (generally where temperatures are above 20 Deg. Cent.) forms may be removed after expiry of the following periods:

				Ordinary Portland	Rapid hardening
				cement concrete	Portland cement
a)	Walls columns	and	vertical	24 to 48 hrs as directed by the Engineer	24 hrs.
	sides of beams				
b)	Slabs proos left under			3 days	2 days
c)	Beam soffits prods left under			7 days	4 days
d)	Removal of props to slabs: i) Spanning upto 4.5m			7 days	4 days
	ii) Spanning over 4.5m.			14 days	8 days
e)	Removal of props to beams & arches i) Spanning upto 6m			14 days	8 days
	ii) Spanning over 6m			21 days	12 days

Striking shall be done slowly with utmost care to avoid damage to arises and projections and without shock or vibration, by gently easing the wedges. If after removing the form work, it is found that timber has been embedded in the concrete, it shall be removed and made good as specified earlier.

Reinforced temporary openings shall be provided as directed by Engineer to facilitate removal of formwork which otherwise may be inaccessible.

Tie rods, clamps, form bolts etc., which must be entirely removed from walls or similar structures shall be loosened not sooner than 24 hours nor later than 40 hrs. After the concrete has been deposited. Ties, except those required to hold forms in place, may be removed at the same time, Ties, withdrawn from walls and grade beams shall be pulled towards the inside face cutting ties back from the faces of walls and grade beams will not be permitted.

For liquid retaining structures no sleeves for through bolts shall be used nor shall through bolts be removed as indicated above. The bolts, in this case, shall be cut at 25mm depth

from the surface and then the hole shall be made good by sand, cement mortar of the same proportions as the concrete just after striking the formwork.

4.8 Pre-cast concrete members

4.8.1 General

This subsection shall be applicable to structural members, which are designated in the Drawings or Bills of Quantities as precast members. It shall also apply to any member of the Works which are proposed by the Contractor to be executed as precast unit, if approved by the Engineer.

All reinforced precast concrete units shall be manufactured by the Contractor at Site, unless otherwise agreed to by the Engineer. The Contractor shall submit his detailed proposals for the setting up and operation of the manufacturing yard for Engineer's approval.

4.8.2 Preparation and installation

As far as preparation of formwork, reinforcement, design, mixing and placing of concrete etc. is concerned, the Specifications for the in-situ concrete are valid analogously.

All units shall be marked with oil paint after stripping, indicating date of manufacture and identification.

The precast units may be lifted from their casting beds and transported to the storage place, when the average crushing strength of at least three cubes is at least 2½ times the stress induced by lifting and stacking, provided the minimum of 3 cube tests is not less than twice such stresses. Necessary calculations shall be submitted by the Contractor for Engineer's information.

Stacking shall be arranged in such a manner that the units can be used in the Works in order of age. The stacks shall be shielded from direct sunrays, allowing curing as per the standards.

Precast units shall not be installed in the Works unless the 28 day cube crushing strength has been confirmed by tests.

All precast elements shall be installed and assembled true to lines and levels, plumb horizontal or inclined in strict accordance with the Drawings.

Hoisting gear made available by the Contractor shall be specially suited for such work with regard to capacity, operation height and range, and in particular guarantee controlled and accurate lifting, lowering and placing of elements.

The Contractor shall be responsible to provide for the duration of the installation works all required supports, bracings, scaffoldings, fixing materials, etc. which are required to ensure a safe and smooth assembly of the precast units and with which the elements can be so rigidly positioned and connected that no movements occur at the time of grouting the joints or bearings. The period necessary to start removal of bracings, supports etc. will depend on the required hardening time of the mortar.

Reinforcing bars may be welded at joints, provided weldability of the steel is ensured and the welding method conforms to applicable Standards.

After installation, all exposed work shall be thoroughly cleaned and finished with water or other methods as approved by the Engineer. The Contractor shall, however, not use any acid for such cleaning.

During installation, the tops of all elements in place shall be covered while work thereon is in progress.

Joints between prefabricated members may be sealed with permanent elastic sealant if so required and at locations as ordered by the Engineer.

4.8.3 Marking of pre-cast concrete members

Pre-cast concrete members shall be unambiguously, discretely, marked for identification of design and date of fabrication.

4.8.4 Tolerances

The appearance of all structures shall be such that no visible deviation from the correct form is noticeable.

Depressions in horizontal or nearly horizontal surfaces of the permanent structures, which are not permanently submerged, shall not be accepted due to the risk of accumulation of puddles.

All visible concrete edges shall be chamfered 20 x 20 mm unless otherwise shown in the Tender or Execution Drawings.

Structural elements of dimensions to be susceptible to visible deflections in the permanent structure shall be constructed with a compensating camber subject to the Engineer's approval.

4.8.5 Pre-cast concrete members

Dimensional tolerances for precast structural members shall be.

• Size and location of penetrations, recesses etc.: ± 10 mm

• Inserts, brackets, steel members etc. to be embedded and which on the Execution Drawings are shown to be flush with the concrete surface: ± 10 mm

4.8.6 Measurement & Payment

For any structural members which may be intended for prefabrication by the Contractor and approved by the Engineer, the installation costs including all required supports, bracings, scaffoldings, fixing materials, joint seal's, etc. are deemed to be covered by the unit rates for the concrete works applicable to the respective member as per Tender Design.

4.9 Reinforcement Steel

4.9.1 General

Reinforcement bars, if supplies are arranged by contractor unless otherwise specified, shall be cold twisted steel bars as per IS 1786, as shown and specified on the drawings. Wire mesh or fabric shall be in accordance with IS 1566. Substitution of reinforcement will not be permitted except upon written approval from Engineer.

All reinforcement shall be clean, free from grease, oil, paint, loose mill scale, loose rust, dust, bituminous material or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated. Pitted and defective rods shall not be used.

4.9.2 Providing, fabricating and placing in position reinforcement steel

The quality of the steel shall be as mentioned in the materials section. The bars shall be fabricated as per the drawings and binding with 0.9 to 1.5mm GI binding wire etc. Laps and splices for reinforcement shall be as shown on the drawings. Splices in adjacent bars shall be approved by Engineer. The bars shall not be lapped unless the length required

exceeds the maximum available lengths of bars at site. Laps, chair, splices shall not be measured and paid separately.

4.9.3 Bending

Reinforcing bars supplied bent or in coils, shall be straightened before they are cut to size. Straightening of bars shall be done in cold and without damaging the bars. This is considered as a part of reinforcement binding fabricating work.

All bars shall be accurately bent according to the sizes and shapes shown on the detailed working drawings/bar bending schedules. They shall be bent gradually by machine or other approved means. Reinforcing bars shall not be straightened and rebent in a manner that will injure the material, bars containing cracks or splits shall be rejected.

4.9.4 Fixing

Reinforcement shall be accurately fixed by any approved means and maintained in the correct position shown in the drawings by the use of block, spacers and chairs as per IS-2502 to prevent displacement during placing and compaction of concrete. Bars intended to be in contact at crossing points shall be strongly bound together at all such points with 0.9 to 1.5mm GI binding wire. The vertical distance required between successive layers of bar in beams or other members shall be maintained by providing of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars.

4.9.5 Cover

Unless indicated otherwise on the drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish) shall be as follows:

a) At each end of reinforcing bar, not less than 25 mm nor less than twice the diameter of the bar whichever is less.

b) For a longitudinal reinforcing bar in a column, not less than 40 mm, nor less than the diameter of the bar. In case of columns of minimum dimensions of 20 cm or under, with reinforcing bars of 12 mm and less in diameter, a cover of 25 mm may be used.

c) For longitudinal reinforcing bars in a beam 25 mm nor less than the diameter of the bar.

d) For tensile, compressive, shear, or other reinforcement in a slab or wall not less than 12 mm nor less than the diameter of such reinforcement.

e) For any other reinforcement not less than 12 mm nor less than the diameter of such reinforcement.

f) For footings and other principal structural members in which the concrete is deposited directly against the ground, cover to the bottom reinforcement shall be75 mm. If concrete is poured on a layer of lean concrete the bottom cover may be reduced to 50 mm.

g) For concrete surfaces exposed to the weather or the ground after removal of forms, such as retaining walls, footing sides and top, etc., not less than 50 mm for bars larger than 16 mm dia and not less than 40 mm for bars 16 mm dia or smaller.

h) Increased cover thickness shall be provided, as indicated on the drawings, for surfaces exposed to the action of harmful chemicals (or exposed to earth contaminated by such chemical, acid, alkali, saline atmosphere, sulphurous smoke, etc.

i) For reinforced concrete members, totally or periodically immersed in sea water or subject to sea water spray, the cover of concrete shall be 50 mm more than those specified in (a) to (e) above.

j) For liquid retaining structures the minimum cover to all steel shall be 40 mm or the diameter of the main bars, whichever is greater. In the presence of sea water and soils and waters of a corrosive character the cover shall be increased by 10 mm.

k) Protection to reinforcement in case of concrete exposed to harmful surroundings may also be given by providing a dense impermeable concrete with approved protective coatings, as specified by the Engineer.

l) The correct cover shall be maintained by cement mortar cover blocks.

Reinforcement for footings, beams and slabs on sub-grade shall be supported on precast concrete blocks as approved by Engineer. The use of pebbles or stones shall not be permitted.

4.9.6 Inspection

Erected and secured reinforcement shall be inspected, jointly measured and recorded and approved by Engineer prior to placement of concrete.

5 MASONRY WORK

5.1 Brick

Bricks used in works shall be bricks of specified crushing strength as described in the Schedule of Quantities. They shall have the following general properties:

They shall be sound, hard, homogenous in texture, well burnt in kiln without being verified, table moulded, deep red, cherry or copper coloured, of regular shape and size and shall have sharp and square edges and parallelled faces. The bricks shall be free from pores, chips, flaws or humps of any kind. Bricks containing unground particles and which absorb water more than 1/5th of their weight when soaked in water for twenty four hours shall be rejected. Overburnt or under burnt bricks shall be liable to rejection. These bricks shall give a clear ringing sound when struck.

Samples of bricks shall be submitted before starting the brickwork to the Engineer for approval. Bricks supplied shall conform to these approved samples. Brick sample shall be got tested as per IS-3495 by Contractor at no extra cost. Bricks rejected by Engineer shall be removed from the site of works within 24 hours.

5.2 Mortar

Mix for cement mortar shall be as specified in the respective items of work. Gauge boxes for sand shall be of such dimensions that one complete bag of cement containing 50 kgs.of cement forms one unit. The sand shall be free from clay, shale, loam, alkali, and organic matter and of sound, hard, clean and durable practices. Sand shall be approved by the engineer. If so directed by the engineer sand shall be thoroughly washed till it is free of any contamination.

For preparing cement mortar the ingredients shall first be mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall preferably be machine mixed, through mixing in a thorough manner may be allowed. The mortar so mixed shall be used within 30 minutes of mixing. Mortar left unused in the specified period shall be rejected.

The Contractor shall arrange for test on mortar samples if so directed by the engineer retempering of mortar shall not be permitted.

5.3 Workmanship

All bricks shall be thoroughly soaked in clean water for at least one hour immediately before being laid. The cement mortar for brick masonry work shall be as specified in the respective item of work. Brick work 230 mm thick and over shall be laid in English bond unless otherwise specified. While laying bricks shall be pressed into the mortar and shoved into final position so as to embed the brick fully in mortar. Bricks shall be laid with frogs uppermost.

All brick work shall be plumb, square and true to dimensions. Vertical joints in alternate courses shall come directly one over the other and be in line. Horizontal courses shall be leveled. The thickness of brick courses shall be kept uniform. For walls of thickness greater than 230 mm both faces shall be kept in vertical planes. No broken bricks shall be used except as closers. Care shall be taken that the bricks forming the top corners and ends of the wall shall be properly radiated and keyed into position. Holes kept in masonry for scaffolding shall be closed before plastering. All interconnected brickwork shall be carried out at nearly one level (so that there is uniform distribution of pressure on the supporting structure) and no portion of the work shall be left more than one course lower than the adjacent work where this is not possible, the work shall be raked back accordingly to bond (and not saw toothed) at an angle not exceeding 45^{o}.

Bricks shall be so laid that all joints are well filled with mortar. The thickness of joints shall not be less than 6 mm and not more than 10 mm. The face joint shall be raked to a minimum depth of 12 mm by raking tools daily during the progress of work when the mortar is still green so as to provide a proper key for the plaster or pointing to be done. Where plastering or pointing is not required to be done the joints shall be uniform in thickness and be struck flush and finished at the time of laying. The face of brickwork shall be cleaned daily and all mortar droppings removed. The surface of each course shall be thoroughly cleaned of all dirt before another course is laid on top. If the mortar in the lower course has begun to set the joints shall be raked out to depth of 12 mm before another course is laid.

All brick work shall be built tightly against columns, floor slabs or other structural member.

Where drawings indicate that structural steel columns are to be fireproofed with brick work the brick shall be built closely against all flanges and webs with all spaces between the steel and bricks works filled solid with mortar. Steel members partly embedded in brickwork and not indicated to be fireproofed with concrete shall be covered with not less than 12 mm thick mortar unless directed otherwise by engineer. The work shall be cured for 15 days.

Miscellaneous inserts in masonry e.g. sleeves, wall ties, anchors, conduits, structural sheet, steel lintels, etc., shall be installed by the Contractor. Furnishing fixing of any of these inserts by the Contractor will be paid for separately under steel work. Openings, arches, etc., shall be provided as shown on the drawings, opening for exhaust fan provision, chasses, pockets, etc., shall be provided as shown on the drawings to receive rain water pipes, etc. Wall ties and flashings shall be built into the brickwork in accordance with the drawings and specifications.

6 JOINERY WORKS ALUMINIUM SECTIONS

Aluminium sections used for fixed, partitions, frame work etc. shall be suitable for use to meet architectural designs to relevant works and shall be subject to approval of the Engineer for technical, structural, functional and visual considerations. The aluminium extruded sections shall conform to the relevant codes specified in the schedule of quantities.

Before proceeding with any fabrication work, the contractor shall prepare and submit, complete fabrication and installation drawings for each type of partition for the approval of the Engineer. If the sections are varied, the contractor shall obtain prior approval of Engineer and nothing extra shall be paid on this account.

6.1 Frame Work

First of all the shop drawings for partitions shall be prepared by using suitable sections based on architectural drawings, adequate to meet the requirement/specifications and by taking into consideration varying profiles of aluminium sections being extruded by approved manufacturers.

The shop drawings shall also show the details of fittings and joints. Before start of the work, all the shop drawings shall be got approved from the Engineer. Actual measurement of openings left at site for glazing etc. shall be taken.

The frames shall be truly rectangular and flat with regular shape corners fabricated to true right angles. The frames shall be fabricated out of section which have been cut to length, mitered and jointed mechanically using appropriate machines. Mitered joints shall be corner crimped or fixed with self-tapping stainless steel screws using extruded aluminium cleats of required length and profile.

Contractor should make provision for fixing all electrical, networking boxes in the paneling framework, cutting and making good the wall/floor etc., wherever required at required heights/levels as directed by Engineer at all levels.

6.2 Fixing of Frames

The holes in concrete/masonry/wood/any other members for fixing anchor bolts/fasteners/screws shall be drilled with an appropriate electric drill. The framework shall be checked for line, level and plumb before final fixing is done.

Where aluminium comes into contact with stone masonry, brick work, concrete, plaster or dissimilar metal, it shall be coated with an approved insulation lacquer, paint or plastic tape to ensure that electrochemical corrosion is avoided. Insulation material shall be trimmed off to a clean flush line on completion.

6.3 Measurement

All aluminium sections shall be measured in kilogram. Aluminium sections fixed in place shall be measured in running meter along the outer periphery of composite section correct to a millimeter and then converted to kilogram based on the standard weight of sections. The weight calculated on the basis of actual average (average of five samples) weight of composite section in kilogram correct to the second place of decimal shall be taken for payment. The weight of cleat shall be added for payment. Neither any deduction nor anything extra shall be paid for skew cuts.

The rate shall include the cost of all the materials, labours involved in all the operations, making provisions for electrical, networking works, cutting and making good the wall/floor etc wherever required at required heights/levels as described in the specification & schedule of quantities.

6.4 SEALANT

The sealants of approved grade and colour shall only be used. The silicone for perimeter joints (between Aluminum/wood section and RCC/Stone masonry) shall be of make approved by the Engineer.

Method of Application

Surface Preparation*:* Clean all joints and glazing pockets by removing all foreign matter and contaminants such as grease, oil, dust, water, frost, surface dirt, old sealants or glazing compounds and protective coatings.

Masking

Areas adjacent to joints shall be masked to ensure neat sealant lines. Masking tape shall not be allowed to touch clean surfaces to which the silicone sealant is to adhere. Tooling shall be completed in one continuous stroke immediately after sealant application and before a skin forms and masking shall be removed immediately after tooling.

Application

Install backer rod of appropriate size and apply silicone sealant in a continuous operation using a positive pressure adequate to properly fill and seal the joint. The silicone sealant shall be tooled with light pressure to spread the sealant against backing material and the joint surfaces before a skin forms. A tool with convex profile shall be used to keep the sealant within the joint. Soap or water shall not be used as a tooling aid. Remove masking tape as soon as silicone joint is tooled.

Tolerance*:* A tolerance of + 3 mm shall be allowed in the width of silicone joints. The depth of the joints at throat shall not be less than 6 mm.

Clear Toughened Glass

10mm thick clear float glass conforming to BS 952 Part – I of the thickness specified in the item shall be used for processing toughened glass. Toughening, which shall be carried out horizontally (without tong-marks), shall conform to ASTM 1048.

All works such as cutting, grinding, drilling etc. on glass shall be carried out prior to toughening. Once toughing is done, no cutting, grinding work will be allowed on the glass. Glass shall be heat soaked.

Final Cleaning

Protective coating and warning markings shall remain undisturbed until final acceptance. Immediately prior to final inspection, temporary protective covering or coating shall be removed and surfaces shall be washed with a suitable thinner and left in a finished condition having approved uniform appearance and free from all marks and blemishes. Both faces of the glass shall be washed and polished.

Pre-laminated Particle Boards

Pre-laminated particle boards are available in two grades namely Grade I and II as per IS 12823. Each grade is further classified in four types; namely Type – I, II, III, IV.

Material

Particle Board Pre-laminated particle board Grade-1 (FPT–I or graded wood particle board FPT-I) bonded with BWP type synthetic resin and pre-laminated conforming to IS 12823 Grade-I, type II or I shall be used.

Impregnated Base Paper: Printed or plain coloured absorbent base paper having a weight of 60-140 g/m^2 impregnated in a suitable synthetic resin and dried to a volatile content of 4-8 per cent shall be used for prelamination on both surfaces of particle board.

Impregnant Overlay: An absorbent tissue paper having a weight of 18-40 g/m^2 impregnated in a suitable synthetic resin and dried to volatile content of 4-8 per cent. **Dimension and Tolerances**

Dimensions of prelaminated particle boards shall be as follows:

Length: The length of prelaminated particle boards shall be 4.8, 3.6, 3.0,

2.7, 2.4, 2.1, 1.8, 1.5, 1.2, 1.0 and 0.9 metres.

Width: The width of prelaminated particle boards shall 1.8, 1.5, 1.2,

1.0, 0.9, 0.6 and 0.45 metres.

Thickness: The thickness of prelaminated particle boards shall be 6, 9, 12, 15,

20, 25, 30, 35, 40 and 45 mm.

Tolerances: Tolerances on the nominal sizes of finished boards shall be as given below:

Dimension	Tolerance
Length + 6 mm	- 0
Width + 3 mm	- 0
Thickness 5 per cent	
Edge straightness 2 mm per 1000 mm or 0.2 per cent	
Squareness 2 mm per 1000 mm or 0.2 per cent	

Note: Edge straightness and squareness shall be tested as per IS 12823.

Sampling and Inspection: The number of prelaminated particle board to be selected from a lot shall be in accordance with the Table 9.4 given below:

Lot Size	Number of prelaminated boards to be selected
Upto 50	2
51 to 100	3
101 to 200	4
201 to 300	5
301 to 500	7
501 and above	10

The prelaminated particle boards shall be selected at random (ref. IS 4903). In order to ensure randomness of selection, all the prelaminated particle boards in the lot may be arranged in a serial order and every r^{th} prelaminated particle board may be selected till the required number is obtained, 'r' being the integral part of N/n, where N is the lot size and n is the sample size.

All board selected as given in para 9.2.9.4.1 shall be tested as specified in IS 2380 (part-2) for length, width, thickness, edge straightness and squareness shall comply with the requirements specified under para 9.2.9.3.2.

Testing and Number of Tests : For each of particle board selected as per para 9.2.9.4 Test specimens shall be cut out from portion 150 mm away from the edges for tests and tests shall be carried out as per IS 12823.

Criteria for Conformity: A lot shall be considered as in conformity to the requirements of the specification if no group of specimens for any of the characteristics fails to meet the conditions as prescribed in para 9.2.9.3 & 9.2.9.5 of this specification.

In case of a failure, double sample shall be taken from the lot for testing. The lot shall be considered as passed, if all these samples conform to the specified requirement.

Marking: Each prelaminated particle board shall be legibly and indelibly marked on any of its edges with following:

(a) Indication of source of manufacturer

(b) Grade and type of prelaminated particle board

(c) Thickness

(d) Batch number and year of manufacture

Marine Plywood

Marine plywood shall be generally conforming to IS 710. Selection of timber species for manufacture of plywood shall be as prescribed in IS 710 and as far as possible a single species of timber shall be used.

Adhesive: The adhesive used for bonding the veneer shall be of the hot press synthetic resin, phenol formaldehyde type (BWP) and shall conform to IS 848. Extender shall not be added to the adhesive by the plywood manufactures. Fillers, if used, shall not exceed 10 percent by mass of solid content of the glue.

Dimensions

The dimensions of plywood boards shall be as stated in para 9.2.10.5.

The thickness of any board shall not exceed the number of pieces multiplied by 2.5 mm. The two face veneers in finished board shall be of the same nominal thickness.

Tolerances: The following tolerances in the nominal size of finished boards shall be permitted.

Dimension	Nominal Size	Tolerance
Length	Upto 120 cm.	+ 3 mm
	Above 120 cm.	+ 6 mm
Width	Upto 90 cm.	+ 3 mm
	Above 90 cm	+ 6 mm
Thickness	Upto 4 mm	± 10 per cent
	Above 4 mm	± 5 per cent

Sampling: The method of drawing representative samples and criteria for conformity shall be as prescribed in IS 7638.

Tests: Test pieces cut from each of board as specified at para 9.2.11.5 shall be subjected to following tests.

(a) Moisture content

(b) Glue adhesive in dry state

(c) Water resistance test.

(d) Tensile strength

(e) Mycological test

(f) Retension of preservative.

These tests shall be carried out as specified in IS 710.

Marking: Each plywood board shall be legibly and indelibly marked or stamped with following particulars along with such other marks as the purchaser may stipulate at the time of placing order.

(g) Manufacturer's name, initials or recognized trade mark, if any.

(h) Year of manufacturing.

(i) Abbreviation indicating the species of timber used in each ply as indicated in col. 3 of Table – 1 and 2 of IS 710.

(j) Batch number

BIS Certification Marking: The plywood board may also be marked with the standard mark, governed by the BIS Act, 1986.

Tender Sample, Inspection and Acceptance: Where samples are required to be tendered, three samples each not less than 90 x 60 mm in size shall be submitted by the supplier, and these samples, if the tender is accepted shall constitute the standard as regards the type of timber, quality and finish.

7 WOOD WORK

The timber shall be free from decay, fungal growth, boxed heart, pitch pockets or streaks on the exposed edges, splits and cracks. For both the grades, knots should be avoided over a specified limit. Testing of timber shall be at Govt. approved material testing laboratories as directed by Engineer.

Seasoning of Timber

The process of drying timber under controlled conditions is called seasoning of timber. Timber shall be either air seasoned or kiln seasoned and in both cases moisture content of the seasoned timber shall be as specified in CPWD unless otherwise specified, air seasoned timber shall be used.

Door, Window and Ventilator Frames

Timber for door, window and ventilators frames shall be as specified. Timber shall be sawn in the direction of the grains. All members of a frame shall be of the same species of timber and shall be straight without any warp or bow. Frames shall have smooth, well-planed (wrought) surfaces except the surfaces touching the walls, lintels, sill etc., which may be left clean sawn. Rebates, rounding or moulding shall be done before the members are jointed into frames. The depth of the rebate for housing the shutters shall be 15 mm, and the width of the rebates shall be equal to the thickness of the shutters. A tolerance of ± 2 mm shall be permitted in the specified finished dimensions of timber sections in frames.

Joints

The Jamb posts shall be through tenon in to the mortise of the transoms to the full thickness of the transoms and the thickness of the tenon shall be not less than 2.5 cm. The tenons shall closely fit into the mortise without any wedging or filling. The contact surface of tenon and mortise before putting together shall be glued with polyvinyl acetate dispersion based adhesive conforming to IS 4835 or adhesive conforming IS 851 and pinned with 10 mm dia hard wood dowels, or bamboo pins or star shaped metal pins. The joints shall be at right angles when checked from the inside surfaces of the respective members. The joints shall be pressed in position. Each assembled door frame shall be fitted with a temporary stretcher and a temporary diagonal brace on the rebated faces.

Fixing of Frames

The frames shall be got approved by the Engineer before being painted, oiled or otherwise treated and before fixing in position. The surface of the frames abutting masonry or concrete and the portions of the frames embedded in floors shall be given a coating of coal tar. Frames shall be fixed to the abutting masonry or concrete with holdfasts or metallic fasteners as specified. After fixing, the jamb posts of the frames shall be plugged suitably and finished neat. Vertical members of the door frames shall be embedded in the floor for the full thickness of the floor finish and shall be suitably strutted and wedged in order to prevent warping during construction. A minimum of three hold fasts shall be fixed on each side of door and window frames one at centre point and other two at 30 cm from the top and bottom of the frames. In case of window and ventilator frames of less than 1 m in height two hold fasts shall be fixed on each side at quarter point of the frames. Hold fasts and metallic fasteners shall be measured and paid for separately.

Measurements

Wood work shall be measured in cum and shall be worked out upto three places of decimal. Wood work wrought, framed and fixed shall be measured for finished dimension without any allowance for the wastage or for dimensions beyond specified dimension. However, in case of members having mouldings, roundings or rebates and members of circular or varying sections, finished dimensions shall be taken as the sides of the smallest square or rectangle from which such a section can be cut. Length of each member shall be measured over all to the nearest cm so as to include projection for tenons. Width and thickness shall be measured to the nearest mm

Rate

The rate shall include the cost of material and labour involved in all the operations described above except the hold fasts or metallic fasteners which will be paid for separately.

7.1 PANELLED OR PANELLED AND GLAZED SHUTTERS

Timber for door, window and ventilators frames shall be as specified. Timber shall be sawn in the direction of the grains. All members of a frame shall be of the same species of timber and shall be straight without any warp or bow. Frames shall have smooth, well-planned (wrought) surfaces except the surfaces touching the walls, lintels, sill etc., which may be left clean sawn. Rebates, rounding or moulding shall be done before the members are jointed into frames. The depth of the rebate for housing the shutters shall be 15 mm, and the width of the rebates shall be equal to the thickness of the shutters. A tolerance of ± 2 mm shall be permitted in the specified finished dimensions of timber sections in frames.

All joints shall be mitred joints unless otherwise mentioned.

Fixing of Frames

The frames shall be got approved by the Engineer before being finished or otherwise treated and before fixing in position. The surface of the frames abutting masonry or concrete and the portions of the frames embedded in floors shall be given a coating. Frames shall be fixed to the abutting masonry or concrete with dash fasteners/hold fasteners as specified. After fixing, the jamb posts of the frames shall be plugged suitably and finished neat. Vertical members of the door frames shall be embedded in the floor for the full thickness of the floor finish and shall be suitably strutted and wedged in order to prevent warping during construction. A minimum of three dash fasteners/hold fasteners shall be fixed on each side of door and window frames one at centre point and other two at 30 cm from the top and bottom of the frames. Dash fasteners/hold fasteners shall be measured and paid for separately.

Measurements

Wood work wrought, framed and fixed shall be measured for finished dimension without any allowance for the wastage or for dimensions beyond specified dimension. However, in case of members having mouldings, roundings or rebates and members of circular or varying sections, finished dimensions shall be taken as the sides of the smallest square or rectangle from which such a section can be cut. Length of each member shall be measured over all to

the nearest cm so as to include projection for tenons. Width and thickness shall be measured to the nearest mm and the quantity shall be worked out in unit of upto three places of decimal.

Rate

The rate shall include the cost of material and labour involved in all the operations described above except the fasteners which will be paid for separately.

7.2 PANELLED OR PANELLED AND GLAZED SHUTTERS

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Measurements

Wood work wrought, framed and fixed shall be measured for finished dimension without any allowance for the wastage or for dimensions beyond specified dimension. However, in case of members having mouldings, roundings or rebates and members of circular or varying sections, finished dimensions shall be taken as the sides of the smallest square or rectangle from which such a section can be cut. Length of each member shall be measured over all to the nearest cm so as to include projection for tenons. Width and thickness shall be measured to the nearest mm and the quantity shall be worked out in unit of upto three places of decimal.

Rate

The rate shall include the cost of material and labour involved in all the operations described above except the fasteners which will be paid for separately.

7.3 PANELLED GLAZED OR PANELLED AND GLAZED SHUTTERS

Panelled or glazed shutters for doors, windows, ventilators and cupboards shall be constructed in the form of timber frame work of stiles and rails with panel inserts of timber, or float glass. The shutters may be single or multi panelled, as shown in the drawings or as directed by the Engineer. Timber for frame work, material for panel inserts and thickness of shutters shall be as specified. All members of the shutters shall be straight without any warp or bow and shall have smooth well planed face at right angles to each other. Any warp or bow shall not exceed 1.5 mm for door shutter and 1 mm for window and ventilator shutters The right angle for the shutter shall be checked by measuring the diagonals and the difference between the two diagonals should not be more than 3 mm. Generally panelled glazed or panelled and glazed shutter shall conform to IS 1003 (Part. 1& 2).

Frame Work

Timber for stiles and rails shall be of the same species and shall be sawn in the directions of grains. Sawing shall be truly straight and square. The timber shall be planed smooth and accurate to the required dimensions. All joints shall be mitred unless otherwise mentioned.

Door Shutters

Rebating

The shutters shall be single-leaf or double leaved as shown in the drawings or as directed by the Engineer. In case of double leaved shutters, the meeting of the stiles shall be rebated by one third the thickness of the shutter.

Paneling

The panel inserts shall be either framed into the grooves or housed in the rebate of stiles and rails. The depth of the groove shall be 12 mm and its width shall accommodate the panel inserts such that the faces are closely fitted to the sides of the groove. Panel inserts shall be framed into the grooves of stiles and rails to the full depth of the groove leaving space of 1.5 mm. Width and depth of the rebate shall be equal to half the thickness of stiles and rails.

Timber Panels

Timber panels shall be preferably made of timber of large width; the minimum width and thickness of the panel shall be 100 mm, and 15 mm respectively. When made from more than one piece, the pieces shall be jointed with a continuous tongued and grooved joint glued together and reinforced with headless nails at regular intervals not exceeding 100 mm. Depth and thickness of such joint shall be equal to one-third of thickness of panel. The panels shall be designed such that no single panel exceeds 0.5 square metre in area. The grains of timber panels shall run along the longer dimensions of the panels. All panels shall be of the same species of timber unless otherwise specified.

Glass Panels

Glass panels shall be fixed by providing a thin layer of putty conforming to IS 419 applied between glass pane and all along the length of the rebate and also between glass panes and wooden beading.

Putty can be prepared by mixing one part of white lead with three parts of finely powdered chalk and then adding boiled linseed oil to the mixture to form a stiff paste and adding varnish to the paste at the rate of 1 litre of varnish to 18 kg of paste. Fixing of glass panes without beading shall not be permitted. Glazing shall be done after the shutters have been primed and prepared for painting, so that wood may not draw oil out of putty.

Finish

Panels of shutters shall be flat and well sanded to a smooth and level surface.

Beading

Beadings in panelled shutter shall be provided where specified in architectural drawings or directed by the Engineer. Each length of beading shall be single piece. Joints at the corners shall be mitred and exposed edges shall be rounded. Beading shall be fixed with headless nails at 75 mm intervals. For external shutters, the beading shall be fixed on the outside face.

Machine/Factory made Shutters

Machine made shutters, where specified, shall be procured from an approved factory. For machine made shutters, operations like sawing, planning, making tongue and tenons, cutting grooves, mortises and rebates, drilling holes and pressing of joints shall be done by suitable machines. Machines made shutters shall be brought to the site fully assembled but without any priming coat. Panel inserts of sheet glass and wire gauze may, however, be fixed at site.

Fixing of Shutters

Screws for fixing the hinges shall be screwed in with screw driver and not hammered in. Unless otherwise specified, shutters of height more than 1.2 mm shall be hung on butt hinges of size 100 mm and for all other shutters of lesser height butt hinges of size 75 mm shall be used. For shutter of more than 40 mm thickness butt hinges of size 125 × 90 × 4 mm shall be used.

Fittings

Fittings shall be provided as per schedule of fittings decided by Engineer. Cost of providing and fixing shutter shall include cost of hinges and necessary screws for fixing the same. All other fittings shall be paid separately.

Wooden Cleats and Blocks

Wooden cleats and blocks shall be fixed to doors and windows as directed by Engineer, as per size and shape approved by him. These are included in the cost of providing and fixing the shutters.

Measurements

Framework and paneling shall be measured separately.

Framework of Shutters

The overall length and width of the framework of the shutters shall be measured nearest to a cm in fixed position (overlaps not to be measured in case of double leaved shutters) and the area calculated in square metres correct to two places of decimal. No deduction shall be made to form panel openings or louvers. No extra payments shall be made for shape, joints and labour involved in all operations described above.

For paneling of each type or for glazed panel length and width of opening for panels inserts or glazed panels shall be measured correct to a cm before fixing the beading and the area shall be calculated to the nearest 0.01 Sq.m The portions of the panel inserts or glazed panel inside the grooves or rebates shall not be measured for payment.

Rate

Rate includes the cost of materials and labour involved in all the operations described above. The framework and paneling of each type or glazed panels shall be paid separately. However, extra shall be paid for providing moulded beading where specified. Nothing extra shall be paid for plain beading.

7.4 FIRE RATED DOORS

Door frame

Providing and fixing fire resistant door frame of section 143x57 mm having built in rebate made out of 16 SWG G.I. sheet (zinc coating not less than 120 gm/ sqm) duly filled with vermiculite based concrete mix, suitable for mounting 60 minutes fire rated door shutters. The frame is fitted with intumescent fire seal strip of size 10x4 mm (minimum) alround the frame and fixing with dash fastener of approved size and make, including applying a coat of approved brand fire resistant primer etc. complete as per direction of Engineer (Dash fastener to be paid for separately).

Door shutter

Providing and fixing 50 mm thick glazed fire resistant door shutters of 60 minutes fire rating conforming to IS : 3614 (Part - II), tested and certified as per laboratory approved by Engineer, with suitable mounting on door frame, consisting of vertical styles, lock rail, top rail 100 mm wide, bottom rail 200 mm wide, made out of 16 SWG G.I. sheet (zinc coating not less than 120 gm/m2) duly filled FR insulation material and fixing with necessary

stainless steel ball bearing hinges of approved make including applying a coat of approved fire resistant primer etc. all complete as per direction of Engineer.

Finish

Door frame and shutters to be primed in the stoving grade epoxy zinc phosphate primer and finished in Aliphatic grade UV resistant polyurethane paint.

Measurements

Clear width and clear height of the opening shall be measured correct to a mm. The clear distance between the openings shall be clear width and the clear distance between the sill and the soffit (bottom of lintel) of the opening shall be the clear height.

The area shall be calculated in square metres correct to two places of decimal.

Rate

The rate shall includes the cost and conveyance of all materials , labour charges, lead, lift, fire rated hardware etc. complete as directed by the Engineer at all levels. All SS fixtures shall be of 304 grade unless otherwise mentioned.

8.0 FITTINGS AND FIXTURES

Scope of Work

The work covered under these specifications consist of supplying different types of fittings and fixtures required for doors, windows, ventilators etc. The supply shall be in accordance with the specification, drawings / approved samples. Samples of various fittings and fixtures proposed to be incorporated in the work shall be submitted by the contractor for approval of the Engineer before order for bulk supply is placed.

General

All fittings and fixtures shall conform to relevant IS code and made SS or approved materials as specified. These shall be well made reasonably smooth and free from sharp edges, corners, flaws and other defects. Screw holes shall be counter sunk to suit the heads of the specified screws. All riveted heads pertaining to hinge pins shall be well formed. Screws supplied for fittings shall be of the same metal and finish as the fittings. Samples of each fixture/ fitting shall be furnished by the contractor for approval of the Engineer. Order for procurement of fittings and fixtures in bulk shall be placed only after approval by the Engineer.

The fittings and fixtures to be incorporated in the work shall be strictly according to the approved sample. Fittings shall be fixed in proper position as shown in the drawing and as directed by the Engineer. These shall be truly vertical or horizontal as the case may be. Screws shall be driven home with a screwdriver and not hammered in. Recess shall be cut to the exact size and depth for the counter sinking of hinges. The fittings and fixtures shall be fixed in a workman like manner and any damages done either to fittings and fixtures or to the shutter frames etc. should be rectified by the contractor at his own cost.

Fittings shall be of Stainless steel or as specified. The fittings shall be well made, smooth, and free from sharp edges and corners, flaws and other defects.

Stainless steel fittings shall be non-magnetic, rust & moisture proof, strong & sturdy. Pin of hinges shall also be of stainless steel.

Measurement

All the fittings with all the necessary accessories shall be measured in numbers and the rate shall include the cost of all materials including taxes, excise duty, if any, loading, unloading, transporting, cost of screws, bolts and other accessories complete, fixing charges etc,. complete.

Rate

The rate shall include the cost &conveyance of all materials as above, and labour involved in all the operations including, installation, lead, lift etc complete as directed by Engineer.

8.1 FLUSH DOOR Applicable Codes

1) IS: 4021 – Timber door, window and ventilator frames

2) IS: 2202 - Wooden flush door shutters (solid core type) Part I

3) IS: 1003 - Timber aneled and glazed shutters (Part I & II)

4) IS: 4020 - Method of tests for wooden flush doors: Type tests

5) IS: 1761 - Transparent sheet glass for glazing and framing purposes

6) IS: 3097 - Specification for veneered particle boards (Exterior Grade)

General

Wood used for all work shall be the best of the respective class specified, and properly seasoned, suitable for joinery work should be of natural growth, uniform in texture, straight grained, free from sapwood, dead knots, open shakes, rot, decay and any other defects and blemishes.

For joints following principles to be observed:

At the joints the weakness of pieces must be minimum as far as possible. To place each abutting surface in a joint as neatly as possible, perpendicular to pressure. To form and fit accurately every pair of surface that come in contact.

All joining shall be wrought on all faces and finished off by hand with sand paper with slightly rounded arises.

The joints shall be pinned with hard wood pins and put together with white lead. Jointing shall be by means of mitred joints as approved. For internal joints where there is no chance of moisture the joint shall be glued. **Driving of screws with hammer is prohibited**. The screws shall be soaked in oil before driving them home. The heads of the screws and nails shall be sunk and puttied.

Any joinery work which shall split, fracture, shrink or show flaws or other defects due to unsoundness, inadequate seasoning or bad workmanship, shall be removed and replaced with sound materials at the contractor's expense.

Door frames shall be rebated. All dimensions shall be as per drawings. The verticals of door frames shall project about 50 mm below finished floor, surface coming in contact with brick work shall be painted as directed by the Engineer. The door frame shall be provided with door anchors/dash fasteners as per manufactures specification. The work shall conform to IS: 4021.

The workmanship of all doors and window shutters shall conform to the requirements of IS: 1003 (Parts I & II) and IS: 2202 (Part I). Flush door panels shall be got tested as per IS: 4020 in standard Laboratories.

Flush door shutters shall have a solid core and may be of the decorative or non- decorative (Paintable type as per IS 2202 (Part I). Nominal thickness of shutters may be 25, 30, 35 or 38 mm.

Thickness and type of shutters shall be as specified.

Width and height of the shutters shall be as shown in the drawings or as indicated by the Engineering in Charge. All four edges of the shutters shall be square. The shutter shall be free from twist or warp in its plane. The moisture content in timbers used in the manufacture of flush door shutters shall be not more than 12 per cent when tested according to IS 1708

Core

The core of the flush door shutters shall be a block board having wooden strips held in a frame constructed of stiles and rails. Each stile and rail shall be a single piece without any joint. Stiles, rails and wooden strips forming the core of a shutter shall be of equal and uniform thickness. Wooden strips shall be parallel to the stiles. End joints of the pieces of wooden strips of small lengths shall be staggered. In a shutter, stiles and rails shall be of one species of timber. Wooden strips shall also be of one species only but it may or may not be of the same species as that of the stiles and rails. Any species of timber may be used for core of flush door. However, any non-coniferous (Hard wood) timber shall be used for stiles, rails and lipping.

Face Panel

The face panel shall be formed by gluing, by the hot-press process on both faces of the core, either plywood or cross-bands and face veneers. The thickness of the cross bands as such or in the plywood shall be between 1.0 mm and 3.0 mm. The thickness of the face veneers as such or in the plywood shall be between 0.5 mm and 1.5 mm for commercial veneers and between 0.4 mm and 1.0 mm decorative veneers, provided that the combined thickness of both is not less than 2.2 mm. The direction of the veneers adjacent to the core shall be at right angles to the direction of the wooden strips. Finished faces shall be sanded to smooth even texture. Commercial face veneers shall conform to marine grade plywood and decorative face veneers shall conform to type I decorative plywood in IS 1328.

Lipping

Lipping, where specified, shall be provided internally on all edges of the shutters. Lipping shall be done with battens of first class hardwood or as specified of depth Joints shall not be permitted in the lipping.

Rebating

In the case of double leaves shutters the meeting of stiles shall be rebated by 8 mm to 10 mm. The rebating shall be either splayed or square type as shown in drawing where lipping is provided.

Opening for Glazing

Opening for glazing shall be provided where specified or shown in the drawing.

Tolerance

Tolerance on width and height shall be + 3 mm and tolerance on nominal thickness shall be ± 1.2mm. The thickness of the door shutter shall be uniform throughout with a permissible variation of not more than 0.8 mm when measured at any two points.

Adhesive

Adhesive used for bonding various components of flush door shutters namely, core, core frame, lipping, cross-bands, face veneers, plywood etc. and for bonding plywood shall conform to BWP type, phenol formaldehyde synthetic resin adhesive conforming to IS-848.

Tests

Samples of flush door shutters shall be subjected to the following tests:

(a) End Immersion Test

(b) Knife Test

(c) Glue Adhesion Test

One end of each sample shutter shall be tested for End Immersion Test. Two specimens of 150 x 150 mm size shall be cut from the two corners at the other end of each sample shutter for carrying out Glue Adhesion Test. Knife Test shall be done on the remaining portion of each sample shutter.

Sample Size

Shutters of decorative and non-decorative type from each manufacturer, irrespective of their thickness, shall be grouped separately and each group shall constitute a lot. The number of shutters (sample size) to be selected at random from each lot for testing If the total number of shutters of each type in a work (and not the lot) is less than twenty five, testing may be

done at the discretion of the Engineer and in such cases extra payment shall be made for the sample shutter provided the sample does not fail in any of the test specified.

Fixing of Shutters

Size and type of hinges and pivots shall be as specified. Flap of hinges shall be neatly counter sunk into the recesses cut to the exact dimensions of flap. Screws for fixing the hinges shall be screwed in with screw driver and not hammered in.

Measurement

The measurement shall be in numbers .Only specified dimensions/size of door shall be allowed.

Rate

The rate shall include the cost of all materials as above, T & P, scaffolding and labour involved in all the operations described above including, installation, lead, lift and all taxes etc. as applicable.

8.2 FIBRE GLASS REINFORCED PLASTIC (FRP) DOOR FRAMES

Door Frames shall be three legged of cross section 90 mm x 45 mm having single rebate of size32 mm x 15 mm to receive shutter of 30 mm thickness. The frame shall be made of laminate of thickness of 2 mm and shall be filled with wooden blocks of exterior grade MDF or seasoned and treated hard wood inside the laminate in all the three legs of the frame. The frame to be moulded by either hand lay up or resin transfer moulding process. The process shall consist of laying gelcoat at 1000 gms./m2 and laid over with layer of FRP Mat (CSM mat) gelcoat and FRP (CSM Mat) are defined in IS 14856. The CSM mat shall be bonded with Isophatholic resin in the ratio not less than 1:2 (One part of Mat to two parts of Isopathlic resin and fillers & additives) by weight. The edge shall be sealed with gelcoat and FRP mat to obtain smooth finish. Sufficient roving shall be laid in the corner to have smooth curve while laying the CSM mat. FRP door shall be manufactured as per specifications laid down in IS 14856, nomenclature of items & direction of Engineer.

Tolerance

Tolerance of size of frame to be + 2 mm and on size of rebate to be + 1 mm.

Finish

The surface of the moulded frame shall be free from any visible defects such as small pores, crazing, blistering, wrinkling, impurities, defective impregration, colour blots and aggregate defects, as mentioned in IS 14856. Scattered pin holes duly repaired and finished by applying resin and not noticeable shall be acceptable. Frame laminate shall be flat and shall have smooth and level surface. Laminate shall be finished in colour & shade as approved by Engineer.

Fixing of Frames

The frames are to be fixed in prepared openings in the walls. All civil work and tiling should be completed before the fixing of the frames. The frames are to be fixed directly on the plastered wall. In case tiling is to be done in the place the frames are to be fitted, a 50 mm strip should be left untiled at the location where the frames are to be fitted. The frames are erected in the prepared opening such that the vertical members of the door frame are embedded 50 mm in the floor. The frame shall be fitted truly in plumb. A minimum of three anchor bolts or screws of size 65/100 shall be used to fix each vertical member. One bolt shall be fixed at 200 mm from the top member and one bolt shall be fixed at 200 mm from the floor. The third anchor bolt shall be fixed in the center. The top horizontal member shall be fixed using two 65/100 size anchor bolts or screws at a distance of 200 mm from both the corners.

Measurement

The outer length of the vertical and horizontal members of door frame shall be measured in running metres including embedded length in floor corrected upto a cm.

Rate

The rate includes the cost of the materials and labour involved in all the operations described above.

The cost of anchor bolts or screws for joining the frame is included in the rate. Any other hardware, which may be required, shall be paid for separately.

8.3 FIBRE GLASS REINFORCED PLASTIC (F.R.P.) SHUTTERS

F.R.P. Shutters shall be manufactured conforming to the specifications as per IS 14856 and nomenclature of item & direction of Engineer.

Blocks of any seasoned hardwood of bulk density not less than 450 kg./m3 at 12 per cent moisture content or any other material of sufficient thickness and length shall be provided inside the shutter at suitable place to hold fittings and fixtures such as aldrops, tower bolt, handle, sliding door bolt, mortice lock etc. Blocks for hinges shall be provided at three locations, unless otherwise specified by the purchaser. One at the centre and other two at 200 mm from the top and the bottom of the shutter. Blocks shall be provided at predetermined places in the shutter so as to fix hinges mortice locks, tower bolts, aldrops, door closures, etc. The finished surface shall be buffed and polished with wax.

Location of Fittings and Accessories

The lock rail of door shutters shall be so placed that is centre line is at a height 850 + 5 mm from the bottom of the shutter. Door shutter shall be fixed to the frame with three hinges, unless otherwise specified by the purchaser, of the type specified. These locations shall be, one at centre and other two at 200 mm from the top and the bottom of the shutter, where blocks have already been provided and suitable indication by depressing the profile has been made. Screws for fixing the hinges shall be screwed in with screwdrivers & not hammered. The length of screw should be 8/30 mm. The hinges used shall best stainless steel or aluminum.

Sampling & Criteria for Conformity

The test specimens shall not have been exposed to a temperature below 40oC for 24 hours immediately preceding the test and shall be free from all visible moisture. The specimen shall be inspected and any specimen with visible flaws shall be discarded. If any test specimen fails because of mechanical reason, such as failure of testing equipment or improper specimen preparation, it shall be discarded and another specimen taken.

Sampling

Sampling criteria for conformity shall be in accordance with IS 4020 (Part –I)

Lot in any consignment of shutters shall be of the same grade and type and manufactured under similar conditions of production which shall be grouped together to form a lot. The number of shutters to be selected at random from a lot shall depend upon its size and shall be in accordance with Table below.

No. of Sample and Criteria for Conformity

Sl.No. Sample size Permissible No. of Defects

(1) (2) (3)

26 to 50 8 1

51 to 100 13 1

101 to 150 20 1

151 to 300 32 1

301 to 500 50 2

501 and above 80 2

Note : For lot size 25 or less, number of samples to be taken for testing shall be as agreed to between the manufacturer & Engineer.

Number of Tests: The samples selected as in column 2 of Table shall be as agreed to between the manufacturer& Engineer. *Criteria for Conformity:* The lot shall be considered conforming to the requirements if the number of samples failing to satisfy the requirements of characteristics does not exceed the permissible number mentioned in col. 3.

Finish The surface of the moulded frame shall be free from any visible defects such as small pores, crazing, blistering, wrinkling, impurities, defective impregration, colour blots and aggregate defects, as mentioned in IS 14856. Scattered pin holes duly repaired and finished by applying resin and not noticeable shall be acceptable. Frame laminate shall be flat and shall have smooth and level surface. Laminate shall be finished in colour & shade as approved by Engineer.

Tests

The door shutters shall be subjected to the following tests in accordance with IS 4020 (Part 1to 16)

Fixing of Shutter

Door shutter shall be side hung on three bolt hinges of size 100 mm, one at the centre and the other two at 200 mm from the top and bottom of the shutter.

The flat of the hinges shall be neatly counter sunk in to the recesses cut out to the exact dimensions of the hinge flap. The door shall be drilled on the thickness to fit hinges. Screws for fixing the hinges shall be screwed in with screwdrivers and not hammered. The length of the screws should be 8 mm/30 mm. The hinges used should be of stainless steel

Tolerance

The tolerance on the width and the height of the door shall be + 5 mm and the tolerance on the nominal thickness of the door shall be + 2 mm.

Measurement

Length and width of the shutters shall be measured to the nearest cm in closed position covering the rebates of the frames but excluding the gap between the shutter and the frame. Area is calculated to the nearest 0.01 sqm.

Rate

The specified rate include the cost of the door shutter and labour involved in fixing of the shutter.

Fittings & fixtures on the door shutter except hinges & screws shall be paid extra as provided.

9 STEEL WORK

9.1 Steel Work In Built Up Section (Welded)

The steel work in built up sections (welded) such as in trusses, form work etc. is specified in this clause.

Laying out

It shall be as specified.

Fabrication

Straightening, shaping to form, cutting and assembling, shall be as per 10.3.2 as far as applicable, except that the words "riveted or bolted" shall be read as "welded" and holes shall only be used for the bolts used for temporary fastening as shown in drawings.

Welding*:* Welding shall generally be done by electric arc process as per IS 816 and IS-823. The electric arc method is usually adopted and is economical. Where electricity for public is not available generators shall be arranged by the contractor at his own cost unless otherwise specified. Gas welding shall only by resorted to using oxyacetylene flame with specific approval of the Engineer. Gas welding shall not be permitted for structural steel work Gas welding required heating of the members to be welded along with the welding rod and is likely to create temperature stresses in the welded members. Precautions shall therefore be taken to avoid distortion of the members due to these temperature stresses. The work shall be done as shown in the shop drawings which should clearly indicate various details of the joint to be welded, type of welds, shop and site welds as well as the types of electrodes to be used. Symbol for welding on plans and shops drawings shall be according to IS 813. As far as possible every efforts shall be made to limit the welding that must be done after the structure is erected so as to avoid the improper welding that is likely to be done due to heights and difficult positions on scaffolding etc. apart from the aspect of economy. The maximum dia of electrodes for welding work shall be as per IS 814. Joint surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter, which adversely affect the quality of weld and workmanship.

Precautions: All operation connected with welding and cutting equipment shall conform to the safety requirements given in IS 818 for safety requirements and Health provision in Electric and gas welding and cutting operations.

Inspection and testing of welds shall be as per IS 822.

Assembly*:* Before welding is commenced, the members to be welded shall first be brought together and firmly clamped or tack welded to be held in position. This temporary connection has to be strong enough to hold the parts accurately in place without any disturbance. Tack welds located in places where final welds will be made later shall conform to the final weld in quality and shall be cleaned off slag before final weld is made.

Erection

The specification shall be as described except that while erecting a welded structure adequate means shall be employed for temporary fastening the members together and bracing the frame work until the joints are welded. Such means shall consists of applying of erection bolts, tack welding or other positive devices imparting sufficient strength and stiffness to resist all temporary loads and lateral forces including wind. Owing to the small number of bolts ordinarily employed for joints which are to be welded, the temporary support of heavy girders carrying columns shall be specially attended.

Different members which shall be fillet welded, shall be brought into as close contact as possible. The gap due to faulty workmanship or incorrect fit if any shall not exceed. 1.5 mm if gap exceeds 1.5 mm or more occurs locally the size of fillet weld shall be increased at such position by an amount equal to the width of the gap.

Painting : Before the member of the steel structures are placed in position or taken out of the workshop these shall be painted as specified . First coat of primer shall be applied once the material reached at the site and the second coat after fabrication. Painting on steelwork shall be done as per the specification given under sub head **Protective coating.**

Measurements

The mode of measurements shall be the same as specified except that weight of welding material shall not be added in the weight of members for payment and nothing extra shall be paid for making and filling holes for temporary fastening of members during erection before welding.

Rate

The rate shall include the cost of all labor and materials involved in all the operations described above.

9.2 Tubular / Hollow Section Trusses
Structural Steel Tube

These shall be of:

1. Hot finished welded (HFW) type, or
2. Hot finished seamless (HFS) type, or

3. Electric resistance or induction butt welded (ERW), YST 310

Conforming to the requirement of IS 4923. Tubes shall be designed by their nominal bore. These shall be light, medium or heavy as specified depending upon the wall thickness. They shall be free from cracks, surface flaws, laminations and other defects. The ends shall be cut clean and square with axis of tube, unless otherwise specified.

Minimum Thickness of Metals

Wall thickness of tubes used for construction exposed to weather shall be not less than 4 mm and for construction not exposed to weather it shall be not less than 3.2 mm where structures are not readily accessible for maintenance, the minimum thickness shall be 5 mm.

Fabrication

The component parts of the structure shall be assembled in such a manner that they are neither twisted nor otherwise damaged and be so prepared that the specified cambers, if any, are, maintained. The tubular steel work shall be painted with one coat of approved steel primer after fabrication. All fabrication and welding is to be done in an approved workshop. The joint details shall be generally as per S.P-38 of B.I.S publication.

Straightening

All material before being assembled shall be straightened, if necessary, unless required to be of curvilinear form and shall be free from twist.

Bolting

Washers shall be specially shaped where necessary, or other means, used to give the nuts and the heads of bolts a satisfactory bearing.

In all cases, where the full area of the bolts is to be developed, the threaded portion of the bolt shall not be within the thickness of the parts bolted together and washers of appropriate thickness shall be provided to allow the nuts to be completely tightened.

Welding

Where welding is adopted, it shall be as per IS 816.

Caps and Bases for Columns

The ends of all the tubes, for columns transmitting loads through the ends, should be true and square to the axis of the tubes and should be provided with a cap or base accurately

fitted to the end of the tube and screwed, welded or shrunk on. The cap or base plate should be true and square to the axis of the column.

Sealing of Tubes

When the end of a tube is not automatically sealed by virtue of its connection be welding to another member the end shall be properly and completely sealed. Before sealing, the inside of the tubes should be dry and free from loose scale.

Flattened Ends

In tubular construction the ends of tubes may be flattened or otherwise formed to provide for welded. Riveted or bolted connections provide that the methods adopted for such flattening do not injure the material. The change of sections shall be gradual.

Hoisting and Erection

Tubular trusses shall be hoisted and erected in position carefully, without damage to themselves, other structure, equipment and injury to workman. The method of hoisting and erection proposed to be adopted shall be got approved from the Engineer. The contractor shall however be fully responsible, for the work being carried out in a safe and proper manner without unduly stressing the various members. Proper equipment such as derricks, lifting tackles, winches, ropes etc. shall be used.

Measurements

The work as fixed in place shall be measured in running metres correct to a centimeter on their weights calculated on the basis of standard tables correct to the nearest kilogram unless otherwise specified. Weight of cleats, brackets, packing pieces bolts nuts, washers distance pieces separators diaphragms gussets (taking overall square dimensions) fish plates, etc. shall be added to the weight of respective items unless otherwise specified. No deduction shall be made for skew cuts.

Rate

The rate shall include the cost of labour and materials involved in all the operations described above including application of pain.

Providing and fixing inserts in concrete works

Inserts are required to be fixed/embedded as indicated in construction drawings and/or as directed by Engineer in foundations, columns and other miscellaneous concrete works. These inserts comprise plates, angles, pipe sleeves, anchor bolt assemblies, etc.

The rate quoted by the Tenderer shall hold good for accurately fixing the inserts at the correct levels/alignment and shall include for the cost of any temporary or permanent supports/anchors such as bars including cutting, bending, welding, etc. as required and cost of grouting.

Steel templates shall be used by Contractor to locate and very accurately position bolts, group of bolts, inserts, embedded parts, etc. at his cost. Such templates shall be previously approved by the Engineer. Templates shall invariably be supported such that the same is not disturbed due to vibration, movement of labourers, materials, shuttering work, reinforcement, etc. while concreting. The Contractor will have to suitably bend, cut or otherwise adjust the reinforcement in concrete at the locations of inserts as directed by the Engineer at no extra cost to OWNER. If the Engineer so directs, the inserts will have to be welded to reinforcement to keep them in place. Contractor shall be responsible for the accuracy of dimensions, levels, alignments and centre lines of the inserts in accordance with the drawings and for maintenance of the same until the erection of equipment/structure or final acceptance by Owner.

Contractor shall ensure proper protection of all bolts, inserts, etc. from weather and other damages by greasing or other approved means such as applying white lead putty and wrapping them with gunny bags or canvas or by other means as directed by Engineer to avoid damage due to movement of his labourers, material, equipment, etc. No extra claim from the Contractor on this account shall be entertained. Contractor shall be solely responsible for all the damages caused to bolts, inserts, etc. due to his negligence and in case damages do occur, they shall be rectified to the satisfaction of Engineer at the Contractor's cost.

Providing and fixing in position grill, railing, steel ladder, etc.

This work shall be carried out as per the detailed drawings. The MS sections shall be of approved quality. The welding shall be perfect and the junctions shall be ground properly. The frames shall be provided with hold fasts and the same shall be grouted with CC

blocks in brick work. It shall be painted with two coats of zinc chromate primer and two coats of synthetic enamel paint of approved make and colour.

Providing & Fixing MS holding down bolts

The MS holding down bolts of specified dia, length and shape shall be provided as per the drawings in line & level. These shall be fixed to RCC work or brick work by grouting it with concrete. The bolt shall be provided with nuts and washers. The grease shall be applied to the threaded portion with the help of templates. If the bolts need some adjustment it shall be provided with a wooden piece 75x75 mm or 50 mm dia GI pipe around bolt shall be provided at the time of concreting and shall be removed after initial set.

9.3 ROLLING SHUTTERS

Supplying and fixing rolling shutters of approved make, made of required size GI laths, interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, GI side guides and arrangements for inside and outside locking with push and pull operation complete, including the cost of providing and fixing necessary 27.5cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS:4454 part 1 and GI top cover of required thickness for rolling shutters including two coats of approved make and colour synthetic enamel paint over two coats of approved make anticorrosive yellow zinc chromate primer, including cost and conveyance of all materials, labour charges, lead, lift etc. complete as directed by Engineer at all levels Rolling shutters shall conform to IS 6248. These shall include necessary locking arrangement and handles etc. These shall be suitable for fixing in the position as specified i.e. outside or inside on or below lintel or between jambs of the opening. The door shall be either push and pull type or operated with mechanical device supplied by the firm. Shutters upto 10 sq. metre shall be of push and pull type and shutters with an area of over 10 sq. metre shall generally be provided with reduction gear operated by mechanical device with chain or handle, if bearings are specified for each of operation, these shall be paid for separately.

Shutter:

The shutter be built up of inter locking lath section formed from cold rolled steel strips. The thickness of the sheets from which the lath sections have been rolled shall be not less than 0.90 mm for the shutters upto 3.5 m width and not less than 1.2mm for shutters above

3.5m width. Shutters above 9 metres width should be divided in 2 parts with provision of one middle fixed or movable guide channel or supported from the back side to resist wind pressure. The lath section shall be rolled so as to have interlocking curls at both edges and a deep corrugation at the centre with a bridge depth of not less than 12 mm to provide sufficient curtain of stiffness for resisting manual pressures and normal wind pressure. Each lath section shall be continuous single piece without any welded joint. When interlocked, the lath sections shall have a distance of 75 mm rolling centers. Each alternate lath section shall be fitted with malleable cast iron or mild steel clips securely riveted at either ends, thus locking in the lath section at both ends preventing lateral movement of the individual lath sections. The clips shall be so designed as to fit the contour of the lath sections.

Spring:

The spring shall be of coiled type. The spring shall be manufactured from high tensile spring steel wire or strips of adequate strength conforming to IS 4454- Part I.

Roller and Brackets:

The suspension shaft of the roller shall be made of steel pipe conforming to heavy duty as per IS 1161. For shutter upto 6 metre width and height not exceeding 5metre, steel pipes of 50 mm nominal bore shall be used. The shaft shall be supported on mild steel brackets of size 375 x 375 x 3.15 mm for shutters upto a clear height of 3.5 metre. The size of mild steel brackets shall be 500 x 500 x 10 mm for shutters of clear height above 3.5 m and upto 6.5 m. The suspension shaft clamped to the brackets shall be fitted with rotatable cast iron pulleys to which the shutter is attached. The pulleys and pipe shaft shall connected by means of pretensioned helical springs to counter balance the weight of the shutter and to keep the shutter in equilibrium in any partly open position.

When the width of the opening is greater than 3.5 mtr. The cast iron pulleys shall be interconnected with a cage formed out of mild steel flats of at least 32 x 6 mm and mild steel dummy rings made of similar flats to distribute the torque uniformly. Self aligning two row ball bearing with special cast iron casings shall be provided at the extreme pulley and caging rings shall have a minimum spacing of 15mm and at least 4 number flats running throughout length of roller shall be provided.

In case of shutters of large opening with mechanical device for opening the shutter the roller shall be fitted with a purion wheel at one end which in contact with a worm fitted to the bracket plate, caging and pulley with two ball bearing shall be provided.

Guide Channels

The guide channels shall be of mild steel deep channel section and of rolled, pressed or built up (fabricated) construction. The thickness of the sheet used shall not be less than 3.15 mm. The depth of the guide should be such that there is sufficient clearance between the curtain ‘and the inner surface of the guide to avoid any rubbing or obstruction for free movement of the curtain. The curtain shall project into the guide at least 40 mm up to 3.5 m width and 60 mm for greater width and there shall be a clearance of 10 mm minimum between the guide wall and the end clips of the curtain to permit free movement of the curtain under normal wind pressure. **Where the shutter is installed in heavy windy zones special wind locking arrangements shall be provided to prevent the curtain coming out of the guide.**

The gap, on either side, between the edge of curtain and the inside edge of the guide channel shall be about 5 mm to allow for the free movement of the curtain and at the same time to prevent rattling of the curtain due to wind.

Size of the guide channel **–** The depth and width of the guide channel shall be as under:

a) Depth Clear width of shutter Depth of guide channel, Min up to 3.5 m 65 mm

3.5 m up to 8 m 75 mm

8 m and above 100 mm

b) Width of guide channel shall be 25 mm for lath sections with bridge depth of about 12 mm and 32 mm for lath sections with bridge depth of about 16 mm.

Each guide channel shall be provided with a minimum of three fixing cleats or supports for attachment to the walls or column-by means of bolts or screws. The spacing of cleats shall not exceed 0.75 m. alternatively, the guide channels may also be provided with suitable dowels, hooks or pins for embedding in the walls.

The guide-channels shall be attached to the jambs, plumb and true, either in the overlapping fashion, projecting fashion or embedded in grooves, depending on the method of fixing.

Cover

Top cover shall be of mild steel sheets not less than 0.90 mm thick and stiffened with angle or flat stiffeners at top and bottom edges to retain shape.

Lock plates with sliding bolts, handles and anchoring rods shall be as per IS 6248.

Fixing

The arrangement for fixing in different situations in the opening shall be as per IS 6248. Brackets shall be fixed on the lintel or under the lintel as specified with rawl. Plugs and screws bolts etc. The shaft along with the spring shall then be fixed on the brackets.

The lath portion (shutter) shall be laid on ground and the side guide channels shall be bound with ropes etc. The shutter shall then be placed in position and top fixed with pipe shaft with bolts and nuts. The side guide channels and cover frames shall then be fixed to the walls through the plate welded to the guides. These plates and bracket shall be fixed by means of steel screws bolts, and rawl plugs concealed in plaster to make their location invisible. Fixing shall be done accurately in a workmen like manner that the operation of the shutter is easy and smooth.

Measurements

Clear width and clear height of the opening for rolling shutter shall be measured correct to a mm. The clear distance between the two jambs of the opening shall be clear width and the clear distance between the sill and the soffit (bottom of lintel) of the opening shall be the clear height.

The area shall be calculated in square metres correct to two places of decimal.

Rate

The rate shall include the cost of materials including painting and labour involved in all the operations described above including cost of top cover and spring except ball bearing and mechanical device of chain and crank operation, which shall be paid for separately.

9.4 ROLLING GRILLS – SHUTTERS

Rolling grill shutter is meant to provide visibility or ventilation or both, the degree of protection and safety is less as compared to a rolling shutter. The situations where a certain amount of ventilation combined with safety is required rolling shutter-cum-grill may be provided in which the rolling shutter may have a rolling grill portion either at the top or at

the bottom or at both places. In addition, the rolling grill portion may also be provided in the middle of the shutter. The total height of the grill portion in all the segments of rolling shutter-cum-grill shall not exceed 1.0 m and the height of the grill portion in any individual segment shall not be more than 0.5 m. Rolling grills shutters are similar in design, construction and operation to rolling shutters and all the provisions of rolling shutter shall be applicable to rolling grills shutters except in respect of the shutter portion, and shall conform to IS 6248.

Shutters

Rolling grill shutter and the rolling grill portion of the rolling shutter-cum-grill shall be fabricated with 8 mm diameter GI steel round bars. Straight bars and bars bent to the required profile are placed alternatively and held in position with 20 mm wide and 5 mm thick GI flat links. Straight bars shall be spaced not exceeding 150 mm centre to centre and the bars bent to required profile shall be placed symmetrically between two consecutive straight bars. Unless otherwise specified or directed by the Engineer, bars placed alternatively with straight bars shall be bent to form a corrugated profile such that the pitch of the corrugation is 100 to 120 mm and the depth of corrugation is 80 to 100mm. all the bent bars shall have uniform profile. Straight bar along with the adjoining bent bars on it both sides shall be held in position by passing the bars through holes in the links. Each link shall have three holes and the length of the links shall be such that the distance from the centre of the hole to the nearest edge of the flat is not less than the diameter of the hole. The corner of the links shall be rounded. All links shall be of uniform size and shape. The spacing of the links measured along the straight bar shall be the same as centre to centre distance between two consecutive crests/ troughs of the bars bent to the required profile. Each bar and link shall be continuous single piece without any joint.

Measurement & Rate

The measurement and rate shall be as specified in specification of Rolling shutter. In case of Rolling Shutter-cum-Grill, where the area of the grill portion is half or less than half the area of opening, it shall be measured and paid as rolling shutter and where the area of grill portion is more than half the area of opening, it shall be measured and paid as rolling grill.

9.5 STAINLESS STEEL WORK

The Stainless steel railing pipes, hardware's & accessories of specified grade to be supplied and installed at site as per the above mentioned specifications as per BOQ , drawings and approved by the Engineer.

Material Properties:

The material properties of stainless steel pipes and accessories should be conforming to SS 304 grade.

Stainless Steel Works

The stainless steel pipes shall be procured from approved manufacture and of approved grade. The quality of stainless steel sheet and pipe shall be approved by Client/Consultant before proceeding with execution any item of work.

Hand Rail

The pipe used for handrail shall be of 16 gauge thick. The welded links are to be ground and organ buffed to get the original finish of the surface of the material welded. The joints or junctions where two pieces are joined/welded to be precisely cut and then welded.

Surface Finish

Surface finish of all the stainless steel materials will be satin/mirror finish free from all marks and blemishes as per drawing and as approved by the Engineer.

Execution

The execution shall be carried out at site respectively as per the BOQ and drawings

Accessories

Fixing will be done by stainless steel bolts and joining shall be with SS connectors of approved type, size and make as per direction of Engineer and welding to be done by using organ welding rods and the surface being duly finished and cleaned by K_2 passivation, which is nitric acid plus fluoric acid solution treatment by which the chances of corrosion will be eliminated and any burn out makes on the metal will also be eliminated.

Final Cleaning:-

Protective coating and warning markings shall remain undisturbed until final acceptance. Immediately prior to final inspection, temporary protective covering or coating shall be removed and surfaces shall be washed with a suitable thinner and left in a finished condition having approved uniform appearance and free from all marks and blemishes.

Fabrication & Tolerances

Unless otherwise shown on the drawing, the fabricating tolerances shall generally be as follows:

Straightness: Compression members shall not deviate from straightness by more than 1/1000 of the axial length between points, which are to be laterally supported.

Completed members shall be free from twist bends and open joints. Sharp links or bends shall be cause for rejection of material.

Length: of 1mm is permissible in the overall length of members with parts of the structure, shall have a variation for the detailed length not greater than 2mm for members 10 meters or less in length and not greater than 3mm for members over 10 meters in length.

Inspection:-

The Agency should arrange for factory inspection of all stainless steel material and glass to ascertain the quality of material i.e. stainless steel fixtures / accessories and glass as per manufacturer's standard / BIS / ASTM standard, including lamination of glass as per specification to the satisfaction of Engineer.

Measurement

All stainless steel sections shall be measured in kilogram. Stainless steel members fixed in place shall be measured in running meter along the length correct to a millimeter. The weight calculated on the basis of actual average (average of five samples) weight of stainless steel section in kilogram correct to the second place of decimal shall be taken for payment.

Rate

The rate shall include the cost of all materials like, Stainless Steel pipes, Stainless steel fitting & accessories, other fixing material, T & P, scaffolding and labour involved in all the operations described above including fixing/installation, lead & lift etc. as applicable.

9.6 MANHOLE COVERS & FRAMES

Manhole Covers

The covers and frames shall conform to IS 1726 for cast Iron and IS 12592 for pre-cast concrete Covers.

Cast Iron Manhole Covers and Frames

(i) Manhole covers and frame shall be manufactured from appropriate grade of grey cast iron not inferior than FG150 grade of IS 210.

(ii) They shall be cleanly cast and shall be free from air and sand holes, cold shuts and warping.

(iii) Covers shall have on its operative top a raised chequered design to provide for an adequate no-slip grip. The rise of chequers shall be not less than 4mm.

(iv) Key holes, keys and lifting devices shall be provided in the manhole covered to facilitate their placement in the frames and their operative maintenance.

(v) Manhole covers and frames shall be coated with materials having base with a black bituminous composition. The coating shall be smooth and tenacious. It shall not flow when exposed to temperature of 63°C and shall not be so brittle as to chip off at temperature of 0°C.

(vi) Size and shape and performance requirement of manhole covers and frames shall conform to IS 1726.

(vii) Each manhole covers and frame shall have cast on them the following information:

(a) Manufacturer's name or trade-mark

(b) Grade designation

(c) Date of manufacturer

(d) The words SWD or 'Sewer' to denote 'storm water drain' or 'sewer' respectively

(e) Identification marks as required by Engineer. (viii) The cover shall be gas tight and water tight.

(ix) The sizes of covers specified shall be taken as the clear internal dimensions of the frame.

(x) The approximate weight of the various type of manhole covers and frames shall be as per IS 1726.

(xi) The cover shall be capable of easy opening and closing and it shall be fitted in the frame in workmanship like manner.

Pre-Cast Concrete Covers & Frames

Pre-cast reinforced cement concrete manhole covers intended for use in sewerage and water works shall generally conform to IS 12592.

Materials

Cement: Cement used for the manufacture of pre-cast concrete manhole covers shall be 43 grade Portland cement conforming to IS-8112.

Aggregates: The aggregates used shall be clean and free from deleterious matter and shall conform to the requirements of IS-383. The aggregates shall be well graded and the nominal maximum size of coarse aggregate shall not exceed 20 mm.

Concrete: The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combing etc. The minimum cement content in the concrete shall be 330 kg/m3 with a maximum water cement ratio of 0.45. Concrete weaker than grade M-25 (design mix) shall not be used. Compaction of concrete shall be done by machine vibration.

Reinforcement

(a) The reinforcement steel shall conform to IS 1786. Reinforcement shall be clean and free from loose mill scale, loose rust, and mud, oil, grease or any other coating which may reduce or destroy the bond between the concrete and steel. A light film of rust may not be regarded as harmful but steel shall not be visibly pitted by rust.

(b) Fibers Steel: The diameter/equivalent diameter of steel fibers where used, shall not be greater than 0.75 mm. The aspect ratio shall be in the range of 50 to 80. The minimum volume of fibers shall be 0.5 percent of the volume of concrete. The reinforced concrete

manhole cover and frame shall be designed in accordance with the provisions of IS 456. Clear cover to reinforcement shall not be less than 15 mm.

Shapes and Dimensions

Shape, dimensions and tolerance of pre-cast concrete manhole covers and frames shall conform to IS 12592. Outside dimension of cover at top shall match with corresponding frame so that the maximum clearance at top between the frame and the cover all round the periphery is not more than 5 mm and the top surface of the frame and covers, is in level within a tolerance of +5 mm. For facility of removing the cover from the frame, suitable taper matching with taper given for the frame shall be provided to the periphery of the cover.

Lifting Device

The minimum diameter of mild steel rod used as lifting device shall be 12 mm for light and medium duty covers and 16 mm for heavy and extra heavy duty covers. The lifting device shall be protected from corrosion by hot galvanizing or epoxy coating or any other suitable treatment.

Finishing & Coating

To prevent any possible damage from corrosion of steel the underside of the covers shall be treated with anticorrosive paint. The top surface of the covers shall be given a chequered finish. In order to protect the edges of the covers from possible damage at the time of lifting and handling it is necessary that the manhole covers shall be cast with a protective mild steel sheet of minimum 2.5 mm thickness around the periphery of the covers. Exposed surface of mild steel sheet shall be given suitable treatment with anticorrosive paint or coating. To prevent the top outer edge of frame from possible damages, it shall be protected by 25 mm X 3 mm mild steel flat as part of the frame.

Physical Requirements

(a) General

All units shall be sound and free from cracks and other defects which interface with the proper placing of the unit or impair the strength or performance of the units. Minor chipping at the edge/surface resulting from the customary methods of handling during delivery shall not be deemed for rejecting.

(b) Load Test

The breaking load of individual units when tested in accordance with the method described in IS 12592 shall be not less than the values specified in CPWD specification.

Fixing

The frames of manhole shall be firmly embedded to correct alignment and level in RCC slab or plain concrete as the case may be on the top of masonry which shall be paid as extra unless specified otherwise.

Measurements

The manhole covers shall be enumerated under relevant items.

Rates

The rate shall include the cost of materials and labour involved in all the operation described above except fixing of frames and covers which shall be paid as extra unless specified otherwise in the item.

Foot Rests

Foot rests shall be of 20 mm M.S. square or round bars as specified.

9.7 G.I. CHAIN LINK FABRIC FENCING Material

G.I. Chain link fabric fencing of required width in mesh size 50 x 50 or 25 x 25 mm or specified otherwise of approved brand and made of specified dia GI wire PVC coated of specified thickness / or not as specified in item of required colour or shade to be used.

Fixing : GI chain link shall be stretched and fixed in specified width, strengthening with 2 mm dia wire or nuts bolts & washers as required to be done complete as per the direction of Engineer.

Measurements: The length and width shall be measured correct to a cm. The area shall be calculated in square metre, correct to two places of decimal.

The rate shall include the cost of material and labour involved in all the operations described as above.

PROTECTIVE COATING
Surface Preparation

Blast Abrasive Cleaning to Sa2.5 Swedish Standard. Solvent cleaning to be done in case of any oil stains on the surface.

PRIMER

Two pack epoxy Phenylkamine Primer with min Vol. Sold of 63% to give 100 mic DFT per cost having salt spray resistance of 1500 hrs Epilux FRX A/C Coating of Berger or Equivalent

INTERMEDIATE

Two pack epoxy cured with aliphatic amine and having a min vol. solids of 85% to give DFT of 150 microns in single coat. The product must possess 2000 hrs of Slat Spray resistance. Epilux 950 Super HB Coating of Berger or equivalent.

FINISH

Two pack aliphatic acrylic PU paint with a min vol solids of 52% and giving a DFT of 50 microns. Product should have 80% gloss level after 1000 hrs of exposure to UV B Lamp.BR ACR PU High Gloss Enamel of Berger or equivalent

FLOORING Applicable codes

1) IS: 1443- Code of practice for laying and finishing of cement concrete flooring.Tiles

2) IS: 2114 -Code of practice for laying in situ terrazzo floor finish

3) IS: 777 - Glazed earthenware tiles

Ceramic tiles in flooring, skirting and dado

The ceramic tiles in flooring and dado shall be of first class quality as specified in the item specification and shall be approved by the Engineer. The tiles shall be of standard size without warp and with straight edges, true and even in shape and size and of uniform colour. The tiles surface shall be of fine grained texture, dense and homogeneous. The thickness of the tile shall be as per the item specification. The tiles shall be submerged in water till the bubbles cease.

They should be laid on a base of 12 mm thick mortar bed (cement or lime 1:3 sand) and cement (3 kg/sq.m) paste. They shall be laid truly vertical on walls and truly horizontal on

floors or to slopes as directed. The joint shall be very thin, uniform and perfectly straight. The tiles in dado shall be finished in such a way that, only the tile thickness projects over the finished plaster or as specified otherwise. Where full tiles are not possible, the same should be cut or sawn to the required size and their edge rubbed to ensure straight and true joints. After the tiles are laid extra cement grout shall be removed. The joints shall be cleaned with wire brush and then the joint shall be floated with white or gray cement as approved by the Engineer. The tiles shall be cleaned after the work is complete.

Vitrified Tile Flooring

The vitrified tiles shall be of approved quality, size and uniform thickness and shall be hard, sound, dense and homogeneous in texture. It shall be uniform in shade free from stains, cracks and defects.

The Dimensional variations, surface quality, physical properties and chemical properties of tiles shall be as per internationally accepted relevant standards.

The edges are straight, with square edges and free from chippings. Tiles should be laid on a bed of cement mortar as specified in item specifications. Thickness of mortar bedding shall be specified in the item specifications and a neat cement shall be spread over the mortar bed. The tiles shall be placed one by one, keeping in check the level and line of the flooring. Tiles are wetted before placing. The tiles are then gently tapped with wooden mallet till it is firmly and properly bedded. There should be no voids left. The joint should be finished with tile joint filler of approved make and shade. The pattern of the flooring shall be as per the architectural drawings or as directed by Engineer.

The base concrete or the RCC slab on which the tiles are to be laid shall be cleaned, batted and mopped. the minimum thickness of bed mortar shall not be less than 12mm. Any undulation in the base concrete or RCC slab shall be corrected by cement mortar without any extra cost and any additional leveling required beyond max. mortar thickness to be carried out with cement concrete.

The flooring shall be cured for a minimum period of 7 days. The surface of the flooring shall be laid to levels and slopes as directed by Engineer.

The tiles which are fixed in the floor adjoining the wall shall enter not less than 12mm under the skirting or dado. The junction between the wall plaster and the floor shall be finished neatly and without waviness.

The free edges shall be cut as per the pattern and shall be polished to match with flooring.

Engineer has liberty to ask for any tests with respect to physical and chemical properties, etc. and the contractor shall arrange the same without any extra cost.

Granite Stone Flooring

Providing and laying 16 to 20 mm thick polished granite slab with edge rounding, nosing & machine polishing to edge to give high gloss finish, triple step groove if required with approved colour, make and pattern on floors, top of counter slabs, skirting, wall cladding, treads of steps, landings etc., including an under layer of cement mortar 1:4 (1 cement : 4 coarse sand) 20mm thick and cement slurry @ 3.3kg of cement per sqm, finished with flush pointing using approved joint filler of matching shade including cost and conveyance of all materials labour etc. Complete as directed by Engineer at all levels.

The granite has to be processed by water cut method and shall be machine polished using Auto polisher or line polisher to mirror finish to have a gloss meter reading of 90 above.

The stone shall be of approved quality, size and uniform thickness and shall be hard, sound, dense and homogenous in texture. It shall be uniform in shade free from stains, cracks, decay and weathering.

The edges are machine cut to fine, straight, with square edges and free from chippings. Stone should be laid on a bed of cement mortar as specified in item specifications. Thickness of mortar bedding shall be specified in the item specifications and a neat cement shall be spread over the motor bed and the slab/tiles shall be placed one by one, keeping in check the level and line of the flooring. Tiles are wetted before placing. The tiles are then gently tapped with wooden mallet till it is firmly and properly bedded. There should be no voids left. The joint should be paper joint. The pattern of the flooring shall be as per the architectural drawings or as directed by Engineer.

The base concrete or the RCC slab on which the tiles are to be laid shall be cleaned, batted and mopped. The minimum thickness of bed mortar shall not be less than 12 mm. Any undulation in the base concrete or RCC slab shall be corrected by cement mortar without any extra cost and any additional leveling required beyond max. mortar thickness to be carried out with cement concrete.

The flooring shall be cured for a minimum period of 7 days. The surface of the flooring shall be laid to levels and slopes as directed by Engineer.

Due care shall be taken to match the grains of tiles which shall be selected judiciously having uniform pattern.

The tiles which are fixed in the floor adjoining the wall shall enter not less than 12 mm under the skirting or dado. The junction between the wall plaster and the floor shall be finished neatly and without waviness.

The free edges shall be cut as per the pattern and shall be polished to match with flooring.

Before starting the work, the contractor shall generally get samples of granite tiles polished to the satisfactory level for approval of Engineer and shall be kept in the custody of the Engineer and the tiles/slabs supplied and used on the work shall confirm to the samples with regard to soundness, colour, shades, general texture and finishing/polishing.

Engineer-in-charge has liberty to ask for any tests with respect to physical properties, level of polishing, etc. and the contractor shall arrange the same without any extra cost.

Granite slabs in steps

It shall be of single piece and type/size shall be to match the sizes of the treads/risers. The edges shall be machine cut to the required shape.

10 CEMENT CONCRETE FLOORING WITH METALLIC HARDENER TOPPING

Wherever floors are required to withstand heavy wear and tear, use of floor hardener shall be avoided as far as possible by using richer mixes of concrete, unless the use of a metallic hardner is justified on the basis of cost. Where metallic hardener topping is used, it shall be 12 mm thick.

Metallic Hardening Compound

The compound shall be of approved quality consisting of uniformally graded iron particles, free from non-ferrous metal particles, oil, grease sand, soluble alkaline compounds. Where so directed by the Engineer.

Base Concrete

Flooring shall be laid on base concrete where so provided. The base concrete shall be provided with the slopes required for the flooring. Flooring in verandah, Courtyard, kitchens & baths shall have slope ranging from 1 : 48 to 1 : 60 depending upon location and as decided by the Engineer.

Floors in water closet portion shall have slope of 1:30 or as decided by the Engineer to drain off washing water. Further, necessary drop in flooring in bath, WC, kitchen near floor traps ranging from 6 mm to 10 mm will also be provided to avoid spread of water. Necessary margin to accommodate this drop shall be made in base concrete. Plinth masonry off set shall be depressed so as to allow the base concrete to rest on it.

The flooring shall be commenced preferably within 48 hours of the laying of base concrete. The surface of the base shall be roughened with steel wire brushes without disturbing the concrete. Immediately before laying the flooring, the base shall be wetted and a coat of cement slurry @ 2 kg of cement spread over an area of one sqm so as to get a good bond between the base and concrete floor.

If the cement concrete flooring is to be laid directly on the RCC slab, the top surface of RCC slab shall be cleaned and the laitance shall be removed and a coat of cement slurry @ 2 kg of cement spread over an area of one sqm so as to get a good bond between the base and concrete floor.

Under Layer

Cement concrete flooring of specified thickness and mix (mentioned in item for under layer) shall be laid as under layer. The top surface shall be roughened with brushes while the concrete is still green and the forms/strips shall be kept projecting up 12 mm over the concrete surface, to receive the metallic hardening compound topping.

Topping

This shall consist of 12 mm thick layer of mix 1:2 (1 cement : 2 stone aggregate 6 mm nominal size) by volume or as otherwise specified with which metallic hardening compound is mixed in the ratio of 1 : 4 (1 metallic concrete hardener : 4 cement) by weight. Metallic hardener shall be dry mixed thoroughly with cement on a clean dry pacca platform. This dry mixture shall be mixed with stone aggregate 6 mm nominal size or as otherwise specified in the ratio of 1 : 2 (1 cement : 2 stone aggregate) and well turned over. Just enough water shall then be added to this dry mix as required for floor concrete.

The mixture so obtained shall be laid in 12 mm thickness, on cement concrete floor within 2 to 4 hours of its laying. The topping shall be laid true to provide a uniform and even surface. It shall be firmly pressed into the bottom concrete so as to have good bond with it. After the initial set has started, the surface shall be finished smooth and true to slope with steel floats.

The junction of floor with wall plaster, dado or skirting and finishing operations shall be dealt with as described .The men engaged on finishing operations shall be provided with raised wooden platform to sit on, so as to prevent damage to new work.

Curing

The curing shall be done for a minimum period of ten days. Curing shall not be commenced until the top layer has hardened. Covering with empty gunnies bag shall be avoided as the colour of the flooring is likely to be bleached due to the remanents of cement dust from the bags.

Precautions

Flooring in lavatories and bath room shall be laid only after fixing of water closet and squatting pans and floor traps. Traps shall be plugged while laying the floors and opened after the floors are cured and cleaned. Any damage done to W.C.'s squatting pans and floor traps during the execution of work shall be made good.

During cold weather, concreting shall not be done when the temperature falls below 4°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone. During hot weather, precautions shall be taken to see that the temperature of wet concrete does not exceed 38° C. No concreting shall be laid within half an hour of the closing time of the day, unless permitted by the Engineer.

To facilitate rounding of junction of skirting, dado and floor, the skirting/dado shall be laid along with the border or adjacent panels of floor.

Measurement

Length and breadth shall be measured before laying skirting, dado or wall plaster. No deduction shall be made nor extra paid for voids not exceeding 0.20 sqm. Deductions for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 sqm. The flooring done either with strips (in one operation) or without strips (in alternate panels) shall be treated as same and measured together.

Rate

The rate shall include the cost of all materials and labour involved in all the operations described above including application of cement slurry on RCC slab or on base concrete including roughening and cleaning the surface but excluding the cost of strips which shall be paid separately under relevant item. Nosing of steps where provided shall be paid for separately in running metre. Nothing extra shall be paid for laying the floor at different levels in the same room or courtyard and rounding off edges of sunk floors. In case the flooring is laid in alternate panels, nothing extra shall be paid towards the cost of shuttering used for this purpose.

CEMENT PLASTER IN RISERS OF STEPS, SKIRTING, DADO

Plaster at the bottom of wall not exceeding 30 cm in height above the floor shall be classified as skirting. It shall be flush with wall plaster or projecting out uniformly by 6 mm from the wall plaster, as specified. The work shall be preferably carried out simultaneously with the laying of floor. It's corners and junctions with floor shall be finished neatly as specified.

Thickness

The thickness of the plaster specified shall be measured exclusive of the thickness of key i.e. grooves or open joints in brick work. The average thickness shall not be less than the specified thickness. The average thickness should be regulated at the time of plastering by keeping suitable thickness of the gauges. Extra thickness required in rounding of corners at junctions of wall shall be ignored.

Preparation of Wall Surface

The joints shall be raked out to a depth of at least 15 mm in masonry walls. In case of concrete walls, the surfaces shall be roughened by hacking. The surface shall be cleaned thoroughly, washed with water and kept wet before skirting is commenced.

Application

Skirting with specified mortar and to specified thickness shall be laid immediately after the surface is prepared. It shall be laid along with the border or adjacent panels of floor. The joints in skirting shall be kept true and straight in continuation of the line of joints in borders or adjacent panels. The skirting shall be finished smooth with top truly horizontal and joints truly vertical except where otherwise indicated.

Finishing

The finishing of surface shall be done simultaneously with the borders or the adjacent panels of floor. The cement to be applied in the form of slurry for smooth finishing shall be at the rate of 2 kg of cement per litre of water applied over an area of 1 sqm. Where skirting is flush with plaster, a groove 10 mm wide and upto 5 mm deep shall be provided in plaster at the junction of skirting with plaster.

Curing

Curing shall be commenced on the next day of plastering when the plaster has hardened sufficiently and shall be continued for a minimum period of 7 days.

Measurement

Length and height shall be measured correct to a cm and its area shall be calculated in sqm correct to two places of decimals for a specified the thickness. Length shall be measured as the finished length of skirting. Height shall be measured from the finished level of floor correct to 5 mm.

Rate

Rate shall include the cost of all materials and labour involved in all the operations described above

Factory made Cement Concrete Interlocking Paver Block

Base

Interlocking paver block to be fixed on the bed 80 mm or specified otherwise thick of coarse sand/6mm metal of approved specification and filling the joints with the sand of approved type and quality or as specified and as directed by Engineer.

Interlocking Paver Block

Paver block shall be conformed to IS 15658.Factory made precast paver block of M-30 or otherwise specified grade to be used. Paver blocks to be of approved brand and manufacturer and of approved quality. Minimum strength as prescribed by manufacturer and as per direction of Engineer for the grade specified to be tested as per method mentioned in specification

Measurement & Rates

Area provided with paver block to be measured in sqm. Correct Upto two places of decimal. The rate include the cost of the material, labour, tools etc. required in all the operations described above shall be made for making holes in angle and nothing shall be deducted on account of holes.

NON METALLIC HARD TOP WITH TROWELING AND FLOATING

Providing Finishing over grade slab by using non - metallic floor hardener Hardtop standard with approved colour for heavy duty floor (10 kg/sqm or as recommended by manufactures) or equivalent with power trowel and floater (including floor hardener sprinkling)

Properties

Abrasion resistance (IS: 1237 - 1980) Hardtop Standard have been tested as per IS: 1237 - 1980 against control concrete for abrasion resistance. Test results showed that Hardtop improves the abrasion resistance of concrete by 225% and Hardtop Standard by 150% when tested as per guidelines in IS: 1237 - 1980

Compressive strength Hardtop & Hardtop Standard shall possess a minimum compressive strength of 60N/mm2 & 50N/mm2 respectively when tested as per IS: 516– 1959.

Application instructions **Base concrete** the base concrete should have a minimum cement content of 340 kg/m3. The concrete mix should be designed to minimize segregation and bleeding. Free water cement ratios of less than 0.55 (in case of Hardtop Standard) are required. The concrete should have a slump of between 75 and 100 mm (in case of Hardtop) and 50 and 75mm (incase of Hardtop Standard).The base concrete should be laid and compacted in accordance with good concrete practice. Accurate finished profile and minimum laitance build-up should be ensured. Particular attention should be paid to bay edges and corners to ensure full compaction.

Hardtop Standard are applied in two stages.

(a) The first application is made using 50% to 70% of the total material. Hardtop/ Hardtop Standard is evenly broadcast onto the concrete surface. When the material becomes uniformly dark by the absorption of moisture from the concrete this first application can be floated. Wooden floats or, on large areas, the power trowel with disc may be used. It is important, however, that the surface is not over worked.

(b) Immediately after floating, the remaining Hardtop/Hardtop Standard is sprinkled evenly over the surface. Again moisture is absorbed and the surface can be floated in the same way as before. Final finishing of the floor using a power trowel can be carried out when the floor has stiffened sufficiently so that damage will not be caused.

Timing of Application The timing of application Hardtop/ Hardtop Standard is important and critical. If applied too early, bleed or excess water will wash away the cementitious content of the products, thereby making them ineffective. Also denser aggregates sink into the concrete. If the application of Hardtop/ Hardtop standard is done too late, there will not be sufficient water/moisture to absorb the material into the concrete. Material forcibly applied and trowelled thus, will cause cracks on the surface later, as there is no water/moisture to hydrate the product. **Bay edges** while applying Hardtop/ Hardtop Standard at the edges of the concrete floor or, at the end of bays, extra precaution should be taken by way of sprinkling more material and finishing it smoothly with a steel trowel. This is an additional protection particularly to bay edges where the reaction due to heavy or impact is felt more.

Application of floor hardener

When the concrete turns in to green the floor hardener is to be sprinkled on the surfaces of the floor and evenly spared it as per the required dosage. The moisture on the top surface of the concrete absorbs the floor hardener and allows it to monolithically sets in to the concrete. The floor hardener chemical does not build up any thickness on the floor but all the abrasive movements will be taken care of by the hardener

Power Floater

The finishing operations – Floating & Toweling – take place right after dewatering. Floating with a disc: - This ensures after mixing of sand & cement particles, power compacting and closing the pores on the surface.

Power Trowel

Trowel ling with blades: - In order further improve the wear resistance, minimize dusting and obtain smoother finish, the concrete surface is power trowel led. Repeated passes with disc and blades improve the wear resistance substantially.

11 ROOFING WORKS

PRE-ENGINEERED SUPERSTRUCTURE AND CLADDING WORKS

General

This specification is in respect of Design, Supply, Fabrication, Erection and supervision of Pre-Engineered Superstructure and cladding for Setting up of RESTRUCTURING CUM AUGMENTATION OF HCSL, KOLKATA. The scope of work in the contract consists of design, detailing, material, supply, fabrication, erection, transportation, labour and supervision of above works complete in all respects as specified herein, and as shown in the drawings enclosed. This specification shall be read in conjunction with other documents forming the contract viz. NIT, Instructions to Tenderers, General Conditions of Contract, Special Conditions of Contract and other documents furnished by the Client/Consultant.

The Contractor shall visit the site and ascertain the local conditions, entry and traffic restriction, all obstructions in the area and also ascertain all site conditions. The Contractor shall allow for extras likely to be incurred due to such conditions and no claim shall be entertained on this account under any circumstances from the Contractor.

The Contractor shall set out and level the works and will be responsible for the accuracy of the same. He is to provide all instruments and proper qualified staff with labors for getting his work checked by the Client/Consultant.

The Contractor shall take adequate precautions to ensure complete safety and prevention of accidents at site. The safety precautions shall conform to the relevant IS codes, laws and local regulations.

The Contractor shall protect surveyor's bench marks and reference lines, ground water gauges and control points from damage or movement during work. In case of any damage, the Contractor shall have to restore to original condition at his own cost.

Standards

The design and installation shall fully comply with the requirements of the statutory regulations that are in force in the place of installation. The work shall be carried out in accordance with the latest editions of relevant Indian Design Codes particularly the following.

1. IS800-2007 - General Construction in steel- Code of Practice

2. IS801-1975 - Code of Practice for use of Cold formed light gauge steel structural members of general building constructions.

3. IS875-1987 - Code of Practice for design loads for buildings & structurals

Part -1 Dead Loads.

4. IS875-1987 - Code of Practice for design loads for buildings & structurals

Part -2 Imposed Loads.

