COCHIN SHIPYARD LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

P.O. BAG NO.1653, COCHIN - 682 015, INDIA
Tel. No. : 0484 - 2501825
Mob. Nos. : 9995804382/ 8138917198/ 9895765812
E-Mail: mathews.pa@cochinshipyard.in
Web: www.cochinshipyard.in

Tender for

CONSTRUCTION OF FIRE WATER TANK, INDUSTRIAL WATER TANK, ACETYLENE ROOM AND COMPRESSOR CLUSTERS (2 Nos.) FOR NEW DRY DOCK PROJECT

Tender No. INFRA/NDD/278/2024
(Last date of submission of Tender is on or before 15:00 Hrs of 26 Nov 2024)

Tender No: INFRA/NDD/278/2024

Name of Work: Construction of Fire Water Tank, Industrial Water Tank, Acetylene Room and Compressor Clusters (2 Nos.) for New Dry Dock Project

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

Sl. No.	Description	Yes/ No
1	Whether the Tenderer has agreed to all Terms & Conditions given in the Tender	
2	Whether the Tenderer has enclosed copy of GST Registration Certificate, EPF/ESI Certificates	
3	Whether the PAN Number, PAN Card of the Tenderer is furnished. If exempted from IT, the Exemption Certificate shall be enclosed.	
4	Whether the Tenderer has furnished Invoice or any other documentary proof of having done works for PWD/ CPWD/ CoPA/ CSL or other Government Agencies.	
5	Whether the Tenderer has submitted Cost of Tender Form (Rs. 1,500/- + 12% GST = Rs 1,680/-) along with Technical Bid in DD/ NEFT mode.	
6	Whether the Tenderer has submitted EMD of Rs. 25,00,000/-along with Technical Bid in DD/ NEFT or RTGS/ BG mode.	
7	Whether the Tenderer has submitted signed Certificates/Undertaking/Declaration as per clause 13 of Conditions of Contract.	
8	Whether the Tenderer has submitted Technical Tender & Financial Tender in separate closed envelopes.	
9	Whether the Tenderer has submitted entire tender documents duly signed and stamped in all pages by authorized representative.	
10	Whether bidder has submitted NEFT details in relevant format	
11	Submitted un-priced Bill of Quantities in Technical Bid	
12	Submitted Undertaking regarding not blacklisted/ put on holiday/ terminated by CSL or any Govt. Dept.	
13	Submitted duly filled Power of Attorney in favour of signatory of bid documents	
14	Proforma at Annexure 1-5, Annexure 7, Annexure 11-16 and Annexure 18 duly filled and signed along with necessary documental evidence	

Name :

Signature of the Bidder:

COCHIN SHIPYARD LIMITED
(A Government of India Enterprise)
P.O. BAG NO.1653, COCHIN-682 015, INDIA

Tel. No: 0484 - 2501825
Mob No: 9995804382/ 8138917198/ 9895765812
Fax No. +91(484) 2370897/2383902
E– Mail: mathews.pa@cochinshipyard.in
Web: www.cochinshipyard.in

No. INFRA/NDD/278/2024 04 Nov 2024

TENDER NOTICE

Sealed bids in the prescribed form are invited on behalf of Cochin Shipyard Limited in Two-Bid system from experienced Contractors for the under mentioned work, so as to reach the undersigned on or before the date and time mentioned below:

Name of Work	:	Construction of Fire Water Tank, Industrial Water Tank, Acetylene Room and Compressor Clusters (2 Nos.) for New Dry Dock Project
Estimated Cost of Work	:	Rs 14,99,45,028/- (incl. 18% GST)
Earnest Money Deposit (EMD)	:	Rs 25,00,000/-
Cost of Tender Form	:	Rs 1,500/- + 12% GST = Rs 1,680/-

(Those who download the tender form from website also will be required to remit the cost alongwith the Tender documents in the form of a separate DD/ Cheque/ NEFT drawn in favour of Cochin Shipyard Ltd.)

Last date and time of issue of Tender Form	:	25 November 2024,12:00 Hrs
Last date and time of receipt of Tender	:	26 November 2024, 15:00 Hrs
Date and time of opening of Tender	:	26 November 2024, 15:30 Hrs
Time of Completion of Work	:	7 Months
Date and time of Pre-bid Meeting	:	14 Nov 2024, 10:30 AM

Short Description of Work

The scope of works involves the structural design and construction of Fire Water Tank & Industrial Water Tank (with pump houses for both) on lumpsum basis and construction of three other Industial Buildings viz. Acetylene Room, Compressor House Cluster-1 and Compressor House Cluster-2 on item rate basis.

The Tender Documents can be obtained from the Office of the undersigned during office hours till the last date and time of issue of Tenders. All the Tender Documents (NIT, Conditions of Contract, Specifications, Bill of Quantities, Tender Drawings, Forms and Formats etc.) are available on Cochin Shipyard's website www.cochinshipyard.in and CPPP website https://eprocure.gov.in/epublish/app. Tenderers can download the Forms and use the same for submission of the Tenders.

Deputy General Manager (Infra Projects)
Cochin Shipyard Limited

Tender No: INFRA/NDD/278/2024

Name of Work: Construction of Fire Water Tank, Industrial Water Tank, Acetylene Room and Compressor Clusters (2 Nos.) for New Dry Dock Project

CONDITIONS OF CONTRACT

1. Conditions of Contract specified herein shall be read in conjunction with Notice Inviting Tender, Bill of Quantities, Technical Specifications, drawings and other relevant documents forming part of the Contract.
2. In the Contract (as hereinafter defined) the following words and expressions will have the meanings hereby assigned to them;
    - "Bidder'' shall mean the individual, firm or Company. "Bidder" is interchangeable with "Tenderer".
    - "Contract" means the formal agreement signed by both parties which includes Contract Agreement, Work Order, Schedule of Accepted Rates, Conditions of Contract, Technical Specifications and Drawings, Notice Inviting Tender including all attachments and appendices thereto and all documents incorporated by reference therein and all correspondences up to the date of signing of Agreement.
    - "Contractor'' shall mean the individual, Firm, or Company who enters into the Contract with the Employer, and shall include his heirs, his executors, administrators, successors, legal representatives, as the case may be.
    - "Contract Period'' shall mean the period during which the work shall be executed as agreed between the Contractor and the Employer in the 'Contract' including defect liability period with approved extensions granted.
    - "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.
    - "Date of Contract" shall mean the calendar date on which Employer and the Contractor have signed the 'Contract'. Date of Work Order precedes the date of Contract & 21st day of issue of Work Order or site handing over whichever is later will be the zeroth date for commencement of work.
    - "Defects Liability 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.
    - "Employer" shall mean Cochin Shipyard Limited (hereinafter referred as "CSL"), having registered office at Perumanoor, Kochi – 682015, 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.

- “Engineer-in-Charge” means the Deputy General Manager (Infra Projects) of Cochin Shipyard Limited in charge of the work or his authorized representatives.
- “Extra work’’ shall mean all ‘labour’, ‘equipment’, ‘materials’, ‘services’, ‘works’ in addition to those required by the ‘Contract’ document & scope.
- “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 applicable under ambit of the Contract as the case may be.
- “Schedule of Rates/ Schedule of Price” means the priced and completed Bill of Quantities forming part of the Bid
- “Scope” shall mean 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. “Services” means the permanent and temporary works to be performed by the Contractor pursuant to the Contract. "Services” is interchangeable with "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.
- “Substituted items” are items that are taken up with partial modification or in lieu of items of works in the Contract.
- “Tender’’ shall mean the offer made by individual, Firm, Company or corporation,for the execution of the works. Tender includes the Technical Tender and theFinancial Tender of the Bidder. "Tender" is interchangeable with "Offer", "Bid" or"Proposal".
- “Time of Completion” means the time for completing the works calculated from the zeroth date for commencement of work with approved extensions granted if any.
- “Work’’ or “Works” shall mean respectively the materials to be supplied and services to be provided by the Contractor under the ‘Contract’. ‘Works’ shall include engineering, construction, manufacturing, supply of materials, equipment, labour, services & complete erection, commissioning including all transportation, handling, loading and unloading, storage etc. as per Contract.
- "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.
- Terms and expressions not herein defined shall have the same meaning as are assigned to them in the Indian Contract Act (1872).

3. If any difference is found in different parts of the tender documents, the following will be in order of precedence:

    i. Contract Agreement
    ii. Work Orderwith accepted Bill of Quantities/ Schedule of Rates
    iii. Bid clarifications and post bid correspondences
    iv. Addendum and Corrigendum to Tender Documents issued by CSL
    v. Conditions of Contract
    vi. Technical Specifications
    vii. Drawings
    viii. Offer submitted by the Bidder

    If the Contractor discovers any ambiguities, omissions, errors, faults and other defects in the Drawings or in other documents, he shall immediately notify the same in writing to the CSL, who will resolve the ambiguity or correct the error and will notify the Contractor of the interpretation to be adopted.