5. IS875-1987 - Code of Practice for design loads for buildings & structurals

Part -3 Wind Loads.

6 .IS1893- Part 1 Criteria for earthquake resistant design of structures.

7. IS1893- Part 4 Criteria for earthquake resistant design of structures- Industrial structures including stack-like structure.

II Building will be manufactured in accordance with the following codes.

1. IS800- 2007 - General Construction in steel- Code of Practice Unless specified all work shall conform to the latest Indian Standards. Site Conditions

Mean annual rainfall 124.5mm average per day as per latest Maximum rainfall meteorological data

Basic wind speed (As per IS 875- Part 3) – 50m/s

Seismic Zone III As per IS 1893

Maximum ambient temperature 45 Deg C

SCOPE OF WORK

The scope of work includes the Pre-engineered superstructure and cladding works for Setting up of RESTRUCTURING CUM AUGMENTATION OF HCSL, KOLKATA. Plan of the buildings showing the overall dimension is attached with the tender as detailed below.

The scope of work of the tender shall include but not be limited to the following:

i. Structural design, preparation of shop detail drawings, bill of materials, bolt lists, etc for the structure concerned on the basis of drawings and obtaining approval of shop detail drawings etc from the Client/Consultant.

ii. Supply structural steel for PEB, and all other materials including foundation bolts for the structure.

iii. Fabrication of structural steelwork for PEB, and delivery of the fabricated steelwork to the site including providing one shop coat primer.

iv. Receiving at site, off-loading, stacking, transporting to the site for erection and erecting the structural steelwork, including aligning, leveling and making ready in all respects for grouting. Corrosion resistant painting shall be applied considering the marine environment. No painting shall be done in frosty/foggy weather or when the humidity is high enough to cause condensation on the surface to be painted.

v. Supply and fixing all roof and side sheeting including hook bolts, sheeting bolts, all necessary washers, flashing, ridging, glazing and all other materials necessary to complete the work according to the drawings and specification.

vi. Providing openings for rolling shutters, windows, etc. canopy above rolling shutters, turbo Ventilators with FRP base as per drawings and specification.

vii. Supply and fixing translucent polycarbonate sheet 2mm thick matching with the profile of cladding sheet for natural lighting. The area of polycarbonate sheet shall be 2% of respective side cladding

Design

The design of the system shall be carried out to comply the following:

i. The design should strictly adhere to architectural profiles and features indicated in the tender drawing. For material store buildings the structure shall be designed for the wheel load for EoT with 5MT capacity and building for Pipe shop the structure shall be designed for the wheel load for EoT with 3MT capacity.

ii. The rainwater disposal arrangement for roofing and cladding shall be provided.

iii. The structural design loads shall conform to IS 875-1987 part 1 to 3 as per latest revisions.

iv. The structure shall be designed for earthquake resistance as per IS 1893 : Part I: 2002 Criteria for earthquake resistant design of structures – General provisions and buildings and IS 1893 : Part 4 : 2005 Criteria for earthquake resistant design of structures – Industrial Structures including stack-like structures.

v. The structural design shall be deemed compliant with the design codes mentioned above. Minimum thickness of Built-up section shall be 5mm & secondary members shall be 1.5mm.

vi. The Contractor shall ensure the availability of all sections proposed by him before submitting his offer. If any such sections become unavailable subsequently, he shall substitute the same with the nearest available higher section at no extra cost and without causing any delay to the contractual time schedule.

vii. Sweep blasting shall be carried out for all members (primary, secondary members etc.)

viii. Primer coat shall be suitable for transport, handling, and corrosion resistance during storage etc.

ix. As far as possible, the vertical bracings shall not cross over or hinder the openings.

x. The Contractor shall submit the design calculation of the structures for approval of the Client/Consultants. The design calculations shall be submitted in STAAD- PRO-V8i or

ETABS. The approval from the Client/ Consultants shall not in any way absolve the Contractor from his responsibilities including Warranty/Guarantee obligations.

xi. The Contractor shall submit the design loads and support reactions for designing the foundation by the Engineer.

Materials

STRUCTURAL STEEL

Column, beam, rafter and other built up sections shall be made from hot rolled plates conforming to IS2062-2006 steel. The plates shall be joined together on one side of the web by a continuous automatic submerged arc welding process to produce the section required. Bracing Rod shall conform to the physical specification of IS2062 and have minimum yield strength of 345 Mpa. All hot rolled sections shall conform to the physical specifications of IS2062 having minimum yield strength of 250Mpa. Cold formed sections shall confirm to the physical specifications of IS 2062. Primary structural connections are made with hot dipped galvanized, high strength bolts conforming to ASTM A-325, type 1 (or equivalent grade). Purlins and girts are connected to their supporting members by machine bolts conforming to ASTM A-307, electro-galvanized with a Chromate color conversion coating (or equivalent) Anchor bolts shall confirm to ASTM A -307 with minimum strength of 400Mpa The steel column strut of PEB and RCC interface shall be designed as a hinged base with a minimum of 20 mm dia anchor bolt according to the design calculation

PRIMARY MEMBERS:

Primary structural framing shall include the transverse rigid frames, lean-to-rafters and columns, canopy rafters, interior columns (beam and column frames), bearing frame rafters and corner columns and end wall wind columns.

SECONDARY MEMBERS:

Secondary structural framing shall include the purlins, girts eave struts, wind bracing, flange bracing, base angles, clips and other miscellaneous structural parts.

PAINT OF STRUCTURAL MEMBERS:

All structural members shall be cleaned by wire brushing to remove dirt, grease, oil and loose mill scale and given one shop coat of red oxide, air drying, phenol modified alkyd resin primer.

CONNECTIONS:

All field connections shall be bolted (Unless otherwise noted).

Primary structural connections are made with hot dipped galvanized, high strength bolts conforming to ASTM A-325, type 1 (or equivalent grade).

Purlins and girts are connected to their supporting members by machine bolts conforming to ASTM A-307, electro-galvanized with a Chromate color conversion coating (or equivalent)

Anchor bolts shall confirm to ASTM A -307 with minimum strength of 400Mpa. The steel column strut of PEB and RCC interface shall be designed as a hinged base with a minimum of 20 mm dia anchor bolt according to the design calculation.

Pre-coated galvalume profile sheets

Roofing - 0.50mm TCT 300Mpa 150GSM colour coated galvalume sheets of approved colour in Profile (34.5mm crest height in 333.3mm pitch) on the top and

0.50mm TCT 300Mpa 150GSM colour coated galvalume slightly ribbed sheets at the bottom with Polyurethane

Foam insulation as infill. The infill insulation material (PUF) shall be fire retardant self-extinguishing CFC/HCFC Free and Zero ODP (Ozone Depletion Potential). Polyurethane Foam shall have a density of 40 + 2Kg/M3 in 30mm thick injected in between the top & bottom sheet using a special foaming machine. The panels will be supplied in 1023mm supply width (1mtr effective width) and length can be up to a maximum of 6mtr. The panel shall be manufactured from a continuous panel manufacturing line using pentane as blowing agent.

CLADDING: 0.50mm TCT cold rolled steel of 550Mpa yield strength with hot dip metallic coating of minimum 150 gm/sqm Zinc Aluminum alloy coating mass (55% Aluminium, 43.5% Zinc and 1.5% Silicon) total of both sides. The colour coating shall have a total coating hickness of 35 micron Silicon Modified Polyester paint system of approved

colour comprising of 20 microns of exterior coat on top surface and 5 microns reverse coat on back surface over 5 micron primer coat on both surface. These sheets will be n hi-rib profile with 28mm crest height in 195mm pitch with 975mm covered width and length can be upto a maximum of 6mtr. These sheets will be fixed to the girts using self drilling and self tapping fasteners with EPDM washers for perfect sealing.

BUILDINGS FOR MARINE COATING SHOP:

The cladding shall be PU Panel-30 made out of 0.50mm TCT 300Mpa 150GSM colour coated galvalume sheets of approved colour in Profile (34.5mm crest height in 333.3mm pitch) on the top and 0.50mm TCT 300Mpa 150GSM colour coated galvalume slightly ribbed sheets at the bottom with Polyurethane Foam insulation as infill. The infill insulation material (PUF) shall be fire retardant self-extinguishing CFC/HCFC Free and Zero ODP (Ozone Depletion Potential). Polyurethane Foam shall have a density of 40 + 2Kg/M3 in 30mm thick injected in between the top & bottom sheet using a special foaming machine. The panels will be supplied in 1023mm supply width (1mtr effective width) and length can be up to a maximum of 6mtr. The panel shall be manufactured from a continuous panel manufacturing line using pentane as blowing agent. The cutting of sheet shall be done as per the direction of approved agency.

Bolts and nuts

All bolts and nuts shall conform to IS: 1363 and IS: 1364 and unless specified otherwise shall be hexagonal. All nuts shall fit tight. The Contractor shall submit test certificates when called for. High strength friction grip bolts (HSFG bolts) and nuts shall conform to IS: 3757 and IS: 6623 respectively.

Washers

Plain washers shall be made of mild steel, unless otherwise specified. One washer shall be supplied with each bolt and in case of special types of bolts more than one washer as needed for the purpose shall be supplied. An additional spring washer shall be provided for bolts carrying dynamic or fluctuating loads and those in direct tension. Washers shall conform to the relevant IS codes. High tensile friction grip washers shall conform to IS: 6649.

Electrodes

Mild steel electrodes shall conform to IS: 814 and high tensile steel electrodes, if required, to IS: 1442. The Contractor shall furnish to the Client/Consultant a certificate issued by the

manufacturer to the effect that the electrodes supplied are in accordance with the above specifications. All electrodes used shall be BIS marked. For welding in any particular position, the electrodes used shall be those recommended by the manufacturer for use in that position.

Other Requirements

Gutters and Downspouts

All elements of the roof drainage system viz., size and slope of gutters, diameter and spacing of downspouts etc., shall be adequately designed to prevent water overflow over the sides of the building. The intensity of the rainfall shall be as per the data available with the meteorological department. It is to be noted that the integrity of a roof drainage system is influenced by the design of its gutters and downspouts and by the proper spacing of the downspouts. Gutter shall be cold-formed "channel shaped" member and of 0.50mm TCT colour coated galvalume sheets as mentioned above, and should be designed to carry water from the roof of the building to the downspouts. Gutters may be either Eave gutters or Valley gutters. Eave gutters may be uniquely shaped to create a distinctive look along the eave of the building as per architectural elevations. A downspout shall be hollow cold-formed section and shall adequately be supported from the portal frame using strips. The downspouts may have fluted sides adding stiffness to their shape. Downspouts shall be provided upto the FGL.

Flashing, Ridge Capping, Trim and Closures

Flashing, ridge capping and trim has to be provided at the rake, corners, eaves, framed openings, ridges and wherever necessary to provide weather tightness and finished appearance. Sheets for flashing, metal closure, trim and other miscellaneous uses shall be of minimum 0.5mm TCT Colour-coated, galvalume sheet of 550Mpa 150GSM fabricated to size as per the site requirement.

All openings are to be provided as per the requirement detailed in the specification and schedule of quantities.

Aesthetics

Final selection of colours and approval of the appearance of the system shall not be made by the Contractor until the submission and approval of samples. A uniform appearance

shall be achieved without distortion of reflections on the glazed external façade. The finish shall be uniform throughout, both in terms of colour and level of gloss.

All finishes shall be stable and not prone to flaking, blistering, colour fading or other potential defects associated with the finish. Any colour fade or change in level of gloss during the design life shall be uniform across the surface of the panel and shall not visibly vary between different elements of the building envelope.

Anchorage and Fixing Support

Anchorage and supports shall be fabricated and installed to comply with all performance criteria specified for the system. The type and location of all fixings shall be subject to approval by the Client/Consultant.

Sealants

Sealants should be applied as per requirement at side laps and end laps of roof panels and around self-flashing windows. Sealant shall be 6 mm wide x 5mm thick, asbestos fiber filled pressure sensitive Butyl tapes. The sealant shall be non-asphaltic, non-shrinking, non-drying and non-toxic and shall have superior adhesion to metals, plastics and painted surfaces at temperatures from–51degree Celsius to + 104 degrees Celsius. The offer shall contain details of sealants to be use

Painting

All roof sheets, wall panels, flashing, trim and other exposed zincalume steel surfaces shall be of approved colour coat.

All fabricated steel structures for primary members (Columns and Rafters) to be cleaned by Sweep Blasting and Painted with necessary corrosion resistant coating as per Manufactures recommendation .Methodology of painting shall be got approved by the Engineer prior to the commencement of work. All secondary Members including purlins girts and all necessary members should be Galvanized sections.

The shop primer coat shall be applied with an average dry film thickness of 100 microns. After the erection/assembly of fabricated structures at the plant site, damaged and defective shop coats shall be touched up with the same type of paint as used for shop coat.

Testing

In addition to the special provisions made hereafter as to the sampling and testing of materials by particular methods, samples of materials and workmanship proposed to be employed in the execution of the work may be called for at any time by the Client/Consultant and when so called for by the Client/Consultant, the same shall be furnished by the Contractor free of cost without delay. The samples when approved shall be kept by the Client who shall reject all materials or workmanship not in conformity with the quality and character of the approved samples.Drawings

On award of work the Contractor shall submit complete set of designs for approval and shop drawings based on the approved structural designs for structure, roofing and cladding works for approval by Client/Consultant. Any corrections required to be made in order to conform to the intent of the drawings forming part of the tender document shall be carried out by the Contractor at no extra cost. Any increase in material quantities or labour arising out of this shall not be paid for by the Client. The Client's decision on this will be final and binding on the Contractor.

The Contractor shall be responsible for the preparation of the shop detail (working) drawings, erection and marking plans and all necessary lists such as indents, and bolt lists, material lists and lists for all bought out items on the basis of design drawings.

All drawings prepared by the Contractor shall be made to Indian standard size A1 according to IS: 696 – code of practice for general engineering drawings – unless otherwise approved by the Client/Consultant. The drawings shall be fully referenced to relevant design drawings, marking/erection drawings and all interconnected drawings. All dimensions and other units shall be given in metric system.

Prior to sending the shop detail drawings to the Client/Consultant for approval, a complete list of detail drawings including arrangement and marking shall be prepared by the Contractor and sent to the Client/Consultant with a programme of submission of these drawings for approval.

Fabrication

Standard

All fabrication of structural steel work shall be as per the approved drawings and as per codes mentioned above. The fabrication shall be carried out in a state of the art manufacturing facility for pre-fabricated structures.

Type of construction

The steel structures shall generally be of shop welded construction. Pre-engineered building system shall be adopted. The type of connections as applicable shall be shown in design drawings.

Storing materials

All materials shall be stored properly on skids, above the ground. It shall be kept clean and properly drained. Structural steel members shall be so stored and handled that members are not subjected to excessive stresses and damage.

Workmanship

All workmanship shall be equal to the best practice in modern structural shops. Greatest accuracy shall be observed in the manufacture of every part of the work and all similar parts shall be strictly interchangeable.

All materials shall be straight and if necessary before work shall be straightened and/or flattened by pressure unless required to be of curvilinear form and shall be free from twists.

The erection clearance for cleated ends of members connecting steel to steel should not be greater than 2mm at each end. The erection clearance at ends of beams without web cleats should not be more than 3mm at each ends, but where for practical reasons a greater clearance is necessary, suitably designed seating or connections shall be provided.

Chipping of angles, flanges and edges of plates wherever necessary shall be done without damaging the parent metal. Chipped edges shall be ground to a neat finish and sharp corners and hammered rough faces shall be rounded off.

The edges and ends of all flange plates and web plates of plate girders and built-up columns, of plates forming chords or web members of lattice girders, and all cover plates, the ends of all angles, tees, channels and other sections forming the flanges of

plate girders and columns, and chords and web members of lattice girders shall be planed. Edge preparation for welding may be done by machine controlled flame cutting with edges free of burrs, clean and straight.

The top ends of all intermediate stiffeners shall be planed or ground to fit tightly to the main angles or flanges. Care shall be taken to ensure a full bearing of the stiffeners at the supports and at other points where concentrated load is applied. The ends shall not be drawn or caulked.

The butting surfaces at all joints of girders or columns shall be planed so as to butt in close contract throughout the finished joint.

Holes for bolts shall be drilled conforming to relevant standards. All holes, except as stated hereunder, shall be drilled to the required size or sub-punched 3mm less in diameter and reamed thereafter to the required size. Thickness of the material for sub- punching shall not be greater than 16mm. All matching holes for bolts shall register with each other so that a gauge of 0.8mm less in diameter than the hole can pass freely through the members assembled for bolting in the direction at right angle to such members. All holes for turned and fitted bolts shall be drilled undersize of 1mm and after assembly, reamed to a tolerance of +0.13mm to 0mm unless otherwise specified. The parts shall be firmly bolted together during such block drilling and taken apart for removal of burrs after drilling.

Holes in purlins, side sheeting runners, packing plates and lacing bars may be punched full size, provided the thickness of the materials does not exceed 13mm. All punching and sub-punching shall be clean and accurate and all drilling shall be free from burrs. No holes shall be made by gas cutting process.

All parts assembled for bolting shall be in close contact over the whole surface and all bearing stiffeners shall bear tightly at both top and bottom without being drawn. The component part shall be so assembled that they are neither twisted nor otherwise damaged. Specified chamfers, if any, shall be provided.

Trial assemblies shall be carried out after fabrication to ensure accuracy of workmanship and those checks shall be witnessed by the Client/Consultant.

All turned and fitted bolts shall be carefully turned and shall be parallel throughout the barrel. The following limits of tolerance shall be permitted upon the diameter of the barrels of turned bolts and holes which they are to fit.

Barrel of bolt hole Limit of tolerance High 0.00mm +0.13mm Low -0.13mm 0.00mm

Each bolt and nut shall be assembled with washers of appropriate shape, quality and number in cases where plane parallel surfaces are involved. Washer shall be placed under the bolt head or the nut, whichever is to be rotated during the tightening operation. The rotated nut or bolt head shall be tightened against a surface normal to the bolt axis, and the appropriate tapered washer shall be used when the surfaces are not parallel.

The nut shall be placed so that the identification mark is clearly visible after tightening. Nuts and bolts shall be always be tightened in a staggered pattern and, where there are more than four in any joint, they shall be tightened from the centre of the joint outwards.

At the time of assembly, the surface in contact shall be free of paint or any other applied finish, oil, dirt, loose rust, loose scales, burrs and other defects which would prevent solid seating of the parts or would interfere with the development of fabrication between them. It shall be the responsibility of the Contractor to work with in the slip factor specified for the particular case.

If after final tightening a nut or bolt is slackened off for any reason, the bolt, nut and washer or washers shall be discarded and not used again. All the high tension bolts if used in construction are to be clearly marked on drawings with the appropriate torque tension required for fixing.

Welding

The welding and welded work shall generally be in accordance with: " American Welding Society (AWS) D1.1.96 Structural welding code – Steel Manual, D1.1 – 2004. All welders should be qualified for the type of welds performed. All electrodes shall be kept under dry conditions. Any electrode damaged by moisture shall not be used unless it is guaranteed by the manufacturer that when it is properly dried, there will be no detrimental effect. Any electrode which has part of its flux coating broken away or is otherwise damaged, shall be rejected. Any electrode older than six (6) months from the date of manufacture shall not be used.

The edges shall be prepared with an automatically controlled flame cutting torch correctly to the shape, size and dimensions of the groove, prescribed in the design and shop drawings. The welding surfaces shall be smooth, uniform and free from fins, tears, notches or any other defect which may adversely affect welding and shall be free of loose scale, slag, rust, grease, paint, moisture or any other foreign matter.

The welding procedure shall be arranged by the Contractor to suit the details of the joints as indicated in the drawings and the position at which welding has to be carried out.

The welding procedure shall be so arranged that the distortion and shrinkage stresses are reduced to a minimum and that the welds meet the requirement of quality specified hereunder. Any weld found defective shall be cut by using either chipping hammer or gouging torch in such a manner that adjacent material is not injured in any way.

The Contractor shall satisfy the Client / Consultant that the welders are suitable for the work for which they will be employed and shall produce evidence to the effect that welders have satisfactorily completed appropriate tests. The Client/Consultant may at their own discretion order periodic tests of the welders and/or of the welds produced by them. Such tests shall be at the expense of the Contractor.

Shop assembly

The steel work shall be temporarily shop assembled as necessary so that accuracy of fit may be checked before dispatch. The parts shall be shop assembled with a sufficient number of parallel drifts to bring and keep the parts in place.

Erection marking

Each fabricated member whether assembled prior to dispatch or not so assembled, shall bear an erection mark, which will help to identify the member and its position in respect of the whole structure, to facilitate re-erection at site. These erection marks shall be suitably incorporated in the shop detail and erection drawings.

Quality Control

To ensure good quality of workmanship the Contractor shall control the fabrication and assembly of structures as per the procedure outlined below.

The Contractor shall routine check execution of established technological processes or general technological instructions. All welds shall be visually examined and measured for external dimensions by appropriate gauges.

The Contractor shall conduct tests in accordance with the following norms:

i. Visual examination – hundred percent (100%) of the welded joints. ii. Dye penetration test

Visual examination

The Contractor shall conduct visual examination and measurement of the external dimensions of the weld for all joints. Before examining the welded joints, areas close to it on both side of weld for a width not less than 20mm shall be cleaned of slag and other impurities. Examination shall be done by a magnifying glass which has a magnification power of ten (10) and measuring instrument which has an accuracy of +0.1mm or by weld gauges. The Contractor shall examine the following during the visual checks.

i. Correctness and shape of the welded joints

ii. Incomplete penetration of weld metal

iii. Influx

iv. Burns

v. Unwelded craters

vi. Under cuts

vii. Cracks in welded spots and heat affected zones

viii. Porosity in welds and spot welds

ix. Compression in welded joints as a result of electrode impact while carrying out contract welding

x. Displacement of welded element

The Contractor shall document all data as per sound laboratory practices. **Mechanical test**

The Contractor shall carry out various mechanical tests to determine weldability, nature of break, correct size and type of electrodes, degree of preheat and post-heat treatment etc. The type, scope and sample of various mechanical tests shall be determined in agreement

with the Client / Consultant. The number of tests conducted shall depend on the results obtained to satisfy the Client that the correct type and size of electrode, degree of preheating and post-heating and weldability of different metal are being followed.

Dye penetration test

The basic stages shall comprise surface preparation, application of penetrant, excess penetrant removal, developer application and inspection. The entire surface shall be subjected to dye-penetration test as per IS 3658 and the minimum acceptance standards shall be as outlined therein.

Inspection and Testing

The Client/Consultant shall have free access at all reasonable times to the Contractor's works where the fabrication of steelwork is carried out and shall be afforded all reasonable facilities by the Contractor for satisfying himself that the fabrication is being undertaken in accordance with the provisions of the drawings and specifications.

The Contractor shall continuously inform the Client/ Consultant of the progress in fabrication and as to when items will be ready for inspection. The Contractor shall give a minimum of fourteen (14) working days' notice to the Client /Consultant for inspection of the items.

Unless directed otherwise, inspection shall be made at the place of manufacture prior to dispatch. Should any structure be found not to comply with any of the provisions of this specification, it shall be liable for rejection. No structure or part of the structure, once rejected shall be re-submitted for inspection/test, except in cases where the Client/Consultant considers the defect as rectifiable.

Defects which may appear during fabrication shall be made good with the consent of and according to the procedure laid down by the Client/Consultant. All gauges and templates necessary to satisfy the Client/Consultants shall be supplied by the Contractor. The Client/Consultant may, at his discretion, check the test results obtained at the Contractor's work by independent tests at the government test house or elsewhere and the costs of such tests shall be borne by the Contractor.

Marking, Packing and Dispatching

Each piece shall be distinctly marked before delivery, in accordance with the approved marking diagram and shall bear such other marks as will facilitate erection. For easy identification at site a small distinguishing mark for each building shall be painted on each end of every member dispatched from fabrication shop. The fabricated steelwork shall be dispatched by the Contractor in such portions as may be found convenient for erection or as ordered by the Client/Consultant to meet the time schedule.

All projecting plates or bars and all ends of members at joints shall be stiffened, all straight bars and plates shall be bundled, all screwed ends and machined surfaces shall be suitably packed and all bolts, nuts, washers and small loose parts shall be packed separately in boxes so as to prevent damage or distortion during transit.

Storing and handling of materials

The fabricated materials on receipt at site shall be carefully unloaded, examined for defects, checked, stored out for each building and stacked securely on skids above level ground. The ground shall be kept clean and properly drained. Girders and beams shall be placed upright and stored. Long members, such as columns and chords, shall be supported on skids, placed near enough to prevent damage from deflection.

The fabricated material shall be verified with respect to markings on the marking plan or shipping lists supplied by the fabricator. Any material found damaged or defective shall be stacked separately and the damaged or defective portions shall be identified by painting in distinct colour. Such materials shall be dealt with as instructed by the Client/Consultant.

The handling and storing of the component parts of a structure shall involve the use of method and appliance not likely to produce damage by twisting, bending or otherwise deforming the metal. No member slightly bent or twisted shall be put in place until the defects are corrected and members seriously damaged in handling shall be rejected.

All small bends or twists received by members shall be rectified before such members are put in place, any serious bends or damage shall be reported at once to the Client/Consultant by the Contractor for instructions. The straightening of bent edges of plates, angles and other shapes shall be done by methods not likely to produce fracture or other injury. Following the completion of straightening of a bend or buckle, the surface

of the metal shall be carefully inspected by the Contractor for evidence of incipient or other fractures. The Contractor shall immediately report to the Client/Consultants presence of any such evidence and act according to his instructions. Materials with irreparable defects shall be rejected by the Client/Consultant and such materials shall be replaced by the Contractor at own risk and cost without delay.

Erection

Erection of structural steelwork shall be carried out in accordance with IS: 800 and in an expeditious manner in conformity with the drawings and specifications. The suitability and capacity of all plant, equipment etc used for erection shall be to the satisfaction of the Client/Consultant. The Contractor shall provide all construction and transport equipment, tools, tackles, consumables, materials, labor, supervision for erection including carrying out the following:

Receiving, unloading, checking and moving into storage at site as outlined under general conditions including prompt attendance to all insurance matters as necessary for all materials arriving at site.

Transporting from site storage, handling, rigging, assembling, bolting, welding, and satisfactory installation of all fabricated materials in proper location according to drawings and or as directed by the Client/Consultant.

Checking centre lines, levels of all foundations blocks including checking lines, level, position and plumb of all bolts and pockets. Any defect observed in the foundation shall be brought to the notice of the Client/Consultant. The Contractor shall fully satisfy himself regarding the correctness of the foundations before installing the fabricated structures on the foundation blocks.

Aligning, lining, leveling, bolting, securely fixing in position in accordance with drawings or as directed by the Client/Consultant.

Painting as per specification including supply of paint. supply of all required consumables, construction and erection materials, including but not limited to gauges, welding, gases and rods, electrodes and wires, oxygen, acetylene, fuel, bolts, nuts, rivets, shims and temporary supports etc as required for incidental works and for the completion of erection.

Erection shall also include the following work:

a) All minor modification such as:

Removal of bends, kinks, twists etc for parts damaged in transport and handling.

Cutting, chipping, filing, grinding etc if required for preparation and finishing of site connections.

Reaming for use of next higher size of rivet or bolt for holes which do not register or which are damaged.

Welding of connections in place of riveting or bolting for which holes or either not drilled at all or wrongly drilled during fabrication. Welding in place of riveting or bolting will be permitted only at the discretion of the Client/Consultant.

b) The following shall be considered as a legitimate part of erection work:

i. Re-fabrication of parts damaged beyond repair during transport and handling or are incorrectly fabricated.

ii. Fabrication of parts omitted during fabrication by error, or subsequently found necessary.

iii. Plug welding and redrilling of holes which do not register and which cannot be reamed for use of next size of rivet or bolt.

iv. Drilling of holes which are either not drilled or drilled in incorrect positions during fabrication.

Setting out

The Contractor shall be responsible for the alignment and levels of foundations, correctness of foundation bolt centres, their projected height above the foundation tops, and length of threading provided and the provision and fitment of nuts for the foundation bolts. These shall be checked well in advance of starting erection work and the Contractor shall be responsible for any consequence for noncompliance thereof. Discrepancies, if any, shall immediately be brought to the notice of the Client/Consultant for his advice.

The contractor shall keep one set of reference axes and one bench mark level till the work is complete in all respect. These shall be used for setting out of structures.

The Contractor shall assume full responsibility for the correct setting out of all steelwork and erecting it correctly as per alignment and levels shown on the drawings and plumbing of vertical members. Notwithstanding any assistance rendered to the Contractor by the Client/Consultant, if at any time during the progress of the work any error should appear or arise therein, on being required to do so, the Contractor at his own cost shall remove and amend the work to the satisfaction of the Client/Consultant.

Assembly and Erection

Before starting erection, the Contractor shall submit to the Client/Consultant for approval, the method he proposes to follow and the number and the type of equipment and temporary work proposes to use for the erection. The approval of the Client/Consultant shall not be considered as relieving the Contractor from his responsibility for the loads which the erection equipment and temporary work will be required to carry or support. Adequate allowance and provision shall be made for lateral forces and wind loads. Drawings for such temporary work shall be submitted to the Client/Consultant for prior approval.

The Contractor shall plumb and level all steelwork and shall thoroughly brace and guy the structures during erection to keep them plumb and rigid till completion. Erected parts of the structure shall be stable during all stages of erection and the structural elements to be erected shall be strong enough to bear erection loads. The stability of structures subject to the action of wind, dead weight and erection forces shall be obtained by observing specified sequence of erection of vertical & horizontal structural members by installing permanent and temporary bracings. As the work progresses, the steel members shall be securely bolted up to take care of all dead loads, wind and erection stresses, including those due to erection equipment or its operation. No riveting, permanent bolting, welding or grouting shall be done until proper alignment has been obtained and approved by the Client/Consultant.

The Contractor shall provide adequate supervision at all stages of the work and examine each portion for accuracy before fabrication or erection is commenced. He shall also provide facilities such as, adequate temporary access ladders, gangways, tools and tackles, instruments etc to the satisfaction of the Client/Consultant, for his inspection at any stage during erection. Irrespective of any inspection and tests made by the Client/Consultant, the Contractor shall be entirely responsible for the proper execution of the work,

notwithstanding any approval, which may have been given by the Client/Consultant of the work or of tests carried out either by the Client/Consultant or by the Contractor.

Preamble to Schedule of Items of Work

The Schedule of Items of Work shall be read in conjunction and with reference to the contents of tender documents, technical specifications and drawings and forms part of the tender.

The rates and prices in the priced Schedule of Items of Work shall be deemed to include, but not limited to, all labour, supervision, materials, erection, maintenance, Plant, temporary/preparatory works, insurance, overhead, profit, together with all general risks, liabilities and obligations set out or implied in the contract.

All linear dimensions shall be measured to the nearest 0.01 m and areas to the nearest 0.01 Sq m.

The rate shall include including all primary members, secondary members, roof sheeting, Louvers, cage ladder, fasteners, sealer/rope sealer, closures/filler stripes, ridge cap, flashing and trim, eave gutters and downspouts, anchor bolts, canopy for openings provision/openings for rolling shutters, windows, ventilators, skylight etc. complete as per the drawing and as directed by the Engineer.

The whole cost of complying with the provisions of the contract shall be included in the items provided in the priced Schedule of Items of Work, and where no items are provided the cost shall be deemed to be distributed among the rates and prices entered for the related items of Work.

General directions and descriptions of work and material are not necessarily repeated nor summarized in the Schedule of Items of Work. Reference to the relevant sections of the Contract document shall be made before entering prices against each item in the priced Schedule of Items of Work.

The method of measurement of completed work for payment shall be in accordance with the modes stipulated in the Schedule of Items of Work and specification. Where such modes are not specified, the works shall be measured as per the relevant part of BIS codes 1200 (latest revisions.) or good engineering practice as approved by Client/Consultant.

The rates quoted shall be for works at all levels, locations and deemed to include all leads and lifts, storage, handling, wastage etc. unless otherwise specified.

The tenderer shall furnish price in the Schedule of Quantities of Work in Indian Rupees only. The rates for all items shall include the following also:

All fibre or plastic plugs, screws, nails, pins, key and such other fixing accessories as per specification, expansion bolts / bolts, dash fasteners and machine screw for fixing to supports where required.Work at all heights, levels and locations. All sampling and testing for quality assurances.

Supply and fixing of materials as specified in the Schedule of Quantities. Preparation and obtaining approval of shop drawings. All forging, pressing, reducing to required size, shape and figure, drilling, tapping, punching, countersinking for screws, grinding etc., and every type of work that may be necessary to fabricate, finish, erect and fix in position all steel work in good, substantial and perfect manner.

Neatly cut and fitted notches, true and squared ends including planning to sheared end of plates, angles etc., where abutting against each other, for transmission of stresses.

All necessary templates, patterns, moulds, mock-ups etc.,

All welding/bolting/riveting as required and as shown.

Necessary hoisting equipment, temporary supports, scaffolds, bracing, connections required for fabrication and erection including removing the same after fixing steel work in final position as per drawings.

Preparation of surface, de-rusting, phosphating and application of primer coat and painting as specified.

Anchoring/fixing the members to/in masonry/concrete as per site requirements. Gutter and downspouts up to FGL designed for a maximum rainfall.

Translucent polycarbonate sheet 2mm thick matching with the profile of cladding sheet for natural lighting as specified.

CORRUGATED GALVANISED STEEL SHEET ROOFING

Providing and fixing Profiled sheets made out of 0.50mm TCT 240Mpa 120 GSM colour coated galvanized sheets with organic coating of 20 Microns Polyester coating of approved

Colour on the top over 5 Microns primer and 5 Microns back up epoxy coating at the bottom over 5 Microns primer. These sheets will be in hi-rib profile with 28mm crest height in 195mm pitch with 975mm covered width and length can be up to a maximum of 12mtrs. These sheets will be fixed to the purlins with hot dipped galvanized imported self-drilling fasteners with EPDM Washers for perfect sealing. All the joints will be sealed with sealants and stitched with stitching screws wherever necessary. Size, shape and pitch of corrugation as approved by Engineer but excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required.

SCOPE

The scope of work is to provide profile roofing sheet on areas shown on the drawings. The work shall include the design, engineering, manufacture, supply, and installation of the roofing system on the roof of buildings as described in the schedule and shown on the drawings, including all fixings, flashings, finishing, gutters, down-spouts etc.

INSTALLATION

General

The contractor shall supply and install the roofing, gutters, down-spouts, as specified and as approved by the Engineer-in-charge with uniform and consistent product quality. All panels shall be factory formed and all materials shall be delivered to site with manufacturer's name or trade mark, grade of coating, length, thickness and item identification with respect to shop drawings legibly marked on top of each item or shown on a label fixed to each bundle. The material may also be marked with a standard mark where applicable.

Accessories

Cappings, Flashings and Trims:

All exposed flashing edges must have a 10mm hem and a 45° drip. All closure flashings shall be hemmed.Material

In substrate, and finish as external sheeting. Fixing Capping's etc. shall be screwed to external sheeting at crests with hex head self-drilling stitching fasteners at max. 500mm centers along the length of the capping/flashing. All fasteners must be installed at 90° to

the material being fastened. If this is not done, the screw must be withdrawn and the hole closed with an oversize screw and EPDM washer.

All longitudinal joints in cappings and flashings shall be overlapped a minimum of 50mm and sealed with a continuous run of sealant. Backing plates shall be provided in 16G steel wherever required at end conditions for proper support of cappings and closures.

Fixing Accessories

External fasteners

Fasteners for roof sheeting clips and self-drilling stitching fasteners for cappings/flashings shall be mechanically galvanised carbon steel self-drilling self tapping fasteners.

Sealants

All laps in flashing and capping shall be sealed with a non-hardening neutral cure silicon sealant.

Wind Loading

Permissible span versus load data table should be furnished with the offer. Load testing as per IS-801, BS and AS shall have to be arranged by the sheeting manufacturer to demonstrate compliance with load/span data conforming to spans and loads (as per IS-875 part 3) at manufacturer's plant.

External roof sheeting shall be capable of withstanding wind uplift and point loads as per IS codes for purlin support spacing as shown on the drawings. **Drawings and Literature**

After award of work the agency shall be required to do the detailed design and engineering of the roof system. He shall prepare detailed shop drawings, bill of materials, and submit the same for approval of the Engineer. before commencement of work. He shall also prepare and furnish technical manuals and erection guides for the project.

Testing and Acceptance Criteria

Materials

Prior to delivery, manufacturers test certificates shall be supplied for all materials certifying grade and conformity with applicable standards. At owner's discretion on number and frequency, random samples drawn from material at site will be got tested at an independent

test house/laboratory approved by the owner. The materials shall be tested for and demonstrate to meet performance criteria and requirements listed elsewhere.

Load testing

Profiles shall be load tested to justify load/span data furnished by manufacturer in accordance with IS-801/AS/BS standards. Profiles must exhibit deflection less than L/150 under live load and point load (as per IS 875) and less than L/100 under wind load.

Measurement

The length and breadth shall be measured correct to a cm. for Providing & fixing Polyester coated Galvanized steel Roofing System and the area calculated in sqm correct to two places of decimal (Payment for flashing, gutter & down take pipe & ridge will be measured separately).

Rates

The rate for Providing & fixing Galvanized steel Roofing System shall include cost of all material and labour involved in all the operations described above.

Providing and fixing ridge/ valley capping in required width (minimum 500mm) galvanized sheets with organic coating of 20 Microns Polyester coating of approved Colour on the top over 5 Microns primer and 5 Microns back up epoxy coating at the bottom over 5 Microns primer including cost and conveyance of all materials, scaffolding, lead, lift, labour charges, etc. complete at all levels as directed by Engineer.

Measurement

The length shall be measured correct to a cm. for providing & fixing Polyester coated Galvanized steel Roofing System for ridge/ valley capping and the length shall be measured in running meter correct to two places of decimal.

MP tiles of size 320mm or nearest

MP tiles of size 320mm or nearest with Class AA Mangalore pattern tiles(COMTRUST) manufactured by M/s Common Wealth Trust Ltd., or equivalent over the cement mortar reeper bands already done to correct lines and levels

Base

Cement mortar reeper bands already done to correct lines and levels. Plastering the surface of sloping roof slabs, troweling to perfect smoothness closing all the voids with CM 1:3 (1 cement, 3 sand) 12mm thick one coat including forming reeper bands of 5cmx2.5cm over the plastered surface simultaneously to the spacing of 320mm (or nearest size of MP tiles) with CM 1:3 (1 cement and 3 sand)

Measurement & Rates

Area provided with MP tile to be measured in sqm. correct upto two places of decimal. The rate include the cost of the material, labour, tools etc. required in all the operations described above

MP hip and ridge tiles

with class AA Mangalore pattern tiles

Base

Cement mortar 1:2 (1 cement : 2 coarse sand)

Measurement & Rates

Total length of MP Hip and Ridge tile to be measured in running meter correct to a cm. The rate include the cost of the material, labour, tools etc. required in all the operations described above.

12 FALSE CEILING WITH GYPSUM BOARD

General

This section covers the requirements for all materials, labour, tools and equipment for suspended false ceiling.

Codes and Standards

The codes and standards generally applicable to the work of this section are listed hereinafter:

IS: 2095 Part - I (2011)- 12.5mm moisture resistant tapered edge Gypsum board

IS: 277 -1982 - Zinc Coating 120 gms Per sqm (both size inclusive) minimum - For galvanising of M.S. sheets/Sections

The following clauses are intended to amplify the requirements of the reference documents listed above and the contractor shall comply with these clauses.

Materials

Frame Work

A GRID of 457 x 1220 mm is made up of GI sections duly suspended from the RCC roof slab (PT slab)/ Truss work

The sizes of the members shall be:

a) Perimeter channels: 0.50mm thick with unequal flanges of 20mm and 30mm and web of 28mm along the perimeter of ceiling.

b) Intermediate channel: Channel Section of size 15x45x0.90 mm thick

c) Ceiling section: 0.50 mm thick having knurled web of 51.5 mm and 2 flanges of 26 mm each with lips of 10.5 mm.

d) Ceiling angle: 25mmx25mmx0.50mm

Boards

The boards to be used in the false ceiling shall be moisture resistant tapered edge

Gypsum Board ceiling 12.5 mm thick conforming to IS 2095 Part - I (2011) and 2542-1981.

The Gypsum boards used for false ceiling shall have following properties.

Characteristics: Gypsum plaster board with water repellent additives in the core firmly bonded with strong paper liners.

Thermal conductivity: 0.24 ($W/m^0 K$)

Thermal resistance: 0.052 sq. M K/W for 12.5mm thick board

Edges: Taper edge along length of board

Square edge along width of board

Fixing the G.I. Suspension System to the Ceiling

The system described here consists of various G.I. components (of sizes mentioned above) used to form a concealed suspended frame work of 457 mm x 1220 mm with one layer of

12.5mm thick Gypsum board confirming IS. 2542 -1981 & IS 2095 Part - I (2011) screwed on the underside of the frame work with self-tapping screws.

The G.I. perimeter channels shall be fixed along the perimeter of the ceiling while intermediate channels shall be suspended at 1220 mm c/c with G.I. Angle, G.I. cleats and metal expansion fasteners as per item specification. Ceiling sections are then fixed to the intermediate channels with connecting clips perpendicular to the intermediate channel at 457 mm c/c and then parallel to the ceiling section with 25mm dry wall screws at 230 mm centre.

Finishing

The boards shall be finished as per the manufacturer's recommendations. All joints shall be carried out in three separate stages. Filling and tape embedding, finishing and applying a surface treatment to even out differences in surface texture and section.

Filling: All boards shall be securely and correctly attached, protruding screws or nail heads should be driven home. Gaps greater than 3mm between boards should be treated with approved jointing compound of approved make pressed firmly into the gap so that it is completely filled. Jointing compound used for this purpose should be stiffer than normal.

Tape Embedding: The joint fiber tape of approved make shall then pressed into the band of jointing compound firmly embedded and free from trapped air bubbles, with sufficient jointing material under the tape to ensure good adhesion.

Immediately after the tape has been fixed, a new layer of jointing compound is applied over it flush with the surface of the board. Before the material begins to stiffen surplus material wiped from the edges of the joint by light sanding without disturbing the main joint filling. Once the material has dried any slight depressions in the surface can be filled again and projections cut back.

When the material has dried about 1 hour after application, a thin layer of jointing compound of approved make is applied in a broad band 200 mm wide. The edges of this band should be immediately feathered out with a light sanding. When the jointing material has completely dried another application is made, 250 mm wide and sanded out as before.

Finish

i) The entire false ceiling system shall be finished to the required line & levels as per specifications/drawing & instructions of Engineer to the complete satisfaction. Any part of work not found meeting the requirement shall be re-done by the contractor at his own cost. The decision of Engineer shall be final and binding in all respect and nothing extra shall be payable in this regard.

ii) The false ceiling finished to the required line and level shall be applied with two coats of putty and two coats of approved primer as per manufacturer's specification and two coats of approved quality and colour plastic emulsion paint.

iii) The work shall be got executed through specialized agency having sufficient experience in such works to be approved by Engineer.

The first coat of finish shall be allowed to dry before final coat is applied.

Sampling and Criteria for Conformity

The Number of Tests, Criteria for Conformity and selection of number boards from the lot depends upon the lot size and shall be in accordance with Clause 9 of IS 2095 (Part1): 2011

Shop Drawings

Shop drawings shall be submitted for approval as required and approval shall be obtained prior to delivery of suspended ceiling components. Shop drawings shall be co-coordinated with all related work and shall show the following information:

a. A reflected ceiling plan of areas indicated to receive the ceiling showing electrical and mechanical features.

b. Typical Intermediate framing for support where required. c. Hanger fastening details.

d. Panels - unit support at ceiling penetrations.

e. Details of splicing method for main and cross runners.

f. A table indicating load bearing capacity of main and cross runner

g. A note stating that the suspension system member furnished will not deflect more than 1/360 of the span under the indicated loading.

Acceptance Criteria

Finished ceiling shall be at the correct plane and present a pleasing and uniform appearance, free from, sags, warps, disfigured, or damaged board. Cutouts for light fixtures, diffusers etc. shall be of exact dimensions and in exact locations.

Cutouts for Light and A/C Fixtures

Rate quoted shall include the cost of making cutouts required and fixing light fixtures, air-conditioning diffusers, and fire detectors, etc. as per manufacturer's specifications. No extra payment shall be made for making cutouts and fixing any fixtures. Quantity of false ceiling material equivalent to cutout area shall be handed over to HCSL.

The rate also includes the cost of angle bead to be provided for vertical drops as per drawing.

The area of vertical drops shall also be measured for payment.

Measurement

Actual area of work shall be measured in Sqm correct to second place of decimal. However, no deduction will be made for opening upto 0.4 Sqm. each in area.

Rates

Rates shall be for the complete item called for in the “Schedule of Items”. No extra payment will be made for alignment, adjustment and fixing of fixtures like lighting fixtures, air-conditioning diffusers, access panels etc. The rate shall include all cutting and wastage from standard size sheets, runners/carries etc.

Level

All the panel should be fitted to ensure accurate positioning & level of the ceiling system as per the site / architectural requirements.

Samples

Samples of Ceiling panels and metal suspension system components as noted below shall be submitted for Engineer's approval:

Panels: 3 samples approximately 300 mm square/long each.

Suspension System: 3 samples of short length: each of main and secondary system.

Shop drawings

Shop drawings shall be submitted for approval as required and approval shall be obtained prior to delivery of suspended ceiling components. Shop drawings shall be co-coordinated with all related work and shall show the following information:

a) A reflected ceiling plan of areas indicated to receive the ceiling showing electrical and mechanical features.

b) Typical Intermediate framing for support where required. c) Hanger fastening details.

d) Panels - unit support at ceiling penetrations.

e) Details of splicing method for main and cross runners.

f) A table indicating load bearing capacity of main and cross runner

Acceptance criteria

The entire false ceiling system shall be finished to the required line & levels, free from sags, warps, disfigured, or damaged board. Cutouts for light fixtures, diffusers etc. shall be of exact dimensions and in exact locations as per specifications/drawing & instructions of Engineer to the complete satisfaction of Engineer. Any part of work not found meeting the requirements shall be re-done by the contractor at his own cost. The decision of Engineer shall be final and binding in all respect and nothing extra shall be payable in this regard.

The work shall be got executed through specialized agency having sufficient experience in such works and to be approved by Engineer. Only skilled and experienced persons shall be employed for this purpose and should ensure guarantee for proper installation, material composition & quality performance of both ceiling panels and supporting system for a period of 10 years from the date of completion of the said work.

Cleaning & Maintenance

Prior to handing over of the false ceiling work to client, the contractor shall provide maintenance training to client maintenance & service personnel which shall consist of false ceiling system maintenance, trouble procedures, emergency procedures, safety requirements,

providing required tools for maintenance of the goods etc. The contractor shall provide procedure including a list of approved cleaning products.

13.0 FINISHING WORKS

Cement Plaster

The cement plaster shall be 12 mm, 15 mm or 18 mm thick as specified in the item

Scaffolding

For all exposed brick work or tile work double scaffolding independent of the work having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed. For all other work in buildings, single scaffolding shall be permitted. In such cases the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one metre in width or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

Note: In case of special type of brick work, scaffolding shall be got approved from Engineer in advance.

Preparation of Surface

The joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scrapping. The surface shall then be thoroughly washed with water, cleaned and kept wet before plastering is commenced. In case of concrete surface if a chemical retarder has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarders is left on the surface.

Mortar

The mortar of the specified mix using the type of sand described in the item shall be used. For external work and under coat work, the fine aggregate shall conform to grading IV. For finishing coat work the fine aggregate conforming to grading zone V shall be used.

Application of Plaster

Ceiling plaster shall be completed before commencement of wall plaster. Plastering shall be started from the top and worked down towards the floor. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 × 15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and sideways movements at a time. Finally the surface shall be finished off true with trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive troweling or over working the float shall be avoided.

All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arises, provision of grooves at junctions etc. where required shall be done without any extra payment. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the sizes required.

When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with cement slurry before plaster is applied to the adjacent areas, to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar. No portion of the surface shall be left out initially to be patched up later on. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

Thickness

Where the thickness required as per description of the item is 20 mm the average thickness of the plaster shall not be less than 20 mm whether the wall treated is of brick or stone. In the case of brick work, the minimum thickness over any portion of the surface shall be not less than 15 mm while in case of stone work the minimum thickness over the bushings shall be not less than 12 mm.

Curing

Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered. The plaster shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages at the contractor's expense by such means as the Engineer may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.

Finish

The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

Precaution

Any cracks which appear in the surface and all portions which sound hollow when tapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the Engineer.

(i) When ceiling plaster is done, it shall be finished to chamfered edge at an angle at its junction with a suitable tool when plaster is being done. Similarly when the wall plaster is being done, it shall be kept separate from the ceiling plaster by a thin straight groove not deeper than 6 mm drawn with any suitable method with the wall while the plaster is green.

(ii) To prevent surface cracks appearing between junctions of column/beam and walls, 150 mm wide chicken wire mesh should be fixed with U nails 150 mm centre to centre before plastering the junction. The plastering of walls and beam/column in one vertical plane should

be carried out in one go. For providing and fixing chicken wire mesh with U nails payment shall be made separately.

Measurements

Length and breadth shall be measured correct to a cm and its area shall be calculated in square metres correct to two places of decimal. Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooves, or open joints in brick work.

The measurement of wall plaster shall be taken between the walls or partitions (the dimensions before the plaster shall be taken) for the length and from the top of the floor or skirting to the ceiling for the height. Depth of coves or cornices if any shall be deducted.

The following shall be measured separately from wall plaster.

(a) Plaster bands 30 cm wide and under

(b) Cornice beadings and architraves or architraves moulded wholly in plaster.

(c) Circular work not exceeding 6 m in radius.

Plaster over masonry pilasters will be measured and paid for as plaster only.

A coefficient of 1.63 shall be adopted for the measurement of one side plastering on honey comb work having 6 x 10 cm. opening.

Moulded cornices and coves.

(a) Length shall be measured at the centre of the girth.

(b) Moulded cornices and coves shall be given in square metres the area being arrived at by multiplying length by the girth.

(c) Flat or weathered top to cornices when exceeding 15 cm in width shall not be included in the girth but measured with the general plaster work.

(d) Cornices which are curved in their length shall be measured separately.

Exterior plastering at a height greater than 10 m from average ground level shall be measured separately in each storey height. Patch plastering (in repairs) shall be measured as plastering new work, where the patch exceed 2.5 sqm. extra payment being made for preparing old wall, such as dismantling old plaster, raking out the joints and cleaning the surface.

Where the patch does not exceed 2.5 sqm in area it shall be measured under the appropriate item under sub head 'Repairs to Buildings.'

Deductions in measurements, for opening etc. will be regulated as follows:

(a) No deduction will be made for openings or ends of joists, beams, posts, girders, steps etc. upto 0.5sqm in area and no additions shall be made either, for the jambs, soffits and sills of such openings. The above procedure will apply to both faces of wall.

(b) Deduction for opening exceeding 0.5sqm but not exceeding 3 sqm each shall be made for reveals, jambs, soffits sills, sills, etc. of these openings.

(i) When both faces of walls are plastered with same plaster, deductions shall be made for one face only.

(ii) When two faces of walls are plastered with different types of plaster or if one face is plastered and other is pointed or one face is plastered and other is unplastered, deduction shall be made from the plaster or pointing on the side of the frame for the doors, windows etc. on which width of reveals is less than that on the other side but no deduction shall be made on the other side.

Where width of reveals on both faces of wall is equal, deduction of 50% of area of opening on each face shall be made from area of plaster and/or pointing as the case may be.

(iii) For opening having door frame equal to or projecting beyond thickness of wall, full deduction for opening shall be made from each plastered face of wall.

(c) For opening exceeding 3sqm in area, deduction will be made in the measurements for the full opening of the wall treatment on both faces, while at the same time, jambs, sills and soffits will be measured for payment. In measuring jambs, sills and soffits, deduction shall not be made for the area in contact with the frame of doors, windows etc.

Rate

The rate shall include the cost of all labour and materials involved in all the operations described

Cement Plaster with a Floating Coat of Neat Cement

When the plaster has been brought to a true surface with the wooden straight edge it shall be uniformly treated over its entire area with a paste of neat cement and rubbed smooth, so that

the whole surface is covered with neat cement coating. The quantity of cement applied for floating coat shall be 1 kg per sqm. Smooth finishing shall be completed with trowel immediately and in no case later than half an hour of adding water to the plaster mix. The rest of the specifications described and shall apply.

6mm Cement Plaster on Cement Concrete and Reinforced Cement Concrete Work

Scaffolding

Stage scaffolding shall be provided for the work. This shall be independent of the walls.

Preparation of Surface

Projecting burrs of mortar formed due to the gaps at joints in shuttering shall be removed. The surface shall be scrubbed clean with wire brushes. In addition concrete surfaces to be plastered shall be pock marked with a pointed tool, at spacing of not more than 5 cm. Centres, the pock being made not less than 3 mm deep. This is to ensure a proper key for the plaster. The mortar shall be washed off and surface, cleaned off all oil, grease etc. and well wetted before the plaster is applied.

Mortars

Mortar of the specified mix using the types of sand described in the item shall be used. It shall be as specified.

Application

To ensure even thickness and a true surface, gauges of plaster 15 x 15 cm. shall be first applied at not more than 1.5 m intervals in both directions to serve as guides for the plastering. Surface of these gauged areas shall be truly in the plane of the finished plaster surface. The plaster shall be then applied in a uniform surface to a thickness slightly more than the specified thickness and shall then be brought to true and even surface by working a wooden straight edge reaching across the gauges. Finally the surface shall be finished true with a trowel or with wooden float to give a smooth or sandy granular texture as required. Excess troweling or over working of the floats shall be avoided. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar. Plastering of ceiling shall not be commenced until the slab above has been finished and centring has been removed. In the case of ceiling of roof slabs, plaster shall not be commenced until the

terrace work has been completed. These precautions are necessary in order that the ceiling plaster is not disturbed by the vibrations set up in the above operations.

Finish

The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

Thickness

The average thickness of plaster shall not be less than 6 mm. The minimum thickness over any portion of the surface shall not be less than 5 mm.

Curing

The specifications shall be as detailed

Precautions

The specifications shall be as detailed

Measurements

Length and breadth shall be measured correct a cm. and its area shall be calculated in sqm correct to two places of decimal. Dimensions before plastering shall be taken.

Thickness of plaster shall be exclusive of the thickness of the key i.e. depth or rock marks and hacking.

Plastering on ceiling at height greater than 5 m above the corresponding floor level shall be so described and shall be measured separately stating the height in stages of 1 m or part thereof.

Plastering on the sides and soffits of the projected beams of ceiling at a height greater than 5 m above the corresponding floor level shall be measured and added to the quantity measured.

Plastering on spherical and groined ceiling and circular work not exceeding 6 m in radius, shall be measured and paid for separately.

Flowing soffits (*viz.* portion under spiral stair case etc.) shall be measured and paid for separately.

Ribs and mouldings on ceiling shall be measured as for cornices, deductions being made from the plastering on ceiling in case the width of the moulding exceed 15 cm.

Deduction shall not be made for openings or for ends of columns, or columns caps of 0.5 sqm each in area and under. No additions will be made either for the plastering of the sides of such openings. For openings etc. of areas exceeding 0.5 sqm deduction will be made for the full opening but the sides of such openings shall be measured for payment.

Rate

The rate shall include the cost of all labour and materials involved in all the operations described above.

CEMENT PRIMER COAT

Cement primer coat is used as a base coat on wall finish of cement or any other surfaces before Paints are applied on them. The cement primer is composed of a medium and pigment which are resistant to the alkalies present in the cement, lime or lime cement in wall finish and provides a barrier for the protection of subsequent coats of Paints.

Primer coat shall be preferably applied by brushing and or by spraying. Hurried priming shall be avoided particularly on absorbent surfaces. New plaster patches in old work should also be treated with cement primer before applying emulsion Paints etc.

Preparation of the Surface

The surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying putty, made of plaster of paris mixed with water on the entire surface including filling up the undulations and then sand papering the same after it is dry.

Application

The cement primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as

uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours, before emulsion Paint is applied.

Scaffolding

Scaffolding shall be got approved from Engineer in advance. Scaffolding has to be in steel, arranged by the contractor at his own cost for carrying out entire painting jobs at all height and provide all facilities for proper inspection of surface at various stages. Material has to be erected as per safe methods. Ropes and guy wires shall be used for tying etc. The scaffolding shall be of steel and shall not endanger the painter. Scaffolding shall be sufficiently away from the surface to be painted so as to enable the painter to work with ease. The scaffolding shall be removed by the contractor promptly after completion of the work.

Protective Measures

Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be painted, shall be protected from being splashed upon. Splashing and droppings, if any shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the contractor.

Measurements

Length and breadth shall be measured correct to a cm. and area shall be calculated in sqm correct to two places of decimals. Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements. The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 50 sq. cm. each with material similar in composition to the surface to be prepared.

Rate

The rate shall include the cost and conveyance of all materials, labour charges, scaffolding, the cost of material wastage, lead, lift etc complete as specified.

CEMENT BASED PUTTY WORK

Surface Preparation

Remove all loosely adhering material from the wall surface with the help of sand paper, putty blade or wire brush. The substrate should be clean, free from dust, grease and loose materials.

Mixing

Mixing with 40-45% clean water slowly to make a paste. It is very important that water be added to putty to make a mix and not vice versa. Continue the mixing or 10-15 minutes till a uniform paste is formed. It is very important that the mixing of putty should be done thoroughly. This will help in easy application, obtaining more coverage and smooth uniform shade. Only prepare a quantity which can be used within 2-3 hours of mixing with water.

Application

After thoroughly mixing Putty apply the first coat on the moistened wall surface from bottom to upward direction uniformly with the aid of putty blade. This would ensure minimum wastage and proper finish.

After drying of first coat of putty just rub the surface gently with wet sponge or very gently with the putty blade in order to remove the loose particles.

Allow the surface to dry for at least 3 hours and then apply second coat of putty. Leave the surface to dry completely. After drying of second coat remove any type of marks with the help of moist sponge or rub the surface very gently with putty blade.

Leave the surface to dry, preferably overnight/10-12 hours. Always prepare a required quantity of putty and use it within 2-3 hours of mixing with water. The total thickness of the coats should be limited to maximum 1.5 mm.

It is not necessary to rub the surface done with putty. However, if at all there is a need to remove unevenness before applying any kind of paint/distemper, gently level the surface with very fine water proof emery paper of not less than 500 number to get a glossy white surface.

Precautions during application

Mixing of the Putty is very important. Hence extreme care should be taken for proper and thorough mixing. It should be preferably mixed with mechanical stirrer in order to get best results. Mixing is to be continued till a uniform paste is formed. Do not add putty into water.

It is recommended not to rub the surface done with Putty strongly & harshly with rough emery paper. This breaks the film formed over it which decreases the water repellency properties.

In case of fresh concrete/mortar surface it is recommended that two coats of cement wash be done before application of Putty.

Scaffolding

Scaffolding shall be got approved from Engineer in advance. Scaffolding has to be in steel, arranged by the contractor at his own cost for carrying out entire painting jobs at all height and provide all facilities for proper inspection of surface at various stages. Material has to be erected as per safe methods. Ropes and guy wires shall be used for tying etc. The scaffolding shall be of steel and shall not endanger the painter. Scaffolding shall be sufficiently away from the surface to be painted so as to enable the painter to work with ease. The scaffolding shall be removed by the contractor promptly after completion of the work.

Protective Measures

Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be painted, shall be protected from being splashed upon. Splashing and droppings, if any shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the contractor.

Measurements

Length and breadth shall be measured correct to a cm. and area shall be calculated in sqm correct to two places of decimals. Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements. The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 50 sq. cm. each with material similar in composition to the surface to be prepared.

Rate

The rate shall include the cost and conveyance of all materials, labour charges, scaffolding, the cost of material wastage, lead, lift etc complete.

PAINTING WORKS Materials

Paints of approved brand and manufacture shall be used. Only ready mixed Paint as received from the manufacturer without any admixture shall be used. If for any reason, thinning is

necessary in case of ready mixed Paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer shall be used.

Approved Paints shall be brought to the site of work by the contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineer.

Commencing Work

Painting shall not be started until the Engineer has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work. Painting of external surface should not be done in adverse weather condition like hail storm and dust storm.

Painting, except the priming coat, shall generally be taken in hand after practically finishing all other building work.

Preparation of Surface

The surface shall be thoroughly cleaned and dusted off. All rust, dirt, scales, smoke splashes, mortar droppings and grease shall be thoroughly removed before painting is started. The prepared surface shall have received the approval of the Engineer after inspection, before painting is commenced.

Application

Before pouring into smaller containers for use, the Paint shall be stirred thoroughly in its containers, when applying also, the Paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform.

The paint shall be applied with a brush/roller/spray on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush/roller/spray marks.

The contractor shall arrange a quality inspection by the manufactures of the paint for ascertaining the quality of the painting application.

Protective Measures

Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be painted, shall be protected from being splashed upon. Splashing and droppings, if any shall be removed by the contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the contractor.

Measurement

Length and breadth shall be measured correct to a cm. and area shall be calculated in sqm correct to two places of decimals. Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements. The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 50 sq. cm. each with material similar in composition to the surface to be prepared.

Rate

The rate shall include the cost and conveyance of all materials, labour charges, scaffolding, the cost of material wastage, lead, lift etc complete.

14 WATERPROOFING WORKS

Providing and applying two coats of two component acrylic polymer modified elastomeric waterproof coating.

Application Methodology:

Pond the surface of sunken slab, building terrace and UG sump and pump room walls with water for minimum 3 days and mark the damp areas if any in the ceiling and later drain out the water and allow to dry

Treating the construction joints by injecting cement slurry mixed with expanding agent using pressure grouting pump with a pressure of 3 to 4 kg/sqm.

Providing coving at the junction of wall and slab on the external face with CM 1:4 mixed with water proofing liquid at a dosage of 100gms/bag of cement

Bore packing around the inlet/outlet pipes shall be done with moisture insensitive epoxy putty

Surfaces of concrete shall be free from frost, surface laitance and contamination by wiping scraping and /or by sand blasting.

Ensure removal of grease & oil by use of solvent or if penetration is deep, remove the top layer of floor by scarifying.

Apply water proofing material to RCC surface. The mixing and application shall be strictly in accordance with manufacturer's technical datasheet and specifications. Two coats are recommended. 2nd coat shall be applied in perpendicular to the first coat and first coat shall be properly dried before 2nd coat application.

After system fully cured (7days) apply two coats of single component cold applied aliphatic polyurethane waterproof membrane coating.

15 MISCELLANEOUS BUILDING WORK

ANTI TERMITE TREATMENT General

The treatment shall create a chemical barrier /Zone and around the building during the construction : 6313 Part (II) 2001 .Treatment shall be got done only by approved specialized agencies who shall provide guarantee of minimum 10 years against re-infestation and in the event of re-infestation shall carry our further treatment free of cost.

Only permitted chemicals procured from authorized agencies shall be used.

Graduated containers shall be used for dilution of chemicals and spraying shall be done by hand operated pumps.

Adequate safety measures and protective gears shall be used while storing & handling the chemicals.

Treatment should start when foundation trenches and pits are ready to take mass concrete foundations. Treatment shall not be carried out during rain or when the soil is wet.

The treated soil barrier shall not be disturbed. If for any reason the barriers are disturbed immediate steps shall be taken to restore continuity and completeness of the barrier system.

The applicator shall be done by fully trained and approved by the manufacturer. The manufacturer should ensure 10 year warranty for the entire system to the client. All application team must obtain the training certificate from the manufacturer and also certify that the installation team is qualified for the anti-termite work. Manufacturer should

ensure the performance guarantee of the system by submitting a BG for 10% value of total work, for a period of 5 years as per special condition.

Chemical

The following chemicals which are effective when applied uniformly over the area to be treated, shall be used in water emulsion for the soil treatment with the concentration shown against it.

Chemical	Relevant Indian Standard	Concentration by weight, percent
Imidacloprid	CIB Approved	0.075 a.i.concentration ie, 2.1 Imidacloprid per litre of water)

Treatment

The principle of the treatment is to create a continuous chemical barrier/Zone below and around the building treatment is designed depending on the type of building is described below:

Treatment for foundations and basement

The bottom surface and the side (up to a height of 300mm) of the excavation made for masonry foundation and basement shall be treated with the chemical emulsion at the rate of t 5 liters per square meter surface area

After the masonry foundations and the retaining wall of the basements come up, the backfilling immediate contact with the foundation structure shall be treated at the rate of 7.5 liters per square meter of the vertical surface of the sub-structure for each side. The earth is usually returned in layer and the treatment shall be carried out in similar stages .The chemical emulsion shall be directed towards the masonry surface so that the earth in contact with these surface is well treated with the chemical.

Treatment of RCC Foundation and basement

The RCC foundation require to be completely enveloped by a chemical barrier. In RCC Foundation the concrete is dense being a 1:2:4 mix or richer, the termites are unable to penetrate it. It is therefore unnecessary to start the treatment from the bottom of excavation.

The treatment shall start at a depth of 500 mm below the ground level. From this depth, the backfill soil in immediate contact with vertical surfaces of RCC Foundations shall be treated at the rate of 7.5 liters per square meter.

Treatment of top surface of plinth filling

The top surface of the consolidated earth within plinth wall shall be treated with chemical emulsion at the rate of 5 liters per square meter of the surface before the sand- bed or sub - grade is laid. If the filled earth has been well rammed and surface does not allow the emulsion to seep through, holes up 50 to 75 mm deep at 150 mm centers both ways may be made with 12 mm diameter mild steel rod on the surface to When pipes, wastes and conduits enter the soil inside the area of the foundation, the soil with the chemical emulsion.

Treatment at junction of the Wall and the floor

Special care shall be taken to establish continuity of the vertical chemical barrier /zone of inner wall surface from ground level up to the level of filled earth surface .To achieve this a small channel 30 mm x 30 mm shall be made at the junction of wall and columns with the floor (before laying the sub-grade) and rod holes made in the channel up to the ground level 150 mm apart and the rod moved backward and forward to break up the earth and chemical emulsion poured along the channel at the rate of 7.5 liters per square meter of the vertical wall or column surface so as to soak the soil right to the bottom. The soil should be tamped back into place after this operation.

Treatment of Soil along External Perimeter of Building

After the building is complete, the earth along the external perimeter of the building should be rodded at intervals of 150 mm and to a depth of 300 mm .The rods should be moved backward and forward, parallel to the wall to break up the earth and emulsion poured along the wall at the rate of 7.5 liter per square meter of vertical surfaces. After the treatment, the earth should be tamped back into place. Should the earth outside the building be graded on completion of building, this treatment should be carried out on the completion of such grading .In the event of filling more than 300 mm, the external perimeter treatment shall extend to the full depth of filling up to the ground level so as to ensure continuity of the chemical barrier /Zone.

Treatment of Soil under Apron along External Perimeter of Building

Top surface of the consolidated earth over which the apron is to be laid shall be treated with chemical emulsion at the rate of 5 liters per square meter of the surface before the apron is laid. If consolidated earth does not all emulsion to seep through, holes up to 50 to 75 mm deep and 150 mm centers both ways may be made with 12 mm diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion.

Treatment for Walls Retaining Soil above Floor Level

Retaining walls like the basement walls or outer walls above floor level retaining soil need to be protected by providing chemical barrier / zone by treatment of retained soil in the immediate vicinity of the wall so as to prevent entry of termites through the voids in masonry cracks and crevices etc, above the floor level .The soil retained shall be treated at the rate of 7.5 mm per square meter of the vertical surface so as to effect a continuous outer chemical barrier /zone.

Treatment of Soil Surrounding Pipes, Wastes and Conduits

When pipes, wastes and conduits enter the soil inside the area of the foundation, soil surrounding the point of entry shall be loosened around each of such pipe, waste or conduits for a distance of 150 mm and up to a depth of 75 mm before the treatment is commenced. When they enter the soil external to the foundation, they shall be similarly treatment for a distance of 300 mm, unless they stand clear of the walls of the building by about 75 mm.

Treatment for Expansion Joints

Expansion joints at ground floor level are one of the biggest hazards for termite infestation. The soil beneath these joints should receive special attention when the treatment under 3.3 is carried out .This treatment should be supplemented by treating through the expansion joint after the sub – grade has been laid, at the rate of 2 liters per linear meter.

Precautions to be taken

• Treatment should not be carried out when it is raining or when the soil is saturated with sub-soil water. The chemical shall be applied to soil when the soil is dry and absorbent. Immediate steps to be taken by the customer to cover the treated layer by laying soiling /PCC etc.

• Once formed treated soil barriers zone must not be disturbed. In case treated soil is disturbed, immediately steps shall be taken to restore the continuity and completeness of barrier system at an additional cost to the customer.

• Infants and aged or any person having breathing problem or sensitive to chemicals should avoid being present in the premises during the treatment.

• Do not touch or let pets touch treated surface.

Measurement

Measurement for anti-termite treatment for building shall be of the area of plinth at ground level correct up to 0.01 square meter. Unless itemized separately, the rate shall include additional treatments for mound, expansion joint etc.

Rate

The rates quoted shall include cost of all materials, spray pumps, tools tackles and other accessories, all labour, storage of insecticides as approved by competent authorities license if required etc. complete.

(Sl No)Water stops

Water stops shall be of approved make provided locations indicated on drawings. Water stops shall be but jointed but heat welding to obtain continuity it shall be cleaned thoroughly of all concrete and mortar coating as directed before resuming concrete work. Water stops shall be in long lengths to avoid joints as for as possible.

If not included in any other item, measurement shall be in Rmt.

16 DISMANTLING AND DEMOLITION WORKS

General

The term dismantling implies carefully taking up or down and removing without damage. This shall consist of dismantling one or more parts of the building as specified or shown on the drawings.

The term Demolition implies taking up or down or breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on drawings.

Precautions

Necessary propping, shoring and /or underpinning shall be provided for the safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property.

Wherever required, temporary enclosures or partitions/barricades shall also be provided. Necessary precautions shall be taken to keep the dust-nuisance down as and when necessary.

Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roofs, masonry etc., shall be carefully dismantled first. The dismantled articles shall be passed by hand where necessary and lowered to the ground and not thrown. The materials then be properly stacked as directed by the Engineer. Methodology of dismantling shall be got approved in writing by Engineer prior to take up work at site.

All materials obtained from dismantling or demolition shall be the property of HSCL unless otherwise specified and shall be kept in safe custody until handed over to the Engineer.

Any serviceable material, obtained during dismantling or demolition shall be separated out and stacked properly as indicated by the Engineer within a lead of 50m, or as specified in the item. All under serviceable materials, rubbish etc., shall be disposed off as directed by the Engineer.

Rates

The rate shall include cost of all such operations mentioned above including necessary labour, materials, transport, scaffolding, stacking the serviceable materials, disposing the unserviceable materials within the lead specified, all as directed by the Engineer.

Providing & Laying non-pressure hume pipe

The pipe shall be with or without reinforcement as required and of the class as specified. These shall conform to IS:456. The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process while unreinforced cement concrete pipes by spun or

pressure process. All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws, the external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding. The unreinforced pipes (non pressure pipes) shall withstand a test pressure equivalent to 0.7 kg/sq.cm (7 m head) of water.

Concrete used for the manufacture of unreinforced and reinforced concrete pipes and collars shall not be leaner than 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate). The max. size of aggregate should not exceed one third of the thickness of the pipe or 20 mm whichever is smaller. The reinforcement in the reinforced concrete pipes shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcements shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across a span equal to the length of pipe plus three times its own weight. The minimum cover for reinforcement of spun pipes and for all other pipes shall be as given below:

Pipe thickness	Spun pipes Pipes mm	other than spun pipe mm
Less than 30 mm	9	12
30 mm to 75 mm	12	18
75 mm and over	18	18

Where the pipe shall be bedded directly on soil, the bed shall be suitably rounded to fit the lower part of the pipe, the cost for this operation being included in the rate for laying the pipe.

Loading, transporting, and unloading of concrete pipes shall be done with care. Handling shall be as to avoid impact. Gradual unloading by inclined plane or by chain block is recommended. All pipe sections and connections shall be inspected carefully before being laid. Broken or defective pipes or connections shall not be used. Pipes shall be lowered into the trenches carefully. Mechanical appliances may be used. Pipes shall be laid true to the line and grade as specified, laying of pipe shall proceed upgrade of a slope.

If the pipe have spigot and socket joints, the socket ends shall face up-stream. In the case of pipes with joints to be made with loose collars, the collars shall be slipped on before the next pipe is laid. Adequate and proper expansion joints shall be provided where directed.

In case where the foundation conditions are unusual such as in the proximity of trees or holes under existing or proposed tracks, manholes etc. the pipe shall be encased all-round in 15 cm thick cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size) or compacted sand or gravel.

In case where the natural foundation is inadequate the pipes shall be laid either in concrete or cradle supported on proper foundations or on any other suitably designed structure. If a concrete cradle bedding is used the depth of concrete below the bottom of the pipe shall be atleast $1/4^{th}$ of the internal dia of the pipe subject to a minimum of 10cm and a maximum of 30cm. The concrete shall extend up the sides of the pipes at least at a distance of $1/4^{th}$ of the outside diameter for pipes 300 cm and over in diameter. The pipe shall be laid in this concrete bedding before the concrete has set, pipes laid in trenches in earth shall be bedded evenly and firmly and as far up the haunches of the pipes as to safely transit the load expected from, the backfill through the pipe to the bed. This shall be done either by excavating the bottom of the trench to fit the curve of the pipe or by compacting the earth under the curve of the pipe to form an even bed. Necessary provision shall be made for joint wherever required. When the pipe is laid in a trench in rock, hard clay, shale or other hard material the space below the pipe shall be excavated and replaced with an equalizing bed of concrete, sand or compacted earth. In no case shall pipe be laid directly on such hard material. When the pipes are laid completely above the ground the foundations shall be made and sufficiently compacted to support the pipe line without any material settlement. Alternatively the pipe line shall be supported on rigid foundations at intervals. Suitable arrangements shall be made to retain the pipe line in the proper alignment such as by shaping the top of the supports to fit the lower part of the pipe. The distance between the supports shall in no case exceed the length of the pipe. The pole shall be supported as far as possible close to the joints. In no case shall the joint come in the centre of the span. Care shall be taken to see that superimposed loads greater than the total load equivalent to the weight of the pipe when running full shall not be permitted. Suitably

designed anchor blocks at change of directions and grades for pressure line shall be provided where required.

Jointing of the pipes shall be done as described below:

a) Collar shall be spaced symmetrically over the two pipes and the space between collar and pipe filled with cement mortar 1:1 thoroughly rammed with caulking tools. The joint shall be finished with a fillet sloping at 45^{o} joints shall be protected and cured for about 10 days. If specified in the item specification wedge shaped groove in the end of the pipe shall be filled with a special bituminous plastic compound for bitumen soaked spun yarn. The collar shall then be slipped over the end of pipe and next pipe butters well against the plastic compound by suitable appliance so as to compress the plastic compound in the grooves, care being taken not to disturb concentricity and level of the pipes.

17 CEMENT CONCRETE PAVEMENT

Materials

***Cement, Water –As specified in RCC head Coarse Aggregate* :**

These shall be crushed or broken from hard stones obtained from approved quarry. These shall be clean strong, durable of fairly cubical shape and free from soft, friable, thin elongated and laminated disintegrated pieces. These shall also be free from dirt, organic deleterious and any other foreign matter and adherent coatings and shall satisfy the physical requirements laid down in para 16.37.19 of CPWD specification 2009 under quality control.

Fine Aggregate:

As specified above ***Grading of Mixed Aggregates:*** The grading of all aggregates (coarse and fine aggregates) to be used in the work shall be determined in the laboratory. The coarse and fine aggregates shall be mixed in suitable proportions so that the grading of the mixed aggregates shall be in the range indicated table

TABLE 16.32 *I.S. Sieve Size (IS 460) %age passing by weight*

45	mm		100
22.4	mm	55	- 60
11.2	mm	45	- 50

5.6	mm	35	- 40
2.8	mm	30	- 35
1.4	mm	20	- 25
710	microns	15	- 20
355	microns	10	- 14
180	microns	2	- 5

Mix Design

The mix shall be approved by Engineer so as to obtain the following mean strength that exceeds the minimum specified flexural strength by 1.64 times the designed standard deviation. Minimum works beam flexural strength at 28 days = 300 kg/sqm. for M-30 or specified in item Designed standard deviation = 60 kg/sqm. for M-30 or for specified grade(s) Design flexural strength at 28 days = 300+60x1.64 = 398.4 kg/sqm. (f + 1.64 s) says 400 kg. Water cement ratio by weight = 0.5 Minimum slump not more than 25mm

For the purpose of tendering the contractor shall base his rate on the assumption that the quantity of cement used for one cum. of finished concrete shall be 340 kg. or M - 30. If the actual quantity of cement required to be used as a result of the laboratory test is different from that assumed above, necessary adjustment in the cost due to short cement used shall be made on the basis of issue rate of cement including storage charges plus b2.5% for handling charges. However, under no circumstances the quantity of cement to be used shall either exceed 350 kg./cum or fall below 330 kg. per cum of finished concrete.

Statistical Field Check

Samples of concrete shall be taken at the mixer and works beams, made, cured and tested in accordance with IS 1199 and IS 516. When a mix is used for the first time, it is important to get a large number of results, as soon as possible, in order to establish the level of control and then suitability of the mix proportions. A sample of concrete shall be taken at random on eight separate occasions during each of the first five days of using that mix. From each sample two beams shall be made one for test at 7 days and the other for test at 28 days. The work beam results shall be examined both individually and in consecutive (but not overlapping) sets of four, for which the average and the range of each set is calculated. The mix proportions shall be modified to increase the strength, if in the first ten consecutive (but not overlapping) sets any of the following conditions are not satisfied. (I) Each sample has a test strength not less than the minimum specified strength i.e. 30 kg/sq. cm.(or

otherwise specified in item). OR (II) (a) Not more than two individual results (Not more than one of first twenty) of the 40 beams tests shall fall below the minimum work beam strength but they shall not be less than 80% of the specified beam strength of 30 kg./sq. cm (or otherwise specified in item) or the minimum specified strength minus 1.35 times the standard deviation whichever is greater. (b) No value of the range in any set shall exceed 3 times the designed standard deviation. (c) The average for all samples (10 sets) shall not be less than the minimum specified strength i.e. 30 kg/sq. cm (or otherwise specified in item) plus 1.64 times the designed standard deviation 60 kg./sq.cm M-30. If either of these conditions are not satisfied, the mix shall be modified and the procedure described above shall be repeated till results satisfying the above criterias are obtained. Subsequently samples shall be taken at the rate of one for every 30 cubic metre of concrete laid. Eight beam specimen shall constitute one sample. A set of 4 specimen shall be tested after 7 days and another set of 4 specimen shall be tested after 28 days. These test results shall be checked individually and in sets of four as the work progresses. If at any stage it is found that either of conditions are not satisfied, the overall average and the standard deviation of the previous consecutive 40 beam test results including the non-complying set shall be calculated. If the overall average strength minus 1.64 times the standard deviation is more than the specified beam strength (30 kgm/sq.cm) (or otherwise specified in item) the concrete shall be accepted. But if it is less than the concrete work corresponding to these 40 beams tests shall be rejected and the mix proportion shall be modified forth with for further work. The rejected work shall be replaced by the contractor immediately at his own cost and expense. The statistical field checks described are meant to control the quality of concrete.

Slump Test

The test shall be carried out as per IS 1199. A slump test shall be carried out at each mixer at least one in fifty batches mixed or more frequently if directed by the Engineer. Any batch from which slump test is being made shall not be transferred to the place of laying till the slump test has been completed. Not only the batch which gives a slumps in excess of that specified shall be rejected but the concrete already laid immediately preceding the batch tested upto the nearest last transverse joint may be rejected by the Engineer or his subordinate, if he is satisfied that such preceding batches were substandard in this respect.

The decision of the Engineer in this respect shall be final and binding on the contractor. Such rejected concrete shall be removed by the contractor immediately and replaced with proper slump concrete at his cost and expense.

Steel Forms

All side forms shall be of mild steel. The steel forms shall be of M.S. Channel sections and their depth shall be equal to the thickness of the pavement.

The side forms shall have a length of at least 3.0 metres except on curves of less than 4.5 metres radius where shorter lengths may be used. When set to grade and stacked in place the maximum deviation of the top surface of any section from a straight line shall not exceed 3 mm. The method of connection between sections shall be such that the joint formed shall be free from play or movement in any direction. The use of bent, twisted or worn out forms shall not be permitted. At least three stake pockets for bracing pins or stakes shall be provided for each 3.0 M length of forms. Bracing and supports must be ample to prevent the springing of forms under pressure of concrete or weight or thrust of the machinery (like screed vibrator) operating on the forms. Support to the forms shall be sufficiently rigid to hold them in position during the entire operation of laying and compacting and finishing and that they shall not at any time deviate more than 3 mm from straight edge 3 metres in length. Forms which show a variation from the required rigidity of the alignment and levels shown on the plans shall be reset or removed as directed. The length and number or pins or stakes shall be such as to maintain the forms at the correct line and grade.

The supply of forms shall be sufficient to permit their remaining in place for at least 12 hrs. after the concrete has been placed or longer, if in the opinion of the Engineer, it is necessary.

The top line of the forms is not to vary from the correct level or alignment and the levels and alignment of the forms are to be checked and corrected as necessary immediately prior to the placing of concrete. The top edges and faces of the forms are to be carefully cleaned and maintained in clean condition. While removing the steel forms, care shall be taken to withdraw them gradually, any damage to the bull nosed edges shall be made good while the concrete is still green.

Setting of Forms

Setting of forms shall be according to the slab plan subject to the approval of Engineer and concreting shall not commence until the setting of forms is approved. (b) Forms shall be set for at least 50 metres in advance of the point where the concrete is being laid and shall not be removed until at least 12 hrs. of placing of the concrete or longer if in the opinion of Engineer is necessary. (c) After setting, the working faces shall be thoroughly oiled by using approved oil before concrete is placed against them. (d) The pavement joints of overlay layer would overlap with the joints of underlay cement concrete.

Batching and Mixing and Placing of Concrete As detailed in RCC work

Compaction of Concrete Compaction shall be carried out by electrically (or) diesel operated needle and screed vibrators as stipulated hereafter. Needle vibrator should be used all over the area for obtaining initial compaction of concrete. These should be of diameter not less than 4.5 cm. If the vibrator are pneumatic the pressure must not be below 4 kg/sq.cm. If electrically operated, they should have a minimum frequency of 3500 impulses per minute.

There should be at least three needle vibrators working in any bay. A vibrating screed consisting of a steel or timber section weighing not less than 15 kg. per metre with a tamping edge of not less than 7 cm width and having a vibrator mounted thereon shall follow needle vibrators to obtain full compaction. The face of the wooden tamping edge of the screed shall be lined with M.S. Plate rigidly fixed by means of counter sunk screw. Where screed vibrators are used for compaction, a standby unit shall always be maintained ready for use, should the other one go out of order. Where electrically driven vibrators are employed, a standby diesel pneumatic unit shall be kept ready for use in case of power failure. At the discretion of the Engineer, for compaction at edges and joints, vibrators may be supplemented by hand tamping and rodding for securing satisfactory results. Under no circumstances, honey combing of concrete at joints or elsewhere shall be permitted.

When using screed vibrator for compaction it should not be dragged over the concrete. During the initial passes it shall be lifted to the adjacent forward position in short steps, subsequently, it shall be slowly slided over the surface with its axis slightly tilted away from the direction of sliding and the operation repeated until a close, dense surface is obtained.

Concreting shall be carried out in one operation between the expansion joints and construction joints without any break at the dummy joints.

Concrete shall be deposited on the base as near the joints as possible without touching them. It shall then be shoveled against the sides, maintaining equal pressure and deposited approx. 50 mm higher than the depth of the joints, care being taken that it is worked well around the joints. The concrete shall not be dumped from the bucket directly upon or against the joints.

Workmen shall not be allowed to walk on freshly laid concrete and proper cat walk shall be provided with independent supports beyond concreting bays.

Finishing of Concrete

During compaction, any low or high spots shall be made up by adding or removing concrete. After longitudinal floating has been completed but while concrete is still plastic, the slab surface shall be tested for trueness with a 3 m straight edge. Any depressions or high spots showing departure from the true surface shall be immediately rectified. High spots shall be cut down and refinished. Depressions shall be enlarged to about 8-10 cm and filled up with fresh concrete, compacted and finished.

The straight edge testing the refloating is to continue until the entire surface: (a) is free from observable departure from the straight edge, (b) conforms to the required levels and across section, and (c) shall conform to the specified surface when the concrete has hardened. The foregoing work is to be carried out while the concrete is still plastic and workable.

Belting

Just before concrete becomes non-plastic, the surface shall be belted with a two ply canvas belt not less than 20 cm wide and at least 1 metre longer than the width of the slab. Hand belts shall have suitable handles to permit controlled uniform manipulation. The belt shall be operated with short strokes transversed to the centre line of the pavement and with rapid advance parallel to the centre line.

Brooming

After belting and as soon as the surplus water, if any, has risen to the surface, the pavement shall be given a broom finish with an approved steel or fiber broom not less than 45 cm wide. The broom shall be pulled gently over the surface of the pavement from edge to

edge. Adjacent strokes shall be slightly overlapped. Brooming shall be perpendicular to the centre line of the pavement and so executed that the corrugations formed shall be uniform in character and width and not more than 1.5 mm deep.

Brooming shall be completed before the concrete reaches such a stage that the surface is likely to be torn or unduly roughened by the operation. The broomed surface shall be free from porous or rough spots, irregularities, depressions, and small pockets such as may be caused by accidental disturbing of particles of coarse aggregates embodied near the surface. The brooming shall be of uniform pattern all through.

Edging :

After belting/brooming has been completed but before the initial setting of concrete, the edges of the slab shall be carefully finished with an edger of 6 mm radius, and the pavement edges shall be left smooth and true to line.

Honey Combing

The side forms shall not be removed until 12 hours or such longer period as the Engineer may decide after the laying of concrete.

As soon as the side forms are removed, any minor honey combed area shall be filled with mortar composed of one part of cement and two parts of fine aggregate. Major honey combing areas or segregated concrete or other defective work or areas damaged by removal of the forms or concrete damaged by rain or due to any other reason whatsoever shall be considered as defective work and shall be removed and replaced by the contractor at his own expense. The total area of honey combed surface shall not exceed 4 per cent of the area of the slab side. However, no individual honeycomb patch shall exceed 0.1 sqm. Engineer's decision as to whether the concrete is defective or not shall be final and binding.

Surface Accuracy

After the concrete has sufficiently hardened after about 12 hours and not later than 24 hours, the surface shall be tested again for high spots. All high spots shall be marked and those exceeding 3 mm shall be ground down immediately. Care shall be taken to see that the grinding does not in any way damage the concrete surface.

The final surface finish is to be such that when tested with a profilograh/ roughness indicator/or a 3 metre long straight edge or an equivalent mechanical unevenness indicator

placed anywhere within the same or adjoining slab in any direction on the surface, there shall be no variation greater than 3 mm.

If the surface irregularity exceeding 3 mm still remains despite grinding as per para the concrete shall be removed to its full depth. The area of concrete to be removed shall be complete slab between the nearest joints, where the defective slab is less than 4.5 metres from the expansion joint, the whole area upto the expansion joint shall be removed to the full depth. The concrete so removed shall not be reused in the work. Fresh concrete shall be laid in the manner already described in above paras and shall again be subject to test for surface accuracy and other quality control measures. Nothing extra shall be paid on this account.

Every slab shall bear an impression not exceeding 3 mm in depth comprising the number allotted to the slab and the date on which it is laid. This impression shall be formed by the contractor when the concrete is green so as to leave permanent mark on setting.

Initial Curing

Immediately after completion of the finishing operations, the surface of the pavement shall be entirely covered with wetted burlap, cotton or jute mats. The mats used shall be of such length (or width) that as laid they shall extend at least 45 cm beyond the edges of the slab. The mats shall be placed so that the entire surface and both edges of the slab are completely covered. This covering shall be placed as soon as, in the judgment of the Engineer the concrete has set sufficiently to prevent damage to the surface prior to being placed, the mats shall be thoroughly saturated with water and shall be placed with the wettest side down. The mats shall be so placed and weighed down as to cause them to remain in intimate contact with the surface covered, and the covering shall be maintained full wetted and in position for 24 hours after the concrete has been placed or until the concrete is sufficiently hard to be walked on without suffering damage. Water shall be gently sprayed so as to avoid damage to the fresh concrete. If it becomes necessary to remove a mat for any reason, the concrete slab shall not be exposed for a period of more than half an hour.

Worn burlap or burlap with holes shall not be permitted. Burlap reclaimed from previous use other than curing concrete shall be thoroughly washed prior to use for curing purposes. If burlap is obtained in strips, shall be laid to overlap by at least 150 mm.

Burlap shall be placed from suitable bridges. Walking on freshly laid concrete to facilitate placing burlap shall not be permitted.

Final Curing

Upon the removal of the burlaps, the slab shall be thoroughly wetted and then cured as follows:-

All joints shall be filled with filler in order to prevent the edges of joints from getting damaged and entry of clay materials into the joints during final curing. Exposed edges of the slab shall be banked with a substantial berm of earth. Upon the slab shall then be laid a system of transverse and longitudinal dykes of clay about 50 mm high immediately covered with a blanket of sandy soil free from stones to prevent the drying up and cracking of clay. The rest of slab shall then be covered with sufficient sandy soil so as to produce a blanket of earth not less than 40 mm deep after wetting. The earth covering shall be thoroughly wetted while it is being placed on the surface and against the sides of the slab and kept thoroughly saturated with water for 21 days and thoroughly wetted down during the morning of the 22nd day and shall thereafter remain in place until the concrete has attained the required strength and permission is given by the Engineer. Thereafter the covering shall be removed and the pavement cleaned and swept. If the earth covering becomes displaced during the curing period, it shall be replaced to the original depth and resaturated.

Contractor shall appoint chowkidars at his expense to prevent workmen, cattle, etc., straying on the pavement concrete.

Concrete shall not be subjected to any load or weight of any plant until at least 28 days after laying.

Construction Joints

Construction joints shall be provided as shown in the drawing and also at places where concreting is stopped due to unforeseen circumstances. The joints shall be straight and vertical through the full thickness of the slab. While concrete in adjacent bay is still green, flats of suitable size shall be drawn along the edge and a groove of size 10 mm × 25 mm deep shall be neatly formed and finished. The edges of the groove shall be full nosed. After curing of concrete is complete, this groove shall be thoroughly cleaned of all sand

dust and shall be perfectly dried and filled with hot poured sealing compound conforming to grade B of IS 1834. Before filling with sealing compound the faces of concrete of the joint shall be coated with primer of approved brand to a depth of 25 mm at the rate of 2.6 liters per 10 square meters. Bitumen emusion shall not be used as primer.

Dummy Joints

The joints shall be 10 mm wide and shall extend vertically from the surface of the slab to a depth equal to 1/3rd of the thickness of the slab but not less than 4 cm in any case. The joint may be formed by depressing into the soft but compacted concrete a high tensile M.S. or other approved Tee of flat bar of depth not less than required depth of the joint plus 25 mm. The bar used for forming the groove shall be coated with soft soap or other suitable lubricant to facilitate its removal when the steel Tee or flat is removed joints shall be neatly formed with proper tools and mortar/fine material from the slab itself. No additional cement mortar (rich or otherwise) shall be used.

Cutting or sawing by a saw mounted on a movable frame and driven mechanically shall also be permitted as a method for making the joint. In this case the width may be reduced to 6 mm. any other method for making joints can be followed with the prior approval of the Engineer.

In all cases, except where cutting is done with saw, the joint edges shall be bullnosed. Care should be taken to see that the edges of the grooves are not damaged.

The grooves shall be filled with hot poured sealing compound conforming to Grade B of IS:1834. Prior to filling with sealing compound, the joints shall be cleaned by compressed air and primed with Shalijet primer or equivalent at the rate specified

All joints shall be sealed as soon as practicable after 28 days of casting of cc pavement. Joints shall be sealed flush with the adjacent pavement surface in summer and 3-4 mm below finished concrete surface in winter. The pavement shall be opened to traffic only after joint sealing over the entire pavement. To prevent tackiness or pickup under traffic, the exposed surfaces of the sealing compound shall be dusted with hydrated lime, if directed by Engineer, for which nothing extra shall be paid to the contractor.

In case of sudden rain or storm, the work can be concluded at the dummy joints but these will then be formed as construction joints.

Before sealing of joints, it may be ensured that the groove extends fully across the bay between consecutive longitudinal joints, in the case of transverse joints and is continuous in the case of longitudinal joints. Any concrete or other foreign matter must be removed from the groove.

Concreting during Rains

To prevent damage to freshly laid concrete during monsoon, or sudden rains, the contractor shall provide an adequate supply of tarpaulins or other water proof covering material. Any concrete damaged by rain shall be removed and replaced by the contractor at his own cost as directed by the Engineer.

Quality Control

The following quality control tests shall be carried out at frequencies specified against each as in Table 16.33 of CPWD specification 2009

Equipment

Equipment as per list at Appendix C shall be provided by the contractor in the field testing laboratory. Nothing extra shall be paid to him on this account. Records as required shall be maintained at site. All tests details in support of mix design shall be maintained as part of records of the contract and shall be signed both by the contractor and the Engineer. The contractor shall provide all labour, materials and equipment required for all tests to be carried out at his own cost.

The Engineer reserves the right to test any part of concrete laid regarding quality soundness, compactness, thickness, strength and finish of the concrete, at any time before the expiry of the "Defect liability period" notwithstanding that necessary tests had been carried out and found satisfactory at the time of execution.

All defective unsound sub-standard work and concrete of sub-standard strength and quality etc. shall be rejected and shall be replaced by the contractor at his own expense.

Measurements

For the purpose of ascertaining the quantity of concrete in the pavement, thickness shall be measured by means of a scale correct to the nearest 2 mm. The thickness of the concrete pavement slabs shall be taken on either side of the pavement at each dummy joint at four corners of the slab immediately after removal of the side forms. In case the

average thickness of the slab exceeds the specified thickness, payment shall be restricted to the specified thickness.

The dimensions of each slab of pavement shall be measured as follows to the nearest 5 mm.

(a) ***Length***

(i) Between the end of a pavement to the centre line of the expansion joints. (ii) Between the centre lines of consecutive expansion joints.

(b) ***Width***

(i) Between the edge of a pavement and the centre line of the construction joints. (ii) Between the centre lines of construction joints and expansion joints. (iii)Between the centre lines of consecutive construction joints.

Note: The quantity of concrete in the pavement slab shall be worked out by multiplying the area of the slab and its average thickness or specified thickness whichever is less. No deduction shall be made for any joints in the concrete slab.

Measurements of concrete slabs shall be recorded jointly by the Engineer or his authorised subordinate and the contractor or his authorised agent.

Rate

The rate of the item for concrete in pavement shall include the cost of all materials and labour including charges for machinery tools & plants required in all the operations described above. The rate also includes all cost of setting up the laboratory at site and carrying out the quality control measures/tests enumerated above by the contractor at his own cost in the presence of Engineer or his authorized representative and submission of test results on completion of tests to the Engineer thereof.

EXPANSION JOINT

Materials

Premoulded Joint Filler in Expansion Joint: It shall conform to IS 1838 (Pt. I). The thickness shall be 25 mm with tolerance 1.5 mm. and shall be of the maximum available standard length not less than one lane width. The filler board shall be positioned vertically with the prefabricated joint assemblies along the line of the joint within tolerance of + 10 mm from the intended line of the joint. The depth of board shall be 25 mm less than thickness

of slab within a tolerance of ± 3mm so that the top of the board shall be below the surface or will not impead the passage of the finishing straight edge or oscillating beam of the paving machine.

Bitumine Hot Sealing Compound: The joint sealing compound shall be fuel and heat resistant type complying to grade B of IS 1834. It shall be capable of adhering to the concrete without cracking, spalling and disintegration.

Construction Procedure

Expansion joints shall be provided as shown in the drawing and as per directions of Engineer. All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. The joint shall be 20 mm wide. The depth of the non-extruding filler pad shall be 25 mm less than the depth of the concrete slab.

Before the provision of expansion joint, the face of the already laid concrete slab shall be painted with primer at the rate of 2.6 liters per 10 square metres. The expansion pad shall be properly cut to shape and shall then be placed in position abutting the painted face of the already laid concrete slab. The adjacent slab shall then be concreted. The face of the pad against which the new concrete slab is to be laid shall also be painted with primer before laying the concrete, while concreting a neat groove of size 20 mm x 25 mm as per drawing shall be formed on top of the pad taking care that the edges are absolutely straight and that the groove so made does not get filled with any material like concrete, mortar and other rubbish.

Before the curing process is started, the top of expansion joint shall be filled with bitumen sand mixture in order to ensure that no foreign material used in curing enters into the joint. This filling shall be removed before filling the joints with sealing compound.

For sealing the joints following operations shall be carried out:— (a) The joints are cleared of any foreign matter to the full depth upto the top of expansion pad with steel spatula. (b) The joints are blown with compressed air. (c) Cleaning is done with Kerosene oil. (d) Priming is done with spray gun @ 2.6 liters per 10 sqm of the surface to be primed. (e) The primer is allowed to dry completely before pouring the sealing compound. (f) The sealing compound grade ‘A’ is heated to the required temperature ranging between 155 deg. C to

165 deg. C or to the temperature range specified by the manufacturer. Overh eating shall be avoided. Pouring shall be done from vessel with spout in such a manner that the material will not get spilled on the exposed surface of the concrete, any excess filler on the surface of the pavement shall be removed immediately and the pavement surface cleaned. (g) The filling shall be worked into the joints with hot flats to ensure escape of trapped air. (h) The filling is then ironed with hot iron. It is recommended that while in summer the joints may be sealed flush with the adjacent pavement surface, in winter the sealing compound may be filled to a depth 3-4 mm below the surface. (i) The edges of the joints are then cut and trimmed to ensure neat and straight line finish. (j) To prevent tackiness or pick up under traffic, the exposed surfaces of the sealing compound shall be dusted with hydrated lime, if directed by Engineer (Nothing extra shall be paid for the same).

Measurements: The measurement of the specified depth of joint shall be recorded in metres correct to two places of decimals.

Rate

Rate for the item shall include the cost of all materials, plant, machinery and labour involved in all operations described above, including all cartages and lifts.

Providing & Constructing Soak pit

The earth excavation shall be carrying out to the exact dimensions as shown in the drawing. The soak pit shall be constructed of honey-comb dry brick work of 250 mm thick in cement mortar 1:6, RCC 1:2:4 precast or cast-in-situ slabs 150 mm thick for top cover with reinforcement, CI manhole cover 500 mm dia of 80 kg weight, 150 mm dia SW tee, outlet vent, 75 mm dia CI pipe 2 m high fixed on masonry pedestal with cowl and bituministic painting, refilling, watering, consolidating etc., all complete.

Providing & Constructing Drop connection

In cases where branch sewer enters the manholes of main pipe sewer at a higher level than the main sewer, a drop connection should be provided. Pipes and specials conforming to IS:1729 shall be of the same size as the branch pipe sewer.

For 150 mm and 250 mm main line if the difference in level between the water line (peak flow level and the invert level) of branch line is less than 60 cm a drop connection may be provided within the manhole by giving a suitable ramp. If the difference in level is more than 60 cm the drop should be provided externally.

The excavation shall be done for the drop connection at the place where the branch line meets the manhole. The excavation shall be carried up to the bed concrete of the manhole and to the full width of the branch line excavation and backfilling shall be done as per respective specifications.

At the end of branch sewer line SCI tee shall be fixed to the line which shall be extended through the wall of manhole by a horizontal piece of SCI pipe to form an inspection of cleaning eye. The open end shall be provided with chain and lid. The SCI drop pipe shall be connected to the tee at the top and to the SCI bend at the bottom. The bend shall be extended through the wall of the manhole by a piece of pipe which shall discharge into the channel. Necessary channel shall be made with cement concrete of grade M-150 and finished smooth to connect the main channel. The joint between CI pipe and fittings shall be lead caulked. The joint between SCI tee and SW branch line shall be made with cement morotar 1:1 (1 cement : 1 fine sand) as for emased alround with minimum 15 cm thick concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size) and cured. For encasing the concrete around the drop connection the necessary centering and shuttering shall be provided the holes made in the walls of the manhole shall be made good with brick work in cement mortar 1:5 (1 cement : 5 coarse sand) and plastered with cement mortar 1:3 (1 cement : 3 fine sand) on the inside of the manhole wall. The excavated earth shall be back filled in the trench in level with the original ground level.

18 ROAD & ALLIED WORKS

GENERAL

These specifications cover the items of work in structural and non-structural parts of the works coming under scope of this document. All work shall be carried out in conformity with the same. These specifications are not intended to cover the minute details. The work shall be executed in accordance with good practices followed for achieving high standards of workmanship, thus ensuring safety and durability of the construction. All codes and

standards referred to in these specifications shall be the latest thereof, unless otherwise stated.

19 INCLUSIVE DOCUMENTS

The provisions of special conditions of contract specified elsewhere in the tender document as well as execution drawings and notes, the design requirements for alternative designs where permitted or other specifications issued in writing by the Engineer shall form part of the technical specifications of this project.

20 ORDER OF PRECEDENCE, CLARIFICATIONS & INTERPRETATION

When various specifications and codes referred to in preceding portion are at variance with each other, the following order of precedence will generally be accepted.

Item specifications, special conditions of contract, technical specification and execution drawings/notes.

21 MEASUREMENT AND PAYMENT

The methods of measurement and payment shall be as described under various items and in the Bill of Quantities. Where specific definitions are not given, the methods described in DSR 2016,"SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" (FIFTH RIVISION, Published in April 2013) and I.S Code will be followed. Should there be any details of construction of materials which has not been referred to in the specification or in the Bill of Quantities and drawings but the necessity for which may be implied or inferred there from or which is usual or essential for the completion of the work, the same shall be deemed to be included in the rates and prices quoted by the Contractor in the Bill of Quantities.

22 EMBANKMENT CONSTRUCTION INCLUDING SUBGRADE

These Specifications shall apply to the construction of embankments including subgrades, earthen shoulders and miscellaneous backfills with approved material obtained from roadway and drain excavation, plinth excavation etc. All embankments, subgrades, earthen shoulders and miscellaneous backfills shall be constructed in accordance with the requirements of these Specifications and in conformity with the lines, grades, and cross- sections shown on the drawings or as directed by the Engineer.

Materials and General Requirements

Physical requirements:

The materials used in embankments, subgrades, earthen shoulders and miscellaneous backfills shall be soil, moorum, gravel, a mixture of these or any other material approved by the Engineer. Such materials shall be free of logs, stumps, roots, rubbish or any other ingredient likely to deteriorate or affect the stability of the embankment/ subgrade.

The following types of material shall be considered unsuitable for embankment:

a) Materials from swamps, marshes and bogs;

b) Peat, log, stump and perishable material; any soil that classifies as OL, 01, OH or Pt in accordance with IS: 1498;

c) Materials susceptible to spontaneous combustion;

d) Materials in a frozen condition;

e) Clay having liquid limit exceeding 50and plasticity index exceeding 25; and

f) Materials with salt resulting in leaching in the embankment.

Expansive clay exhibiting marked swell and shrinkage properties ("free swelling index" exceeding 50 per cent when tested as per IS: 2720 - Part 40) shall not be used as a fill material. Where expansive clay with acceptable "free swelling index" value is used as a fill material, subgrade and top 500 mm portion of the embankment just below subgrade shall be non-expansive in nature.

Any fill material with a soluble sulphate content exceeding 1.9 grams of sulphate (expressed as SO3) per litre when tested in accordance with BS: 1377 Test 10, but using a 2:1 water-soil ratio shall not be deposited within 500 mm or other distance described in the Contract, of concrete, cement bound materials or other cementitious materials forming part of the Permanent Works.

Materials with a total sulphate content (expressed as SO3) exceeding 0.5 per cent by mass, when tested in accordance with BS: 1377 Test 9 shall not be deposited within 500 mm, or other distances described in the Contract, of metallic items forming part of the Permanent Works.

The size of the coarse material in the mixture of earth shall ordinarily not exceed 75 mm when being placed in the embankment and 50 mm when placed in the subgrade. However, the Engineer may at his discretion permit the use of material coarser than this also if he is satisfied that the same will not present any difficulty as regards the placement of fill material and its compaction to the requirements of these Specifications. The maximum particle, size shall not be more than two-thirds of the compacted layer thickness.

Ordinarily, only the materials satisfying the density requirements given in Table below shall be employed for the construction of the embankment and the subgrade.

TABLE 300-1. DENSITY REQUIREMENTS OF EMBANKMENT AND SUBGRADE MATERIALS

S. No.	Type of Work	Maximum laboratory dry unit weight when tested as per IS: 2720 (Part 8)
1	Embankments up to 3 metres	Not less than 15.2 kN/cu.m. height, not subjected to extensive flooding.
2	Embankments exceeding 3 metres height or embankments of any height subject to long periods of inundation	Not less than 16.0 kN/cu. m.
3	Subgrade and earthen shoulders/verges/backfill	Not less than 17.5 kN/cu. m.

General requirements :

The materials for embankment shall be obtained from approved sources with preference given to materials becoming available from nearby roadway excavation or any other excavation under the same Contract.

The work shall be so planned and executed that the best available materials are saved for the subgrade and the embankment portion just below the subgrade.

Borrow materials :

Where the materials are to be obtained from designated borrow areas, the location, size and shape of these areas shall be as indicated by the Engineer and the same shall not be opened without his written permission. Where specific borrow areas are not designated by the Employer/the Engineer, arrangement for locating the source of supply of material for embankment and subgrade as well as compliance to environmental requirements in respect

of excavation and borrow areas as stipulated, from time to time by the Ministry of Environment and Forests, Government of India and the local bodies, as applicable, shall be the sole responsibility of the Contractor.

Borrow pits along the road shall be discouraged. Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction plant is operating at the place of deposition.

No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. Should the Contractor be permitted to remove acceptable material from the site to suit his operational procedure, and then he shall make good any consequent deficit of material arising therefrom.

Where the excavation reveals a combination of acceptable and unacceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carry out the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the unacceptable materials. The acceptable materials shall be stockpiled separately.

The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants or siting of temporary buildings or structures.

The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme approved by the Engineer. It shall be ensured that the subgrade material when compacted to the density requirements as in Table 300-2 shall yield the design CBR value of the subgrade.

COMPACTION REQUIREMENTS FOR EMBANKMENT AND SUBGRADE

Type of work/material		Relative compaction as percentage of max. laboratory dry density as per IS: 2720 (Part 8)
1Subgrade and earthen shoulders		Not less than 97
2 Embankment		Not less than 95

The Contractor shall at least 7 working days before commencement of compaction submit the following to the Engineer for approval:

i) The values of maximum dry density and optimum moisture content obtained in accordance with IS: 2720 (Part 7) or (Part 8), as the case may be, appropriate for each of the fill materials he intends to use.

ii) A graph of density plotted against moisture content from which each of the values in (i) above of maximum dry density and optimum moisture content were determined.

Once the above information has been approved by the Engineer, it shall form the basis for compaction.

GRANULAR SUB BASE (GSB)

The materials to be used for the work shall be Stone aggregate.

Physical requirements: The material shall have a 10 per cent fines value of 50 kN or more (for sample in soaked condition) when tested in compliance with BS :812 (Part III). The water absorption value of the coarse aggregate shall be determined as per IS : 2386 (Part 3); if this value is greater than 2 per cent, the aggregates shall be tested for wet aggregate impact value (IS 5640). The material passing 425 micron (0.425 mm) sieve for all the three gradings when tested according to IS : 2720 (Part 5) shall have liquid limit and plasticity index not more than 25 and 6 percent respectively.

It shall be ensured prior to actual execution that the material to be used in the sub–base satisfies the requirements of CBR and other physical requirements when compacted and finished.

When directed by the Engineer, this shall be verified by performing CBR tests in the laboratory as required on specimens remoulded at field dry density and moisture content and any other tests for the “quality” of materials, as may be necessary.

WET MIX MACADAM (WMM)

Physical requirements: Coarse aggregates shall be Stone aggregate. The aggregates shall conform to the physical requirements set forth in Table below.

PHYSICAL REQUIREMENTS OF COARSE AGGREGATES FOR WET MIX MACADAM FOR SUB-BASE/BASE COURSES

Test	**Test Method**	**Requirements**
* Los Angeles abrasion value or	IS : 2386 (Part-4)	40 per cent (Max.)
* Aggregate Impact value	IS : 2386 (Part-4) or IS : 5640	30 per cent (Max.)
Combined Flakiness and Elongation indices (Total)	IS : 2386 (Part-1)	35 per cent (Max.)**

GRADING REQUIREMENTS OF AGGREGATES FOR WET MIX MACADAM

IS Sieve Designation	Percent by weight passing the IS sieve
53.00 mm	100
45.00 mm	95-100
26.50 mm	-
22.40 mm	60-80
11.20 mm	40-60
4.75 mm	25-40
2.36 mm	15-30
600.00 micron	8-22
75.00 micron	0-5

Materials finer than 425 micron shall have Plasticity Index (PI) not exceeding 6.

The final gradation approved within these limits shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa.

BITUMINOUS MACADAM

Bituminous Macadam (BM) is more open graded than DBM and consists of single course or multiple courses of compacted crushed aggregates premixed with bituminous binder.

Material

Bitumen same as 16.46.2.1

Course Aggregates same as 16.46.2.2 excepting strength which shall be max 40% for Los Angeles Abrassion value and aggregate impace value of max 30%.

Fine Aggregates : Same as 16.46.2.3.

Aggregate grading and binds content aggregate grading, quantity of bitumen and appropriate thickness are as given in table 16.41

TABLE 16.41
Composite Of Bituminous Macadam

Mix Designation	Grading 2
Nominal aggregate size	19 mm
Layer Thickness	50-75 mm
IS Sieve[1] (mm)	Cummulative % by weight of total aggregate passing
26.5	100
19	90-100
13.2	56-88
4.75	16-36
2.36	4-19
0.3	2-10
0.075	0-8
Bitumen content % by weight of total mix[2]	3.3-3.5
Bitumen grade	60/70 grade or as specified

Measurement : BM shall be measured as furnished work in cubic meters correct to two places of decimal.

Rate : The rate includes the cost of all material labour and equipments in all the operations described.

BITUMINOUS CONCRETE

Bituminous Concrete (BC), is used in wearing and profile corrective courses, in a single or multiple layers on a previously prepared bound surface. A single layer shall be 25 mm to 100 mm in thickness.

Bitumen: as specified.

Coarse Aggregates : The coarse aggregates shall be generally as specified in Table 16.23. (CPWD Specifications)

Fine Aggregates : The fine aggregates shall be all as specified in 16.33.2.3. .(CPWD Specifications)

Filler : Filler shall be generally as specified in 16.33.2.4.(CPWD Specifications)

Aggregate Grading and Binder Content : When tested in accordance with IS 2386 part 1 (wet grading method), the combined grading of the coarse and fine aggregates and added filler shall fall within the limits shown in Table No. 16.41 for grading 1 or 2 specified in the contract.

Requirements for the Mixture : Apart from conformity with the grading and quality requirements for individual ingredients, the mixture shall meet the requirements set out in Table 16.39 except loss of stability of immersion in water at 60°C. The requirements for minimum percent voids in mineral aggregate (VMA) are as per 16.46.3.1. .(CPWD Specifications)

Binder Content : The Marshall method for determining the optimum binder content shall be adopted as described in the Asphalt Institute Manual MS-2, replacing the aggregates retained on the 26.5 mm Sieve and retained on the 22.4 mm Sieve, where approved by the Engineer.

Job Mix Formula **:** The procedure for formulating the job mix formula shall be generally as specified in 16.46.3.3. .(CPWD Specifications)

Plant Trials – Permissible Variation In Job Mix Formula : The requirements for plant trials shall be as specified in 16.46.3.4. .(CPWD Specifications)

Laying Trials: The requirements for laying trials shall be as specified in 16.46.3.5.(CPWD Specifications)

TABLE NO. 16.42
Composition of Bituminous Concrete Pavement Layers

Grading	*1*	*2*
Nominal aggregate size	19 mm	13 mm
Layer Thickness	50-65 mm	30-45 mm
IS Sieve[1] (mm)	Cumulative % by weight of total aggregate passing	
45	-	-
37.5	-	-
26.5	100	
19	79-100	100
13.2	59-72	79-100
9.5	52-79	70-88
4.75	35-55	53-71
2.36	28-44	42-58
1.18	20-34	34-48
0.6	15-27	26-38
0.3	10-20	18-28
0.15	5-13	12-20
0.075	2-8	4-0
Bitumen content % by mass of total mix[2]	5.5% or specified in item or directed otherwise	5.5% or specified in item or directed otherwise
Bitumen grade (pen)	Specified in item or directed otherwise	Specified in item or directed otherwise

Note:
1. The combined aggregate shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.
2. Determined by the Marshal method.

Tack Coat : Where specified in the Contract, or otherwise required by the Engineer, a tack coat shall be applied.

Mixing and Transportation of the Mixture : The provisions as specified in item and MORTH specification shall apply.

Spreading : The general provisions of 16.46.4.4 shall apply.

Rolling : The general provisions of 16.46.4.5 shall apply.

Opening to Traffic : The newly laid surface shall not be open to traffic for at least 24 hour after laying and completion of compaction, without the approval of the Engineer in writing.

Surface Finish and Quality Control : The surface finish of the completed construction shall conform to the requirements of "Clause 9.2 and provisions set out in Section 900 of MORTH specification".

Arrangements for Traffic : During the period of construction, arrangements for traffic shall be made in accordance with the provisions of 16.46.4.8.

Measurement for Payment : DBC measured as finished work in cubic meters, correct to two places of decimal.

Rate : The rate include the cost of material, labour and equipments, involved in all theoperations described above.

ROAD MARKINGS STRIPS

The colour width and layout of road makings shall be in accordance with the Code of Practice for Road Markings with paints, IRC : 35, and as specified in the drawings or as directed by the Engineer.

Materials

Road markings shall be of ordinary road marking paint (retro-reflective), hot applied thermoplastic compound as specified in the item.

Hot Applied Thermoplastic Road Marking

General

(i) The thermoplastic material shall be homogenously composed of aggregate, pigment, resins and glass reflectorizing beads.

(ii) The thermoplastic compound shall be screeded/extruded on to the pavement surface in a molten state by suitable machine capable of controlled preparation and laying with surface application of glass beads at a specific rate. Upon cooling to ambient pavement temperature, it shall produce an adherent pavement marking of specified thickness and width and capable of resisting deformation by traffic.

(iii) The thermoplastic material shall conform to ASTM D36/BS-3262-(Part I).

(iv) The material shall meet the requirements of these specifications for a period of one year. The thermoplastic material must also melt uniformly with no evidence of skins or unmelted particles for the one year storage period. Any material not meeting the above requirements shall be replaced by the manufacturer/supplier/Contractor.

(v) Marking: Each container of the thermoplastic material shall be clearly and indelibly marked with the following information:

1. The name, trade mark or other means of identification of manufacturer.
2. Batch number
3. Date of manufacture
4. Colour (White or yellow)

5. Maximum application temperature and maximum safe heating temperature.

(vi) Sampling and Testing: The thermoplastic material shall be sampled and tested in accordance with the appropriate ASTM/BS method. The Contractor shall furnish to the Engineer a copy of certified test reports from the manufacturers of the thermoplastic material showing results of all tests specified herein and shall certify that the material meets all requirements of this Specification.

Preparation

(i) The material shall be melted in accordance with the manufacturer's instructions in a heater fitted with a mechanical stirrer to give a smooth consistency to the thermoplastic material to avoid local overheating. The temperature of the mass shall be within the range specified by the manufacturer, and shall on no account be allowed to exceed the maximum temperature stated by the manufacturer. The molten material should be used as expeditiously as possible and for thermoplastic material which has natural binders or is otherwise sensitive to prolonged healing, the material shall not be maintained in a molten condition for more than 4 hours.

(ii) After transfer to the laying equipment, the material shall be maintained within the temperature range specified by the manufacturer for achieving the desired consistency for laying.

Properties of Finished Road Marking

(a) The stripe shall not be slippery when wet.

(b) The marking shall not lift from the pavement in freezing weather.

(c) After application and proper drying, the stripe shall show no appreciable deformation or discolouration under traffic and under road temperatures upto 60^{o}C.

(d) The marking shall not deteriorate by contact with sodium chloride, calcium chloride or oil

(e) The stripe or marking shall maintain its original dimensions and position. Cold ductility of the material shall be such as to permit normal movment with the road surface without chopping or cracking.

(f) The colour of yellow marking shall conform to IS Colour No. 356 as given in IS 164.

Application

Marking shall be done by fully /semi-automatic paint applicator machine fitted with profile shoe, glass beads dispenser, propane tank heater and profile shoe heater, driven by experienced operator as specified in item. For locations where painting cannot be done by machine, approved manual methods shall be used with prior approval of the Engineer. The Contractor shall maintain control over traffic while painting operations are in progress so as to cause minimum inconvenience to traffic compatible with protecting the workmen.

The thermoplastic material shall be applied hot either by screeding or extrusion process. After transfer to the laying apparatus, the material shall be laid at a temperature within the range specified by the manufacturer or otherwise directed by the Engineer for the particular method of laying being used. The paint shall be applied using a screed or extrusion machine.

The pavement temperature shall not be less than 10oC during application. All surfaces to be marked shall be thoroughly cleaned of all dust, dirt, grease, oil and all other foreign matter before application of the paint.

Thermoplastic paint shall be applied in intermittent or continuous lines of uniform thickness of at least 2.5 mm unless specified otherwise. Where arrows or letters are to be provided, thermoplastic compound may be hand-sprayed.

The minimum thickness specified is exclusive of surface applied glass beads. The finished lines shall be free from ruggedness on sides and ends and be parallel to the general alignment of the carriageway. The upper surface of the lines shall be level, uniform and free from streaks.

Measurements for Payment

The painted markings shall be measured in sq. metres of actual area marked (excluding the gaps, if any) correct upto the two places of decimal.

The rate include the cost of all materials, labour and equipment's required in all the above operations.

23 CRANE RAILS

Rail and fixing

The work covered by this Subsection includes the supply of all other materials and the provision of all labour, plant, equipment, temporary work, installation, testing, completion and maintenance of the crane rails in accordance with the Drawings, these Specifications and instructions from the Engineer.

The crane rail system shall be of the continuously supported type and shall include rail, support plate, rail clamps, anchor bolts, cement grouting and the like and shall be designed for full crane operational and standby loading.

The following minimum requirements have to be fulfilled:

- Specified rails of JSPL or SAIL
- Distance of anchors and clamps: max. 500 mm

Top level of crane rail shall be as per the drawings and as directed by the Engineer.

Rails considered in the project are CR 100, CR 80 and bright bars as specified in the tender drawings and schedule of quantity.

The Contractor shall be responsible for the horizontally and vertically detailed alignment of the crane rails, the preparation of detailed installation drawings and supply, installation and commissioning of all components of the crane rails.

The Contractor shall submit all necessary shop drawings with supporting documentation to the Engineer for his approval.

Measurement and payment shall be per meter and the rates shall include the complete supply, installation, etc. of rail, support plate, rail clamps, anchor bolts, grouting, complete in every respect.

Buffer

The work covered by this Subsection includes the design, supply of all other materials and the provision of all labour, plant, equipment, temporary work, installation, testing, completion and maintenance of the crane buffer in accordance with the Drawings, these Specifications and instructions from the Engineer.

The crane buffers shall be the installed at each end of the crane rails. The buffer material shall be as per IS 2062.

The buffer including mounting and fixing steel parts shall be painted with protective anticorrosive coating.

The Contractor shall be responsible for the horizontally and vertically detailed alignment of the crane buffers and the preparation of detailed installation drawings and supply, installation and commissioning of all components of the buffer.

The tolerances for the installation shall be in accordance with the requirements of the crane manufacturer. Construction drawings will be issued to the Contractor.

The Contractor shall submit all necessary shop drawings with supporting documentation to the Engineer for his approval.

Stow pins / tie downs

The work covered by this Subsection includes the supply of all other materials and the provision of all labour, plant, equipment, temporary work, installation, testing, completion and maintenance of the crane stow pins and tie downs in accordance with the Drawings, these Specifications and instructions from the Engineer.

The crane stow pins and tie downs shall be the installed for all gantry cranes. One set consists of at least 4 tie downs and 4 stow pins.

The crane stow pins and tie downs material shall be as per IS 2062 and shall be and painted with anticorrosive paint. The design of the crane stow pins and tie downs shall be in accordance with the requirements of the crane manufacturer and the drawings will be issued to the contractor.

The Contractor shall be responsible for the horizontally and vertically detailed alignment of the crane stow pins and tie downs, the preparation of detailed installation drawings and supply, installation and commissioning of all components of the crane stow pins and tie downs including surrounding L profile and cover plate.

The tolerances for the installation shall be in accordance with the requirements of the crane manufacturer.

24 LIST OF APPROVED MAKE

1.	Cement	Malabar, Ultra Tech, Zuari, Ramco, ACC, India Cements, Dalmia, Ambuja, J.P. Rewa, Vikram, Shri Cement, Birla Jute and Cement Corporation of India, Chettinadu, JSW Cement etc. or any other approved brand
2.	Steel (TMT)	Tata, Vizag, SAIL, TISCO, IISCO, RINL, Jindal Steel and Power Ltd, JSW Steel Ltd or equivalent as approved
3.	Structural Steel	Tata, Vizag, SAIL, Jindal Steel & Power Ltd, or equivalent as approved
4.	Welding rode	ESAB, Advani, Best Arc, Solar or equivalent as approved
5.	Teak Wood	Best Quality Plantation teak
6.	Hard Wood	Best Quality treated jack, Sal Wood, Irul, Anjili, Thambakom, Cherutheku
7.	Vitrified tile	Euro Ceramic Ltd, Kerroges, Nitco, Kajaria, RAK Ceramics India, Mirage Ceramics Pvt. Ltd, Orient Bell, Swastik Ceracon Ltd or equivalent as approved
8.	Ceramic Tiles	Kajaria, Regency, Nitco, RAK, Mirage Ceramics Pvt. Ltd, Naveen, Orient Bell, Swastik Ceracon Ltd. or equivalent as approved
9.	Cement Concrete floor tiles	Eurocon Tiles, Excello or equivalent as approved
10.	Paver tile	Kajaria Ceramics Ltd, Pavit Ceramic Pvt. Ltd or equivalent as approved
11.	Industrial Flooring	Euro Build, BASF, Fosroc, Sika, Pidilite or Equivalent as approved
12.	Concrete Paver blocks	Basant Beton, Conwood, Automatic, Amcon, Sirex or equivalent as approved.
13.	Metallic Hardener	BASF, Fosroc , Sika, Kironite, Eurobuild Construction Chemicals & Coating or equivalent as approved
14.	Integrated water proofing	India water proofing, Sika, Pidilite, BASF, Fosroc, Euro Build, Bostik, MAPEI, The Structural Waterproofing co. Pvt.Ltd. / CHRYSO or equivalent

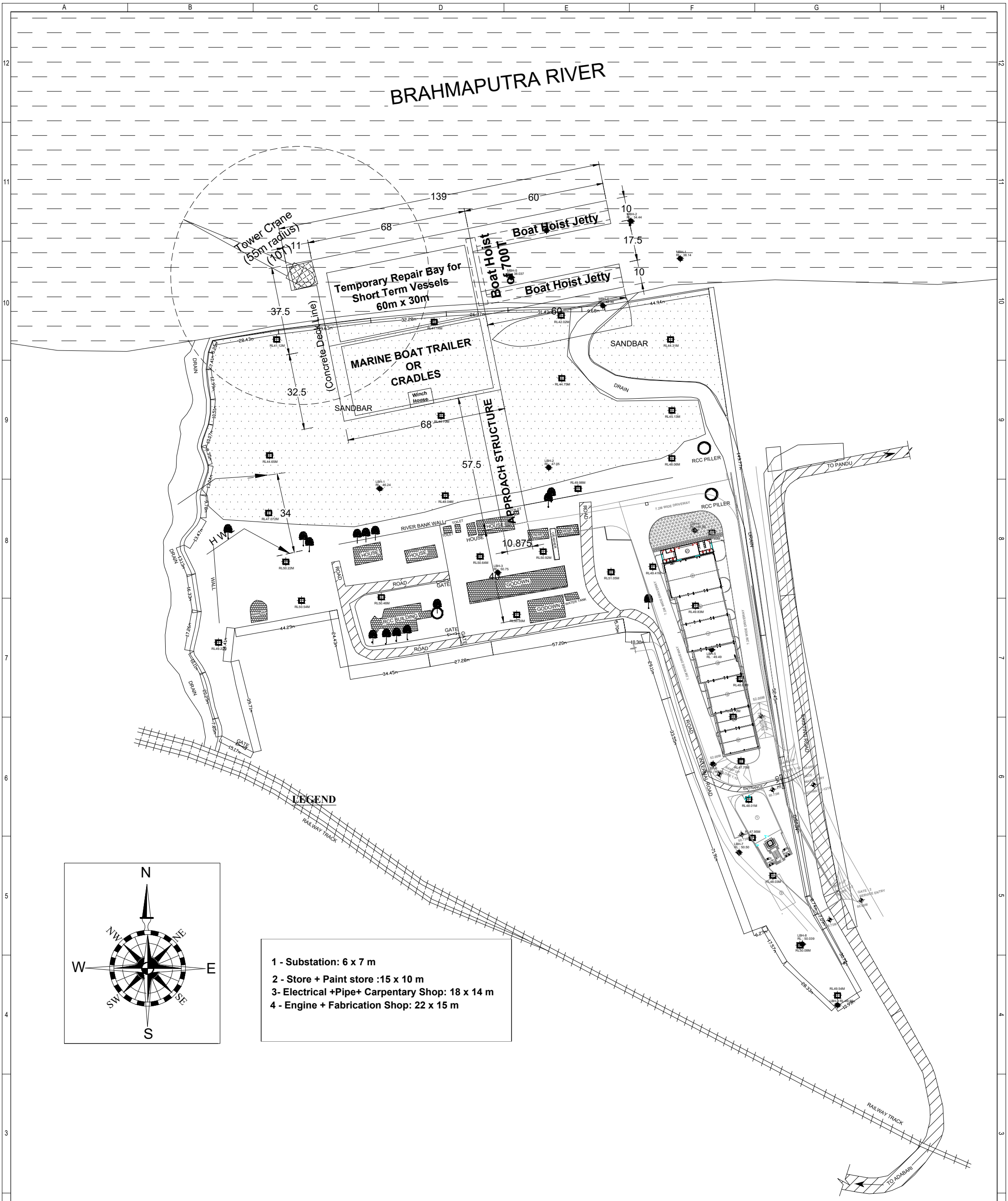
15.	Water proofing compound	Roffe, Fosroc, Sika, Pidilite, StructuralWaterproofing Co.Pvt. Ltd, BASF, Eurobuild Construction Chemicals & Coating, Bostik, MAPEI, CICO Technologies Ltd., Sunanda Speciality Coatings Pvt. Ltd, Kunal Conchem Private Ltd., The Structural Waterproofing co. Pvt.Ltd. / CHRYSO, MYK Schomburg or equivalent as approved

16.	Paint & Primer, Distemper	ICI (Akzonobel), Berger, Asian, Jotun or equivalent as approved
17.	Water Proof Cement paint	Super Snowcem, Supercem or equivalent as approved
18.	Sealers	ICI (Akzonobel), Berger, Asian, Euro Build or equivalent as approved
19.	Wall Putty	Birla White, NCL, Altek, Berger, ICI or equivalent as approved
20.	Primer	Altek, Berger, Asian, ICI, Jotun or equivalent as approved
21.	Synthetic Enamel Paints & Primer	ICI (Akzonobel), Asian Paints, Berger, Jotun or equivalent as approved
22.	Epoxy Paint	ICI (Akzonobel), Asian Paints, Berger, Jotun or equivalent as approved
23.	Fire retardant paint	Akzonobel, Promat or equivalent as approved
24.	Premium Textured Exterior Paint	Terraco India Ltd., Spectrum, Jotun or equivalent
25.	Protective Paints	AkzoNobel, Jotun India Private Limited, Berger Paints India Limited, Asian Paints Ltd, Grand Polycoats Co. (P) Ltd, Euro Build, Hempel Paints, CIPY Polyurethanes Pvt Ltd, MYK Schomburg or equivalent as approved.
26.	PVC Water stopper	Fosroc, Sika, Euro Build, BASF or equivalent as approved.
27.	Door hardwares	Dorma, Ozone Overseas Pvt. Ltd., Dorset Kaba Security Systems Pvt. Ltd., ASSA ABLOY India Pvt. Ltd., Hafele, Godrej, Everite Agencies, Dyna, Door king, Hettich India Pvt. Ltd or equivalent as approved
28.	Mortice locks, locks, latch	Godrej, Dorset Kaba Security Systems Pvt. Ltd., Magnum, Ozone Overseas Pvt. Ltd, Dorma or equivalent as approved
29.	Rolling Shutter	Popular, Gandhi Automation Pvt. Ltd, Falcon, Jacob Engineering or equivalent as approved
30.	Ball bearings	SKF, FAG, KOYO or equivalent as approved
31.	Steel doors /windows	Shakthi hormann, Indigatech, Ozone Overseas Pvt. Ltd, NCL Alltek & Seccolor Ltd, Kutty Flush Doors & Furniture Co. Pvt. Ltd, Madhu Industries or equivalent as approved

32.	Glazed Doors with patch fittings	Dorma, Ozone Overseas Pvt. Ltd, ASSA ABLOY India Private Ltd., Dorset Kaba Security Systems Pvt. Ltd. or equivalent as approved
33.	Fire Rated Doors	Sakti Horman, Indigatech, Ozone Overseas Pvt. Ltd, Kutty Flush Doors & Furniture Co. Pvt. Ltd., Promat International (Asia Pacific) Ltd or equivalent as approved
34.	Flush Doors	Godrej & Boyce Mfg. Co. Ltd, Kutty Flush Doors & Furniture Co. Pvt. Ltd, Jacsons or equivalent as approved
35.	SS Hand Rails	D Line, Sky Port, Q-railing India Pvt. Ltd, Impact metals, Cochin tech, or equivalent as approved
36.	Galvalume Roofing sheet	Tata Blue Scope, Interarch, LLOYD Insulations or equivalent as approved
37.	Pre-engineered Building system **REFER CORRIGENDUM NO:1, SI. NO: 43**	Kirby, Tata Blue Scope, Lloyd Insulations (India) Ltd., Zamil steel, Smith Structures or OWN make (with proof) as approved by the Engineer
38.	Laminates	Kitply, Formica, Greenlam, National, Century, Decolam, Merino or equivalent as approved
39.	Plain float glass /lacquered glass & Mirror	Saint Gobain, Asahi, Pilkington, Modiguard or equivalent as approved
40.	Marine Plywood	Century, Kitply, Anchor, Green Ply, Apple Ply or equivalent as approved
41.	Pre Laminated Ply	Greenlam, Merino Industries Ltd, Kitply, or equivalent as approved
42.	Veneers	Century, Kitply, Anchor, Green ply, Kenwood, Jacsons or equivalent as approved
43.	Particle board	Jacksons (Exterior grade), Associate or equivalent as approved
44.	Adhesive Tape/Double sided tape/Single sided multipurpose Adhesive	3 m, Scotch Tape, Bow Tape, Norton or equivalent as approved
45.	Silicon Sealant	Dow corning, GE Silicon, Euro Build, CIPY Polyurethanes Pvt Ltd, MYK Schomburg or equivalent as approved
46.	Epoxy chemical for anchoring grout	HILTI India Pvt. Ltd, Fisher, Euro Build, Pidilite or equivalent as approved
47.	Chemical /Mechanical Anchor Fasteners	HILTI, Fisher, MKT (Germany), Black and Decker India Ltd., MAPEI, SS Fasteners Pvt. Ltd or equivalent as approved.
48.	Plasticisers, Non shrink grout	Fosroc, BASF, Krishna conchem, Fairmate, Eurobuild Construction Chemicals & Coating, MYK Schomburg or equivalent as approved

49.	Admixtures	FOSROC, Polygon, STP, BASF, CERACHEM, DonChemicals, Sika, Eurobuild Construction Chemicals
		& Coating, MAPEI, Bostik, MYK Schomburg, Sunanda Speciality Coatings Pvt. Ltd, Kunal Conchem Private Ltd., The Structural Waterproofing co. Pvt.Ltd. / CHRYSO or equivalent as approved
50.	High tensile Bolts /Screws	Hilti, Fischer, Unbrako, TVS, Euro Build or equivalent as approved
51.	EPDM Gaskets	Osaka Rubber Private Limited, AMEE Rubber Industries Pvt. Ltd or equivalent as approved
52.	Glass Processing	AIS Glass Solutions Ltd, Gold Plus Group, GSC Toughened Glass Pvt. Ltd., Sejal Architectural Glass Limited, Impact Safety Solutions Ltd, TPRS Enterprises Pvt. Ltd, FUSO Glass india Pvt. Ltd or equivalent as approved
53.	Aluminum Structural Members	Hindalco Industries Ltd, Jindal Aluminium Ltd,Indalco Alloys or equivalent as approved.
54.	GI Section for Partitions & False Ceiling	Saint Gobain – Gyproc or equivalent as approved.
55.	Stainless steel	Salem Steel, Hindalco, Jindal or equivalent as approved
56.	Expansion Joint Filler	Sil Fex of Supreme Industries Ltd. or equivalent as approved
57.	Floor hardeners	Fosroc, Roffe, Fairmate, STP Ltd, Apurva India Ltd, Eurobuild Construction Chemicals & Coating, Pidilite or equivalent as approved
58.	Bolts /Screws (SS 316)	HILTI, Fischer, MKT (Germany), S.S. Fasteners Pvt Ltd or equivalent as approved
59.	Glass Hardwares	Dorma, Ozone, Hafele, Kinlong or equivalent as approved
60.	Self-tapping screw	Corroshield or equivalent
61.	Crane rails	JSPL, SAIL

Equivalent Make: Non-availability certificate for the makes mentioned in the list of Approved make tables shall be produced by the contractor in order to consider equivalent make



LAYOUT OF SHIP REPAIR FACILITY PHASE I

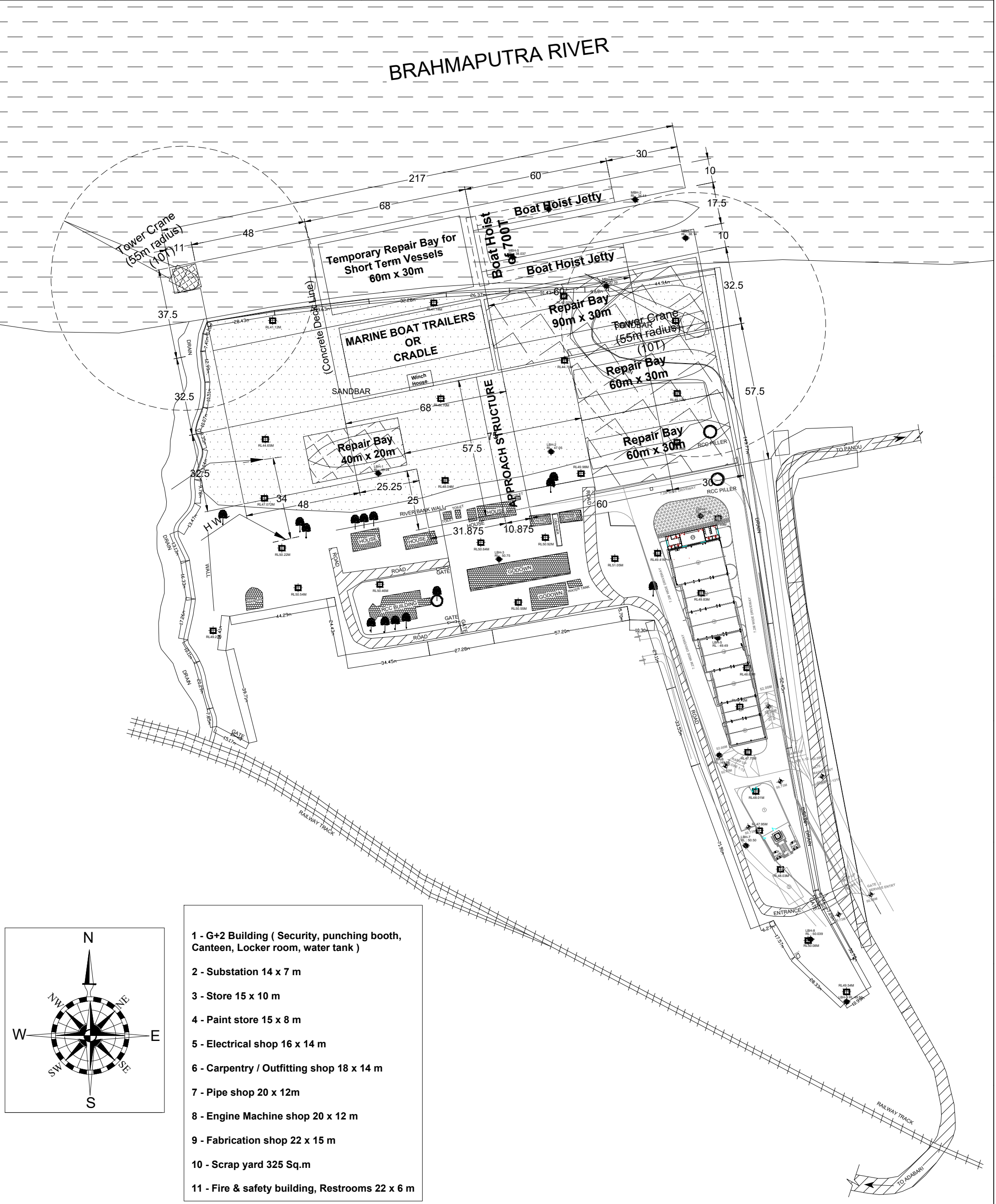
NOTES :-

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO MEAN SEA LEVEL .

REV.	DDMMYY / DATE	DESCRIPTION	INIT.	SIGN. (DRAWN)	INIT.	SIGN. (CHECKED)	INIT.	SIGN. (APPROVED)

ORIGINAL SIZE:A1

CLIENT:	HOOGLY COCHIN SHIPYARD LIMITED	
PROJECT:	DESIGN PROJECT FOR SHIP REPAIR FACILITY TO HANDLE INLAND WATERWAYS VESSELS AT PANDU, GUWAHATI	DATE: 11.04.2022
DRAWING TITLE:	LAYOUT OF SHIP REPAIR FACILITY (SHEET 1 OF 2)	
DRAWING NO:	IITM-DOE-HCSL-SRF-100-01	REV 0
ENGINEERING FIRM:	Prof.S.A.SANNASIRAJ Prof.K. MURALI DEPARTMENT OF OCEAN ENGINEERING,IIT MADRAS, CHENNAI - 36	



1 - G+2 Building (Security, punching booth, Canteen, Locker room, water tank)

2 - Substation 14 x 7 m

3 - Store 15 x 10 m

4 - Paint store 15 x 8 m

5 - Electrical shop 16 x 14 m

6 - Carpentry / Outfitting shop 18 x 14 m

7 - Pipe shop 20 x 12m

8 - Engine Machine shop 20 x 12 m

9 - Fabrication shop 22 x 15 m

10 - Scrap yard 325 Sq.m

11 - Fire & safety building, Restrooms 22 x 6 m

LAYOUT OF SHIP REPAIR FACILITY PHASE I & II

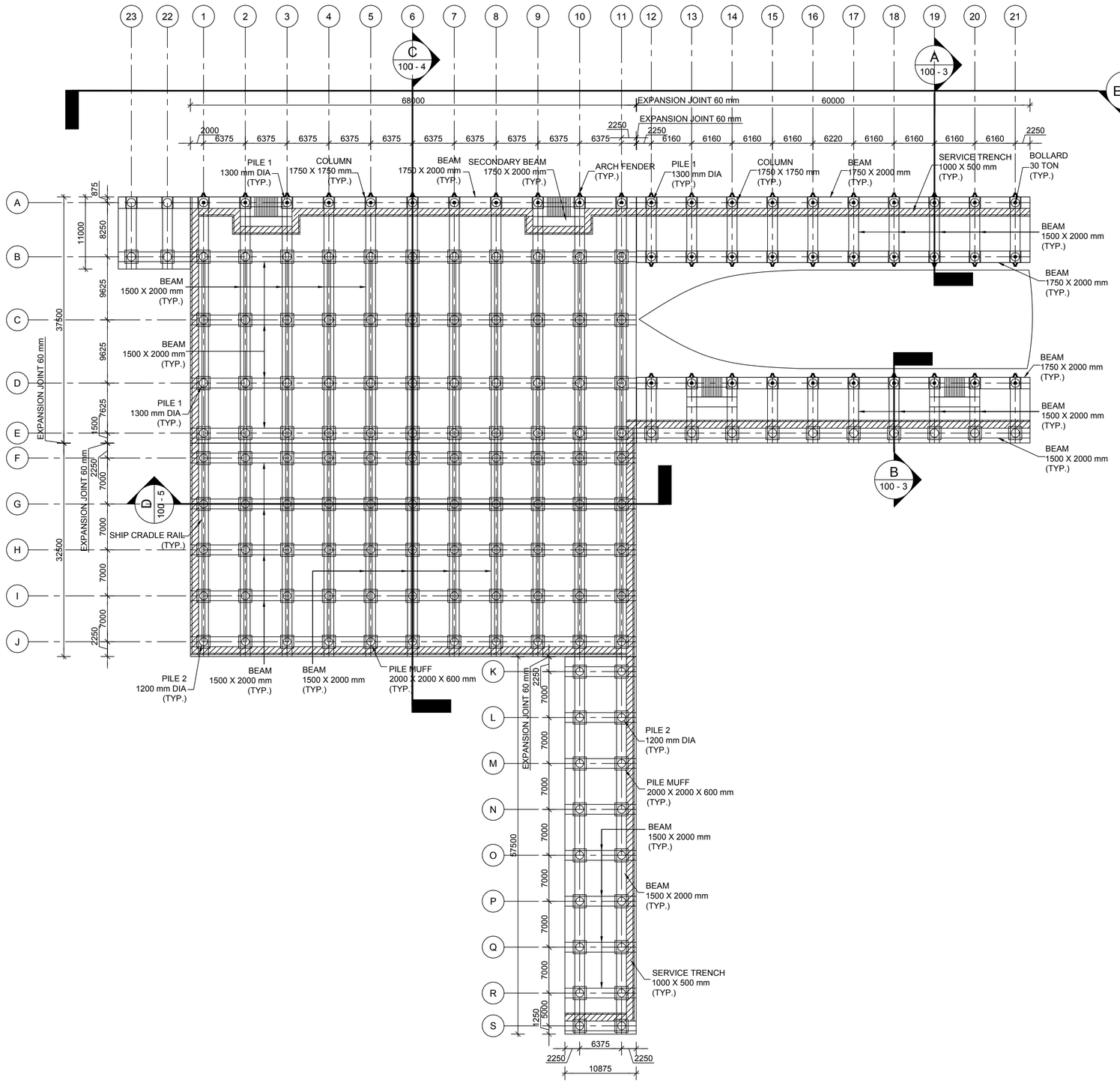
NOTES :-

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO MEAN SEA LEVEL .

REV.	DDMMYY / DATE	DESCRIPTION	INIT.	SIGN. (DRAWN)	INIT.	SIGN. (CHECKED)	INIT.	SIGN. (APPROVED)

ORIGINAL SIZE:A1

CLIENT:	HOOGLY COCHIN SHIPYARD LIMITED	
PROJECT:	DESIGN PROJECT FOR SHIP REPAIR FACILITY TO HANDLE INLAND WATERWAYS VESSELS AT PANDU, GUWAHATI	DATE: 11.04.2022
DRAWING TITLE:	LAYOUT OF SHIP REPAIR FACILITY (SHEET 2 OF 2)	
DRAWING NO:	IITM-DOE-HCSL-SRF-100-02	REV 0
ENGINEERING FIRM:	Prof.S.A.SANNASIRAJ Prof.K. MURALI DEPARTMENT OF OCEAN ENGINEERING,IIT MADRAS, CHENNAI - 36	



OVERALL PLAN VIEW OF SHIP LIFT PHASE I
Scale 1:350

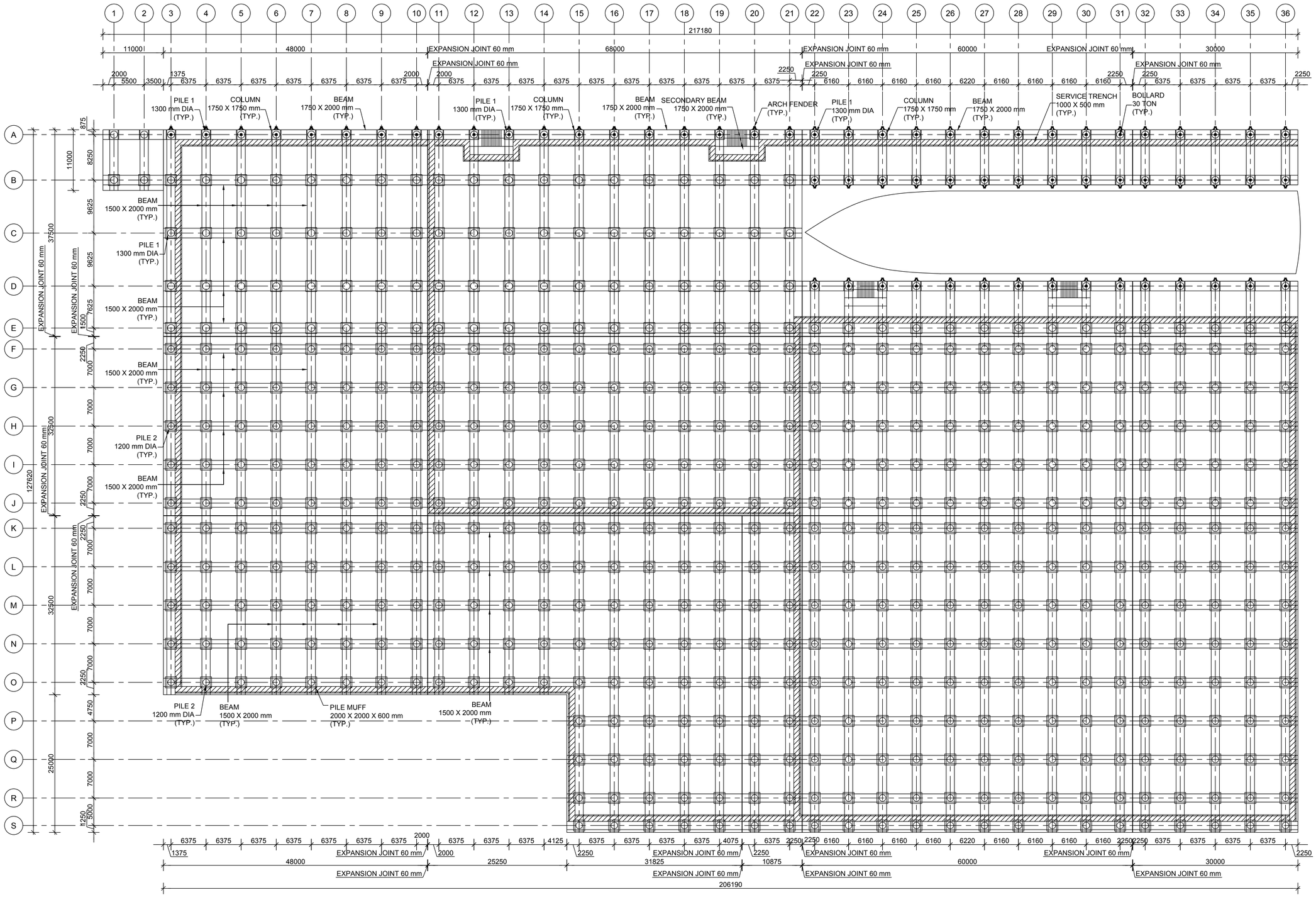
NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO MEAN SEA LEVEL
3. CONCRETE GRADE FOR ALL RC STRUCTURE SHALL BE M40 WITH MINIMUM 28 DAYS CHARECTERISTIC STRENGTH OF 40 MPa.
4. STEEL GRADE FOR ALL REINFORCEMENTS USED IN RC STRUCTURES SHALL BE CORROSION RESISTANT STEEL WITH A MINIMUM YIELD STRESS OF 500 MPa.

REV.	DDMMYY / DATE	DRAWING NO:	TITLE	D R N	INIT.	SIGN.	INIT.	SIGN.
					CHECKED		APPROVED	

ORIGINAL SIZE:A1

CLIENT:	HOOGLY COCHIN SHIPYARD LIMITED	
PROJECT:	DESIGN PROJECT FOR SHIP REPAIR FACILITY TO HANDLE INLAND WATERWAYS VESSELS AT PANDU, GUWAHATI	DATE: 25.03.2022
DRAWING TITLE:	GENERAL ARRANGEMENT OF SHIP REPAIR FACILITY PHASE - I (SHEET 1 OF 6)	
DRAWING NO:	IITM-DOE-HCSL-SRF-100-01	Scale as shown REV 0
ENGINEERING FIRM:	Prof.S.A.SANNASIRAJ Prof.K. MURALI DEPARTMENT OF OCEAN ENGINEERING,IIT MADRAS, CHENNAI - 36	



OVERALL PLAN VIEW OF SHIP LIFT PHASE I & II
Scale 1:350

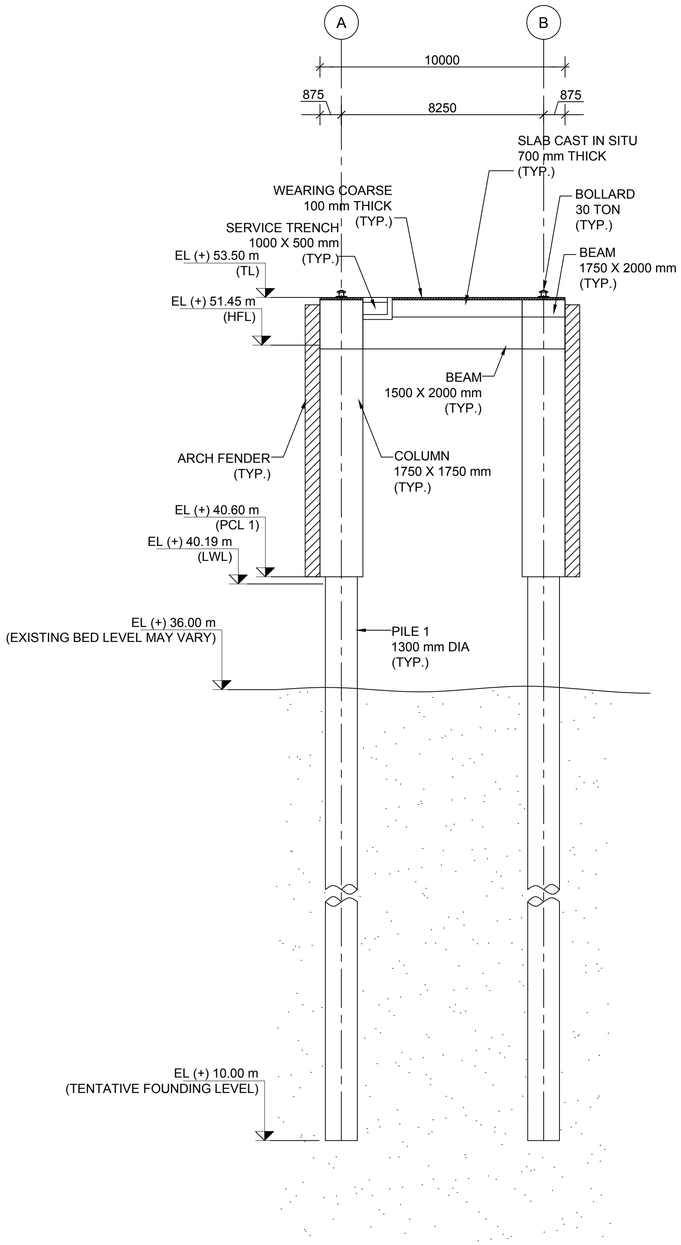
NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO MEAN SEA LEVEL
3. CONCRETE GRADE FOR ALL RC STRUCTURE SHALL BE M40 WITH MINIMUM 28 DAYS CHARECTERISTIC STRENGTH OF 40 MPa.
4. STEEL GRADE FOR ALL REINFORCEMENTS USED IN RC STRUCTURES SHALL BE CORROSION RESISTANT STEEL WITH A MINIMUM YIELD STRESS OF 500 MPa.

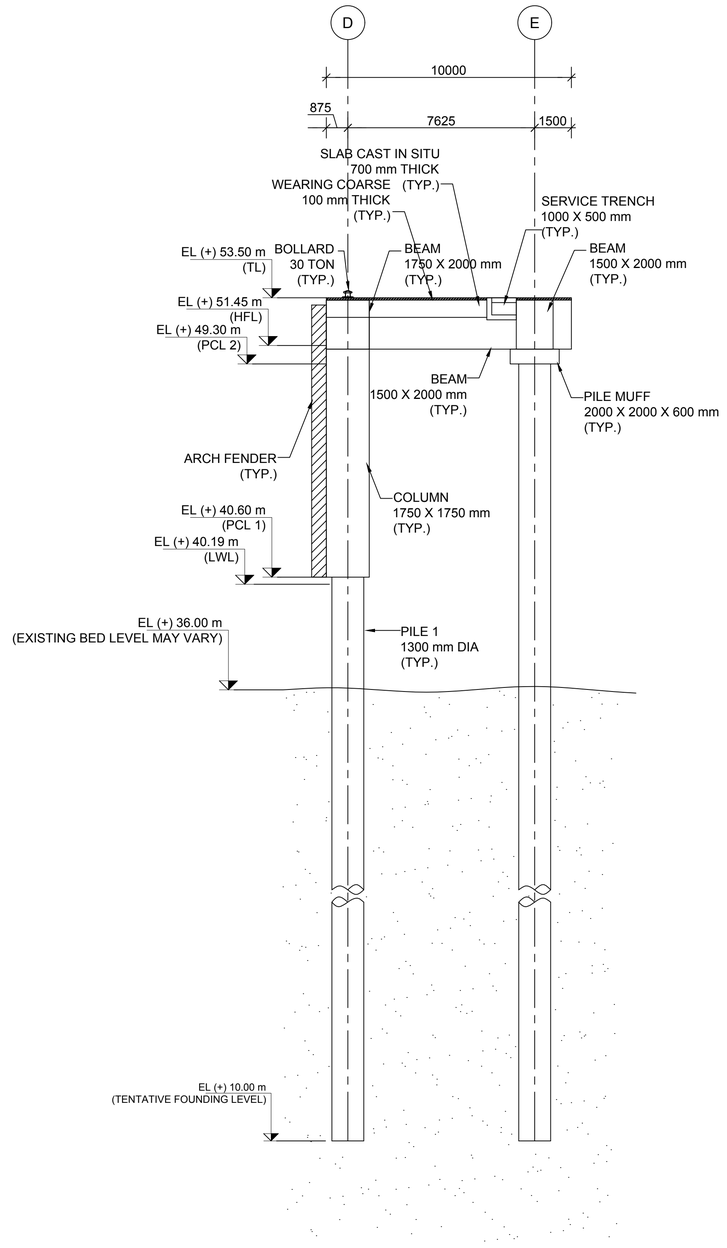
REV.	DDMMYY / DATE	DRAWING NO:	TITLE	D R N	INIT.	SIGN.	INIT.	SIGN.
					CHECKED		APPROVED	

ORIGINAL SIZE:A1

CLIENT:	HOOGLY COCHIN SHIPYARD LIMITED	DATE: 25.03.2022
PROJECT:	DESIGN PROJECT FOR SHIP REPAIR FACILITY TO HANDLE INLAND WATERWAYS VESSELS AT PANDU, GUWAHATI	
DRAWING TITLE:	GENERAL ARRANGEMENT OF SHIP REPAIR FACILITY PHASE - II (SHEET 2 OF 6)	
DRAWING NO:	IITM-DOE-HCSL-SRF-100-02	Scale as shown REV 0
ENGINEERING FIRM:	Prof.S.A.SANNASIRAJ Prof.K. MURALI DEPARTMENT OF OCEAN ENGINEERING,IIT MADRAS, CHENNAI - 36	



SECTION AA
Scale 1:125



SECTION BB
Scale 1:125

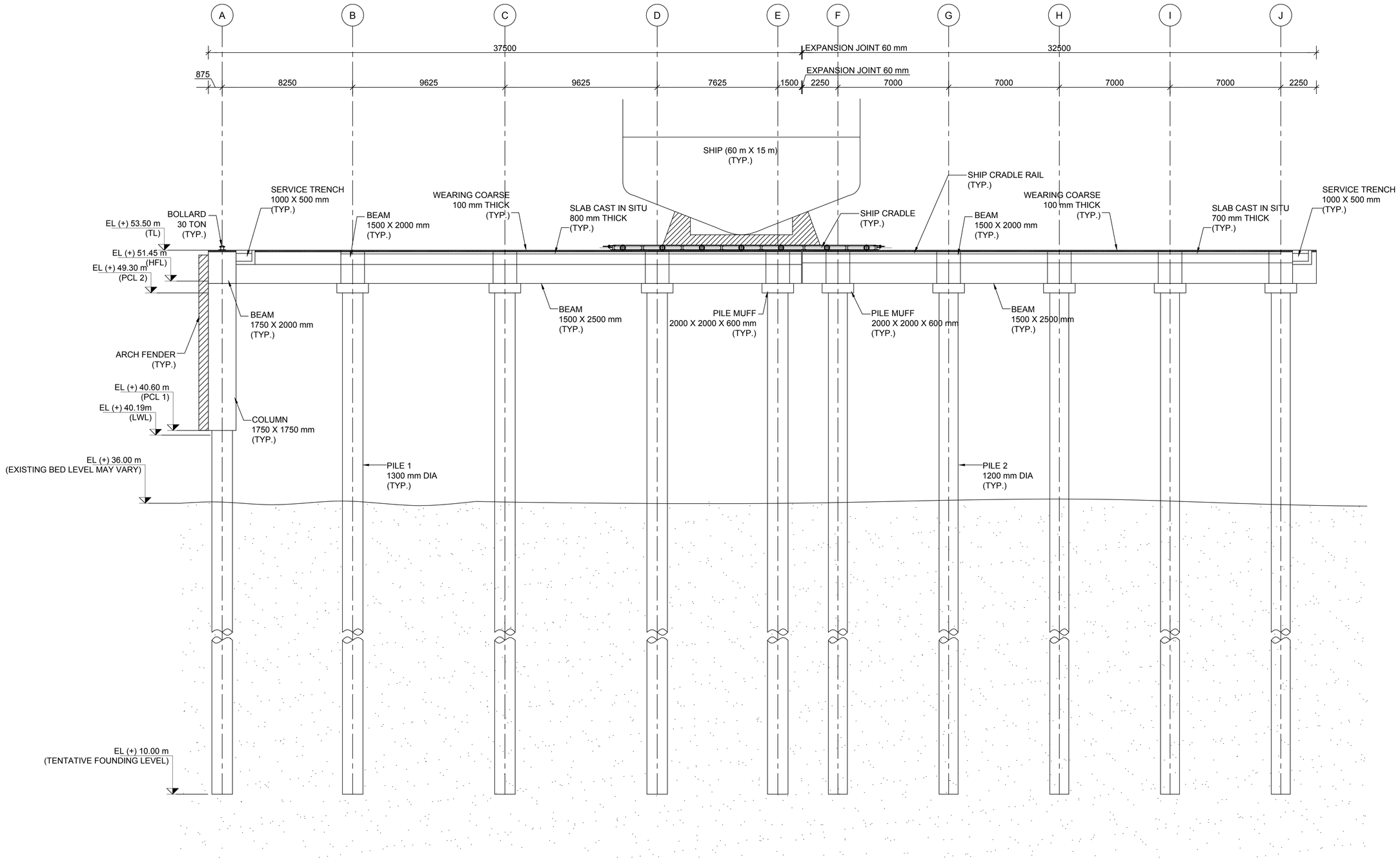
NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO MEAN SEA LEVEL
3. CONCRETE GRADE FOR ALL RC STRUCTURE SHALL BE M40 WITH MINIMUM 28 DAYS CHARECTERISTIC STRENGTH OF 40 MPa.
4. STEEL GRADE FOR ALL REINFORCEMENTS USED IN RC STRUCTURES SHALL BE CORROSION RESISTANT STEEL WITH A MINIMUM YIELD STRESS OF 500 MPa.

REV.	DDMMYY / DATE	DRAWING NO:	TITLE	D R N.	INIT.	SIGN.	INIT.	SIGN.
					CHECKED		APPROVED	

ORIGINAL SIZE:A1

CLIENT:	HOOGLY COCHIN SHIPYARD LIMITED	
PROJECT:	DESIGN PROJECT FOR SHIP REPAIR FACILITY TO HANDLE INLAND WATERWAYS VESSELS AT PANDU, GUWAHATI	DATE: 25.03.2022
DRAWING TITLE:	GENERAL ARRANGEMENT OF SHIP REPAIR FACILITY (SHEET 3 OF 6)	
DRAWING NO:	IITM-DOE-HCSL-SRF-100-03	Scale as shown REV 0
ENGINEERING FIRM:	Prof.S.A.SANNASIRAJ Prof.K. MURALI DEPARTMENT OF OCEAN ENGINEERING,IIT MADRAS, CHENNAI - 36	



SECTION CC
Scale 1:125

NOTES :-

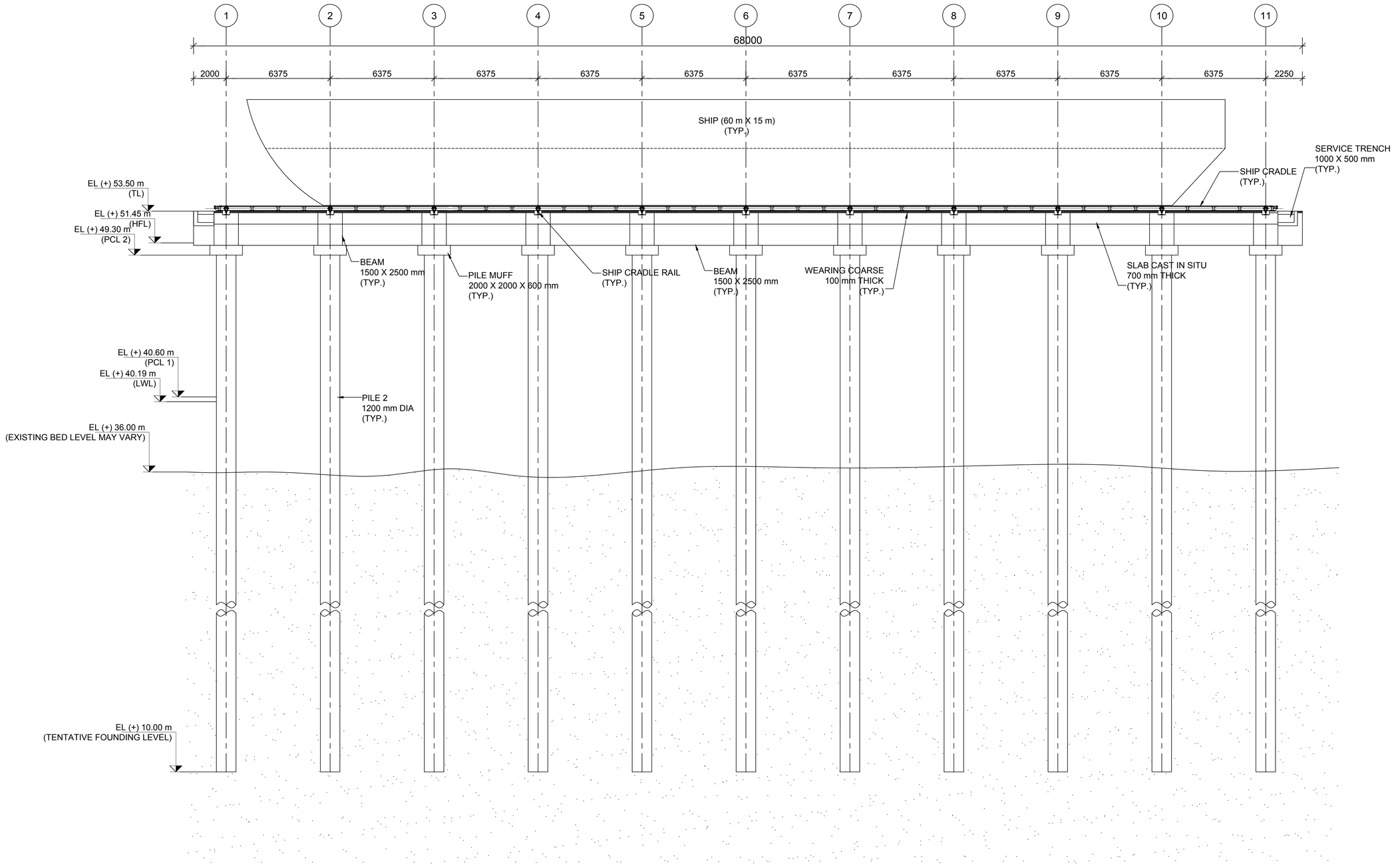
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO MEAN SEA LEVEL
3. CONCRETE GRADE FOR ALL RC STRUCTURE SHALL BE M40 WITH MINIMUM 28 DAYS CHARECTERISTIC STRENGTH OF 40 MPa.
4. STEEL GRADE FOR ALL REINFORCEMENTS USED IN RC STRUCTURES SHALL BE CORROSION RESISTANT STEEL WITH A MINIMUM YIELD STRESS OF 500 MPa.

REV.	DDMMYY / DATE	DRAWING NO:	TITLE	D R N.	INIT.	SIGN.	INIT.	SIGN.
					CHECKED		APPROVED	

ORIGINAL SIZE:A1

CLIENT:	HOOGLY COCHIN SHIPYARD LIMITED
PROJECT:	DESIGN PROJECT FOR SHIP REPAIR FACILITY TO HANDLE INLAND WATERWAYS VESSELS AT PANDU, GUWAHATI
DRAWING TITLE:	GENERAL ARRANGEMENT OF SHIP REPAIR FACILITY (SHEET 4 OF 6)
DRAWING NO:	IITM-DOE-HCSL-SRF-100-04
ENGINEERING FIRM:	Prof.S.A.SANNASIRAJ Prof.K. MURALI DEPARTMENT OF OCEAN ENGINEERING,IIT MADRAS, CHENNAI - 36

DATE: 25.03.2022
Scale as shown
REV 0



SECTION DD
Scale 1:125

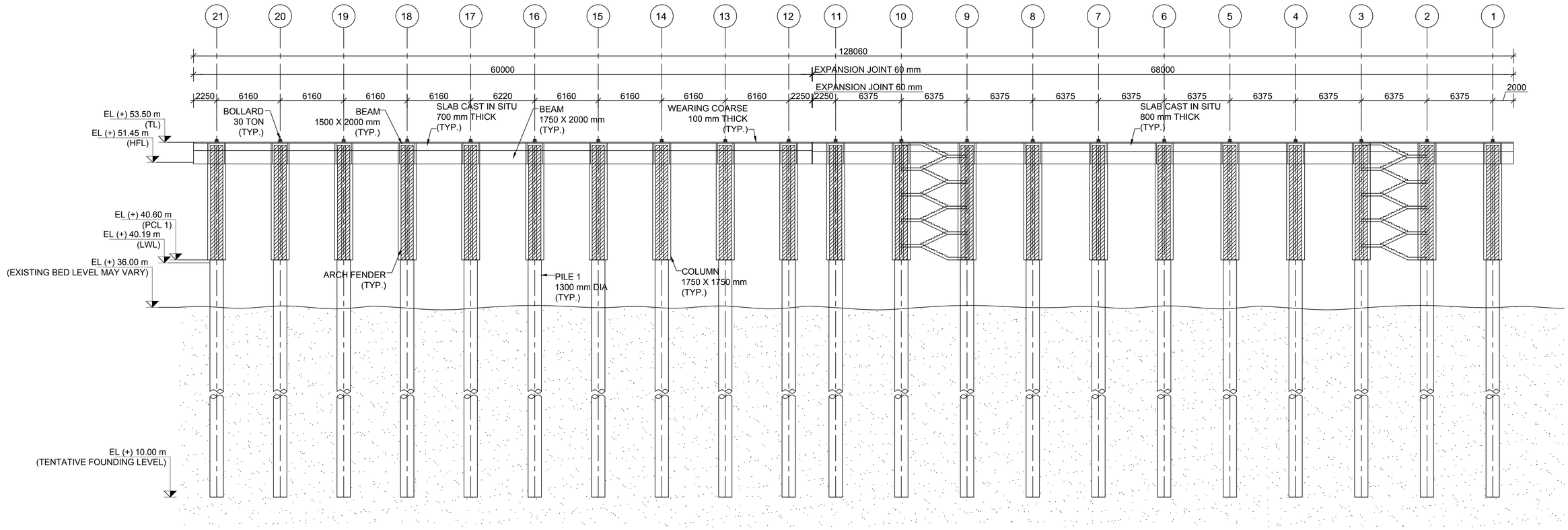
NOTES :-

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO MEAN SEA LEVEL
3. CONCRETE GRADE FOR ALL RC STRUCTURE SHALL BE M40 WITH MINIMUM 28 DAYS CHARECTERISTIC STRENGTH OF 40 MPa.
4. STEEL GRADE FOR ALL REINFORCEMENTS USED IN RC STRUCTURES SHALL BE CORROSION RESISTANT STEEL WITH A MINIMUM YIELD STRESS OF 500 MPa.

REV.	DDMMYY / DATE	DRAWING NO:	TITLE	D R N	INIT. / CHECKED	SIGN. / CHECKED	INIT. / APPROVED	SIGN. / APPROVED

ORIGINAL SIZE A1

CLIENT:	HOOGLY COCHIN SHIPYARD LIMITED	DATE: 25.03.2022
PROJECT:	DESIGN PROJECT FOR SHIP REPAIR FACILITY TO HANDLE INLAND WATERWAYS VESSELS AT PANDU, GUWAHATI	
DRAWING TITLE:	GENERAL ARRANGEMENT OF SHIP REPAIR FACILITY (SHEET 5 OF 6)	
DRAWING NO:	IITM-DOE-HCSL-SRF-100-05	Scale as shown REV 0
ENGINEERING FIRM:	Prof.S.A.SANNASIRAJ Prof.K. MURALI DEPARTMENT OF OCEAN ENGINEERING,IIT MADRAS, CHENNAI - 36	



SECTION EE
Scale 1:200

NOTES :-

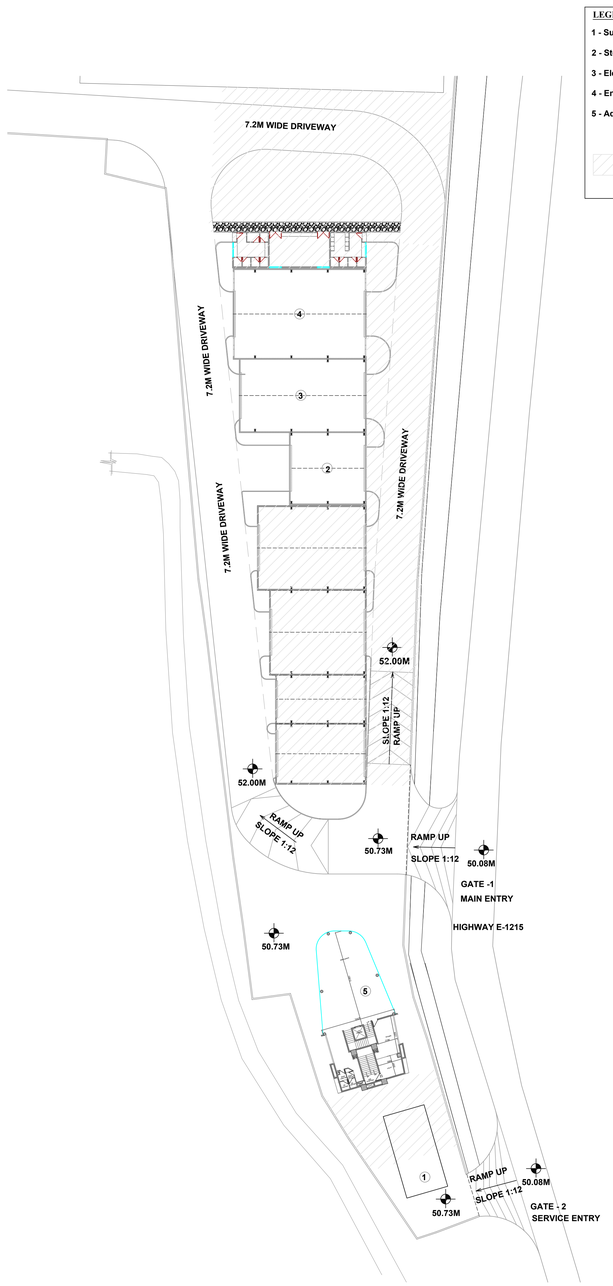
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO MEAN SEA LEVEL
3. CONCRETE GRADE FOR ALL RC STRUCTURE SHALL BE M40 WITH MINIMUM 28 DAYS CHARECTERISTIC STRENGTH OF 40 MPa.
4. STEEL GRADE FOR ALL REINFORCEMENTS USED IN RC STRUCTURES SHALL BE CORROSION RESISTANT STEEL WITH A MINIMUM YIELD STRESS OF 500 MPa.

REV.	DDMMYY / DATE	DRAWING NO:	TITLE	D R N	INIT.	SIGN.	INIT.	SIGN.
					CHECKED		APPROVED	

ORIGINAL SIZE:A1

CLIENT:	HOOGLY COCHIN SHIPYARD LIMITED
PROJECT:	DESIGN PROJECT FOR SHIP REPAIR FACILITY TO HANDLE INLAND WATERWAYS VESSELS AT PANDU, GUWAHATI
DRAWING TITLE:	GENERAL ARRANGEMENT OF SHIP REPAIR FACILITY (SHEET 6 OF 6)
DRAWING NO:	IITM-DOE-HCSL-SRF-100-06
ENGINEERING FIRM:	Prof.S.A.SANNASIRAJ Prof.K. MURALI DEPARTMENT OF OCEAN ENGINEERING,IIT MADRAS, CHENNAI - 36

DATE: 25.03.2022
Scale as shown
REV 0



LEGEND

1 - Substation : 6 x 7 m

2 - Store + Paint Store : 12.5 x 12 m

3 - Electrical + pipe + carpentry shop : 21 x 12 m

4 - Engine + fabrication shop : 22 x 15 m

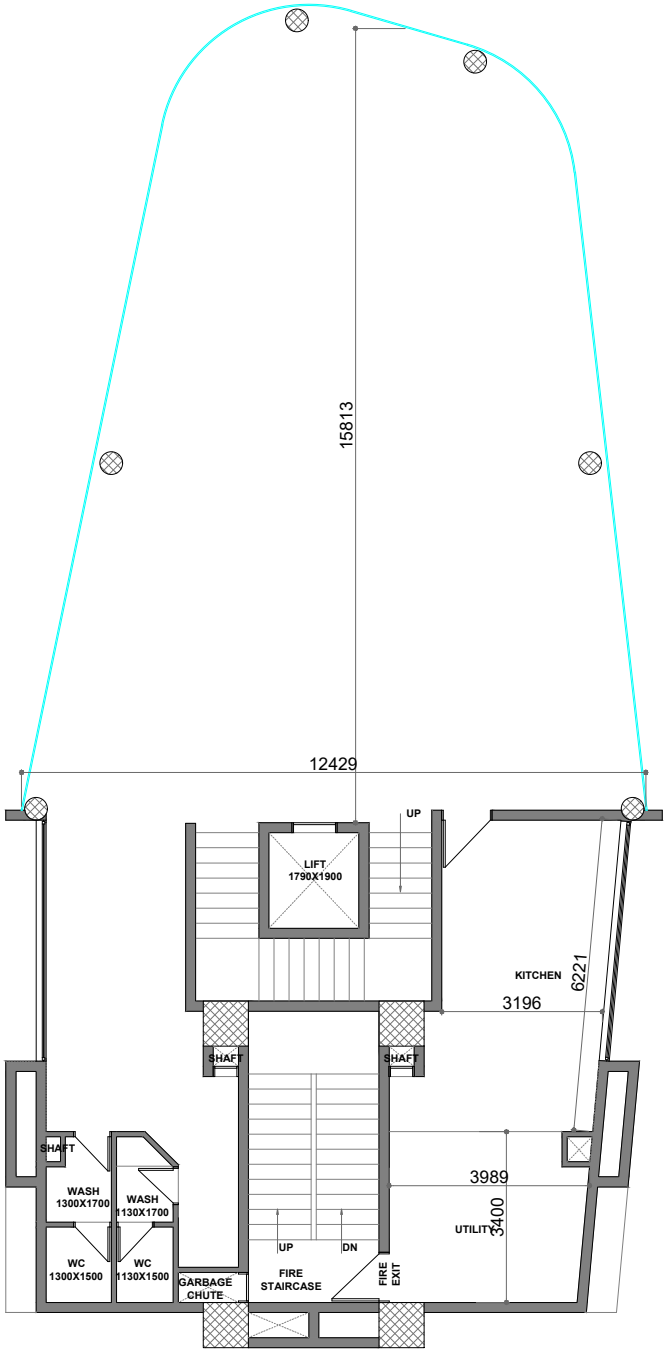
5 - Admin Building: 5400 sqm

PHASE 2 WORKS

NTCPW LIMITED
COCHIN SHIPYARD LIMITED
JEGANATH JB ARCHITECTS

SITE PLAN

SHEET SIZE : A2
SCALE : 1 : 500
SHIP REPAIR FACILITY AT PANDU



NTCPW LIMITED

COCHIN SHIPYARD LIMITED

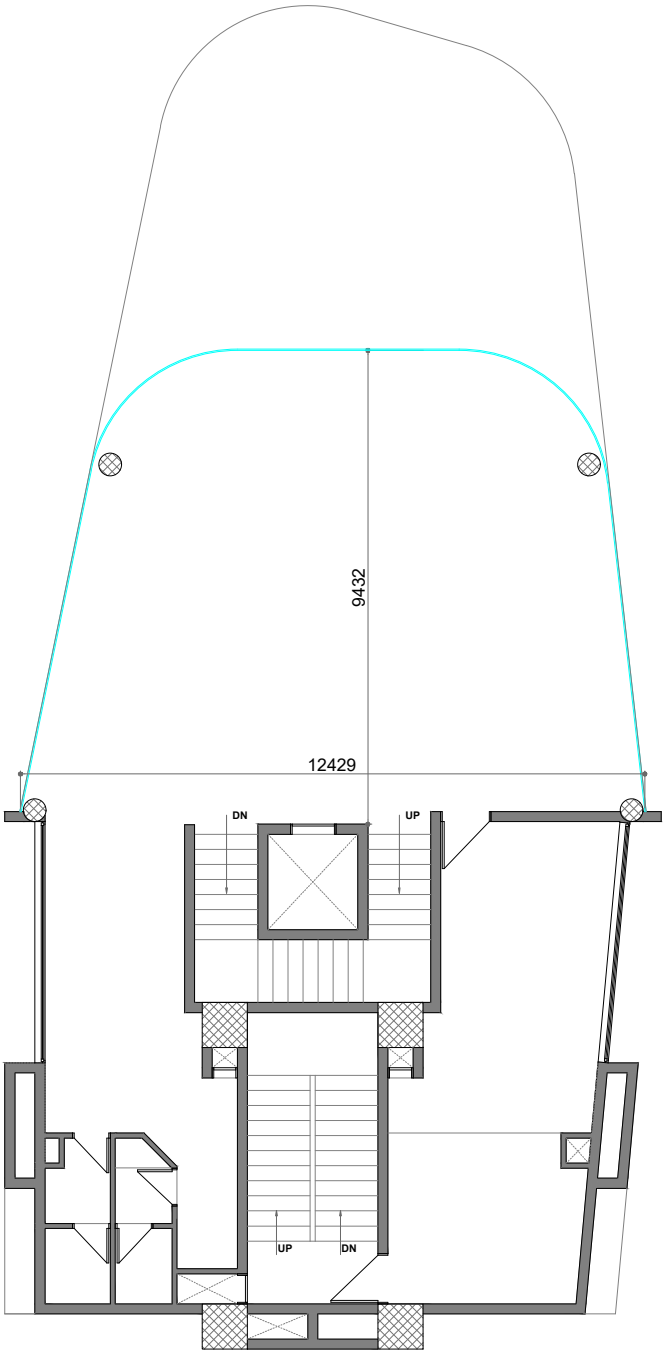
JEGANATH JB ARCHITECTS

GROUND FLOOR PLAN
ADMIN BLOCK

SHIP REPAIR FACILITY
AT PANDU

SHEET SIZE : A4

SCALE : 1 : 125



NTCPW LIMITED

COCHIN SHIPYARD LIMITED

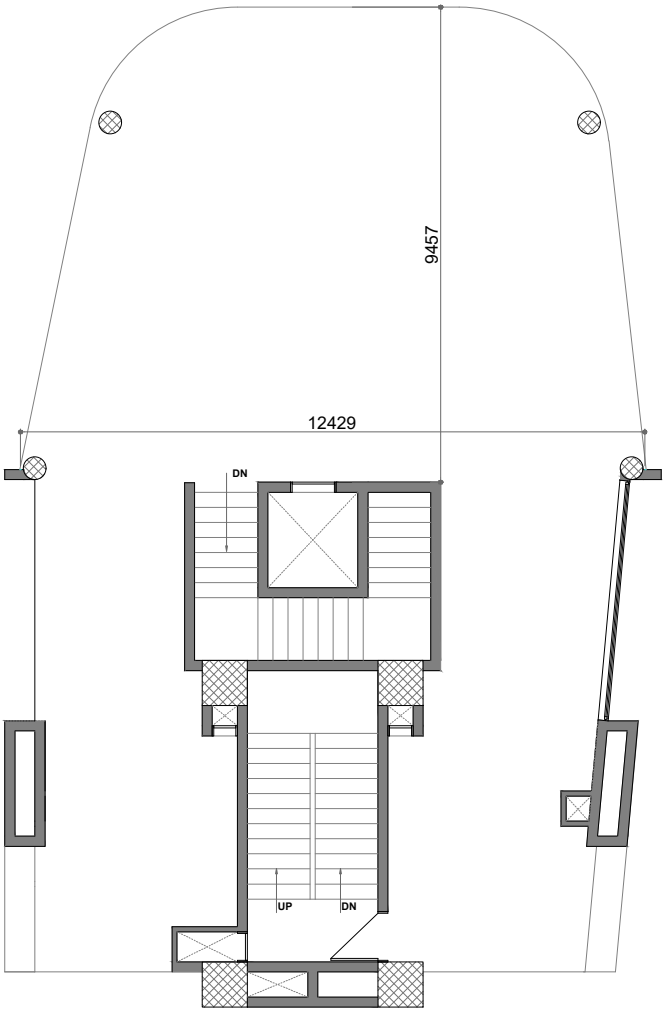
JEGANATH JB ARCHITECTS

FIRST FLOOR PLAN
ADMIN BLOCK

SHIP REPAIR FACILITY
AT PANDU

SHEET SIZE : A4

SCALE : 1 : 125



NTCPW LIMITED

COCHIN SHIPYARD LIMITED

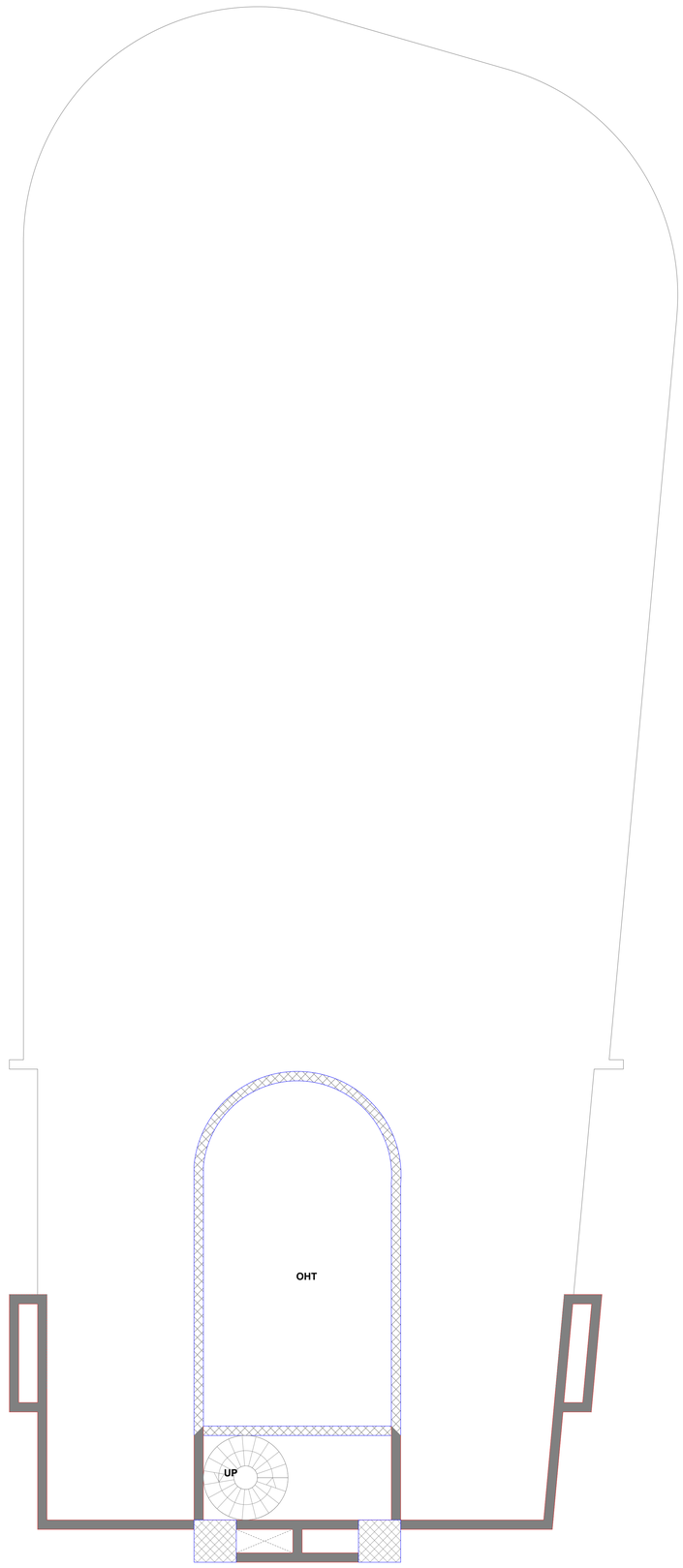
JEGANATH JB ARCHITECTS

TERRACE FLOOR PLAN
ADMIN BLOCK

SHIP REPAIR FACILITY
AT PANDU

SHEET SIZE : A4

SCALE : 1 : 125



NTCPW LIMITED

COCHIN SHIPYARD LIMITED

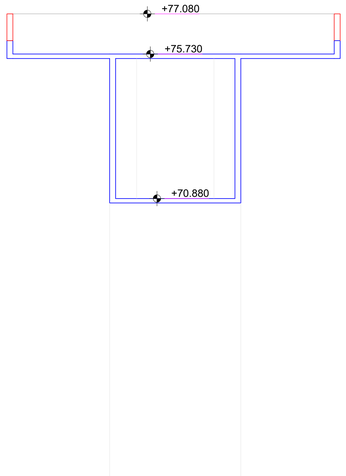
JEGANATH JB ARCHITECTS

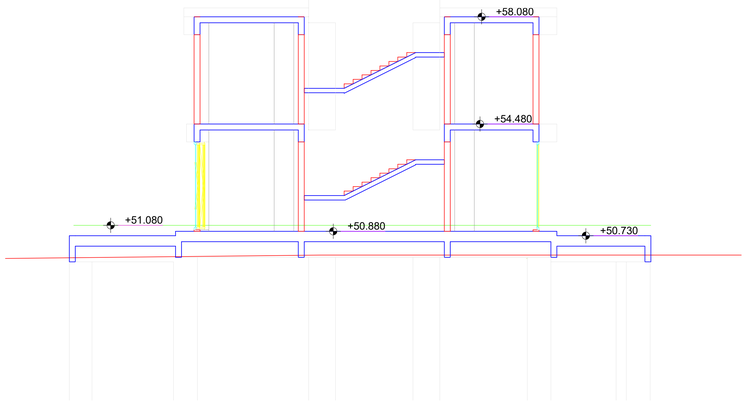
OHT LEVEL PLAN
SECURITY BLOCK

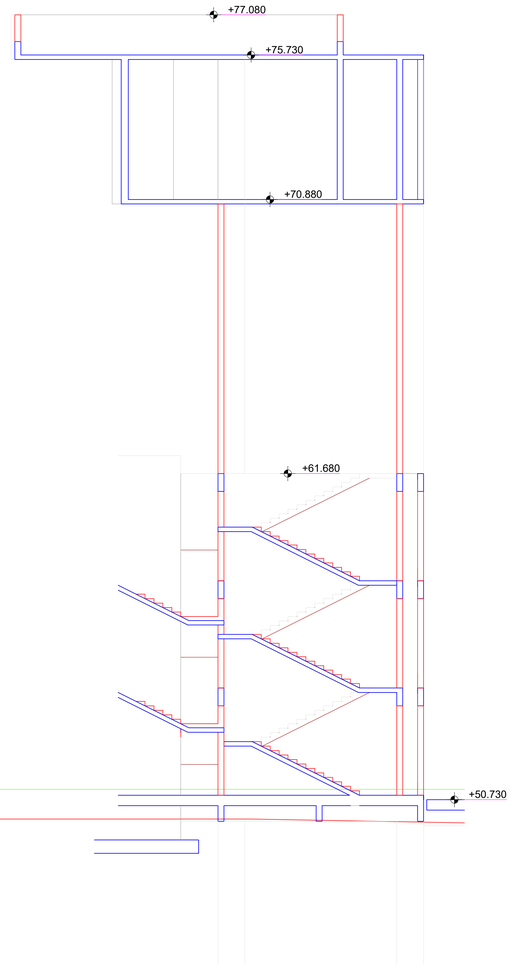
SHIP REPAIR FACILITY
AT PANDU

SHEET SIZE : A4

SCALE : 1 : 125







DOCUMENT STATUS

REFERENCE DRAWING

PRINTS

REVISIONS

NOTES

1.ALL DIMENSIONS ARE IN MM.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH RELEVANT CONSULTANTS DRAWINGS. DISCREPANCIES IF ANY ARE TO BE BROUGHT TO THE NOTICE OF THE ARCHITECT PRIOR.