    However, all of the above shall be read in conjunction while operating any item. The order of precedence shall only govern in case of any discrepancy.

4. Throughout the bidding documents, the terms "bid" and "tender" and their derivatives ("bidder / tenderer", "bid /tender", "bidding / tendering", etc.) are synonymous, and day means calendar day. Singular also means plural.
5. The location of the site is inside the premises of Cochin Shipyard Limited, Perumanoor, Kochi - 682 015.
6. The tenderers are expected to have inspected the site before quoting, read the conditions thoroughly and understood the nature of works to be executed and site conditions in all respects. Clarifications, if any may be obtained from Engineer-in-Charge before the tender is submitted, and if clarifications/details are not obtained before the tender is submitted, no claim on this account will be admitted.
7. Claims and objections due to ignorance of existing 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 CSL 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 CSL 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 a result thereof. The gate entry pass is required for site visit or for the purpose of making the offer or for the execution of work for successful Tenderer. The Tenderer shall contact AGM (IP), Cochin Shipyard Limited, Perumanoor P.O., Kochi, Kerala, India – 682015 Tel: 0484-2501826, Mob: 09995804382, Email: dhannya.kk@cochinshipyard.in.

8. 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 situation and conditions. Any extra claim on this account will not be entertained.

9. Site Visit

   Bidders are advised to visit and examine the site in compliance with its surroundings and familiarize himself with the existing facilities and environment. The bidder and any of his personnel or agents will be granted permission by CSL to enter upon CSL premises for the purpose of such inspection, but only upon the explicit condition that the bidder, his personnel or agents will release and indemnify CSL 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 by CSL as a result thereof.

   For site visit, bidders are requested to contact following officials of CSL:

   Email: mathews.pa@cochinshipyard.in

   with Copies to: dhannya.kk@cochinshipyard.in and aravind.v@cochinshipyard.in

10. Pre-Bid Meeting

    a. Bidder shall examine the tender document thoroughly in all respects and if any conflict, discrepancy, error or omission is observed, such clarification requests shall be directed to the emails mentioned below:

       Contact person for Tender Clarification

       Deputy General Manager (Infra Projects),
       Infra Projects Dept.,
       Administrative Building,
       Cochin Shipyard Ltd.,
       Kochi-15, Kerala, India.
       Ph: 0484 2501825
       Email: mathews.pa@cochinshipyard.in

       Pre-bid queries shall be also copied to following email IDs.

       dhannya.kk@cochinshipyard.in and aravind.v@cochinshipyard.in

    b. Only a single pre-bid meeting is envisaged and the same will be held at CSL on the time and date mentioned in Notice Inviting Tender.

    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.

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 in the pre-bid questionnaire attached as Annexure-22 by courier/e-mail to reach CSL 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 thetime and to the address mentioned above

h. The compilation of all queries discussed during the pre-bid meeting shall be distributed, togetherwith replies, to the officially named email address of all bidders.

i. Any modification of the tender document which may become necessary as a result of the pre-bidmeeting shall be made by CSL through the issuance of a corrigendum/addendum which shall bedistributed to all bidders to an authorized e-mail address and will be uploaded in CSL website.

j. Non-attendance of the pre-bid meeting will not be a cause for disqualification of a bidder. In caseany bidder does not attend the pre bid meeting, it shall be understood that the bidder has a clearunderstanding 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 thenon-attending bidder shall not be entertained later.

k. Reply to pre-bid queries shall be considered as part of Tender document.

11. The bidder is expected to examine carefully the contents of the tender document. Failure to comply with the requirements of the tender will be at the bidder's own risk. It would be deemed prior to the submission of the tender that the bidder has made a complete and careful examination of requirements and other information set out in the tender document.

12. All corrigenda, addenda, amendments and clarifications to Tender Specifications will be hosted only in the CSL website www.cochinshipyard.in. Bidders shall keep themselves updated with all such developments till the last date and time of submission of tender. All corrigenda, addenda, amendments and clarifications will be part and parcel of the Contract agreement.

13. The tender for the work will be based on Two-Bid system. The tender has to be submitted in Two Covers. (Cover ‘A’ & Cover ‘B’)

Cover A shall contain the following:

Technical Bid - shall consist of two separate Covers A1 and A2.

Cover A1 shall contain cost of Tender Form (DD/ NEFT) specified in the Tender Notice payable at Kochi and EMD for Rs. 25 Lakhs in the form of DD/ NEFT or RTGS payable/ encashable at Kochi drawn in favour of ‘Cochin Shipyard Limited’ from any Nationalized/ Scheduled Banks in India and shall be kept inside of Cover A. Alternatively the Contractor can also deposit EMD as Bank Guarantee for Rs 25 Lakhs from a Nationalized Bank or Scheduled Bank in India (enforceable and encashable at Kochi) as per the Form at Annexure -7. The BG shall be kept valid up to 3 months (shall be extendable upto further 2 months based on the request of CSL) after the due date of submission of Tender. EMD will not

accrue any interest. Bank Account details of CSL for remitting cost of Tender Form/ EMD is mentioned below:

State Bank of India
Shipyard Branch
Account No.: 10319928321
IFS Code : SBIN0003229

Cover A2 shall consist of the following

a) Proforma of checklist duly filled and signed.

b) Following Certificate signed by the Contractor.

A. "I / WE HAVE GONE THROUGH THE TENDER TERMS AND CONDITIONS IN FULL AND UNDERSTAND AND ACCEPT THE SAME AND HEREBY TRULY CONFIRM AND DECLARE THAT THE RATES QUOTED IN THE PRICE BID ARE BASIC RATES AND GST IS SHOWN SEPARATELY. I / WE ALSO CONFIRM THAT COVER B (PRICE BID) DOES NOT CONTAIN ANY CONDITIONS."

B. "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."

C. "I/ WE HAVE NOT BEEN BLACKLISTED BY ANY GOVT. DEPT./ COMPANY."

c) Proforma at Annexure 1-5, Annexure 7, Annexure 11-16 and Annexure 18 duly filled and signed along with necessary documental evidence.

d) Signed and stamped Tender document along with Annexures and Corrigenda (if any) as a token of acceptance of all terms & conditions of the Tender document.

e) Copy of unpriced price bid with written as "Quoted" in all pages.

f) Any other document as per requirement of Tender.

Cover B:

Financial/ Price Bid/ Tender Schedule shall be submitted exactly in the same format as in the tender and shall contain the rates and amount for each item of work and GST should be shown separately. There shall not be any clause, added by the tenderers in the price bid. Price Bid with any clause and conditions other than amount will be summarily rejected.

The Cover A & Cover B shall then put together in another cover marked Cover C, which shall be sealed and super-scribed with name of work, the address & contact No. of Contractor. The Cover C shall be dropped in the Tender Box kept at the Infra Projects Department on or before 15:00 hrs on 26/11/2024.

Cover C shall be opened at 15:30 hrs on 26/11/2024 at the Conference Room in Infra

Projects Department. At first, Cover A1 containing EMD, cost of Tender Form and Cover A2 containing technical bid shall be opened. In case the cost of Tender Form, EMD are not deposited or is not in order, the tender shall be returned to the tenderer unopened either on the spot, if the tenderer is present or later by post. Only a mention to this effect shall be made in the Tender Opening Register.

Price Bids (Cover B) of those tenderers who have submitted the cost of Tender Form, EMD, found technically qualified and submitted undertaking that the Cover B does not contain any conditions shall be opened on a later date after giving notice to the qualified bidders. **Tenderer should ensure that his quoted amount as per Cover B is not mentioned anywhere in other documents, directly or indirectly. If any such mention is made, the tender will become invalid and shall become liable for rejection.**

14. Late tenders, tenders with conditions and conditional rebates/ discounts will be summarily rejected.
15. The tenderers shall have to sign in each page of the tender documents with official stamp as a token of his acceptance of the conditions stated therein.
16. Person or persons signing the tender shall state in what capacity he/she or they is/are signing the tender, e.g.as Sole Proprietor of the Firm concerned or as Managing Director or Director or Secretary or Manager of a Limited Company.

    In the case of partnership firm, the names of all the partners should be recorded and the tender shall be signed by all the partners or their duly constituted attorney, having authority to bind all the partners in all matters pertaining to the Contract as accorded in the deed of Power of Attorney or in the partnership deed. In such a case, a registered copy of the "Partnership Deed" should be furnished along with the tender. It shall be obligatory on the part of every partner of the firm, which enters into agreement, to fulfill the conditions of agreement during the currency thereof, notwithstanding the dissolution of the partnership in the meantime.