PROJECT
SHIP REPAIR FACILITY AT PANDU, GUWAHATI

CLIENT
COCHIN SHIPYARD LTD
COCHIN - 682 015

CHIEF CONSULTANT
NTCPWC, IIT-MADRAS

DRAWING TITLE
SECURITY BLOCK SECTIONS

DATE	SCALE	DRAWN BY
11.03.2022	A3 - 1:200	SHARATH
PROJECT NO.	DRAWING NO.	REVISION NO.
325 - SRF	W - 101	REV 0

NORTH

CHECKED AND APPROVED BY
Ar. Jeganath.J.Balakrishnan

JEGANATH JB ARCHITECTS
Tel(m): 91 - 9840570026
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Address: No.6, 6th floor, Ram Swathi Towers,
Durghabai Deshmukh Road,
R.A.Puram, Chennai - 28.

HOOGHLY COCHIN SHIPYARD LIMITED

(A WHOLLY-OWNED SUBSIDIARY OF COCHIN SHIPYARD LTD)

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

TENDER NO: HCSL/PANDU/TEN/002/2022-23, Dt- 01.11.2022

COVER A:

SECTION-IX

SITE DATA AND SOIL INVESTIGATION REPORT

SECTION-IX- CONTENTS TO SITE DATA

SECTION IX- SITE DATA

The analysis of the prevailing environmental aspects of the project site is essential for the better understanding of the site that will help in development and modification of the ship repair facility. Hence an overall environmental data on the location, connectivity, meteorological parameters, geotechnical aspects, and basic details of the project site are reproduced from the earlier reports for better appreciation.

1.0 Water level

The maximum and minimum water levels observed at Pandu over a period of 2004-2014 are tabulated in **Table. 1**. The observed Highest Flood level at Pandu is 50.05 m and lowest water level at Pandu is 40.31 m with reference to the Mean Sea Level.

Table.1 Maximum and Minimum water levels observed at Pandu

		Year								
		2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
January	**Max.**	41.43	41.56	41.04	40.94	41.74	-	41.16	41.52	40.89
	Min.	41.26	41.20	40.50	40.41	41.38	-	40.52	41.10	40.38
February	**Max.**	41.26	42.33	41.11	40.79	41.78	-	40.50	41.45	40.70
	Min.	41.11	41.06	40.31	40.39	41.43	-	40.35	40.99	40.52
March	**Max.**	44.64	44.28	42.21	40.98	42.57	-	43.43	43.66	41.34
	Min.	41.06	41.75	40.92	40.51	41.43	-	40.40	40.94	40.60
April	**Max.**	45.39	45.15	-	-	42.92	-	47.26	44.13	44.24
	Min.	42.48	43.21	-	-	42.92	-	43.13	42.28	41.31
May	**Max.**	47.09	44.91	44.91	47.18	-	44.51	48.05	44.98	46.13
	Min.	43.03	43.60	44.01	44.57	-	42.61	44.16	42.94	43.19
June	**Max.**	48.21	46.84	48.70	48.34	-	45.29	48.79	46.27	48.87
	Min.	44.85	44.46	46.20	46.09	-	43.64	46.21	44.17	44.59
July	**Max.**	49.20	47.73	48.42	50.05	-	47.42	48.91	47.84	48.47
	Min.	46.88	46.02	47.24	47.16	-	45.40	48.30	45.71	47.22
August	**Max.**	47.56	47.89	47.45	50.05	-	47.78	49.39	47.79	48.16
	Min.	46.73	46.02	45.57	47.63	-	46.53	47.41	46.22	46.35

		Year								
		2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
September	**Max.**	47.54	47.41	48.59	48.13	-	46.75	49.92	46.88	49.40
	Min.	45.42	44.38	45.87	46.17	-	45.05	48.09	45.21	46.18
October	**Max.**	47.64	45.39	46.15	45.92	-	46.22	-	46.58	48.23
	Min.	43.65	43.44	45.42	44.40	-	42.86	-	42.87	44.17
November	**Max.**	43.82	43.76	-	44.19	-	43.36	-	42.81	-
	Min.	42.12	42.00	-	42.62	-	42.45	-	41.65	-
December	**Max.**	42.15	41.96	-	42.56	-	41.90	-	41.63	-
	Min.	41.57	41.07	-	41.76	-	41.19	-	40.93	-

It could be observed that during the months of February and March the water levels are lowest, while during the months of July and August these are highest.

2.0 Rainfall

Annual rainfall in the catchment area varies widely from over 250 cm in the Assam Valley to less than 50 cm in Tibet. Rainfall in the region is negligible from November to March. The rainfall commences from April and reaches its peak towards end of May. The average annual rainfall is about 160 cm at Pandu.

3.0 Current

From available data on river velocities, the mean velocity during the normal and flood periods has been observed to be about 1 m/s and 4 m/s respectively. The annual records of maximum and minimum mean velocities of the river Brahmaputra at Pandu are tabulated in **Table. 2.** It could be observed that during months of higher discharge viz. June to September the maximum velocities could reach 3.0 to 5.0 m/s. These velocities are too high for the vessel to align along the slipway. However during these months minimum velocities are well below 2.0 m/s which could be considered as limit upto which the vessels could be handled at the slipway safely. The ship/vessel would be placed in position using tug boats of adequate capacity during monsoon season so as to transfer it to trolley for hauling upto slipway. Additional mooring structure such as buoy shall be installed during slipway operation.

Table. 2 Maximum & Minimum Mean Velocities (m/s) of the River Brahmaputra at Pandu

Months		1959	1961	1977	1978
Jan.	**Max.**	0.52	0.53	1.16	0.83
	Min.	0.39	0.47	0.83	0.73
Feb.	**Max**	0.54	0.53	1.10	0.86
	Min.	0.34	0.47	0.76	0.75
Mar.	**Max**	0.58	0.80	1.31	0.93
	Min.	0.38	0.47	0.89	0.72
Apr.	**Max.**	1.19	1.35	1.49	1.28
	Min.	0.47	0.68	1.02	0.86
May	**Max.**	2.21	2.74	2.05	1.76
	Min.	0.76	0.95	1.05	1.12
June	**Max.**	3.14	2.50	2.61	3.63
	Min.	1.28	1.52	1.76	1.29
Jul.	**Max.**	2.14	3.21	3.00	2.57
	Min.	1.55	1.50	2.00	1.70
Aug.	**Max.**	5.57	5.85	3.11	2.58
	Min.	1.61	1.84	2.55	1.63
Sept.	**Max.**	2.10	2.19	2.90	2.16
	Min.	1.36	1.24	1.65	1.60
Oct.	**Max.**	1.50	1.53	2.40	1.84
	Min.	1.08	0.92	1.16	1.20
Nov.	**Max.**	1.15	0.97	1.14	1.33
	Min.	0.64	0.57	0.95	0.97
Dec.	**Max.**	0.66	0.64	1.12	1.02
	Min.	0.32	0.45	0.82	0.78

4.0 Temperature

Guwahati enjoys moderate weather with average high temperature of 29°C and average minimum is 19°C. Summer (April-May) has a maximum of 40°C and winter (October to March) has a minimum 5°C.

5.0 Topographic Information

In addition to the Geotechnical Investigation, M/s Reliant Foundation parallely carried out Topographic Survey on 25th February 2022 in presence of NTCPWC and HCSL officials. All the boundary areas are surveyed by using the Total Station Survey Equipment, Benchmark levels and coordinates were Transferred from the Central Water Commission(CWC) Guwahati, Assam.

- Permanent Benchmark has been fixed in site with respect to local Chart datum
- All-natural features have been marked like ditches and water bodies.
- The Low water level and High Water level.
- Existing buildings, roads, overhead electric lines, wells, pipelines, etc., and all other permanent structures are marked.

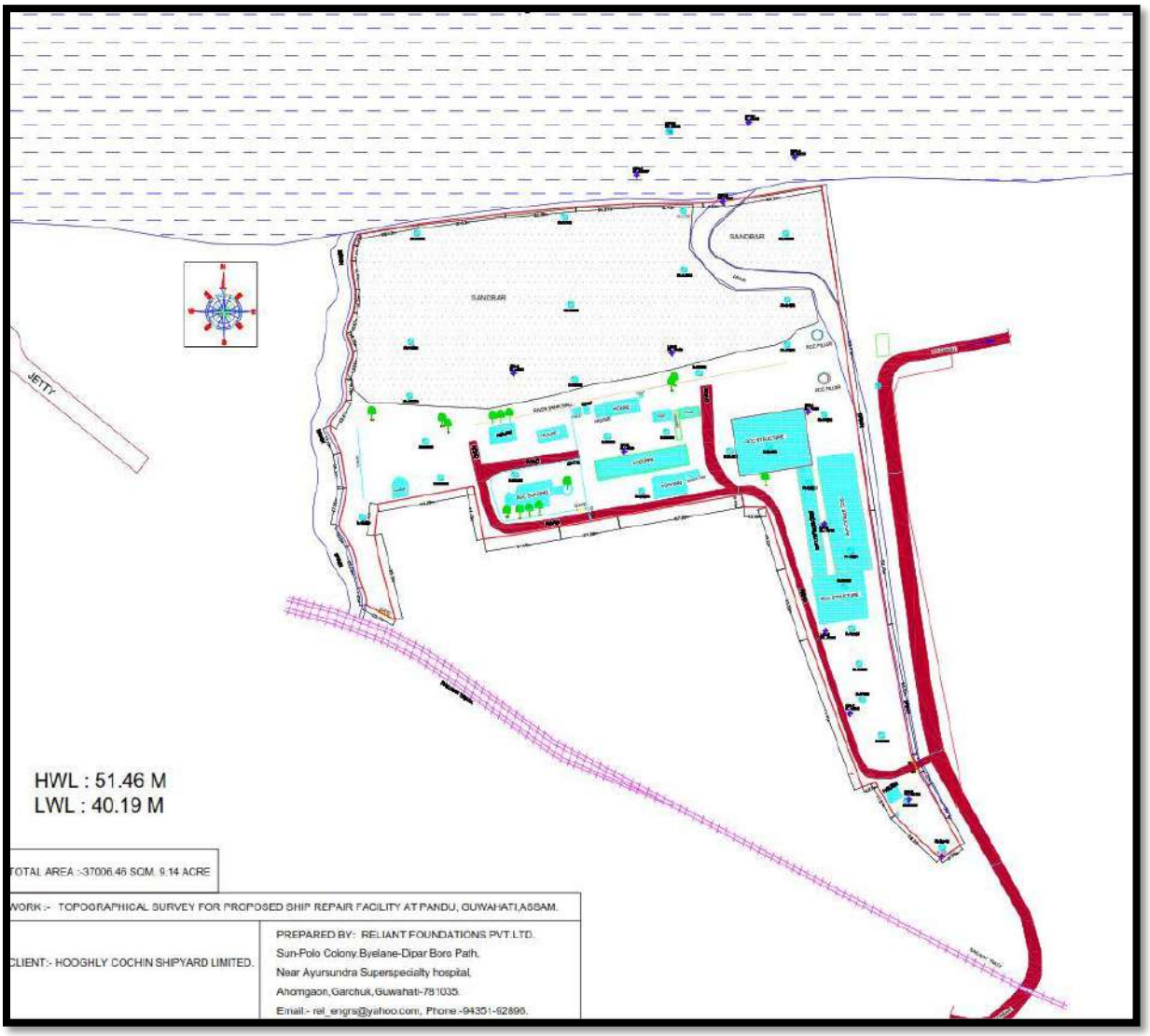

Fig. 1 Topography details of site

After the original design of the proposed Ship Repair Facility carried out based on the earlier LWL and HWL have been reviewed based on the revised Topography survey. As observed during the revised topographic survey, the LWL and HWL are 40.19m and 51.46m respectively. Based on the above observation, the Boat Hoist and other facilties which were located at a depth varying between 2.0m and 5.0 m below CD earlier had to be moved 40m towards the waterside to ensure the availability of the required water depths (7.0m-11.0m below CD) at the location of the Boat Hoist Jetty in order to enable operation at all seasons. The Finalized layout now proposed covers all these aspects.

6.0 Hydrographic Information

The hydrographic survey was conducted by IWAI on river Brahmaputra near the slipway location the extract of the data are shown in **Figure. 2**

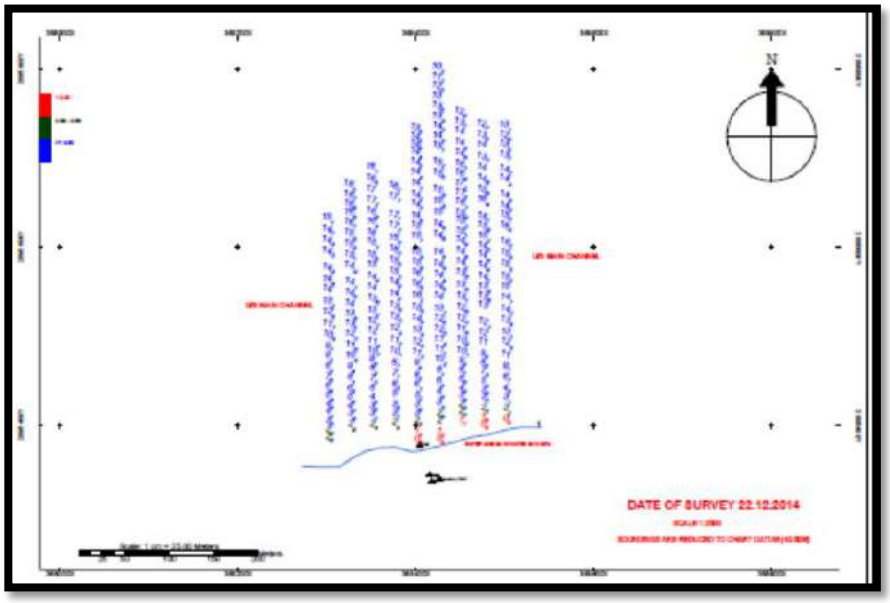

Fig. 2 Details of Hydrographic Survey near shiprepair facility

7.0 Seismicity

Pandu is in Zone V of Indian Map of Seismic zones (IS-1893 Part-1 2016) which is a very severe risk seismic intensity zone (**Fig.3**). Accordingly, while carrying out the design this aspect shall be taken into account and all the relevant codal provision in this regard shall be followed.

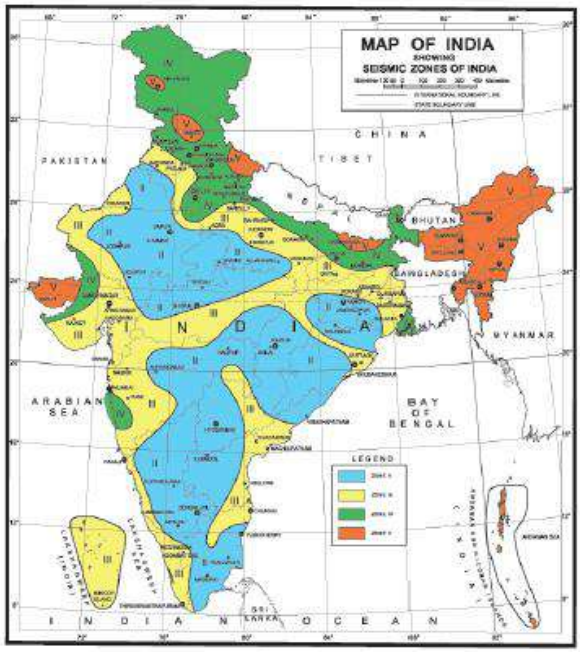

Fig. 3 Seismic Zoning Map of India as per IS-1893 Part 1-2016

REPORT ON

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU. ASSAM

REPORT SUBMITTED TO

HOOGHLY COCHIN SHIPYARD LIMITED, HOWRAH

REPORT PREPARED BY:

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1. **INTRODUCTION:** The prime object of this investigation work is to find out subsoil profile, important engineering properties, recommendation of type of foundation, capacities of subsoil for different types of foundation. Bore hole is made at the site for conducting field test and collection of samples.

1.1 The field and laboratory investigations is carried out by us to access the nature of sub-strata and to evaluate the soil parameters required for design of foundations proposed to be constructed for proposed construction.

1.2 Client's help is gratefully acknowledged in providing bore hole locations, close supervision and checking during boring, sampling, various testing operations and cooperation and guidance during finalization of report.

1.3 This report is based upon the results of field, laboratory tests conducted on selected soil samples collected from borehole locations.

2. SCOPE OF WORK:

The scope of work provided to us for this project is limited to the following: -

2.1 Mobilizing necessary plant, equipments and personnel to the project site, setting up the equipment, carrying out the field investigations and demobilization on completion of work.

2.2 Making bore holes at the site in all types of soil/ boulder / rock by using suitable approved method of boring to be given at site by the Engineer-in-Charge.

2.3 Collection of soil/ rock cores from boulder and rock.

2.4 Recording the depth of ground water table in all the bore holes

2.5 Conducting the laboratory tests on selected samples.

2.6. Analysis**,** Preparation and submission of report.

3.0 FIELD INVESTIGATIONS:

The investigation is made by making boreholes by using Rotary drilling machine.

The drilling method involves a powered rotary cutting head on the end of a shaft, driven into the ground as it rotates. The system requires lubrication (air, water or drilling mud) to keep the cutting head cool.

There are two types of rotary boring, open-hole and core drilling. Material recovered from open-hole drilling is mixed with the drilling lubricant. It is unsuitable for effective sampling, and it is often difficult to observe and record the strata. Open-hole boring is only suitable for rapid drilling to enable core recovery at a greater depth or for the installation of monitoring wells.

Core drilling is carried out using wire-line, double or triple-tube core barrels with diamond or tungsten-tipped core bits. Wire-line core barrels are rotated from the surface by rods normally of the same

diameter as the outer core barrel. The core is brought to the surface within the inner barrel using a wire rope or attached line to a recovery tool. This system is particularly suitable for superficial or weak deposits, as any vibration from the drilling action is minimised due to close-fitting rods used within the hole.

The conventional double-tube core consists of two barrels; the outer barrel is rotated by the drill rods and carries the coring bit. The inner barrel does not rotate, and the core passes up into this inner barrel, enabling the sample to be recovered and brought to the surface. With triple-core barrels, the non-rotating inner barrel contains a removable tube or liner. At the end of each core run, this liner with the core it contains is extracted and stored in a core box. This method does not increase core recovery but is more likely to preserve the core in original condition.

Standard penetration tests were conducted in the above bore hole at every 1.50 m interval & at change of strata as per specifications / instructions of Engineer-in-Charge. The bore was cleaned up to the desired depths. Standard split spoon sampler attached to lower end of 'A' drill rods was driven in the bore holes by means of standard hammer of 63.5 Kg. falling freely from a height of 75 cm. The sampler was driven 45 cm as per specifications & the numbers of blows required for each 15 cm penetration were recorded. The numbers of blows for the first 15 cm penetration were not taken into account. This was considered as seating drive. The numbers of blows for next 30 cm penetration were designated as SPT 'N' value. N value more than 100 is termed as refusal.

4. Summary of boreholes:

SL No.	Borehole No.	RL (m)	Co-ordinates		Depth of Borehole (m)	Water level during the time of fieldwork (m)
			Easting (M)	Northing (M)		
1	MBH 01	38.140	368401.00	2895435.00	52.00	2.35 above EGL
2	MBH 02	34.440	368380.00	2895451.00	51.00	6.00 above EGL
3	MBH 03	34.190	368344.00	2895447.00	45.00	6.30 above EGL
4	MBH 04	42.397	368368.00	2895415.00	52.00	2.50 below EGL
5	MBH 05	38.039	368329.00	2895427.00	48.00	2.50 above EGL
6	LBH 01	46.238	368273.00	2895337.00	18.00	5.50 below EGL
7	LBH 02	47.051	368320.00	2895297.00	18.00	6.00 below EGL
8	LBH 03	50.75	368323.287	2895301.25	22.50	5.50 below EGL
9	LBH 04	48.963	368407.094	2895319.24	21.00	4.80 below EGL
10	LBH 05	49.486	368414.321	2895268.46	21.00	5.30 below EGL
11	LBH 06	49.596	368414.969	2895219.66	21.00	5.50 below EGL
12	LBH 07	50.498	368426.06	2895182.00	22.50	5.00 below EGL
13	LBH 08	50.039	368453.00	2895143.00	22.00	2.00 below EGL
14	LBH 09	49.564	368468.00	2895117.00	21.00	0.50 below EGL

5.0 LABORATORY INVESTIGATIONS:

5.1 The following laboratory tests are conducted on selected soil samples recovered from bore hole / test location as relevant.

(1) Specific gravity. As per IS: 2720, part-III
(2) Water absorption
(3) Unconfined compression test. of rock sample
(4)Direct shear test. As per IS: 2720; part-XIII

All the above laboratory tests ae carried out as per relevant Indian Standards.

6.0 FINDING OF GEOTECHNICAL INVESTIGATION:

The study of bore logs/results of laboratory and other field tests are tabulated through different tables as annexed.

7.0 CALCULATION OF SCOUR DEPTH

7.1 Method for calculation of mean depth of scour (cl: 703.2 IRC 78-2014)

The mean scour depth below Highest Flood Level (HFL) for natural channel flowing over scourable bed can be calculated theoretically from the following equation:

$d_s = 1.34 (D_b^2/K_{sf})^{1/3}$

where,

D_b = The design discharege for foundation per meter width of effective waterway.

K_{sf} = Silt factor for a representative sample of bed material obtained up to the level of anticipated deepest scour.

The value of D_b may be determined by dividing the design discharge for foundation by lower of theoretical and actual effective linear waterway as given in IRC: 5.703.2.2

K_{sf} is determined by the expression $1.76\sqrt{d_m}$

d_m being the weighted mean diameter in millimeter.

The values of K_{sf} for various grades of sandy bed are given below for ready reference and adoption: cl 703.2.2.1: IRC 78-2014

Type of bed material	d_m (mm)	K_{sf}
Coarse silt	0.04	0.35
Silt/fine sand	0.081 to 0.158	0.5 to 0.7
Medium sand	0.223	0.85 to 1.25
Coarse sand	0.223 to 0.505	1.5
Fine bajri and sand	0.988	1.75
Heavy sand	1.29 to 2.00	2.0 to 2.42

Guidelines for calculating silt factor for bed materials consisting clay

The clayey bed having weighted diameter normally less than 0.04mm offer more resistance to scour as per the formula given in Clause 703.2 indicates more scour. In the absence of any accepted rational formula or and data of scour at the site of the proposed bridge; the following theoretical calculation may be adopted:

i) In case of soil having $\emptyset<15^O$ and c (cohesion of soil)> $0.2kg/cm^2$

$K_{sf} = F(1+\sqrt{c})$,

Where,

F = 1.50 for $\emptyset > 10^O$ and $< 15^O$

= 1.75 for $\emptyset > 5^O$ and $< 10^O$

= 2 for $\emptyset < 5^O$

ii) In case of soil having $\emptyset>15^O$, it will be treated as sandy coil even if c> $0.2kg/cm^2$ and silt factor will be treated as per provisions o Clause 703.2.2.

8.0 Calculation of allowable bearing capacity: As per IS 6403-1981, the allowable bearing capacity shall be taken as either of the following, whichever is less

(A) Net ultimate bearing capacity divided by suitable factor of safety that is net safe bearing capacity

(B) The net soil pressure that can be imposed on the basis without the settlement exceeding the permissible value as given in IS : 1904-1986 . In present case it is 75mm (For raft)

(A) **Calculation of Net Safe Bearing Capacity** (Shear Criteria)

IS: 6403-1981 recommends the following equation to calculate the net Safe Bearing Capacity ' q_s' based on Hansen's Bearing Capacity analysis for c-¢ soil

$$q_s=1/F \{CNc\, S_c\, d_c\, I_c + q\,(N_q- 1)\, S_q\, d_q\, i_q + 0.5\, \gamma\, B\, N_\gamma\, S_\gamma\, d_\gamma\, i_\gamma\, x\, W'\}$$

Where, C = Cohesion of soil.

γ = Saturated Density of soil

B = Width of footing = 2.0 m (assumed)

W' = Water table correction factor depending upon position of water table with respect to founding level

Q = Effective surcharge at footing level = γ D (D = depth of footing)

N_c, N_q , N_γ = Bearing capacity factor

S_c, S_q ,S_γ = Shape factor

d_c, d_q, d_γ = depth factor

i_c, i_q , i_γ = inclination factors

F = Factor of safety =3.0

For Cohesive soil: As per cl. 5.3 of IS 6403: 1981, the net ultimate bearing capacity immediately after construction on fairly saturated homogeneous cohesive soils shall be calculated from following formula

q_d **= cNc Sc dc ic**

q_d **= net ultimate bearing capacity**

c= Cohesion of soil.

S_c = Shape factor

d_c = depth factor

i_c = inclination factors

N_c = 5.14

For cohesion less soil: As per cl. 5.2.2.1 of IS- 6403 -1981: The ultimate net bearing capacity shall be calculated from following formula (covering effect of other factors as mentioned in 5.1.2 of IS 6403):

$qd= \quad q(Nq-1)\ q\ (N_q-1)\ S_{q.}\ d_q\ i_q + 0.5\ \gamma\ B\ N_\gamma\ S_\gamma\ d_\gamma\ i_\gamma\ x\ W'$

Where ¢ may be read from Fig. 1 of IS 6403

Nq, Ny, , may be read from Table 1, of IS 6403

$S_{q.,}\ d_{q\ ,}\ i_q\ S_\gamma\ ,d_{\gamma\ ,}\ i_{\gamma\ ,}\ W'$ from cl 5.1 of IS 6403

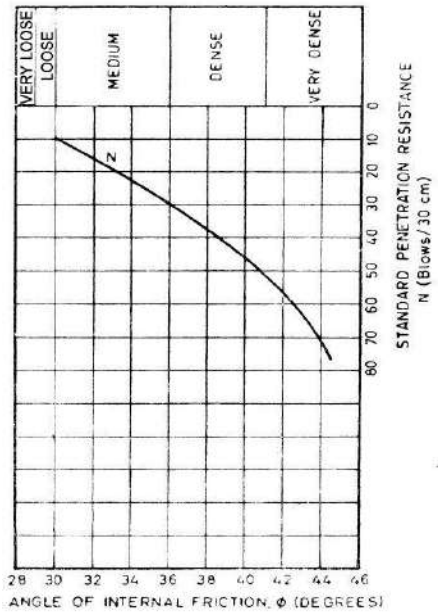


Fig1: IS-6403-1981

Table1: Bearing capacity factors of IS-6403-1981

ϕ egrees)	N_c	N_q	$N\gamma$
0	5.14	1.00	0.00
5	6.49	1.57	0.45
10	8.35	2.47	1.22
15	10.98	3.94	2.65
20	14.83	6.40	5.39
25	20.72	10.66	10.88
30	30.14	18.40	22.40
35	46.12	33.30	48.03
40	75.31	64.20	109.41
45	138.88	134.88	271.76
50	266.89	319.07	762.89

(B) Calculation of allowable bearing pressure based on tolerable settlement.

Settlement Criteria :

The safe bearing pressure is to be found out from the elastic settlement consideration and is found from the following equation given I.S. 8009 (part-1) 1976

In the case of clay layers, the total settlement should be computed from

Sf = Si+-Sc

Si = Immediate settlement

Sc = consolidation settlement

(I) Immediate settlement (Si)

$Si=pxB\ (1-\mu^2)xI/E$

p= Foundation pressure

B= Width of foundation

μ = Poisson's ratio =0.5 for clay

I = influence factor depends on L/B ratio from Fig 11 for various Ht/B ratio

E= Modulus of elasticity of soil

(II) Consolidation settlement (Sc)

$S_f = S_c = S_{oed} = (H_t/ 1+e_o)\, C_c \log_{10} (po + \Delta p)/ p_o$

S_f = Final settlement

S_{fd} = Final settlement in after correction

S_{oed} = Settlement computed from one dimensional test

H_t = Thickness of soil layer

e_o = Initial void ratio at mid height of of layer

C_c = Compression Index to be read from e-logp curve or from empirical relation as per cl 9.2.2.2 of IS 8009- Part-I

Po = Initial effective pressure at mid height of layer

Δp = pressure increment

e_o = Initial void ration calculated from the following relationship

For the computation of settlement of foundation founded at certain depth, a correction should be applied to the calculated S_f

Corrected settlement S_{fd} = S_f x depth factor x rigidity factor x Pore pressure correction factor

i. Depth factor is dependent on the following (from Fig: 12 of I.S. 8009 (part-1) 1976.)

D= Depth of footing ii. L= Length of footing iii. B= Width of footing

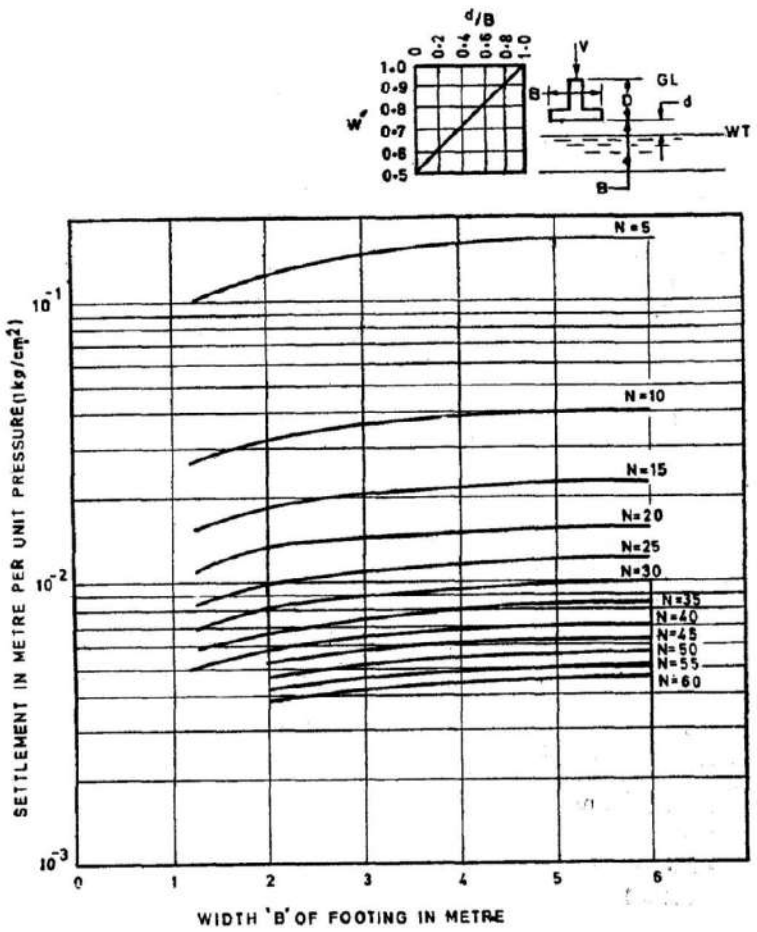
ii. Rigidity factor = 0.8 (cl 9.5.2 of I.S. 8009 (part-1) 1976)

iii. Pore pressure factor λ = 0.7-1.0 for normal clay, considered as 0.8 as in between (cl9.2.3 , table1 of I.S. 8009 (part-1) 1976)

(III) Settlement calculation of granular soil:

For granular soil settlement is calculated from the *method Based on Dynamic penetration Test as per IS 8009-Part-I, 1976, reaffirmed 1998*

— Settlement of a footing of width *B* under **unit intensity** of pressure resting on dry cohesion less deposit with known standard **penetration** resistance value N, (determined according to IS: 2131- 1963), may be read from Fig. 9 (*IS 8009-Part-I)* . The settlement under any other pressure may be **computed by** assuming that it is proportional to the intensity of pressure.



GL = Ground level. WT = Water table.

FIG. 9 SETTLEMENT PER UNIT PRESSURE FROM STANDARD PENETRATION RESISTANCE

9.0 Recommendation of foundation: After obtaining the laboratory test results of the samples collected from the field and analyzing the subsoil parameters in a very careful manner, bearing capacity of rock at different depths are calculated and shown in tables below.

The load carrying capacities of bored cast in situ uniform piles with pile diameters 1.0 m, and 1.2 m respectively are calculated.

Table1: Pile load capacity for Pile foundation

Borehole No.	Foundation Depth from LBL (M)	Pile Diameter (mm)	Safe load on pile in compression (Metric ton)	Safe load on pile in uplift (Metric ton)	Safe load on pile in lateral (Metric ton)
MBH-01, MBH-02, MBH-03, MBH-04 & MBH-05	20.0	1000	158.70	45.26	60.85
		1200	244.18	59.11	97.75
	22.0	1000	174.25	58.72	60.85
		1200	274.24	75.83	97.75
	24.0	1000	192.63	74.20	60.85
		1200	296.29	94.97	97.75
	26.0	1000	213.83	91.70	60.85
		1200	321.73	116.54	97.75
	28.0	1000	237.86	111.21	60.85
		1200	350.56	140.52	97.75
	30.0	1000	264.71	132.75	60.85
		1200	382.79	166.93	97.75

Table2: Pile load capacity for Pile foundation

Borehole No.	Foundation Depth from LBL (M)	Pile Diameter (mm)	Safe load on pile in compression (Metric ton)	Safe load on pile in uplift (Metric ton)	Safe load on pile in lateral (Metric ton)
LBH-01 & LBH-03	16.0	1000	35.98	24.85	20.24
		1200	48.60	33.49	29.14
	16.5	1000	37.41	26.46	20.24
		1200	50.32	35.57	29.14
	17.0	1000	38.84	28.07	20.24
		1200	52.04	37.64	29.14

Table3: Pile load capacity for Pile foundation

Borehole No.	Foundation Depth from LBL (M)	Pile Diameter (mm)	Safe load on pile in compression (Metric ton)	Safe load on pile in uplift (Metric ton)	Safe load on pile in lateral (Metric ton)
LBH-04, LBH-07 & LBH-08	18.0	1000	132.41	47.45	40.14
		1200	179.31	57.57	64.49
	19.0	1000	143.77	53.03	40.14
		1200	194.44	64.54	64.49
	20.0	1000	156.63	59.89	40.14
		1200	211.37	73.06	64.49

Table4: Pile load capacity for Pile foundation

Borehole No.	Foundation Depth from LBL (M)	Pile Diameter (mm)	Safe load on pile in compression (Metric ton)	Safe load on pile in uplift (Metric ton)	Safe load on pile in lateral (Metric ton)
LBH-02, LBH-05 & LBH-06	12.0	1000	77.12	11.49	54.54
		1200	112.09	16.34	87.62
	14.0	1000	96.73	16.54	54.54
		1200	139.41	22.96	87.62
	16.0	1000	118.84	23.38	54.54
		1200	169.75	31.73	87.62
	18.0	1000	143.47	32.02	54.54
		1200	203.10	42.66	87.62

Table5: Pile load capacity for Pile foundation

Borehole No.	Foundation Depth from LBL (M)	Pile Diameter (mm)	Safe load on pile in compression (Metric ton)	Safe load on pile in uplift (Metric ton)	Safe load on pile in lateral (Metric ton)
LBH-09	15.0	1000	164.03	25.44	55.03
		1200	234.50	33.92	88.41
	17.0	1000	188.74	34.03	55.03
		1200	268.33	44.79	88.41
	19.0	1000	207.28	44.80	55.03
		1200	305.22	58.28	88.41
	21.0	1000	219.64	57.75	55.03
		1200	320.06	74.39	88.41

10.0 CONCLUSION AND RECOMMENDATION:

Description of soil layers:

LOCATION	DEPTH (M)	DESCRIPTION OF SOIL LAYER
MBH 01	0.00 - 52.00	Sandy Strata
MBH 02	0.00 - 51.00	Sandy Strata
MBH 03	0.00-45.00	Sandy Strata
MBH 04	0.00-52.00	Sandy Strata
MBH 05	0.00-48.00	Sandy Strata
LBH 01	0.00-9.00	Clayey Strata
	9.00-14.00	Sandy Strata
	14.00-17.00	Clayey Strata
	17.00-18.00	Sandy Strata
LBH 02	0.00-10.00	Clayey Strata
	10.00-18.00	Sandy Strata
LBH 03	0.00-15.00	Sandy Strata
	15.00-20.00	Clayey Strata
	20.00-22.50	Sandy Strata
LBH 04	0.00-10.00	Clayey Strata
	10.00-13.00	Sandy Strata
	13.00-16.00	Clayey Strata
	16.00-21.00	Sandy Strata
LBH 05	0.00-7.00	Clayey Strata
	7.00-21.00	Sandy Strata
LBH 06	0.00-8.00	Clayey Strata

	8.00-21.00	Sandy Strata
LBH 07	0.00-10.50	Clayey Strata
	10.50-13.00	Sandy Strata
	13.00-16.00	Clayey Strata
	16.00-22.00	Sandy Strata
LBH 08	0.00-8.00	Clayey Strata
	8.00-12.00	Sandy Strata
	12.00-18.00	Clayey Strata
	18.00-22.50	Sandy Strata
LBH 09	0.00-15.00	Clayey Strata
	15.00-21.00	Sandy Strata

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 23-02-2022 Date completed: 25-02-2022

BH: MBH-01 DEPTH OF WATER TABLE = 2.35M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	3	3	**CL**	Grayish Silty Clay																
2	U				3.00M			20	80	1.68	1.31	2.65	1.02	27.9	0.40	0.20		0.22	35.23	24.57	10.66
3.0-3.45	P	5	7		Grayish Fine Sand with Silt																
3.5	D						80	20		1.49		2.65					29				
4.5-4.95	P	25	31																		
5	D						90	10		1.98		2.65					33				
6.0-6.45	P	39	45	**SP**																	
6.5	D						95	5		2.15		2.66					36				
7.5-7.95	P	43	46																		
8	D						100			2.18											
9.0-9.45	P	51	51		9.00M																
9.5	D				Grayish Brown Fine to Medium Sand		100			2.20		2.66					36				
10.5-10.95	P	56	53																		
11	D						100			2.21											
12.0-12.45	P	61	55																		
12.5	D			**SW**			100			2.21		2.67					38				
13.5-13.95	P	64	55																		
14	D						100			2.23											
15.0-15.45	P	69	56																		
15.5	D				15.00M		100			2.21		2.67					40				

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 23-02-2022 Date completed: 25-02-2022

BH: MBH-01 DEPTH OF WATER TABLE = 2.35M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	75	59		Grayish Brown Fine to Medium Sand																
17	D						100			2.24		2.66					41				
18.0-18.45	P	80	60																		
18.5	D						100														
19.5-19.95	P	80	58																		
20	D						100			2.28		2.67					42				
21.0-21.45	P	87	61																		
21.5	D						100														
22.5-22.95	P	85	57																		
23	D			**SW**			100			2.27		2.67					42				
24.0-24.45	P	85	55																		
24.5	D						100														
25.5-25.95	P	85	53																		
26.0	D						100			2.28		2.67					43				
27.0-27.45	P	90	55																		
27.5	D						100														
28.5-28.95	P	90	53																		
29.0	D						100			2.30		2.67					44				
30.0-30.45	P	93	53																		
30.5	D				30.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 23-02-2022 Date completed: 25-02-2022

BH: MBH-01 DEPTH OF WATER TABLE = 2.35M above EGL

	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
31.5-31.95	P	96	53		Grayish Brown Fine to Medium Sand																
32	D						100			2.32		2.66					40				
33.0-33.45	P	99	53	**SW**																	
33.5	D						100														
34.5-34.95	P	98	51																		
35	D						100			2.30		2.66					41				
36.0-36.45	P	R	R																		
36.5	D						100														
37.5-37.95	P	R	R																		
38	D						100			2.34		2.66					42				
39.0-39.45	P	R	R																		
39.5	D						100														
40.5-40.95	P	R	R	**SW**																	
41	D						100			2.35		2.66					43				
42.0-42.45	P	R	R																		
42.5	D						100														
43.5-43.95	P	R	R																		
44	D						100			2.34		2.66					41				
45.0-45.45	P	R	R																		
45.5	D				45.5M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 23-02-2022 Date completed: 25-02-2022

BH: MBH-01 DEPTH OF WATER TABLE = 2.35M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm^3	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm^2)	Cohesion 'c' Kg/cm^2	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
46.5-46.95	P	R	R	**SW**	Grayish Brown Fine to Medium Sand																
47	D						100			2.30		2.66					41				
48.0-48.45	P	R	R																		
48.5	D						100														
49.5-49.95	P	R	R																		
50	D						100			2.35		2.66					42				
51.0-51.45	P	R	R																		
51.5	D				52.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 27-02-2022 Date completed: 01-03-2022

BH: MBH-02 DEPTH OF WATER TABLE = 6.00M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	5	9		Grayish Fine Sand with silts																
2	D						80	20		1.49		2.65					30				
3.0-3.45	P	13	20	**SP**																	
3.5	D						80	20		1.81		2.65					33				
4.5-4.95	P	28	26																		
5	D				6.00M		90	10		2.03		2.65					35				
6.0-6.45	P	30	26		Grayish Brown Fine to Medium Sand																
6.5	D						90	10		2.06		2.66					35				
7.5-7.95	P	32	27																		
8	D						95	5		2.09											
9.0-9.45	P	52	55																		
9.5	D						100			2.13		2.66					37				
10.5-10.95	P	56	56	**SW**																	
11	D						100			2.17											
12.0-12.45	P	57	54																		
12.5	D						100			2.20		2.67					38				
13.5-13.95	P	65	58																		
14	D						100			2.23											
15.0-15.45	P	72	61																		
15.5	D				15.00M		100			2.23		2.67					40				

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 27-02-2022 Date completed: 01-03-2022

BH: MBH-02 DEPTH OF WATER TABLE = 6.00M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	79	64		Grayish Brown Fine to Medium Sand																
17	D						100			2.25		2.66					40				
18.0-18.45	P	86	67																		
18.5	D						100			2.26											
19.5-19.95	P	R	R																		
20	D						100			2.26		2.67					41				
21.0-21.45	P	R	R																		
21.5	D						100														
22.5-22.95	P	R	R																		
23	D			**SW**			100			2.27		2.67					42				
24.0-24.45	P	R	R																		
24.5	D						100														
25.5-25.95	P	R	R																		
26.0	D						100			2.28		2.67					43				
27.0-27.45	P	R	R																		
27.5	D						100														
28.5-28.95	P	R	R																		
29.0	D						100			2.28		2.67					44				
30.0-30.45	P	R	R																		
30.5	D				30.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 27-02-2022 Date completed: 01-03-2022

BH: MBH-02 DEPTH OF WATER TABLE = 6.00M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
31.5-31.95	P	R	R		Grayish Brown Fine to Medium Sand																
32	D						100			2.30		2.66					42				
33.0-33.45	P	R	R																		
33.5	D						100														
34.5-34.95	P	R	R																		
35	D						100			2.25		2.66					41				
36.0-36.45	P	R	R																		
36.5	D						100														
37.5-37.95	P	R	R																		
38	D			**SW**			100			2.23		2.66					42				
39.0-39.45	P	R	R																		
39.5	D						100														
40.5-40.95	P	R	R																		
41	D						100			2.23		2.66					43				
42.0-42.45	P	R	R																		
42.5	D						100														
43.5-43.95	P	R	R																		
44	D						100			2.24		2.66					41				
45.0-45.45	P	R	R																		
45.5	D				45.5M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 27-02-2022 Date completed: 01-03-2022

BH: MBH-02 DEPTH OF WATER TABLE = 6.00M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm^3	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm^2)	Cohesion 'c' Kg/cm^2	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
46.5-46.95	P	R	R	**SW**	Grayish Brown Fine to Medium Sand																
47	D						100			2.29		2.66					41				
48.0-48.45	P	R	R																		
48.5	D						100														
49.5-49.95	P	R	R																		
50	D						100			2.32		2.67					42				
51.0-51.45	P	R	R																		
51.5	D				51.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 03-03-2022 Date completed: 06-03-2022

BH: MBH-03 DEPTH OF WATER TABLE = 6.30M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt and Clay <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	R	R	SW	Grayish Fine to Medium Sand																
2	D						80	20		1.92		2.65					32				
3.0-3.45	P	R	R																		
3.5	D						85	15		1.95		2.65					32				
4.5-4.95	P	66	109																		
5	D						85	15		1.95		2.65					33				
6.0-6.45	P	R	R																		
6.5	D						90	10		1.98		2.66					33				
7.5-7.95	P	R	R																		
8	D						95	5		2.00											
9.0-9.45	P	29	28																		
9.5	D						95	5		1.97		2.66					34				
10.5-10.95	P	45	56																		
11	D						100			2.12							40				
12.0-12.45	P	78	89																		
12.5	D						100			2.18		2.67					41				
13.5-13.95	P	R	R																		
14	D						100														
15.0-15.45	P	R	R																		
15.5	D				15.00M		100			2.20		2.67					40				

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 03-03-2022 Date completed: 06-03-2022

BH: MBH-03 DEPTH OF WATER TABLE = 6.30M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt and Clay <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	R	R		Grayish Fine to Medium Sand																
17	D						100			2.22		2.66					40				
18.0-18.45	P	R	R																		
18.5	D						100			2.24											
19.5-19.95	P	R	R																		
20	D						100			2.24		2.67					41				
21.0-21.45	P	R	R																		
21.5	D						100														
22.5-22.95	P	R	R																		
23	D			**SW**			100			2.25		2.67					42				
24.0-24.45	P	R	R																		
24.5	D						100														
25.5-25.95	P	R	R																		
26.0	D						100			2.28		2.67					43				
27.0-27.45	P	R	R																		
27.5	D						100														
28.5-28.95	P	R	R																		
29.0	D						100			2.27		2.67					41				
30.0-30.45	P	R	R																		
30.5	D				30.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 03-03-2022 Date completed: 06-03-2022

BH: MBH-03 DEPTH OF WATER TABLE = 6.30M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt and Clay <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
31.5-31.95	P	R	R		Grayish Fine to Medium Sand																
32	D						100			2.29		2.66					42				
33.0-33.45	P	R	R																		
33.5	D						100														
34.5-34.95	P	R	R																		
35	D						100			2.30		2.66					41				
36.0-36.45	P	R	R																		
36.5	D						100														
37.5-37.95	P	R	R																		
38	D			**SW**			100			2.31		2.66					42				
39.0-39.45	P	R	R																		
39.5	D						100														
40.5-40.95	P	R	R																		
41	D						100			2.32		2.67					42				
42.0-42.45	P	R	R																		
42.5	D						100														
43.5-43.95	P	R	R																		
44	D						100			2.24		2.67					42				
45.0-45.45	P	R	R																		
45.5	D				45.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 10-03-2022 Date completed: 12-03-2022

BH: MBH-04 DEPTH OF WATER TABLE = 2.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt and Clay <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	5	9	**SP**	Grayish Fine Sand with Silt																
2	D				3.00M		80	20		1.49		2.64					32				
3.0-3.45	P	3	5	**SW**	Grayish Fine to Medium Sand																
3.5	D						90	10		1.60		2.65					32				
4.5-4.95	P	8	12																		
5	D						90	10		1.65		2.65					33				
6.0-6.45	P	9	12																		
6.5	D						100			1.71		2.66					33				
7.5-7.95	P	17	18																		
8	D						100			1.89											
9.0-9.45	P	23	21																		
9.5	D						100			1.95		2.66					34				
10.5-10.95	P	38	41																		
11	D						100			2.14							40				
12.0-12.45	P	59	59																		
12.5	D						100			2.17		2.66					41				
13.5-13.95	P	49	46																		
14	D						100			2.20											
15.0-15.45	P	31	21																		
15.5	D				15.00M		100			2.08		2.67					40				

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 10-03-2022 Date completed: 12-03-2022

BH: MBH-04 DEPTH OF WATER TABLE = 2.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt and Clay <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	73	63		Grayish Fine to Medium Sand																
17	D						100			2.20		2.66					40				
18.0-18.45	P	R	R																		
18.5	D						100			2.24											
19.5-19.95	P	R	R																		
20	D						100			2.24		2.67					41				
21.0-21.45	P	R	R																		
21.5	D						100														
22.5-22.95	P	R	R																		
23	D			**SW**			100			2.25		2.67					42				
24.0-24.45	P	R	R																		
24.5	D						100														
25.5-25.95	P	R	R																		
26.0	D						100			2.28		2.67					43				
27.0-27.45	P	R	R																		
27.5	D						100														
28.5-28.95	P	R	R																		
29.0	D						100			2.27		2.67					41				
30.0-30.45	P	R	R																		
30.5	D				30.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 10-03-2022 Date completed: 12-03-2022

BH: MBH-04 DEPTH OF WATER TABLE = 2.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt and Clay <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
31.5-31.95	P	R	R		Grayish Fine to Medium Sand																
32	D						100			2.29		2.66					42				
33.0-33.45	P	R	R																		
33.5	D						100														
34.5-34.95	P	R	R																		
35	D						100			2.30		2.66					41				
36.0-36.45	P	R	R																		
36.5	D						100														
37.5-37.95	P	R	R																		
38	D			**SW**			100			2.31		2.66					42				
39.0-39.45	P	R	R																		
39.5	D						100														
40.5-40.95	P	R	R																		
41	D						100			2.32		2.67					42				
42.0-42.45	P	R	R																		
42.5	D						100														
43.5-43.95	P	R	R																		
44	D						100			2.34		2.67					42				
45.0-45.45	P	R	R																		
45.5	D				45.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 10-03-2022 Date completed: 12-03-2022

BH: MBH-04 DEPTH OF WATER TABLE = 2.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt and Clay <0.075mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
46.5-46.95	P	R	R	SW	Grayish Brown Fine to Medium Sand															
47	D						100		2.31		2.66					41				
48.0-48.45	P	R	R																	
48.5	D						100													
49.5-49.95	P	R	R																	
50	D						100		2.32		2.67					42				
51.0-51.45	P	R	R																	
51.5	D				52.00M		100													

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 07-03-2022 Date completed: 09-03-2022

BH: MBH-05 DEPTH OF WATER TABLE = 2.50M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	%Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	3	6		Grayish Fine Sand with silts																
2	D						80	20		1.48		2.65					29				
3.0-3.45	P	5	8	**SP**																	
3.5	D						80	20		1.49		2.65					29				
4.5-4.95	P	24	25																		
5	D				6.00M		90	10		1.85		2.65					34				
6.0-6.45	P	64	83		Grayish Brown Fine to Medium Sand																
6.5	D						90	10		1.98		2.66					37				
7.5-7.95	P	103	121																		
8	D						95	5													
9.0-9.45	P	94	103																		
9.5	D						100			2.08		2.66					36				
10.5-10.95	P	81	84	**SW**																	
11	D						100														
12.0-12.45	P	33	32																		
12.5	D						100			2.00		2.67					36				
13.5-13.95	P	52	49																		
14	D						100														
15.0-15.45	P	94	84																		
15.5	D				15.00M		100			2.10		2.67					37				

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 07-03-2022 Date completed: 09-03-2022

BH: MBH-05 DEPTH OF WATER TABLE = 2.50M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	%Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	R	R		Grayish Brown Fine to Medium Sand																
17	D						100			2.14		2.66					39				
18.0-18.45	P	R	R																		
18.5	D						100			2.17											
19.5-19.95	P	R	R																		
20	D						100			2.17		2.67					40				
21.0-21.45	P	R	R																		
21.5	D						100														
22.5-22.95	P	R	R																		
23	D			**SW**			100			2.21		2.67					41				
24.0-24.45	P	R	R																		
24.5	D						100														
25.5-25.95	P	R	R																		
26.0	D						100			2.24		2.67					41				
27.0-27.45	P	R	R																		
27.5	D						100														
28.5-28.95	P	R	R																		
29.0	D						100			2.24		2.67					42				
30.0-30.45	P	R	R																		
30.5	D				30.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 07-03-2022 Date completed: 09-03-2022

BH: MBH-05 DEPTH OF WATER TABLE = 2.50M above EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	%Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
31.5-31.95	P	R	R		Grayish Brown Fine to Medium Sand																
32	D						100			2.28		2.66					43				
33.0-33.45	P	R	R																		
33.5	D						100														
34.5-34.95	P	R	R																		
35	D						100			2.25		2.66					41				
36.0-36.45	P	R	R																		
36.5	D						100														
37.5-37.95	P	R	R																		
38	D						100			2.27		2.66					42				
39.0-39.45	P	R	R	**SW**																	
39.5	D						100														
40.5-40.95	P	R	R																		
41	D						100			2.27		2.66					43				
42.0-42.45	P	R	R																		
42.5	D						100														
43.5-43.95	P	R	R																		
44	D						100			2.30		2.67					42				
45.0-45.45	P	R	R																		
45.5	D						100														
46.5-46.95	P	R	R							2.32		2.67									
47	D				48.00M		100														

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 27-02-2022 Date completed: 01-03-2022

BH: LBH-01 DEPTH OF WATER TABLE = 5.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
0.0-1.5					Grayish Silty Clay																
1.5-1.95	P				Sand bag																
2	D				2.00M		100														
3.0-3.45	P	2	4	SP	Grayish Fine Sand with Silt																
3.5	D				and Clay 3.50M		70	10	20	1.48		2.65					28				
3.50-5.00	P	R	R		Grayish Brown Boulder	Core recovery=19.33% RQD=Nil															
5.50-7.00	P	R	R		6.00M	Core recovery=23.33% RQD=7.33%				1.95		2.65									
7.5-7.95	P	13	13		Brownish Silty Clay																
8	U				9.00M		100			2.02					1.74	0.87					
9.0-9.45	P	14	16	SP	Grayish Fine Sand with Silt																
9.5	D						100			1.82		2.66					32				
10.5-10.95	P	16	17																		
11	D						100			1.86											
12.0-12.45	P	21	18																		
12.5	D						100			1.92		2.67					32				
13.5-13.95	P	25	20																		
14	D				14.00M		100			1.98											
15.0-15.45	P			CL	Grayish Silty Clay																
15.5	U				15.00M		100			1.92	1.532	2.65	0.73	25.34	1.20	0.60	8	0.14	31.98	23.59	8.39

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 27-02-2022 Date completed: 01-03-2022

BH: LBH-01 DEPTH OF WATER TABLE = 5.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	17	17	**CL**	Grayish Silty Clay																
17	U				17.00M			20	80	2.09		2.66			2.26	1.13					
18.0-18.45	P	29	20		Grayish Fine Sand with Silt																
18.5	D				18.00M		80	20		2.05							33				

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 25-02-2022 Date completed: 26-02-2022

BH: LBH-02 DEPTH OF WATER TABLE = 6.00M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
0.0-1.5					Grayish Silty Clay																
1.5-1.95	P	4	7		Grayish Fine Sand with Silt																
2	D				2.50M		80	20		1.49							29				
2.5-3.0					Whitish Brown Boulder																
3.0-3.45	P	8	13	**SP**	Grayish Fine Sand with Silt																
3.5	D				4.00M		70	30		1.65		2.65					31				
4.5-4.95	P	9	9		Brownish Silty Clay																
5	U							30	70	1.85	1.476	2.65	0.795	25.34	1.20	0.6	5	0.16	34.75	24.42	10.33
6.0-6.45	P	8	8																		
6.5	U			**CL**				20	80	1.82	1.454	2.65	0.822	25.13	1.06	0.53	7	0.17	34.52	24.36	10.16
7.5-7.95	P	11	11																		
8	U							10	90												
9.0-9.45	P	16	16																		
9.5	U				10.0M			10	90	1.95		2.66			1.68	0.84					
10.5-10.95	P	17	15		Grayish Fine Sand with Silt																
11	D						90	10		1.87							31				
12.0-12.45	P	26	18																		
12.5	D			**SP**			85	15		2.00		2.67					32				
13.5-13.95	P	26	18																		
14	D						85	15													
15.0-15.45	P																				
15.5	U				15.00M		90	10													

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 25-02-2022 Date completed: 26-02-2022

BH: LBH-02 DEPTH OF WATER TABLE = 6.00M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	14	11	**SP**	Grayish Fine Sand with Silt and Clay																
17	U						80	10	10	1.87		2.67					30				
18.0-18.45	P	20	15																		
18.5	D				18.8M		80	10	10	1.90							31				

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 02-03-2022 Date completed: 03-03-2022

BH: LBH-03 DEPTH OF WATER TABLE = 5.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	4	4		Brownish Silty Clay																
2	D				2.00M			20	80	1.76											
3.0-3.45	P	6	8		Grayish Fine Sand with Silt and Clay																
3.5	D						70	10	20	1.55		2.65					29				
4.5-4.95	P	7	9																		
5	U						80	10	10	1.60		2.65					30				
6.0-6.45	P	16	19																		
6.5	U						90	5	5	1.86		2.65					33				
7.5-7.95	P	16	18																		
8	U						85	10	5	1.86											
9.0-9.45	P	9	10																		
9.5	U			**SP**			80	10	10	1.71		2.66					30				
10.5-10.95	P	16	16																		
11	D						80	10	10	1.86							32				
12.0-12.45	P	14	14																		
12.5	D						80	10	10	1.82		2.67					31				
13.5-13.95	P	15	14																		
14	D						75	5	30	1.84											
15.0-15.45	P	10	9																		
15.5	U				15.00M		60	5	35	1.76											

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 02-03-2022 Date completed: 03-03-2022

BH: LBH-03 DEPTH OF WATER TABLE = 5.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	7	7	CL	Grayish Silty Clay with Fine Sand																
17	U						20	5	75	1.88	1.509	2.65	0.756	24.56	0.94	0.47	5	0.15	35.69	24.7	10.99
18.0-18.45	P																				
18.5	U						10	10	80	1.82	1.454	2.65	0.822	25.13	1.26	0.63	7	0.17	34.92	24.48	10.44
19.5-19.95	P	13	13																		
20	U				20.0M		30	10	60						1.74	0.87					
21.0-21.45	P	17	15	SP	Grayish Fine Sand with Silt and Clay																
21.5	D						60	10	30	1.87							31				
22.5-22.95	P	26	18																		
23	D				22.50M		80	10	10	2.00							32				

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 04-03-2022 Date completed: 06-03-2022

BH: LBH-04 DEPTH OF WATER TABLE = 4.80M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	R	R		Grayish Sandy Clay with Gravel and Boulder 2.0M	Core recovery=10.00% RQD=Nil															
2	D																				
3.0-3.45	P	16	27	SP	Grayish Fine to Medium Sand with Clay 4.0M																
3.5	D						70	10	20	1.86		2.65					32				
4.50-4.95	P	R	R		Concrete Material 5.00M	Core recovery=12.00% RQD=Nil															
5	U																				
6.0-6.45	P	5	5	CL	Brownish Silty Clay																
6.5	U							10	90	1.80		2.64			0.66	0.33					
7.5-7.95	P	6	6																		
8	U							20	80	1.84		2.64			0.80	0.40					
9.0-9.45	P																				
9.5	D				10.0M			20	80	1.84	1.471	2.65	0.801	25.08	1.34	0.67	7	0.16	34.33	24.29	10.04
10.5-10.95	P	8	9	SP	Grayish Fine Sand with Silt																
11	D						80	20		1.65		2.65					30				
12.0-12.45	P	18	17																		
12.5	D				13.0M		75	25		1.89		2.66					32				
13.5-13.95	P	25	25	CL	Grayish Sandy Clay with silt																
14	D							20	80	2.12		2.64			3.34	1.67					
15.0-15.45	P																				
15.5	U				16.00M		20	10	70	1.98	1.589	2.65	0.667	24.58	1.90	0.95		0.12	34.85	24.45	10.40

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 04-03-2022 Date completed: 06-03-2022

BH: LBH-04 DEPTH OF WATER TABLE = 4.80M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	17	15	**SP**	Grayish Brown Fine Sand with Silt																
17	U						70	20	10	1.87		2.66					31				
18.0-18.45	P	18	15																		
18.5	D						80	15	5	1.89											
19.5-19.95	P	33	21																		
20	U						90	10		2.10		2.67					33				
21.0-21.45	P	35	21																		
21.5	D				21.00M		90	10		2.12											

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 07-03-2022 Date completed: 08-03-2022

BH: LBH-05 DEPTH OF WATER TABLE = 5.300M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	20	20		Grayish Sandy Clay																
2	U						30	10	60	1.95					2.26	1.13					
3.0-3.45	P	5	5																		
3.5	U			**CL**			20	10	70	1.80	1.422	2.65	0.863	26.54	0.66	0.33	6	0.18	35.24	24.57	10.67
4.50-4.95	P	5	5																		
5	U						30	5	75												
6.0-6.45	P																				
6.5	U				7.00M		30	10	60	1.82	1.458	2.65	0.818	24.85	1.30	0.65	8	0.16	35.12	24.53	10.59
7.5-7.95	P	10	17		Grayish Fine Sand with Silt and Clay																
8	D						70	10	20	1.76		2.64					32				
9.0-9.45	P	13	19																		
9.5	D						75	15	10												
10.5-10.95	P	23	23																		
11	D						80	10	10	1.95		2.65					33				
12.0-12.45	P	14	17	**SP**																	
12.5	D						85	10	5	1.82		2.66					32				
13.5-13.95	P	15	17																		
14	D						90	5	5												
15.0-15.45	P	30	24																		
15.5	D				16.00M		90	10		1.98							34				

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 07-03-2022 Date completed: 08-03-2022

BH: LBH-05 DEPTH OF WATER TABLE = 5.300M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	36	26	SP	Grayish Brown Fine Sand with Silt																
17	D						90	10		2.06		2.66					35				
18.0-18.45	P	27	21																		
18.5	D						85	15		2.00											
19.5-19.95	P	39	36																		
20	D						90	10		2.10		2.67					36				
21.0-21.45	P	45	40																		
21.5	D				21.00M		95	5		2.15											

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 09-03-2022 Date completed: 10-03-2022

BH: LBH-06 DEPTH OF WATER TABLE = 5.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	3	3		Grayish Sandy Clay with Boulder																
2	U					10	20	10	60	1.68					0.40	0.20					
3.0-3.45	P	10	10																		
3.5	U						20	10	70	1.96	1.56	2.64	0.69	25.84	1.34	0.67	7	0.13	35.42	24.62	10.80
4.50-4.95	P	11	11																		
5	U			**CL**			30	5	75	1.98		2.64			1.46	0.73					
6.0-6.45	P																				
6.5	U						30	10	60	1.9	1.51	2.64	0.75	25.63	1.26	0.63	6	0.14	34.66	24.39	10.27
7.5-7.95	P	11	11																		
8	U				8.00M		35	10	55	1.98		2.64									
9.0-9.45	P	25	28		Brownish Fine Sand with Silt																
9.5	D						65	25	10	1.98							33				
10.5-10.95	P	26	26																		
11	D						70	20	10	2.00		2.65					33				
12.0-12.45	P	9	12																		
12.5	D						70	10	20	1.79		2.66					31				
13.5-13.95	P	25	22																		
14	D						80	15	5	1.98											
15.0-15.45	P																				
15.5	D				16.00M		90	10													

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 09-03-2022 Date completed: 10-03-2022

BH: LBH-06 DEPTH OF WATER TABLE = 5.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	26	22	**SP**	Brownish Fine Sand with Silt and Clay																
17	D						90	5	5	2.00		2.66					35				
18.0-18.45	P	23	20																		
18.5	D						85	10	5	1.95											
19.5-19.95	P	25	20																		
20	D						80	10	10	1.98		2.67					36				
21.0-21.45	P	43	41																		
21.5	D				21.00M		80	15	5	2.12											

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 11-03-2022 Date completed: 12-03-2022

BH: LBH-07 DEPTH OF WATER TABLE = 5.0M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	5	5		Brownish Sandy Clay																
2	U						20	10	70	1.80	1.43	2.64	0.85	26.15	0.4	0.20	5	0.17	36.98	25.09	11.89
3.0-3.45	P	17	17																		
3.5	U					10	20	10	60	2.02		2.64			2.14	1.07					
4.50-4.95	P	13	13																		
5	U			**CL**		5	20	10	65	1.98					1.7	0.85					
6.0-6.45	P																				
6.5	U						25	10	65	1.92	1.54	2.64	0.72	24.92	1.48	0.74	6	0.13	36.22	24.86	11.36
7.5-7.95	P	7	7																		
8	U						20	5	75	1.88		2.64			0.94	0.47					
9.0-9.45	P																				
9.5	U				10.50M		25	5	70	1.82	1.46	2.64	0.81	24.92	1.42	0.71	7	0.16	35.87	24.76	11.11
10.5-10.95	P	9	16		Brownish Fine Sand with Silt																
11	D			**SP**			70	20	10	1.71		2.65					32				
12.0-12.45	P	23	24																		
12.5	D				13.00M		80	20		1.88		2.66					34				
13.5-13.95	P	25	25		Brownish Silty Clay with Sand																
14	U			**CL**			20	15	65	1.98					3.24	1.62					
15.0-15.45	P																				
15.5	U				16.00M		20	10	70	1.88	1.51	2.64	0.74	24.26	2.08	0.74	9	0.14	34.54	24.36	10.18

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 11-03-2022 Date completed: 12-03-2022

BH: LBH-07 DEPTH OF WATER TABLE = 5.0M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	20	20	**CL**	Brownish Silty Clay with Sand																
17	D				17.00M		25	5	70			2.66			2.60	1.30					
18.0-18.45	P	21	21	**SP**	Brownish Fine Sand with Silt																
18.5	D						80	10	10	1.92							33				
19.5-19.95	P	24	22																		
20	D						90	5	5	1.97		2.67					33				
21.0-21.45	P	46	51																		
21.5	D						95	5		2.18							36				
22.5-22.95	P	49	51																		
23	D				22.50M		95	5		2.20											

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 13-03-2022 Date completed: 14-03-2022

BH: LBH-08 DEPTH OF WATER TABLE = 2.0M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	5	5		Grayish Sandy Clay																
2	U					10	10	5	75	1.80	1.43	2.64	0.85	26.25	0.66	0.33	5	0.17	35.15	24.54	10.61
3.0-3.45	P	7	7																		
3.5	U					5	20	5	70	1.88	1.49	2.64	0.77	25.88	0.94	0.47	7	0.15	34.98	24.49	10.49
4.50-4.95	P	11	11																		
5	U			**CL**			30	5	65	1.98					1.46	0.73					
6.0-6.45	P																				
6.5	U						25	10	65												
7.5-7.95	P	10	10																		
8	U				8.00M		30	10	60	1.94		2.64			1.34	0.67					
9.0-9.45	P	17	22		Brownish Fine Sand with Silt and Clay																
9.5	D						75	10	15	1.87											
10.5-10.95	P	12	18	**SP**																	
11	D						80	15	5	1.79		2.65					32				
12.0-12.45	P	18	19																		
12.5	D				12.00M		70	10	20	1.89		2.66					34				
13.5-13.95	P	14	14		Brownish Sandy Clay																
14	U			**CL**			10	10	80	2.02					1.86	0.93					
15.0-15.45	P	18	18																		
15.5	U				16.00M		15	10	75	2.06					2.24	1.12					

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 13-03-2022 Date completed: 14-03-2022

BH: LBH-08 DEPTH OF WATER TABLE = 2.0M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	21	21		Brownish Sandy Clay																
17	U			**CL**			20	10	70	2.10		2.65			2.8	1.40					
18.0-18.45	P																				
18.5	U				18.00M		20	10	70	2.08	1.67	2.64	0.58	24.36	1.48	0.74	7	0.09	34.58	24.37	10.21
19.5-19.95	P	R	R	**SP**	Brownish Fine to Medium Sand																
20	D						90	5	5	2.15		2.67					36				
21.0-21.45	P	R	R																		
21.5	D						100			2.18		2.67					38				
22.5-22.95	P	R	R																		
23	D				22.50M		100			2.20											

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 15-03-2022 Date completed: 16-03-2022

BH: LBH-09 DEPTH OF WATER TABLE = 0.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive Strength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ˚)	Compression Index Cc	LL%	PL%	PI%
1.5-1.95	P	1	1	CL	Grayish Sandy Clay with Gravel 2.00M																
2	U					10	10	5	75	1.60		2.64									
3.0-3.45	P	10	10		Grayish Sandy Clay																
3.5	U						20	5	75	1.96	1.56	2.64	0.70	25.88	1.34	0.67	6	0.13	35.66	24.7	10.96
4.50-4.95	P	10	10																		
5	U						20	10	70												
6.0-6.45	P																				
6.5	U						20	10	70	1.98		2.65			1.42	0.71					
7.5-7.95	P	12	12																		
8	U						20	15	65	2.00		2.64			1.6	0.80					
9.0-9.45	P	11	11																		
9.5	D						25	5	70												
10.5-10.95	P	14	14																		
11	D						30	10	60	2.04		2.65			1.84	0.92					
12.0-12.45	P																				
12.5	D						35	5	60	1.95	1.55	2.64	0.70	25.88	1.54	0.77	5	0.13	34.74	24.42	10.32
13.5-13.95	P	18	18																		
14	U						35	10	55	2.10		2.66			2.4	1.20					
15.0-15.45	P	20	20																		
15.5	U				15.00M		40	5	55												

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

BORE LOG CUM LABORATORY TEST RESULT

GEOTECHNICAL INVESTIGATION WORK FOR THE CONSTRUCTION OF PROPOSED SHIP REPAIR FACILITY AT PANDU, ASSAM

Boring method: Rotary Drilling Boring dia: 150mm Date Commenced: 15-03-2022 Date completed: 16-03-2022

BH: LBH-09 DEPTH OF WATER TABLE = 0.50M below EGL

Depth in meters below reference	Types of Sample	Observed N-Value	Corrected N-Value	Group Symbol	Visual description of soil	% Gravel > 4.75 mm	% Sand 4.75-0.075 mm	% Silt <0.075mm	% Clay <0.002mm	Field density, gms/cm³	Dry density, gms/cm3	Specific Gravity	Void Ratio	Natural moisture content	Unconfined compressive rength (Kg/cm²)	Cohesion 'c' Kg/cm²	Angle of shearing resistance (Φ°)	Compression Index Cc	LL%	PL%	PI%
16.5-16.95	P	39	55	**SP**	Brownish Fine Sand with Silt																
17	U						80	20		2.15		2.65					36				
18.0-18.45	P	50	62																		
18.5	U				18.00M		95	5		2.18											
19.5-19.95	P	72	82	**SW**	Brownish Fine to Medium Sand																
20	D						100			2.20		2.67					36				
21.0-21.45	P	112	118																		
21.5	D				21.00M		100			2.24		2.67					38				

U: Undisturbed Sample:: D: Disturbed Sample:: P: Standard Penetration test:: EGL: Existing Ground Level :: R : Refusal N>100, NP: Non plastic

CALCULATION OF PILE LOAD CAPACITY (for MBH-01, MBH-02, MBH-03, MBH-04 & MBH-05)

Pile Length .(M)	20.000		If Liquified strata than liquified level	No
Pile cutoff Length (m)	3.000		Pile Terminating level	
Angle of Internal Friction at Pile Tip (Degree)	ø		32	
Cohesion at Pile tip (t/m2)	c		0	

Bearing Capacity Factor		
Nc	Nq	Ny
9	28.00	32.65

Ultimate pile capacity , Qu = QP + Qs = { Ap Nc Cp + Ap (1/2 D γ Nγ + P_D Nq} +{ Sum (K P_{Di} tan d Asi) + alpha x Ca As }

Qp = End bearing resistnce , Qs = Frictional resistsnce

1 Pile dia (m) = 1

Depth from	Depth to	Length below cutoff (m)	Thickness of sand layer	Li	C, T/m2	alpha	Pile dia D, m	Circumferential area As, m2	K	phi	Y (metric ton/m3)	Ysub (metric ton/m3)	po' ton/m2	Qs, Tonne	Qp, Tonne	Qu, Tonne	Qsafe in copression , Metric Tonne	Q safe Uplift, Metric Tonne
0.00	10.00			10.00	Ignored													
10.00	20.00		10.00	10.00			1.00	31.42	1.00	32	1.90	0.90	4.50	88.34				
15D =	15.00	17.00	10.00	15.00			1.00			0	1.90	0.90	13.50	88.34	308.42	396.76	158.70	45.26

2 Pile dia (m) = 1.2

0.00	10.00			10.00	Ignored						0.0							
10.00	20.00		10.00	10.00			1.20	37.70	1.00	32	1.90	0.90	4.50	106.01				
15D =	18.00	17.00	10.00	17.00			1.20			0	1.90	0.90	15.30	106.01	504.45	610.46	244.18	59.11

CALCATION OF PILE LOAD CAPACITY (for LBH-01 & LBH-03)

Pile Length .(M)	17.000	
Angle of Internal Friction at Pile Tip (Degree)	ø	0
Cohesion at Pile tip (t/m2)	c	8

Bearing Capacity Factor		
Nc	Nq	Ny
9	28.00	32.65

Ultimate pile capacity , Qu = QP + Qs = { Ap Nc Cp + Ap (1/2 D γ Nγ + P_D Nq} +{ Sum (K P_{Di} tan d Asi) + alpha x Ca As }
Qp = End bearing resistnce , Qs = Frictional resistsnce

1 Pile dia (m) = 1.0 Pile cutoff = 3 m

Depth from	Depth to	Length below cutoff (m)	Thickness of sand layer	Li	C, T/m2	alpha	Pile dia D, m	Circumferential area As, m2	K	phi	Y (metric ton/m3)	Ysub (metric ton/m3)	po' ton/m2	Qs, Tonne	Qp, Tonne	Qu, Tonne	Qsafe in copression , Metric Tonne	Q safe Uplift, Metric Tonne
0.00	10.00			10.00	Ignored						0.0							
10.00	15.00			5.00			1.00	15.71	1.00	32	1.75	0.75	3.75	26.23				
15.00	17.00		2.00	2.00	6.00	0.38	1.00	6.28		0	1.82	0.82	4.57	14.33				
15D =	15.00	14.00		13.50			1.00			0				40.55	56.55	97.10	38.84	28.07

2 Pile dia (m) = 1.2 Pile cutoff = 3 m

0.00	10.00			10.00	Ignored						0.0							
10.00	15.00			5.00			1.20	18.85	1.00	32	1.75	0.75	3.75	31.47				
15.00	17.00		2.00	2.00	6.00	0.38	1.20	7.54		0	1.82	0.82	4.57	17.19				
15D =	18.00	14.00		13.50			1.20			0				48.66	81.43	130.09	52.04	37.64

CALCULATION OF PILE LOAD CAPACITY (for LBH-02, LBH-05 & LBH-06)

Pile Length .(M)	18.000	If Liquified strata than liquified level	No
Pile cutoff Length (m)	3.000	Pile Terminating level	
Angle of Internal Friction at Pile Tip (Degree)	ø	32	
Cohesion at Pile tip (t/m2)	c	0	

Bearing Capacity Factor		
Nc	Nq	Ny
9	28.00	32.65

Ultimate pile capacity , Qu = QP + Qs = { Ap Nc Cp + Ap (1/2 D γ Nγ + P_D Nq} +{ Sum (K P_{Di} tan d Asi) + alpha x Ca As }

Qp = End bearing resistnce , Qs = Frictional resistsnce

1 Pile dia (m) = 1

Depth from	Depth to	Length below cutoff (m)	Thickness of sand layer	Li	C, T/m2	alpha	Pile dia D, m	Circumferential area As, m2	K	phi	Y (metric ton/m3)	Ysub (metric ton/m3)	po' ton/m2	Qs, Tonne	Qp, Tonne	Qu, Tonne	Qsafe in copression , Metric Tonne	Q safe Uplift, Metric Tonne
0.00	10.00			10.00	Ignored													
10.00	18.00		8.00	8.00			1.00	25.13	1.00	32	1.80	0.80	3.20	50.25				
15D =	15.00	15.00	8.00	15.00			1.00			0	1.90	0.90	13.50	50.25	308.42	358.68	143.47	32.02

2 Pile dia (m) = 1.2

0.00	10.00			10.00	Ignored						0.0							
10.00	18.00		8.00	8.00			1.20	30.16	1.00	32	1.80	0.80	3.20	60.31				
15D =	18.00	15.00	8.00	15.00			1.20			0	1.90	0.90	13.50	60.31	447.45	507.76	203.10	42.66

CALCULATION OF PILE LOAD CAPACITY (for LBH-04, LBH-07 & LBH-08)

Pile Length .(M)	20.000	If Liquified strata than liquified level	No
Pile cutoff Length (m)	3.000	Pile Terminating level	
Angle of Internal Friction at Pile Tip (Degree)	Ø	32	
Cohesion at Pile tip (t/m2)	c		

Bearing Capacity Factor		
Nc	Nq	Ny
9	28.00	32.65

Ultimate pile capacity , Qu = QP + Qs = { Ap Nc Cp + Ap (1/2 D γ Nγ + P_D Nq} +{ Sum (K P_{Di} tan d Asi) + alpha x Ca As }
Qp = End bearing resistnce , Qs = Frictional resistsnce

1 Pile dia (m) = 1.0

Depth from	Depth to	Length below cutoff (m)	Thickness of sand layer	Li	C, T/m2	alpha	Pile dia D, m	Circumferential area As, m2	K	phi	Y (metric ton/m3)	Ysub (metric ton/m3)	po' ton/m2	Qs, Tonne	Qp, Tonne	Qu, Tonne	Qsafe in copression , Metric Tonne	Q safe Uplift, Metric Tonne
0.00	10.00			10.00	Ignored													
10.00	13.00		3.00	3.00			1.00	9.42	1.00	32	1.70	0.70	1.50	63.27				
13.00	16.00			3.00	9.00	0.28	1.00	9.42	1.00	0	1.85	0.85	3.38	23.75				
16.00	20.00		4.00	4.00			1.00	12.57	1.00	32	1.90	0.90	6.69	52.53				
15D =	15.00	17.00		15.00			1.00			0	1.98	0.98	14.45	139.55	330.34	469.89	156.63	59.89

2 Pile dia (m) = 1.2

0.00	10.00			10.00	Ignored						0.0							
10.00	13.00		3.00	3.00			1.20	11.31	1.00	32	1.70	0.70	1.50	63.27				
13.00	16.00			3.00	9.00	0.28	1.20	11.31	1.00	0	1.85	0.85	3.38	28.50				
16.00	20.00		4.00	4.00			1.20	15.08	1.00	32	1.90	0.90	6.69	63.04				
15D =	18.00	17.00		17.00			1.20			0	1.98	0.98	14.45	154.80	479.31	634.11	211.37	73.06

CALCULATION OF PILE LOAD CAPACITY (for LBH-09)

Pile Length .(M)	17.000	If Liquified strata than liquified level	No
Pile cutoff Length (m)	3.000	Pile Terminating level	
Angle of Internal Friction at Pile Tip (Degree)	ø	34	
Cohesion at Pile tip (t/m2)	c	0	

Bearing Capacity Factor			
Nc	Nq	Ny	
9	37.00	42.90	34

Ultimate pile capacity , Qu = QP + Qs = { Ap Nc Cp + Ap (1/2 D γ Nγ + P_D Nq} +{ Sum (K P_{Di} tan d Asi) + alpha x Ca As }

Qp = End bearing resistnce , Qs = Frictional resistsnce

1 Pile dia (m) = 1.0

Depth from	Depth to	Length below cutoff (m)	Thickness of sand layer	Li	C, T/m2	alpha	Pile dia D, m	Circumferential area As, m2	K	phi	Y (metric ton/m3)	Ysub (metric ton/m3)	po' ton/m2	Qs, Tonne	Qp, Tonne	Qu, Tonne	Qsafe in copression , Metric Tonne	Q safe Uplift, Metric Tonne
0.00	10.00			10.00	Ignored						0.0							
10.00	15.00			5.00	9.00	0.28	1.00	15.71		0	1.85	0.85	4.25	39.58				
15.00	17.00		2.00	2.00			1.00	6.28	1.00	34	1.90	0.90	5.15	21.83				
15D =	15.00	14.00		14.00			1.00			0	1.90	0.90	16.85	61.41	504.82	566.23	188.74	34.03

2 Pile dia (m) = 1.2

0.00	10.00			10.00	Ignored						0.0							
10.00	15.00			5.00	9.00	0.28	1.20	18.85		0	1.85	0.85	4.25	47.50				
15.00	17.00		2.00	2.00			1.20	7.54	1.00	34	1.90	0.90	5.15	26.19				
15D =	18.00	14.00		14.00			1.20			0	1.90	0.90	16.85	73.69	731.31	805.00	268.33	44.79

CALCULATION OF LATERAL LOAD CAPACITY OF PILE

(for MBH-01, MBH-02, MBH-03, MBH-04 & MBH-05)

Ref : Appendix-C (cl 6.5.2) of IS 2911 (Part 1/Sec. 2) – 2010

Stiffness factor R = $\sqrt[4]{\frac{EI}{KB}}$ for clay soil

T = $\sqrt[5]{\frac{EI}{\eta h}}$ for sandy soil

E = Modulus of Elasticity of pile material= $5000\sqrt{f_{ck}}$

E = $25x10^6$ KN/m^2 for concrete for f_{ck} = 25 N/mm^2

I = Moment of Inertia = $\pi D^4/64$

B= D = diameter of pile

Deflection of pile

$$y = \frac{H(e+Zf)x1000}{12\ EI}$$

H= lateral load in KN

y = deflection of pile head in mm

e = cantilever length above ground/ bed

E= Modulus of elasticity in KN/m^2

I = Moment of Inertia in m^4

Z_f = Depth of point of fixity in m

Calculation details (For Sand)

		fck=	25	N/mm2	
		E=	25000	N/mm2	
		E=	25000000	KN/m2	
1	Pile dia B=D(m)		1.00		
2	Pile Length L(m)		20.00		
	Pile Length (				
3	soft soil) L1(m)				
4	ηh =Modulus of subgrade reaction		6000.00	KN/m3	for Cohesionless soil
5	I= Moment of inertia		0.0491	m4	
6	E = Modulus of elasticity		25000000	KN/m2	
7	T		2.90		
8	L1/T		0.00		
9	Lf/T		2.15	(From Fig 4 of IS 2911(Part 1/Sec. 2) – 2010)	
10	Lf		6.23		
11	e (m) eccentricity		0.00		
12	zf (m) (Length of fixity)		0.00		
13	y=(Permissible deflection mm)		10.00		
14	**H = lateral load capacity**		**608.46**	**KN =**	**60.85** **Ton**

CALCULATION OF LATERAL LOAD CAPACITY OF PILE

(for LBH-02, LBH-05, & LBH-06)

Ref : Appendix-C (cl 6.5.2) of IS 2911 (Part 1/Sec. 2) – 2010

Stiffness factor R = $\sqrt[4]{\frac{EI}{KB}}$ for clay soil

T = $\sqrt[5]{\frac{EI}{\eta h}}$ for sandy soil

E = Modulus of Elasticity of pile material= $5000\sqrt{f_{ck}}$

E = $25x10^6$ KN/m^2 for concrete for f_{ck} = 25 N/mm^2

I = Moment of Inertia = $\pi D^4/64$

B= D = diameter of pile

Deflection of pile

$$y= \frac{H(e+Zf)x1000}{12\ EI}$$

H= lateral load in KN

y = deflection of pile head in mm

e = cantilever length above ground/ bed

E= Modulus of elasticity in KN/m^2

I = Moment of Inertia in m^4

Z_f = Depth of point of fixity in m

Calculation Details (Clay)

		fck=	25	N/mm2	
		E=	25000000	KN/m2	
1	Pile dia	B=D(m)	1.20		
2	Pile Length	L(m)	16.00		
	Pile Length				
3	(soft soil)	L1(m)	0.00		
5	k1= Modulus of subgrade reaction		15000.00	KN/m3	for Cohesive soil
6	K = k1x0.3/(1.5 xB)		2500.00		(medium stiff)
7	I= Moment of inertia		0.10	m4	
8	E = Modulus of elasticity		25000000	KN/m2	
9	R		5.40		
10	L1/R		0.00		
11	2R		10.79		L=12 > 2R
12	3.5R				
13	Lf/R		2.00		
14	Lf		10.79		
15	e (m)	eccentricity	0.00		
16		(Length of fixity)	13490.04		
17	y=(Permissible deflection mm)		12.00		
18	**H = lateral load capacity**		**291.38**	**KN =**	**29.14 Ton**

CALCULATION OF LATERAL LOAD CAPACITY OF PILE

(for LBH-02, LBH-05, & LBH-06)

Ref : Appendix-C (cl 6.5.2) of IS 2911 (Part 1/Sec. 2) – 2010

Stiffness factor R = $\sqrt[4]{\frac{EI}{KB}}$ for clay soil

T = $\sqrt[5]{\frac{EI}{\eta h}}$ for sandy soil

E = Modulus of Elasticity of pile material= $5000\sqrt{f_{ck}}$

E = $25x10^6$ KN/m^2 for concrete for f_{ck} = 25 N/mm^2

I = Moment of Inertia = $\pi D^4/64$

B= D = diameter of pile

Deflection of pile

$$y = \frac{H(e+Zf)x1000}{12\ EI}$$

H= lateral load in KN

y = deflection of pile head in mm

e = cantilever length above ground/ bed

E= Modulus of elasticity in KN/m^2

I = Moment of Inertia in m^4

Z_f = Depth of point of fixity in m

Calculation details (For Sand)

		fck=	25	N/mm2	
		E=	25000	N/mm2	
		E=	25000000	KN/m2	
1	Pile dia B=D(m)		1.00		
2	Pile Length L(m)		18.00		
	Pile Length (				
3	soft soil) L1(m)				
4	ηh =Modulus of subgrade reaction		5000.00	KN/m3	for Cohesionless soil
5	I= Moment of inertia		0.0491	m4	
6	E = Modulus of elasticity		25000000	KN/m2	
7	T		3.01		
8	L1/T		0.00		
9	Lf/T		2.15		(From Fig 4 of IS 2911(Part 1/Sec. 2) – 2010)
10	Lf		6.46		
11	e (m) eccentricity		0.00		
12	zf (m) (Length of fixity)		0.00		
13	y=(Permissible deflection mm)		10.00		
14	**H = lateral load capacity**		**545.41**	**KN =**	**54.54** **Ton**

CALCULATION OF LATERAL LOAD CAPACITY OF PILE

(for LBH-04, LBH-07, & LBH-08)

Ref : Appendix-C (cl 6.5.2) of IS 2911 (Part 1/Sec. 2) – 2010

Stiffness factor R = $\sqrt[4]{\frac{EI}{KB}}$ for clay soil

T = $\sqrt[5]{\frac{EI}{\eta h}}$ for sandy soil

E = Modulus of Elasticity of pile material= $5000\sqrt{f_{ck}}$

E = $25x10^6$ KN/m^2 for concrete for f_{ck} = 25 N/mm^2

I = Moment of Inertia = $\pi D^4/64$

B= D = diameter of pile

Deflection of pile

$$y = \frac{H(e+Zf)x1000}{12\ EI}$$

H= lateral load in KN

y = deflection of pile head in mm

e = cantilever length above ground/ bed

E= Modulus of elasticity in KN/m^2

I = Moment of Inertia in m^4

Z_f = Depth of point of fixity in m

Calculation details (For Sand)

		fck=	25	N/mm2	
		E=	25000	N/mm2	
		E=	25000000	KN/m2	
1	Pile dia B=D(m)		1.00		
2	Pile Length L(m)		18.00		
3	Pile Length (soft soil) L1(m)				
4	ηh =Modulus of subgrade reaction		3000.00	KN/m3	for Cohesionless soil
5	I= Moment of inertia		0.0491	m4	
6	E = Modulus of elasticity		25000000	KN/m2	
7	T		3.33		
8	L1/T		0.00		
9	Lf/T		2.15	(From Fig 4 of IS 2911(Part 1/Sec. 2) – 2010)	
10	Lf		7.16		
11	e (m) eccentricity		0.00		
12	zf (m) (Length of fixity)		0.00		
13	y=(Permissible deflection mm)		10.00		
14	**H = lateral load capacity**		**401.43**	**KN =**	**40.14** **Ton**

CALCULATION OF LATERAL LOAD CAPACITY OF PILE

(for LBH-09)

Ref : Appendix-C (cl 6.5.2) of IS 2911 (Part 1/Sec. 2) – 2010

Stiffness factor R = $\sqrt[4]{\frac{EI}{KB}}$ for clay soil

T = $\sqrt[5]{\frac{EI}{\eta h}}$ for sandy soil

E = Modulus of Elasticity of pile material= $5000\sqrt{f_{ck}}$

E = $25x10^6$ KN/m^2 for concrete for f_{ck} = 25 N/mm^2

I = Moment of Inertia = $\pi D^4/64$

B= D = diameter of pile

Deflection of pile

$$y = \frac{H(e+Zf)x1000}{12\ EI}$$

H= lateral load in KN

y = deflection of pile head in mm

e = cantilever length above ground/ bed

E= Modulus of elasticity in KN/m^2

I = Moment of Inertia in m^4

Z_f = Depth of point of fixity in m

Calculation details (For Sand)

		fck=	25	N/mm2	
		E=	25000	N/mm2	
		E=	25000000	KN/m2	
1	Pile dia B=D(m)		1.20		
2	Pile Length L(m)		17.00		
	Pile Length (				
3	soft soil) L1(m)		0.00		
4	ηh =Modulus of subgrade reaction		4000.00	KN/m3	for Cohesionless soil
5	I= Moment of inertia		0.1017	m4	
6	E = Modulus of elasticity		25000000	KN/m2	
7	T		3.64		
8	L1/T		0.00		
9	Lf/T		2.05	(From Fig 4 of IS 2911(Part 1/Sec. 2) – 2010)	
10	Lf		7.45		
11	e (m) eccentricity		0.00		
12	zf (m) (Length of fixity)		0.00		
13	y=(Permissible deflection mm)		12.00		
14	**H = lateral load capacity**		**884.10**	**KN =**	**88.41** **Ton**

SITE PHOTOGRAPHS

SITE PHOTOGRAPHS

SITE PHOTOGRAPHS

SITE PHOTOGRAPHS

SITE PHOTOGRAPHS

SITE PHOTOGRAPHS

SITE PHOTOGRAPHS

SITE PLAN


MBH 3
MBH 2
MBH 5
MBH 4
MBH 1
LBH 3
LBH 1
LBH 4
LBH 2
LBH 5
LBH 6
LBH 7
LBH 8
LBH 9
Pandu Port
Shree Shree Sevni Mandir
Mishra's Shiv Mandir
Pandu Water Resources Office
Pandu Nursery
Pandunath Primary Health Center
Ganesh mandir pandu maligaon
Central Reserve Police Force
Dry Fish Store
Pandu Railway Bazaar
NRC Office, Pandu Bazar
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SIEVE ANALYSIS

OF

BOREHOLE NO.