    In the case of a Limited Company, the tender shall be signed by a person mentioned supra empowered to do so by the company. A copy of the Memorandum of Association and Articles of Association of the Company and the letter empowering the person mentioned supra shall be attached to the tender.
17. The person signing the tender form on behalf of another or on behalf of a firm, shall enclose to the tender, a Power of Attorney or the said deed duly executed in his favour or the partnership deed giving him such power showing that, he has the authority to bind such other persons or the firm, as the case may be, in all matters pertaining to the Contract. If the Person so signing the tender fails to enclose the said Power of Attorney, his tender shall be liable for being summarily rejected.The Power of Attorney shall be signed by all partners in the case of partnership concern, by the Proprietor in the case of a proprietary concern, and by the person who by his signature can bind the company in the case of a Limited Company.

18. **Qualifying Parameters for the Tender**

Parties, meeting the following qualifying parameters as per details mentioned below only need apply:

I. **EXPERIENCE**

1. The bidder should have successfully completed at least:

One Similar Work costing not less than Rs 12 Crores

OR

Two Similar Works, each Work costing not less than Rs 9 Crores

OR

Three Similar Works, each Work costing not less than Rs 6 Crores

during the preceding seven years ending on the date of submission of this Tender.The tenderer shall furnish attested documents in proof for their experience. For Contracts under which the bidder participated as a joint venture member, only the bidder's share, by value, shall be considered to meet this requirement.

Similar Work(s) means Civil construction works involving excavation, piling works, RCC works, structural steel works and roofing works.

Attested/ notarized copy of Work Completion Certificate for Similar Works where experience is being claimed should be submitted. Original Work Order and Work Completion Certificate shall be produced for verification if situation warrants. In case bidder is furnishing experience certificate of works executed for private agencies to qualify for the work, bidder should submit relevant TDS Certificate along with Work Completion Certificate.

Following enhancement factors will be used for the costs of works executed for bringing the financial figures to a common base value in respect of the works completed in the past years.

Year before multiplying factor:

Year before	**Multiplying Factor**
One Year	1.07
Two Years	1.14
Three Years	1.21
Four Years	1.28
Five Years	1.35
Six Years	1.42
Seven Years	1.49

II. FINANCIAL TURNOVER

a) Average Annual Financial Turnover of the tenderer during the last three Financial Years ending on 31 March 2024 shall not be less than Rs. 7.50 Crores. An attested/ notarized copy

of audited Balance Sheet and Profit & Loss Account for the preceding 3 Financial Years (i.e., 2021-22, 2022-23& 2023-24) have to be submitted in proof of Financial Turnover. Year in which no turnover is shown would also be considered for working out the average financial turnover per annum by assuming zero to be that year's turnover. 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.

b) 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 sheets (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.

c) Net Worth of the bidder during the financial year ending 31 March 2024 shall be at least 1.5 Crore.

OR

The tenderer shall furnish financial capability/ solvency certificate for an amount not less than Rs 6 Crores as per the proforma at Annexure-12 along with the tender document, from his bankers/ financial institutions, to the effect that the tenderer is financially sound and has sufficient resources for executing the work as per schedule. The financial capability certificate shall not be older than 3 months prior to the last date of submission of this bid.

III. <u>PERSONNEL CAPABILITY AND EQUIPMENT/ MACHINERY FOR EXECUTING THE WORK</u>

The tenderer shall furnish details of technically qualified personnel in their employment to be deployed for the above work, if awarded, as per the proformas at Annexure-14 and Annexure-15. The tenderer shall also furnish the details of equipment/ machinery to be deployed for the above work, if awarded, as per the proforma at Annexure –16.

IV. <u>EVALUATION CRITERIA:</u>

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

(a) Experience in similar nature of work during last 7 years - Maximum 40 marks

(b) Financial strength - Maximum 30 marks

(c) Personnel and Establishment - Maximum 15 marks

(d) Plant & Equipment - Maximum 15 marks

Total = 100 Marks

To become eligible for short listing, the sole bidder must secure at least fifty percent marks in each category (a), (b), (c), (d) and sixty percent marks in aggregate. The marking system for evaluation will be as given in Annexure-17.

19. The Applicant (firm) who applied for Corporate Debt Restructuring (CDR) in last five years 2019-2020, 2020-2021, 2021-2022, 2022-2023 and 2023-2024 and till the time of submission of the bid

is not eligible to participate in this tender. The undertaking that the Applicant has not applied or is not applying for CDR shall be submitted.

20. **Test of Responsiveness**

i. Prior to evaluation of Tender, the Authority shall determine whether each Tender is responsive to the requirements of the tender. A tender shall be considered responsive only if:

a) It is received by the Tender due date and time including any extension thereof.

b) Cost of Tender Form and EMD are submitted.

c) Attested/ notarized copy of Work Completion Certificate for similar works where experience is being claimed is submitted.

d) Attested/ notarized (Original copy should certified by Chartered Accountant/Statutory Auditor) copy of audited Balance Sheet and Profit & Loss Account for the preceding 3 Financial Years (i.e., 2021-22, 2022-23 & 2023-24) of the bidder in proof of financial turnover are submitted. Relevant documentary evidence with regards to PAT criteria are submitted. Relevant documentary evidence in proof of Net Worth or Financial Capability/ Solvency Certificate of required value is submitted.

e) Details of Personnel and Establishment, Plant and Equipment as mentioned in clause No. 18 above are submitted.

f) Bidder has to score the minimum marks specified in clause No. 18 above.

g) The Power of Attorney as per Annexure-4 is submitted.

h) The tender document along with all the forms filled, signed and sealed by the bidder is submitted.

i) The bank NEFT details like name of Bank, Bank Branch, type of account, Bank Account No., MICR code etc. of the bidder as per Annexure-18 is submitted.

ii. The bidder shall submit copy of valid GST Registration Certificate and PAN.

iii. The bidder should not be put on holiday by CSL or blacklisted by any Government Dept. / Company.

iv. Bidder has not applied for CDR in last 5 years and submitted undertaking in this regard.

v. Notwithstanding any other condition/ provision in the tender documents, in case of ambiguity or incomplete documents pertaining to Qualifying Parameters, bidders shall be given only one opportunity with a fixed deadline after bid opening to provide complete & unambiguous documents in support of meeting the Qualifying Parameters. In case the bidder fails to submit any document or submits incomplete document within the given time, the bidder's tender will be rejected.

21. The tenderer should keep open the validity of the tender for 90 days (shall be extendable upto further 60 days if requested by CSL) from the date fixed for its opening or from the date of its opening whichever is later. Should any tenderer withdraw his tender before the validity period or make any modification in the terms and condition of the tender, which are not acceptable to CSL,

the earnest money deposited by the tenderer shall be forfeited in addition to other administrative actions.

22. Joint Venture/ Consortium shall not be permitted to participate in this tender.
23. If the firm does not have in-house capability to carry out the structural design, association with structural engineering firm may be allowed for considering the CV of structural engineer only. The firm's experience of associate firm should not be considered for bidders' experience.
24. CSL reserves the right to conduct negotiations with L1 bidder to have possible reduction from the original offer or if condition so warrants. The bidder shall attend the negotiation meeting in time upon intimation to them by CSL.
25. The clarifications, if any may be obtained from the office of Deputy General Manager (Infra Projects) before the tender is submitted, and if clarifications/ details are not obtained before the tender is submitted, no claim on this account will be admitted. The submission of a tender by tenderer implies that he has read this Tender Document and has made himself aware of the scope and specifications and other factors bearing on the tender.
26. Contractors registered under the GST Act should only participate in the tender. The GST ID of Cochin Shipyard Ltd. is 32AAACC6905B1ZD and the address of the registered place of business of CSL is "Administrative Building, Perumanoor, Cochin - 682 015".
27. **CSL's Right to Annul the Bidding Process**
    i. Notwithstanding anything contained in this tender document, CSL reserves the right to annul the bidding process at any time without any liability or any obligation for such annulment, without assigning any reason.
    ii. CSL reserves the right to invite revised Techno-commercial bids with or without amendment of the tender document at any stage, without liability or any obligation for such invitation and without assigning any reason.
    iii. CSL reserves the right to reject any Tender if at any time, a material misrepresentation is made or uncovered OR the Bidder does not respond promptly and thoroughly to requests for supplemental information required for the evaluation of the tender.
28. **Mobilisation Advance**

    Mobilisation Advance to the tune of 10% of the Contract Value will be paid, if required by the Contractor, 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 mobilisation advance should be 110% of the advance amount paid. The form of Bank Guarantee to be executed exactly as per proforma at Annexure – 9. The mobilisation advance shall be paid in two equal instalments. Utilization certificate, along with supporting documents, of the mobilisation advance paid is to be submitted by the Contractor. Second instalment will be paid only after getting utilization certificate of the first instalment. Part/Split 'Bank Guarantees' (BGs) against mobilisation advance is permitted.

An interest at 8.5% per annum shall be charged on the mobilisation advance paid. The mobilisation advance paid will not be more than 10% of the Contract Value and shall be recovered from each running account bill on pro data basis. Along with the recovery towards the mobilisation advance, the interest accrued on the advance will also be recovered from each interim payment. 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 Employer. The recovery of Mobilisation advance shall commence once the Contractor's progress of work reaches 10% of the Contract Value and the recovery of entire mobilisation advance should be complete by the time works for 80% of the Contract Value is executed. BG will be returned to Contractor after 100% recovery of mobilisation advance. In case of termination of Contract, the entire value will be recovered at a stretch or the bank guarantee will be encashed by CSL to realize the amount.

29. **Interest Free Secured Advance**

The Contractor, on signing an Indenture in the format as specified in the tender 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 lower 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.

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 Cochin, 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, whichever is less.

If fabrication of works under the scope of this Contract is carried out offsite with CSL's prior consent, secured advance can be released upon production of Bank Guarantee for an equivalent amount.

30. Any clarifications regarding the tender can be obtained from the office of Assistant General Manager (Infra Projects) or Ph: 0484-2501826 / 2501831.

31. All expenses either directly and or indirectly incurred by the bidder and/ or his agents, managers in preparation and submission of the tender or for any negotiations, thereafter, should be borne entirely by the bidder.
32. The tender submitted by the bidder and all correspondence and documents relating to the tender exchanged by the bidder and CSL shall be written in the English language.
33. The Tender must be submitted in hardcopy format (1 No. hardcopy only).
34. During the evaluation of techno-commercial tender, Engineer-in-Charge, at his discretion may ask the bidders for clarifications. Bidders shall submit the clarifications or confirmations with details well within the specified time limit and in case any bidder fails to do so, technical evaluation will be completed with the furnished information/ data and that bidder will not have any right to make any claim on the same. 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.
35. Only experienced Contractors who have undertaken works for PWD, CPWD, CoPA, CSL or other government agencies are eligible for participating in this tender. The tenderer should furnish invoice or any other documentary proof of having done works for PWD/ CPWD/ CoPA/ CSL or other government agencies.
36. The bidder of shall not be put on holiday by CSL or blacklisted or terminated by any Government Department / Public Sector Undertaking etc.
37. Canvassing in connection with tender is strictly prohibited and tenders submitted by the Contractors who resort to canvassing will be liable to rejection.
38. The bidder shall have valid GST, PAN, ESI/ EPF Registration etc. Contractors registered under the GST Act should only participate in the tendering process. GST Registration number is to be clearly mentioned in the tender. The tenderer shall furnish documentary evidence in support of GST Registration. The income tax/ labour cess/ any other statutory taxes, as per the rules /directions of the concerned government departments, prevailing in force at the time of payment of bills will be deducted while making payment or when crediting the amount to the account.
39. It will be mandatory for the bidder to indicate their bank account numbers and other relevant E-payment details as per Annexure-18 so that payments could be made through NEFT mechanism.
40. The rates quoted by the Contractor shall be for finished items of works including supplying appropriate materials, labour, equipment/tools, conveyance, mobilisation & demobilisation charges, loading and unloading charges, transportation charges etc. all complete, unless specified in the tender schedule.
41. Rates shall be quoted both in figures and words. Rates quoted should be in Indian Rupees inclusive of all taxes, all cess and duties, but excluding GST in accordance with the tender schedule.
42. All rates shall be quoted in the price bid. 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 L1 during such evaluation, then non quoted items (s) of work have to be executed with zero rates.

43. The tenderers should note that the structural design and construction of Fire Water Tank & Industrial Water Tank (with pump houses for both) is on lumpsum basis and construction of three other Industial Buildings viz. Acetylene Room, Compressor House Cluster-1 and Compressor House Cluster-2 is on item rate basis. Tenderers attention is drawn to the fact that the rates for each and every item should be correct, workable and self-supporting. The tenderer should quote for all the items in tender schedule.
44. The rates quoted by bidder shall remain firm till completion of all works even during the extended period, if any, on any account what so ever nature.
45. Price Bids shall be evaluated based on overall total amount (Landed cost of CSL). The overall total amount is arrived from the sum of the total amount of individual items quoted by the Contractor plus applicable GST.
46. 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;
    i. When there is a difference between the rate in figures and in words for an item, the lowest of rate specified in words/figures shall be considered.
    ii. When the rate quoted by the bidder in figures and words tallies but the amount specified is incorrect, the correct amount shall be worked out by the department by multiplying quoted rate with quantity specified in bill of quantities.
47. **Errors in the Price Bid**

    In case of ambiguities in the quotes by the Contractor, the following procedure will be followed:

    a) When there is a difference between the rates in figures and in words, the rates which correspond to the amounts worked out by the Contractor, will be taken as correct.
    b) When the amount of an item is not worked out by the Contractor or it does not correspond with the rates written either in figures or in words, then the rates quoted by the Contractor in words will be taken as correct.
    c) 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.
    d) When the rate quoted by the Contractor in figures and in words tallies but the amount is not worked out correctly, the rate quoted by the Contractor will be taken as correct and not the amount.

e) In the event of NO rate has been quoted for any items, leaving space both in figures, words, and amount blank, it will be presumed that the Contractor has included the cost of this/these items in other items and rate for such items will be considered as ZERO and work will be required to be executed accordingly without rates.

If the tenderer, having been notified that its tender has been successful, does not accept the corrected amount, the tender will be rejected and the EMD will be forfeited.

The total GST amount should be calculated as per the percentage mentioned in the tender schedule. In case any bidders make arithmetical errors or quote with a different percentage, the same will be corrected as per the notified percentage in the tender.

48. All costs, charges and expenses including any duty in connection with the Contract as well as preparations and completions of Agreement shall be borne and payable by the Bidder. Bidder shall ascertain the taxes and duties to be paid on his own before the submission of the bid. All taxes & duties, to be paid to Govt. of India, Govt. of Kerala or any statutory bodies shall be paid by the Contractor for stamp duty.
49. Normally CSL 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 CSL, the total price or certain item rates quoted by the lowest evaluated bidder are considered high, CSL may invite such bidder for price negotiation. Lowest quoted bidder shall attend such negotiation meetings and if requested by CSL 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. But CSL shall not be bound to recognize/accept the bidder's analysis. As a result of negotiation, bidder may offer rebate on his earlier quoted Price. The acceptance of tender will rest with CMD of CSL 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.
50. CSL reserves the right to award the work to one or more Contractors or delete any part of the work from the scope of the Contract or cancel the tender without assigning any reason.
51. The successful bidder will be required to execute an agreement at his expense on proper value Kerala State Non-Judicial Stamp Paper in the prescribed departmental form value along with hardcopy of the tender documents within 28 days of issuance of Work Order by Employer. Till signing of agreement, the tender together with the acceptance letter/ Work Order shall constitute a binding Contract between the Contractor and Cochin Shipyard Ltd.
52. In the event of the tenderer, after the issue of work order by CSL, 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 willful breach of the Contract, the cost and consequence of which shall be to the sole account of the tenderer and upon such an event CSL shall have full right to claim damages thereof either together with or in addition to the forfeiture of Earnest Money Deposit.

53. EMD of unsuccessful bidders except L1 and L2 bidders will be released after the checking of the comparative statement by the Finance department. EMD of L2 bidder will be released on issue and acceptance of the Work order by the successful bidder (L1 bidder) or after expiry of 3 months (shall be extendable upto further 2 months based on the request of CSL) whichever is earlier. EMD of successful bidder shall be released upon the submission of Performance Guarantee.
54. The Contract shall come into effect on the date of signature of both the parties on the Contract (effective date) and shall remain valid until the completion of the obligation of the parties under the Contract. The deliveries, supplies and performance of the service shall commence from the effective date of the Contract.
55. The Time of Completion of work shall be 7 months which shall be reckoned from the 21st day of the date of issue of 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 executed with diligence keeping in view that time being deemed to be the essence of the Contract.
56. Total Security Deposit for the work shall be 5% of executed value of work. The amount of Security Deposit shall be recovered from running account bills at the rate of 5% of Running Account Bills subject to maximum of 5% of executed value of works. Security Deposit will not accrue any interest. Security Deposit shall be released after the successful completion of the defect liability period of 12 months from the completion date of the work. However, If the Contractor submits an irrevocable Bank Guarantee of value equivalent to Security Deposit, then Security Deposit available with CSL shall be released to the Contractor. Irrevocable Bank Guarantee in lieu of security deposit has to be taken from any Nationalized or Scheduled Bank in India and should be enforceable and encashable at Cochin and should be valid up to defect liability period. The Contractor has to make good all defects during the defect liability period at his own cost. Security Deposit shall be forfeited on failure to perform or non-fulfilment by the Contractor of the terms and conditions of the Contract.
57. **Performance Guarantee**

    The successful bidder shall submit Performance Guarantee @ 5% of Contract Value within 21 days from the date of issue of Work Order. Performance Guarantee should be in the form of unconditional and irrevocable Bank Guarantee enforceable and encashable at Cochin, issued by a Scheduled Commercial Bank of Indian/ Foreign origin having office in India, acceptable to CSL, as per the form in Annexure-8.