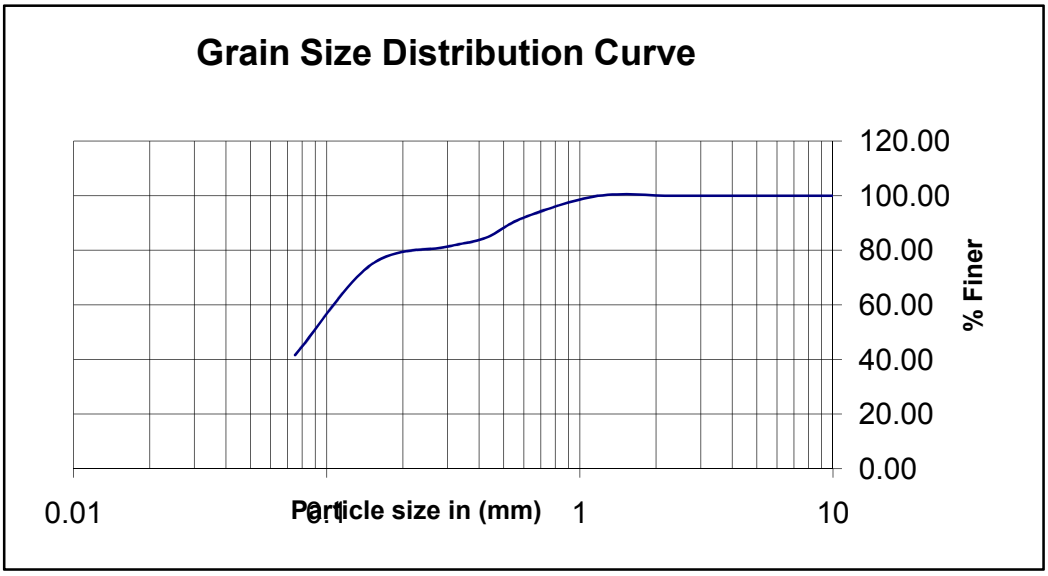
MBH-01

GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 3.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.06	0.04	0.04	99.96	**0.07**
0.6	0.89	11.31	7.98	8.03	91.97	**7.11**
0.425	0.51	10.45	7.38	15.40	84.60	**3.78**
0.3	0.36	4.60	3.25	18.65	81.35	**1.18**
0.15	0.23	9.32	6.58	25.23	74.77	**1.48**
0.075	0.11	47.02	33.19	58.43	41.57	**3.73**
Residue		58.89	58.43			**17.35**
		141.65				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.297 mm**

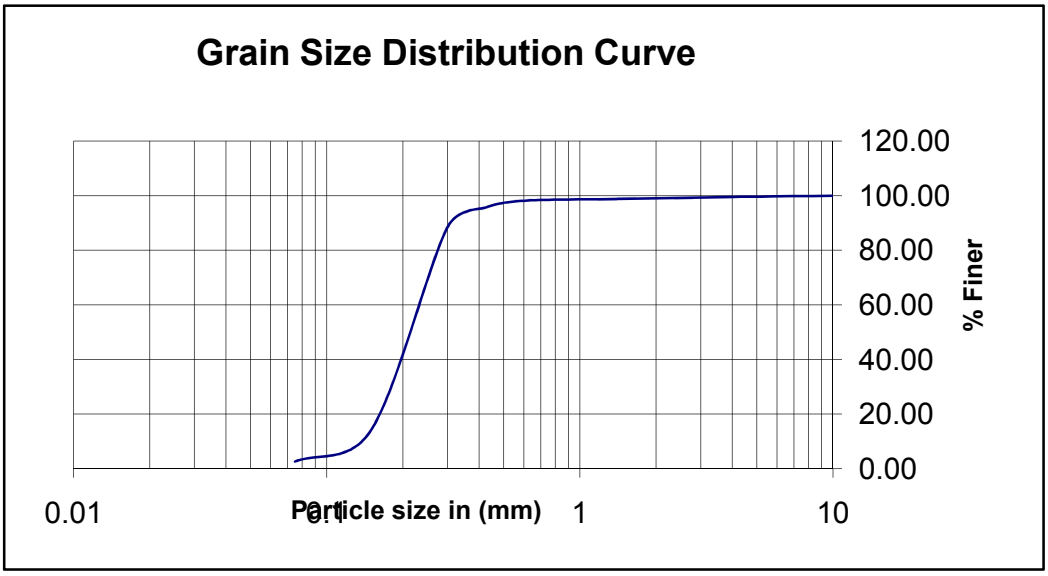


GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 6.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.84	0.35	0.35	99.65	**2.61**
2.36	3.56	1.10	0.46	0.82	99.18	**1.65**
1.18	1.77	1.04	0.44	1.26	98.74	**0.78**
0.6	0.89	1.38	0.58	1.84	98.16	**0.52**
0.425	0.51	5.82	2.45	4.29	95.71	**1.26**
0.3	0.36	17.20	7.25	11.54	88.46	**2.63**
0.15	0.23	176.23	74.25	85.78	14.22	**16.71**
0.075	0.11	27.48	11.58	97.36	2.64	**1.30**
Residue		6.26	97.36			**27.44**
		237.35				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.282 mm**

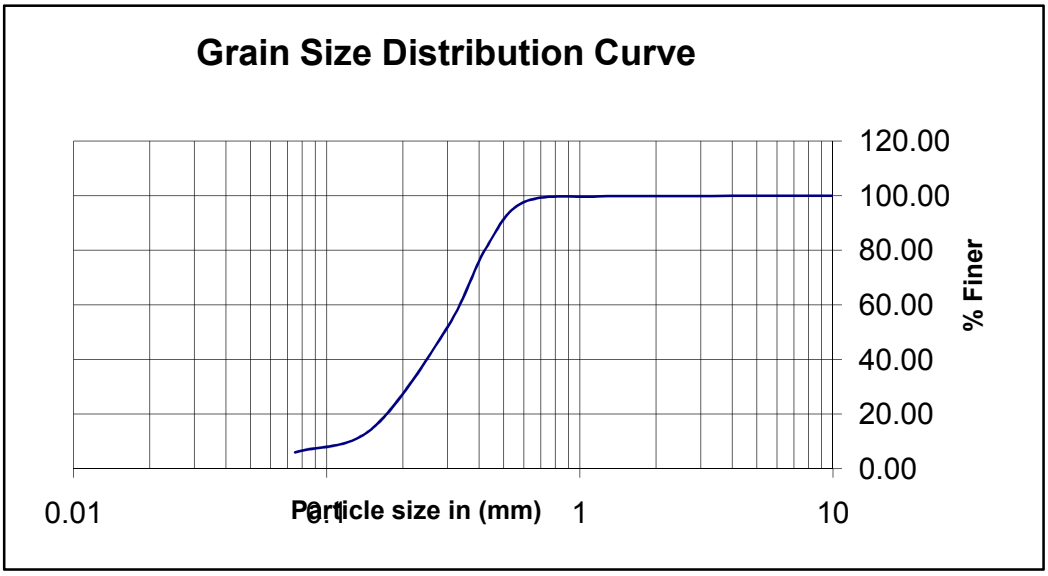


GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 9.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.43	0.14	0.14	99.86	**0.49**
1.18	1.77	0.34	0.11	0.25	99.75	**0.19**
0.6	0.89	6.49	2.10	2.35	97.65	**1.87**
0.425	0.51	52.56	16.98	19.32	80.68	**8.70**
0.3	0.36	89.17	28.80	48.13	51.87	**10.44**
0.15	0.23	115.95	37.45	85.58	14.42	**8.43**
0.075	0.11	26.19	8.46	94.04	5.96	**0.95**
Residue		18.45	94.04			**31.08**
		309.58				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.330 mm**

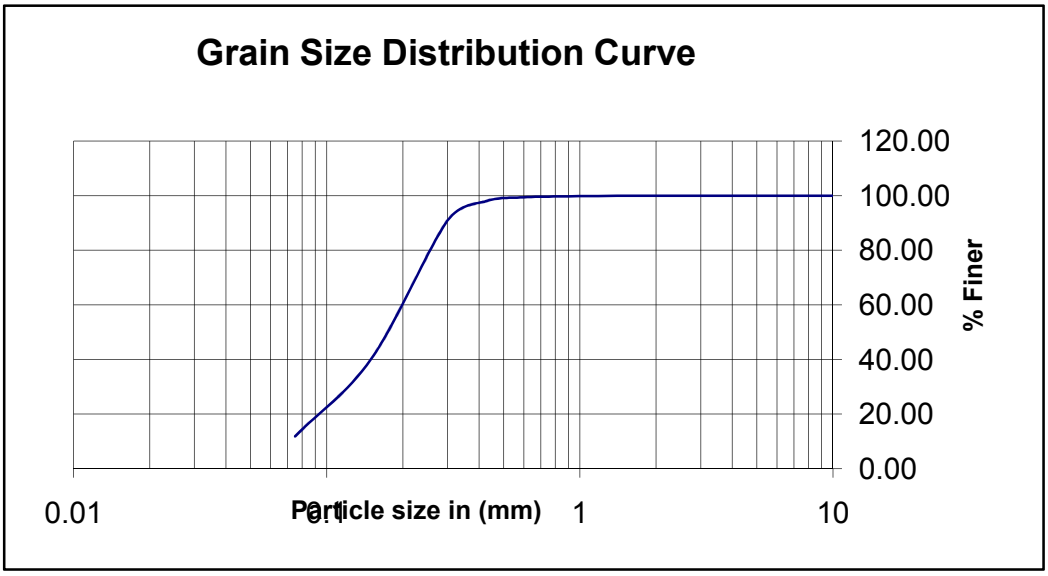


GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 15.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.13	0.07	0.07	99.93	**0.12**
0.6	0.89	0.90	0.47	0.54	99.46	**0.42**
0.425	0.51	2.79	1.46	2.00	98.00	**0.75**
0.3	0.36	13.59	7.12	9.12	90.88	**2.58**
0.15	0.23	96.67	50.66	59.78	40.22	**11.40**
0.075	0.11	54.26	28.44	88.22	11.78	**3.20**
Residue		22.48	88.22			**18.47**
		190.82				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.209 mm**

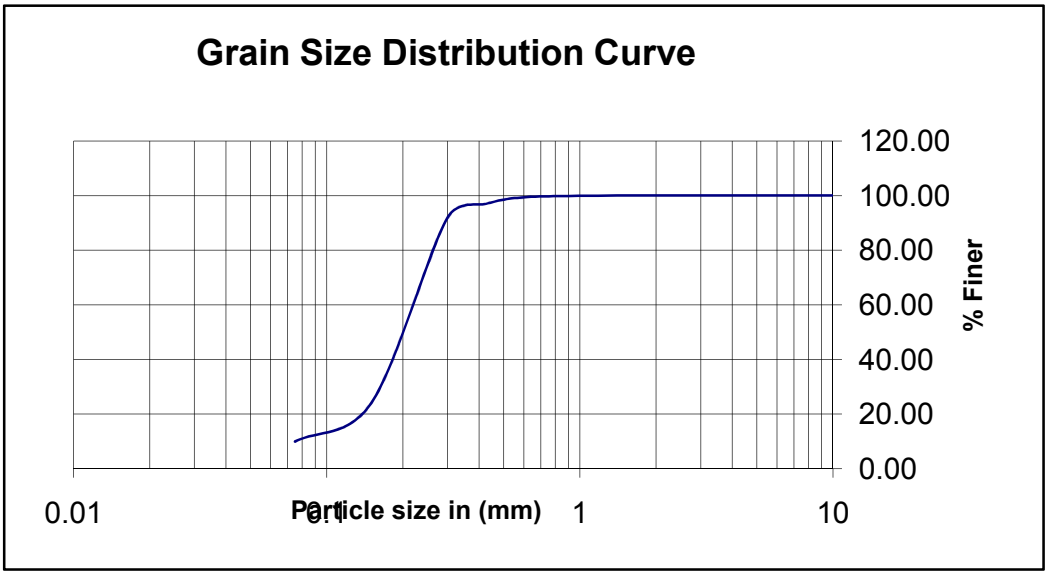


GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 21.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.12	0.06	0.06	99.94	**0.11**
0.6	0.89	1.07	0.58	0.64	99.36	**0.51**
0.425	0.51	4.50	2.42	3.07	96.93	**1.24**
0.3	0.36	9.34	5.03	8.10	91.90	**1.82**
0.15	0.23	125.95	67.85	75.95	24.05	**15.27**
0.075	0.11	26.19	14.11	90.06	9.94	**1.59**
Residue		18.45	90.06			**20.55**
		185.62				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.228 mm**

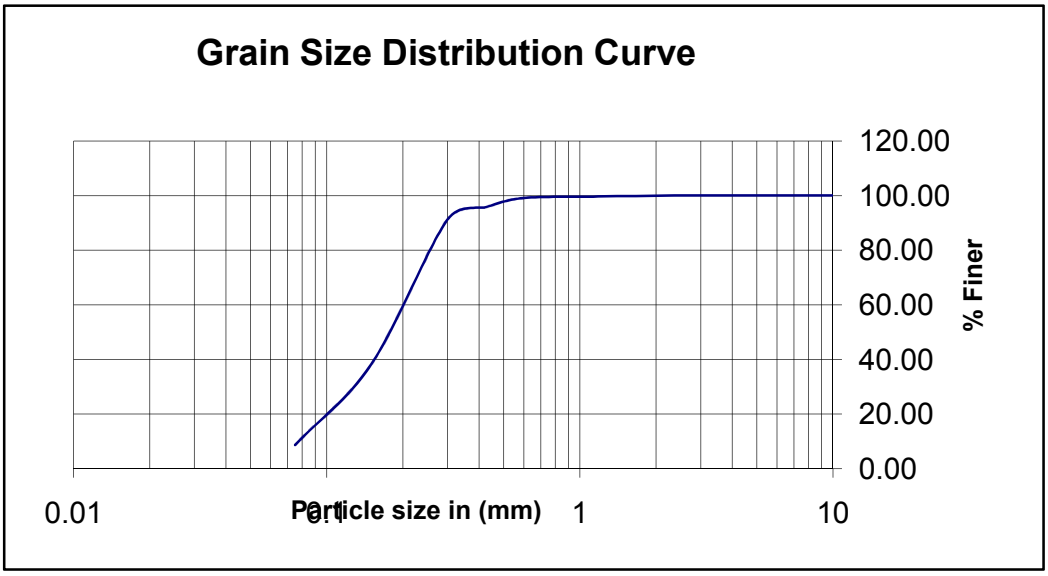


GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 30.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.64	0.34	0.34	99.66	**0.60**
0.6	0.89	1.07	0.57	0.90	99.10	**0.50**
0.425	0.51	6.29	3.32	4.23	95.77	**1.70**
0.3	0.36	8.64	4.56	8.79	91.21	**1.65**
0.15	0.23	100.28	52.97	61.76	38.24	**11.92**
0.075	0.11	56.03	29.60	91.35	8.65	**3.33**
Residue		16.37	91.35			**19.71**
		189.32				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.216 mm**

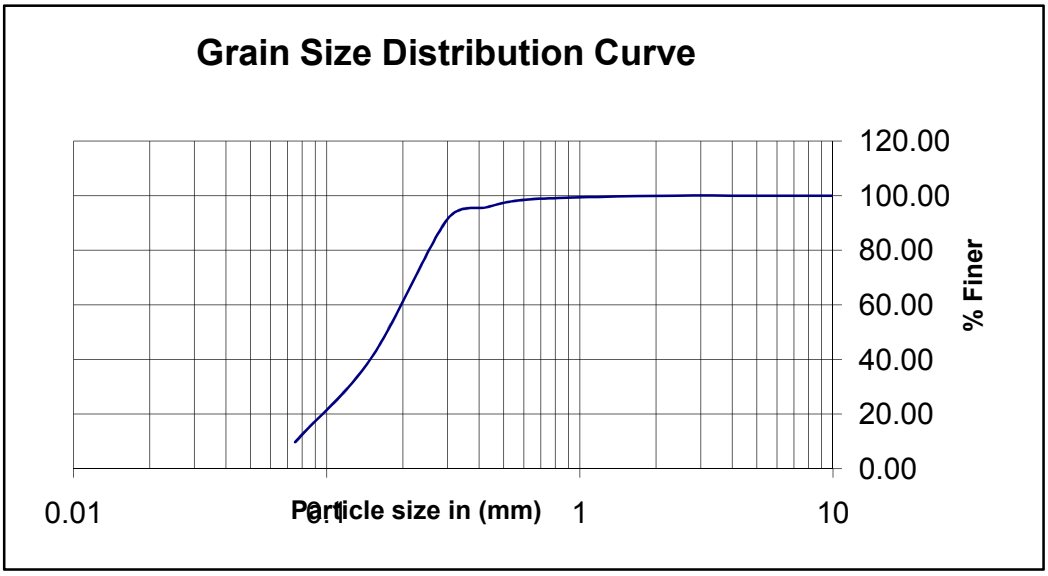


GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 35.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.87	0.47	0.47	99.53	**0.83**
0.6	0.89	2.00	1.08	1.54	98.46	**0.96**
0.425	0.51	5.17	2.78	4.33	95.67	**1.43**
0.3	0.36	7.94	4.27	8.60	91.40	**1.55**
0.15	0.23	94.56	50.89	59.49	40.51	**11.45**
0.075	0.11	57.29	30.83	90.32	9.68	**3.47**
Residue		17.98	90.32			**19.68**
		185.81				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.218 mm**

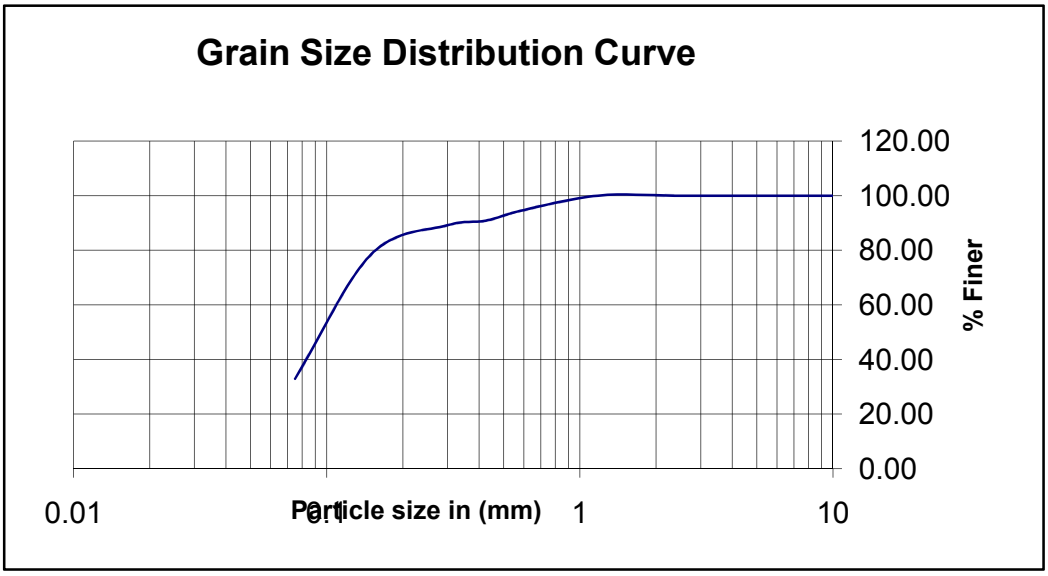


GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 40.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	8.56	5.29	5.29	94.71	**4.70**
0.425	0.51	6.31	3.90	9.18	90.82	**2.00**
0.3	0.36	2.74	1.69	10.87	89.13	**0.61**
0.15	0.23	17.14	10.58	21.46	78.54	**2.38**
0.075	0.11	73.87	45.62	67.07	32.93	**5.13**
Residue		53.32	67.07			**14.83**
		161.94				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.221 mm**

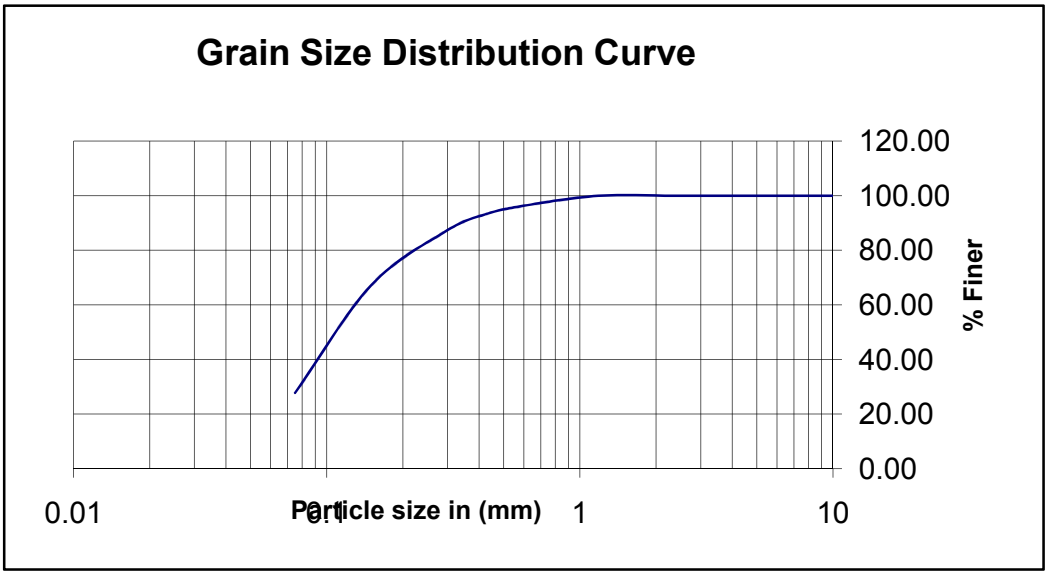


GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 45.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	7.04	3.66	3.66	96.34	**3.26**
0.425	0.51	5.91	3.08	6.74	93.26	**1.58**
0.3	0.36	11.31	5.89	12.63	87.37	**2.13**
0.15	0.23	38.68	20.13	32.76	67.24	**4.53**
0.075	0.11	75.89	39.50	72.25	27.75	**4.44**
Residue		53.32	72.25			**15.94**
		192.15				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.221 mm**

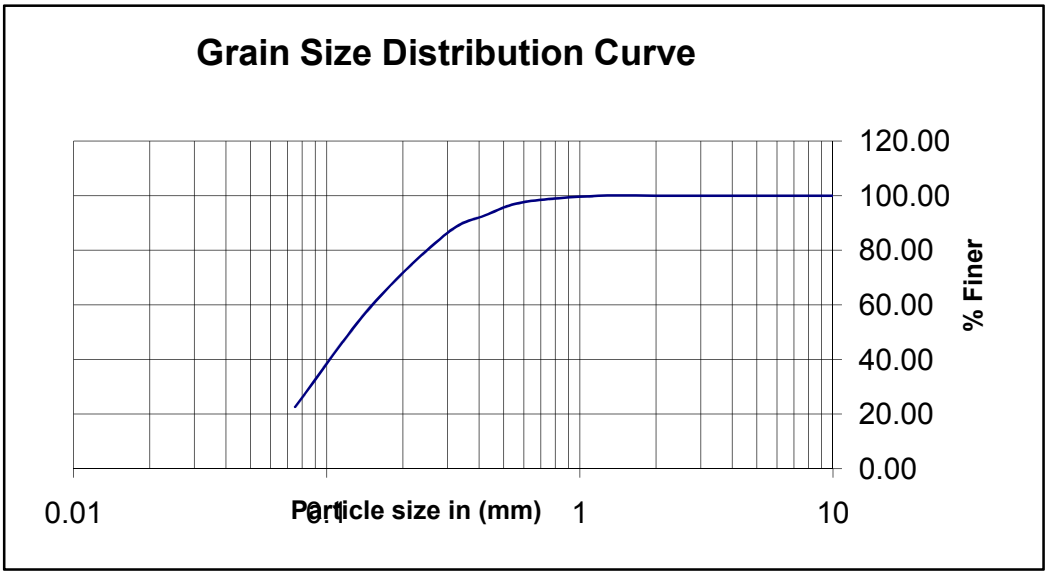


GRAIN SIZE ANALYSIS

Borehole No: MBH1
Depth- 51.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	5.02	2.31	2.31	97.69	**2.06**
0.425	0.51	10.35	4.77	7.08	92.92	**2.44**
0.3	0.36	14.07	6.48	13.56	86.44	**2.35**
0.15	0.23	58.29	26.86	40.42	59.58	**6.04**
0.075	0.11	80.21	36.96	77.38	22.62	**4.16**
Residue		49.10	77.38			**17.05**
		217.04				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.220 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

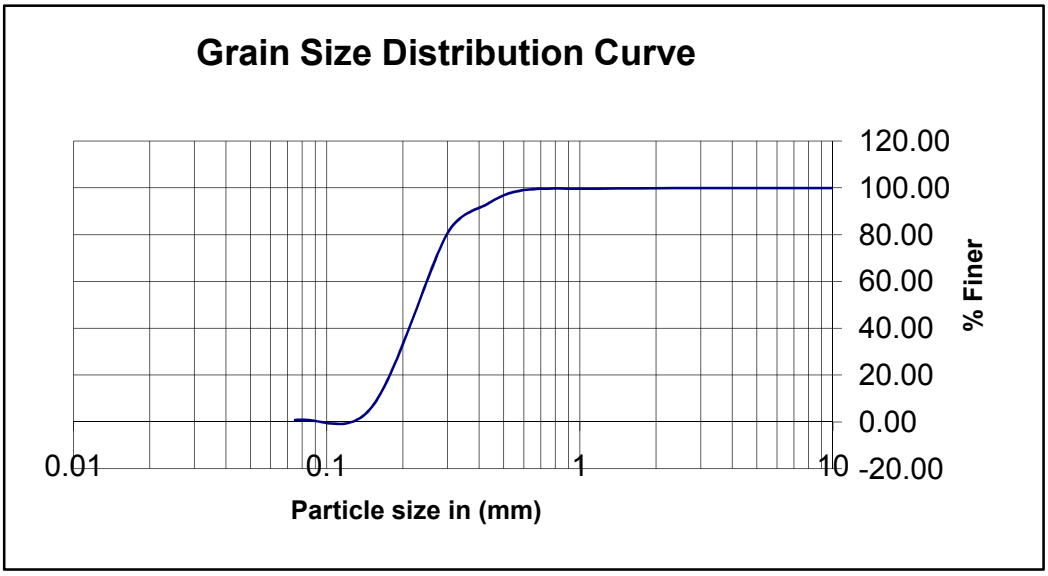
MBH-02

GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 3.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.81	0.27	0.27	99.73	**0.48**
0.6	0.89	1.88	0.63	0.90	99.10	**0.56**
0.425	0.51	18.86	6.30	7.20	92.80	**3.23**
0.3	0.36	36.22	12.10	19.30	80.70	**4.39**
0.15	0.23	223.60	74.71	94.02	5.98	**16.81**
0.075	0.11	15.83	5.29	99.30	0.70	**0.60**
Residue		2.08	99.30			**26.06**
		299.28				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.262 mm**

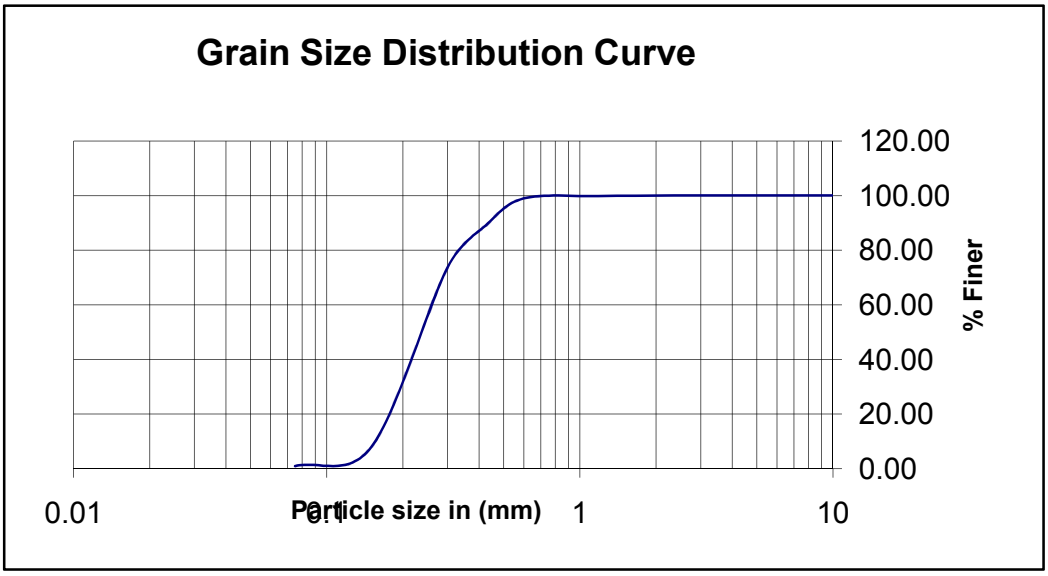


GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 6.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.58	0.19	0.19	99.81	**0.34**
0.6	0.89	2.54	0.85	1.04	98.96	**0.76**
0.425	0.51	29.53	9.89	10.93	89.07	**5.07**
0.3	0.36	46.02	15.41	26.34	73.66	**5.59**
0.15	0.23	196.31	65.74	92.08	7.92	**14.79**
0.075	0.11	20.64	6.91	99.00	1.00	**0.78**
Residue		3.00	99.00			**27.32**
		298.62				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.276 mm**

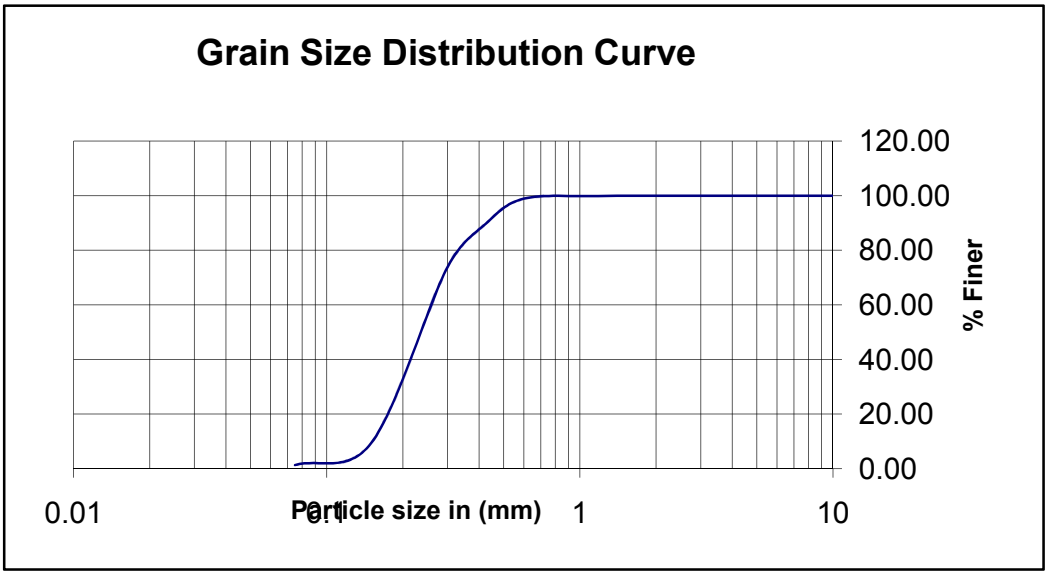


GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 9.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.40	0.13	0.13	99.87	**0.24**
0.6	0.89	2.97	0.99	1.13	98.87	**0.88**
0.425	0.51	27.40	9.15	10.28	89.72	**4.69**
0.3	0.36	47.43	15.85	26.13	73.87	**5.74**
0.15	0.23	193.08	64.50	90.63	9.37	**14.51**
0.075	0.11	24.16	8.07	98.70	1.30	**0.91**
Residue		3.89	98.70			**26.98**
		299.33				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.273 mm**

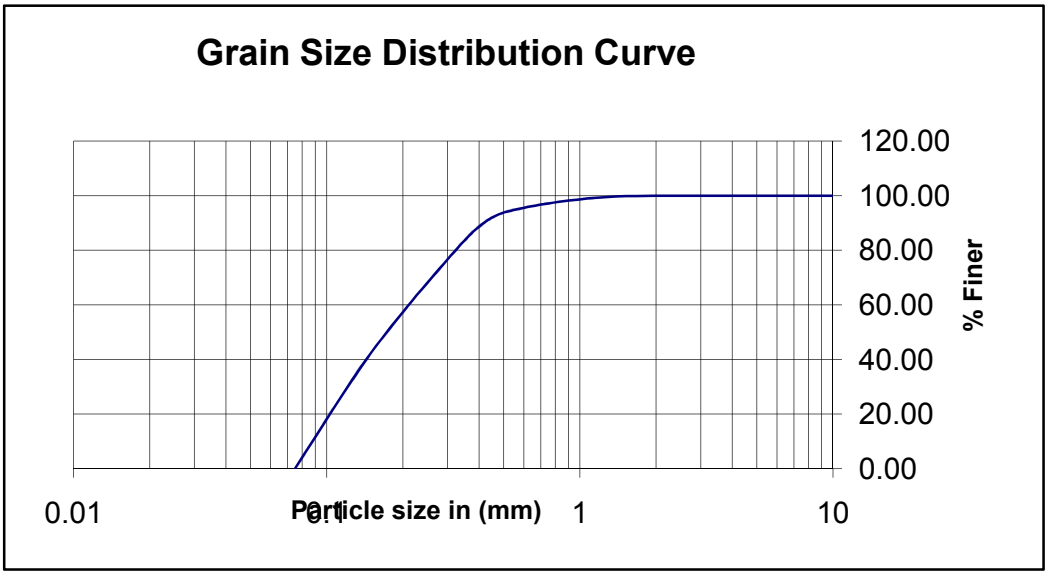


GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 12.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.01	0.00	0.00	100.00	**0.03**
2.36	3.56	0.03	0.01	0.02	99.98	**0.04**
1.18	1.77	1.74	0.67	0.69	99.31	**1.19**
0.6	0.89	9.67	3.74	4.43	95.57	**3.33**
0.425	0.51	13.00	5.03	9.47	90.53	**2.58**
0.3	0.36	35.94	13.92	23.38	76.62	**5.04**
0.15	0.23	88.02	34.08	57.47	42.53	**7.67**
0.075	0.11	109.64	42.45	99.92	0.08	**4.78**
Residue		0.20	99.92			**24.66**
		258.25				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.247 mm**

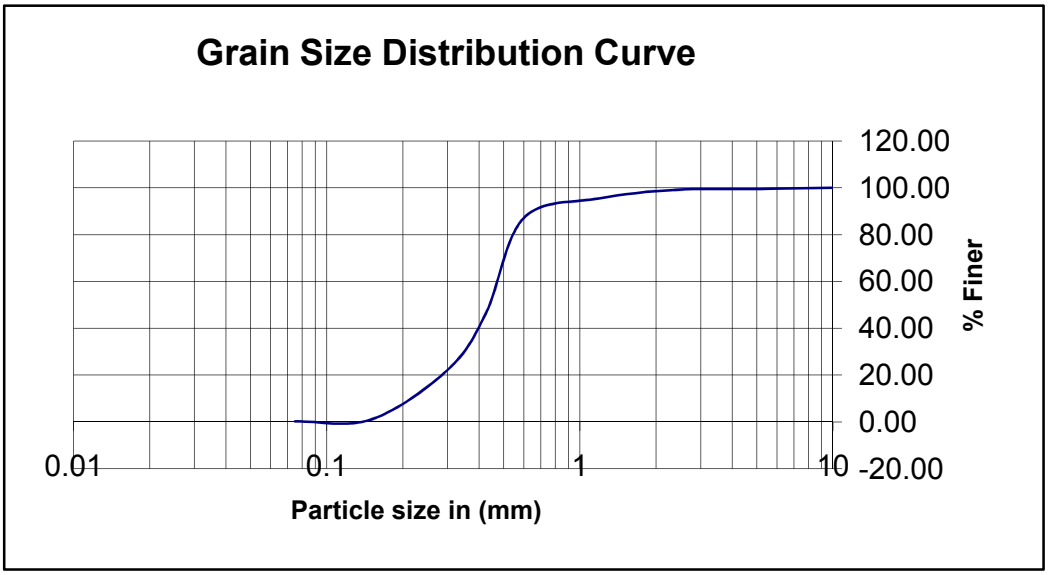


GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 18.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	1.71	0.57	0.57	99.43	**4.22**
2.36	3.56	0.96	0.32	0.89	99.11	**1.14**
1.18	1.77	11.14	3.73	4.62	95.38	**6.60**
0.6	0.89	24.92	8.34	12.96	87.04	**7.42**
0.425	0.51	122.03	40.83	53.79	46.21	**20.92**
0.3	0.36	71.94	24.07	77.86	22.14	**8.73**
0.15	0.23	63.17	21.14	98.99	1.01	**4.76**
0.075	0.11	2.50	0.84	99.83	0.17	**0.09**
Residue		0.51	99.83			**53.88**
		298.88				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.540 mm**

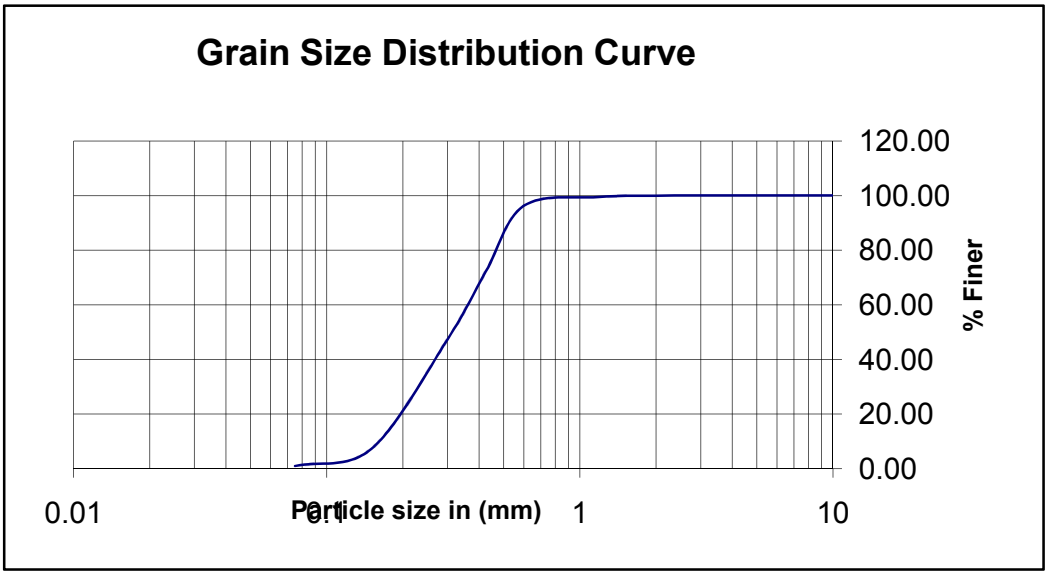


GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 28.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	1.66	0.55	0.55	99.45	**0.98**
0.6	0.89	9.72	3.25	3.80	96.20	**2.89**
0.425	0.51	72.06	24.08	27.89	72.11	**12.34**
0.3	0.36	74.22	24.81	52.69	47.31	**8.99**
0.15	0.23	119.94	40.09	92.78	7.22	**9.02**
0.075	0.11	18.73	6.26	99.04	0.96	**0.70**
Residue		2.87	99.04			**34.93**
		299.20				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.353 mm**

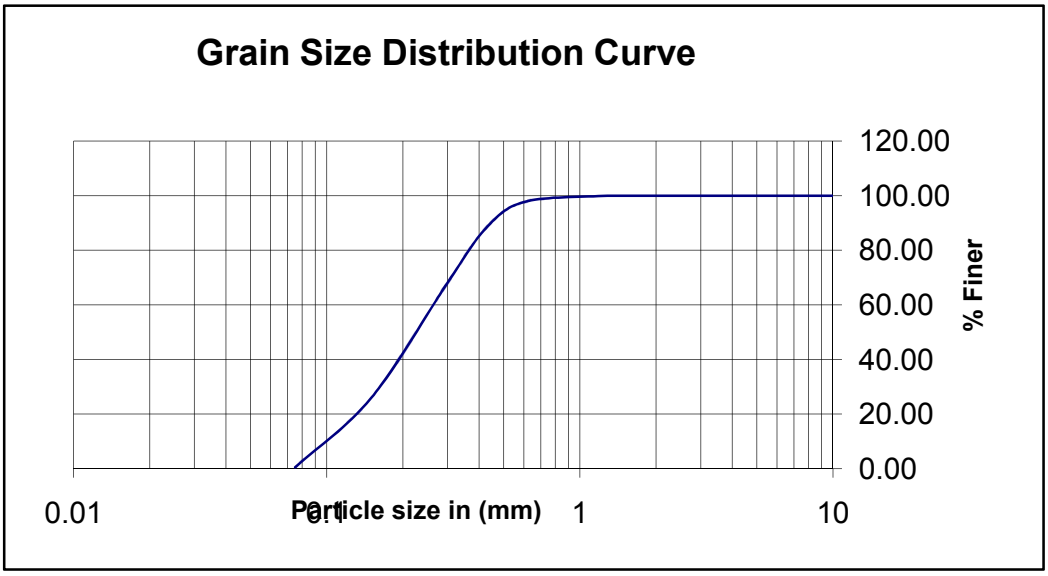


GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 31.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.34	0.13	0.13	99.87	**0.24**
0.6	0.89	5.50	2.18	2.32	97.68	**1.94**
0.425	0.51	24.21	9.60	11.92	88.08	**4.92**
0.3	0.36	50.33	19.96	31.88	68.12	**7.24**
0.15	0.23	106.27	42.15	74.03	25.97	**9.48**
0.075	0.11	64.25	25.48	99.51	0.49	**2.87**
Residue		1.23	99.51			**26.69**
		252.13				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.268 mm**

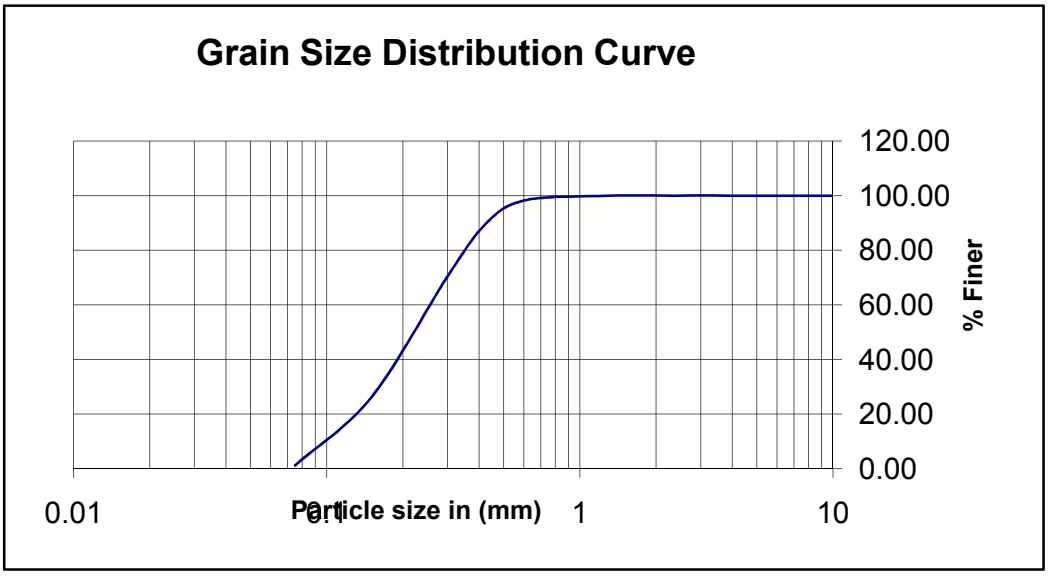


GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 40.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.29	0.13	0.13	99.87	**0.23**
0.6	0.89	3.84	1.70	1.83	98.17	**1.51**
0.425	0.51	19.21	8.50	10.32	89.68	**4.35**
0.3	0.36	43.60	19.28	29.61	70.39	**6.99**
0.15	0.23	100.29	44.36	73.97	26.03	**9.98**
0.075	0.11	56.37	24.93	98.90	1.10	**2.80**
Residue		2.49	98.90			**25.87**
		226.09				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.262 mm**

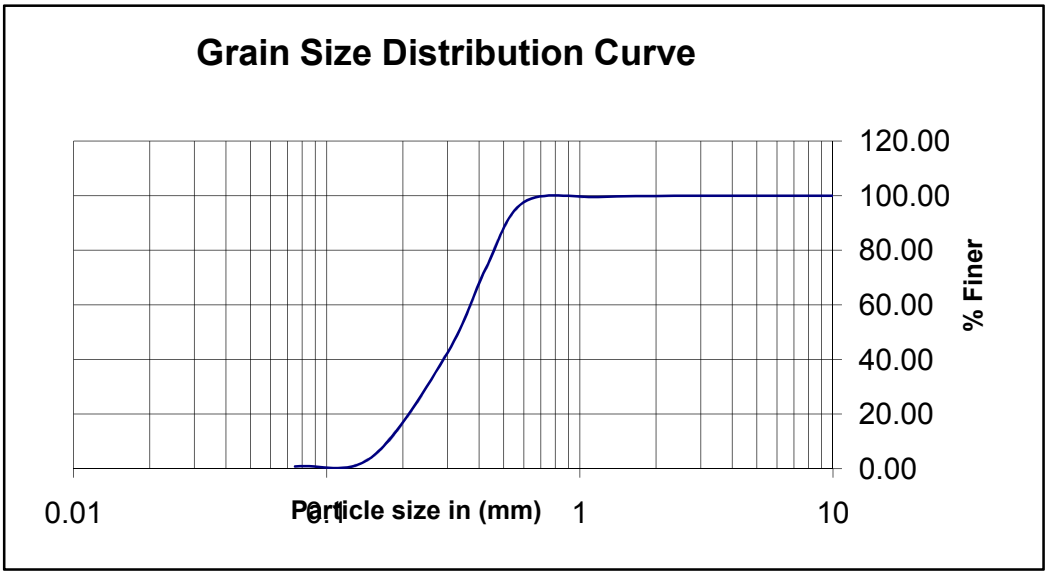


GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 46.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.03	0.01	0.01	99.99	**0.04**
1.18	1.77	1.17	0.39	0.40	99.60	**0.69**
0.6	0.89	5.86	1.96	2.37	97.63	**1.75**
0.425	0.51	72.46	24.28	26.64	73.36	**12.44**
0.3	0.36	92.13	30.87	57.51	42.49	**11.19**
0.15	0.23	114.47	38.35	95.86	4.14	**8.63**
0.075	0.11	9.93	3.33	99.19	0.81	**0.37**
Residue		2.43	99.19			**35.11**
		298.48				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.354 mm**

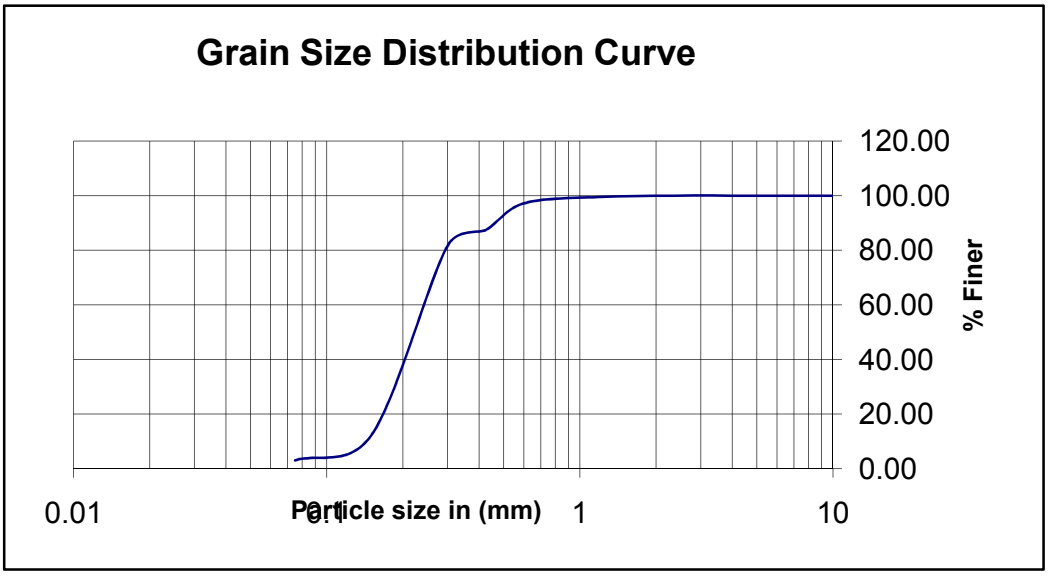


GRAIN SIZE ANALYSIS

Borehole No: MBH2
Depth- 46.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.02	0.01	0.01	99.99	**0.03**
1.18	1.77	1.03	0.50	0.50	99.50	**0.88**
0.6	0.89	4.86	2.34	2.84	97.16	**2.08**
0.425	0.51	20.27	9.74	12.58	87.42	**4.99**
0.3	0.36	12.13	5.83	18.41	81.59	**2.11**
0.15	0.23	144.47	69.44	87.86	12.14	**15.62**
0.075	0.11	19.03	9.15	97.01	2.99	**1.03**
Residue		6.23	97.01			**26.75**
		208.04				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.276 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

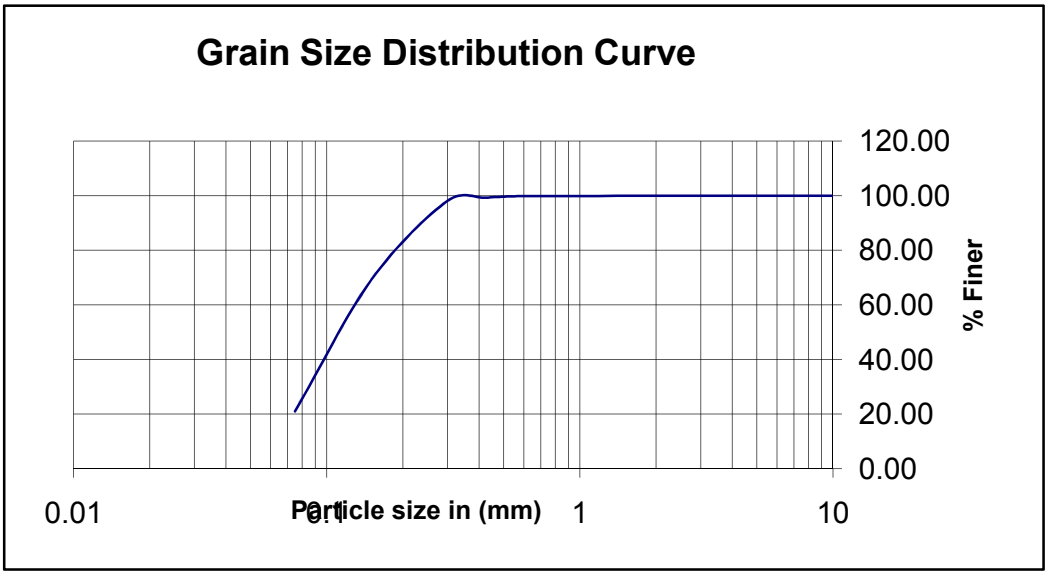
MBH-03

GRAIN SIZE ANALYSIS

Borehole No: MBH 3
Depth- 3.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.25	0.12	0.12	99.88	**0.21**
0.6	0.89	0.09	0.04	0.17	99.83	**0.04**
0.425	0.51	1.23	0.60	0.76	99.24	**0.31**
0.3	0.36	2.37	1.15	1.91	98.09	**0.42**
0.15	0.23	59.67	28.96	30.88	69.12	**6.52**
0.075	0.11	99.31	48.20	79.08	20.92	**5.42**
Residue		43.10	79.08			**12.92**
		206.02				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.163 mm**

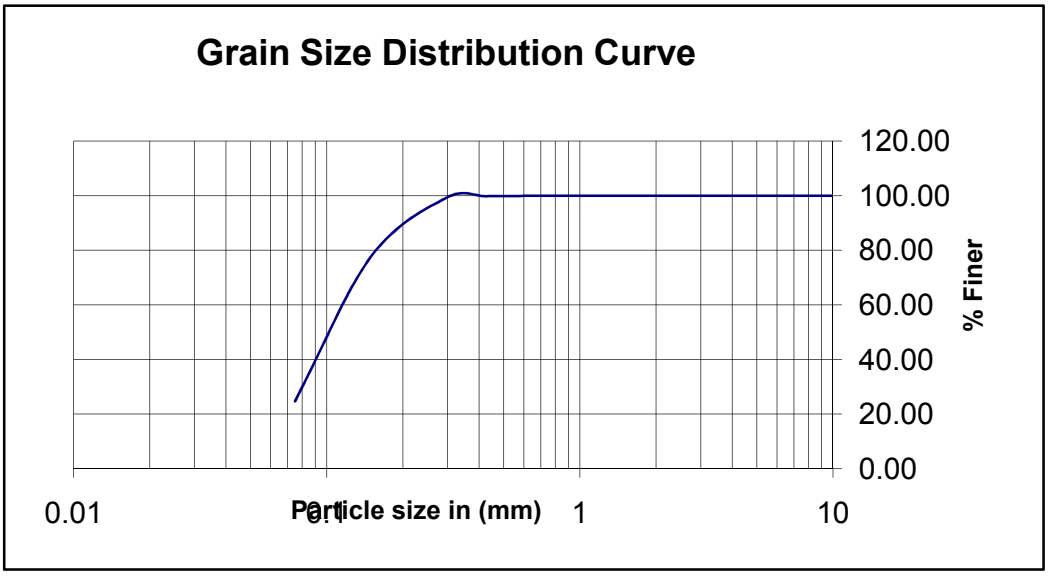


GRAIN SIZE ANALYSIS

Borehole No: MBH 3
Depth- 6.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.06	0.05	0.05	99.95	**0.04**
0.425	0.51	0.16	0.12	0.17	99.83	**0.06**
0.3	0.36	0.51	0.38	0.55	99.45	**0.14**
0.15	0.23	28.80	21.62	22.17	77.83	**4.86**
0.075	0.11	70.83	53.17	75.34	24.66	**5.98**
Residue		32.85	75.34			**11.09**
		133.21				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.147 mm**

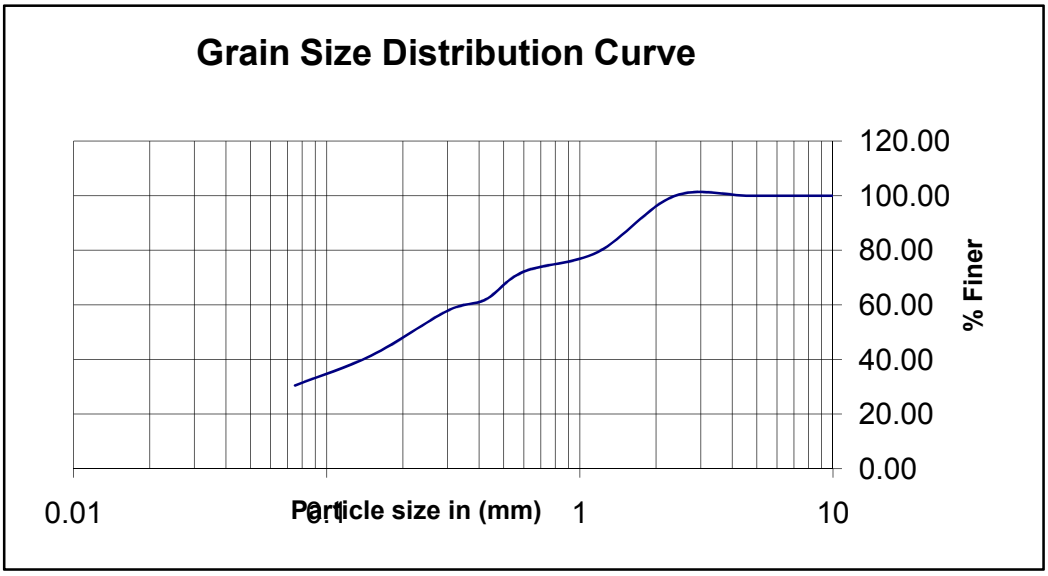


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 9.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.35	0.11	0.11	99.89	**0.38**
1.18	1.77	66.60	20.44	20.55	79.45	**36.19**
0.6	0.89	23.65	7.26	27.81	72.19	**6.46**
0.425	0.51	33.14	10.17	37.98	62.02	**5.21**
0.3	0.36	13.55	4.16	42.14	57.86	**1.51**
0.15	0.23	53.53	16.43	58.58	41.42	**3.70**
0.075	0.11	35.79	10.99	69.56	30.44	**1.24**
Residue		99.16	69.56			**54.68**
		325.77				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.786 mm**

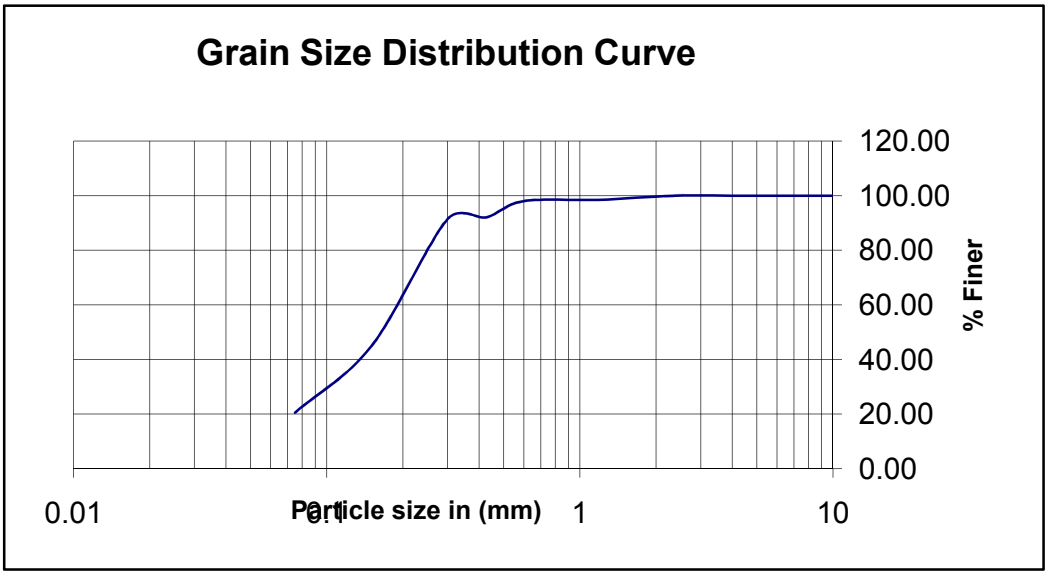


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 12.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	3.28	1.49	1.49	98.51	**2.64**
0.6	0.89	0.99	0.45	1.94	98.06	**0.40**
0.425	0.51	13.23	6.01	7.95	92.05	**3.08**
0.3	0.36	1.43	0.65	8.60	91.40	**0.24**
0.15	0.23	102.59	46.60	55.20	44.80	**10.49**
0.075	0.11	53.56	24.33	79.53	20.47	**2.74**
Residue		45.05	79.53			**19.58**
		220.13				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.246 mm**

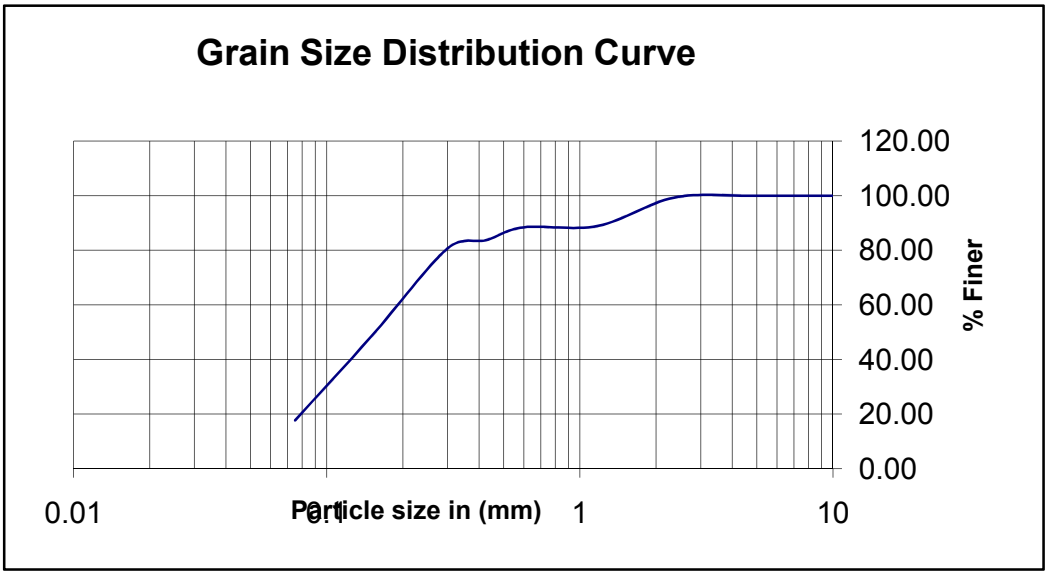


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 15.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.03	0.02	0.02	99.98	**0.12**
2.36	3.56	1.12	0.62	0.64	99.36	**2.20**
1.18	1.77	18.80	10.39	11.02	88.98	**18.38**
0.6	0.89	0.92	0.51	11.53	88.47	**0.45**
0.425	0.51	8.64	4.77	16.30	83.70	**2.45**
0.3	0.36	5.40	2.98	19.29	80.71	**1.08**
0.15	0.23	58.38	32.25	51.54	48.46	**7.26**
0.075	0.11	55.68	30.76	82.30	17.70	**3.46**
Residue		32.04	82.30			**35.40**
		181.01				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.430 mm**

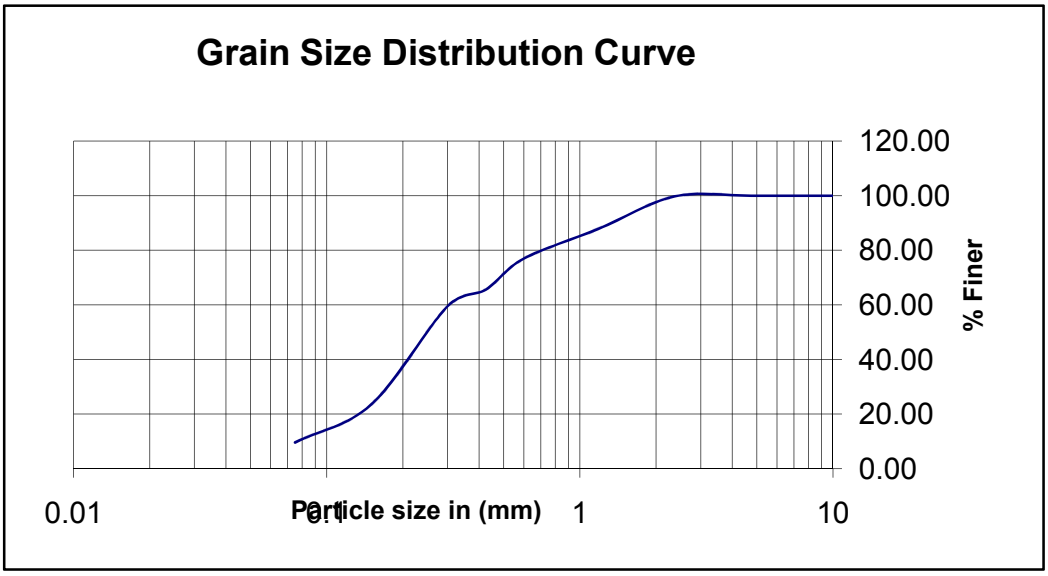


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 19.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.64	0.31	0.31	99.69	**1.09**
1.18	1.77	24.78	11.92	12.23	87.77	**21.10**
0.6	0.89	22.56	10.85	23.08	76.92	**9.66**
0.425	0.51	23.58	11.34	34.43	65.57	**5.81**
0.3	0.36	12.71	6.11	40.54	59.46	**2.22**
0.15	0.23	74.73	35.95	76.50	23.50	**8.09**
0.075	0.11	28.97	13.94	90.44	9.56	**1.57**
Residue		19.88	90.44			**49.55**
		207.85				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.548 mm**

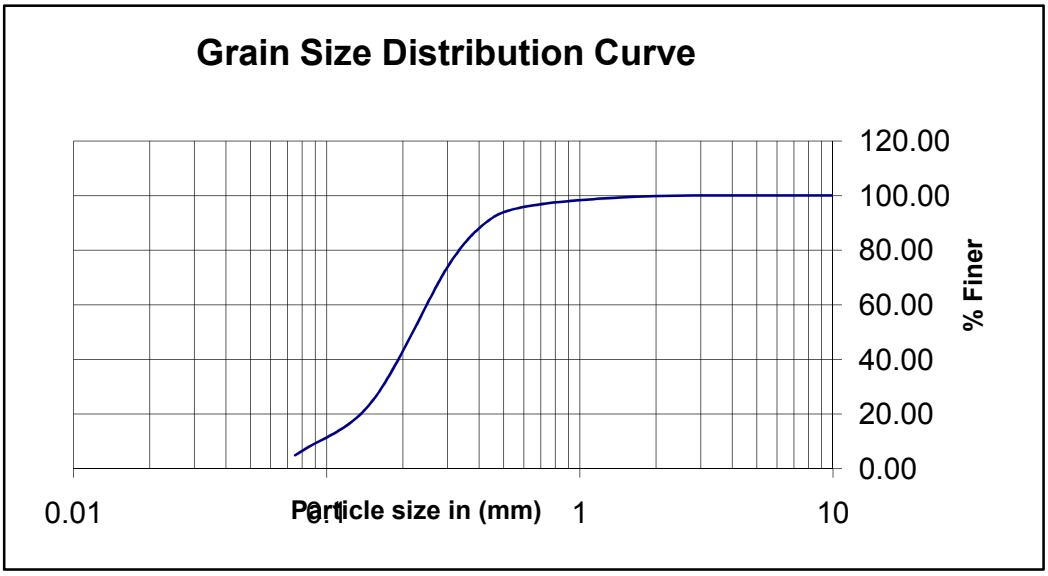


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 24.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.04	0.02	0.02	99.98	**0.07**
1.18	1.77	2.30	1.14	1.16	98.84	**2.02**
0.6	0.89	6.06	3.01	4.17	95.83	**2.68**
0.425	0.51	11.53	5.73	9.90	90.10	**2.94**
0.3	0.36	32.71	16.26	26.16	73.84	**5.89**
0.15	0.23	99.73	49.56	75.72	24.28	**11.15**
0.075	0.11	38.97	19.37	95.09	4.91	**2.18**
Residue		9.88	95.09			**26.93**
		201.22				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.283 mm**

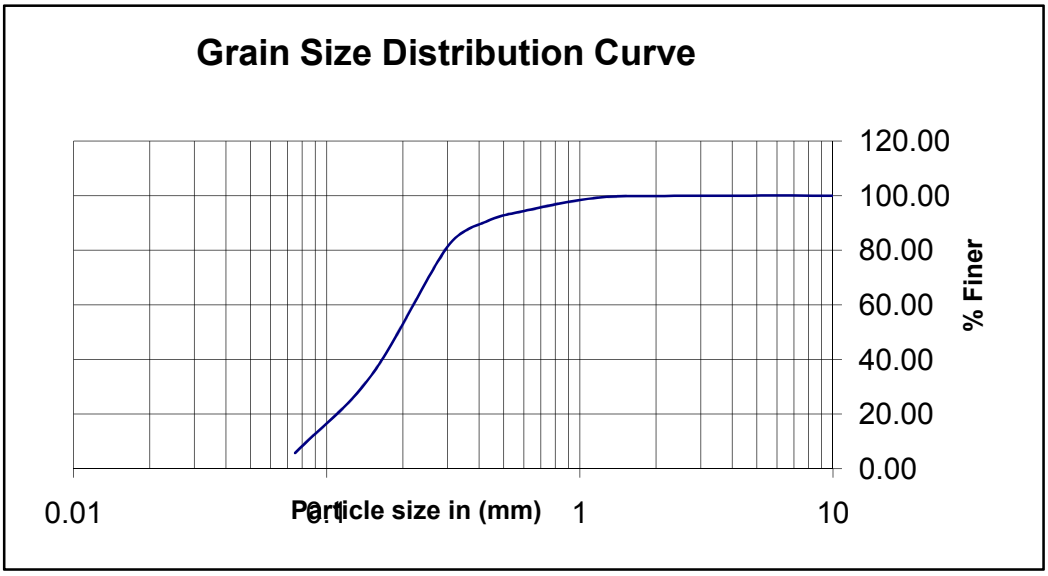


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 27.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.20	0.10	0.10	99.90	**0.34**
1.18	1.77	1.37	0.65	0.75	99.25	**1.16**
0.6	0.89	10.30	4.91	5.66	94.34	**4.37**
0.425	0.51	8.21	3.91	9.57	90.43	**2.00**
0.3	0.36	19.31	9.20	18.77	81.23	**3.34**
0.15	0.23	98.93	47.14	65.90	34.10	**10.61**
0.075	0.11	59.55	28.37	94.28	5.72	**3.19**
Residue		12.01	94.28			**25.00**
		209.88				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.265 mm**

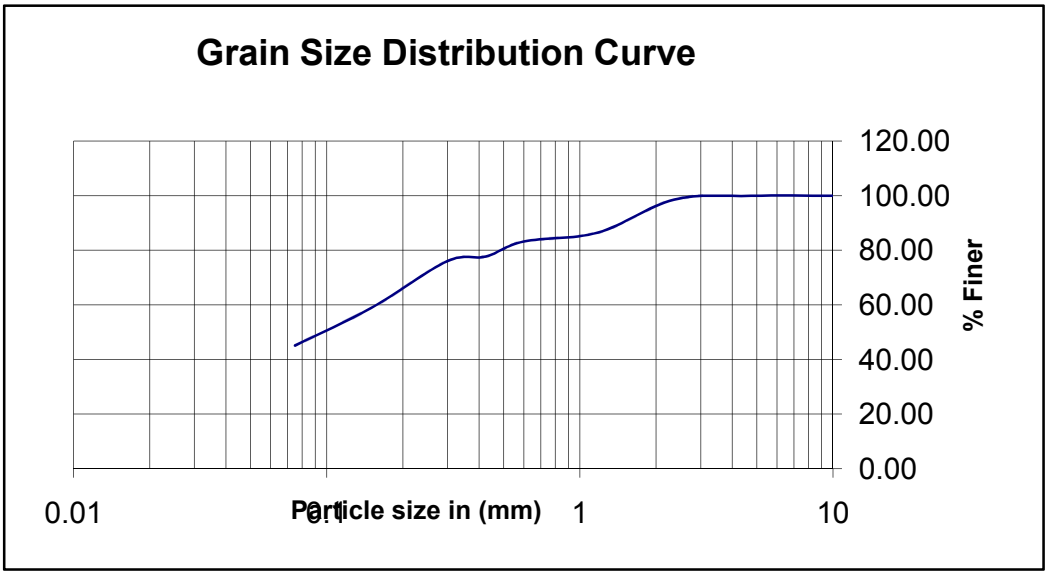


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 34.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.08	0.05	0.05	99.95	**0.34**
2.36	3.56	2.40	1.39	1.44	98.56	**4.94**
1.18	1.77	20.80	12.05	13.49	86.51	**21.33**
0.6	0.89	5.68	3.29	16.78	83.22	**2.93**
0.425	0.51	9.53	5.52	22.30	77.70	**2.83**
0.3	0.36	2.83	1.64	23.94	76.06	**0.59**
0.15	0.23	29.69	17.20	41.14	58.86	**3.87**
0.075	0.11	23.76	13.76	54.90	45.10	**1.55**
Residue		77.85	54.90			**38.38**
		172.62				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.699 mm**

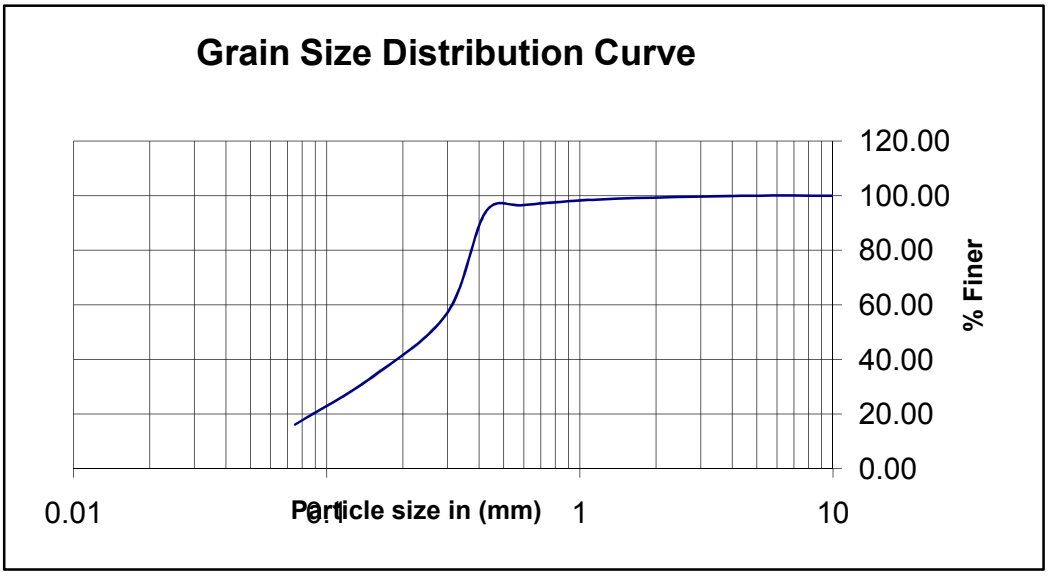


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 37.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.03	0.01	0.01	99.99	**0.11**
2.36	3.56	1.09	0.53	0.54	99.46	**1.87**
1.18	1.77	1.80	0.87	1.41	98.59	**1.54**
0.6	0.89	4.28	2.07	3.48	96.52	**1.84**
0.425	0.51	5.04	2.44	5.92	94.08	**1.25**
0.3	0.36	76.31	36.92	42.84	57.16	**13.38**
0.15	0.23	49.23	23.82	66.66	33.34	**5.36**
0.075	0.11	35.52	17.18	83.84	16.16	**1.93**
Residue		33.40	83.84			**27.29**
		206.70				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.326 mm**

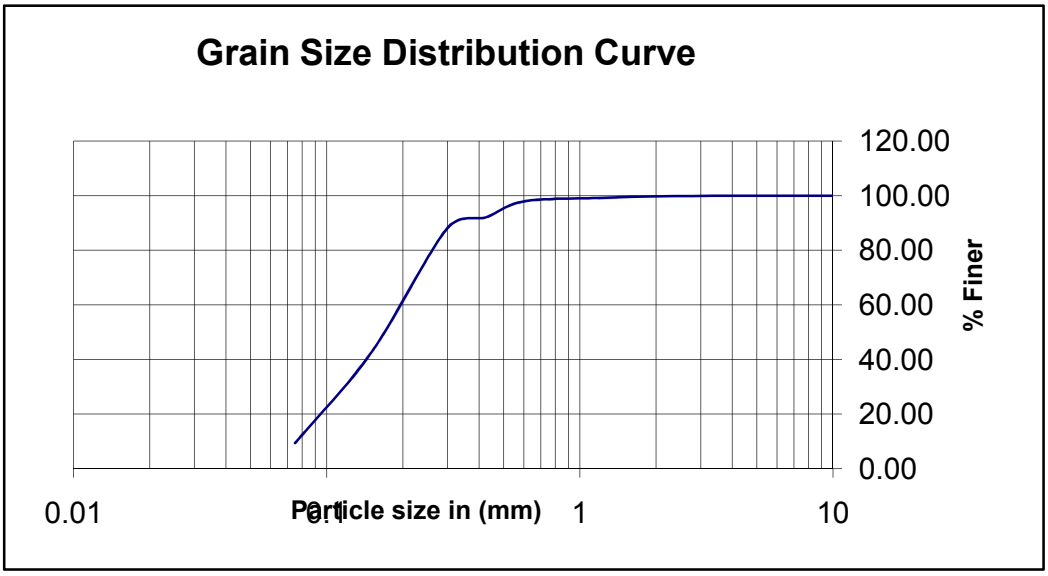


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 42.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.30	0.14	0.14	99.86	**0.49**
1.18	1.77	1.40	0.64	0.78	99.22	**1.13**
0.6	0.89	2.80	1.28	2.06	97.94	**1.14**
0.425	0.51	12.82	5.86	7.92	92.08	**3.00**
0.3	0.36	8.58	3.92	11.84	88.16	**1.42**
0.15	0.23	99.80	45.62	57.46	42.54	**10.26**
0.075	0.11	72.61	33.19	90.65	9.35	**3.73**
Residue		20.45	90.65			**21.18**
		218.76				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.234 mm**

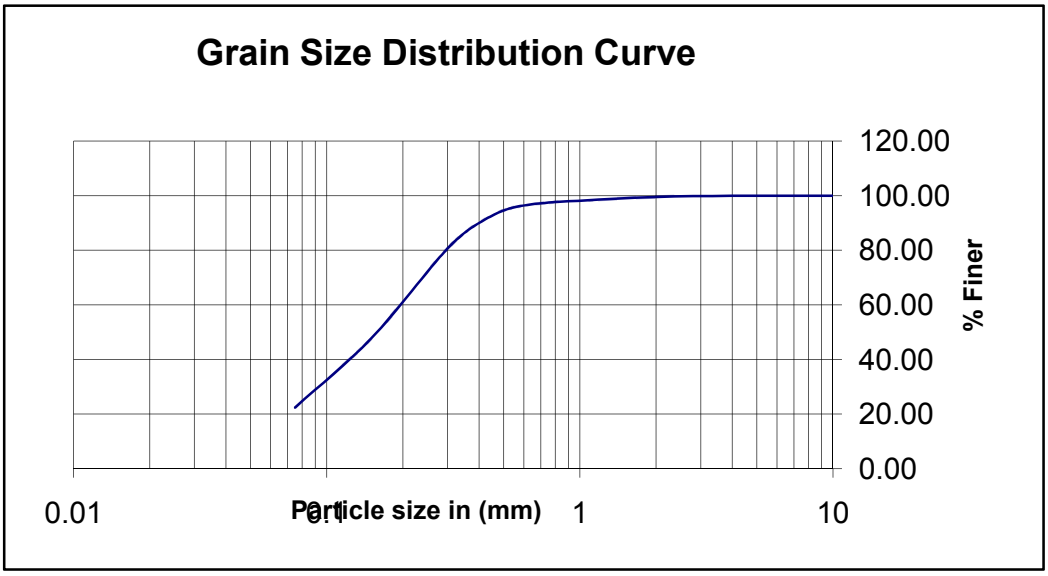


GRAIN SIZE ANALYSIS

Borehole No: MBH3
Depth- 45.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.08	0.04	0.04	99.96	**0.28**
2.36	3.56	0.40	0.19	0.23	99.77	**0.67**
1.18	1.77	2.50	1.18	1.41	98.59	**2.09**
0.6	0.89	4.60	2.17	3.58	96.42	**1.93**
0.425	0.51	10.53	4.97	8.55	91.45	**2.55**
0.3	0.36	22.88	10.81	19.36	80.64	**3.92**
0.15	0.23	69.69	32.92	52.28	47.72	**7.41**
0.075	0.11	53.76	25.40	77.68	22.32	**2.86**
Residue		47.25	77.68			**21.71**
		211.69				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.279 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

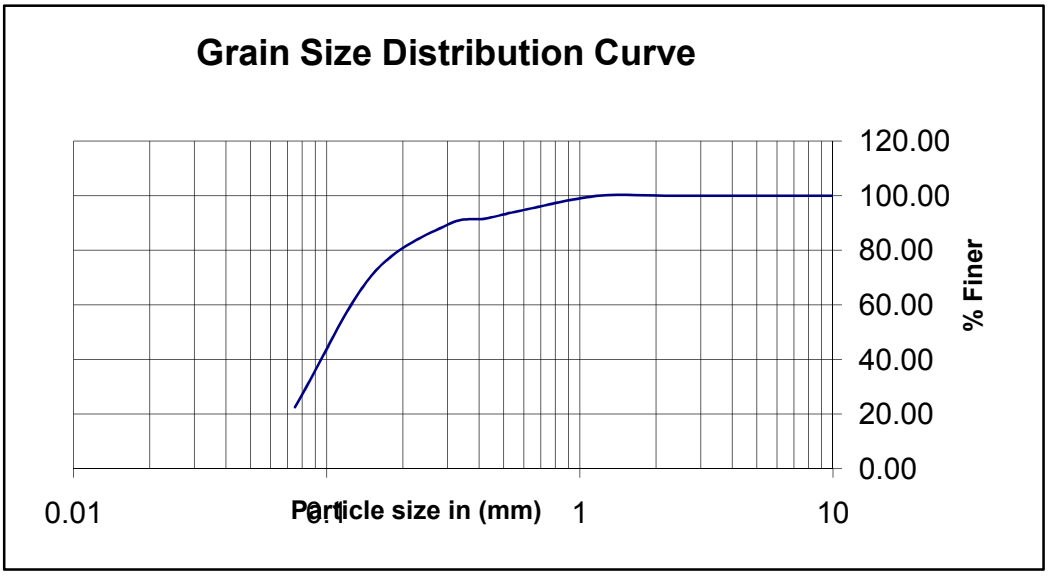
MBH-04

GRAIN SIZE ANALYSIS

Borehole No: MBH4
Depth- 3.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.02	0.01	0.01	99.99	**0.02**
0.6	0.89	10.45	5.18	5.19	94.81	**4.61**
0.425	0.51	6.31	3.13	8.32	91.68	**1.60**
0.3	0.36	4.60	2.28	10.60	89.40	**0.83**
0.15	0.23	37.88	18.77	29.37	70.63	**4.22**
0.075	0.11	97.26	48.20	77.57	22.43	**5.42**
Residue		45.27	77.57			**16.70**
		201.79				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.215 mm**

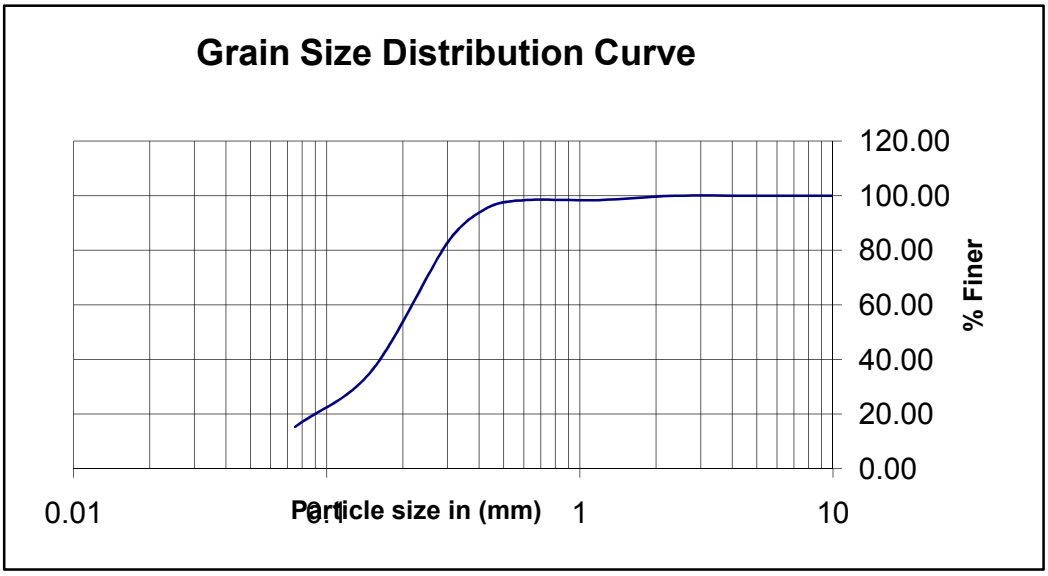


GRAIN SIZE ANALYSIS

Borehole No: MBH4
Depth- 12.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.01	0.00	0.00	100.00	**0.04**
2.36	3.56	0.13	0.06	0.07	99.93	**0.22**
1.18	1.77	3.25	1.55	1.62	98.38	**2.75**
0.6	0.89	0.09	0.04	1.66	98.34	**0.04**
0.425	0.51	6.57	3.14	4.81	95.19	**1.61**
0.3	0.36	25.94	12.41	17.22	82.78	**4.50**
0.15	0.23	98.38	47.06	64.27	35.73	**10.59**
0.075	0.11	42.54	20.35	84.62	15.38	**2.29**
Residue		32.15	84.62			**22.03**
		209.06				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.260 mm**

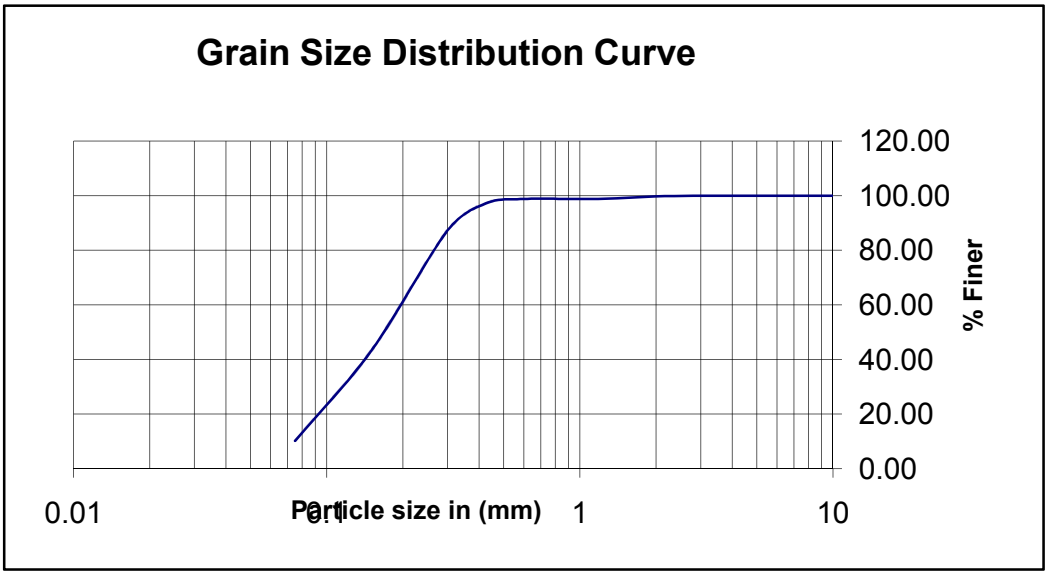


GRAIN SIZE ANALYSIS

Borehole No: MBH4
Depth- 19.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.11	0.05	0.05	99.95	**0.19**
1.18	1.77	2.25	1.07	1.13	98.87	**1.90**
0.6	0.89	0.07	0.03	1.16	98.84	**0.03**
0.425	0.51	3.42	1.63	2.79	97.21	**0.84**
0.3	0.36	20.89	9.97	12.77	87.23	**3.62**
0.15	0.23	92.20	44.02	56.79	43.21	**9.90**
0.075	0.11	69.21	33.04	89.83	10.17	**3.72**
Residue		21.30	89.83			**20.19**
		209.45				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.225 mm**

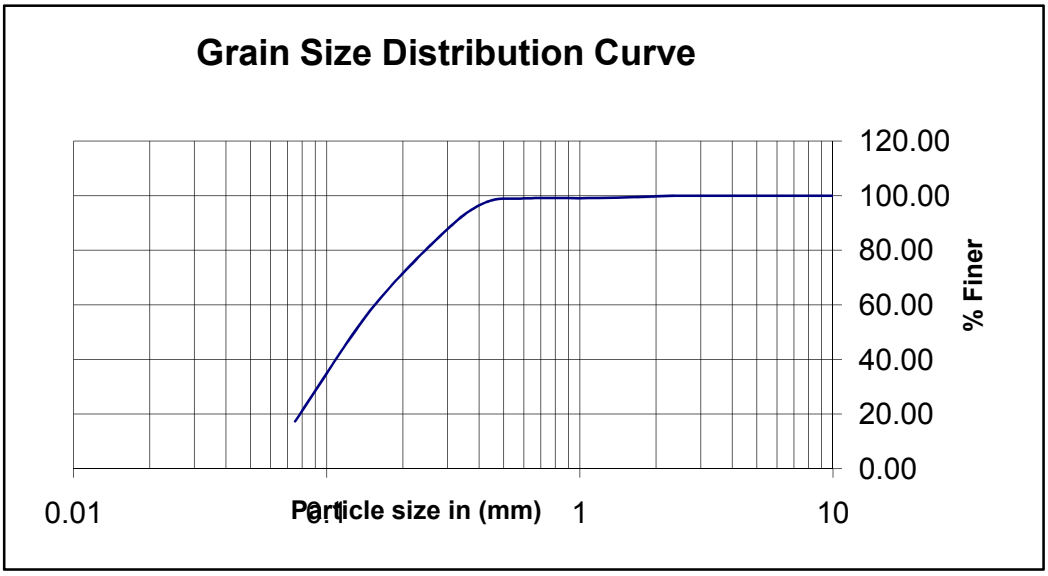


GRAIN SIZE ANALYSIS

Borehole No: MBH4
Depth- 25.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	1.65	0.81	0.81	99.19	**1.44**
0.6	0.89	0.28	0.14	0.95	99.05	**0.12**
0.425	0.51	2.94	1.45	2.40	97.60	**0.74**
0.3	0.36	19.85	9.80	12.20	87.80	**3.55**
0.15	0.23	59.63	29.44	41.64	58.36	**6.62**
0.075	0.11	83.22	41.09	82.73	17.27	**4.62**
Residue		34.98	82.73			**17.11**
		202.55				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.207 mm**

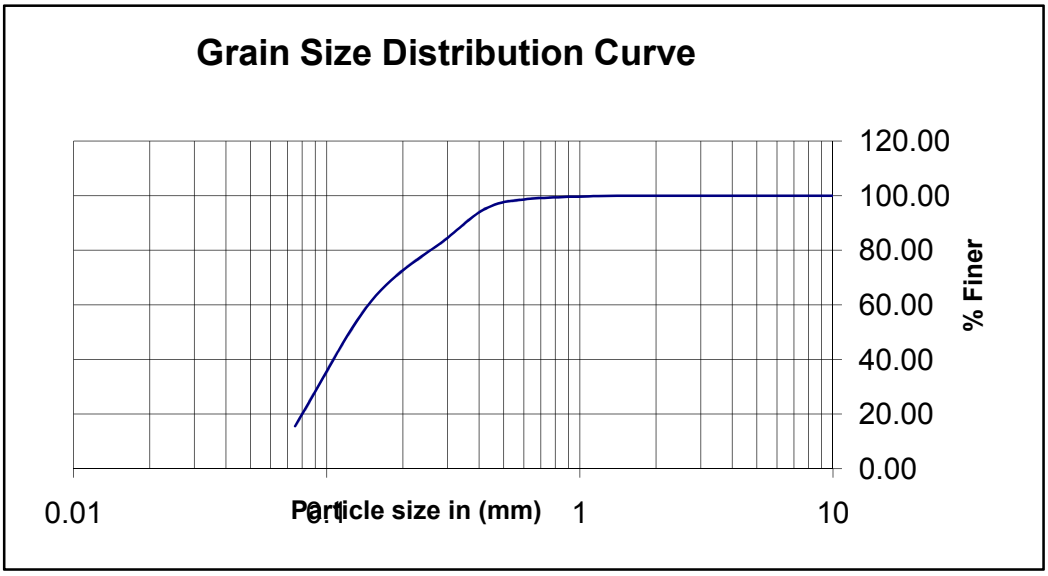


GRAIN SIZE ANALYSIS

Borehole No: MBH4
Depth- 30.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.28	0.13	0.13	99.87	**0.24**
0.6	0.89	2.60	1.25	1.38	98.62	**1.11**
0.425	0.51	6.93	3.33	4.71	95.29	**1.71**
0.3	0.36	22.38	10.75	15.46	84.54	**3.90**
0.15	0.23	48.27	23.18	38.64	61.36	**5.22**
0.075	0.11	95.40	45.81	84.45	15.55	**5.15**
Residue		32.38	84.45			**17.32**
		208.24				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.205 mm**

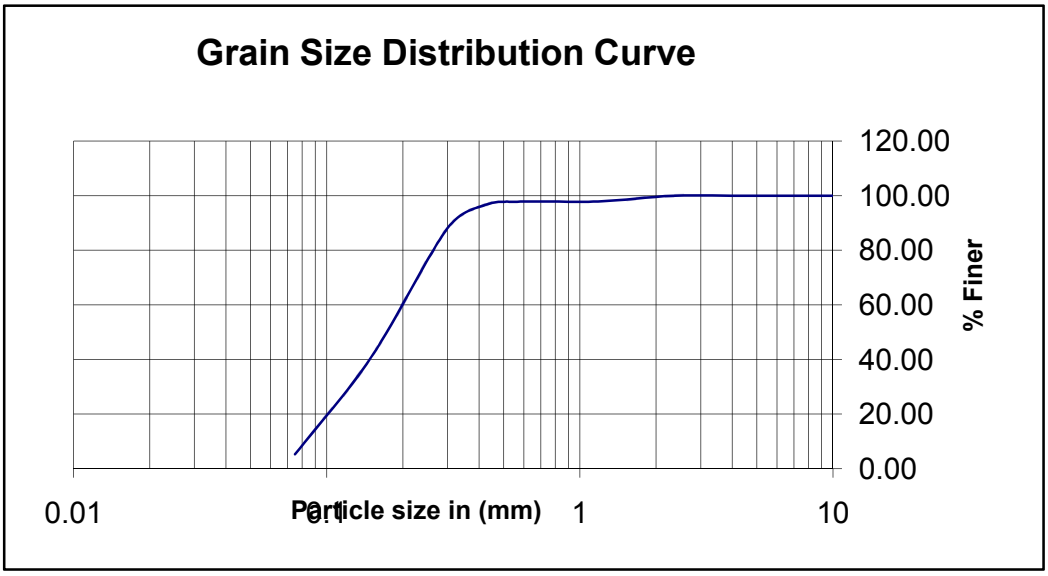


GRAIN SIZE ANALYSIS

Borehole No: MBH4
Depth- 36.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	4.09	2.09	2.09	97.91	**3.69**
0.6	0.89	0.11	0.06	2.14	97.86	**0.05**
0.425	0.51	2.30	1.17	3.32	96.68	**0.60**
0.3	0.36	16.87	8.60	11.92	88.08	**3.12**
0.15	0.23	92.54	47.20	59.12	40.88	**10.62**
0.075	0.11	69.83	35.62	94.74	5.26	**4.01**
Residue		10.32	94.74			**22.09**
		196.06				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.233 mm**

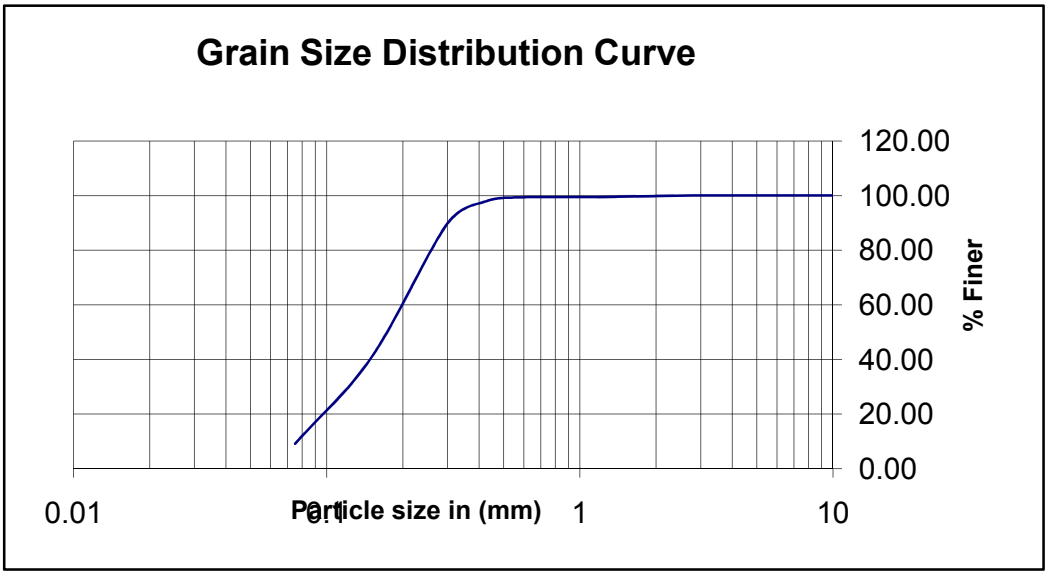


GRAIN SIZE ANALYSIS

Borehole No: MBH4
Depth- 43.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.09	0.04	0.04	99.96	**0.16**
1.18	1.77	1.03	0.51	0.55	99.45	**0.89**
0.6	0.89	0.12	0.06	0.61	99.39	**0.05**
0.425	0.51	3.10	1.52	2.13	97.87	**0.78**
0.3	0.36	16.52	8.10	10.23	89.77	**2.94**
0.15	0.23	100.21	49.14	59.37	40.63	**11.06**
0.075	0.11	64.28	31.52	90.89	9.11	**3.55**
Residue		18.57	90.89			**19.42**
		203.92				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.214 mm**

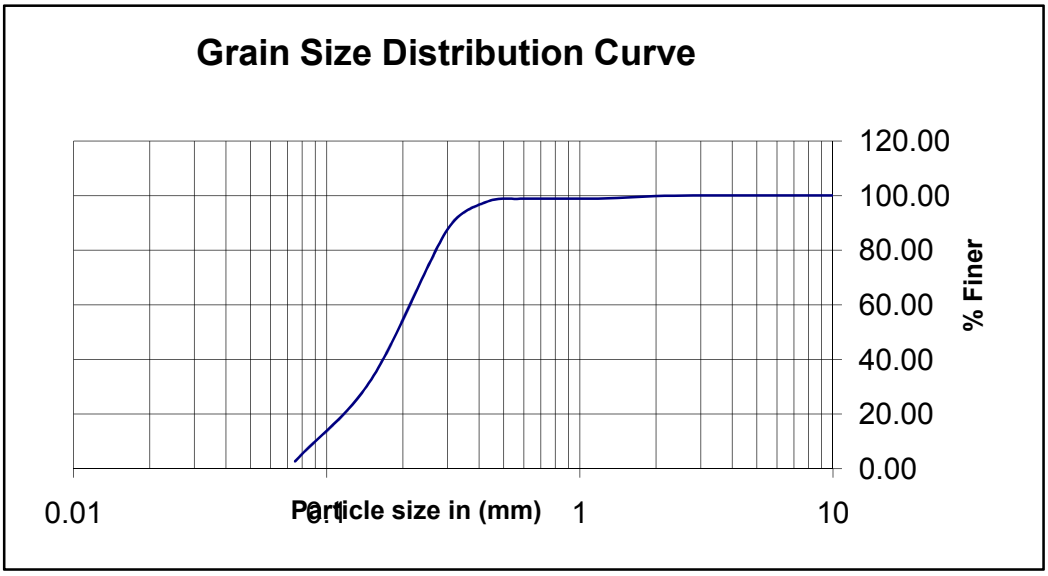


GRAIN SIZE ANALYSIS

Borehole No: MBH4
Depth- 45.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.03	0.02	0.02	99.98	**0.06**
1.18	1.77	2.02	1.08	1.10	98.90	**1.91**
0.6	0.89	0.09	0.05	1.15	98.85	**0.04**
0.425	0.51	2.41	1.29	2.44	97.56	**0.66**
0.3	0.36	18.59	9.95	12.39	87.61	**3.61**
0.15	0.23	102.70	54.97	67.36	32.64	**12.37**
0.075	0.11	56.08	30.02	97.38	2.62	**3.38**
Residue		4.90	97.38			**22.03**
		186.82				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.226 mm**

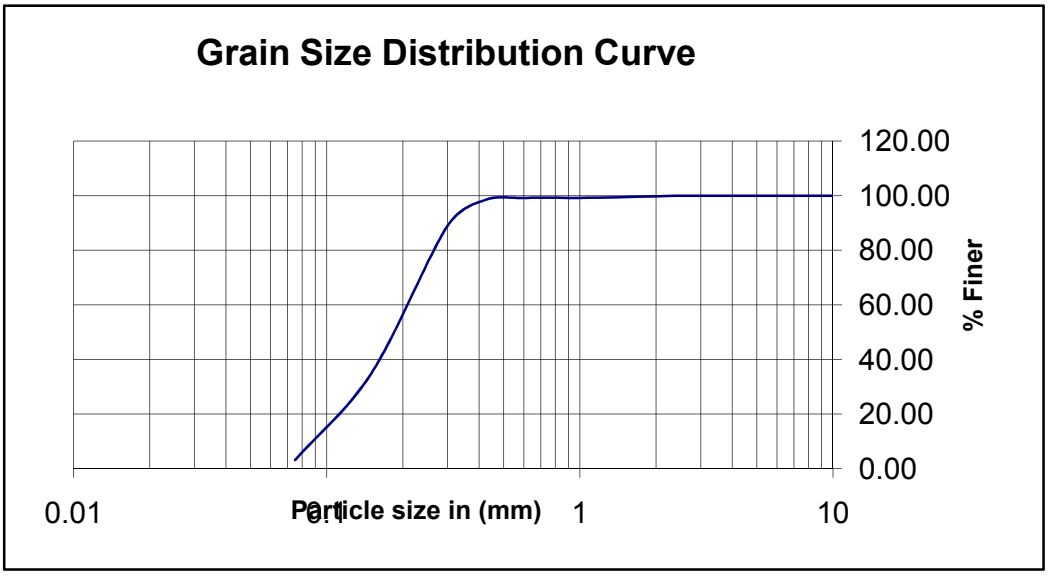


GRAIN SIZE ANALYSIS

Borehole No: MBH4
Depth- 51.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.04	0.02	0.02	99.98	**0.07**
1.18	1.77	1.35	0.67	0.69	99.31	**1.18**
0.6	0.89	0.16	0.08	0.77	99.23	**0.07**
0.425	0.51	1.36	0.67	1.44	98.56	**0.34**
0.3	0.36	19.37	9.56	11.00	89.00	**3.47**
0.15	0.23	109.64	54.12	65.11	34.89	**12.18**
0.075	0.11	64.37	31.77	96.89	3.11	**3.57**
Residue		6.31	96.89			**20.88**
		202.60				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.216 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