    Performance Bank Guarantee shall be released after the successful completion of work. Performance Guarantee shall not accrue any interest. In case the completion of work is likely to be delayed beyond the Contractual period or this period is required to be extended, the validity of the Performance Bank Guarantee shall have to be extended till such extended period. In case of failure to comply with such extension of the Bank Guarantee, the Bank Guarantee is liable for encashment by CSL.

58. **EXECUTION OF WORK**

1. The entire works shall be carried out under the direction of the client or their representative at site. The date of commencement of work and the date of completion of work shall be strictly adhered-to, by the Contractor. Contractor shall submit a work execution schedule prior to its commencement.
2. All the materials required for the successful completion of the work is to be supplied by the Contractor unless until specified in the schedule. All the materials used shall be got approved by the Client before being used and the materials used for this work shall be as per the approved make of materials.
3. All labour (skilled or unskilled) shall be provided by the Contractor. The workers engaged for the work should have sufficient knowledge and experience in the respective fields. If found required, Contractor shall ensure round the clock deployment of employees/workers to complete the work within the time frame.
4. Labour accommodation at site is not permitted. Night Shift working is permitted only with proper safety practices, signage and illumination.
5. The Contractor shall not construct any structure, even of temporary nature, for any purpose at site, except with the written permission of the Engineer-in-Charge of the work and any construction so put up shall be removed by the Contractor whenever the Engineer-in-Charge calls upon the Contractor to do so.
6. If the Contractor is required to engage a sub-Contractor for any part of work, then the credentials of the sub-Contractor should be got approved by the Engineer-in-Charge after award of work. The sub-Contractor shall not be put on holiday by CSL or blacklisted by any Government Dept. / Company.
7. The responsibility of successful completion of work by sub-Contractor shall lie with Contractor. Sub-Contracting will in no way relieve the Contractor to execute and complete the work as per terms of the Contract. The Contractor shall indemnify CSL against any direct claims of sub-Contractor.
8. The Contractor shall release payment to the sub-Contractor(s) promptly and shall endeavor to resolve all issues amicably and speedily with the sub-Contractor(s), so that the execution of work is not affected in any manner whatsoever.

59. CSL 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 CSL 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.

60. The Contractor shall insure against such liability and shall continue such insurance during the whole of the time that any persons are employed by him on the works. Provided that, in respect of any persons employed by any sub-contractor, the Contractor's obligations to insure as aforesaid

under this sub-clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that CSL is indemnified under the policy, but the Contractor shall require such sub-contractor to produce before CSL, such policy of insurance and the receipt for the payment of current premium.

61. The Contractor shall take Contractors' All Risk (CAR) Insurance Policy. The Contractor shall provide in the joint names of the Employer and the Contractor, insurance cover from the zeroth date for commencement of work (i.e., 21st day of the date of issue of Work Order or the date of handing over the site whichever is later) to the end of the Defects Notification Period for the following events which are due to the Contractor's risks.

    a) loss of or damage to the Works, Plant and Materials, 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 equipment.

    c) The insurance 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 affect 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. 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. Insurance of the Works/Equipment/ Supplies shall be arranged by the contractor from Nationalized insurance companies. The transfer of title shall not in any way relieve the Contractor of the above responsibilities during the period of Contract. The Contractor shall also inform the Employer 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. The CAR policy shall be effected and maintained by the Contractor as Insuring Party. It shall be in the joint names of the Employer and the Contractor, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated between the Employer and the Contractor for the sole purpose of rectifying the loss or damage. It shall cover all loss and damage from any cause not listed in clause No. 84 below. The relevant evidence of insurance and policy documents shall be submitted to the Employer within 14 days of zeroth date for commencement of work.

62. All labour, skilled and unskilled shall be provided by the Contractor. Settling any dispute with the labour/ subContractor will be Contractor's responsibility. The workers engaged for works should

have sufficient knowledge and experience in the respective fields. This shall be proved to the Engineer-in-Charge. 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 Employer is no way liable or responsible for any of its omissions, non-compliances and Contractor should implement the same scrupulously. All disputes or non-compliance shall immediately be addressed and settled by the Contractor at his risk and cost. The Contractor shall indemnify and keep employer indemnified against payments to be made under and for the observance of the laws aforesaid and relevant Labour Regulations without prejudice to his right to claim indemnity from his sub-Contractors. It is also expressly informed that Employer is no way responsible or liable for 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:

Contract Labour (Regulation and Abolition Act)

- Employees Compensation Act.
- ESI Act
- EPF Act
- Minimum Wages Act
- Payment of Gratuity Act
- BOCW Act
- Any other Acts/ rules stipulated by Govt. Authority during Contract period

63. Sub-Letting of the Work

The sub-letting of the work is not permitted in this Contract. However, if bidder intends to subContract any works of this tender, the same shall be mentioned in the Techno-commercial offer.

64. The Contractor shall cooperate with other Contractors working at CSL.
65. The Contractor is required to comply with the provisions of the rule in force (amended from time to time) regarding entry/exit of Contractors workmen, vehicles and materials. Necessary police clearance certificate and other photo identity cards approved by CSL should be produced for this purpose.
66. The workmanship shall be as per Industrial Standard in every respect both for the equipment supplied and for the installation carried out. All equipment used for this work shall have a valid registration certificate and insurance. All certificates shall be produced if requested by CSL.
67. The Contractor himself shall be liable for maintenance of Works and remedying of any defects carried out by sub-Contractors during the Defects Notification Period. Any works/ defects noticed within the observation period have to be rectified by the Contractor at his costs and if the defects are not attended within a reasonable time given by the Engineer-in-Charge, the work will be arranged by CSL at the risk and cost of the Contractor.
68. FACILITIES TO BE ARRANGED BY THE CONTRACTOR

    a. 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, material storage room/ godowns, etc. after getting prior approval from employer.

b. Industrial gases, Compressed air, water and Electric power for the work will be in Contractor's scope and Contractor has to make his own arrangements for availing the same at site required for execution of work. All necessary general lighting in the work area shall be provided by the Contractor during the period of Contract.

c. Unless otherwise specified all tools /equipments /machineries required for the work has to be arranged by the contactor. The Contractor should declare all tools/ equipments/ machineries/ accessories and other materials brought into CSL site for the work must have valid certification and make necessary entries at the CSL and a copy of the Material Declaration Form is to be submitted to the office of the undersigned for records and issuing necessary out passes for taking out the same after completion of work.

d. The Contractor shall make his own arrangement for all his communication needs such as Fax, Internet, and telephone at his site office.

e. Necessary registers and stationeries required for entering data and test results shall be provided by the Contractor at his own cost as directed by the Engineer-in-Charge.

f. In the event of any break down of the plant, vehicles and machineries deployed for the work, the Contractor shall take prompt remedial measure to put them back in working condition and nothing extra will be paid. To minimize break down period, necessary spare parts shall be kept readily available at site by the Contractor at his own expense.

69. If the work has to be carried out at night time for the successful completion, the same shall be allowed with the prior approval from the Engineer-in-Charge. Necessary lighting and safety at site has to be ensured by the Contractor.

70. On acceptance of the tender, the Contractor shall intimate the name of Project Manager who would be supervising the works and would be responsible for taking instructions for carrying out the work. Project Manager shall have 10 years' experience in executing such Contract of comparable nature including not less than five years as Manager. The Project Manager shall be available at CSL site throughout the period of Contract.

71. Also, Contractor shall intimate CSL the names of Supervisors with their qualification and experience / Workers engaged by him for the work.

72. Demolition of structures shall be carried out in such a manner that there will be no damage to the adjoining structures.

73. In addition to his general obligations under the Contract, full and complete notice shall be given by the Contractor of all operations to be carried out at the CSL project site. Such notice shall be provided in sufficient time for CSL to make all necessary arrangements for inspection and checking. Such inspection and checking shall not relieve in any way the obligations of the

Contractor under the Contract. Work on holidays / Sundays / off-working hours planned by Contractor is to be intimated to CSL at least one day in advance.

69. For the construction purpose, the entire site will be handed over. If this is not possible due to reasons, which cannot be anticipated now, the site will be handed over in parts. Proportionate extra time will be granted if found necessary by the Engineer-in-Charge and the decision of Engineer-in-Charge shall be final in this regard.
74. The Contractor shall be responsible for the safe custody of materials issued to him or brought in by him. Contractor has to make arrangements at own risk and cost for ensuring material handling equipment, other equipment such as welding/grinding/buffing machine etc., site office, workers hygiene and sanitation facilities, material storage facility, watch and ward facility for safety of materials and equipment etc. at work site.
75. The Contractor shall ensure the protection of all his 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-Charge in the prescribed manner.
76. The steel reinforcement shall be stored by the Contractor at site of work in such a way as to prevent distortion and corrosion and nothing extra shall be paid on this account. Cement shall be stored in weather proof air tight manner to prevent dampness and formation of lumps.
77. A list of approved makes is specified in this tender. It will be deemed that the Contractor has priced the respective items on the basis of those approved makes. However, it shall be the prerogative for CSL to choose any particular make among the list as the most appropriate one and the Contractor shall be bound to provide the same without any variation in the Contract rate. Whenever equivalent is specified in the list of approved makes, permission for use of equivalent make shall be subject to Contractor submitting valid regret letters from the makes listed along with the comparison table of properties of proposed make w.r.t specified make. Decision of the Engineer-in-Charge on approving equivalent makes shall be final and binding on the Contractor.
78. All materials not herein detailed and fully specified but which may be required for use on works, shall be subjected to the approval of the Engineer-in-Charge without which they shall not be used anywhere in the permanent works.
79. Contractor shall submit digitally signed GST Tax Invoice and Material Test Certificates (MTC) wherever available of major bought out items such as reinforcement steel, structural steel, cement, paint etc. to CSL prior to use in permanent works.
80. All rejected materials shall be removed within 3 days 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 CSL at the cost and risk of the Contractor.
81. Waste materials /scraps shall be cleared without fail from site on a day-to-day basis and to outside CSL premises and dumping location to be identified by the Contractor. If non-compliance of this is noted, CSL will clear the site at the cost of the Contractor.

82. Time is the essence of Contract. In case the Contractor fails to complete the whole work within the stipulated period, including all approved extensions granted, Contractor shall be liable to pay liquidated damages (not by the way of penalty) at the rate of 0.5% of the value of the 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 amount. The parties agree that this is a genuine pre-estimate of the loss or damage which will be suffered by CSL 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 Employer shall be at liberty to adjust or deduct the said amount of liquidated damages (not by the way of penalty) from any amount due to the Contractor including security deposit.
83. If the Contractor abandons the Contract or fails to commence the work in time or suspend the work for long duration (10 days) or delay the progress of the works without valid reasons acceptable to CSL or labour dispute with their workers or poor safety records or poor quality of work or workmanship etc. is noticed, then CSL will terminate the Contract and arrange the work at the risk and cost of the terminated Contractor. In such case, security deposit submitted by the Contractor shall be forfeited forthwith.
84. The Contractor shall not stop the work or abandon the site for whatsoever reason except Force Majeure conditions. The following shall amount to Force Majeure:
    a. War, hostilities (whether war be declared or not), invasion, act of foreign enemies
    b. Rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war
    c. Riot, commotion, disorder, strikes or lockout by persons other than the Contractor's personnel and other employees of the Contractor
    d. Munitions of war, explosive materials, ionizing radiation or contamination by radioactivity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio- activity, and Natural catastrophes such as earthquake, flood, Tsunami, hurricane, typhoon or volcanic activity.
    e. Epidemic, pandemic, famine etc.
    f. Strikes, Harthal or boycotts interrupting supplies and services to the site (excluding strikes or boycotts by employees, agents or representatives of Contractor, or its sub-contractors for any reason whatsoever);
    g. Fire caused otherwise than by any act or omission on the part of the Contractor or its agents, servants or employees or its subContractor;
    h. Quarantine and lockdowns etc. enforced by statutory authorities
    i. Any event or circumstance of nature analogues to any of the above or an Act of God.
85. 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 period

of delay, provided that on the occurrence of any such contingency, the Contractor should report in writing to CSL within three days of occurrence of event with all supporting evidences. A Hindrance Register shall be maintained by CSL in which the hindrances due to Force Majeure and hindrances attributable to CSL/ Contractor shall be recorded and signed by both parties. The hindrance so recorded will be regularized in accordance with the Contract provisions. The Contractor shall resume performance of its obligations under this Contract as soon as possible after the Force Majeure event no longer exists. During the period of Force Majeure, CSL shall not be responsible for any cost resulting from a Force Majeure event.

86. The monthly payment shall be based on the bill submitted by the Contractor. The bill for previous month along with detailed measurement shall be prepared and submitted on 7th working day of the current month and payment shall be released within one month from the date of submission of claim (bill) by the Contractor or date of acceptance of the bill by both parties whichever is later. The Contractor shall submit running account bills in one Original and one copy along with joint measurements. The Contractor shall inform the Engineer-in-Charge 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 joint measurement along with all necessary site documents such as pour card, and other statutory documents such as workmen attendance register, wage register, EPF/ESI remittance details etc. Based on the joint measurement of works, CSL shall prepare computerized measurement book which shall be certified and returned back to CSL by the Contractor in one Original and one copy along with the bill claim.
87. Payment shall be released based on monthly Running Account Bill basis. For the completed items of the work (where measurements are specifically noted in the measurements book as final measurements and as such have been signed and accepted by the Contractor and CSL) 75% of the net amount payable on each bill can be paid as advance within 15 working days from the date of acceptance of bill, on receipt of request from the Contractor at the discretion of Engineer-in-Charge. Balance amount will be paid after scrutiny and checking of the bill within 30 working days from the date of release of advance.
88. Contractor shall clear all dues if any in connection with statutory authorities such as EPFO, labour department, ESIC, other government agencies prior to submission of final bill. The final bill shall be paid within two 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 final bill by both parties whichever is later.
89. Engineer-in-Charge shall have the right to take possession of or use completed or partially completed part of the work. Such possession or use shall not be deemed to be an acceptance of such work.
90. CSL is an ISO 9001, ISO 14001 and ISO 45001 certified firm. All the Contractors and subContractors shall comply with the measures related to the Quality, Health, and Safety & Environment (QHSE) policy of CSL.

91. It is the responsibility of the Contractor to follow all safety rules and regulations in force, during the currency of Contract in CSL, 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.
92. Nurturing a robust Safety culture in CSL involves Enabling and Enforcing. Enabling encompasses creation of an environment that empowers and motivates individuals to prioritize safety and health. Enforcing, on the other hand deals with compelling to adhere to safety standards/SOPs. Keeping this in view, the Reward and Reprimand policy (R&R) shall be binding on the Contractor in order to enable and enforce the safety systems and procedures with hierarchy of controls such as Elimination, Substitution, Engineering controls, Administrative controls and use of appropriate PPEs. This policy shall be applicable for all workers employed by CSL and sub-contracting firms. The details of the rewards and reprimand for each categories are summarised in Annexure-20.
93. Welding Sets without ELCB and Safety Relay shall not be permitted at site. Also flashback arrester is to be provided in all cutting torches. Necessary instructions regarding safety shall be strictly adhered to by the Contractor. Safety permits for working in height, excavation work etc. shall be taken prior to commencement of work.
94. The Contractor shall report to the Engineer-in-Charge details of any accidents as soon as possible after its occurrence. In the case of any fatal or serious accident, the Contractor shall in addition, notify the local police authorities immediately by available means.
95. The workmen 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.
96. 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.
97. All notices / written orders issued by CSL to the Contractor under the terms of the Contract shall be served by sending by Post or email or delivering the same to the Contractors authorized site official nominated for this purpose. All notices to be given to CSL under the terms of Contract shall be served by sending by post, email or delivering the same to Engineer-in-Charge.
98. The Contractor may have to work round the clock including holidays, night shift and monsoon, if required to complete the work in time without any extra cost to CSL. However, works executing out of office hours and holiday shall be informed to the Engineer-in-Charge well in advance and get his clearance.
99. The normal working time of the CSL is from 8:00 A.M. to 4.20 P.M on all weekdays and Saturdays with half an hour interval from 12.15 noon to 12.45 P.M. All Sundays, second Saturday and fourth Saturday are holidays. 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. Necessary supervision will be arranged by the department.
100. The Contractor or his authorized representative with sufficient experience shall be available at site throughout the period of Contract for receiving instructions from department, arranging and

executing the work. Work should not be carried out without presence of Contractor's technical staff with sufficient experience.

101. The Contractor / representative shall report at the office of the Engineer-in-Charge on all working days before 8:30 Hrs and receive instruction regarding the works.
102. 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.
103. 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 well in advance so that a final decision in the matter could be given in time. The Tender drawings are only indicative and detailed GFC drawings shall be issued by CSL progressively after award of work.
104. The Contractor shall provide temporary barricading for excavations during construction at site for day and night as per requirement, drawing and directions of Engineer-in-Charge, including illuminating the periphery of boards with serial string lights at night time. All care shall be taken to keep the site clean without dumping any debris as far as possible. The Contractor shall take into consideration the above aspect while quoting for the work.
105. Contractor should avoid disturbance to the smooth flow of traffic along the CSL roads during the course of execution of work.
106. In case of any road subsidence, the Contractor shall make good the damaged area at no extra cost to CSL.
107. If warranted, Contractor shall dismantle, remove and shift staging and scaffolding materials, existing temporary barricading etc. from site premises as enabling work to ensure smooth execution of work as per instruction of Engineer-in-Charge at no extra cost to CSL.
108. The work shall be carried out without damaging any of the existing structures/ structures under construction/ underground pipelines or cables, bought out items procured by CSL/CSL appointed Contractors, etc. in the locality. If any damage occurs to the CSL property due to the Contractor's operation, it shall be compensated / made good at Contractor's risk and cost to the satisfaction of the Engineer-in-Charge of the works, failing which department will do the rectification work and the cost incurred will be recovered from his bill or from security deposit.
109. While earthwork excavation is carried out near to any existing structure, utmost care should be taken to avoid any damage to the nearby structure by giving proper shoring etc. No extra claim is admissible on this account. If any damage occurs to the existing structure the same should be rectified at Contractor's cost.
110. Empty cement bags are to be stacked in bundles and to be cleared from site at Contractor's expense as directed by the Engineer-in-Charge.
111. Each area of working is to be cordoned off with necessary signboards and barriers 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.