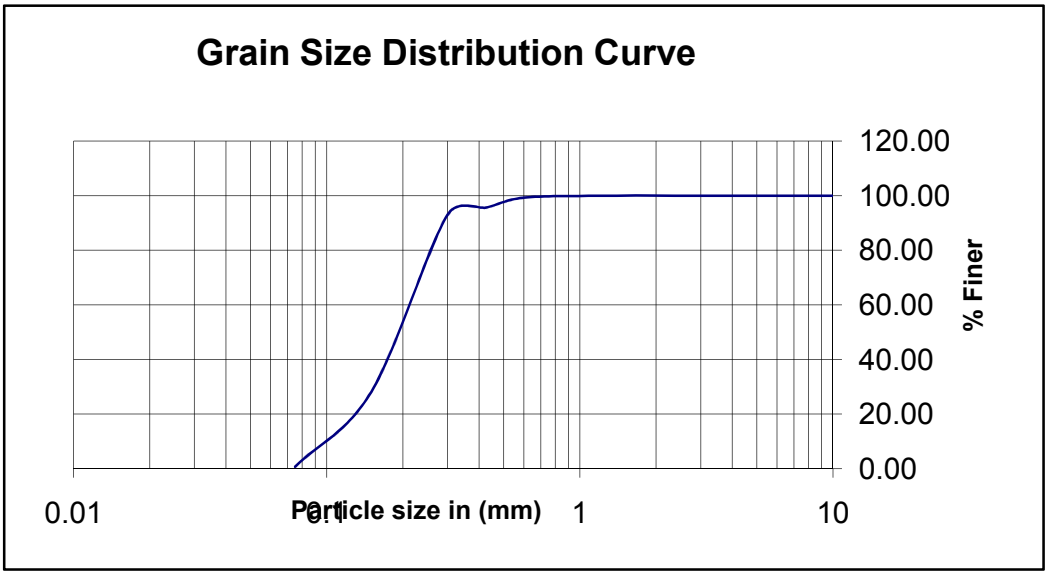
MBH-05

GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 3.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.16	0.05	0.05	99.95	**0.10**
0.6	0.89	2.04	0.70	0.75	99.25	**0.62**
0.425	0.51	10.70	3.66	4.41	95.59	**1.87**
0.3	0.36	7.69	2.63	7.03	92.97	**0.95**
0.15	0.23	189.67	64.80	71.83	28.17	**14.58**
0.075	0.11	80.42	27.47	99.31	0.69	**3.09**
Residue		2.03	99.31			**21.21**
		292.71				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.214 mm**

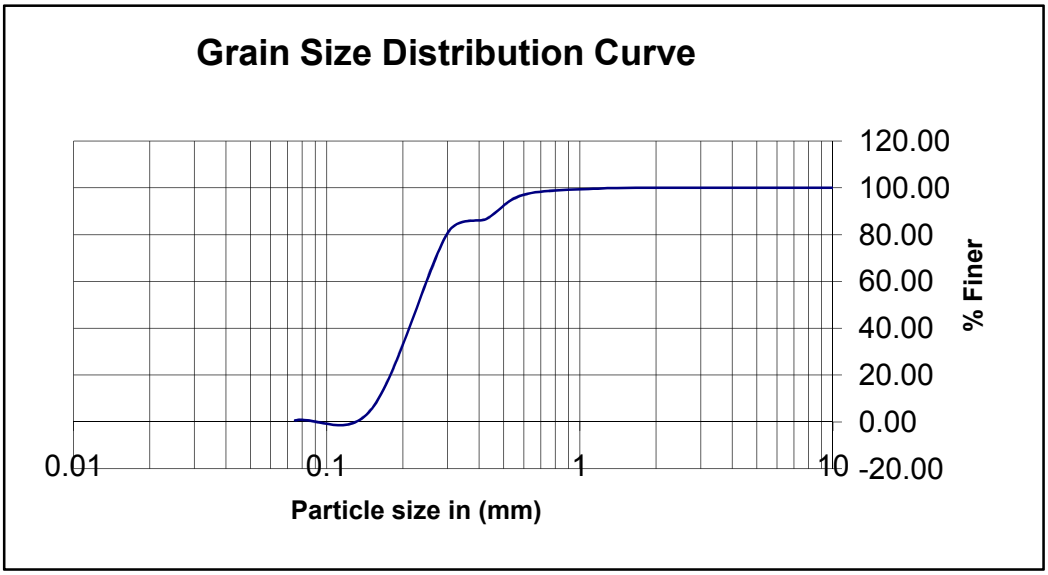


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 4.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.76	0.34	0.34	99.66	**0.60**
0.6	0.89	5.92	2.62	2.96	97.04	**2.33**
0.425	0.51	23.70	10.50	13.45	86.55	**5.38**
0.3	0.36	13.33	5.90	19.36	80.64	**2.14**
0.15	0.23	170.12	75.34	94.70	5.30	**16.95**
0.075	0.11	10.44	4.62	99.32	0.68	**0.52**
Residue		1.53	99.32			**27.92**
		225.80				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.281 mm**

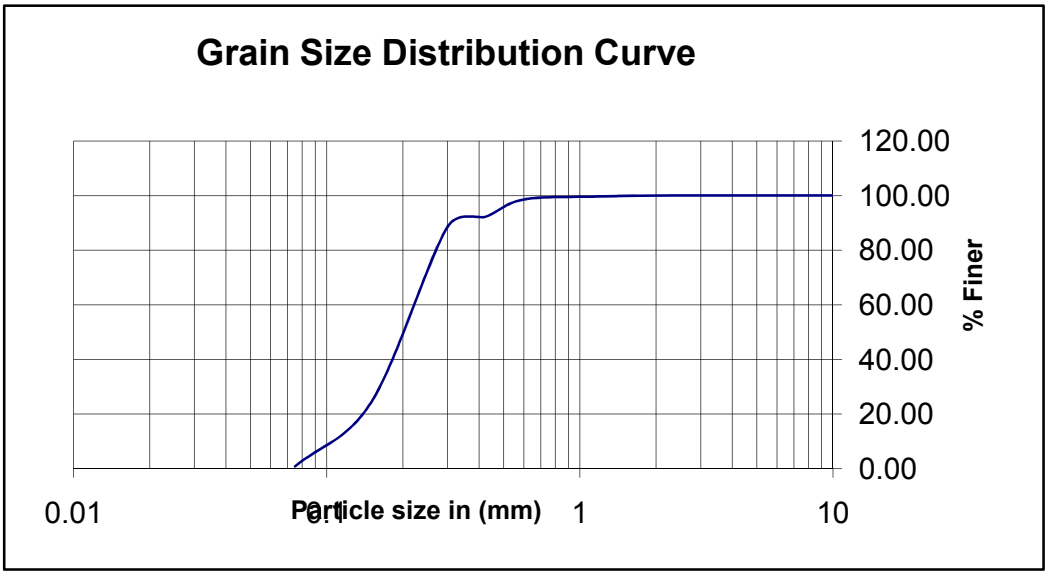


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 9.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	1.03	0.35	0.35	99.65	**0.62**
0.6	0.89	3.22	1.09	1.44	98.56	**0.97**
0.425	0.51	18.64	6.30	7.74	92.26	**3.23**
0.3	0.36	11.08	3.75	11.49	88.51	**1.36**
0.15	0.23	189.67	64.14	75.63	24.37	**14.43**
0.075	0.11	69.74	23.59	99.22	0.78	**2.65**
Residue		2.31	99.22			**23.26**
		295.69				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.234 mm**

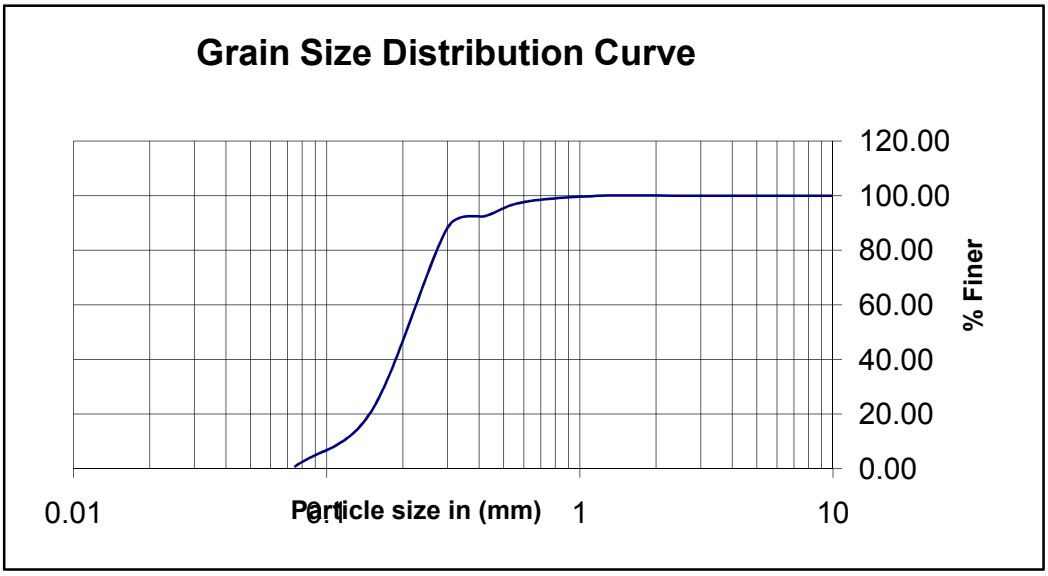


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 15.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.21	0.08	0.08	99.92	**0.13**
0.6	0.89	6.30	2.27	2.34	97.66	**2.02**
0.425	0.51	14.17	5.10	7.44	92.56	**2.61**
0.3	0.36	12.08	4.34	11.78	88.22	**1.57**
0.15	0.23	187.09	67.29	79.07	20.93	**15.14**
0.075	0.11	56.07	20.17	99.23	0.77	**2.27**
Residue		2.13	99.23			**23.74**
		278.05				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.239 mm**

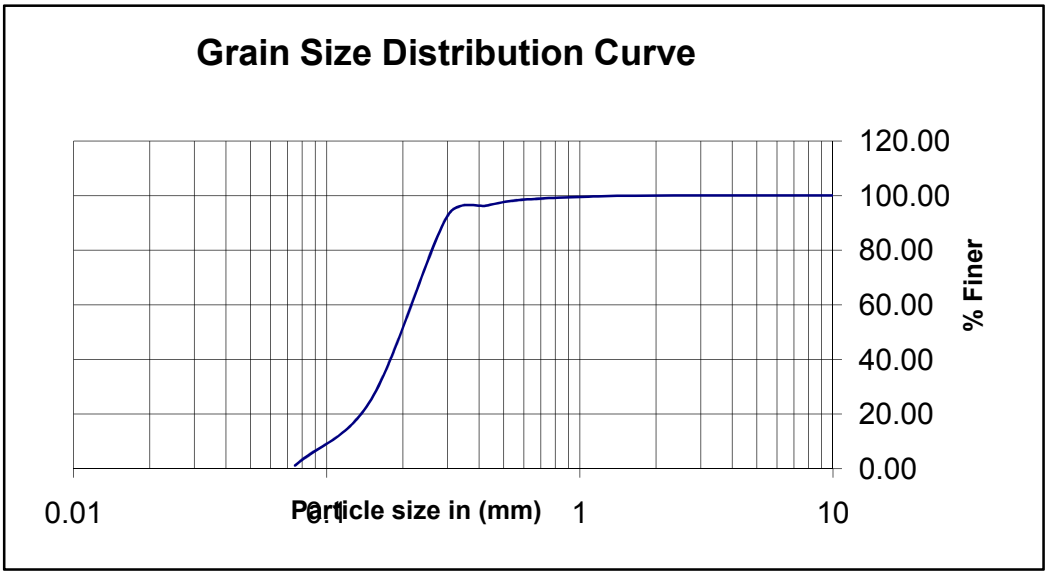


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 18.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.77	0.27	0.27	99.73	**0.48**
0.6	0.89	3.51	1.25	1.52	98.48	**1.11**
0.425	0.51	6.27	2.22	3.74	96.26	**1.14**
0.3	0.36	10.38	3.68	7.42	92.58	**1.33**
0.15	0.23	189.34	67.16	74.59	25.41	**15.11**
0.075	0.11	68.39	24.26	98.85	1.15	**2.73**
Residue		3.25	98.85			**21.91**
		281.91				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.222 mm**

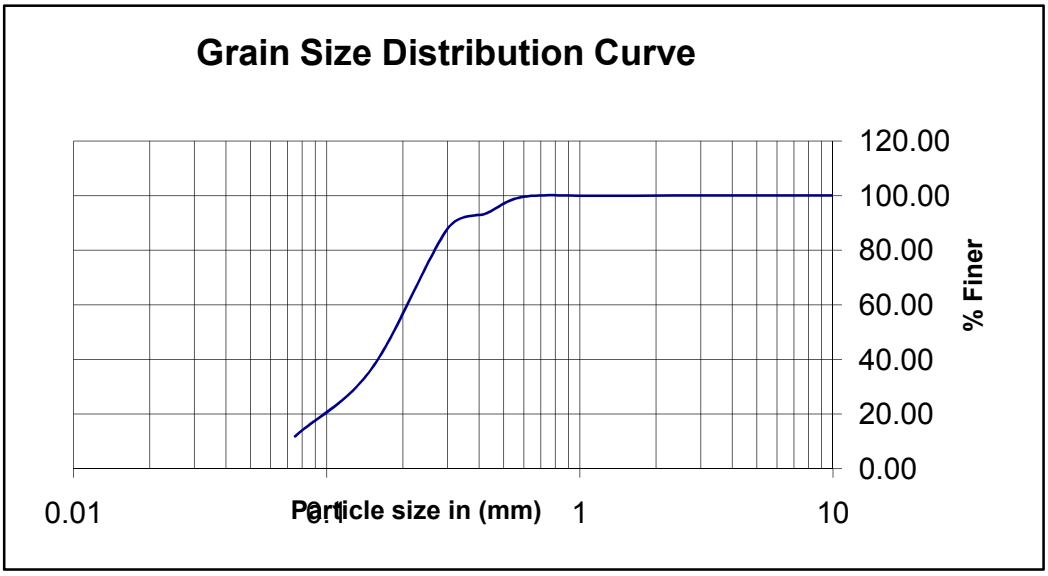


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 24.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.28	0.10	0.10	99.90	**0.18**
0.6	0.89	0.98	0.35	0.45	99.55	**0.31**
0.425	0.51	17.35	6.16	6.60	93.40	**3.16**
0.3	0.36	15.76	5.59	12.20	87.80	**2.03**
0.15	0.23	144.87	51.41	63.60	36.40	**11.57**
0.075	0.11	69.30	24.59	88.19	11.81	**2.77**
Residue		33.28	88.19			**20.00**
		281.82				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.227 mm**

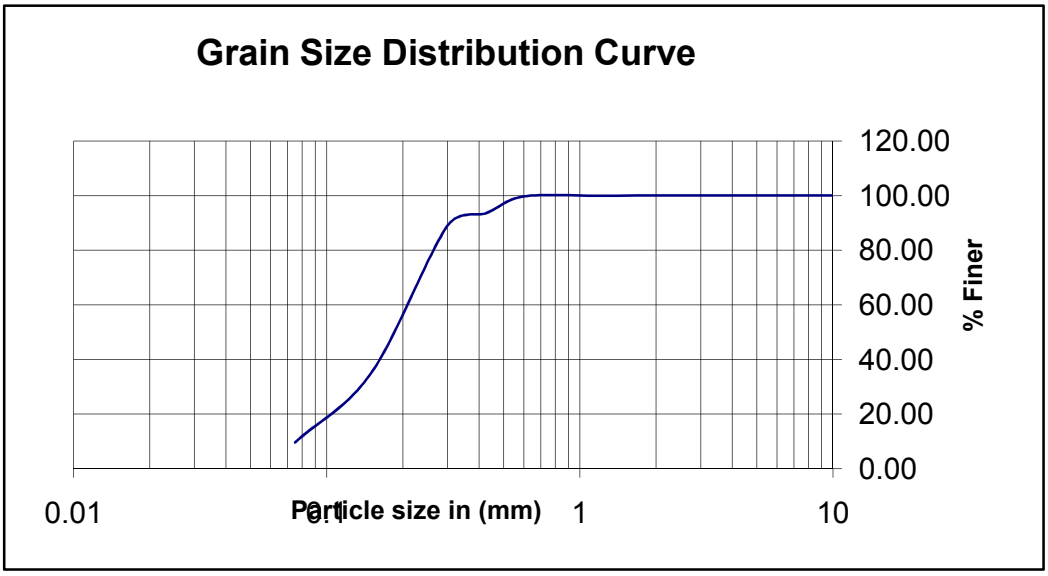


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 27.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.14	0.05	0.05	99.95	**0.09**
0.6	0.89	0.77	0.28	0.33	99.67	**0.25**
0.425	0.51	16.84	6.19	6.52	93.48	**3.17**
0.3	0.36	12.30	4.52	11.05	88.95	**1.64**
0.15	0.23	146.58	53.88	64.93	35.07	**12.12**
0.075	0.11	69.27	25.46	90.39	9.61	**2.86**
Residue		26.14	90.39			**20.14**
		272.04				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.223 mm**

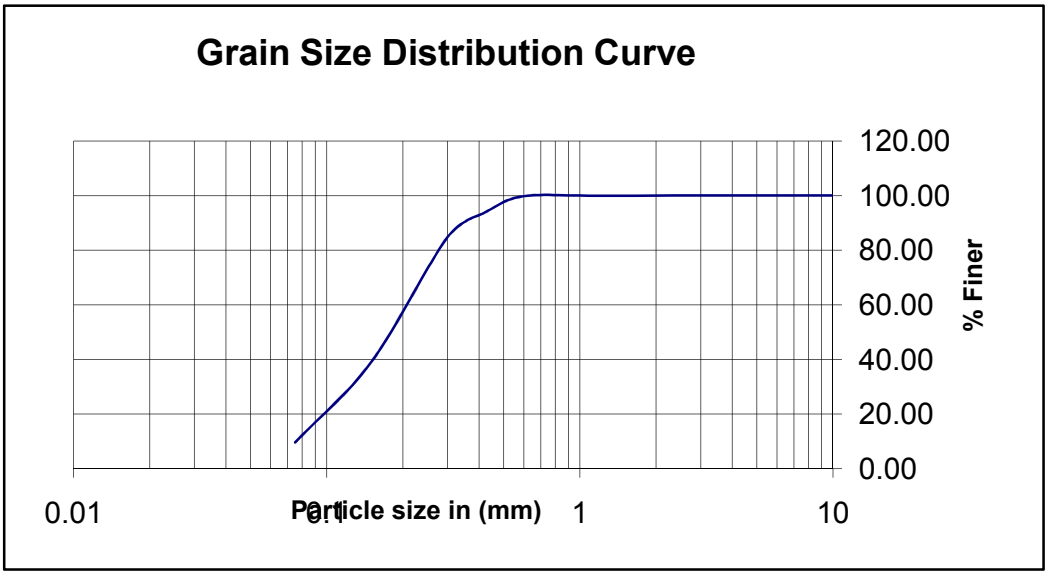


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 31.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.29	0.11	0.11	99.89	**0.19**
0.6	0.89	0.37	0.14	0.24	99.76	**0.12**
0.425	0.51	15.80	5.80	6.04	93.96	**2.97**
0.3	0.36	25.19	9.24	15.28	84.72	**3.35**
0.15	0.23	124.46	45.68	60.96	39.04	**10.28**
0.075	0.11	80.27	29.46	90.42	9.58	**3.31**
Residue		26.11	90.42			**20.22**
		272.49				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.224 mm**

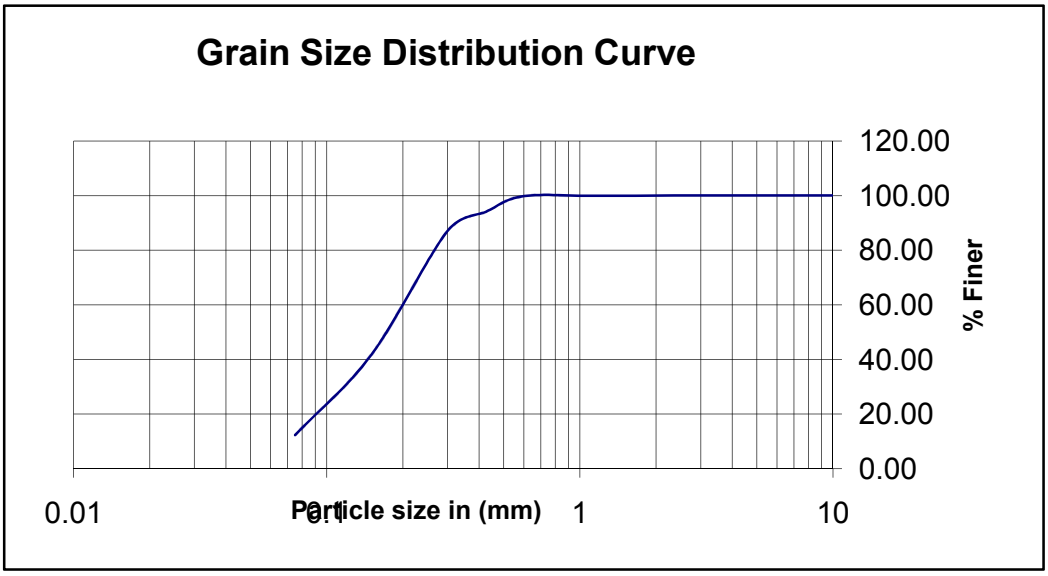


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 42.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.34	0.12	0.12	99.88	**0.21**
0.6	0.89	0.26	0.09	0.21	99.79	**0.08**
0.425	0.51	16.37	5.73	5.94	94.06	**2.94**
0.3	0.36	20.11	7.04	12.98	87.02	**2.55**
0.15	0.23	129.61	45.37	58.35	41.65	**10.21**
0.075	0.11	83.96	29.39	87.74	12.26	**3.31**
Residue		35.02	87.74			**19.30**
		285.67				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.220 mm**

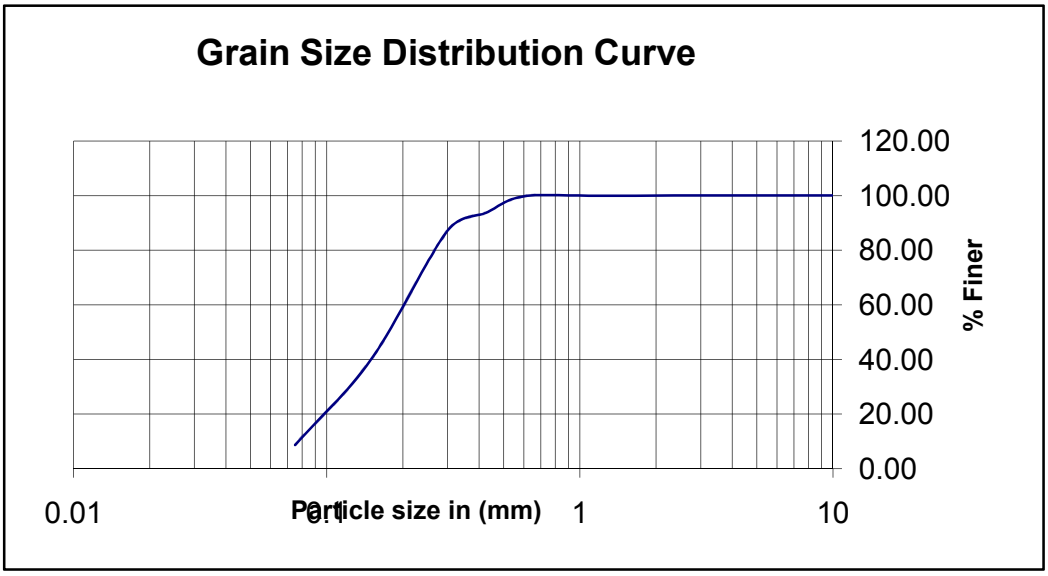


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 46.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.29	0.10	0.10	99.90	**0.18**
0.6	0.89	0.55	0.19	0.30	99.70	**0.17**
0.425	0.51	17.24	6.06	6.36	93.64	**3.11**
0.3	0.36	18.56	6.53	12.89	87.11	**2.37**
0.15	0.23	133.56	46.98	59.87	40.13	**10.57**
0.075	0.11	89.37	31.44	91.31	8.69	**3.54**
Residue		24.70	91.31			**19.94**
		284.27				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.218 mm**

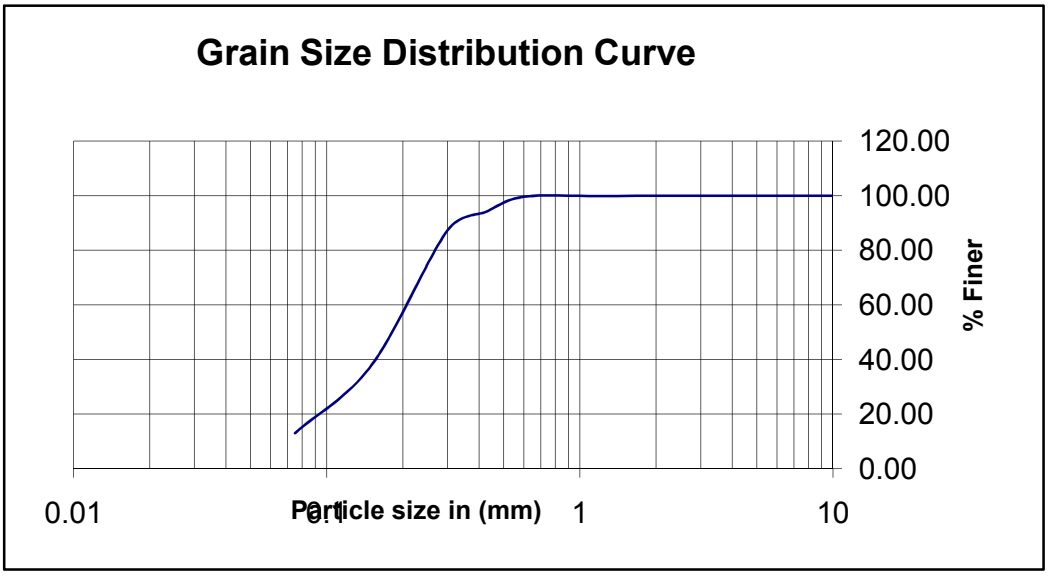


GRAIN SIZE ANALYSIS

Borehole No: MBH5
Depth- 52.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.31	0.11	0.11	99.89	**0.19**
0.6	0.89	0.76	0.27	0.38	99.62	**0.24**
0.425	0.51	15.66	5.53	5.90	94.10	**2.83**
0.3	0.36	19.20	6.78	12.68	87.32	**2.46**
0.15	0.23	140.27	49.51	62.19	37.81	**11.14**
0.075	0.11	70.19	24.77	86.96	13.04	**2.79**
Residue		36.94	86.96			**19.65**
		283.33				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.226 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

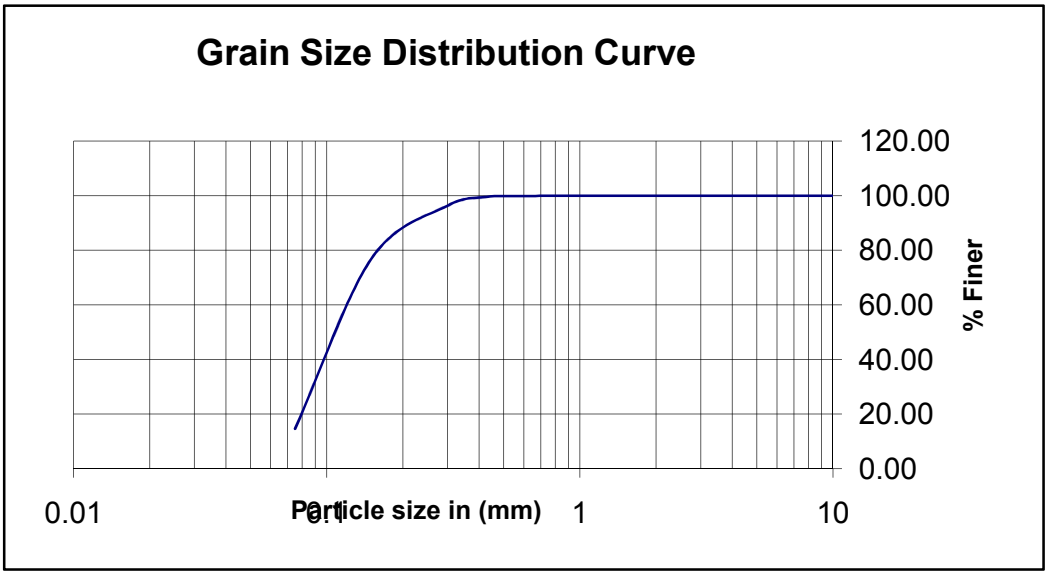
LBH-01

GRAIN SIZE ANALYSIS

Borehole No: LBH1
Depth- 9.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.25	0.09	0.09	99.91	**0.08**
0.425	0.51	1.07	0.37	0.46	99.54	**0.19**
0.3	0.36	9.16	3.17	3.63	96.37	**1.15**
0.15	0.23	56.23	19.48	23.11	76.89	**4.38**
0.075	0.11	179.64	62.23	85.35	14.65	**7.00**
Residue		42.30	85.35			**12.80**
		288.65				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.150 mm**

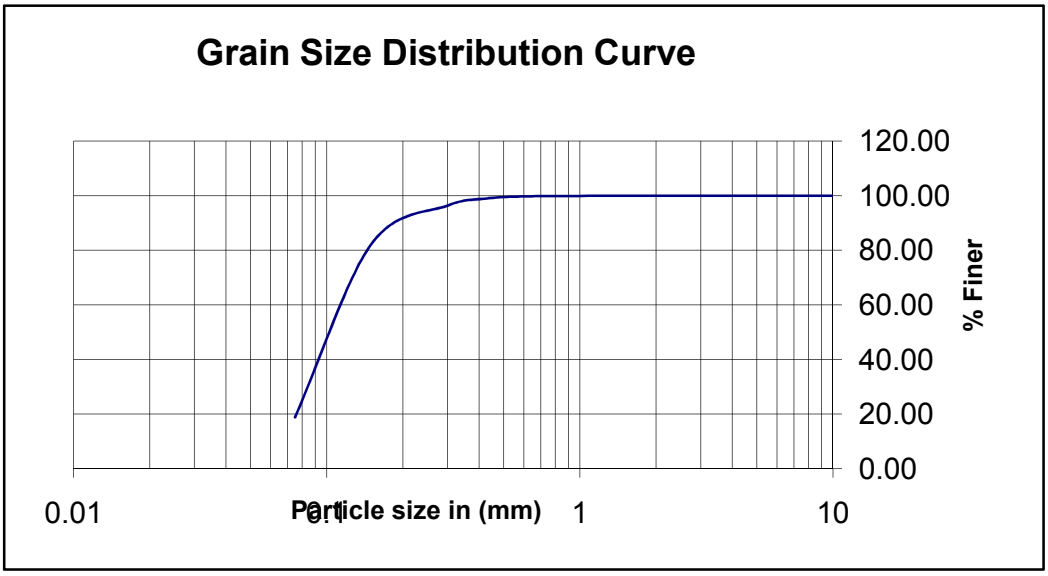


GRAIN SIZE ANALYSIS

Borehole No: LBH1
Depth- 10.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.64	0.21	0.21	99.79	**0.19**
0.425	0.51	2.36	0.79	1.00	99.00	**0.41**
0.3	0.36	7.69	2.58	3.58	96.42	**0.93**
0.15	0.23	42.13	14.11	17.69	82.31	**3.18**
0.075	0.11	189.37	63.43	81.13	18.87	**7.14**
Residue		56.34	81.13			**11.84**
		298.53				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.146 mm**

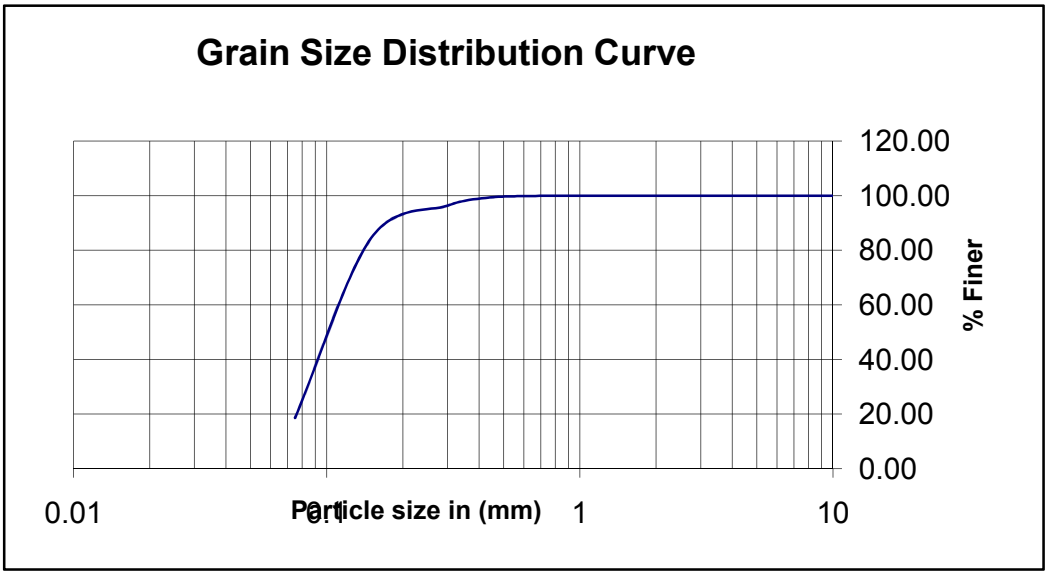


GRAIN SIZE ANALYSIS

Borehole No: LBH1
Depth- 12.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.33	0.11	0.11	99.89	**0.10**
0.425	0.51	2.01	0.67	0.79	99.21	**0.35**
0.3	0.36	8.40	2.82	3.61	96.39	**1.02**
0.15	0.23	35.27	11.84	15.45	84.55	**2.66**
0.075	0.11	196.43	65.96	81.41	18.59	**7.42**
Residue		55.37	81.41			**11.55**
		297.81				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.142 mm**

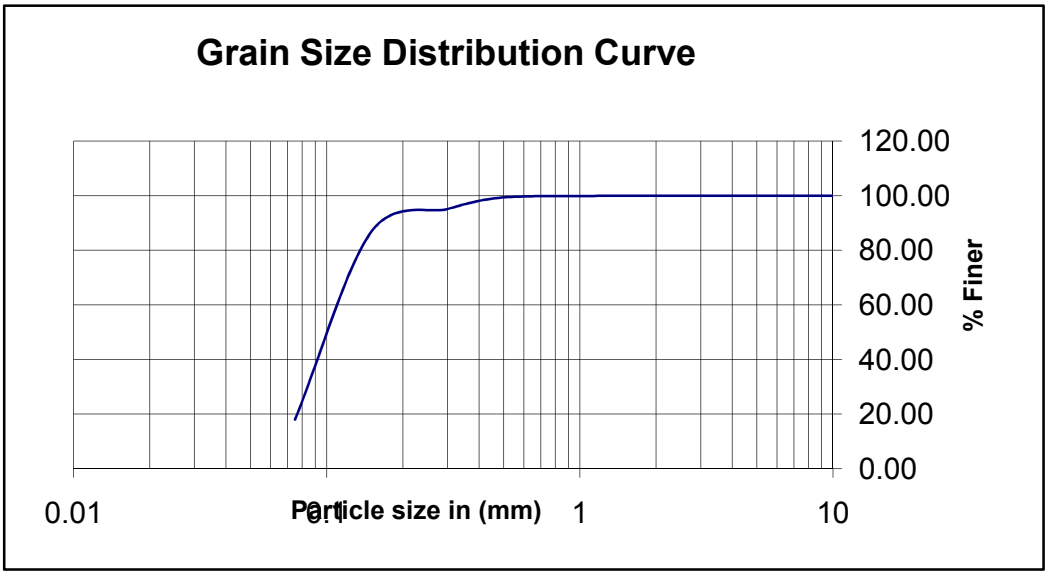


GRAIN SIZE ANALYSIS

Borehole No: LBH1
Depth- 13.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.13	0.05	0.05	99.95	**0.08**
0.6	0.89	0.56	0.20	0.25	99.75	**0.18**
0.425	0.51	3.24	1.16	1.41	98.59	**0.59**
0.3	0.36	9.67	3.46	4.87	95.13	**1.25**
0.15	0.23	23.29	8.33	13.20	86.80	**1.88**
0.075	0.11	192.34	68.82	82.02	17.98	**7.74**
Residue		50.24	82.02			**11.73**
		279.47				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.143 mm**

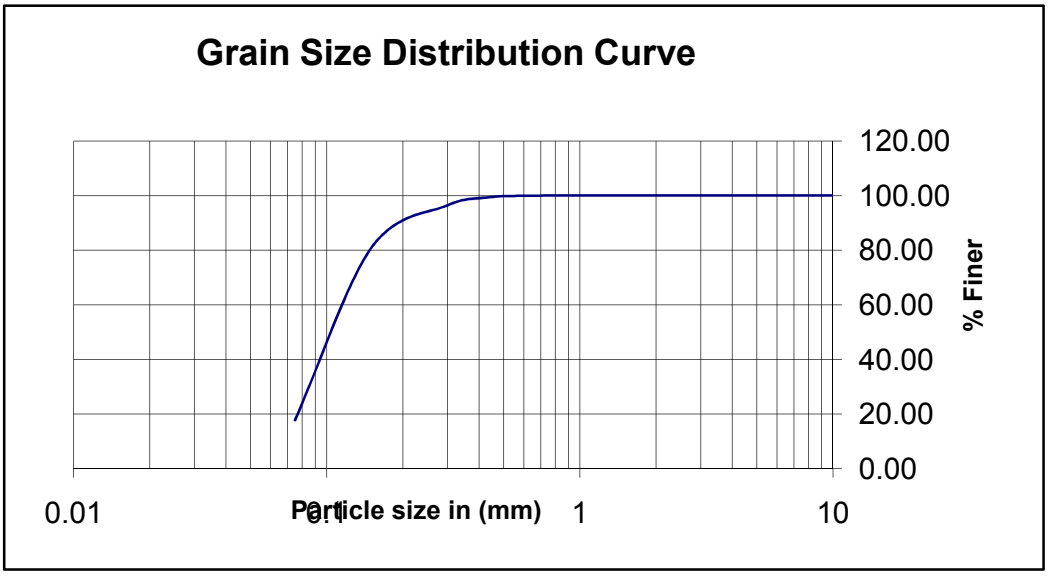


GRAIN SIZE ANALYSIS

Borehole No: LBH1
Depth- 18.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.23	0.08	0.08	99.92	**0.07**
0.425	0.51	2.00	0.67	0.75	99.25	**0.34**
0.3	0.36	8.46	2.83	3.58	96.42	**1.03**
0.15	0.23	46.57	15.59	19.17	80.83	**3.51**
0.075	0.11	188.20	63.00	82.16	17.84	**7.09**
Residue		53.29	82.16			**12.03**
		298.75				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.146 mm**

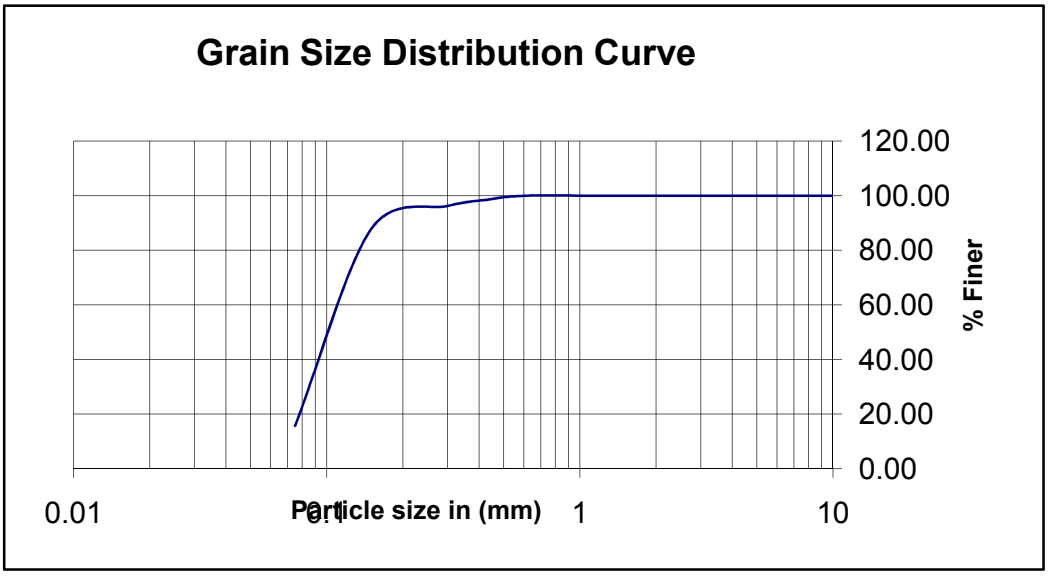


GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 3.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.05	0.02	0.02	99.98	**0.02**
0.425	0.51	4.07	1.47	1.49	98.51	**0.76**
0.3	0.36	6.31	2.28	3.78	96.22	**0.83**
0.15	0.23	23.10	8.36	12.14	87.86	**1.88**
0.075	0.11	199.37	72.19	84.33	15.67	**8.12**
Residue		43.28	84.33			**11.60**
		276.18				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.138 mm**

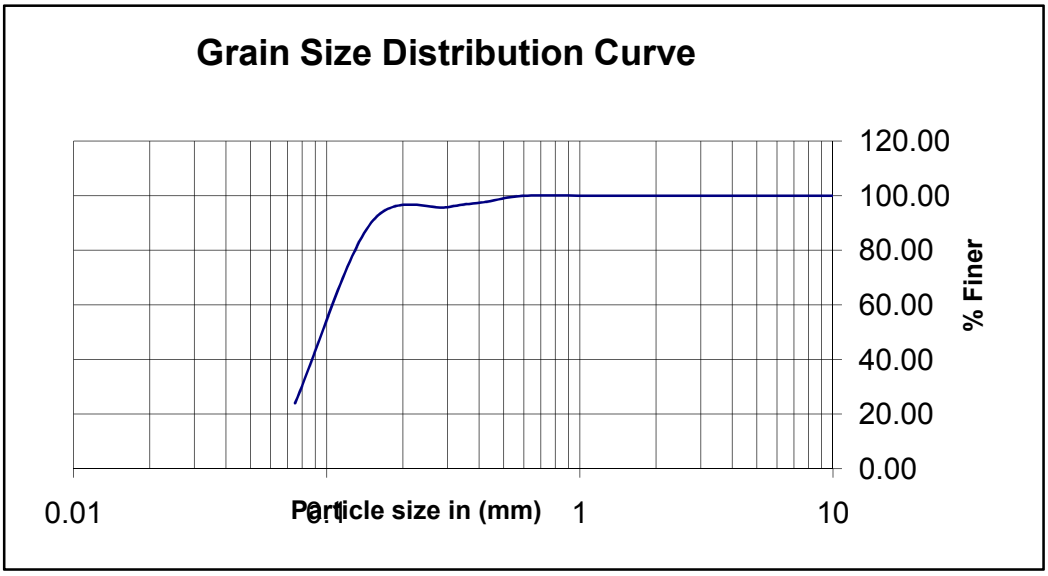


GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 10.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.03	0.01	0.01	99.99	**0.02**
0.6	0.89	0.02	0.01	0.02	99.98	**0.01**
0.425	0.51	6.27	2.26	2.28	97.72	**1.16**
0.3	0.36	5.27	1.90	4.18	95.82	**0.69**
0.15	0.23	15.69	5.66	9.84	90.16	**1.27**
0.075	0.11	183.27	66.13	75.97	24.03	**7.44**
Residue		66.59	75.97			**10.59**
		277.14				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.139 mm**

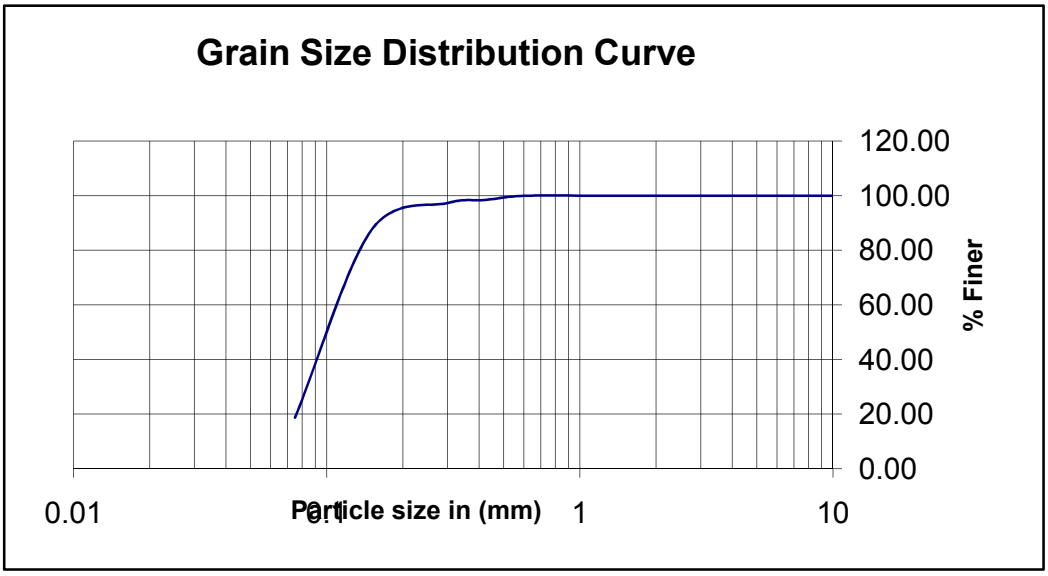


GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 13.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.12	0.04	0.04	99.96	**0.07**
0.6	0.89	0.07	0.02	0.07	99.93	**0.02**
0.425	0.51	4.23	1.49	1.56	98.44	**0.76**
0.3	0.36	3.27	1.15	2.71	97.29	**0.42**
0.15	0.23	28.34	10.00	12.71	87.29	**2.25**
0.075	0.11	194.28	68.52	81.23	18.77	**7.71**
Residue		53.21	81.23			**11.24**
		283.52				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.138 mm**

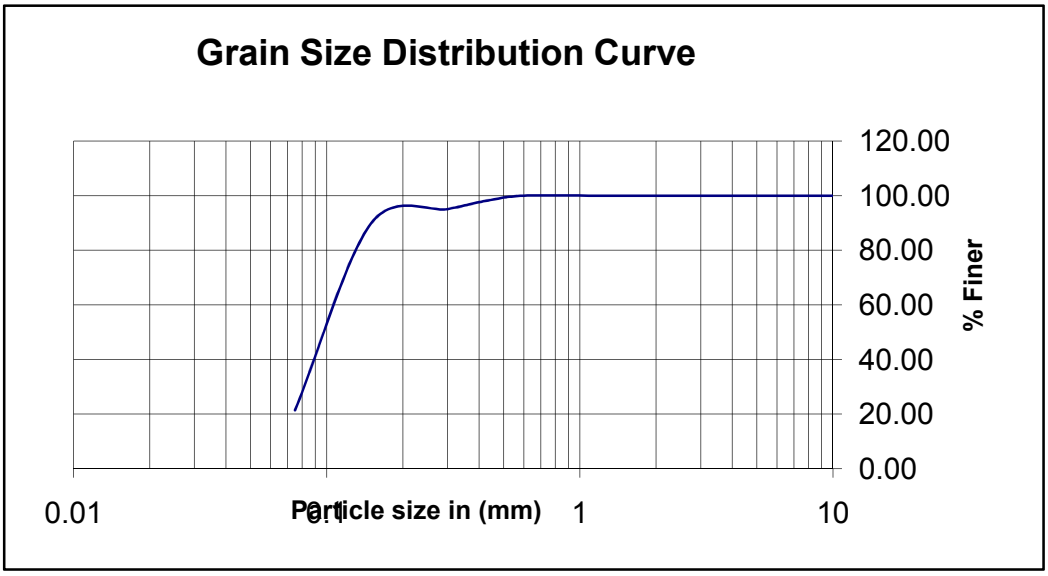


GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 15.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.07	0.03	0.03	99.97	**0.04**
0.6	0.89	0.03	0.01	0.04	99.96	**0.01**
0.425	0.51	5.23	1.89	1.93	98.07	**0.97**
0.3	0.36	8.31	3.01	4.93	95.07	**1.09**
0.15	0.23	14.20	5.14	10.07	89.93	**1.16**
0.075	0.11	189.37	68.49	78.55	21.45	**7.70**
Residue		59.30	78.55			**10.97**
		276.51				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.140 mm**

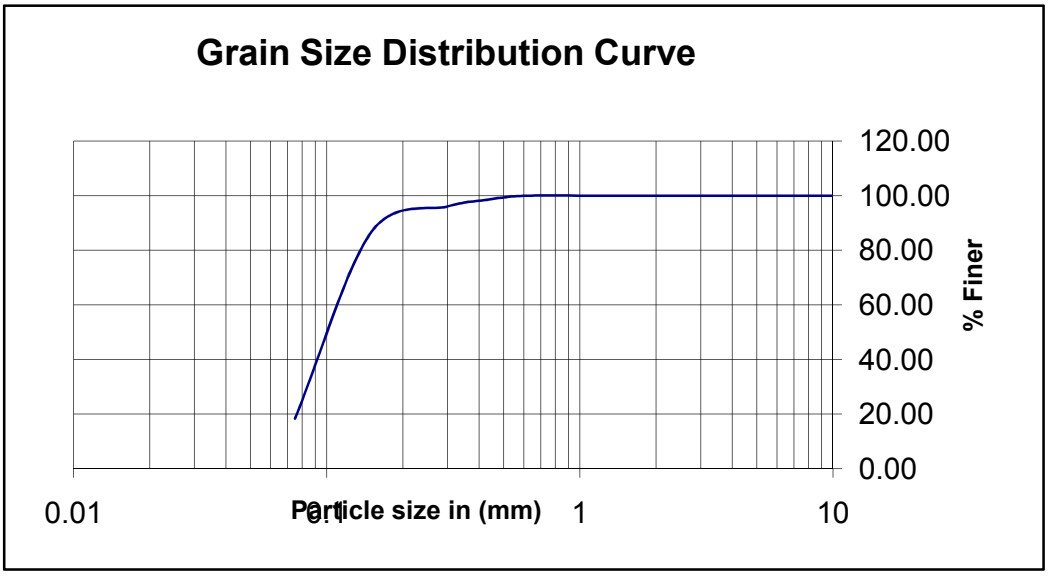


GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 18.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.04	0.01	0.01	99.99	**0.03**
0.6	0.89	0.09	0.03	0.05	99.95	**0.03**
0.425	0.51	4.28	1.54	1.58	98.42	**0.79**
0.3	0.36	6.59	2.36	3.95	96.05	**0.86**
0.15	0.23	26.21	9.40	13.35	86.65	**2.12**
0.075	0.11	190.24	68.24	81.59	18.41	**7.68**
Residue		51.33	81.59			**11.49**
		278.78				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.141 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

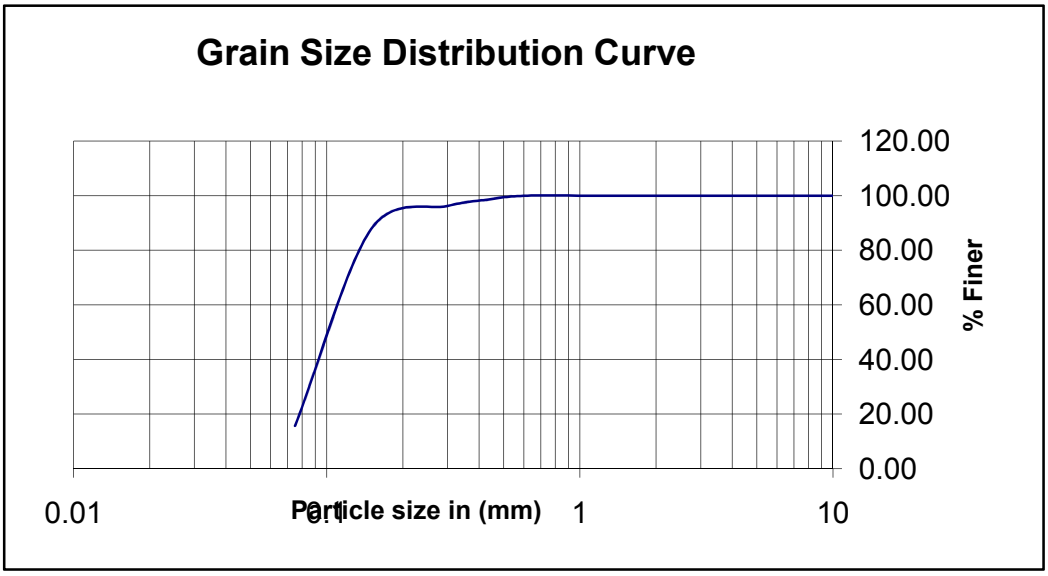
LBH-02

GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 3.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.05	0.02	0.02	99.98	**0.02**
0.425	0.51	4.07	1.47	1.49	98.51	**0.76**
0.3	0.36	6.31	2.28	3.78	96.22	**0.83**
0.15	0.23	23.10	8.36	12.14	87.86	**1.88**
0.075	0.11	199.37	72.19	84.33	15.67	**8.12**
Residue		43.28	84.33			**11.60**
		276.18				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.138 mm**

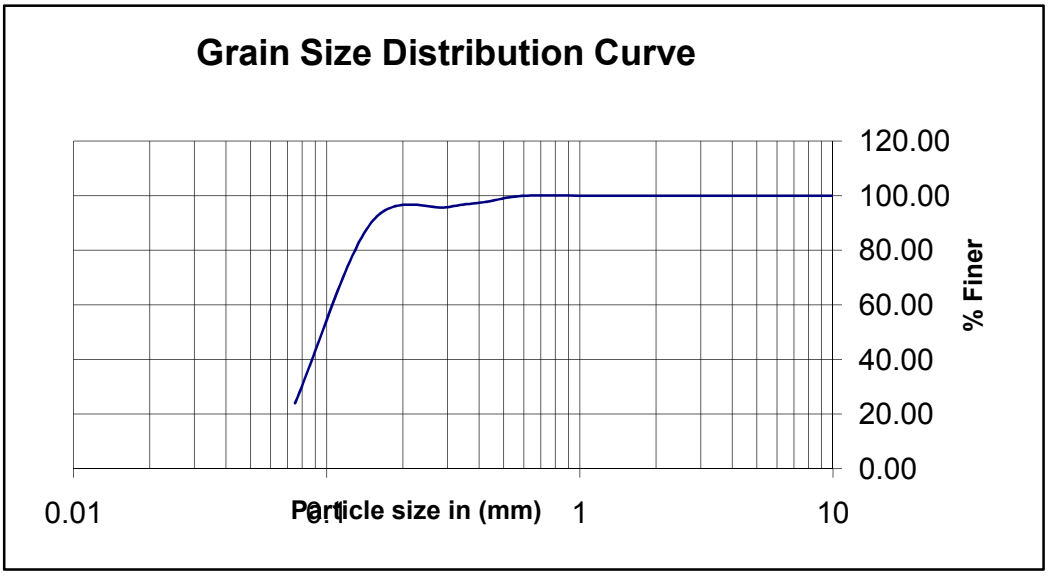


GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 10.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.03	0.01	0.01	99.99	**0.02**
0.6	0.89	0.02	0.01	0.02	99.98	**0.01**
0.425	0.51	6.27	2.26	2.28	97.72	**1.16**
0.3	0.36	5.27	1.90	4.18	95.82	**0.69**
0.15	0.23	15.69	5.66	9.84	90.16	**1.27**
0.075	0.11	183.27	66.13	75.97	24.03	**7.44**
Residue		66.59	75.97			**10.59**
		277.14				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.139 mm**

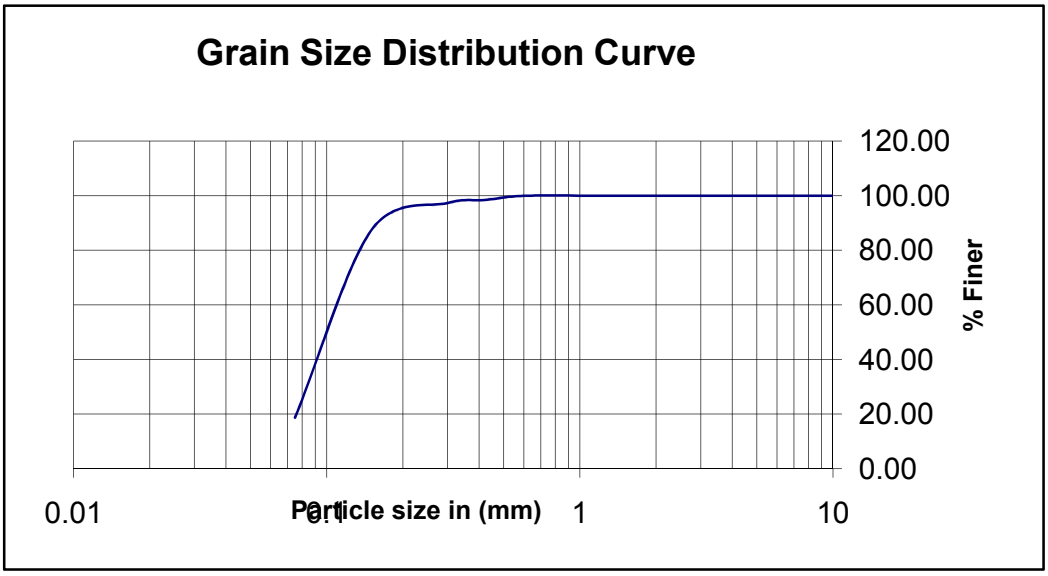


GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 13.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.12	0.04	0.04	99.96	**0.07**
0.6	0.89	0.07	0.02	0.07	99.93	**0.02**
0.425	0.51	4.23	1.49	1.56	98.44	**0.76**
0.3	0.36	3.27	1.15	2.71	97.29	**0.42**
0.15	0.23	28.34	10.00	12.71	87.29	**2.25**
0.075	0.11	194.28	68.52	81.23	18.77	**7.71**
Residue		53.21	81.23			**11.24**
		283.52				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.138 mm**

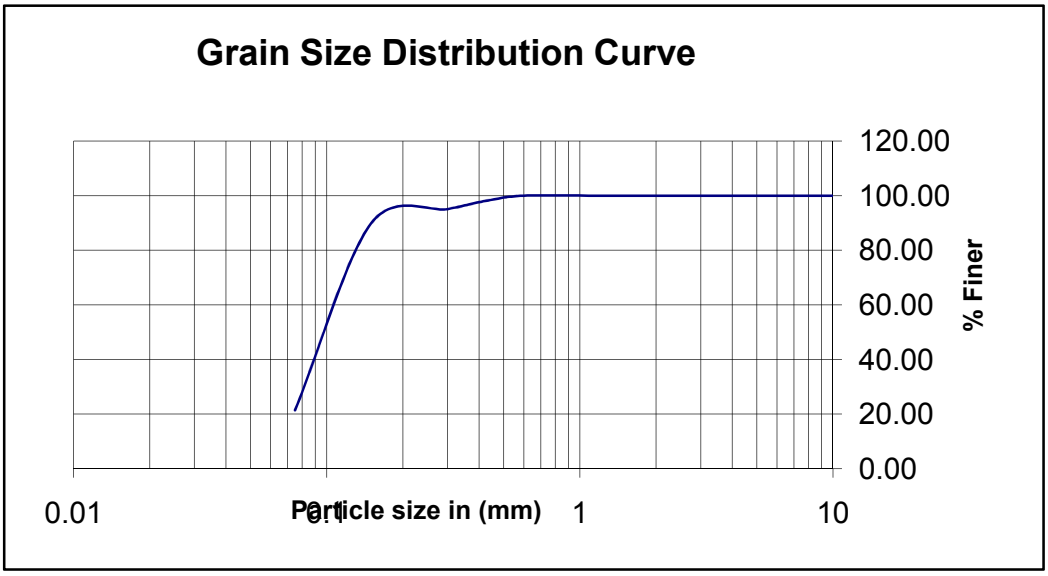


GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 15.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.07	0.03	0.03	99.97	**0.04**
0.6	0.89	0.03	0.01	0.04	99.96	**0.01**
0.425	0.51	5.23	1.89	1.93	98.07	**0.97**
0.3	0.36	8.31	3.01	4.93	95.07	**1.09**
0.15	0.23	14.20	5.14	10.07	89.93	**1.16**
0.075	0.11	189.37	68.49	78.55	21.45	**7.70**
Residue		59.30	78.55			**10.97**
		276.51				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.140 mm**

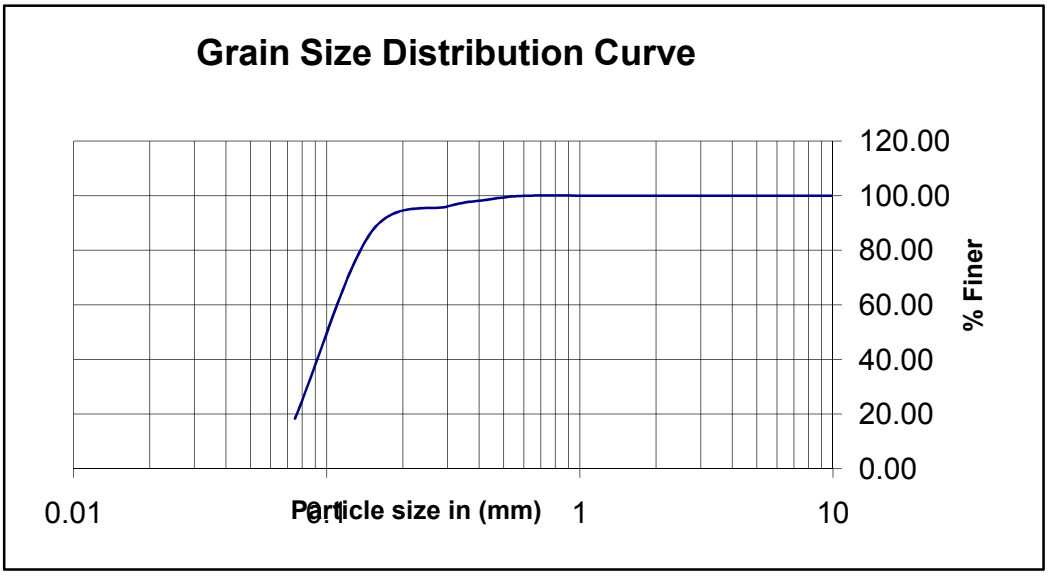


GRAIN SIZE ANALYSIS

Borehole No: LBH2
Depth- 18.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.04	0.01	0.01	99.99	**0.03**
0.6	0.89	0.09	0.03	0.05	99.95	**0.03**
0.425	0.51	4.28	1.54	1.58	98.42	**0.79**
0.3	0.36	6.59	2.36	3.95	96.05	**0.86**
0.15	0.23	26.21	9.40	13.35	86.65	**2.12**
0.075	0.11	190.24	68.24	81.59	18.41	**7.68**
Residue		51.33	81.59			**11.49**
		278.78				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.141 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

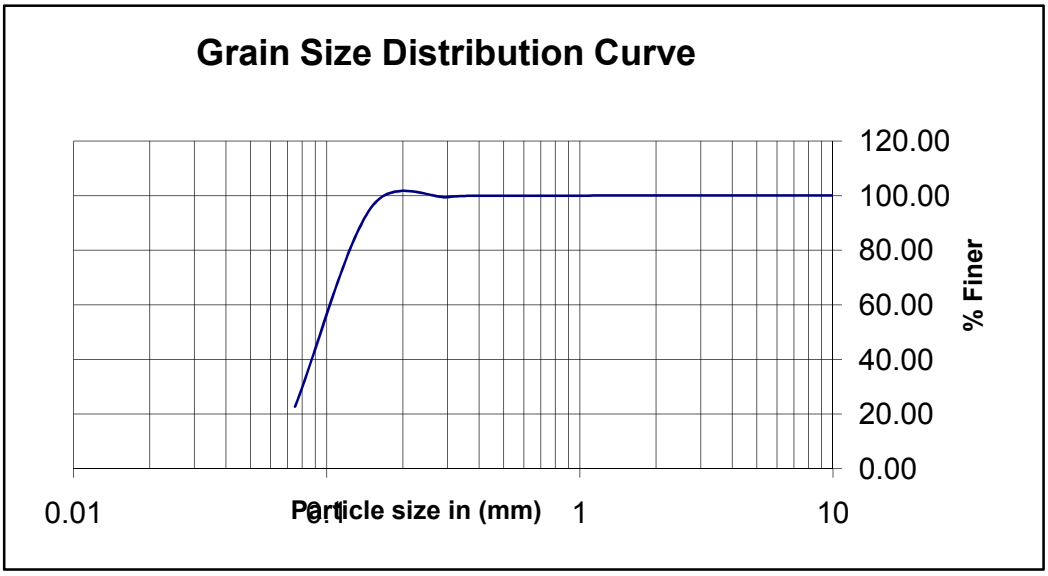
LBH-03

GRAIN SIZE ANALYSIS

Borehole No: LBH3
Depth- 3.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.25	0.09	0.09	99.91	**0.08**
0.425	0.51	0.00	0.00	0.09	99.91	**0.00**
0.3	0.36	1.31	0.48	0.57	99.43	**0.17**
0.15	0.23	10.21	3.73	4.30	95.70	**0.84**
0.075	0.11	199.64	72.94	77.24	22.76	**8.21**
Residue		62.30	77.24			**9.30**
		273.71				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.120 mm**

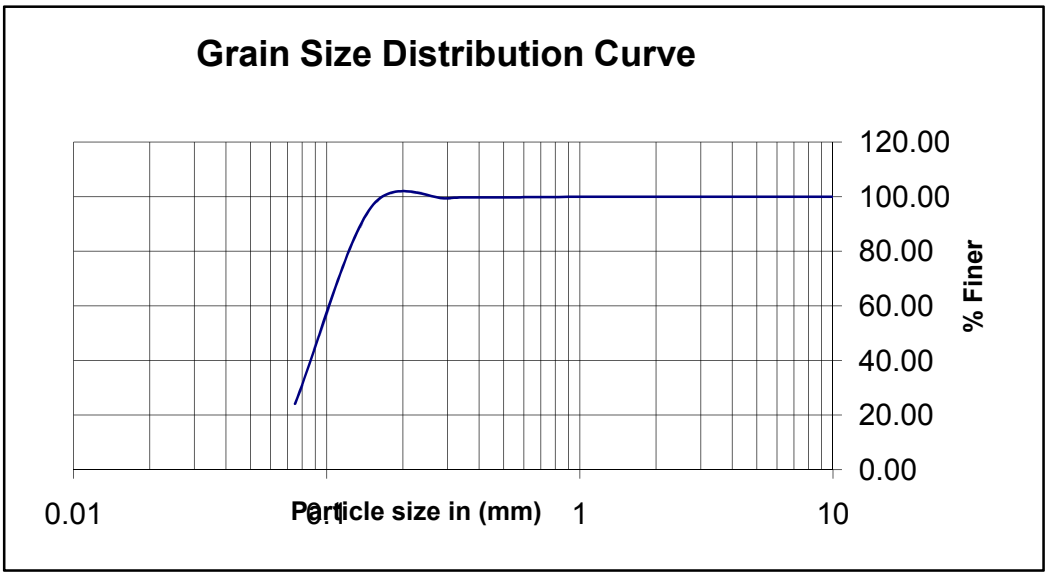


GRAIN SIZE ANALYSIS

Borehole No: LBH3
Depth- 6.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.55	0.20	0.20	99.80	**0.18**
0.425	0.51	0.11	0.04	0.24	99.76	**0.02**
0.3	0.36	1.02	0.38	0.62	99.38	**0.14**
0.15	0.23	8.64	3.19	3.81	96.19	**0.72**
0.075	0.11	195.27	72.08	75.89	24.11	**8.11**
Residue		65.31	75.89			**9.16**
		270.90				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.121 mm**

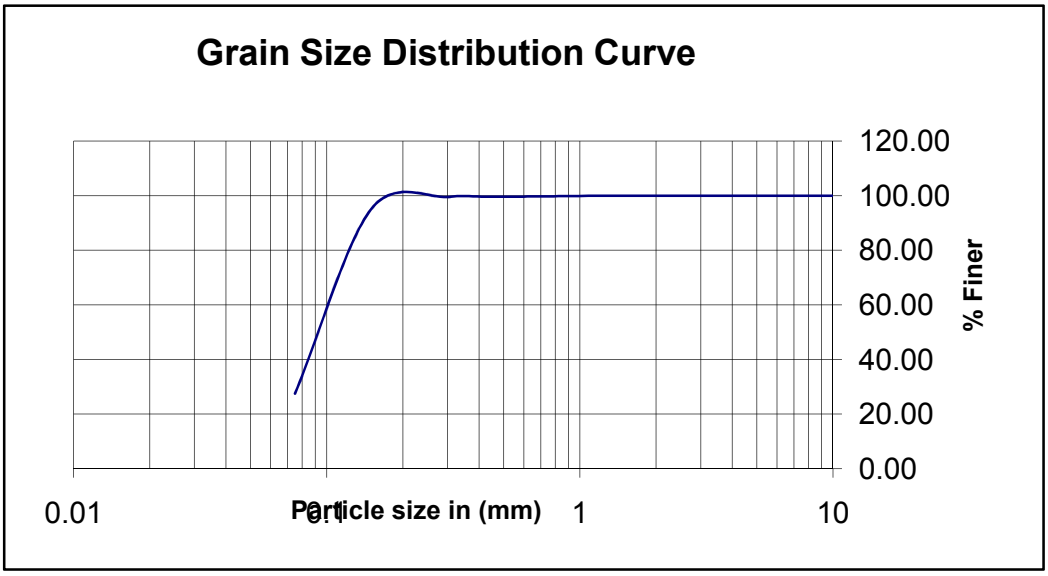


GRAIN SIZE ANALYSIS

Borehole No: LBH3
Depth- 9.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.77	0.27	0.27	99.73	**0.24**
0.425	0.51	0.11	0.04	0.31	99.69	**0.02**
0.3	0.36	0.26	0.09	0.41	99.59	**0.03**
0.15	0.23	12.37	4.41	4.82	95.18	**0.99**
0.075	0.11	189.64	67.62	72.44	27.56	**7.61**
Residue		77.29	72.44			**8.90**
		280.44				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.123 mm**

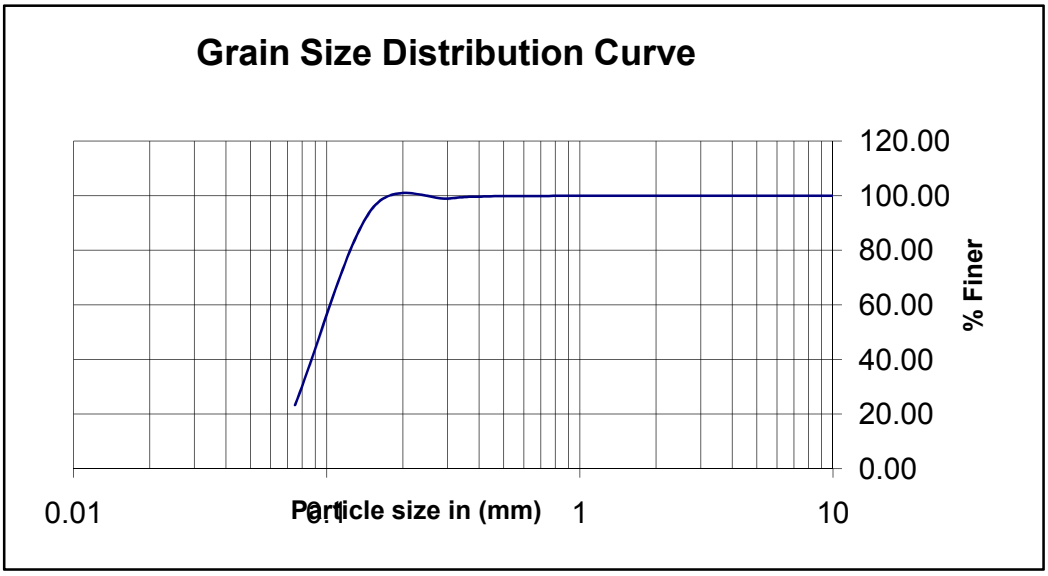


GRAIN SIZE ANALYSIS

Borehole No: LBH3
Depth- 12.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.00	0.00	0.00	100.00	**0.00**
0.6	0.89	0.46	0.17	0.17	99.83	**0.15**
0.425	0.51	0.34	0.12	0.29	99.71	**0.06**
0.3	0.36	2.19	0.79	1.08	98.92	**0.29**
0.15	0.23	11.27	4.09	5.17	94.83	**0.92**
0.075	0.11	197.26	71.54	76.71	23.29	**8.05**
Residue		64.21	76.71			**9.47**
		275.73				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.123 mm**

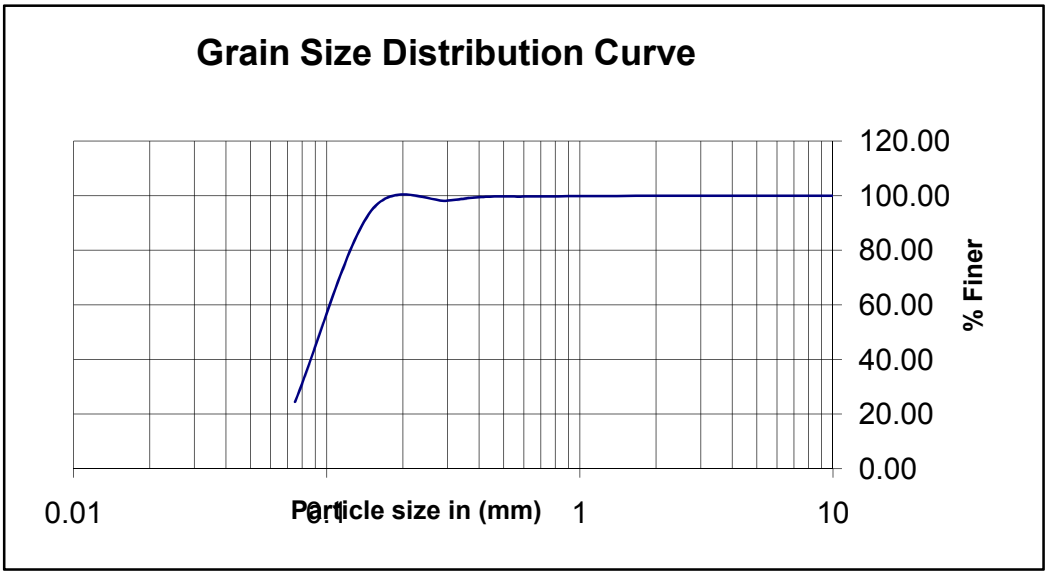


GRAIN SIZE ANALYSIS

Borehole No: LBH3
Depth- 15.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.21	0.08	0.08	99.92	**0.13**
0.6	0.89	0.52	0.19	0.26	99.74	**0.17**
0.425	0.51	0.22	0.08	0.34	99.66	**0.04**
0.3	0.36	3.94	1.42	1.76	98.24	**0.51**
0.15	0.23	10.23	3.69	5.45	94.55	**0.83**
0.075	0.11	194.59	70.12	75.57	24.43	**7.89**
Residue		67.81	75.57			**9.57**
		277.52				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.127 mm**

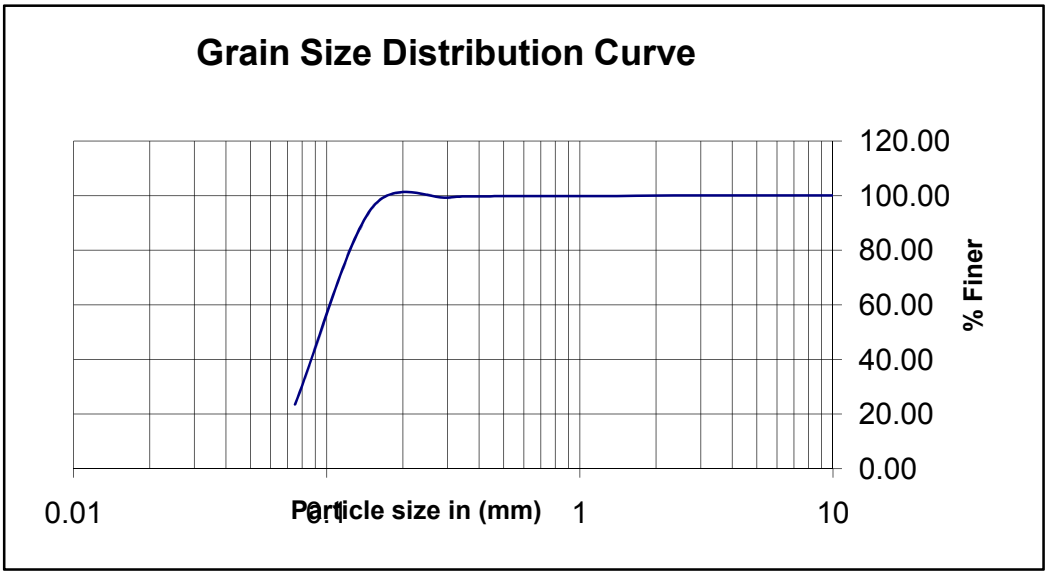


GRAIN SIZE ANALYSIS

Borehole No: LBH3
Depth- 22.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.44	0.16	0.16	99.84	**0.28**
0.6	0.89	0.06	0.02	0.18	99.82	**0.02**
0.425	0.51	0.24	0.09	0.27	99.73	**0.04**
0.3	0.36	1.29	0.47	0.74	99.26	**0.17**
0.15	0.23	11.25	4.11	4.85	95.15	**0.92**
0.075	0.11	196.17	71.67	76.52	23.48	**8.06**
Residue		64.28	76.52			**9.51**
		273.73				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.124 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

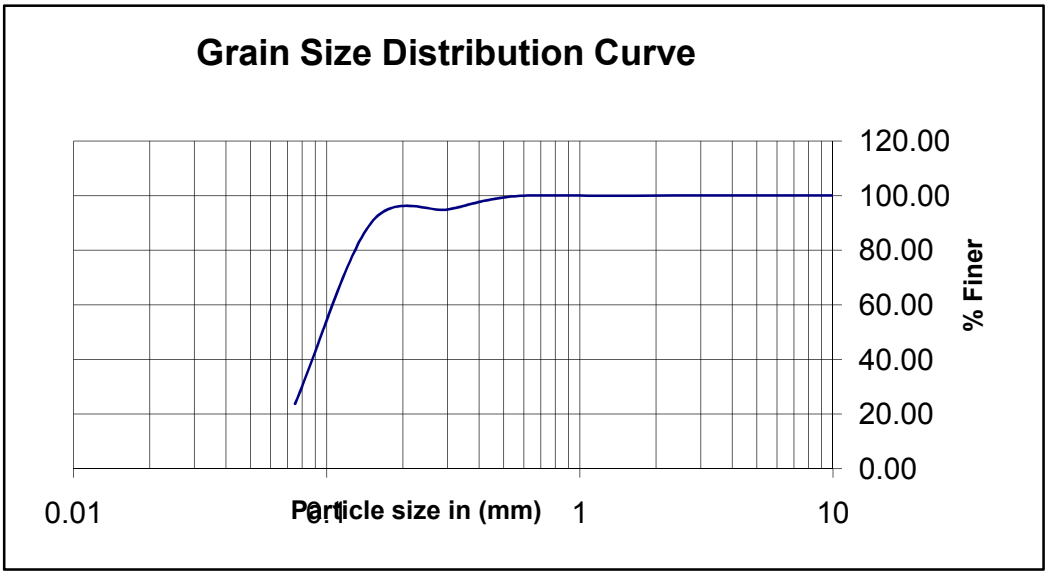
LBH-04

GRAIN SIZE ANALYSIS

Borehole No: LBH4
Depth- 10.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.10	0.03	0.03	99.97	**0.06**
0.6	0.89	0.06	0.02	0.05	99.95	**0.02**
0.425	0.51	5.28	1.78	1.84	98.16	**0.91**
0.3	0.36	9.67	3.27	5.11	94.89	**1.18**
0.15	0.23	14.28	4.82	9.93	90.07	**1.09**
0.075	0.11	196.27	66.31	76.24	23.76	**7.46**
Residue		70.31	76.24			**10.72**
		295.97				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.141 mm**

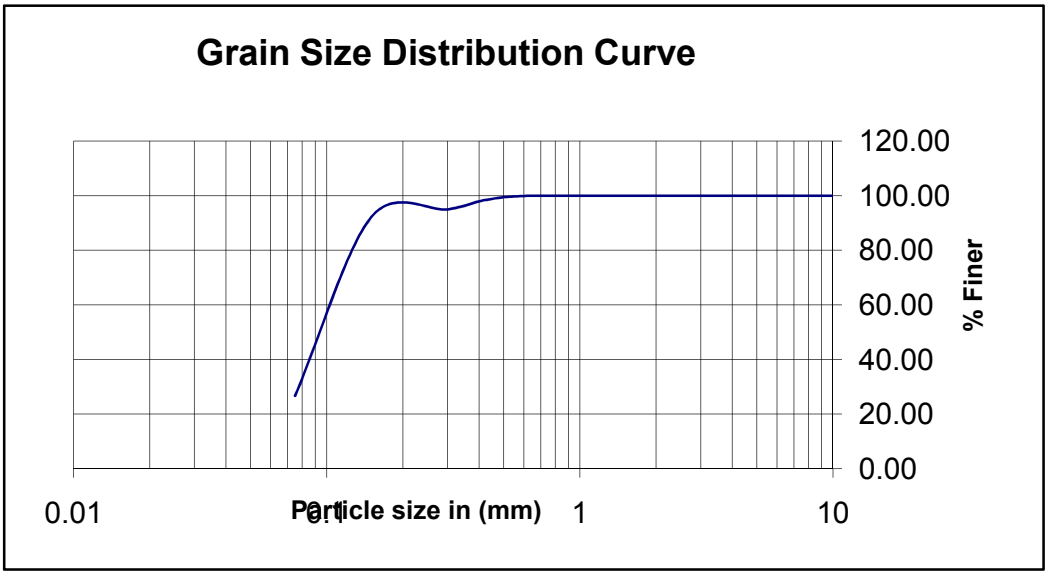


GRAIN SIZE ANALYSIS

Borehole No: LBH4
Depth- 12.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.16	0.05	0.05	99.95	**0.10**
0.6	0.89	0.21	0.07	0.12	99.88	**0.06**
0.425	0.51	4.29	1.45	1.57	98.43	**0.74**
0.3	0.36	10.28	3.46	5.03	94.97	**1.26**
0.15	0.23	8.37	2.82	7.85	92.15	**0.63**
0.075	0.11	194.28	65.46	73.31	26.69	**7.36**
Residue		79.21	73.31			**10.15**
		296.80				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.138 mm**

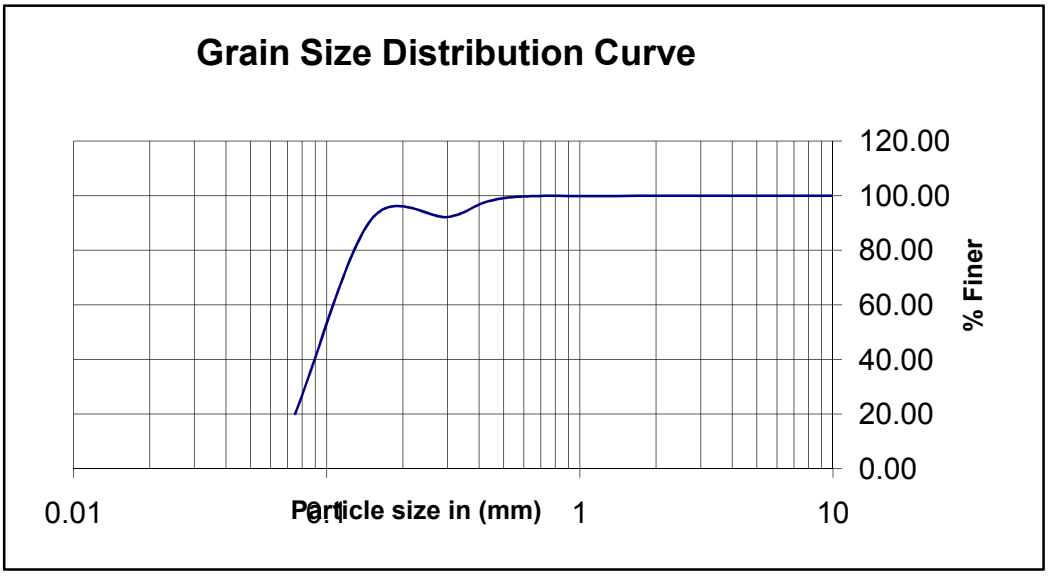


GRAIN SIZE ANALYSIS

Borehole No: LBH4
Depth- 15.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.26	0.09	0.09	99.91	**0.17**
0.6	0.89	0.36	0.13	0.22	99.78	**0.12**
0.425	0.51	5.67	2.05	2.28	97.72	**1.05**
0.3	0.36	15.27	5.52	7.80	92.20	**2.00**
0.15	0.23	2.46	0.89	8.69	91.31	**0.20**
0.075	0.11	197.23	71.34	80.03	19.97	**8.03**
Residue		55.21	80.03			**11.56**
		276.46				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.144 mm**

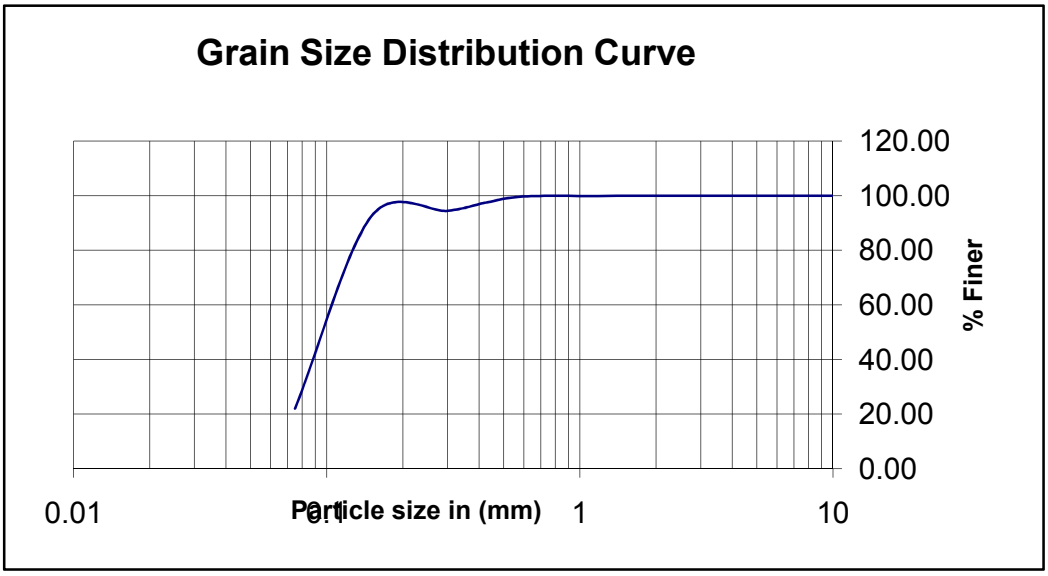


GRAIN SIZE ANALYSIS

Borehole No: LBH4
Depth- 16.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.19	0.07	0.07	99.93	**0.12**
0.6	0.89	0.51	0.18	0.25	99.75	**0.16**
0.425	0.51	6.27	2.25	2.50	97.50	**1.15**
0.3	0.36	8.42	3.02	5.53	94.47	**1.10**
0.15	0.23	5.64	2.03	7.55	92.45	**0.46**
0.075	0.11	196.28	70.48	78.03	21.97	**7.93**
Residue		61.20	78.03			**10.92**
		278.51				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.140 mm**

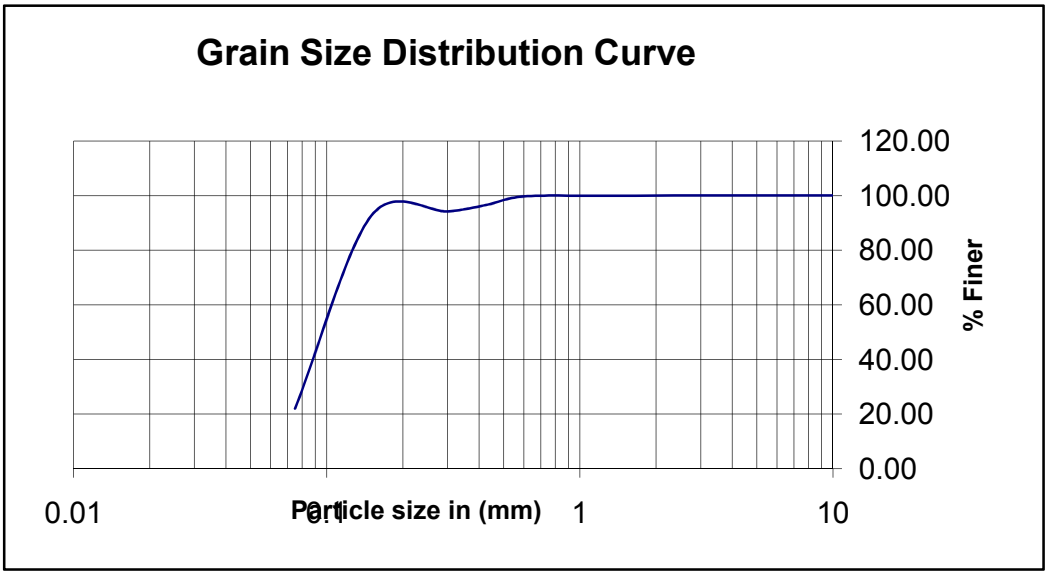


GRAIN SIZE ANALYSIS

Borehole No: LBH4
Depth- 18.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.20	0.07	0.07	99.93	**0.13**
0.6	0.89	0.64	0.24	0.31	99.69	**0.21**
0.425	0.51	8.54	3.17	3.48	96.52	**1.62**
0.3	0.36	6.29	2.33	5.82	94.18	**0.85**
0.15	0.23	4.21	1.56	7.38	92.62	**0.35**
0.075	0.11	190.34	70.64	78.02	21.98	**7.95**
Residue		59.23	78.02			**11.11**
		269.45				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.142 mm**

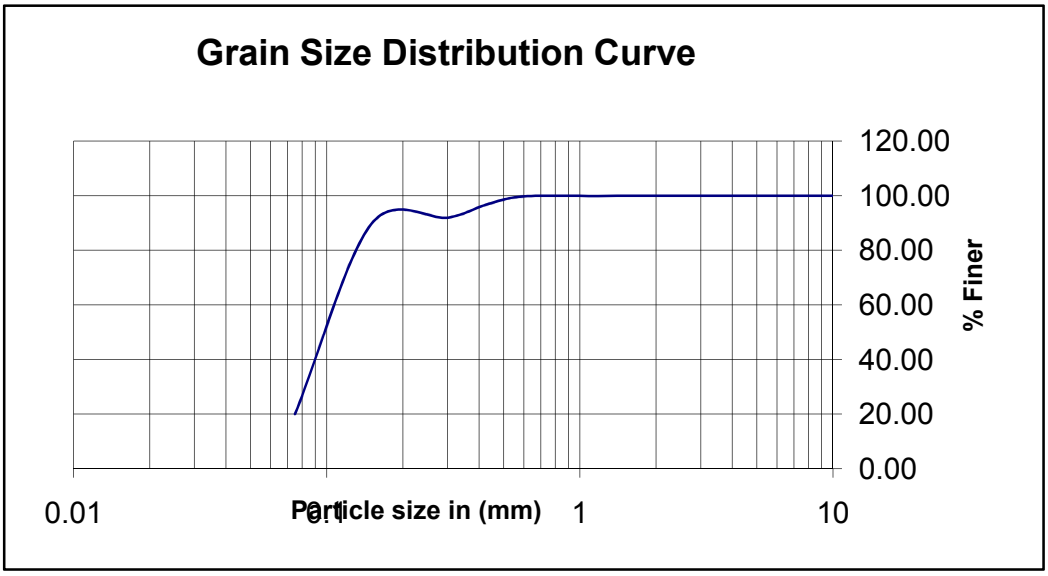


GRAIN SIZE ANALYSIS

Borehole No: LBH4
Depth- 19.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.12	0.04	0.04	99.96	**0.08**
0.6	0.89	0.46	0.16	0.21	99.79	**0.15**
0.425	0.51	8.64	3.08	3.29	96.71	**1.58**
0.3	0.36	13.27	4.73	8.02	91.98	**1.71**
0.15	0.23	6.49	2.31	10.33	89.67	**0.52**
0.075	0.11	195.34	69.62	79.95	20.05	**7.83**
Residue		56.27	79.95			**11.87**
		280.59				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.148 mm**

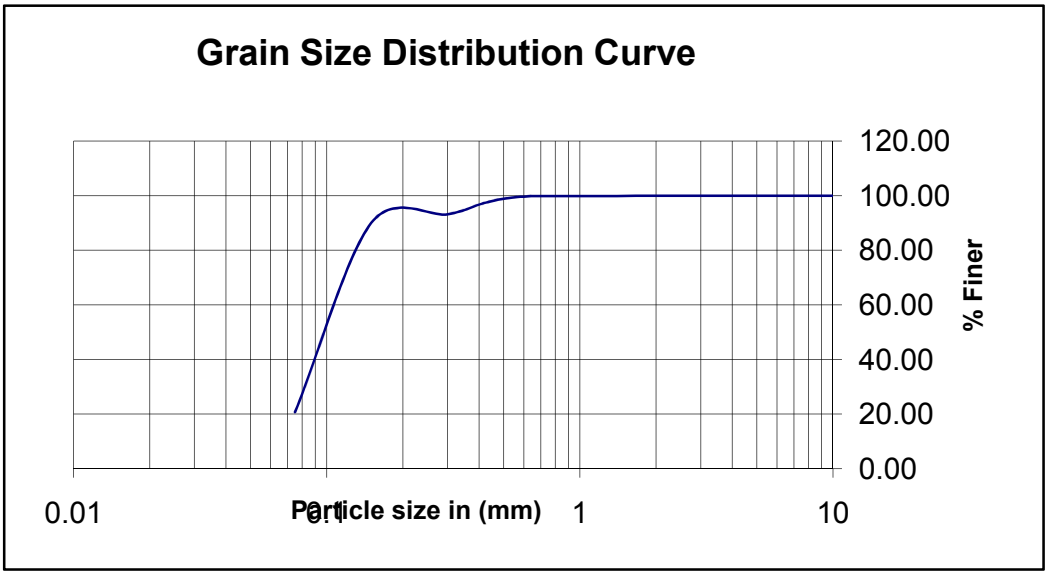


GRAIN SIZE ANALYSIS

Borehole No: LBH4
Depth- 21.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.02	0.01	0.01	99.99	**0.02**
1.18	1.77	0.33	0.12	0.12	99.88	**0.20**
0.6	0.89	0.54	0.19	0.31	99.69	**0.17**
0.425	0.51	6.37	2.23	2.54	97.46	**1.14**
0.3	0.36	12.27	4.29	6.83	93.17	**1.55**
0.15	0.23	8.99	3.14	9.97	90.03	**0.71**
0.075	0.11	198.20	69.29	79.26	20.74	**7.79**
Residue		59.34	79.26			**11.59**
		286.06				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.146 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