112. Contractor shall work in close co-ordination with those agencies working in the same work site at the same time. The space for storage of equipment/ materials will be very limited and Contractor should plan the work accordingly. The space for storage of materials/ equipment for each work should also be decided by mutual agreement among the Contractors working in the same area based on availability. CSL shall not be liable to provide any extra storage space other than what is available. CSL will not entertain any claims regarding non-availability of space for storing materials/ equipment nor can enter into any discussion to settle the dispute between Contractors regarding usage of space for storing materials etc.
113. Any dispute(s) or differences arising out of or in connection with the Contract shall, to the extent possible, be settled amicably between CSL and the Contractor. Any grievance in connection with the work/Contract can be addressed to the Grievance Redressal Committee of Cochin Shipyard Ltd. All representations to the Grievance Redressal Committee should be submitted to the Company Secretary, 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.
114. Any litigation in connection with Contract shall be subjected to the exclusive jurisdiction of the Courts at Kochi, India.
115. 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 CSL indemnified and harmless against any claims that may be against CSL in this behalf.
116. In execution of the Works no person other than the Contractor, sub-contractors and his and their employees shall be allowed on the site except by the written permission of the Engineer-in-Charge or his authorised representative, but the Engineer-in-Charge, his authorised representative, other authorities and officials of CSL shall be afforded to inspect all facilities arranged by the Contractor at site.
117. Prior to submission of bids, if required, bidders may carry out soil investigation. No cost or time claims on account of soil variation shall be entertained from the Contractor.
118. Contractor shall be responsible for the mobilisation all lifting tools and tackles, other required equipment and consumable, labour etc. for the subject work. Contractor shall make alternate arrangements promptly in case of breakdown of any machine during it's running condition.
119. Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any Contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than Indemnities. The total liability of the Contractor to the Employer, under or in connection with the Contract other than against Site Facilities provided by the Contractor, Indemnities and Intellectual and Industrial Property Rights shall not exceed accepted Contract price. However, the provisions of this clause shall not limit

liability in any case of fraud, deliberate default, acts of omissions or reckless misconduct by the defaulting Party.

120. 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. The Contractor shall not disclose to anybody the details of drawings prepared for the work without the approval of CSL. No photographs of the CSL area shall be taken or permitted by the Contractor to be taken by any of his employees without the approval of the competent authority and no such photographs shall be published, or otherwise circulated without the approval of CSL.
121. 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. 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.
122. The Contractor shall be responsible for the true and proper setting out of the works and for the correctness of the position, levels, dimensions, and alignment of all parts of the works and for the provision of all necessary instruments, 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 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.
123. Wherever earth work is provided in the tender, unless otherwise specified, such items include works such as dewatering, shoring, strutting etc., whether it is mentioned in the respective items or not. The rate for earth work includes all the above operations and nothing extra shall be paid for the same.
124. Foundation of temporary structures, if noticed, shall to be removed and trenches or holes thus created be filled back with earth. The Contractor should clear the site of debris, rubbish and balance materials including any built-up structures for construction purpose and clean the area, to the satisfaction of the Engineer-in-Charge when the work is completed, at no extra cost.
125. Measurement shall be as per relevant IS code IS 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.

126. 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.
127. For concrete works provisions of IS: 456 (2000) and its amendments shall be followed as general guidance, along with all other relevant Indian Standards, unless otherwise specifically mentioned. Contractor shall deploy mechanized system for production, transportation and placement of concrete.
128. 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. Necessary arrangements for casting and curing of concrete cubes for testing, collection of reinforcement steel/solid block samples etc. for testing shall be ensured by the Contractor. Sampling shall be done as per the direction of Engineer-in-Charge. CSL reserves the right to get concrete cubes, reinforcement steel, solid blocks etc. tested at CSL laboratory or any other NABL approved laboratories at its discretion. The charges for testing shall be borne by the Contractor or deducted by CSL from running account bills or any money due to the Contractor. Only materials conforming to specifications and approved by Engineer-in-Charge shall be used in permanent works.
129. 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 BIS 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 shall only be used by the Contractor.
130. Relevant I.S. codes are to be followed for all items of work. If any deviation for the work is found with this tender documents, Indian Standard specifications and Central Public Works Department specifications are to be followed. If specifications are silent about any aspect, other codes as directed by the Engineer-in-Charge will be followed. In the absence of any code dealing with particular aspect, sound engineering practice shall prevail. Decision of the Engineer-in-Charge in this respect will be final. In case there is a difference between Indian standard code and CPWD specification, the former shall prevail.
131. 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.
132. Contractor shall be permitted to use manufactured sand in place of “clean river sand” subject to the approval of Engineer-in-Charge. Each type of aggregate shall be stored separately for the approval

of the Engineer-in-Charge. Wet aggregate delivered at site shall be kept in storage for at least 24 hours to ensure adequate drainage before being used for concreting.

133. Waste materials to be disposed off from site by the Contractor without any additional cost.

134. COORDINATION

The Contractor will carry out the entire work in a planned manner by coordinating his work with other Contractors, who will be simultaneously carrying out work in the same area and also coordinate in connection with the position of various fixtures, inserts, embedment's and other allied work connected with the completion of the building / subject work.

In case of any dispute between the Contractors engaged on the same work, decision of In-Charge (Engineering Department) shall be final and binding.

135. The site being inside CSL Industrial Area, all precautions shall be taken to see that minimum disturbance is caused to the normal functioning of CSL. The Contractor shall not cause any obstruction in the premises and the roads while storing/ keeping the materials/ tools/ equipment. All care shall be taken to keep the premises clean without dumping any debris as far as possible.

136. The Contractor shall provide green shade nets all around in the executing site toprevent dust pollution to nearby working areas at no extra cost. The Contractor shalltake into consideration the above aspect while quoting for the work.

137. Cost of Laboratory & Field Test

The Contractor shall conduct the laboratory & field test for all the building materials as per the frequency mentioned in the tender/ IS Codes and as and when asked by Engineer-in-Charge. This includes load test, compaction test, etc for foundation, plinth filling, etc. The cost of all those tests shall be borne by the Contractor.

138. The Contractor shall submit Method Statements to CSL for the Approval soon after the Award of Work. Method Statement is a statement by which the construction procedures for important activities of construction are stated, checked and approved. Method Statement shall have description of the item with elaborate procedures in steps to implement the same, equipment to be used, precautions to be taken, etc.

139. Each of the Method Statements, when considered ready for use, be submitted to the Employer for review. Unless otherwise stated, each review by the Employer shall not exceed 21 days, calculated from the date on which the Employer receives the Method Statement. The Engineer-in-Charge shall be deemed to have provided with no objection for the Construction upon the expiry of the review periods for all the Construction which are relevant to the design and execution of such parts, unless the Engineer-in-Charge has previously notified otherwise.

The Employer may during the review period, give notice to the Contractor that a Method Statement fails (to the extent stated) to comply with the Employer's requirements, it shall be rectified, resubmitted and reviewed (and if specified, approved) in accordance with this Sub-clause, at the Contractor's cost.

Errors, omissions, ambiguities, inconsistencies. inadequacies and other defects if found at any stage in construction, then shall be rectified by the Contractor at his own cost and any approval or consent or review (under this sub-clause or otherwise) by the Employer of the Method Statement under this clause shall not relieve the Contractor from any obligations or responsibility under the Contract.

140. Technical Standards and Regulations

The design, the Construction andlor Manufacture Documents, the execution and the completed Works (including remedying of defects therein) shall comply with the specifications, technical standards, building construction, safety and environmental regulations and other standards specified in the Contract applicable to the Works or defined by the applicable laws and regulations.

141. Samples

The Contractor shall submit to the Engineer-in-Charge at his own cost samples and relevant information of the construction material used for the works.

142. Price Adjustment/ Escalation is not applicable in this Tender.

143. Field Testing Instruments

Following instruments in sufficient quantity as directed by the Engineer- in-Charge shall be made available by the Contractor. It shall be ensured that the instruments always remain in serviceable condition else the same will be replaced. In case of non-availability of instrument Engineer-in-Charge will purchase the same and the invoice amount will be deducted from the bill and will be bound to Contractor in the interest of work.