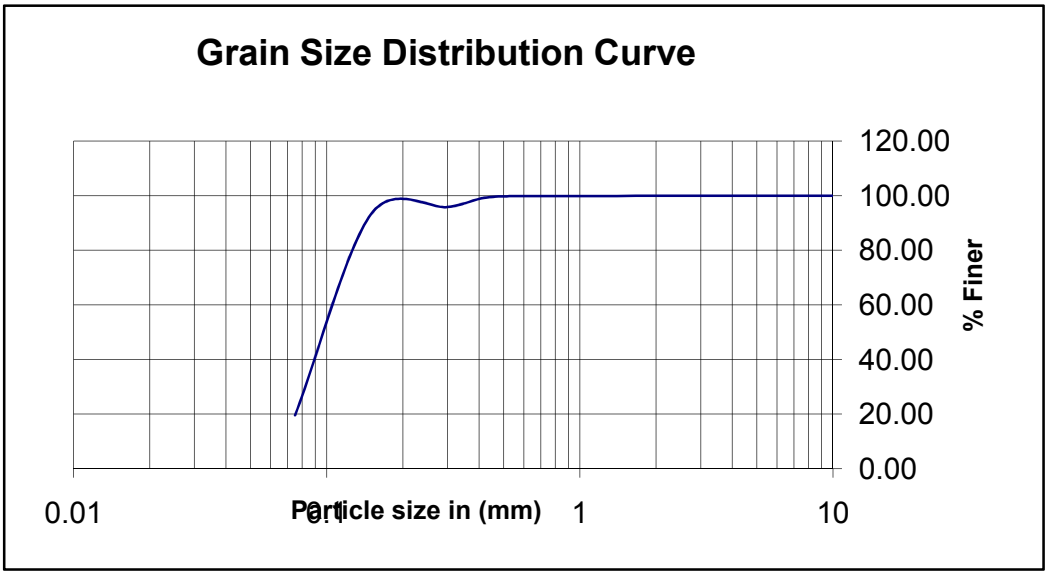
LBH-05

GRAIN SIZE ANALYSIS

Borehole No: LBH5
Depth- 16.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.26	0.10	0.10	99.90	**0.18**
0.6	0.89	0.13	0.05	0.15	99.85	**0.04**
0.425	0.51	1.32	0.50	0.65	99.35	**0.26**
0.3	0.36	9.13	3.49	4.14	95.86	**1.26**
0.15	0.23	6.49	2.48	6.62	93.38	**0.56**
0.075	0.11	193.27	73.80	80.42	19.58	**8.30**
Residue		51.27	80.42			**10.60**
		261.87				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.132 mm**

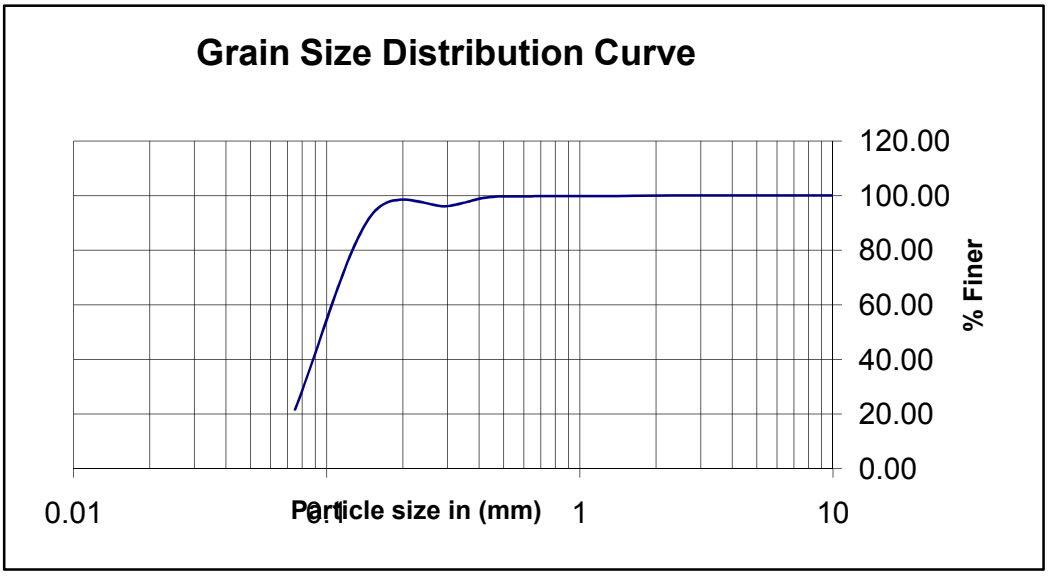


GRAIN SIZE ANALYSIS

Borehole No: LBH5
Depth- 18.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.44	0.16	0.16	99.84	**0.28**
0.6	0.89	0.30	0.11	0.27	99.73	**0.10**
0.425	0.51	1.29	0.47	0.74	99.26	**0.24**
0.3	0.36	8.56	3.13	3.87	96.13	**1.13**
0.15	0.23	9.12	3.34	7.21	92.79	**0.75**
0.075	0.11	194.34	71.08	78.29	21.71	**8.00**
Residue		59.37	78.29			**10.51**
		273.42				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.134 mm**

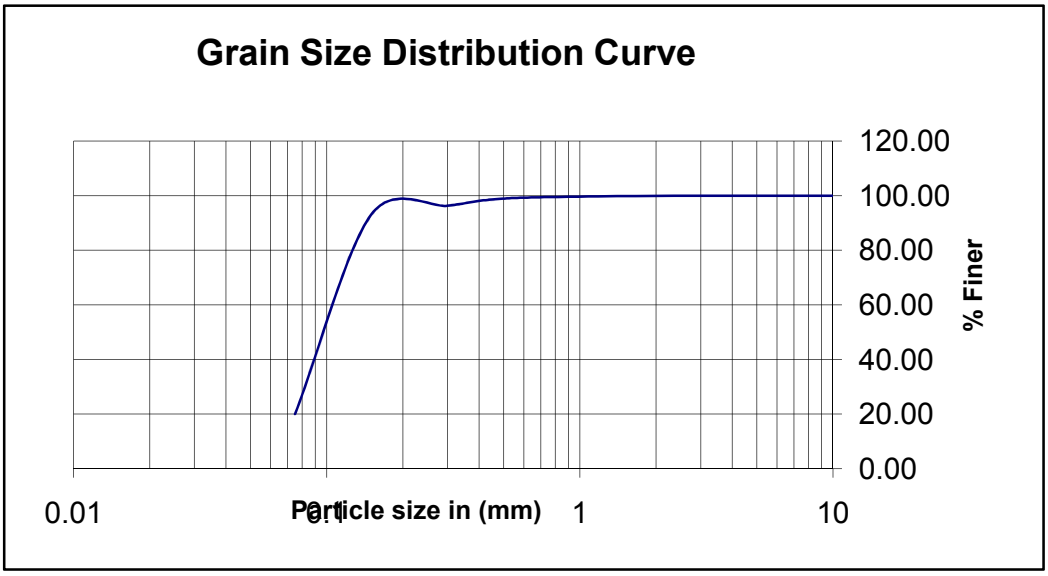


GRAIN SIZE ANALYSIS

Borehole No: LBH5
Depth- 19.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.52	0.19	0.19	99.81	**0.34**
0.6	0.89	1.30	0.48	0.67	99.33	**0.43**
0.425	0.51	2.36	0.87	1.55	98.45	**0.45**
0.3	0.36	5.67	2.10	3.65	96.35	**0.76**
0.15	0.23	8.64	3.20	6.85	93.15	**0.72**
0.075	0.11	197.36	73.08	79.93	20.07	**8.22**
Residue		54.21	79.93			**10.92**
		270.06				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.137 mm**

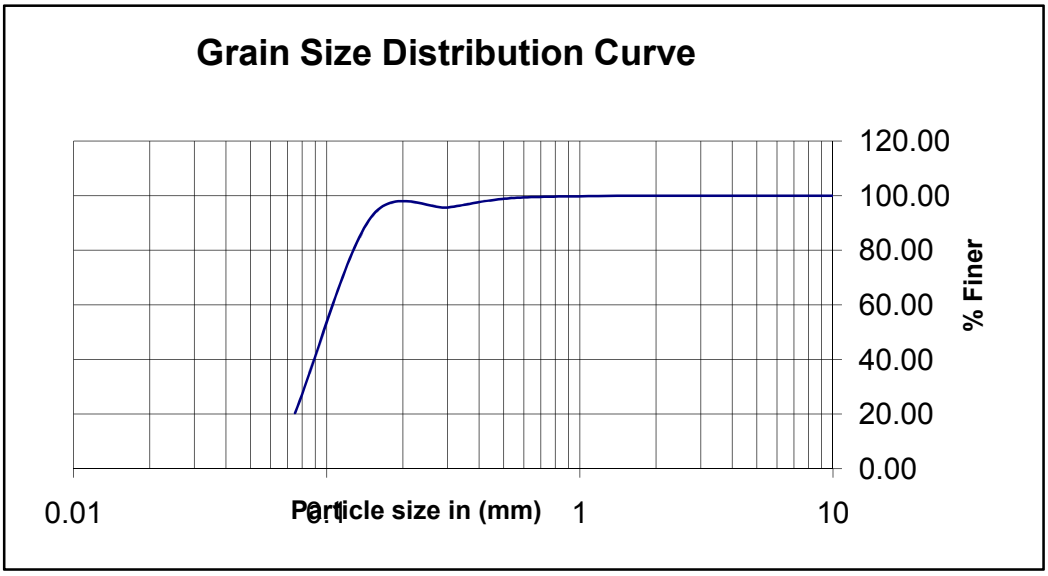


GRAIN SIZE ANALYSIS

Borehole No: LBH5
Depth- 21.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.36	0.13	0.13	99.87	**0.24**
0.6	0.89	1.35	0.50	0.63	99.37	**0.44**
0.425	0.51	3.59	1.33	1.96	98.04	**0.68**
0.3	0.36	6.47	2.39	4.35	95.65	**0.87**
0.15	0.23	9.34	3.45	7.81	92.19	**0.78**
0.075	0.11	194.20	71.82	79.62	20.38	**8.08**
Residue		55.10	79.62			**11.08**
		270.41				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.139 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

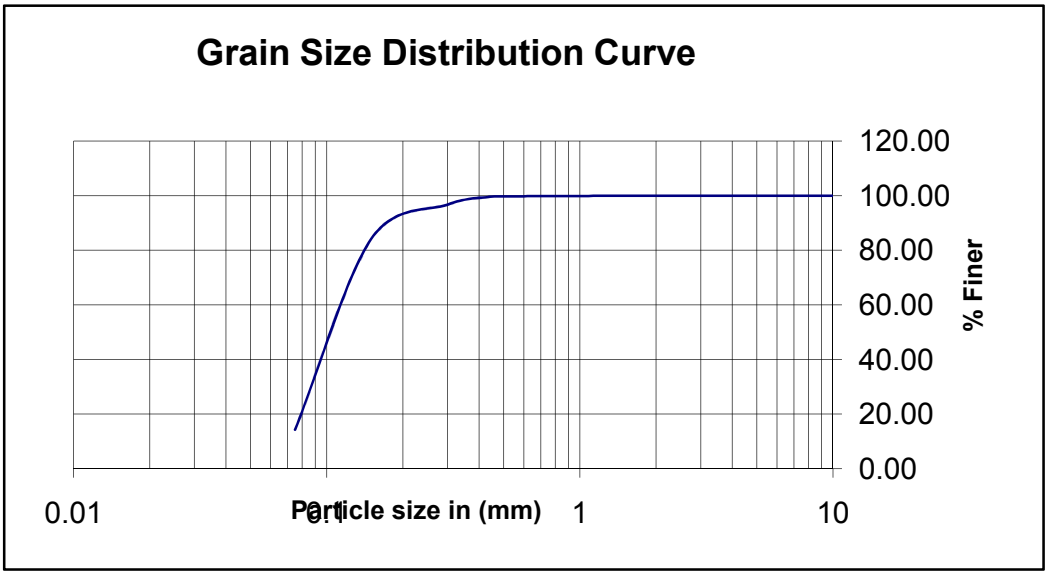
LBH-06

GRAIN SIZE ANALYSIS

Borehole No: LBH6
Depth- 9.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.01	0.00	0.00	100.00	**0.01**
1.18	1.77	0.12	0.04	0.05	99.95	**0.08**
0.6	0.89	0.39	0.14	0.19	99.81	**0.12**
0.425	0.51	1.02	0.36	0.55	99.45	**0.19**
0.3	0.36	7.60	2.71	3.25	96.75	**0.98**
0.15	0.23	35.21	12.54	15.79	84.21	**2.82**
0.075	0.11	196.34	69.92	85.71	14.29	**7.87**
Residue		40.12	85.71			**12.07**
		280.81				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.141 mm**

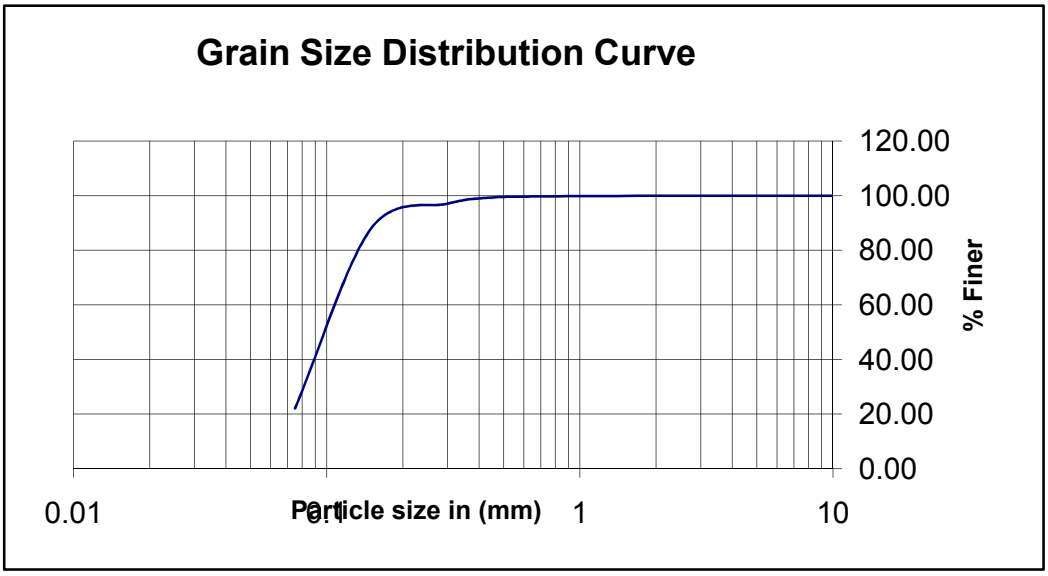


GRAIN SIZE ANALYSIS

Borehole No: LBH6
Depth- 12.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.03	0.01	0.01	99.99	**0.04**
1.18	1.77	0.26	0.09	0.10	99.90	**0.16**
0.6	0.89	0.64	0.22	0.32	99.68	**0.19**
0.425	0.51	1.39	0.47	0.79	99.21	**0.24**
0.3	0.36	6.28	2.13	2.92	97.08	**0.77**
0.15	0.23	26.54	9.01	11.92	88.08	**2.03**
0.075	0.11	194.30	65.93	77.85	22.15	**7.42**
Residue		65.27	77.85			**10.84**
		294.71				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.139 mm**

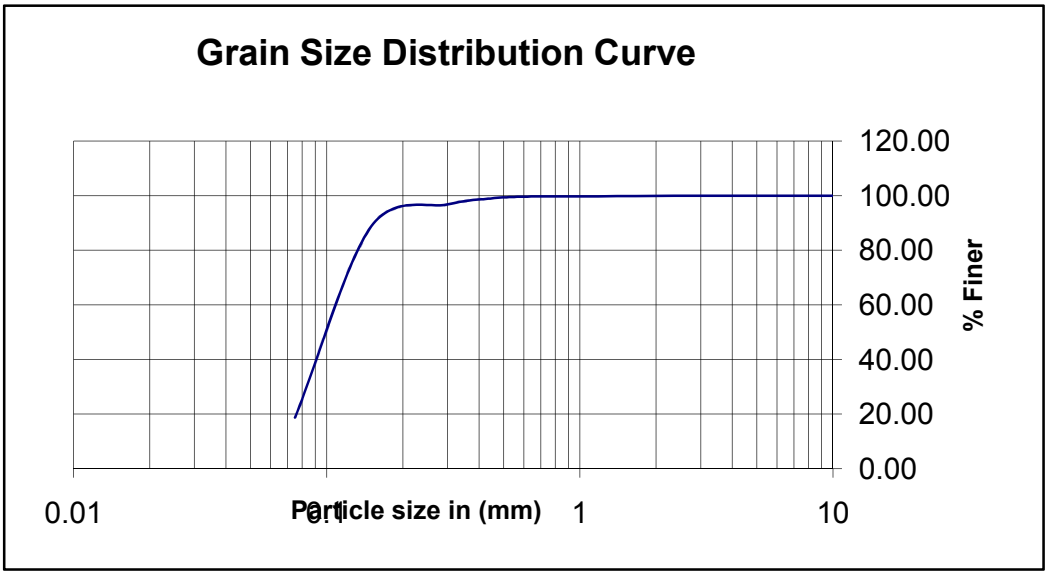


GRAIN SIZE ANALYSIS

Borehole No: LBH6
Depth- 19.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.55	0.20	0.20	99.80	**0.35**
0.6	0.89	0.34	0.12	0.32	99.68	**0.11**
0.425	0.51	2.31	0.83	1.15	98.85	**0.42**
0.3	0.36	5.67	2.04	3.18	96.82	**0.74**
0.15	0.23	22.36	8.03	11.21	88.79	**1.81**
0.075	0.11	195.21	70.08	81.29	18.71	**7.88**
Residue		52.13	81.29			**11.31**
		278.57				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.139 mm**

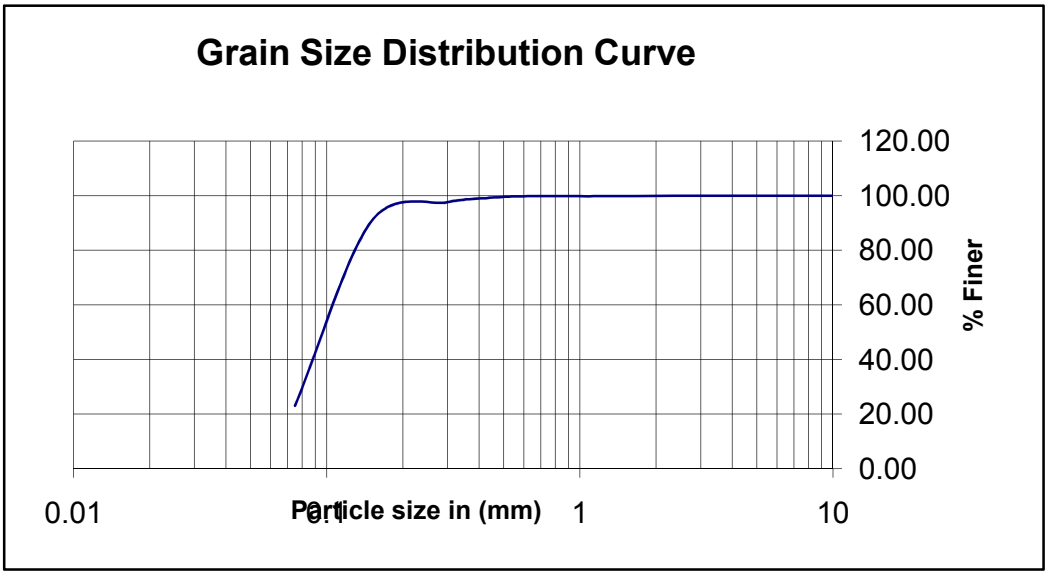


GRAIN SIZE ANALYSIS

Borehole No: LBH6
Depth- 21.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.03	0.01	0.01	99.99	**0.04**
1.18	1.77	0.56	0.19	0.20	99.80	**0.34**
0.6	0.89	0.02	0.01	0.21	99.79	**0.01**
0.425	0.51	2.03	0.70	0.91	99.09	**0.36**
0.3	0.36	4.31	1.49	2.40	97.60	**0.54**
0.15	0.23	20.39	7.04	9.44	90.56	**1.58**
0.075	0.11	195.24	67.43	76.87	23.13	**7.59**
Residue		66.97	76.87			**10.45**
		289.55				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.136 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

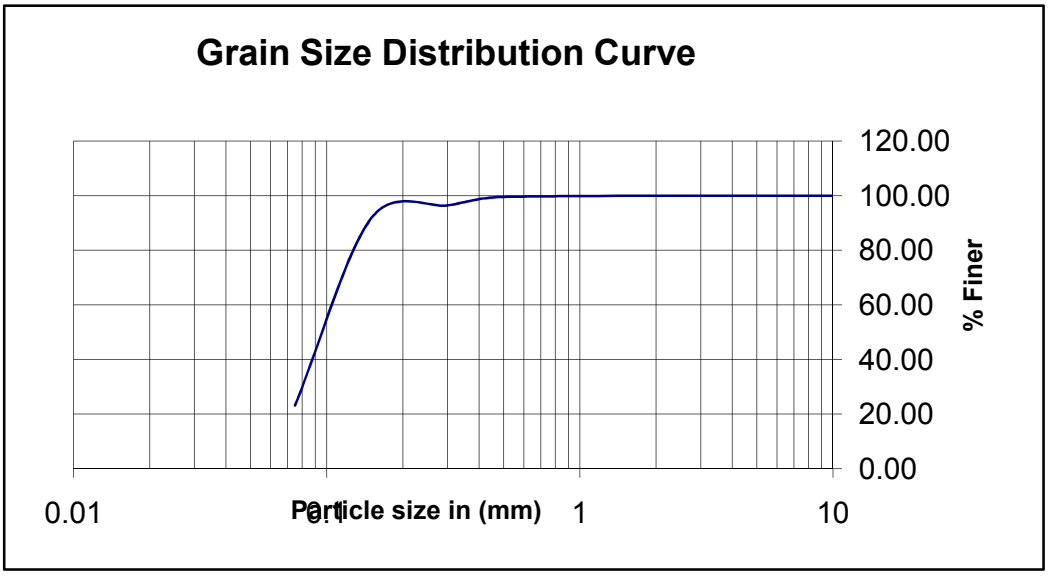
LBH-07

GRAIN SIZE ANALYSIS

Borehole No: LBH7
Depth- 10.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.39	0.14	0.14	99.86	**0.24**
0.6	0.89	0.58	0.20	0.34	99.66	**0.18**
0.425	0.51	1.69	0.59	0.93	99.07	**0.30**
0.3	0.36	7.66	2.68	3.61	96.39	**0.97**
0.15	0.23	13.28	4.64	8.25	91.75	**1.04**
0.075	0.11	196.32	68.61	76.85	23.15	**7.72**
Residue		66.23	76.85			**10.46**
		286.15				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.136 mm**

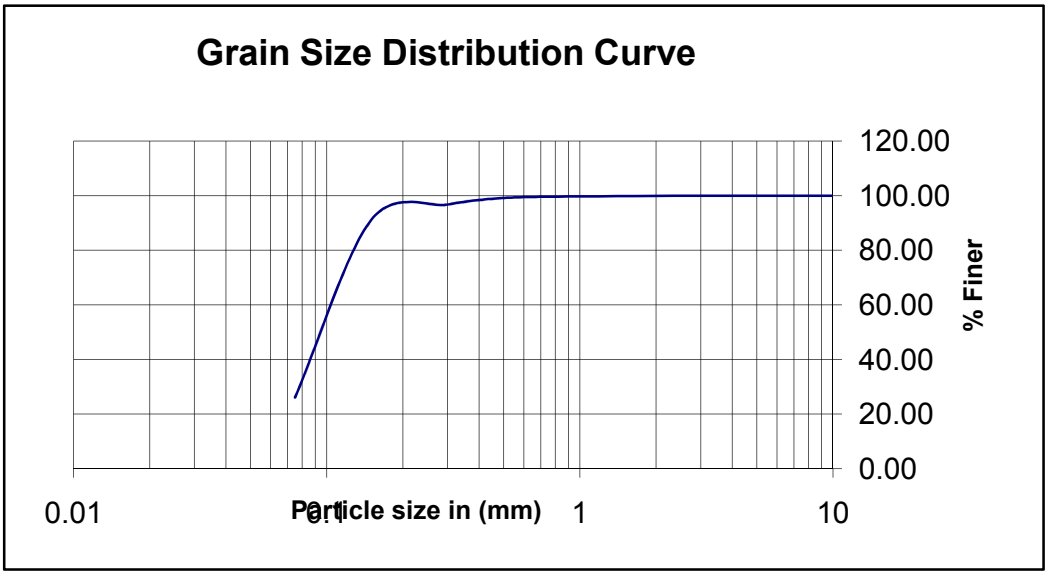


GRAIN SIZE ANALYSIS

Borehole No: LBH7
Depth- 12.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.54	0.18	0.18	99.82	**0.33**
0.6	0.89	0.94	0.32	0.51	99.49	**0.29**
0.425	0.51	2.30	0.79	1.29	98.71	**0.40**
0.3	0.36	5.61	1.92	3.21	96.79	**0.70**
0.15	0.23	16.37	5.60	8.81	91.19	**1.26**
0.075	0.11	190.24	65.07	73.88	26.12	**7.32**
Residue		76.38	73.88			**10.29**
		292.38				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.139 mm**

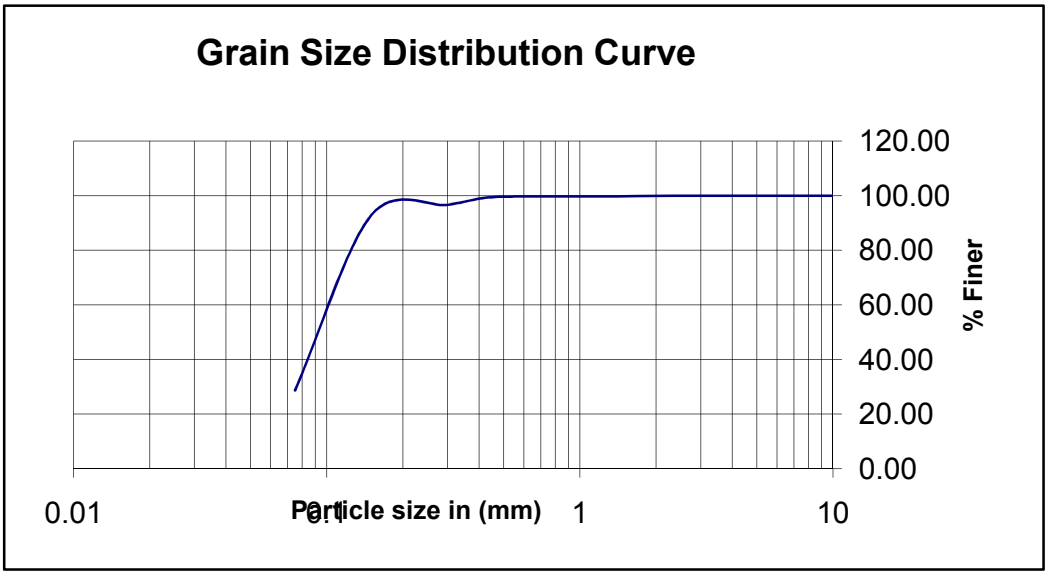


GRAIN SIZE ANALYSIS

Borehole No: LBH7
Depth- 15.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.64	0.22	0.22	99.78	**0.38**
0.6	0.89	0.06	0.02	0.24	99.76	**0.02**
0.425	0.51	1.29	0.44	0.67	99.33	**0.22**
0.3	0.36	7.84	2.64	3.32	96.68	**0.96**
0.15	0.23	11.22	3.78	7.10	92.90	**0.85**
0.075	0.11	190.23	64.16	71.26	28.74	**7.22**
Residue		85.22	71.26			**9.65**
		296.50				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.135 mm**

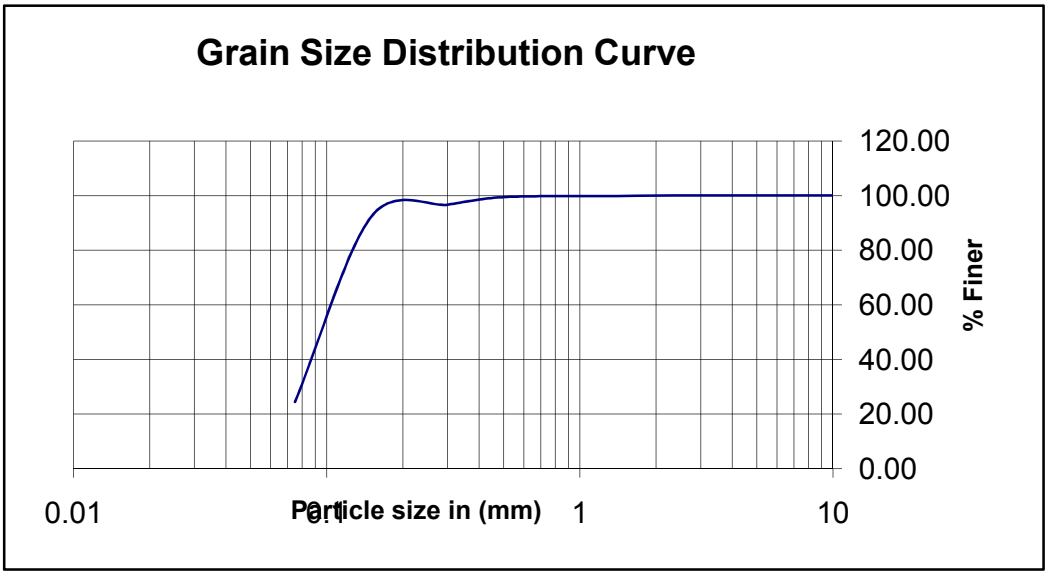


GRAIN SIZE ANALYSIS

Borehole No: LBH7
Depth- 18.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.65	0.23	0.23	99.77	**0.41**
0.6	0.89	0.23	0.08	0.31	99.69	**0.07**
0.425	0.51	2.37	0.84	1.15	98.85	**0.43**
0.3	0.36	6.21	2.20	3.35	96.65	**0.80**
0.15	0.23	12.37	4.38	7.73	92.27	**0.99**
0.075	0.11	191.34	67.75	75.48	24.52	**7.62**
Residue		69.24	75.48			**10.31**
		282.41				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.137 mm**

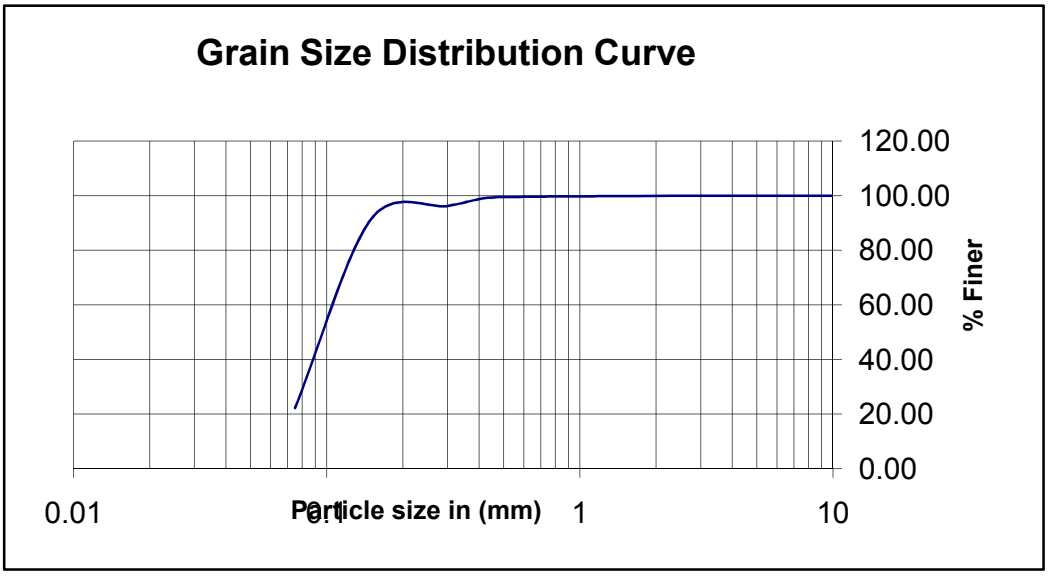


GRAIN SIZE ANALYSIS

Borehole No: LBH7
Depth- 19.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.42	0.15	0.15	99.85	**0.26**
0.6	0.89	0.64	0.23	0.37	99.63	**0.20**
0.425	0.51	1.29	0.46	0.83	99.17	**0.23**
0.3	0.36	8.34	2.94	3.77	96.23	**1.07**
0.15	0.23	13.28	4.69	8.46	91.54	**1.05**
0.075	0.11	196.24	69.24	77.70	22.30	**7.79**
Residue		63.21	77.70			**10.61**
		283.42				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.137 mm**

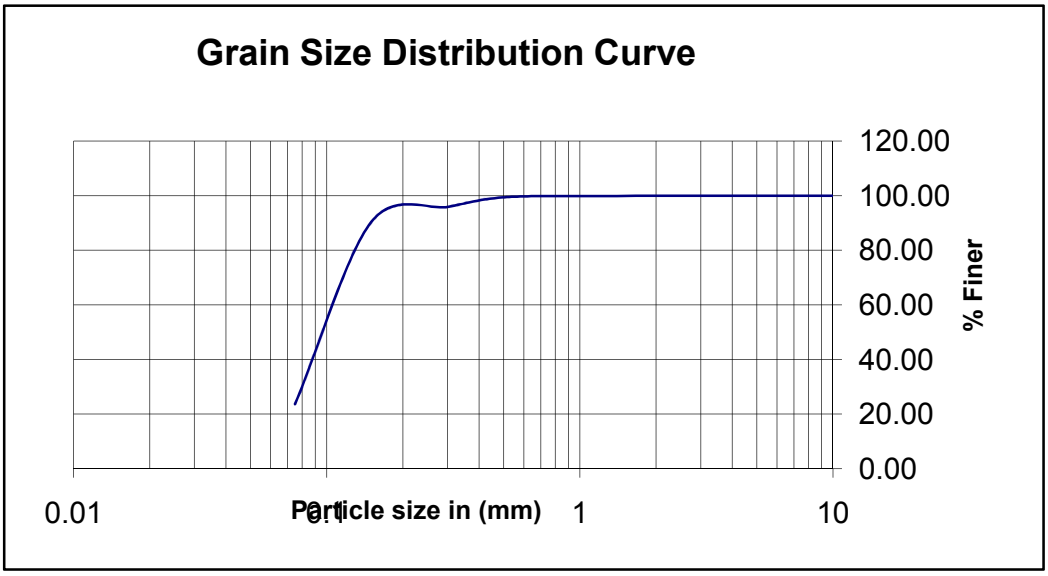


GRAIN SIZE ANALYSIS

Borehole No: LBH7
Depth- 21.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.21	0.07	0.07	99.93	**0.13**
0.6	0.89	0.39	0.13	0.20	99.80	**0.12**
0.425	0.51	3.26	1.10	1.30	98.70	**0.56**
0.3	0.36	8.31	2.80	4.10	95.90	**1.01**
0.15	0.23	16.32	5.50	9.60	90.40	**1.24**
0.075	0.11	198.20	66.78	76.38	23.62	**7.51**
Residue		70.12	76.38			**10.57**
		296.81				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.138 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

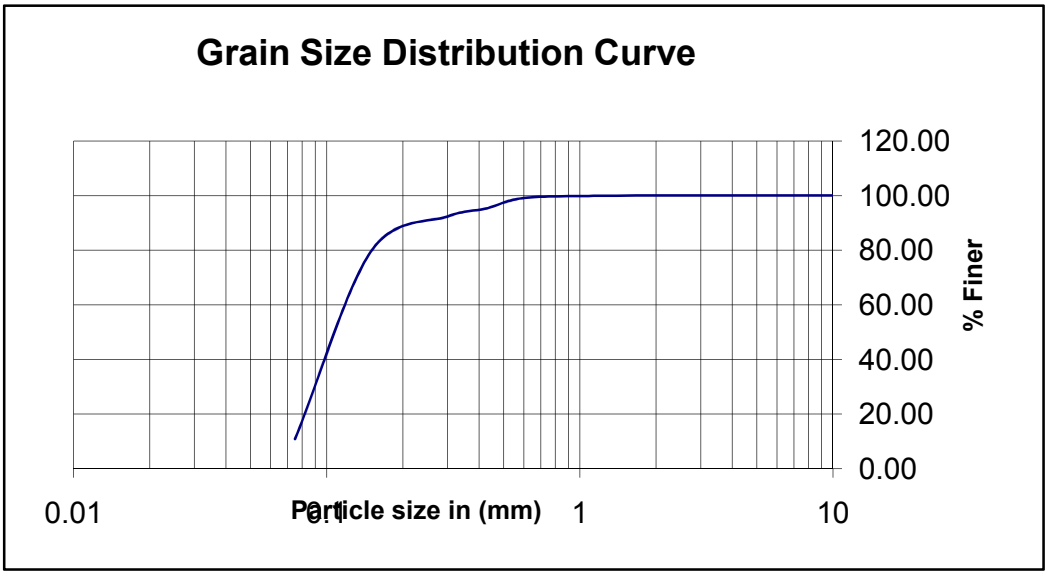
LBH-08

GRAIN SIZE ANALYSIS

Borehole No: LBH8
Depth- 9.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.29	0.10	0.10	99.90	**0.18**
0.6	0.89	2.31	0.80	0.90	99.10	**0.71**
0.425	0.51	11.20	3.88	4.78	95.22	**1.99**
0.3	0.36	8.34	2.89	7.67	92.33	**1.05**
0.15	0.23	36.49	12.65	20.32	79.68	**2.85**
0.075	0.11	198.64	68.84	89.15	10.85	**7.74**
Residue		31.30	89.15			**14.52**
		288.57				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.163 mm**

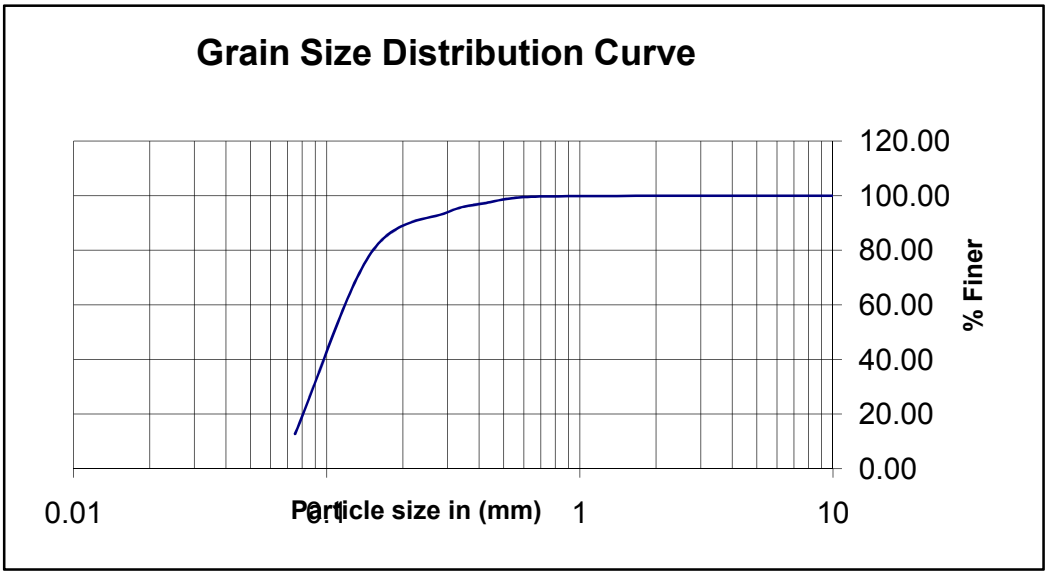


GRAIN SIZE ANALYSIS

Borehole No: LBH8
Depth- 12.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.33	0.11	0.11	99.89	**0.20**
0.6	0.89	1.08	0.37	0.48	99.52	**0.33**
0.425	0.51	6.37	2.18	2.66	97.34	**1.12**
0.3	0.36	9.86	3.37	6.03	93.97	**1.22**
0.15	0.23	43.28	14.80	20.83	79.17	**3.33**
0.075	0.11	194.27	66.44	87.27	12.73	**7.47**
Residue		37.21	87.27			**13.67**
		292.40				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.157 mm**

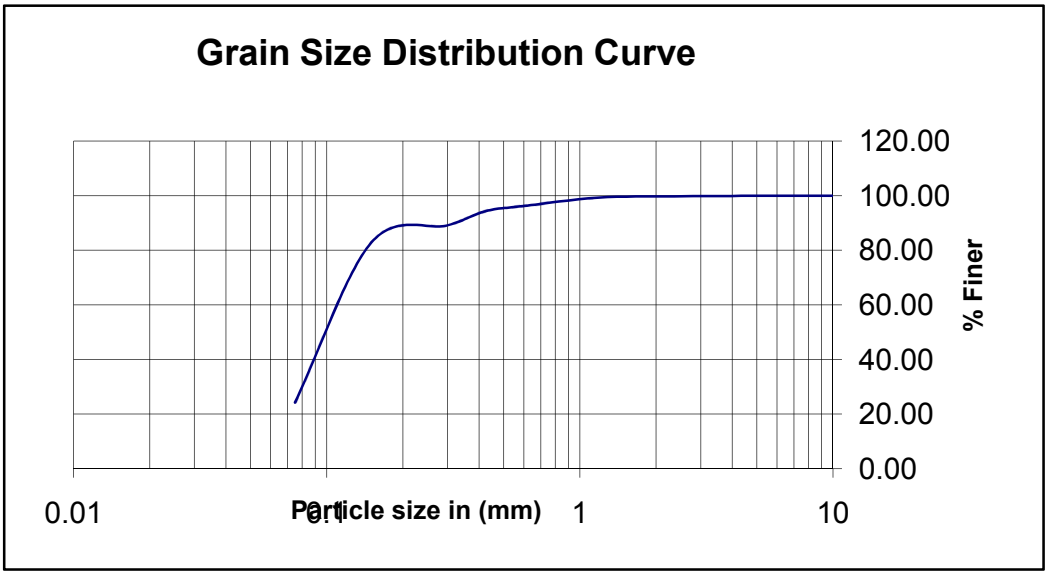


GRAIN SIZE ANALYSIS

Borehole No: LBH8
Depth- 19.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.59	0.20	0.20	99.80	**0.72**
1.18	1.77	1.32	0.45	0.66	99.34	**0.81**
0.6	0.89	8.94	3.08	3.74	96.26	**2.74**
0.425	0.51	5.34	1.84	5.58	94.42	**0.94**
0.3	0.36	15.20	5.24	10.82	89.18	**1.90**
0.15	0.23	18.28	6.30	17.12	82.88	**1.42**
0.075	0.11	170.21	58.67	75.79	24.21	**6.60**
Residue		70.23	75.79			**15.13**
		290.11				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.200 mm**

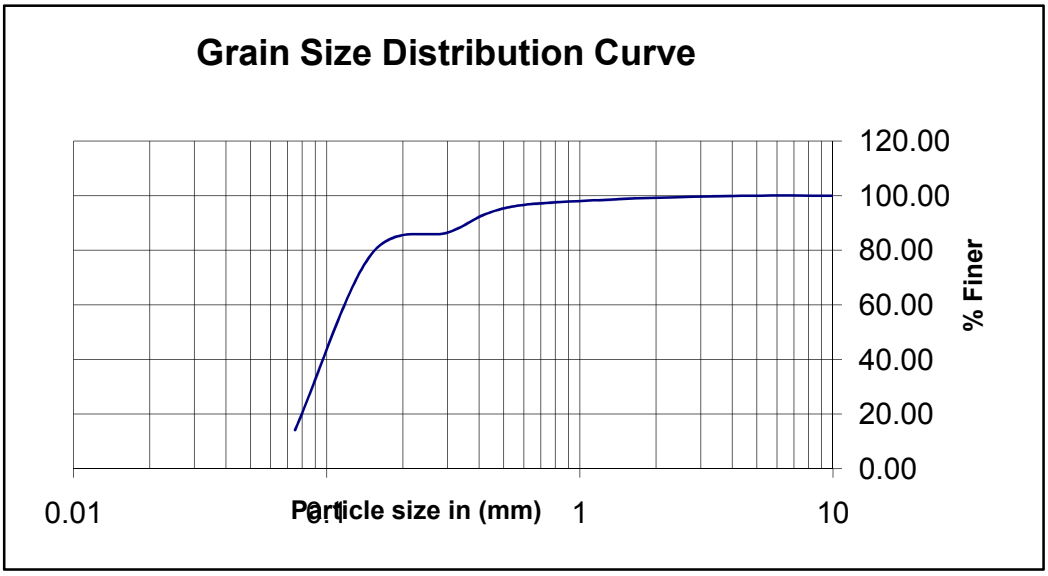


GRAIN SIZE ANALYSIS

Borehole No: LBH8
Depth- 21.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	1.64	0.57	0.57	99.43	**2.01**
1.18	1.77	3.05	1.05	1.62	98.38	**1.86**
0.6	0.89	5.14	1.77	3.39	96.61	**1.58**
0.425	0.51	9.66	3.33	6.72	93.28	**1.71**
0.3	0.36	19.71	6.79	13.51	86.49	**2.46**
0.15	0.23	23.16	7.98	21.50	78.50	**1.80**
0.075	0.11	186.49	64.29	85.79	14.21	**7.23**
Residue		41.22	85.79			**18.65**
		290.07				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.217 mm**

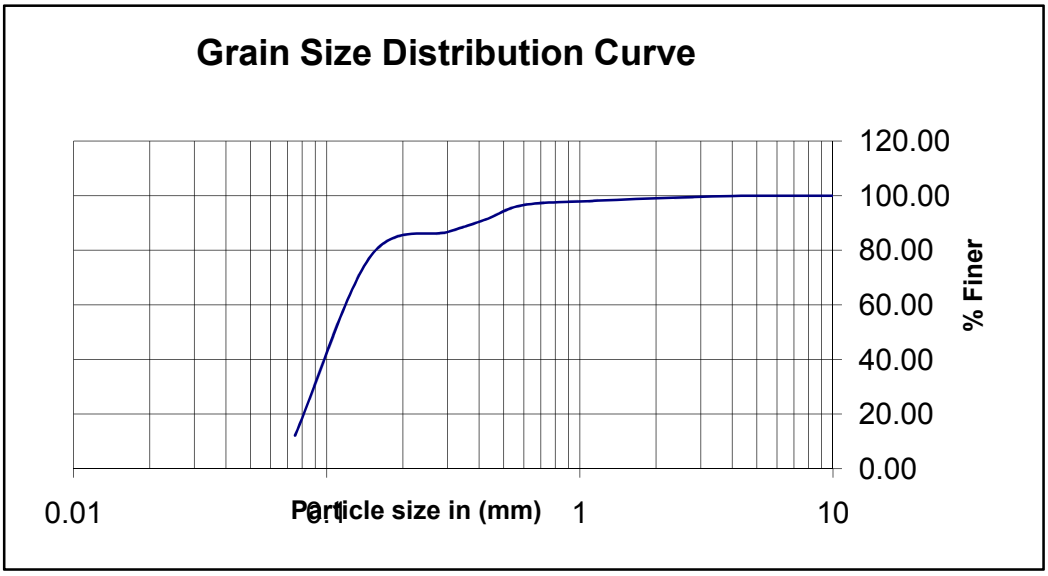


GRAIN SIZE ANALYSIS

Borehole No: LBH8
Depth- 22.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	2.02	0.70	0.70	99.30	**2.49**
1.18	1.77	3.16	1.10	1.80	98.20	**1.94**
0.6	0.89	4.59	1.59	3.39	96.61	**1.42**
0.425	0.51	15.27	5.30	8.68	91.32	**2.71**
0.3	0.36	13.27	4.60	13.29	86.71	**1.67**
0.15	0.23	24.69	8.56	21.85	78.15	**1.93**
0.075	0.11	190.12	65.93	87.78	12.22	**7.42**
Residue		35.24	87.78			**19.57**
		288.36				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.223 mm**



SIEVE ANALYSIS

OF

BOREHOLE NO.

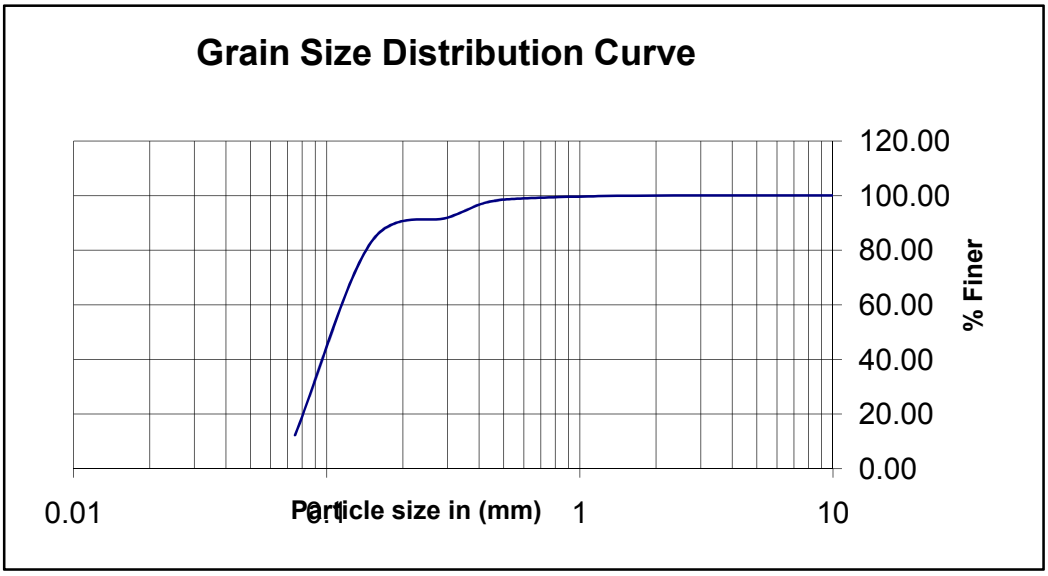
LBH-09

GRAIN SIZE ANALYSIS

Borehole No: LBH9
Depth- 16.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.00	0.00	0.00	100.00	**0.00**
1.18	1.77	0.63	0.23	0.23	99.77	**0.40**
0.6	0.89	2.31	0.83	1.06	98.94	**0.74**
0.425	0.51	4.29	1.54	2.60	97.40	**0.79**
0.3	0.36	15.30	5.51	8.11	91.89	**2.00**
0.15	0.23	24.65	8.87	16.98	83.02	**2.00**
0.075	0.11	196.37	70.68	87.66	12.34	**7.95**
Residue		34.29	87.66			**13.88**
		277.84				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.158 mm**

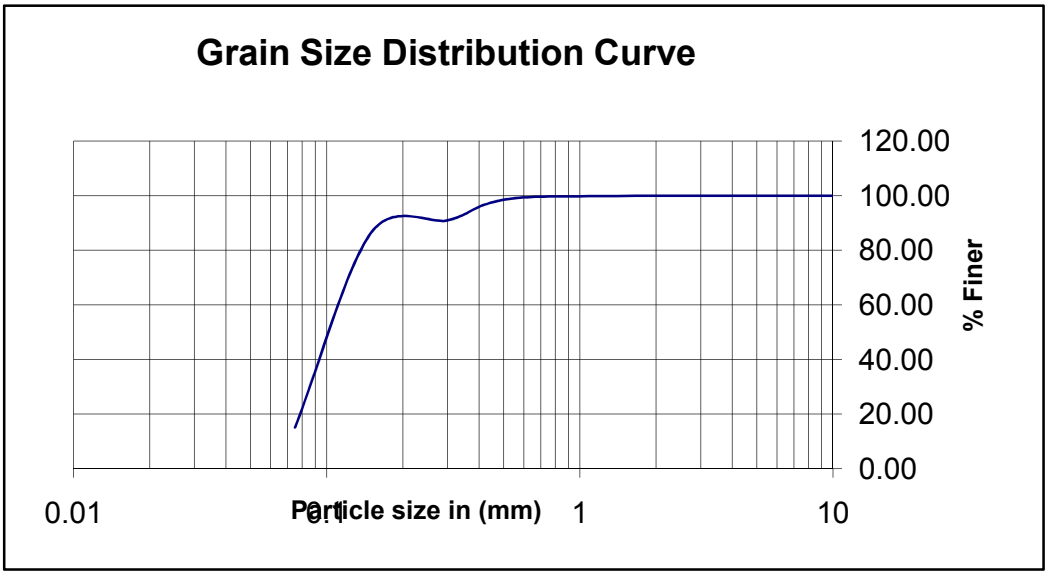


GRAIN SIZE ANALYSIS

Borehole No: LBH9
Depth- 18.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.00	0.00	0.00	100.00	**0.00**
2.36	3.56	0.02	0.01	0.01	99.99	**0.03**
1.18	1.77	0.33	0.12	0.13	99.87	**0.21**
0.6	0.89	1.34	0.48	0.60	99.40	**0.43**
0.425	0.51	6.97	2.49	3.10	96.90	**1.28**
0.3	0.36	16.54	5.92	9.01	90.99	**2.14**
0.15	0.23	12.37	4.42	13.44	86.56	**1.00**
0.075	0.11	199.64	71.41	84.85	15.15	**8.03**
Residue		42.35	84.85			**13.11**
		279.56				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.155 mm**

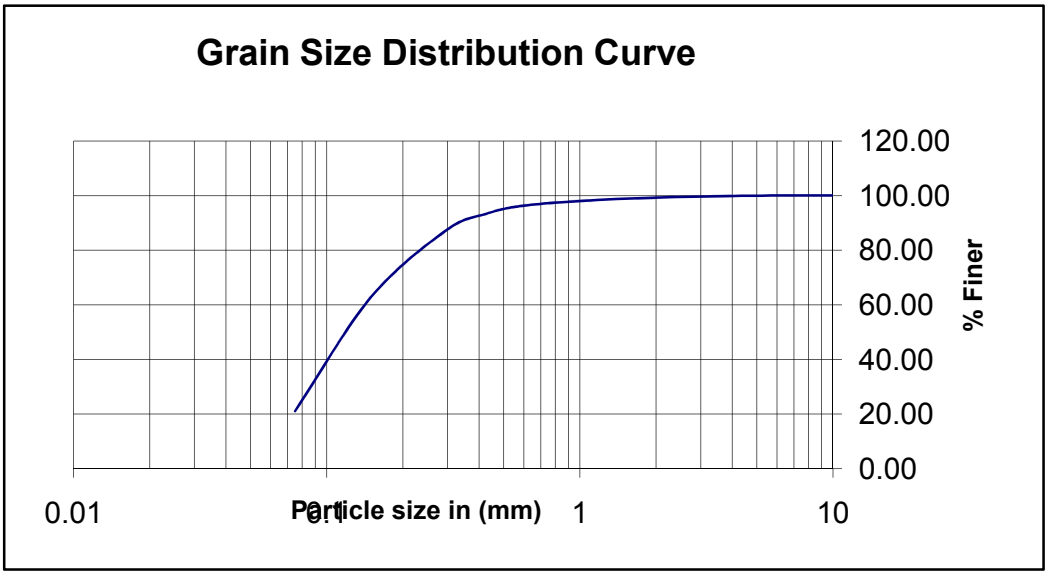


GRAIN SIZE ANALYSIS

Borehole No: LBH9
Depth- 19.50 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.10	0.04	0.04	99.96	**0.29**
2.36	3.56	1.36	0.54	0.58	99.42	**1.91**
1.18	1.77	2.55	1.01	1.59	98.41	**1.79**
0.6	0.89	5.31	2.10	3.69	96.31	**1.87**
0.425	0.51	7.64	3.03	6.72	93.28	**1.55**
0.3	0.36	14.29	5.66	12.38	87.62	**2.05**
0.15	0.23	62.34	24.69	37.06	62.94	**5.55**
0.075	0.11	105.69	41.85	78.92	21.08	**4.71**
Residue		53.24	78.92			**19.73**
		252.52				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.250 mm**

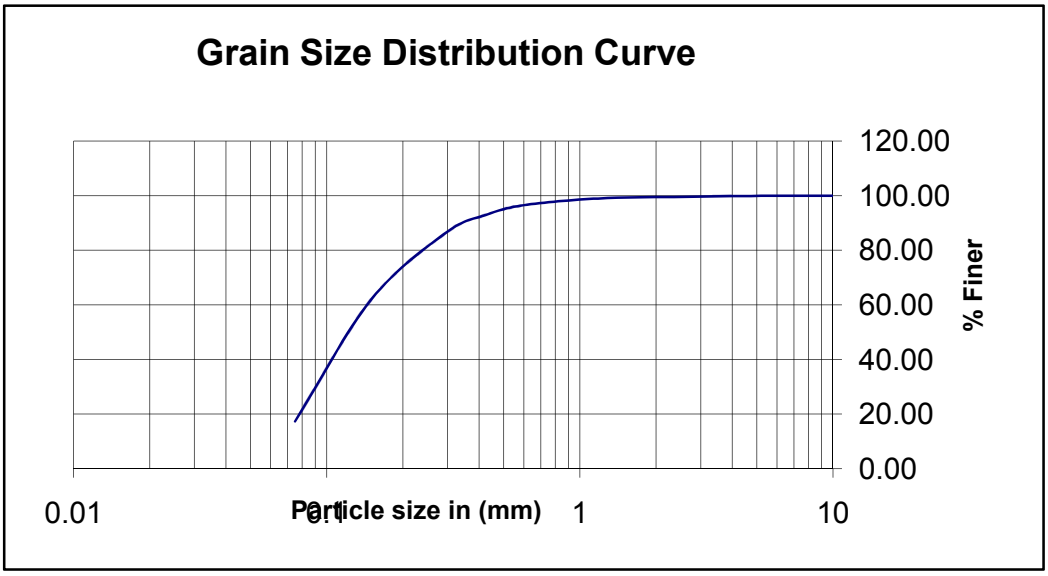


GRAIN SIZE ANALYSIS

Borehole No: LBH9
Depth- 21.00 M

IS Sieve Size(MM)	Aperture Size 'd'(MM)	Wt. Retained (f)	Percentage Wt. Ret. (f)	Cum. % material Retained	% Passing	Weighted diameter (fi * d)
10		0	0	0	100.00	
4.75	7.375	0.13	0.05	0.05	99.95	**0.36**
2.36	3.56	0.94	0.35	0.40	99.60	**1.25**
1.18	1.77	1.56	0.58	0.98	99.02	**1.03**
0.6	0.89	6.58	2.46	3.45	96.55	**2.19**
0.425	0.51	9.54	3.57	7.01	92.99	**1.83**
0.3	0.36	16.34	6.11	13.13	86.87	**2.22**
0.15	0.23	66.49	24.87	38.00	62.00	**5.60**
0.075	0.11	119.48	44.69	82.69	17.31	**5.03**
Residue		46.28	82.69			**19.50**
		267.34				

Weighted mean diameter = (∑fi * d /∑fi) =	**0.236 mm**



HOOGHLY COCHIN SHIPYARD LIMITED

(A WHOLLY-OWNED SUBSIDIARY OF COCHIN SHIPYARD LTD)

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

TENDER NO: HCSL/PANDU/TEN/002/2022-23, Dt.- 01.11.2022

COVER B

SECTION-X

FINANCIAL BID

Due Date of Submission: 15.00 Hrs on 30 NOV 2022

HOOGHLY COCHIN SHIPYARD LTD

DEVELOPMENT OF SHIP REPAIR FACILITY AT PANDU, GUWAHATI, ASSAM

PACKAGE I TENDER FOR CIVIL WORKS

COVER B

SECTION-X

FINANCIAL BID

CONTENTS OF FINANCIAL BID

COVER B – FINANCIAL BID

PART I PREAMBLE TO RATE SCHEDULE

1. General

The contractor's attention is drawn to the conditions of contract, the specifications and the drawings all of which are to be read in conjunction with the Bill of Quantities hereinafter. Directions and descriptions of work and material given in the other parts of the Contract Documents are not necessarily repeated in the Bill of Quantities.

The total cost of complying with all the provisions, conditions, obligations and liabilities etc. described in the contract and of carrying out the works as specified including, but not by way of limitation, all charges and the rates and prices inserted in the Bill of Quantities hereinafter unless expressly otherwise provided for in the contract. Consequently, the contractor shall have no claim for further or extra payment in respect of any work or rates and prices set against each item are to be for full and / or described in the specification which can reasonably be inferred there from and are to cover the cost of provision of all labour, materials, tools, tackles, plants, equipment, fuel, overhead & profit etc., all as per conditions stipulated elsewhere. The rates shall also include all contingent costs and charges including all taxes such as Income Tax, Building & other Construction workers welfare cess and general tax, (excluding GST) and all the contractor's obligations under the contract and all matters and things necessary for the proper completion and maintenance of the works. The quantities given in the Bill of Quantities are estimated. The basis of payment shall be the actual quantities of work ordered and carried out as measured jointly by the contractor and by the Engineer or his representative and valued at the rates and prices specified in the Bill of Quantities, where acceptable and otherwise at such rates and prices as the Engineer may fix within the terms of the contract.

The quantities of work and materials stated in the Bill of Quantities shall not be considered as limiting of extending the amount of work to be done or material to be supplied by the contractor.

The contractor is deemed to be familiar with all site conditions at the Port Site, weather, all site investigation records, available means of access and the locality of any existing services and working restrictions due to testing site features or other contractor's works in order to execute the works. General directions and descriptions of work and materials are not necessarily repeated or summarized in the Bill of Quantities. The contractor is deemed to have referred to the relevant sections of the contract documentation and prices incorporated against each item in the Bill of Quantities. The method of measurement is described in the following preambles and / or is demonstrated in the measured items included in the Bill of Quantities.

Unless separate items are measured, rates and prices must include for all testing in accordance with the specification.

The following abbreviations have been used:

PS -Provisional Sum

LS -Lump Sum

M /m -metre

M^2/ m^2 -square metre

M^3/ m^3 -cubic metre

T/t /Te/ te/MT -tonne

wk -week

No. -Number

Rs. -Indian Rupee

2. METHOD & MODE OF MEASUREMENT

2.1 General

Unless stated or billed otherwise, quantities shall be measured in accordance with IS: 1200 and are net a s they are finished and fixed in the works. The rates and prices shall include whatever allowance is considered by the contractor to be necessary for waste, working area, construction slopes, batters etc. The method of measurement shall comply with the pro vision hereafter.

2.2 Units Rates Prevail

In case of any arithmetical errors in the calculations (Quantity x Unit Rates) in the Bill of Quantities, the quoted unit rates shall prevail. Arithmetical errors will be corrected by the employer in the manner se t out in the Instructions to Tenderers.

The required area shall be worked out correct up to 2 places of decimals of sqmts and quantity shall be worked out up to 2 places of decimals of cubic meters of all measurements. The length & width shall be worked out correct up to 2 places of decimals of running meter for all the measurements. However, levels shall be recorded in three decimals.

2.3 Dismantling/ Demolition

The dismantling/ demolition works shall be measured by taking Pre measurements jointly record ed by the contractor (or his representative) and Engineer's representatives before starting the dismantling work. The final quantity of dismantling will be the levels taken prior to and after completion of the dismantling work at site.

2.4 Concrete

The concrete works shall be measured net to the dimensions shown on the drawings or ordered by the Engineer or his representative except where otherwise specially described at prescribed in the specifications.

The rates for concrete shall include for all lab our, material, tools, tackles, plant, equipment, fuel, shuttering, centering, transporting, depositing, concrete compacting, forming construction joints, curing etc.

2.5 Reinforcement Steel

Steel bars will be measured as fabricated by their weight in tones as calculated from the approved bending schedules and bar lists on the basis of the nominal weights in IS: 1786. Authorized laps, Chairs/ Separators, lifting hooks shall also be measured and paid based on the nominal weights as specified in IS: 1786.

2.6 Steel Works

Except where indicated otherwise the measurement shall be by weight, calculated from the approved working drawings.

The weight of steel shall exclude the weight of fastenings such as bolts, nuts, washers, etc. These fastenings shall be included in the rates for the steel work.

No subtractions will be made for bolt holes.

No allowance will be made for welding and for loss due to any material being cut away.

In general, the weight shall be calculated by the product of volume and the specific weight of 7.85 metric tonne / cu.m.

The measurement of the bollard shall be the unit as fixed in position.

2.7 Bored Concrete Piles

i) Shifting and Set up of Piling Equipment's:

Measurement shall be made at the rate of one shift and set up for each pile irrespective of whether the piling platform is moved or not.

ii) Steel Liners

The quantity shall be measured from the bottom of the driven length of the liner up to the cut off level. Steel liners need not be painted.

iii) Boring:

(a) For boring in soil other than rock: Measurements will be made from cut-off level to termination level.

(b) Rock boring: Measurements shall be made downwards commencing from the level certified by the Engineer or his representative.

iv) Concrete

Concrete shall be measured in cubic metres and be taken as theoretical volume between the toe of the pile and cut off level. No measurement shall be made for the extra concrete provided above the cut off level. A minimum of 1000 mm is required to be provided to permit removal of all laitance and week concrete before pile cap concreting. Excess concrete, any excess diameter shall be deemed to be included in the rates.

v) Reinforcement

Steel reinforcement cages fabricated for piles will be measured as fabricated by their weight in tonnes as calculated from the approved bending schedules and bar lists on the basis of the nominal weights in IS: 1786. The quantity shall also include authorized laps, lifting hook etc.

2.8 Pre-Cast Units

All the pre-cast units shall be measured in cubic metres for casting and the same measurements shall be made for transporting and placing in position also.

3. PAYMENT

3.1 General

Payment to the contractor shall be made on the recorded measurements and the contractor will have to submit bills in the prescribed form once in a month and payment will be made ordinarily once in a month. HSCL shall pay 75% of the net amount of the bill submitted within 10 days from the date of receipt of the bill and the balance within 30 days from the date of receipt of the bill. On completion of the work or on the prior termination of the contract final measurement will be taken and account adjusted accordingly. No separate mobilization/ demobilization fee shall be payable for bringing all the plants, machinery and equipment required for piling and for any other work. The contractor shall include the same suitably in the respective items of the rate schedule.

3.2 Concrete

The rate for concrete items shall include all costs that are necessary to obtain concrete quality as described in the specifications but not limited to the following items:

- Supply, delivery and storage of all materials
- Provision of all mixing, transport equipment etc.
- Curing concrete and making and curing of test cubes and testing
- Provision of all shuttering, centering
- Provision of ducts and void formers
- Finishing as specified

- All labour, fuel, tools, tackles, and contingent items.

3.3 Pre-Cast Concrete

i) Casting:

The rates for all pre-cast units (reinforced/ plain) shall cover all costs that are necessary for casting, curing necessary to complete all the items according to specification and will be paid under respective items of rate schedule.

ii) Fixing:

The rates for all pre-cast units (reinforced/ plain) shall cover all costs that are necessary for lifting, transportation, placing and fixing in position to complete all the items according to specification and will be paid under respective items of rate schedule.

3.4 Payment for PCC & RCC items

75 % of the rate quoted for the items will be released only after the concrete is laid and cured and after satisfactory test results for 7 days cube strength. The balance will be released after finishing work if any and satisfactory test results for 28 days cube strength as specified in the tender. If 28 days cube strength is not satisfactory, the payment made earlier will be recovered from any moneys due to the contractor in respect of the execution of the works.

3.5 Bored Piles

The activity of piling works shall include but not be limited to the following:

- Carrying out seabed survey in the areas to be piled and making results available to the Engineer or his representative;
- Positioning and setting up of all equipment, platform and all temporary works necessary for the construction of piles;
- Supplying, fabricating, storing, transporting, welding and cutting of steel liners including driving to comply with the specification and drawings;
- Boring pile shaft including provision and use of bentonite slurry
- Stiffening of pile reinforcement cages and inclusion of spacers to ensure straightness and correct positioning of the cages;

- Clean out of pile shafts including sampling and testing of bentonite suspension from the pile shaft as described in the specification;
- Monitoring and recording of concreting operations;
- Carrying out, recording, interpreting and reporting Dynamic Pile Load Test payment will be made only as per the relevant items of the rate schedule.

3.6 Steel works

The activity of steel items shall include but not limited to the following:

- Producing and submitting of working drawings and calculations;
- Hot dip galvanizing where specified and the thickness of galvanizing shall not be less than 80 microns and galvanizing shall comply with the requirements as specified in BS 729.
- Painting /coating before and after erection or assemblage.
- Transportation from workshop to the site, including loading, unloading and all necessary tests;
- All fastenings including bolts, washers, nuts etc. required for fixing of steel items in position;
- All other items necessary and incidental to the completion of the work;
- Bollards shall be paid for the installed unit complete with the anchoring units.
- Unless specified all steel items shall be measured in tonnes.

For all works where specific mention is not made in this preamble, rates entered shall include providing all equipment, supply of all materials and performing all operations in accordance with the specification, applicable drawings and instructions of the Engineer or his representative.

3.7 General

1) The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, Conditions of Contract, General description of works and other conditions, Technical Specifications, Drawings, Schedules and Annexure.

2) The quantities given in the Bill of Quantities are estimated and provisional and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices tendered in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix within the terms of the Contract.

3) The rates and prices bid in the priced Bill of Quantities except insofar as it is otherwise, provided under the Contract, include all constructional plant, labour, supervision, materials, all temporary works and false works, erection, maintenance, establishment and overhead charges, profit, foreign taxation and levies, local levies and other charges, together with all general risks, liabilities and obligations set out or implied in the Contract and including remedy of any defects during the Defects Liability Period.

4) "Re-preparation as per Specifications requirement of previously completed similar works before construction of subsequent layers/works shall be deemed to be included in the Bid Rates and Prices in the Priced Bill of Quantities (BOQ) of respective items".

5) The rates and prices shall be quoted entirely in Indian Rupee.

6) The rate or price rounded off to the nearest Indian Rupee shall be entered against each item in the Bill of Quantities both in figures and words, whether quantities are stated or not. The cost of items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

7) The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Bill of Quantities, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of work.

8) General directions and descriptions of work and materials are not necessarily repeated or summarized in the Bill of Quantities. References to the relevant sections of the contract documentation shall be made before entering rates or prices against each item in the Bill of Quantities.

9) The method of measurement of completed work for payment shall be in accordance with the requirements as stated in the individual sections of the Technical Specifications.

Coarse Sand: In this tender, the contractor can use river sand / M sand confirming specification as per relevant IS code & with the approval of Engineer in charge / Engineer-in charge's representative for all works. Payment shall be made as per respective BoQ items

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PACKAGE I TENDER FOR CIVIL WORKS

COVER B –SECTION X FINANCIAL BID

PART II SUMMARY OF BILL OF QUANTITIES

SL.NO.	BILL NO	DESCRIPTION OF WORK	AMOUNT (INR)	
			FIGURES	WORDS
1	1	Construction of Marine side structures.		
2	2	Construction of Landside Facilities.		
3	3	Construction of Water supply, Sewerage & Rainwater System.		
	3a	Ground Floor		
	3b	First Floor		
TOTAL OF BILL NO 1 TO 3				
APPLICABLE GST				
GRAND TOTAL				

Signature of Tenderer

COVER B – SECTION X FINANCIAL BID

PART III BILL OF QUANTITIES

BILL NO 1 CONSTRUCTION OF MARINE SIDE STRUCTURES.

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
	SUB STRUCTURES				
1.1	172 Nos	**Positioning and setting piling equipment** Positioning and setting upon and/or shifting and setting up piling equipment required for piling work at each piling locations for 1300mm and 1200mm Piles as shown in the drawing and as directed including all labour, materials, fuel, tools, equipment etc., complete	1 No (One Number)		
1.2	996 Te	**Liners** **Supplying, fabricating cylindrical M.S welded liners of 8mm thickness MS Plate:** Supplying, fabricating and providing cylindrical M.S welded liners of 8mm thickness to a required depth for 1300 and 1200mm dia piles as shown in approved construction drawings below existing ground including providing additional stiffener plates 12mm thick, 1000mm high as shown in the drawing for cast in-situ piles	1 Te (One Tonne)		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		including lowering & pitching the fabricated liners in position, driving the liners below river bed level through all types of soil, fixing the liners in position including necessary lateral bracings etc. for stability until completion of all deck works etc. including gas cutting, bending, welding at yard & site, transporting, driving of liners, all labour, materials, tools, equipment, fuel etc., complete. Note: i) The stiffener shall be measured under this item. ii) Any wastage in the liner shall be paid by the contractor. iii) Only length of liner from bottom of the driven length upto cutoff level will be paid. iv) The tentative founding level of the liner(s) are shown in the relevant drawing which may vary due to the site conditions with the prior approval of the Engineer in-charge. It shall be noted the payment shall be made for the actual quantity used for the permanent work irrespective of the termination levels.			
1.3		**Boring** **Boring for the piles**			

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		Boring of the piles for the1300 and 1200mm to the required depth through all types of soil strata including cemented sand, boulder layers , weathered rock and hard rock if any upto the founding level and stacking the bored soil at convenient place and transported to the low lying area anywhere inside /outside the harbour area within a lead to outside site premises or as directed by the Engineer's representative and pile shaft cleaning and keeping of all records etc. including bentonite solution, labour, tools, equipment, fuel, hydraulic rig etc..all as per drawing, specification etc complete as directed. **Note:** i) In case the soil stratum at the founding level is loose the Engineer or his representative may direct the contractor to carryout additional length of boring. ii) The sample of bored materials of regular interval shall be collected. iii) Boring through all type of soil strata means soft soil, weathered rock, cemented sand, boulders and hard rock etc.,			

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		iv) Bentonite slurry should be disposed of outside the site premises and no part of the bentonite slurry should be disposed into the river. v) All the boring depths shall be jointly measured actually at site and Engineer in-charge decision is final.			
(a)	3535 Rm	For 1300 mm dia piles	1 Rm (one Running Metre)		
(b)	2870 Rm	For 1200 mm dia piles	1 Rm (one Running Metre)		
1.4	2405 Te	**Reinforcement for Piles** Supplying, fabricating and placing of TMT Fe 500D grade steel for piles including cutting, bending, welding, binding, with binding wire, positioning of pile reinforcements from founding level up to reinforcement bars above pile cut off level in to deck beams with adequate lapping lengths all as per drawing, technical specifications and including all labour, materials, tools transport, cage lowering, equipment, fuel etc., complete.	1Te (one Tonne)		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		Note: Provision of spacer bars, rings, authorized lapping, hooking arrangements etc., as per the approved bar bending schedule shall also be measured and paid under this item.			
1.5	7940 m^3	**Concrete for Piles** Providing and placing in-situ concrete of grade M40 for piles using tremmie method or approved methods including compacting, curing etc. for the whole length of the pile, from the founding level up to cut off level ,casting the pile at least 1000 mm above the specified cut-off level, all sampling testing and records and all labour, materials, tools, equipment, fuel, etc.,all as per drawing, specification etc complete as directed. Note: i) The Contractor shall make arrangements to prevent the spillage/overflow of the concrete into the river. ii) Supply, fabrication of steel reinforcement shall be measured and paid under item 1.4. iii) No payment shall be paid extra for the portion of concreting above the cut off level.	1 m3 (one cubic metre)		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
1.6		**Trimming of pile heads** Trimming of pile heads built up above the cut off level (casted minimum 1m above the required cut off level) and/ or as directed and stacking the debris at convenient place and transported to the low lying area any where inside/ outside the port premises with in a lead to outside premises or all as directed by the engineers representative and all associated cleaning of projecting reinforcements including all cost for cutting the excess liner up to cut off level, materials, tools, equipment, fuel, shifting of scrap liner to the designated location etc. complete all as directed.(The excess liner scrap material is property of the contractor)			
(a)	99 No	For 1300 mm dia piles	1 No (One Number)		
(b)	73 No	For 1200 mm dia piles	1 No (One Number)		
1.7	160 m^3	**Pre cast concrete for Pile muffs** Casting of precast concrete components of pile muff of grade M40 for 1300/1200 mm dia piles of sizes as shown in the drawing and or any other size as directed to suit the site condition including shuttering	1 m^3 (one cubic metre)		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		/ formwork, mixing, transporting, placing, vibrating, curing the concrete and all labour, materials, tools, equipment, fuel, all sampling, testing and records etc., complete. **Note**: i) Supply and fabrication of steel reinforcement shall be measured and paid under item No1.9. ii) The quoted rate is inclusive of placing the precast units in the piles.			
1.8	160 m^3	**Insitu concrete for Pile muffs** Supply, deliver, transport to site and place of M40 grade concrete for in-situ pile muffs including all sampling, necessary shuttering / formwork, mixing, transporting, placing, vibrating, curing of concrete, testing and maintaining records including all labour, materials, tools, equipment ,fuel etc., complete. **Note:** Supply, fabrication of steel reinforcement shall be measured and paid under item No 1.9.	1 m^3 (one cubic metre)		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
1.9	56 Te	**Reinforcement for Pile Muffs** Supplying, fabricating and placing of Fe 500 D grade steel reinforcement of all diameter for pile muff including cutting, bending, welding, binding, with binding wire, positioning of reinforcement for pile muff all as per drawing, technical specifications and including all labour, materials, tools transport, cage lowering, equipment, fuel etc., complete.	1 Te (One Tonne)		
1.10		**Routine Dynamic Pile Tests** Supply necessary equipment and perform routine dynamic load test on the marine piles according to the specifications and as directed by the Engineer's representative all as per relevant IS codes, etc., complete. **Note:** i) The tenderer shall furnish method statement for the load testing method he proposes to adopt. ii) The pile shall be extended by at least 2m beyond the cut-off level prior to conducting the test and shall be chipped and removed after the test is completed. iii) The cost shall inlcude the cost for construction of pile cap and all other requirements needed as per relevant IS codes.			

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		iv) The test load for 1300 dia pile is 7350 KN and for 1200 dia pile is 5600KN			
(a)	1 No	For 1300 mm dia Piles	1 No (One Number)		
(b)	1 No	For 1200 mm dia Piles	1 No (One Number)		
1.11 (a)	172 No	**Integrity Test on Working Piles.** Conduct non-destructive integrity test on working piles using low strain sonic diagnostic system as specified and as directed by the Engineer for 1300 mm dia and 1200mm dia piles complete.	1 No (One Number)		
1.11 (b)		**INITIAL VERTICAL LOAD TEST** Conducting, Supervising & preparation/ submission of test report for Initial load test of single pile in accordance with IS 2911 Part- IV for determining the safe allowable compression load on pile. Test conducting including installation of loading platform by Kentledge			

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		method or any other method as per the relevant Indian Standards subject to the approval of the Engineer incharge and preparation of pile head for construction test of piles and dismantling the same after test, necessary testing equipment/ instruments duly calibrated all completed as per codal requirement and direction of Engineer-in-charge shall be in scope of piling contractor. **Note:** The tenderer shall furnish method statement for the load testing method he proposes to adopt. The test load for 1300 dia pile is 12250 KN and for 1200 dia pile is 9334 KN			
(i)	1 No	For 1300 mm dia Piles	1 No (One Number)		
(ii)	1 No	For 1200 mm dia Piles	1 No (One Number)		
1.12	1370m^3	**Insitu Concrete for Columns**	1 m^3		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		Providing and placing concrete of grade M40 for columns including all sampling, shuttering / formwork, mixing, transporting, placing, vibrating, curing the concrete and all labour, materials, tools, equipment, fuel, all sampling, testing and records etc., complete. **Note:** Supply, fabrication of steel reinforcement shall be measured and paid under item No 1.13	(one cubic metre)		
1.13	410 Te	**Reinforcement for Column** Supplying, fabricating and placing of TMT, Fe500D grade steel for reinforcement of columns including welding, binding, with binding wire all as per drawing, technical specifications and including all labour, materials, tools transport, cage lowering, equipment, fuel etc., complete	1 Te (One Tonne)		
	DECK STRUCTURE				
1.14		**Precast Concrete** Casting of precast concrete components such as beams/slabs/ trench wall& cover slab etc. of grade M40 of various sizes as shown in the drawing and or any other size as directed to suit the site condition			

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		including shuttering / formwork, mixing, transporting, placing, vibrating, curing the concrete and all labour, materials, tools, equipment, fuel, all sampling, testing and records etc., complete. **Note:** i) Supply and fabrication of steel reinforcement shall be measured and paid under item No 1.18. ii) Placing the precast units shall be measured and paid under relevant item No 1.15.			
(a)	4025 m^3	Main Beams	1 m^3 (one cubic metre)		
(b)	1835 m^3	Deck slab	1 m^3 (one cubic metre)		
(c)	90 m^3	Other works	1 m^3		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
			(one cubic metre)		
1.15		**Placing/erecting the precast elements** Handling, transporting and placing/erecting of precast cement concrete components such as beams/slabs/trench cover slab etc., of varying sizes in position as specified in drawings and as directed including all operations, all labour, tools, tackles, plant & equipment fuel etc., complete.			
(a)	4025 m^3	Beams	1 m^3 (one cubic metre)		
(b)	1835 m^3	Deck slab	1 m^3 (one cubic metre)		
(c)	90 m^3	Other works	1 m^3		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
			(one cubic metre)		
1.16		**In-situ Concrete** Providing and placing in-situ concrete of grade M40 for various components such as Beams /slabs /trench etc all as per drawing and or as directed by the Engineer including provision of shuttering, mixing, transporting ,placing, vibrating, curing the concrete including all labour, materials, tools, equipment, fuel and all sampling, testing and records etc., complete. **Note:** Supply, Fabrication of steel reinforcement shall be measured and paid under relevant item No 1.18			
(a)	4050m^3	Beams	1 m^3 (one cubic metre)		
(b)	1835 m^3	Deck slab	1 m^3		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
			(one cubic metre)		
(c)	90m^3	Other works	1 m^3 (one cubic metre)		
(d)	160 m^3	Pile muffs infill area	1 m^3 (one cubic metre)		
1.17	610m^3	**Wearing Coat** Providing and placing in-situ grade of M30 concrete as wearing coat over the deck slab with necessary slope for drainage, all as per drawings with necessary shuttering, mixing, transporting, placing, vibrating, finishing and curing the concrete including all labour, materials tools, equipment, fuel and all sampling, testing and records etc., complete	1 m^3 (one cubic metre)		
1.18	2235 Te	**Reinforcement Bars**	1Te		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		Supplying, fabricating and placing of TMT Fe 500D grade steel bars of all diameter for precast / in situ components of beams, slabs, other works in the Deck structure etc ., including lifting hooks for precast units and cutting, bending, welding, binding wire all as per technical specification, drawing, including all labour, materials tools, equipment, fuel and all sampling, testing and records etc., complete.	(One Tonne)		
	ACCESSORIES				
1.19	41 No	**ARCH Fender** Design, manufacture, test, Supplying, handling, transporting and fixing in position of Arch fender(800) as per design and drawings and in accordance with the marine specifications and approved shop drawings with anchor bolts, U hooks, Chains, cutting, concrete chipping, drilling, grouting, necessary welding with deck reinforcement steel and necessary coal tar painting(wherever required) including all materials, labour, consumable items, machineries, tools, tackles, transportation etc. and complete as per Engineer In charge(EIC). **Note:**	1 No (One Number)		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		i) Fender rated energy shall include manufacturer tolerance taken in to account while selecting the fender. Third party inspection certificate shall be provided ii) Sampling and testing requirements shall be as per specifications. No separate payment will be made for sampling and testing. The cost of all such testing shall be included in this item. iii) Fender supplier shall submit all necessary calculations for the selected fender, frame, facial pad, tension chain, shear chain, weight chain and embedment bolt etc. and obtain approval from Engineer / Engineer's representative prior to manufacture. No separate payment will be made for all design related activities for the fender and its accessories including erection			
1.21	41 No	**Bollard** Design, manufacture, Supplying, handling, transporting and fixing in position cast steel Bollard (30 ton capacity) with SS 316 bolts as per drawings and in accordance with the marine specifications and approved shop drawings with necessary cutting, concrete chipping, drilling, grouting, welding with deck reinforcement steel and necessary	1 No (One Number)		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		coal tar painting(wherever required) including all materials, labour , consumable items etc. Complete as per drawing and specifications as directed by the EIC. **Note:** i) Third party test certificate shall be provided. ii) Sampling and testing requirements shall be as per specifications. No separate payment will be made for sampling and testing. The cost of all such testing shall be included in this item. iii) Bollard supplier shall submit all necessary calculations for the selected Bollard including anchor bolt and its embedment length in to M40 concrete and obtain approval from Engineer / Engineer's representative prior to manufacture. No separate payment will be made for all design related activities for th fender and its accessories including erection.			
1.22	430 RM	**Indian Standard Crane Rail** Supply, fabricate and fix in position crane support rails (ISCR 100) all as per specifications, drawings and/or as directed by Engineer Inchrage including all rail sections, rail fixtures such as stud, nut, washer,	1 RM (One Running Meter)		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		screws, clips, clamps, sole plates, rail pad etc., epoxy grouting and all other applicable fixtures as per drawings, including Thermite welding of rail joints, including all materials, testing charges, labour, equipment etc. all as per the directions of Engineer-in-charge. Note: This item is applicable for Marine and land side works			
1.23	335 RM	**Curbs - Rubber** Supply and installation of rubber curbs of section 250 W x 200 H as per Drawings and/or as directed by Engineer Inchrage and in accordance with the Specifications, complete, including all stainless steel fixtures, fixing/anchoring charges, yellow colour retro reflective sheeting material as per relevant IRC standard, all material and testing charges, labour, equipment, other incidental expenses, providing anchor bolts wherever applicable etc. all as per direction of Engineer-in-charge. Note : Stainless steel fixtures/fastners shall be of 304 grade.	1RM (One Running Meter)		
1.24		**Expansion Joint** Supplying and fixing in position pre joint filler in the expansion joints including fabricating and fixing in position of M.S. plates etc., all as			

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		per drawing and/or as directed by Engineer Inchrage and specification including all labour, materials, tools, equipment, etc., complete			
(a)	3Te	M.S angles and Plate	1 Te (One Tonne)		
(b)	30m^2	Bituminous pad 25mm thick	1 m^2 (one square metre)		
1.25	120 RM	**Sealing compound** Supplying and laying bitumen sealing compound of grade ' A' conforming to IS 1834-1984 (or its latest revision) for joints as directed by Engineer Inchrage, painting the edges of the Joints with an approved primer all as specified and as directed including all labour, materials, tools, equipment, fuel, transport curing etc, complete	1 RM (One Running Meter)		
1.26	2Nos	**Mooring rings** Supply, fabricate and fix in position M.S galvanized mooring rings of 32mm dia rod including provision of MS anchor bolts with ragged surface including painting the ring as per specification and/or as	1 No (One Number)		

Sl.No	Probable Qty	Description of work	Unit	Rate in Figures and in words (INR)	Amount (INR)
		directed by Engineer Inchrage, including all labour, materials, tools, equipment, fuel, transport curing etc, complete			
1.27	40RM	**Safety chains** Supplying, fabricating and fixing in position M.S galvanised safety chains of 12mm dia. Chain link, including painting the chain as per specification as per details shown in the drawing and/or as directed by Engineer Inchrage, including all labour, materials, tools, equipment, fuel, transport, curing etc., complete.	1RM (One Running Meter)		
1.28	2 Te	**M.S Inserts** Supply, fabricate and fix in position M.S inserts consisting of MS flat in service trench for cable support all as directed at site of work and include galvanizing the fixtures and painting the exposed surfaces including all labour, materials, tools, equipment , fuel, transport etc., Complete.	1 Te (One Tonne)		
		TOTAL OF BILL NO 1			

COVER B – SECTION X FINANCIAL BID

PART III BILL OF QUANTITIES

BILL NO 2 CONSTRUCTION OF LAND SIDE FACILITIES

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
1		**PRE CONSTRUCTION WORKS &EARTH WORK**			
		PRE CONSTRUCTION WORK			
1.01	2550 m^2	Providing & doing barricading on all sides of the site up to 6m height with the following specs. The main vertical pipe of 75mmx75mmx3mm is fixed at a distance of 3000mm c/c. 900mm shall go on the floor with a concrete base. Cross horizontal members shall be fixed 38mmx38mmx2mm shall be fixed at 1500mm c/c. Pipes shall be finished with red oxide & enamel painted. 0.5mm thick colored profile sheet shall be fixed on it up to 6m height from floor level. The job shall include doing all necessary arrangements for fixing & stability. After site handover, all material shall be the property of the owner. Visible sheet size shall be paid for billing.			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
1.02	650m^2	Clearing of of site of vegetation including bushes, shrubs, grass, ground cover etc as directed., including dispoasl of all unusable plant material outside the site premises. Rate to include complete clearance of roots of lant matter as required. Only plan area to be measured (The contractor shall quote the rate after visiting the site from the contractor side before quoting)			
1.03	1130m^3	Dismantling of existing RCC structures of any mix at all leads and lifts including stacking of steel bars s directed by the engineer in charge, and disposal of unserviceable materials outside site premises (The contractor shall quote the rate after visiting the site from the contractor side before quoting)			
		EARTH WORKS			
1.04	710m^3	Earth work in excavation by mechanical means using JCB, in all types of soils in foundations trenches, rafts, column pits, pile caps etc. including dressing of sides and ramming of bottom, disposing surplus earth within the premises in a manner as directed by the Engineer in charge including all and lead upto 250 metres.	1 m^3 (one cubic metre)	400.00	
1.05		Filling in plinth (compacted) including watering, ramming, consolidating and dressing etc.			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
a)	710m^3	With selected excavated earth available within the compound including all lead & lift.	1 m^3 (one cubic metre)	175.00	
b)	270m^3	with quarry dust brought form outside	1 m^3 (one cubic metre)	3250.00	
1.06	1215m^2	Providing and injecting chemical emulsion chlorophyriphos 20% emulsifiable with concentrates 1 % @ 5 Ltr. /Sqm of the surface or as directed by Engineer-in-charge, for pre-constructional anti -termite treatment and creating a continuous chemical barrier under and around the column pits, wall trenches, basements excavation, top surface of plinth filling, junction of wall and floor along the external perimeter of the of the building, expansion joints over the top surface of consolidated earth on which apron is to be laid, surroundings of pipes and conduits etc. complete as per specifications (plinth area of building at ground floor only shall be measured for payment)	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
2.00		**PILING WORKS**			
2.01		Boring in all kinds of soils (as met at site) gravel shingle etc. including water bearing strata, disposal of earth etc. taken out from bores outside the site or as directed by Engineer-in-charge, providing and installing cast in situ reinforced cement concrete pile of specified dia meter and length below the pile cap, in M-35 cement concrete - ready mixed concrete, design mix with minimum cementitious material 400 Kg/ cum including admixture as approved by Engineer-in-charge to carry a safe working load not less than 40T excluding the cost of steel reinforcement but including the cost for suitable boring equipment, cost of bentonite solution for bore stabilisation, etc. by using pumps (of suitable capacity) prior to placing concrete, disposal of bentnite solution etc as directed all complete (length of the pile shall be considered for payment). NB: The bentonite slurry should be disposed off outside the site premises and no part of the slurry should be disposed into the river.			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		Note i) The rate shall include cost of alignment of two nos. of bar of required diameter which is to be used to hold the reinforcement cage vertical during concreting, built up of atleast 1000mm above cut off level, making slurry vats at pre-approved location of site, using bentonite, removal & shifting of bentonite slurry, solid, semisolid liquid muck from vat/drain, dry/wet soil mixed with bentonite and the surplus earth excavated from vat to outside of the site premises by Tanker & other transport. Piles shall be cast as per the schedule of cut off - level given in the execution drawing. No extra payment for concrete above the cutoff level ii) Supply and fabrication of steel reinforcement shall be measured and paid under item No 2.02			
	2220RM	**800 mm Dia, 18.65 m long.**	1 RM		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
			(One Running Meter)		
2.02		Providing & fixing reinforcement for RCC work in cast in situ bored piles including straightening, cutting, bending, binding with necessary binding wire or welding ,cover blocks (including cost of binding wire) with 20 &16mm stiffener bars @1.5m c/c (Tor Steel as per IS-1786, Fe 500D) lowering the cage for piling work including welding, transporting, decoiling, straightening, removing loose rust and binding with 18 gauge annealed wire , placing in position complete, in all shapes, size and sections etc. at all floors and all heights / depths as per design and drawings: **Note:** Provision of spacer bars, rings, authorized lapping, hooking arrangements etc., as per the approved bar bending schedule shall also be measured and paid under this item.			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
	350 Tonne	HYSD (High yield strength deformed bars) / Thermo Mechanical Treated bars (TMT) bars	1Te (One Tonne)		
2.03		**TESTING OF PILE**			
(a)		**Initial Load Test**			
	1 No	Conducting, Supervising & preparation/ submission of test report for Initial load test of 100T on single pile in accordance with IS 2911 Part-IV for determining the safe allowable compression load on pile. Test conducting including installation of loading platform by Kentledge method or any other method as per the Relevant Indian Standards and preparation of pile head for construction test of piles and dismantling the same after test, necessary testing equipment/ instruments duly calibrated all completed as per codal requirement and direction of Engineer-in-charge shall be in scope of piling contractor.	1 No (One Number**)**		
(b)		**Routine Load Test**			
	2 Nos	Conducting ,Supervising & preparation/ submission of test report for Routine load test of 60T on single pile in accordance with IS 2911 Part-IV for determining the safe allowable compression load on	1 No (One Number**)**		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		pile. Test conducting including installation of loading platform by Kentledge method or any other method as per the Relevant Indian Standards and preparation of pile head for construction test of piles and dismantling the same after test, necessary testing equipment/ instruments duly calibrated all completed as per codal requirement and direction of Engineer-in-charge shall be in scope of piling contractor.			
(c)		**Integrity Test**			
		Carrying out Pile integrity test on piles at site all complete, test equipment shall be of testing agency & submit test report.			
	108.00 No	**800 mm Dia, 18.65 m long.**	1 No (One Number)		
3.00		**CONCRETE WORKS**			
		Note: Rate of shuttering to be inclusive of for circular, semi-circular, irregular shaped concrete work is , in regular shuttering, R.C.C and additional height in shuttering is not payable. The tenderer while quoting the rates, the shuttering /centring shall be included and no extra payments in this regard.			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
3.01		Providing and laying in position cement concrete of specified grade including the cost of centering and shuttering - all work in foundations and in Super Structure.			
a)	900m^3	M10 Concrete.	1 m^3 (one cubic metre)		
b)	80m^3	M15 Concrete.	1 m^3 (one cubic metre)		
3.02		Providing and laying Cement concrete in M35 for all RCC works all as per the details shown in the drawings , specified in the relevant schedules and as directed including centering, shuttering, scaffolding, mixing, transporting, placing, vibrating, curing including all labour, materials, tools, equipment, etc, complete at all depths, heights and levels. **Note:** Supply, Fabrication and Placing the reinforcement for the work shall be measured separately under item No 3.03 of this schedule.			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
a)	390m^3	Footings, Pile cap, foundations, pedestals, grade beams, plinth beams, etc.	1 m^3 (one cubic metre)		
b)	710m^3	Suspended floors, grade slabs, roof slabs, staircase landings, shelves, balconies, OHT Slabs etc.	1 m^3 (one cubic metre)		
c)	30m^3	Columns, Stub Columns. etc.	1 m^3 (one cubic metre)		
d)	70m^3	Beams of all shapes, tie beams, lintels etc.	1 m^3 (one cubic metre)		
e)	10m^3	Staircase waist slab	1 m^3		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
			(one cubic metre)		
f)	25m^3	Retaining walls, butresses, lift walls, OHT walls etc.	1 m^3 (one cubic metre)		
3.03	195Te	Supplying, transporting and fabricating TMT Fe500D bars and placing in position as reinforcement for all RCC members of item No 3.02 of this schedule , as shown in the drawing including all handling, cutting, bending and tying with 18G MS black annealed binding wire including all materials and labour, lifting, tools, equipment, etc., complete.	1Te (One Tonne)		
3.04	37m^2	Providing & laying 40mm thick damp proof course of CC 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12mm and down gauge) including providing and applying two coats of hot bitumen @ 1.70 Kg/Sq.m for each coat and sanded over including providing and mixing water proofing compound @ 1 kg. per bag of cement (with CICO No. 1 or equivalent approved).	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
3.05	7.50m^3	Providing & laying cinder filling / AAC block in sunken slab or wherever called for, including consolidating/ ramming.	1 m^3 (one cubic metre)		
4.00		**MASONRY WORKS**			
		Note: No extra charge for rectangular, square, curved or chamfered brick work shall be payable.			
4.01	65m^3	Providing and laying Brick work using bricks of class designation 50 in cement mortar 1:4 (1 cement: 4 coarse sand) for foundations & plinth., all as per the details shown in the drawings and specified in the relevant schedules and as directed including scaffolding, curing all labour, materials, tools, equipment etc., complete	1 m^3 (one cubic metre)		
4.02	5.50 m^3	Providing and laying Brick work using bricks of class designation 50 in cement mortar 1:4 (1 cement: 4 coarse sand) for staircase steps including cutting/chamfering of blocks., all as per the details shown in the drawings and specified in the relevant schedules and as directed including scaffolding, curing all labour, materials, tools, equipment etc., complete	1 m^3 (one cubic metre)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
4.03	200m^2	Providing and laying autoclaved aerated cement blocks masonry with 100mm thick AAC blocks in super structure above plinth level up to all floor levels as per manufacturers' instructions and recommendations in cement mortar 1:4 (1 cement : 4 coarse sand) The rate includes providing and placing in position 2 Nos. 6 mm dia M.S. bars at every third course of masonry work.	1m^2 (One Square Meter)		
4.04	124m^3	Providing and laying autoclaved aerated cement blocks masonry with 200mm thick AAC blocks in super structure above plinth level up to all floor levels as per manufacturers' instructions and recommendations in cement mortar 1:4 (1 cement : 4 coarse sand) The rate includes providing and placing in position 2 Nos. 6 mm dia M.S. bars at every third course of masonry work.	1 m^3 (one cubic metre)		
5.00		**FINISHING WORKS**			
5.01	960m^2	Providing & applying 12 to 15mm thick internal wall plaster in CM 1:4 (1 cement : 4 sand using 25% coarse sand and 75% fine sand) at all heights and levels including scaffolding, curing etc. complete, inclusive of internal jambs at actual measurement.(all openings to be deducted on actual measurement) . Rate to included fixing G.I plaster lath 200 mm wide at all junctions.	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
5.02	690m^3	Providing & applying upto 10mm thick plaster in CM 1:3 (1 cement : 3 coarse sand using 25% coarse sand and 75% fine sand) on ceiling including hacking the surface, scaffolding, curing etc. at all levels and heights etc.	1m^2 (One Square Meter)		
5.03	465 m^2	Providing & applying ±18mm thk external plaster cement plaster in 2 layers in 1:4 CM (1 cement : 4 coarse sand) finished smooth including scaffolding and using admixture of approved make while plastering the junction of two different materials such as RCC and brick etc; inclusive of external jambs at actual measurement.(all openings to be deducted on actual measurement) Rate to include dripcourse etc complete	1m^2 (One Square Meter)		
5.04	690m^2	Providing & applying two or more coats of plastic emulsion paint of approved brand and manufacture on **ceiling** over a coat of approved primer to give an even shade including preparing the surface complete.	1m^2 (One Square Meter)		
5.05	960 m^2	Providing & applying two or more coats of premium emulsion paint of approved brand and manufacture on interior wall over putty and a coat of approved primer to give an even shade including preparing the surface complete.	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
5.06	465m^2	Providing and applying exterior emulsion of approved brand and manufacturer (two or more coats) of required shade on new work over and including preparation of surface and a coat of approved primer.	1m^2 (One Square Meter)		
6.00		**DOOR / ROLLING SHUTTER WORK**			
6.01	225m^2	Providing and fixing **MS Perforated rolling shutter** of size as mentioned below with TATA coil - 18G strip, 10G channel, 12G bottom, Hindustan spring (heavy) shaft rod 12G "c" class pipe, 6mm flat, 6mm drum flat, BRK bearing (heavy), gear import MS steel box (heavy), gear teeth steel (heavy), gear warm steel, 23 GI top cover sheet with angle, one coat of red oxide paint. (Shutter over material measurement calculation only). Side safety lock, Centre lock, Top cover, Motor costs to be included.	1m^2 (One Square Meter)		
6.02	14.00 No	P/F 40 mm thk Commercial Flush shutter with 1mm thick **laminate on both sides** 6mm thk ghana teak margins. The laminate shall have groves as per pattern. The doors will have best quality 4 Nos 125 mm long SS hinges, SS finished double legged foot operated door stays, Polyvinyl door stopper fixed to skirting, Brushed SS finish mortise lock set of Dorset make along with brushed finished C.P brass tower bolts of	1No (One Number)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		approved quality. All hinges to be oil filled friction free. **(Toilet Doors)**			
6.03	17.00 No	P/F 40 mm thk Commercial Flush shutter with 1mm thick **laminate on one side and veneer on the other with** 6mm thk ghana teak margins. The laminate/ veneer shall have groves as per pattern. The doors will have best quality 4 Nos 125 mm long SS hinges, SS finished double legged foot operated door stays, Polyvinyl door stopper fixed to skirting, Brushed SS finish mortise lock set of Dorset make along with brushed finished C.P brass tower bolts of approved quality. All hinges to be oil filled friction free.Veneer to be melamine polished. **(Main doors)**	1No (One Number)		
6.04	96m^2	Providing and fixing UPVC glazed openable windows/ ventilators and sliding window with approved colour & sliding shutters using 2 track of required frame section alround fixed with G.I steel reinforcement & 40 mm X 26.7 mm 1.1 mm thick interlock section for shutters. The shutter should be mounted on nylon roles with non-friction stays, approved quality fixtures such as handles, tower bolts etc. providing 5.0 mm thick clear glass of Saint Gobain or equivalent for shutter fitted with EPDM rubber beading. installation with all lead and lift etc. complete as per the specifications/ relevant drawings,as directed by the Architect / Engineer	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		In Charge. Shop Drawings to be prepared by the Manufacture/ Contractor and approved by the Architect / Engineer In Charge. Base Rate: Rs. 475/Sft- **(In windows and ventilators)**			
6.05	99.00	Supply & Fixing in position seasoned ghana teak wood in frames of door moulded frames/beads fixed with suitable150mm long Fischer anchor fasteners including applying wood preservative/antitermite paint (coal tar creosote) to the surface coming in contact with wall . **(All door frames)**	1 RM (One Running Meter)		
		Frame size 50mm thick x 175mm wide (internal frame) melamine polished -			
6.06	15.00 No	Supplying & fixing GI sheet & frame door shutter for shaft using frame of size 100X57mm & 1.2 mm thickness ,shutter of 46 mm thick including the required accessories such as SS hinges,mortice shaft cam lock with allen key ,D type pull handle,door closure ,concealed flush bolt,float glass of 5mm thick for viewing panel etc with suitable rubber beading & locking arrangement. Shutter to be powder coated complete of approved colour .(2'6" x 7'0") **(In shafts)**	1No (One Number)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
6.07	260 m^2	Supplying & covering Skylights - open area & PHE shafts at terrace level with 6mm thick with 2 layer polycarbonate Sheets of approved agencies fixed with Al channels with rubber beading & self tab screws on existing tubular structure as detailed in drawing & as per the manufactures specification, directed by the Architects/ Engineer In Charge. -**(Skylights in Workshop roof)**	1m^2 (One Square Meter)		
7.00		**FLOORING / CLADDING WORKS**			
7.01 (a)		Providing and laying design mix good quality concrete flooring of M30 Grade with OPC of 43/53 grade mixed 450 kg/ Cum.,laying in panels of approved size compacting using vacuumed dewatering floor laying technique & finishing, concrete surface smooth using Ride On trawls including wet curing, conforming to IS standards of concrete floor etc complete as approved and as directed by the Engineer in charge.**(Workshop Flooring)**			
i)	810m^2	100mm Thick	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
b)	810m^2	Providing and laying **Epoxy coating** over concrete floor of thickness upto 3mm , sanding of surface, priming, screeding / levelling with epoxy top coat application complete.	1m^2 (One Square Meter)		
c)	2820 Kg	Extra over above the screed concrete floor by providing highly abrasion resistant non-metallic floor hardener by applying NITOFLOR HARDTOP of FOSROC / SIKA CHAPDUR of SIKA / MATERTOP 100 of BASF/STP for a minimum of 3.5 kgs / sqm under dry shake method as directed by EIC	1KG (One Kilogram)		
d)	120 RM	**SAW CUTTING OF JOINTS -** Initial Cutting of Contraction Joints in concrete not less than 3 mm and not more than 5mm in width and 1/3 of the thickness of Pavement Quality Concrete layer but not less than 100mm with saw cutting machine as per MORTH Pavement Quality Concrete specification clause and approved design drawings including Quality Control testing, maintenance and protection as directed by and to the satisfaction of Engineer-in-Charge.	1 RM (One Running Meter)		
e)	120 RM	**SEALING OF JOINTS -** Priming and Sealing of joints in position with polysulphide sealant or polyurethane sealant conforming to B.S.5212 of approved brand applied in expansion/ contraction/construction joints	1 RM		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		including painting contact surface of the joints with primer of approved brand, over and including a polyethylene rod in expansion/contraction/construction joints etc., complete by approved mechanical means, tools and tackles etc., as per MORTH Pavement Quality Concrete specification clause and approved design drawings including Quality Control testing, maintenance and protection as directed by and to the satisfaction of Engineer-in-Charge. A closed cell polyethylene foam backing rod shall be inserted in the groove to arrest sealant leakage.	(One Running Meter)		
7.02	810 m^2	Providing and laying Low Density Poly Ethylene **LDPE** sheet below flooring shall be Uniform In Colour,Texture & Finish,Substantially Free From Pin Holes,& Undispersed Raw Materials, Streaks & Particles Of Foreign Matter,no other visible defects such as melt fracture,holes,tears or blisters. &Marking as per resp. size,Grade & Batch no. Grade of film : 030, (Heavy duty and High impact) flat sheet.Free from any objectionable odour and Dispersion of Carbon black shall be satisfactory. **(Workshop Flooring)**	$1m^2$ (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
7.03	255 m^2	Soft lanscape preparation with necessary fertilised sub-soil	1m^2 (One Square Meter)		
7.04		Providing and laying in floors and wall dado of minimum 10 mm thick vitrified/ ceramic tile of approved make, size and colour laid on 20 mm thick cement mortar 1:4 (1 cement :4 coarse sand) or with adhesive including grouting the joints with white cement and matching pigment etc. complete. Joints to be flush.			
		With Tile - 300 X 600 mm ceramic tile in Toilet Walls			
	115 m^2	a) Flooring	1m^2 (One Square Meter)		
		With Tile - 600 x 600 mm ceramic tile in General Flooring			
	575 m^2	a) Flooring	1m^2		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
			(One Square Meter)		
	410 RM	b) Skirting	1 RM (One Running Meter)		
	36 m^2	c) With Tile - 300 X 300 mm ceramic tile in Toilet Flooring	1m^2 (One Square Meter		
7.05		Providing and laying non-slip, Thematec Tile Flooring (Size - 10"x10"). of approved make and sample in pattern as per detailed drawings on min. of 35mm thick bed of cement mortar, 1:4, including surface preparation, applying neat cement float, giving necessary slopes and spacer of 6mm, cleaning joints and Epoxy grouting joints or equivalent in neat white cement paste with pigmented additives to match shade of the tile. etc complete. Also rate to include the screed of about M15 grade concrete			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		for a thickness of an average 100mm to be laid with neccessry slopes. **Terrace**			
a)	170m^2	Flooring	1m^2 (One Square Meter)		
b)	60RM	Skirting	1 RM (One Running Meter)		
8.00		**ELEVATION WORKS**			
8.01	180m^2	Providing and fixing **Aluminium Composite Panel** of Eurobond/Aludecor make, cladding in combination of Metallic / Solid colours, including all necessary frames work and all complete. Panel should consist core of Anti-toxic Low Density Polyethylene (LDPE) 3.5mm sandwiched between 2 skins of thick Aluminium coil of 0.25mm. The system shall be installedusing50mm x 50mm x 50mm Long 3mm thickness G.I 'L' brackets / 75mmx50mmx50mm Long 3mmthicknessG.I.'L' brackets @ min 1.5 metre interval vertically	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		Fastened By 8mm Dia x 75mm Long Double Ring/Single Ring Wedge Anchors and 6mm x 60mmLong Rawal 'P'/'T' Type Anchor Fastener of UIP brand(Germany Make). 38mm x 38mm thick and 38mm x25mm L-Angle and 50mm x 25mm box section will be used for mullions and transom with necessary accessories, such as Screws, Rivets, bolts, Nuts and washers shall be in Zinc coated/Galvanized steel.The bracket support shall be designed as per manufacturer's specification. Sealing shall be done, using weather sealant of Dowsil or Equivalent. **(In Workshop elevation)**			
8.02	220m^2	**STRUCTURAL GLAZING :** Providing and fixing Anodized Aluminium glazed sliding / openable shutters of approved colour with suitable frame sections all around & interlock section for shutters. The shutter should be mounted on nylon roles with approved quality fixtures such as aluminium handles tower bolts etc. providing 5mm thick plain glass for shutter as approved by the architect fitted with EPDM rubber beading. All the aluminium section should be anodized and fabricated by reputed firm by cutting to the required length joint mitered sub dividing the frame tennoned and reverted in the assembled frame to be stiffened with and clip corner angels etc.fixed to be the wall lintel, floor	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		rawl plugs and teakwood gutas etc including cutting masonry / concrete and making good to the original surface using cement mortar all the aluminium section should be pretreated for removal of any rust and prevention of further rust and coated with greasy materials for non-adherence of mortar and any other sticky materials. This coating should be cleaned after installation with all lead and lift etc. complete as per the specifications/ relevant drawings,as directed by the Architect / Engineer In Charge. Shop Drawings to be prepared by the Manufacture/ Contractor and approved by the Architect / Engineer In Charge.			
9.00		**ROAD / PAVING WORKS**			
9.01	135m^3	Providing, laying, spreading and compacting crushed graded stone aggregate of size 90mm to 45mm WBM, mechanically interlocking by rolling using power road roller and voids thereof file width screening and binding materials consisting of fine grain material passing 0.425 mm sieve, with the assistance of water, shall be laid in two layers of 100 mm each on well prepared under base and compacting with Roller having minimum80-100 KN static weight to achieve the desired density of 98% of MDD including lighting, guarding, barricading and maintenance of diversion etc. complete for all leads and lifts as per drawings and	1 m^3 (one cubic metre)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		specifications and as directed by EIC including all labour, material, royalty, supervision, fuel, equipment, etc. (In Road/ Driveway)			
9.02	525m^3	Providing & laying M35 RCC including cost of centring, shuttering and excluding reinforcement but including mechanically mixing, vibrating, curing etc. complete at all depths, heights and levels . Note Reinforcement bars will be measured and paid in the item No 9.05 of this schedule.	1 m^3 (one cubic metre)		
9.03	210m^3	**PRECAST DRAIN/TRENCH COVER** - Providing and fixing factory made precast RCC perforated drain covers, having concrete of strength not less than M-25, of size 1000 x450x50 mm, reinforced with 8 mm dia four no longitudinal & 9 nos cross sectional T.M.T. hoop bars, including providing 50 mm dia perforations @ 100 to 125 mm c/c, including providing edge binding with M.S. flats of size 50 mm x 1.6 mm complete, all as per direction of Engineer-in-charge. (Size should be changed as per site requirement).	1 m^3 (one cubic metre)	9000.00	
9.04		**MANHOLE/CHAMBER** - Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 coarse sand) R.C.C. top slab with 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		size), foundation concrete 1:4:8 mix (1 cement : 4 coarse sand : 8 graded stone aggregate 40mm nominal size) inside plastering 12mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm size) finished with a floating coat of neat cement complete as per nominal standard design :			
		Inside size 90x80 cm and up to 90 cm deep including C.I. cover with frame (light duty) 455x610 mm internal dimensions total weight of cover and frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg)			
a)	6No	With F.P.S. bricks with class designation 75	1No (One Number)	7500.00	
9.05		Supplying, Laying, fabricating, and fixing in position steel reinforcement of Grade Fe 500 D in all reinforced concrete work, including straightening, cutting, removal of loose rust by wire brush and coating with cement slurry, bending, hoisting, laying in position to the shape and profile required at all levels and heights as per drawing & design and/or as directed, binding with 18 gauge MS annealed wire etc.			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		complete. (quoted rate also to include providing & fixing the binding wire, cement mortar, spacer blocks etc.)			
	42 Te	Thermomechanical treated reinforcement (TMT and/or high yield strength deformed Tor Steel Fe 500 D) bars of all grades	1 Te (One Tonne)	92000.00	
9.07	116 m^3	**BRICK WORK** - Brick work with common burnt clay non modular bricks of class designation 50 in foundation and plinth. Cement mortar 1:4 (1 cement : 4 coarse sand) all as per the details shown in the drawings and specified in the relevant schedules and as directed including scaffolding, curing etc., complete	1 m^3 (one cubic metre)	7000.00	
10.00		**STRUCTURAL STEEL**			
a)		Providing, fabricating, transporting, assembling & erection in position of Steel members for steel columns, built up beams using structural tubular sections (round, square or rectangular hollow tubes etc. confirming to IS 4923 / IS 1161, Yield strength 310 MPA as per latest IS Code) to the required profile & shape as called for as per the drawing & specifications. This item also includes the shear connectors /studs & fusion weld to top of horizontal member. This item also includes preparation of shop drawings & their approval, necessary templates,			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		adequate temporary supports, scaffolding & staging, all cutting, grinding, sliding & all labour, tools, plants& equipment & operations etc. required to complete the job as per drawing & specification. every precaution to be taken to prevent rusting of sections. This item also includes all test on materials & welded fabricated parts as per specification & direction of Engineer - in - Charge. Temporary bolts & nuts (grade EN 8) to be used during assembling & shall be removed before site erection. All site erection bolts shall be HSFG type only. The item to include cost of sand blasting on materials, application of primer & various coats of internal & external painting in fabrication shop & final painting on site including all touch up works after erection as per technical specification.			
i)		The scope of work for this item includes :			
		a) Design & fabrication of any additional temporary structure including all type of lifting brackets, supporting brackets, which will be required for transportation & erection in position / launching of fabrication part or complete element in position.			
		b) Making provision & arrangement for required opening / inserts for fixing lights fixtures & funning cable conduits .			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		c) All incidentals .labour, equipment & plants required to execute & complete the job from fabrication to erection at final position as per drawing, specification & direction of Engineer - in -Charge.			
		d) Cleaning & removing of all spoil, temporary arrangement for casting of deck slab.			
		e) All safety measures required to execute & complete the work.			
		f) Procurement of all materials from approved manufactures & fabrication. Complete methodology for structural steel work . Name of workshop for fabrication works. Testing facilities & erection procedures etc.to be intimated for approval of Engineer - in - Charge.			
		g) The provision of temporary bearing / sand jacks for supporting steel members during erection.			
		h) Provision of stability during erection against wind load or any other type of loading on structural steel members during erection.			
ii)	37070Kg	Measurement shall be only for structural steel which is erected & is part of permanent structure & paid as per approved shop drawings. All wastages, temporary works, Jigs, temporary assembly bolts etc. are deemed to be included in quoted rates . No allowance or increase in weight for welding, nuts & bolts etc will be applicable.	1KG (One Kilogram)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
c.)		Providing and fixing Colored Galvalume sheets for roofing and cladding of 0.47mm-5mm thk with minimum end overlaps of 150mm and appropriate side laps including cost and conveyance of all materials, labour, all leads and lifts, other incidentals,.self drilling screws, ridge cap and rainwater downtake pipes including fixing skylight panels with Butyle sealant beads. NB: 1. Overlapped region will not be considered for measurement. 2. The cost shall also include the cost of fixtures necessary as per drawings and /or as directed by the Engineer Incharge and specifications as per the Relevant Indian Standards.			
(i)	960 m^2	Roofing	1m^2 (One Square Meter)		
(ii)	1060 m^2	Cladding	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
11.00		**SITE DEVELOPMENT - BOUNDARY WALL & ENTRANCE ARCH**			
11.01	380 m^3	Earthwork in excavation in foundation, trenches, columns, etc. including side fills upto existing G.L. in layers not exceeding 150mm thick (compacted) including watering, ramming, consolidating and dressing etc. including all lift and lead upto 100 metres.	1 m^3 (one cubic metre)		
11.02	38 m^3	Providing and laying (150mm thick compacted thickness) boulder soling under grade slab including compaction by plate compactor/ vibro roller. (Voids if any shall be filled with small stones or spoils before dust blindage) .	1 m^3 (one cubic metre)		
11.03	25.50 m^3	Providing & laying PCC 1:4:8 (1 cement : 4 coarse sand : 8 graded stone aggregate 40mm nominal size) for foundation and under floor including formwork.	1 m^3 (one cubic metre)		
11.04	115 m^3	Providing & laying RCC as per main item 3.02	1 m^3 (one cubic metre)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
11.05	18 Te	Providing and laying reinforcement, high yield strength ribbed TMT steel of various diameters grade FE 500D conforming to IS code 1786-2008 for reinforced concrete work including cutting, bending, binding with annealed 18G MS binding wire, placing in position according to drawings. (Rate shall include cost of binding wire, cover blocks, etc.	1 Te (One Tonne)		
11.06	615 m^3	Providing and laying Brick work of brick designation of 50 in foundations & plinth in cement mortar 1:4 (1 cement : 4 coarse sand). all as per the details shown in the drawings and specified in the relevant schedules and as directed including scaffolding, curing etc., complete	1 m^3 (one cubic metre)		
11.07	85 m^3	Providing and laying autoclaved aerated cement blocks masonry with 200mm thick AAC blocks in super structure above plinth level up to all floor levels as per manufacturers' instructions and recommendations in cement mortar 1:4 (1 cement : 4 coarsesand) The rate includes providing and placing in position 2 Nos. 6 mm dia M.S. bars at every third course of masonry work.	1 m^3 (one cubic metre)		
11.08	920 m^2	Providing sand faced plaster to external walls, columns, etc. in cement plaster 1:4 applied **in two layers of total ±18mm thick,** finished to line and level to approved sand faced texture for all heights. Rate to include	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		all lifts, leads, scaffolding & curing etc. inclusive of fixing G.I plaster lath 150 mm wide in all junctions			
11.09	85 m^2	Providing & laying 40mm thick damp proof course of CC 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12mm and down gauge) including providing and applying two coats of hot bitumen @ 1.70 Kg/Sq.m for each coat and sanded over including providing and mixing water proofing compound @ 1 kg. per bag of cement (with CICO No. 1 or equivalent approved).	1m^2 (One Square Meter)		
11.11	420 RM	Providing and fixing **Concertina coil fencing** with 2.5mm thick galvanized GI wire IS:513 & IS:4454, coil of 1.5 feet dia uniform spacing of 8-9 inches c/c, with Grade 90 GSM ,barbed razor type, supported over boundary wall by M.S Medium duty "L" angle of size 40 x 40 x 5 mm at every 2.00m c/c in position with necessary fittings.	1 RM (One Running Meter)		
12.00		**WATERPROOFING WORKS**			

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
12.01		Providing & laying brick bat coba water proofing treatment with requisite slope and approved specifications of selected specialised agency Acrylic chemicals of approved make @ 1% by weight i.e minimum 1 Kg. of chemical shall be mixed with 100 Kgs of ordinary Portland cement including vertical surface of wall, finishing the surface complete as per specification. Area treated shall be measured for payment. minimum thickness to be 75 mm. **(In Terrace)**			
a)	65 m^2	(i) Horizontal area	1m^2 (One Square Meter)		
b)	15.50 m^2	(ii) 40 mm vertical treatment upto 300 mm from slab top including providing and making gola as per specifications	1m^2 (One Square Meter)		
12.02	43 m^2	Providing and applying tapecrete (minimum 2 coats) water proofing to sunken toilets as per manufacturer's specifications including base plaster & protective cement plaster in horizontal and vertical surface.- surface to be punned with neat cement complete. **(In toilets)**	1m^2 (One Square Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
12.03	139m^2	**OVERHEAD TANK WATERPROOFING** - CRYSTALLINE METHOD COATING: Providing and applying water proofing treatment to the Lift Pit, Water Tank concrete floors / walls etc. to make the structure completely water tight, coated with penetron or equivalent crystalline penetration water proofing material (applied as per manufacturers specification). The treated surfaces are to be permanently exposed to the liquids only after 7 days. The contractor shall provide a performance guarantee for 10 years. (Specialist applied rate Rs. 500/- per sqm)	1m^2 (One Square Meter)		
13.00		**METAL WORKS**			
13.01	57RM	Fabricating, supplying and installing in position M.S. railing along stairs & balcony as per drawing using M.S. tubes, round & square bars, angles, tees, channels, bolts flats , anchor bolts, anchor plates GI plates, cleats etc. including cost of cutting bending , drilling bolting and welding plugs etc. with all tools and tackles and labour as per design or as directed by engineer in charge including hold fast and embedding in position with 1:2:4 cement concrete and applying a priming coat of approved steel primer and two coats of approved make and shade of synthetic enamel paint and flay on top. The hand railing and other	1 RM (One Running Meter)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
		horizontal members shall be bent to the correct radius shown on the drawings by appropriate means without losing the profile of the pipe. **(For staircase / parapet railing)**			
13.02	96 m^2	Providing and fixing M.S. Safety grill main frame out of 40mm x 40mm box sections with intermediate section out of 20 x 40 box sections duco painted white. Rate to be inclusive of pivot, base pedestal for pivot fixing, hinges, latches/ locks/ drop bolts complete. (Per Sq.m 30kg) **(For UPVC windows/ventilators)**	$1m^2$ (One Square Meter)		
14		**NDT Investigation of the existing structures**			
14.01	8nos	Conducting detailed visual inspection wherever required and documentation of the distresses through photographs	1No (One Number)		
14.02	250nos	Rebound hammer test to be conducted as IS 13311(part- 2)- 1992 or as directed by consultant and submission of test report.	1No (One Number)		
14.03	250nos	Conducting Ultrasonic Pulse Velocity Tests in the various RC structural elements wherever required at the Berths to assess the integrity of the concrete as per IS 516 Part 5 Sec 1	1No (One Number)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
14.04	15nos	Drilling core samples of 69 mm diameter and of sufficient length in the various RC structural elements wherever required at the Berths. Conducting compressive strength tests on the core samples after trimming and capping and evaluation of the equivalent cube compressive strength as per IS standards IS-456 2000, ASTM D2113	1No (One Number)		
14.05	15nos	Conducting carbonation test on the core samples through Phenolphthalein test as per IS 1920 Part-12	1No (One Number)		
14.06	18nos	Conducting Half-cell Potential test in the various RC structural elements as per ASTM C-876	1No (One Number)		
14.07	18nos	Drilling powder samples for the evaluation of chlorides and pH as per the relevant IS standards	1No (One Number)		
14.08	18nos	Profoscope survey at selected location in each berth	1No (One Number)		
14.09	8nos	Suggesting suitable Rehabilitation methodology for the distressed RC structural elements.	1No (One Number)		

Sl. No.	Probable Qty	Description	Unit	Rate in Figures and in words (INR)	Amount in INR
14.10	8nos	Preparation of the Bill of Quantity along with the detailed specifications for the rehabilitation of the distressed RC structural elements of the required Berths	1No (One Number)		
14.11	8nos	Processing the NDT measured data, preparation and submission of detailed report on NDT including condition assessment.	1No (One Number)		
		TOTAL OF BILL NO 2			

COVER B –SECTION X FINANCIAL BID

PART III BILL OF QUANTITIES

BILL NO 3 WATER SUPPLY, SWERAGE SYSTEM & RAINWATER SYSTEM

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
I	**GROUND FLOOR**						
A.	**Internal Water Supply**						
	NOTE: The concealed pipe lines, the lines running in ducts / on walls, at terrace & in floor of Toilets shall be considered under Internal water supply.						
A-1	Providing and fixing CPVC (Chlorinated Poly Vinyl Chloride) water supply pipes of SDR 11 (Chlorinated Poly Vinyl Chloride) of approved make as per list of makes as per CTS SDR - 11 at a working pressure of 320 PSI at 23 deg C & 80 PSI at 82 deg C, using solvent welded CPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	Male & Female threaded) conforming to ASTM D-2846 with only CPVC solvent cement conforming to ASTM F-493 with fabricated & sub sequently GI clamps excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including cutting chases and fitting the same with cement concrete / cement mortar as required, All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings. (Inside Toilet)						
a	20mm nominal bore	Rmt	20.00				
b	25mm nominal bore	Rmt	20.00				
c	32mm nominal bore	Rmt	10.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
A-2	Providing and fixing uPVC (Poly Vinyl Chloride) water supply pipes of SCH 80 as per ASTM D 1785 of approved make as per list of makes, using solvent welded uPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2467 with only uPVC solvent cement conforming to ASTM D-2564 with fabricated & sub sequently GI clamps excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including cutting chases and fitting the same with brick masonary as required, All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings. (Inside Duct and Terrace Piping)						
a	20 mm nominal bore	Rm	20.00				
b	25 mm nominal bore	Rm	20.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
c	32 mm nominal bore	Rm	10.00				
d	40 mm nominal bore	Rm	10.00				
e	50 mm nominal bore	Rm	10.00				
f	65 mm nominal bore	Rm	2.00				
g	80 mm nominal bore	Rm	2.00				
h	100 mm nominal bore	Rm	2.00				
A-3	Extra for the item 1 for concealing the cPVC pipes of dia 20 to 50mm, including cutting the wall face and making good the same, clamping the pipes in chase etc all complete as per standard specifications and as directed by the engineer in charge.	Rm	25.00				
A-4	Disinfecting of water mains with 50ppm of chlorine solution and then flushing the entire pipeline with water etc. all complete as per standard specifications and directed by Engineer-in-charge						
a	20 mm nominal bore	Rm	20.00				
b	25 mm nominal bore	Rm	20.00				
c	32 mm nominal bore	Rm	20.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
d	40 mm nominal bore	Rm	10.00				
e	50 mm nominal bore	Rm	10.00				
f	65 mm nominal bore	Rm	2.00				
g	80 mm nominal bore	Rm	2.00				
h	100 mm nominal bore	Rm	2.00				
A-5	Constructing brick pedestals in CM (1:4) and plastered on all surfaces in CM (1:4), 15mm thick for supporting the pipe including 2 nos of L angles, 25 x 25 x 5mm, with U Clamps etc all complete. as per specifications and as directed by the engineer in charge.						
a	450x300x300mm	No	20.00				
b	750x300x300mm	No	20.00				
A-6	Providing and fixing CP brass ball valves of model and make as specified in list of make and as per IS all complete as per specifications and as directed by the engineer in charge.						
a	20mm nominal bore	Nos	2.00				
b	25mm nominal bore	Nos	2.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
c	32mm nominal bore	Nos	1.00				
d	40mm nominal bore	Nos	1.00				
e	50mm nominal bore	Nos	1.00				
A-7	Providing and fixing pressurized float valve (ball cock) PN 10 of SS 304 Ball, Body, piston, Lever and PTEF seat of approved make as specified etc. complete as per specifications and as directed by the engineer in charge.						
a	32mm nominal dia	Nos	4.00				
b	50mm nominal dia	Nos	1.00				
A-8	Supplying and fixing in position water meter with direct meter dial in KL of approved make of required dia. with all integral parts of gunmetal of brass with necessary fittings such as threaded pipes, unions, including necessary fittings and accessories etc. all complete.						
a	40mm nominal dia	Nos	1.00				
b	32mm nominal dia	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
A-9	Providing and fixing CI butterfly valve with flanges of Audco or equivalent make with necessary nuts, bolts, gaskets etc all complete as per specifications.PN-10						
a	65 mm dia	Nos	4.00				
b	80 mm dia	Nos	4.00				
A-10	Providing, fixing, testing and commissioning of brass body nickel plated automatic air release valves with brass spindle, NBR and join franite elastomer, stainless steel spring polypropylene float at the top most points of water supply distribution ring main etc. complete as per requirement / instructions given by Engineer-in-charge.						
a	20mm nominal bore	Nos	2.00				
b	25mm nominal bore	Nos	2.00				
A-16	Providing and fixing in RCC tank GI / MS galvanized insert with flanged ends 450mm to 750mm long including puddle flange required, no of companion flanges, bolts, nuts, rubber gaskets, a thick coat of non-setting mastic or plastic cement etc complete.						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
a	40mm nominal bore	Nos	2.00				
b	50mm nominal bore	Nos	2.00				
c	65mm nominal bore	Nos	1.00				
d	80mm nominal bore	Nos	1.00				
e	100mm nominal bore	Nos	1.00				
f	150mm nominal bore	Nos	1.00				
A-17	Providing and fixing PPR Vents of 50 mm dia in O.H.T. over delivery pipes along with provision of inverted U bend & mosquito proof jalli at the end etc. complete as directed by engineer-in-charge	Nos	5.00				
A-19	Providing and fixing electronic type level indicator for water tanks with low voltage Relays and Seamless Steel probes and PVC shroud, including necessary wiring and conduiting from probes to display panel/motor control panels, mounting in panel with following features, level display, alarm when water level is low or high, full range from one level to 3 level display and manual reset from alarm, etc with electrical wiring conduit supports from	Set	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	wall & ceiling probs and other accessories complete as required.						
A-20	Providing and fixing heavy duty Polypropylene pvc rungs in RCC wall of water tanks etc. including cutting, chasing the RCC work and making good the same complete as required.						
a	Polypropylene PVC Rungs	Nos	60.00				
A-21	Providing and fixing 600 mm x 600mm dia cast iron (Medium duty) Overhead water tank cover with frame CI seat and lock complete in all regards (Total WT of cover and frame to be not less than 21 kg). (OHT)	Nos	1.00				
	Sub Total for Internal Water Supply (A)						
B.	**Internal Sewerage System**						
B-1	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with solvent joints laid on wall face, Suspended to ceiling / under sunken areas in toilet, in ground including fittings						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	(plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection with sanitary fittings and taking the pipelines outside the building into the ducts / crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. excluding erecting necessary temporary scaffolding, civil works etc. all complete as per specifications and as directed by the engineer in charge. (INTERNAL TOILET PIPING)						
a	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	3.00				
b	110 mm dia. (conforming to IS:13592 /1990 -Type B)	Rm	20.00				
c	75 mm dia (conforming to IS:13592 /1990 -Type B)	Rm	20.00				
d	50 mm dia (8 Kg /sqcm) confirming to IS 4985	Rm	20.00				
e	40 mm dia (8 Kg /sqcm) confirming to IS 4985	Rm	20.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
B-2	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with rubber ring joints laid on wall face, vertical in duct, including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection fittings and inspection chambers \ gully traps crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. Excluding MS support as required, erecting necessary temporary scaffolding and make good the walls, ceiling etc, Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.(DUCT)						
a	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	0.00				
b	110 mm dia. (conforming to IS:13592 /1990 -Type B)	Rm	2.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
c	75 mm dia (conforming to IS:13592 /1990 -Type B)	Rm	20.00				
d	63 mm dia (conforming to IS:13592 /1990 -Type A)	Rm	20.00				
B-3	Supply and fixing SWR PVC floor traps 125 mm deep seal with SS grating (heavy quality hopper type with frame) and 75 mm outlet with necessary cement concrete including connection to PVC waste pipe, providing and fixing top tail piece (For Internal toilets) etc complete as per specifications and as directed by the engineer in charge.						
a	PVC PLAIN FLOOR TRAP (100mm X 75mm)	Nos	2.00				
b	PVC MULTI FLOOR TRAP (100mm X 75mm)	Nos	2.00				
	Sub Total for Internal Sewerage System (B)						
C	**Internal Rain Water System**						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
C-1	Providing and fixing uPVC pipes, as per IS 4985 of approved make for rain water pipes with rubber ring joints laid on wall face, vertical in duct, Suspended to ceiling including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, erecting necessary temporary scaffolding and make good the walls, ceiling etc., making connection fittings and inspection chambers crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.						
a	160mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	3.00				
b	110mm dia (4 Kg /sqcm) confirming to IS 4985	Rm	20.00				
c	75mm dia (4 Kg /sqcm) confirming to IS 4985	Rm	20.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
C-2	Providing and fixing rainwater Stainless Steel grating over PVC of dia. As mentioned below of model and make as specified in the list of makes etc all complete						
a	110mm dia Terrace	Nos	4.00				
b	75 mm dia Balcony	Nos	4.00				
	Sub Total for Internal Rain Water System (C)						
D.	**Sanitary Ware Fixtures**						
	European Water Closets (Wc)						
D.1	Supplying Installing, testing and commissioning of approved make white vitreous china glazed floor mounted pattern European water closet of P/S trap with WC connector etc. with flush tank and angle valves with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make etc., including Supplying and fixing medium grade 40 mm dia. PVC heavy grade 8Kg/sqm pipe of required length for flush pipe Including cutting & making good the walls,	Nos	2.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	floors, slab wherever required etc complete and or as directed by Engineer-in-charge.						
D.2	Supplying Installing, testing and commissioning of approved make white vitreous china glazed floor mounted pattern European water closet of P/S trap with WC connector etc. with flush tank and angle valves with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make etc., including Supplying and fixing medium grade 40 mm dia. PVC heavy grade 8Kg/sqm pipe of required length for flush pipe Including cutting & making good the walls, floors, slab wherever required etc complete and or as directed by Engineer-in-charge. **(OTHER Toilets)**	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
D.3	Supplying Installing, testing and commissioning of approved make white vitreous china glazed wall hung pattern European water closet of P/S trap with WC connector etc. with concealed 6/3 Dual Flush metropolitan flush valve with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make etc., including Supplying and fixing medium grade 40 mm dia. PVC heavy grade 8 Kg/sqm pipe of required length for flush pipe Including cutting & making good the walls, floors, slab wherever required etc complete and or as directed by Engineer-in-charge. **(Common Area Toilets)**	Nos	1.00				
D.4	Supply, Installing, testing and commissioning of wall hung wash basin with semi pedstal from approved make white Wash basin including cutting and making good the walls/ floors wherever necessary all complete as per specifications with CP brass bottle trap 1no; CP inlet connection pipe 8mm dia of required length; CP waste half threaded coupling 32mm dia; and CP wall flanges	Nos	2.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	rate shall include 40mm PVC waste pipe of 8kg/sq.cm with necessary pipe fittings of required length of approved make. etc., complete as per specifications and as directed by the engineer in charge						
D.5	Supply, Installing, testing and commissioning of wall hung wash basin from approved make white Wash basin including cutting and making good the walls/ floors wherever necessary all complete as per specifications with CP brass bottle trap 1no; CP inlet connection pipe 8mm dia of required length; CP waste half threaded coupling 32mm dia; and CP wall flanges rate shall include 40mm PVC waste pipe of 8kg/sq.cm with necessary pipe fittings of required length of approved make. etc., complete as per specifications and as directed by the engineer in charge.**(Other Toilets)**	Nos	0.00				
D.6	Providing, fixing, testing and commissioning of vitreous china **below counter oval wash basin (Size 550 x 400 mm)** with CP brass waste assembly, CP cast brass bottle	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	trap with extension piece, wall flanges and rubber adapters for waste connection complete including CI / MS brackets duly painted, cutting and making good the walls floors wherever required as per specifications and as directed by the engineer in charge.						
	Sub Total for Sanitary Ware Fixtures (D)						
E	**C P Fittings**						
E.1	Supplying and fixing of wash basin single lever basin mixer of approved make with all flexible pipes of required length & all accessories etc. complete and or as directed by Engineer-in-charge.	Nos	2.00				
E.2	Supplying and fixing of wash basin Pillar cock of approved make with all flexible pipes of required length & all accessories etc. complete and or as directed by Engineer-in-charge. **(Other Toilets)**	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
E.3	Supplying and fixing of shower head, concealed Single lever Shower Mixer divertor of approved make with plate with wall flanges including CP overhead shower arm with wall flange and CP shower rose with CP spout of approved make all accessories etc. The work shall include cutting, chasing the walls and making good the walls etc complete and as directed by Engineer-in-charge. of model and make as specified in the list of makes etc all complete.	Nos	2.00				
E.4.	Supplying and fixing of shower head, concealed Single lever Shower Mixer divertor of approved make with plate with wall flanges including CP overhead shower arm with wall flange and CP shower rose with CP spout of approved make all accessories etc. The work shall include cutting, chasing the walls and making good the walls etc complete and as directed by Engineer-in-charge. **(for other Bed toilets)** of model and make as specified in the list of makes etc all complete.	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
E.5	Supply, installing, testing and commissioning of 15mm CP health faucet with 1.0 meter flexible hose, CP brass hook & CP brass angle valve with wall flanges of approved make etc. complete. model and make as specified in list of makes with CP brass screws, wooden rawl plugs etc all complete as per specifications and as directed by Engineer-in-charge.	Nos	3.00				
E.6	Supply, installing, testing and commissioning of 15mm CP of Concealed stop cock with wall flanges etc. complete and or as directed by Engineer-in-charge.	Nos	1.00				
E.7	Providing and Fixing in position 15 mm C.P. brass angle valve of model and make as specified in the list of approved make all complete as per standard specifications with wall flanges etc. complete and or as directed by Engineer-in-charge.	Nos	2.00				
E.8	Supplying and fixing of BIB COCK (FOR SERVENT/Driver TOILET/Common) etc. complete and or as directed by Engineer-in-charge.	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
E.9	Supplying and fixing of 15mm nominal bore C.P brass long body bibcock with flange of Model and make etc. complete and or as directed by Engineer-in-charge. **(UTILITY AREA)**	Nos	1.00				
E.10	Supplying and fixing in position sink tap with swinging spout (wall mounted model) model and make as specified in the list of makes with necessary fittings of required length of approved make. etc., complete and or as directed by Engineer-in-charge.	Nos	2.00				
E.11	Installing, testing and commissioning of approved make SS kitchen sink with single bowl & single drain board made of Stainless steel 18 Gage 1 No.40mm dia CP bottle trap with extension pipe, CP wall flange, CP waste coupling, C.I.brackets.etc. complete and or as directed by Engineer-in-charge.	Nos	1.00				
	Sub Total for C P Fittings (E)						
F	**Miscellaneous Items - Internal**						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
F-1	Providing and fixing MS supports for pipes fabricated from MS flats angles and plates including fixing the brackets to walls, slab, beam etc. with anchor, fasteners 12mm 'U' or 'J' bolts for fixing the pipes to clamp including applying red oxide paint & 2 coats of enamel paint of approved colour to brackets etc. complete as per directions of engineer-in-charge.	Kg	100.00				
F-2	Make core cutting in RCC beams, slabs, floors etc of one dia higher size than the pipe/trap to be provided excluding filling the annular space with EPOXY based water proofing compound for sealing the joints around the pipes by pressure grouting to make it water tight making good the same after pipes have been duly laid and testing complete etc all complete as per specifications and as directed by the engineer in charge.						
a	25mm dia upto 50 mm dia.	Nos	1.00				
b	50mm dia upto 110 mm dia.	Nos	1.00				
c	110mm dia. upto 160 mm dia.	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
F-3	Providing & Fixing in position UPVC sleeves with 4Kg/sqcm in RCC slab & Beams excluding filling the annular space with EPOXY based water proofing compound for sealing the joints around the pipes. by pressure grouting to make it water tight including making good the same after pipes have been duly laid and testing complete etc all complete as per specifications and as directed by the engineer in charge.						
a	75mm dia	Nos	1.00				
b	110mm dia	Nos	1.00				
c	160mm dia	Nos	1.00				
d	200 mm dia	Nos	1.00				
	Sub Total for Miscellaneous Items (F)						
	Total of Ground Floor Internal water supply, sewage and rainwater system (A-F)						
	GROUND FLOOR						
G	**External Water Supply**						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
G.1	Providing and fixing uPVC (Poly Vinyl Chloride) water supply pipes of SCH 80 as per ASTM D 1785 of approved make as per list of makes, using solvent welded uPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2467 with only uPVC solvent cement conforming to ASTM D-2564 with fabricated & sub sequently GI clamps excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including cutting chases and fitting the same with brick masonary as required, All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings.. **(PIPING FROM UG SUMP TO OHT and Pump room Drain Sump + Irrigation)**						
a	25 mm dia	RM	20				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
b	32 mm dia	RM	20				
c	40 mm dia	Rm	20				
d	50mm dia	Rm	20				
e	65mm dia	Rm	2				
f	80mm dia	Rm	3				
g	100mm dia	Rm	2				
G.2	Providing, laying, jointing and testing in position the following medium class GI pipes for under ground piping conforming to IS:1239 including all necessary fittings (conforming to IS : 1879) such as elbow, coupler & tee etc. Cost shall be inclusive of excavation, dewatering, backfilling, ramming surrounding the pipe all-round with minimum 150 mm thick compacted silver sand and providing thrust block at distance 2 M C/C. (Pipe shall be provided with anti corrosive protective treatment as per BIS / manufacturer specifications). All work complete as per specification and satisfaction of the Project Manager.						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	(Main Connection to UG sump + River well pipe to UG sump)						
a	50 mm dia	RM	20.00				
b	65 mm dia	RM	20.00				
c	80 mm dia	RM	20.00				
d	100 mm dia	RM	3.00				
G.3	Supply, installation in position, testing and commissioning of electrically driven horizontal Monobloc pumps of approved equivalent make capable of discharging as indicated below, shall be automatic in operation with control panel, low and high level sensors of approved make provided in the overhead tank of the building, with necessary cables upto the control panel in the pump house near the sump, accessories like pressure guages, footvalves,termination of cables, earthing leads, excluding civil works etc. all complete.						
a	21 cum/hr at 45m head (1 Working + 1 Stand by) - Domestic Transfer Pumps	Nos	1				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
b	10 cum/hr at 45m head (1 Working + 1 Stand by) - Drinking Transfer Pumps	Nos	1				
G.4	Providing and fixing CP brass ball valves of model and make as specified in list of make and as per IS all complete as per specifications and as directed by the engineer in charge.						
a	32mm dia	Nos	4.00				
b	50mm dia	Nos	8.00				
G.5	Providing and fixing cast iron wafer type Butterfly valve of the following size complete with bolts, nuts, washers and neoprene gaskets as per specifications.						
a	65mm dia	Nos	2.00				
b	80mm dia	Nos	1.00				
c	100mm dia	Nos	1.00				
d	150mm dia	Nos	1.00				
G.6	Supply, erection, testing and commissioning of CI non-return valve with flanged ends conforming IS 5312						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
a	50mm dia	Nos	3.00				
b	65mm dia	Nos	2.00				
c	80mm dia	Nos	1.00				
d	100mm dia	Nos	1.00				
G.7	Supplying and fixing of motorised valves of model and make as specified in the list of makes PN 1.0 suitable for 240 Volts, with suitable motorised rotor 3 nos of float type sensors and control panel, to shut and close valve when water level is low / high in water tanks including necessary cabling from terrace OHT to sump pump and control panel etc all complete						
a	32mm dia	Nos	4				
b	40mm dia	Nos	1				
c	50mm dia	Nos	5				
G.8	Providing, installation, testing, & commissioning of pressure switches complete with pressure vessel of 50 ltrs. on delivery header of water supply pumps. (To stop start	Nos	4.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	pump incase of closing and opening motorised valves) including necessary wiring upto control panel & other materials.						
G.9	Construction of water meter chamber 1200x900x800 mm inside with brick masonry in CM (1:4), 230mm thick, inside and outside plastering in CM (1:4), for water meter with 100 mm THK RCC top slab 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominalsize), 150mm thick, necessary reinforcement, excavation, foundation concrete 1:3:6 (1 sand : 3 coarse sand : 6 graded stone aggregate 40mm nominal size), 100mm thick, inside and outside plastering with cement mortar 1:3 (1 cement : 3coarse sand) 12mm thick finished with a floating coat of neat cement complete as per standard design. etc all complete as per specifications and as directed by the engineer in charge.						
	1200mm x 900mm x 800mm clear inside	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
G.10	Constructing masonry chamber with 75 class designation brick work in cement mortar 1:3 (1 cement : 3 coarse sand) for butterfly valve/ scour valve with RCC top slab 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size), necessary excavation, foundation concrete 1:3:6 (1 sand : 3 coarse sand : 6 graded stone aggregate 20mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3coarse sand) 12mm thick finished with a floating coat of neat cement complete as per standard design.						
a	600x600x600 MM clear inside	No	1.00				
b	450x450x600 MM clear inside	No	1.00				
G.11	Providing and fixing truck fill point consisting of 80 mm dia water filling point having 80 mm dia SS 304 single headed hydrant with plug, chain and NRV etc complete as required (Truck fill point shall be housed in suitable lockable chamber)	Set	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
G.12	Providing and fixing 600mm x 600mm dia cast iron (Medium duty) water tank cover double sealed with frame CI seat complete in all regards (Total WT of cover and frame to be not less than 110 kg). (UG SUMP)	Nos	1.00				
	Sub Total for External Water Supply (G)						
H	**External Sewerage System**						
H.1	Excavating trenches of required width for pipes including excavation for sockets and dressing of sides, ramming of bottoms, depth up to 1.5m including getting out the soil as required and refilling, consolidating in layers, and transport stacking neatly the surplus excavated soil within a lead of 50M all complete.						
a	All types of soils						
i)	Exceeding 80mm dia but not exceeding 300mm dia	Rm	20				
H-2	All as in item B-1 above but for the depth upto 2.5M						
a	All types of soils						
i)	Exceeding 80mm dia but not exceeding 300mm dia	Rm	2				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
H-3	Providing and laying plain cement concrete bedding in 1:5:10 below the pipes 100mm thick, projecting 100mm on either side of pipe at all depths etc. all complete						
a	100mm dia.	Rm	10				
b	160mm dia	Rm	5				
c	200mm dia	Rm	2				
H-4	Providing and fixing grade "A" P type 150mm square mouth stoneware gully trap with 100mm dia. Outlet of approved make with cast iron grating housed in 200mm thick brick masonry chamber and water tight cast iron cover 12 Kg with frame of 300x300mm size (inside) as per standard design and drawing including necessary excavation and back filling all complete as per specifications and as directed by the engineer in charge.	Nos	1				
H-5	**SOIL, WASTE AND RAIN WATER PIPELINE CEILING SUSPENDED AT STILT AN UPPERBASEMENT**						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	Providing, fixing and jointing uPVC as per IS 4985 for soil, waste and vent pipes with solvent joints laid at required slope suspended to ceiling including fittings (plain or door) tees, bends, collars, crosses reducers including anchor fasteners, supported by galvanized steel clamps & hangers etc. provided at required intervals to prevent sagging of pipes of approved make including cutting and making good masonry or concrete walls wherever necessary, erecting necessary temporary scaffolding and make good the walls, ceiling etc., making connection fittings and inspection chambers\gully traps crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.						
a	110 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	20				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
b	75 mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	20				
H-6	Providing, fixing and jointing uPVC as per IS 4985 with solvent joints laid at required slope , with available fittings including cutting and making good masonry or concrete walls wherever necessary and make good the walls, retaining wall etc., making connection fittings and inspection chambers\gully traps etc. complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.						
a	75 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	2				
a	110 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	10				
b	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	5				
c	200 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	10				
H-7	Supplying, fixing P or S type 150mm square mouth PVC gully trap with 100mm dia. Outlet of approved make with	Nos	4				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	grating housed in 150mm thick brick masonry chamber with frame of 300 x 300mm size (inside) as per standard design and drawing including necessary excavation and backfilling all complete as per specifications and as directed by the engineer in charge.						
H-8	Providing and fixing SWR PVC P trap with 110mm dia outlet of approved make including connection to PVC Soil pipe, providing and fixing top tail piece with with necessary cement concrete. (For Internal toilets) etc complete as per specifications and as directed by the engineer in charge.	Nos	2				
H-9	Construction brick masonry inspection chamber as per standard design in cement mortar 1:4, foundation concrete 1:2:4, 150mm thick, inside and outside plastering 12mm thick with cement mortar 1:3 finished with a floating coat of neat cement and making channels in cement concrete M15 neatly finished, top RCC/SFRC cover for medium loads, polypropylene steps, earthwork excavation, getting out the excavated soil and returning the suitable soil as						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	required for refilling, consolidating and disposal of surplus excavated soil within a lead of 50m etc. all complete including manhole cover and frame as per IS etc all complete as per specifications and as directed by the engineer in charge.						
a	600 x 600 x up to 900 mm inside dimension with100mm thick RCC slab M20 grade with 200 thick side walls	Nos	4				
b	800 x 800 x 1200 mm inside dimension with 100mm thick RCC slab M20 grade with 200 mm thick side walls	Nos	4				
c	1200 x 800 x 1500 mm inside dimension with 100mm thick RCC slab M20 grade with 200 mm thick side walls	Nos	1				
d	1500 mm dia inside dimension circular manhole with 200 mm thick walls upto 2000 mm depth	Nos	1				
e	1500mm dia inside dimension circular manhole with 230 mm thick walls above 2000 mm depth upto 3000 mm depth	Nos	1				
	Sub Total for External Sewerage System (H)						
I	**External Storm Water Drainage System**						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
I.1	Supplying, installing, testing and commissioning of R.C.C NP2 class pipe conforming to IS:458 laid laid to correct levels below ground in trenches upto required depth and grade including collars joining made of spun yarn and stiff mixture of cement mortar 1:1 and curing the joints, testing the joints as per specifications and rectifying any leakages etc and filling the excavated trench with approved quality saturated sand on sides, bottom and top surface of pipe with all leads and lifts, making necessary connections as required etc.,complete as required. (UNDERGROUND)						
a	160mm dia	Rm	20				
b	200mm dia	Rm	20				
c	250mm dia	Rm	10				
d	300mm dia	Rm	2				
I.1.1	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with solvent joints laid on wall face, Suspended to ceiling / under sunken areas in toilet, in ground including fittings						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	(plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection with sanitary fittings and taking the pipelines outside the building into the ducts / crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. excluding erecting necessary temporary scaffolding, civil works etc. all complete as per specifications and as directed by the engineer in charge..						
a	200mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	2				
b	160mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	3				
c	110mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	20				
d	75mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	10				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
I.2	Constructing brick masonry open surface drain with class designation 75 bricks, 200 mm thick in cement mortar 1:4 (1 cement : 4 fine sand) including earth excavation, 10 cm thick bed concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40mm nominal size) and 25 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm nominal size for filling haunches including 12 mm cement plaster 1:4 (1 cement : 4 coarse sand) with a floating coat of neat cement over exposed surface of masonry including disposal of surplus earth and covering the drains with precast RCC gratings/slabs 100mm thick (1:2:4) of size as shown in drawing and approved by the Engineer.						
	40 cm drain x 50 cm average depth	Rm	5				
I.3	Excavation in trenches all kind of soils (other than in rock requiring chiselling and blasting) for sockets and dressing of sides, ramming of bottoms, including getting out the soil as required and refilling, and refilling of trenches after pipes are laid in layers not exceeding 20 cm watering and						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	consolidation and disposing off surplus earth within a lead of 100M or as directed by the Engineer in charge, providing necessary Shoring & Strutting while excavating etc., complete						
a	Depth of excavation up to 1.5m	Cum.	5				
b	Depth of excavation up to 2.5m	Cum.	2				
I.4	Providing and laying plain cement concrete bedding in 1:5:10 below the pipes 100 mm thick, projecting 100mm on either side of pipe at all depths and haunches upto the center of pipe including shuttering & timbering etc. all complete						
a	160mm dia	Rm	10				
b	200mm dia	Rm	10				
c	250mm dia	Rm	5				
d	300mm dia	Rm	2				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
I.5	Construction of Catch Basin of size mentioned below for external storm water drainage with 230mm thick walls in well burnt table moulded bricks in CM 1:4 over a bed of 100 mm thick PCC 1:4:8 internal walls plastered smooth in CM 1:3 and external walls plastered in1:3 with sponge finish with Fixing perforated Pre-cast RCC covers, capable of taking Medium Duty Vehicular loads manhole cover on top surface flushed to the finished floor level with necessary excavation, back filling the selected excavated earth withall leads and lifts etc., complete as per specifications and as directed by the engineer in charge.						
a	300mm x 300mm (clear internal dimension) upto 450 mm depth	Nos	2				
b	450mm x 450mm (clear internal dimension) above 450mm depth upto 600 mm depth	Nos	10				
c	600mm x 600mm (clear internal dimension) above 600mm depth upto 900 mm depth	Nos	10				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
d	750mm x750mm (clear internal dimension) above 900mm depth upto 1200 mm depth	Nos	5				
e	900mm x900mm (clear internal dimension) above 1200mm depth upto 1500 mm depth	Nos	5				
I.6	Providing and constructing Rain water recharge pits the clear dimensions mentioned as per drawing and filling the normal aggreate gelly up to 300 mm, coarse sand 300mm, 40mm size aggregate gelly up to 400mm and brick bat up to 500mm depth with precast SFRC cover with frame and recessed top cover of 600 x 600mm, 110 mm IS 4985 6kg PVC pipe upto 3M and perforated IS 4985 6kg PVC pipe with Geo filter fabric upto 6M, inlet and outlet arrangements, and including excavation, backfilling, curing with all leads and lifts as per the detailed drawings, disposing the surplus earth according to site condition as directed by site in charge. etc,complete as per specifications and as directed by the engineer in charge.						
a	Size : 3000mm X1500mm X 1500mm effective depth	Nos	1				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
I.7	Providing, fixing and commissioning non clog type mono block submersible drainage pumps suitable for handling solids of 12 mm size with totally water and dust proof motor as specified complete including suitable starter, required relays along with control panel and float switch, inclusive of all terminations and earthing required all complete as per specifications. (STP ROOM+PUMP ROOM)						
a	Capacity 200 lpm & Head 12 m (1 W + 1 SB)	Set	1				
I.9.8	Providing, fixing and commissioning non clog type mono block submersible drainage pumps suitable for handling solids of 12 mm size with totally water and dust proof motor as specified complete including suitable starter, required relays along with control panel and float switch, inclusive of all terminations and earthing required all complete as per specifications. (BASEMENT STORM WATER SUMP)						
a	Capacity 200 lpm & Head 12 m (1 W + 1 SB)	Set	1				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	Sub Total for External Storm Water Drainage System (I)						
J	**Miscellaneous Items - External**						
J-1	Providing and fixing MS supports for pipes fabricated from MS flats angles and plates including fixing the brackets to walls, slab, beam etc.with anchor, fasteners 12mm 'U' or 'J' bolts for fixing the pipes to clamp including applying red oxide paint & 2 coats of enamel paint of approved colour to brackets etc. complete as per directions of engineer-in-charge.	Kg	100				
J-2	Providing, fixing, testing and commissioning of lawn hydrant ball valves (for irrigation) of brass body nickel plated with stainless steel ball, lever operated with gun metal nozzle for connecting rubber hose.						
a	20 mm dia	Nos	10				
J-3	Providing and fixing 125 mm dia dial pressure gauge to read upto 10kg/sq.cm, to be fixed on delivery main of pump sets with isolation cock.	Nos	1				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
J-4	Providing and fixing in position 125mm dia flanged Cast Iron dirt box Y-Type Strainer having body fabricated in Cast Iron and strainer made of SS perforated sheet having perforations of suitable size.	Nos	1				
J-5	Supply, delivery and fixing of approved make reflux valve (non return valve) on delivery side of pumps of sizes as mentioned below.						
a	80 mm dia.	Nos	1				
b	65 mm dia.	Nos	1				
c	50 mm dia.	Nos	1				
J-6	Providing and fixing in RCC tank GI / MS galvanized insert with flanged ends 450mm to 750mm long including puddle flange required, no of companion flanges, bolts, nuts, rubber gaskets, a thick coat of non-setting mastic or plastic cement etc complete.						
a	40mm nominal bore	Nos	1				
b	50mm nominal bore	Nos	3				
c	65mm nominal bore	Nos	2				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
d	80mm nominal bore	Nos	4				
e	100mm nominal bore	Nos	6				
f	150mm nominal bore	Nos	1				
g	200mm nominal bore	Nos	1				
	Sub Total for Miscellaneous Items (J)						
	Total of Ground Floor External water supply, sewage and rainwater system (G-J)						
	TOTAL OF GROUND FLOOR WATER SUPPLY, SEWAGE AND RAINWATER SYSTEM. (A-J)						
II	**FIRST FLOOR**						
K.	**Internal Water Supply**						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	NOTE: The concealed pipe lines, the lines running in ducts / on walls, at terrace & in floor of Toilets shall be considered under Internal water supply.						
K-1	Providing and fixing CPVC (Chlorinated Poly Vinyl Chloride) water supply pipes of SDR 11 (Chlorinated Poly Vinyl Chloride) of approved make as per list of makes as per CTS SDR - 11 at a working pressure of 320 PSI at 23 deg C & 80 PSI at 82 deg C, using solvent welded CPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2846 with only CPVC solvent cement conforming to ASTM F-493 with fabricated & sub sequently GI clamps excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including cutting chases and fitting the same with cement concrete / cement mortar as required, All termination points for installation of faucets shall have brass termination fittings.						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings. (Inside Toilet)						
a	20mm nominal bore	Rmt	20.00				
b	25mm nominal bore	Rmt	20.00				
c	32mm nominal bore	Rmt	10.00				
K-2	Providing and fixing uPVC (Poly Vinyl Chloride) water supply pipes of SCH 80 as per ASTM D 1785 of approved make as per list of makes, using solvent welded uPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2467 with only uPVC solvent cement conforming to ASTM D-2564 with fabricated & sub sequently GI clamps excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	cutting chases and fitting the same with brick masonary as required, All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings. (Inside Duct and Terrace Piping)						
a	20 mm nominal bore	Rm	20.00				
b	25 mm nominal bore	Rm	20.00				
c	32 mm nominal bore	Rm	10.00				
d	40 mm nominal bore	Rm	10.00				
e	50 mm nominal bore	Rm	10.00				
f	65 mm nominal bore	Rm	2.00				
g	80 mm nominal bore	Rm	2.00				
h	100 mm nominal bore	Rm	2.00				
K-3	Extra for the item 1 for concealing the cPVC pipes of dia 20 to 50mm, including cutting the wall face and making good the same, clamping the pipes in chase etc all complete	Rm	25.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	as per standard specifications and as directed by the engineer in charge.						
K-4	Disinfecting of water mains with 50ppm of chlorine solution and then flushing the entire pipeline with water etc. all complete as per standard specifications and directed by Engineer-in-charge						
a	20 mm nominal bore	Rm	20.00				
b	25 mm nominal bore	Rm	20.00				
c	32 mm nominal bore	Rm	20.00				
d	40 mm nominal bore	Rm	10.00				
e	50 mm nominal bore	Rm	10.00				
f	65 mm nominal bore	Rm	2.00				
g	80 mm nominal bore	Rm	2.00				
h	100 mm nominal bore	Rm	2.00				
K-5	Constructing brick pedestals in CM (1:4) and plastered on all surfaces in CM (1:4), 15mm thick for supporting the pipe including 2 nos of L angles, 25 x 25 x 5mm, with U	Nos					

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	Clamps etc all complete. as per specifications and as directed by the engineer in charge.						
a	450x300x300mm		20.00				
b	750x300x300mm		20.00				
K-6	Providing and fixing CP brass ball valves of model and make as specified in list of make and as per IS all complete as per specifications and as directed by the engineer in charge.						
a	20mm nominal bore	Nos	2.00				
b	25mm nominal bore	Nos	2.00				
c	32mm nominal bore	Nos	1.00				
d	40mm nominal bore	Nos	1.00				
e	50mm nominal bore	Nos	1.00				
K-7	Providing and fixing pressurized float valve (ball cock) PN 10 of SS 304 Ball, Body, piston, Lever and PTEF seat of approved make as specified etc. complete as per specifications and as directed by the engineer in charge.						
a	32mm nominal dia	Nos	4.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
b	50mm nominal dia	Nos	1.00				
K-8	Supplying and fixing in position water meter with direct meter dial in KL of approved make of required dia. with all integral parts of gunmetal of brass with necessary fittings such as threaded pipes, unions, including necessary fittings and accessories etc. all complete.						
a	40mm nominal dia	Nos	1.00				
b	32mm nominal dia	Nos	1.00				
K-9	Providing and fixing CI butterfly valve with flanges of Audco or equivalent make with necessary nuts, bolts, gaskets etc all complete as per specifications.PN-10						
a	65 mm dia	Nos	4.00				
b	80 mm dia	Nos	4.00				
K-10	Providing, fixing, testing and commissioning of brass body nickel plated automatic air release valves with brass spindle, NBR and join franite elastomer, stainless steel spring polypropylene float at the top most points of water						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	supply distribution ring main etc. complete as per requirement / instructions given by Engineer-in-charge.						
a	20mm nominal bore	Nos	2.00				
b	25mm nominal bore	Nos	2.00				
K-16	Providing and fixing in RCC tank GI / MS galvanized insert with flanged ends 450mm to 750mm long including puddle flange required, no of companion flanges, bolts, nuts, rubber gaskets, a thick coat of non-setting mastic or plastic cement etc complete.						
a	40mm nominal bore	Nos	2.00				
b	50mm nominal bore	Nos	2.00				
c	65mm nominal bore	Nos	1.00				
d	80mm nominal bore	Nos	1.00				
e	100mm nominal bore	Nos	1.00				
f	150mm nominal bore	Nos	1.00				
K-17	Providing and fixing PPR Vents of 50 mm dia in O.H.T. over delivery pipes along with provision of inverted U	Nos	5.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	bend & mosquito proof jalli at the end etc. complete as directed by engineer-in-charge						
K-19	Providing and fixing electronic type level indicator for water tanks with low voltage Relays and Seamless Steel probes and PVC shroud, including necessary wiring and conduiting from probes to display panel/motor control panels, mounting in panel with following features, level display, alarm when water level is low or high, full range from one level to 3 level display and manual reset from alarm, etc with electrical wiring conduit supports from wall & ceiling probs and other accessories complete as required.	Set	1.00				
K-20	Providing and fixing heavy duty Polypropylene pvc rungs in RCC wall of water tanks etc. including cutting, chasing the RCC work and making good the same complete as required.						
a	Polypropylene PVC Rungs	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
K-21	Providing and fixing 600 mm x 600mm dia cast iron (Medium duty) Overhead water tank cover with frame CI seat and lock complete in all regards (Total WT of cover and frame to be not less than 21 kg). (OHT)	Nos	1.00				
	Sub Total for Internal Water Supply (K)						
L.	**Internal Sewerage System**						
L-1	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with solvent joints laid on wall face, Suspended to ceiling / under sunken areas in toilet, in ground including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection with sanitary fittings and taking the pipelines outside the building into the ducts / crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. excluding erecting						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	necessary temporary scaffolding, civil works etc. all complete as per specifications and as directed by the engineer in charge. (INTERNAL TOILET PIPING)						
a	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	2.00				
b	110 mm dia. (conforming to IS:13592 /1990 -Type B)	Rm	20.00				
c	75 mm dia (conforming to IS:13592 /1990 -Type B)	Rm	20.00				
d	50 mm dia (8 Kg /sqcm) confirming to IS 4985	Rm	20.00				
e	40 mm dia (8 Kg /sqcm) confirming to IS 4985	Rm	20.00				
L-2	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with rubber ring joints laid on wall face, vertical in duct, including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection fittings and inspection chambers \ gully traps crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	required as per manufacturer. Excluding MS support as required, erecting necessary temporary scaffolding and make good the walls, ceiling etc, Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.(DUCT)						
a	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	1.00				
b	110 mm dia. (conforming to IS:13592 /1990 -Type B)	Rm	2.00				
c	75 mm dia (conforming to IS:13592 /1990 -Type B)	Rm	20.00				
d	63 mm dia (conforming to IS:13592 /1990 -Type A)	Rm	20.00				
L-3	Supply and fixing SWR PVC floor traps 125 mm deep seal with SS grating (heavy quality hopper type with frame) and 75 mm outlet with necessary cement concrete including connection to PVC waste pipe, providing and fixing top tail piece (For Internal toilets) etc complete as per specifications and as directed by the engineer in charge.						
a	PVC PLAIN FLOOR TRAP (100mm X 75mm)	Nos	2.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
b	PVC MULTI FLOOR TRAP (100mm X 75mm)	Nos	2.00				
	Sub Total for Internal Sewerage System (L)						
M	**Internal Rain Water System**						
M-1	Providing and fixing uPVC pipes, as per IS 4985 of approved make for rain water pipes with rubber ring joints laid on wall face, vertical in duct, Suspended to ceiling including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, erecting necessary temporary scaffolding and make good the walls, ceiling etc., making connection fittings and inspection chambers crossing of beams and testing of pipelines, etc. Complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
a	160mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	1.00				
b	110mm dia (4 Kg /sqcm) confirming to IS 4985	Rm	20.00				
c	75mm dia (4 Kg /sqcm) confirming to IS 4985	Rm	20.00				
M-2	Providing and fixing rainwater Stainless Steel grating over PVC of dia. As mentioned below of model and make as specified in the list of makes etc all complete						
a	110mm dia Terrace	Nos	4.00				
b	75 mm dia Balcony	Nos	4.00				
	Sub Total for Internal Rain Water System (M)						
N.	**Sanitary Ware Fixtures**						
	European Water Closets (WC)						
N.1	Supplying Installing, testing and commissioning of approved make white vitreous china glazed floor mounted pattern European water closet of P/S trap with WC connector etc. with flush tank and angle valves with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make	Nos	2.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	etc., including Supplying and fixing medium grade 40 mm dia. PVC heavy grade 8Kg/sqm pipe of required length for flush pipe Including cutting & making good the walls, floors, slab wherever required etc complete and or as directed by Engineer-in-charge.						
N.2	Supplying Installing, testing and commissioning of approved make white vitreous china glazed floor mounted pattern European water closet of P/S trap with WC connector etc. with flush tank and angle valves with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make etc., including Supplying and fixing medium grade 40 mm dia. PVC heavy grade 8Kg/sqm pipe of required length for flush pipe Including cutting & making good the walls, floors, slab wherever required etc complete and or as directed by Engineer-in-charge. **(OTHER Toilets)**	Nos	1.00				
N.3	Supplying Installing, testing and commissioning of approved make white vitreous china glazed wall hung pattern European water closet of P/S trap with WC	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	connector etc. with concealed 6/3 Dual Flush metropolitan flush valve with all required accessories and of approved make with flap, rubber buffer, bolts, nuts and hinges of all approved make etc., including Supplying and fixing medium grade 40 mm dia. PVC heavy grade 8 Kg/sqm pipe of required length for flush pipe Including cutting & making good the walls, floors, slab wherever required etc complete and or as directed by Engineer-in-charge. **(Common Area Toilets)**						
N.4	Supply, Installing, testing and commissioning of wall hung wash basin with semi pedstal from approved make white Wash basin including cutting and making good the walls/ floors wherever necessary all complete as per specifications with CP brass bottle trap 1no; CP inlet connection pipe 8mm dia of required length; CP waste half threaded coupling 32mm dia; and CP wall flanges rate shall include 40mm PVC waste pipe of 8kg/sq.cm with necessary pipe fittings of required length of approved	Nos	2.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	make. etc., complete as per specifications and as directed by the engineer in charge						
N.5	Supply, Installing, testing and commissioning of wall hung wash basin from approved make white Wash basin including cutting and making good the walls/ floors wherever necessary all complete as per specifications with CP brass bottle trap 1no; CP inlet connection pipe 8mm dia of required length; CP waste half threaded coupling 32mm dia; and CP wall flanges rate shall include 40mm PVC waste pipe of 8kg/sq.cm with necessary pipe fittings of required length of approved make. etc., complete as per specifications and as directed by the engineer in charge.**(Other Toilets)**	Nos	1.00				
N.6	Providing, fixing, testing and commissioning of vitreous china **below counter oval wash basin (Size 550 x 400 mm)** with CP brass waste assembly, CP cast brass bottle	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	trap with extension piece, wall flanges and rubber adapters for waste connection complete including CI / MS brackets duly painted, cutting and making good the walls floors wherever required as per specifications and as directed by the engineer in charge.						
	Sub Total for Sanitary Ware Fixtures (N)						
O	**C P Fittings**						
O.1	Supplying and fixing of wash basin single lever basin mixer of approved make with all flexible pipes of required length & all accessories etc. complete and or as directed by Engineer-in-charge.	Nos	2.00				
O.2	Supplying and fixing of wash basin Pillar cock of approved make with all flexible pipes of required length & all accessories etc. complete and or as directed by Engineer-in-charge. **(Other Toilets)**	Nos	2.00				
O.3	Supplying and fixing of shower head, concealed Single lever Shower Mixer divertor of approved make with plate with wall flanges including CP overhead shower arm with	Nos	2.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	wall flange and CP shower rose with CP spout of approved make all accessories etc. The work shall include cutting, chasing the walls and making good the walls etc complete and as directed by Engineer-in-charge. of model and make as specified in the list of makes etc all complete.						
O.4.	Supplying and fixing of shower head, concealed Single lever Shower Mixer divertor of approved make with plate with wall flanges including CP overhead shower arm with wall flange and CP shower rose with CP spout of approved make all accessories etc. The work shall include cutting, chasing the walls and making good the walls etc complete and as directed by Engineer-in-charge. of model and make as specified in the list of makes etc all complete.	Nos	1.00				
O.5	Supply, installing, testing and commissioning of 15mm CP health faucet with 1.0 meter flexible hose, CP brass hook & CP brass angle valve with wall flanges of approved make etc. complete. model and make as specified in list of makes with CP brass screws, wooden rawl plugs etc all	Nos	3.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	complete as per specifications and as directed by Engineer-in-charge.						
O.6	Supply, installing, testing and commissioning of 15mm CP of Concealed stop cock with wall flanges etc. complete and or as directed by Engineer-in-charge.	Nos	1.00				
O.7	Providing and Fixing in position 15 mm C.P. brass angle valve of model and make as specified in the list of approved make all complete as per standard specifications with wall flanges etc. complete and or as directed by Engineer-in-charge.	Nos	2.00				
O.8	Supplying and fixing of BIB COCK (FOR SERVENT/Driver TOILET/Common) etc. complete and or as directed by Engineer-in-charge.	Nos	1.00				
O.9	Supplying and fixing of 15mm nominal bore C.P brass long body bibcock with flange of Model and make etc. complete and or as directed by Engineer-in-charge. **(UTILITY AREA)**	Nos	1.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
O.10	Supplying and fixing in position sink tap with swinging spout (wall mounted model) model and make as specified in the list of makes with necessary fittings of required length of approved make. etc., complete and or as directed by Engineer-in-charge.	Nos	2.00				
O.11	Installing, testing and commissioning of approved make SS kitchen sink with single bowl & single drain board made of Stainless steel 18 Gage 1 No.40mm dia CP bottle trap with extension pipe, CP wall flange, CP waste coupling, C.I.brackets.etc. complete and or as directed by Engineer-in-charge.	Nos	1.00				
	Sub Total for C P Fittings (O)						
P	**Miscellaneous Items - Internal**						
P-1	Providing and fixing MS supports for pipes fabricated from MS flats angles and plates including fixing the brackets to walls, slab, beam etc. with anchor, fasteners 12mm 'U' or 'J' bolts for fixing the pipes to clamp including applying red oxide paint & 2 coats of enamel paint of	Kg	100.00				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	approved colour to brackets etc. complete as per directions of engineer-in-charge.						
P-2	Make core cutting in RCC beams, slabs, floors etc of one dia higher size than the pipe/trap to be provided excluding filling the annular space with EPOXY based water proofing compound for sealing the joints around the pipes by pressure grouting to make it water tight making good the same after pipes have been duly laid and testing complete etc all complete as per specifications and as directed by the engineer in charge.						
a	25mm dia upto 50 mm dia.	Nos	1.00				
b	50mm dia upto 110 mm dia.	Nos	1.00				
c	110mm dia. upto 160 mm dia.	Nos	1.00				
P-3	Providing & Fixing in position UPVC sleeves with 4Kg/sqcm in RCC slab & Beams excluding filling the annular space with EPOXY based water proofing compound for sealing the joints around the pipes. by pressure grouting to make it water tight including making						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	good the same after pipes have been duly laid and testing complete etc all complete as per specifications and as directed by the engineer in charge.						
a	75mm dia	Nos	1.00				
b	110mm dia	Nos	1.00				
c	160mm dia	Nos	1.00				
d	200 mm dia	Nos	1.00				
	Sub Total for Miscellaneous Items – Internal (P)						
	Total of First Floor Internal water supply, sewage and rainwater system (K-P)						
Q	**EXTERNAL WATER SUPPLY**						
Q.1	Providing and fixing uPVC (Poly Vinyl Chloride) water supply pipes of SCH 80 as per ASTM D 1785 of approved make as per list of makes, using solvent welded uPVC fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, brushings etc. including transition fittings connection between CPVC & metal pipe/GI) i.e. Brass Adaptors (both Male & Female threaded) conforming to ASTM D-2467 with only uPVC solvent cement conforming to ASTM D-						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	2564 with fabricated & sub sequently GI clamps excluding structural steel supports will be paid separately as per actuals as required intervals/ directed at site including cutting chases and fitting the same with brick masonary as required, All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of Project Manager /Consultant / manufacturer of pipes & fittings.. **(PIPING FROM UG SUMP TO OHT and Pump room Drain Sump + Irrigation)**						
a	25 mm dia	RM	20				
b	32 mm dia	RM	20				
c	40 mm dia	Rm	20				
d	50mm dia	Rm	20				
e	65mm dia	Rm	2				
f	80mm dia	Rm	2				
g	100mm dia	Rm	2				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
Q.2	Providing, laying, jointing and testing in position the following medium class GI pipes for under ground piping conforming to IS:1239 including all necessary fittings (conforming to IS : 1879) such as elbow, coupler & tee etc. Cost shall be inclusive of excavation, dewatering, backfilling, ramming surrounding the pipe all-round with minimum 150 mm thick compacted silver sand and providing thrust block at distance 2 M C/C. (Pipe shall be provided with anti corrosive protective treatment as per BIS / manufacturer specifications). All work complete as per specification and satisfaction of the Project Manager. **(Main Connection to UG sump + River Well pipe to UG sump)**						
a	50 mm dia	RM	20.00				
b	65 mm dia	RM	20.00				
c	80 mm dia	RM	20.00				
d	100 mm dia	RM					

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
Q.3	Supply, installation in position, testing and commissioning of electrically driven horizontal Monobloc pumps of approved equivalent make capable of discharging as indicated below, shall be automatic in operation with control panel, low and high level sensors of approved make provided in the overhead tank of the building, with necessary cables upto the control panel in the pump house near the sump, accessories like pressure guages, footvalves,termination of cables, earthing leads, excluding civil works etc. all complete.						
a	21 cum/hr at 45m head (1 Working + 1 Stand by) - Domestic Transfer Pumps	Nos	1				
b	10 cum/hr at 45m head (1 Working + 1 Stand by) - Drinking Transfer Pumps	Nos	1				
Q.4	Providing and fixing CP brass ball valves of model and make as specified in list of make and as per IS all complete as per specifications and as directed by the engineer in charge.						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
a	32mm dia	Nos	4.00				
b	50mm dia	Nos	8.00				
Q.5	Providing and fixing cast iron wafer type Butterfly valve of the following size complete with bolts, nuts, washers and neoprene gaskets as per specifications.						
a	65mm dia	Nos	2.00				
b	80mm dia	Nos	1.00				
c	100mm dia	Nos	1.00				
d	150mm dia	Nos	1.00				
Q.6	Supply, erection, testing and commissioning of CI non-return valve with flanged ends conforming IS 5312						
a	50mm dia	Nos	3.00				
b	65mm dia	Nos	2.00				
c	80mm dia	Nos	1.00				
d	100mm dia	Nos	1.00				
Q.7	Supplying and fixing of motorised valves of model and make as specified in the list of makes PN 1.0 suitable for 240 Volts, with suitable motorised rotor 3 nos of float type						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	sensors and control panel, to shut and close valve when water level is low / high in water tanks including necessary cabling from terrace OHT to sump pump and control panel etc all complete						
a	32mm dia	Nos	4				
b	40mm dia	Nos	1				
c	50mm dia	Nos	5				
Q.8	Providing, installation, testing, & commissioning of pressure switches complete with pressure vessel of 50 ltrs. on delivery header of water supply pumps. (To stop start pump incase of closing and opening motorised valves) including necessary wiring upto control panel & other materials.	Nos	4.00				
Q.9	Construction of water meter chamber 1200x900x800 mm inside with brick masonry in CM (1:4), 230mm thick, inside and outside plastering in CM (1:4), for water meter with 100 mm THK RCC top slab 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	nominalsize), 150mm thick, necessary reinforcement, excavation, foundation concrete 1:3:6 (1 sand : 3 coarse sand : 6 graded stone aggregate 40mm nominal size), 100mm thick, inside and outside plastering with cement mortar 1:3 (1 cement : 3coarse sand) 12mm thick finished with a floating coat of neat cement complete as per standard design. etc all complete as per specifications and as directed by the engineer in charge.						
	1200mm x 900mm x 800mm clear inside	Nos	1.00				
Q.10	Constructing masonry chamber with 75 class designation brick work in cement mortar 1:3 (1 cement : 3 coarse sand) for butterfly valve/ scour valve with RCC top slab 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size), necessary excavation, foundation concrete 1:3:6 (1 sand : 3 coarse sand : 6 graded stone aggregate 20mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3coarse sand) 12mm thick finished with a floating coat of neat cement complete as per standard design.						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
a	600x600x600 MM clear inside	No	1.00				
b	450x450x600 MM clear inside	No	1.00				
Q.11	Providing and fixing truck fill point consisting of 80 mm dia water filling point having 80 mm dia SS 304 single headed hydrant with plug, chain and NRV etc complete as required (Truck fill point shall be housed in suitable lockable chamber)	Set	1.00				
Q.12	Providing and fixing 600mm x 600mm dia cast iron (Medium duty) water tank cover double sealed with frame CI seat complete in all regards (Total WT of cover and frame to be not less than 110 kg). (UG SUMP)	Nos	1.00				
	Sub Total for External Water Supply (Q)						
R	**External Sewerage System**						
R.1	Excavating trenches of required width for pipes including excavation for sockets and dressing of sides, ramming of bottoms, depth up to 1.5m including getting out the soil as required and refilling, consolidating in layers, and						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	transport stacking neatly the surplus excavated soil within a lead of 50M all complete.						
a	All types of soils						
i)	Exceeding 80mm dia but not exceeding 300mm dia	Rm	20				
R-2	All as in item B-1 above but for the depth upto 2.5M						
a	All types of soils						
i)	Exceeding 80mm dia but not exceeding 300mm dia	Rm	1				
R-3	Providing and laying plain cement concrete bedding in 1:5:10 below the pipes 100mm thick, projecting 100mm on either side of pipe at all depths etc. all complete						
a	100mm dia.	Rm	10				
b	160mm dia	Rm	5				
c	200mm dia	Rm	1				
R-4	Providing and fixing grade "A" P type 150mm square mouth stoneware gully trap with 100mm dia. Outlet of approved make with cast iron grating housed in 200mm thick brick masonry chamber and water tight cast iron cover 12 Kg with frame of 300x300mm size (inside) as per	Nos	1				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	standard design and drawing including necessary excavation and back filling all complete as per specifications and as directed by the engineer in charge.						
R-5	**SOIL, WASTE AND RAIN WATER PIPELINE CEILING SUSPENDED AT STILT AN UPPERBASEMENT**						
	Providing, fixing and jointing uPVC as per IS 4985 for soil, waste and vent pipes with solvent joints laid at required slope suspended to ceiling including fittings (plain or door) tees, bends, collars, crosses reducers including anchor fasteners, supported by galvanized steel clamps & hangers etc. provided at required intervals to prevent sagging of pipes of approved make including cutting and making good masonry or concrete walls wherever necessary, erecting necessary temporary scaffolding and make good the walls, ceiling etc., making connection fittings and inspection chambers\gully traps crossing of beams and testing of pipelines, etc. Complete						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. Cutting, chases / holes in floors / Retaining walls / slab including making good the walls, ceiling etc. all complete as per specifications and as directed by the engineer in charge.						
a	110 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	20				
b	75 mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	20				
R-6	Providing, fixing and jointing uPVC as per IS 4985 with solvent joints laid at required slope , with available fittings including cutting and making good masonry or concrete walls wherever necessary and make good the walls, retaining wall etc., making connection fittings and inspection chambers\gully traps etc. complete including testing of pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. including making good the walls, ceiling etc. all complete						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	as per specifications and as directed by the engineer in charge.						
a	75 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	1				
a	110 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	10				
b	160 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	5				
c	200 mm dia. (6 Kg /sqcm) confirming to IS 4985	Rm	10				
R-7	Supplying, fixing P or S type 150mm square mouth PVC gully trap with 100mm dia. Outlet of approved make with grating housed in 150mm thick brick masonry chamber with frame of 300 x 300mm size (inside) as per standard design and drawing including necessary excavation and backfilling all complete as per specifications and as directed by the engineer in charge.	Nos	4				
R-8	Providing and fixing SWR PVC P trap with 110mm dia outlet of approved make including connection to PVC Soil pipe, providing and fixing top tail piece with with necessary cement concrete. (For Internal toilets) etc	Nos	1				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	complete as per specifications and as directed by the engineer in charge.						
R-9	Construction brick masonry inspection chamber as per standard design in cement mortar 1:4, foundation concrete 1:2:4, 150mm thick, inside and outside plastering 12mm thick with cement mortar 1:3 finished with a floating coat of neat cement and making channels in cement concrete M15 neatly finished, top RCC/SFRC cover for medium loads, polypropylene steps, earthwork excavation, getting out the excavated soil and returning the suitable soil as required for refilling, consolidating and disposal of surplus excavated soil within a lead of 50m etc. all complete including manhole cover and frame as per IS etc all complete as per specifications and as directed by the engineer in charge.						
a	600 x 600 x up to 900 mm inside dimension with100mm thick RCC slab M20 grade with 200 thick side walls	Nos	1				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
b	800 x 800 x 1200 mm inside dimension with 100mm thick RCC slab M20 grade with 200 mm thick side walls	Nos	1				
c	1200 x 800 x 1500 mm inside dimension with 100mm thick RCC slab M20 grade with 200 mm thick side walls	Nos	1				
d	1500 mm dia inside dimension circular manhole with 200 mm thick walls upto 2000 mm depth	Nos	1				
e	1500mm dia inside dimension circular manhole with 230 mm thick walls above 2000 mm depth upto 3000 mm depth	Nos	1				
	Sub Total for External Sewerage System (R)						
S	**External Storm Water Drainage System**						
S.1	Supplying, installing, testing and commissioning of R.C.C NP2 class pipe conforming to IS:458 laid laid to correct levels below ground in trenches upto required depth and grade including collars joining made of spun yarn and stiff mixture of cement mortar 1:1 and curing the joints, testing the joints as per specifications and rectifying any leakages etc and filling the excavated trench with approved quality						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	saturated sand on sides, bottom and top surface of pipe with all leads and lifts, making necessary connections as required etc.,complete as required. (UNDERGROUND)						
a	160mm dia	Rm	20				
b	200mm dia	Rm	20				
c	250mm dia	Rm	10				
d	300mm dia	Rm	2				
S.1.1	Providing, fixing and jointing uPVC (SWR) of Type B as per IS 13592/1990 for soil, waste and vent pipes with solvent joints laid on wall face, Suspended to ceiling / under sunken areas in toilet, in ground including fittings (plain or door) tees, bends, collars, crosses reducers etc. of approved make including cutting and making good masonry or concrete walls wherever necessary, making connection with sanitary fittings and taking the pipelines outside the building into the ducts / crossing of beams and testing of pipelines, etc. Complete including testing of						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	pipelines as per spec. etc. Making proper connection with joint as required as per manufacturer. excluding erecting necessary temporary scaffolding, civil works etc. all complete as per specifications and as directed by the engineer in charge..						
a	200mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	0				
b	160mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	0				
c	110mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	20				
d	75mm dia (6 Kg /sqcm) confirming to IS 4985	Rm	10				
S.2	Constructing brick masonry open surface drain with class designation 75 bricks, 200 mm thick in cement mortar 1:4 (1 cement : 4 fine sand) including earth excavation, 10 cm thick bed concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40mm nominal size) and 25 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm nominal size for filling haunches including 12 mm cement plaster 1:4 (1 cement : 4 coarse sand) with a floating coat of neat cement over						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	exposed surface of masonry including disposal of surplus earth and covering the drains with precast RCC gratings/slabs 100mm thick (1:2:4) of size as shown in drawing and approved by the Engineer.						
	40 cm drain x 50 cm average depth	Rm	5				
S.3	Excavation in trenches all kind of soils (other than in rock requiring chiselling and blasting) for sockets and dressing of sides, ramming of bottoms, including getting out the soil as required and refilling, and refilling of trenches after pipes are laid in layers not exceeding 20 cm watering and consolidation and disposing off surplus earth within a lead of 100M or as directed by the Engineer in charge, providing necessary Shoring & Strutting while excavating etc., complete						
a	Depth of excavation up to 1.5m	Cum.	5				
b	Depth of excavation up to 2.5m	Cum.	0				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
S.4	Providing and laying plain cement concrete bedding in 1:5:10 below the pipes 100 mm thick, projecting 100mm on either side of pipe at all depths and haunches upto the center of pipe including shuttering & timbering etc. all complete						
a	160mm dia	Rm	10				
b	200mm dia	Rm	10				
c	250mm dia	Rm	5				
d	300mm dia	Rm	2				
S.5	Construction of Catch Basin of size mentioned below for external storm water drainage with 230mm thick walls in well burnt table moulded bricks in CM 1:4 over a bed of 100 mm thick PCC 1:4:8 internal walls plastered smooth in CM 1:3 and external walls plastered in1:3 with sponge finish with Fixing perforated Pre-cast RCC covers, capable of taking Medium Duty Vehicular loads manhole cover on top surface flushed to the finished floor level with necessary excavation, back filling the selected excavated						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	earth withall leads and lifts etc., complete as per specifications and as directed by the engineer in charge.						
a	300mm x 300mm (clear internal dimension) upto 450 mm depth	Nos	1				
b	450mm x 450mm (clear internal dimension) above 450mm depth upto 600 mm depth	Nos	5				
c	600mm x 600mm (clear internal dimension) above 600mm depth upto 900 mm depth	Nos	5				
d	750mm x750mm (clear internal dimension) above 900mm depth upto 1200 mm depth	Nos	2				
e	900mm x900mm (clear internal dimension) above 1200mm depth upto 1500 mm depth	Nos	2				
S.6	Providing and constructing Rain water recharge pits the clear dimensions mentioned as per drawing and filling the normal aggreate gelly up to 300 mm, coarse sand 300mm, 40mm size aggregate gelly up to 400mm and brick bat up to 500mm depth with precast SFRC cover with frame and						

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
	recessed top cover of 600 x 600mm, 110 mm IS 4985 6kg PVC pipe upto 3M and perforated IS 4985 6kg PVC pipe with Geo filter fabric upto 6M, inlet and outlet arrangements, and including excavation, backfilling, curing with all leads and lifts as per the detailed drawings, disposing the surplus earth according to site condition as directed by site in charge. etc,complete as per specifications and as directed by the engineer in charge.						
a	Size : 3000mm X1500mm X 1500mm effective depth	Nos	1				
S7	Providing, fixing and commissioning non clog type mono block submersible drainage pumps suitable for handling solids of 12 mm size with totally water and dust proof motor as specified complete including suitable starter, required relays along with control panel and float switch, inclusive of all terminations and earthing required all complete as per specifications. (STP ROOM+PUMP ROOM)						
a	Capacity 200 lpm & Head 12 m (1 W + 1 SB)	Set	1				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
S.9=8	Providing, fixing and commissioning non clog type mono block submersible drainage pumps suitable for handling solids of 12 mm size with totally water and dust proof motor as specified complete including suitable starter, required relays along with control panel and float switch, inclusive of all terminations and earthing required all complete as per specifications. (BASEMENT STORM WATER SUMP)						
a	Capacity 200 lpm & Head 12 m (1 W + 1 SB)	Set	1				
	Sub Total for External Storm Water Drainage System (S)						
T	**Miscellaneous Items - External**						
T-1	Providing and fixing MS supports for pipes fabricated from MS flats angles and plates including fixing the brackets to walls, slab, beam etc.with anchor, fasteners 12mm 'U' or 'J' bolts for fixing the pipes to clamp including applying red oxide paint & 2 coats of enamel paint of approved colour to brackets etc. complete as per directions of engineer-in-charge.	Kg	100				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
T-2	Providing, fixing, testing and commissioning of lawn hydrant ball valves (for irrigation) of brass body nickel plated with stainless steel ball, lever operated with gun metal nozzle for connecting rubber hose.						
a	20 mm dia	Nos	10				
T-3	Providing and fixing 125 mm dia dial pressure gauge to read upto 10kg/sq.cm, to be fixed on delivery main of pump sets with isolation cock.	Nos	1				
T-4	Providing and fixing in position 125mm dia flanged Cast Iron dirt box Y-Type Strainer having body fabricated in Cast Iron and strainer made of SS perforated sheet having perforations of suitable size.	Nos	1				
T-5	Supply, delivery and fixing of approved make reflux valve (non return valve) on delivery side of pumps of sizes as mentioned below.						
a	80 mm dia.	Nos	1				
b	65 mm dia.	Nos	1				
c	50 mm dia.	Nos	1				

Sl.No	Description of item	Unit	Quantity	Rate in Figure and words (INR)		Amount (INR)	
				Supply	Installation	Supply	Installation
T-6	Providing and fixing in RCC tank GI / MS galvanized insert with flanged ends 450mm to 750mm long including puddle flange required, no of companion flanges, bolts, nuts, rubber gaskets, a thick coat of non-setting mastic or plastic cement etc complete.						
a	40mm nominal bore	Nos	1				
b	50mm nominal bore	Nos	3				
c	65mm nominal bore	Nos	2				
d	80mm nominal bore	Nos	4				
e	100mm nominal bore	Nos	6				
f	150mm nominal bore	Nos	1				
g	200mm nominal bore	Nos	1				
	Sub Total for Miscellaneous Items (T)						
	Total of First Floor External water supply, sewage and rainwater system (Q- T)						
	TOTAL OF FIRST FLOOR WATER SUPPLY, SEWAGE AND RAINWATER SYSTEM.(K- T)						