(1) Steel tapes – 3 m / 5m / 7.5m / 15m / 30m
(2) Vernier Calipers
(3) Micrometer screw 25 mm gauge
(4) A good quality plumb bob
(5) Spirit level, minimum 30 cms long with 3 bubbles for horizontal vertical
(6) Wire gauge (circular type) disc
(7) Foot rule
(8) Long nylon thread
(9) Rebound hammer for testing concrete
(10) Magnifying glass
(11) Ball pin hammer, 100gms
(12) Plastic bags for taking samples
(13) Total Station
(14) Auto level
(15) Step Ladder

144. The Contractor should make available a concrete Cube Testing Machine at site for testing of concrete cubes. In case Contractor is not able to arrange for such cube testing at site, the Contractor

shall test the cubes at an NABL approved lab as per IS code requirement and the details of the lab and the test results should be submitted to CSL.

145. All materials brought into CSL shall have material declarations in the name of Contractor with the work order number duly filled from the entry gate CISF officials. All material declarations shall be supported with purchase bills/invoices. Department's copy of material declaration forms (MDF) and copy of purchase bills/invoices shall be furnished before the Engineer-in-Charge or his representative. No payments will be made for items which are not backed by MDFs & purchase bills.
146. Upon completion of all the works/termination of Contract, the Contractor has to clear all the debris and make the work site area neat and tidy and dismantle and demobilize all plant and machinery, temporary structures etc. within a period of two weeks. The final bill shall be paid only upon compliance of same.
147. Contractor should avoid disturbance to the smooth flow of traffic along the CSL roads during the course of execution of work.
148. In case the Contractor proposes precast elements for part of structural elements, the same will be measured and paid as per the relevant item (RCC works and reinforcement) in Bill of quantities without any additional cost for lifting, Transportation, erection at site etc. Designing (if any) required to execute work or parts of work as pre-cast shall be in the scope of the Contractor. The same shall be submitted to CSL before commencement. Fabrication yard for pre-casting will not be allowed inside CSL. In the event of damage due to the precast unit the same shall be rejected by the Engineer and the Contractor shall remove the same from the site promptly.
149. All materials to be used for 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.
150. Contractor shall strictly adhere to the instructions of CSL during execution of work.
151. As some part of the site is currently adjacent to the Dry Dock project site being executed by M/s L&T, in case of access from that project site, the Contractor has to comply to the Entry/ Exit procedures, Gate Entry of L&T construction and make separate Gate Entry Reocrds of men, material and equipment brought through the Dry Dock project site.
152. The works should be carried out without any obstruction to the CSL operations and also works of other Contractors/ agencies.

Sd/-
Deputy General Manager (Infra Projects)
Cochin Shipyard Limited

Signature & Date

Name & Address of Contractor

TECHNICAL SPECIFICATIONS

1. GENERAL INFORMATION

1.1 Introduction

Cochin Shipyard Limited (CSL) is a premier Ship Building & Ship Repair Company and a Government of India Enterprise. CSL was incorporated in the year 1972 with a land area of 170 acres. CSL is located on the South Western coast of India at latitude 9^0 57' 14" N and longitude 76^0 17' 20" E, in the State of Kerala. Further details of the yard can be obtained from the website www.cochinshipyard.in.

CSL is developing its third Dry Dock at the Northern side of the CSL yard. In connection with the Dry Dock project, following Industrial Structures have to be established and commissioned inside CSL Industrial Area:

A) Fire Water Tank incl. pump house (semi-underground structure)
B) Industrial Water Tank incl. pump house (semi-underground structure)
C) Acetylene Room
D) Compressor House Cluster-1 and
E) Compressor House Cluster-2

The Civil Works associated with the construction of the above mentioned 5 Industrial Structures has to be executed in the subject Tender.

M&E Works associated with the above mentioned 5 Industrial Structures including design (incl. layout & dimensions of structures, foundation details of equipment), supply, installation, testing and commissioning of all equipment, piping, electrical works and instrumentation works are not covered in the scope of the subject Tender and will be executed by an existing M&E Contractor.

The broad scope of the Civil Works includes following :

- Structural design and construction of Fire Water Tank (incl. pump house), Industrial Water Tank (incl. pump house) on Lumpsum basis with Stage Payment as per the layout drawings provided by existing M&E Contractor.
- Construction of Acetylene Room, Compressor House Cluster-1, Compressor House Cluster-2 and Miscellaneous Items on Item Rate Basis as per the layout drawings and Good For Construction drawings issued by CSL.

The Civil Works pertaining to the construction of these structures is to be executed based on the General Civil Layout drawings freezed by the existing M&E Contractor. The scope of Civil Contractor also includes the installation of embedments provided by the existing M&E Contractor.

2. Scope of Works

A) Structural Design and Construction of Fire Water Tank and Industrial Water Tank (with pump houses for both) on Lumpsum basis

INDUSTRIAL WATER STORAGE TANK AND PUMP HOUSE

The new semi underground single compartment type Industrial Water Tank has to be constructed adjacent to existing Industrial Water Tank. The general layout is provided in Annexure-25. The pump house is located above the Industrial Water Tank. The structural design and construction of Industrial Water Tank and Pump House shall be done by the Contractor based on the layout drawings submitted by the existing M&E Contractor engaged by CSL. The scope of Civil Contractor also includes the installation of embedments provided by the existing M&E Contractor.

Details like foundations for the Pumps, Strainers, Piping Supports, pedestal for Panels and like included in the layout drawing provided by existing M&E Contractor. All embedments to be casted along with civil work shall be supplied by existing M&E Contractor. **The foundation of Industrial Water Tank has to be piled foundation.**

B) FIRE WATER TANK AND PUMP HOUSE

The new semi underground type Fire Tank is subdivided into two sections and with sluice valves opening to a common sump and shall follows the recommendations of NFPA 22 and National Building Code of India regulations. The fire pump house is located above the Fire Water Tank. The general layout is provided in Annexure-24. The structural design and construction of Fire Water Tank and Pump House shall be done by the Contractor based on the layout drawings submitted by the existing M&E Contractor engaged by CSL.

Details like foundations for the Pumps, Strainers, Piping Supports, pedestal for Panels and like included in the layout drawing provided by existing M&E Contractor. All embedments to be casted along with civil work shall be supplied by existing M&E Contractor. **The foundation of Fire water Tank has to be piled foundation.**

The Contractor has to carry out structural design and construction of Fire Water Tank and Industrial Water Tank (with pump houses for both) and prepare GFC drawings based on the structural design. The Civil Contractor should get the structural design and GFC drawings of Fire Water Tank and Indutrial Water Tank vetted by a reputed Govt. Institution before commencement of construction.The Civil Works pertaining to the construction of these structures is to be executed based on the General Civil Layout drawings submitted by the existing M&E Contractor. The Civil Contractor shall not be allowed to make any alterations in the General Civil Layout drawings, General Arrangement drawings, and Tank capacities freezed by the existing M&E Contractor unless approved by CSL.

The entire structural design of Fire Water Tank and Industrial Water Tank including their foundation, beams, slabs etc. has to be done by the Civil Contractor based on the Geotechnical Investigation Report provided along with the Tender and the equipment loads specified by existing M&E Contractor.

The scope of Civil Contractor also includes the installation of embedments provided by the existing M&E Contractor. Contractor will be eligible to receive Stage Payments incorporated against completion of Milestones of each Tank like design completion, completion of foundation etc. For the benefit of quoting, CSL has prepared a tentative list of items of work with specification to be executed for both the Tanks and the same can be seen at Annexure-31. Bidders should note that this list is not exhaustive and no claims on account of any variation in quanties, addition or deletion of any item of work shall be entertained from the Contractor during Execution Stage. After award of work, Contractor shall submit to CSL the complete list of items of work to be executed for both the Tanks along with corresponding quantities. The Stage Payment for both the Tanks shall be released based on this list of qunatities to be submitted by the Contractor. For those items listed in the tentative list of items of work, the corresponding items of work shall be executed as per the Specification provided therein unless otherwise approved by the Engineer-in-Charge.

C) Construction of Acetylene Room, Compressor House Cluster-1 and Compressor House Cluster-2 on Item Rate basis

The Civil Works pertaining to the construction of these structures are to be executed based on the General Civil Layout drawings submitted by the existing M&E Contractor. The Civil Contractor shall not be allowed to make any alterations in the General Civil Layout drawings and General Arrangement drawings freezed by the existing M&E Contractor unless approved by CSL.The drawings of these structures prepared by CSL may be seen along with this Tender.The drawings enclosed with the tender documents are meant only for the general guidance of the bidders. They are liable to change subject to any additions or deletions required later. The Engineer-in-Charge, Cochin Shipyard Limited reserves the right to make necessary changes to the drawings whenever required. Final detailed drawings, good for execution, shall be issued in due course. Any discrepancy found in the drawings and any variation of quantity available in the schedule with the drawings shall be brought to the notice of the Engineer-in-Charge before commencement of work. The scope of the Civil Contractor also includes the installation of embedments provided by the existing M&E Contractor.

D) Miscellaneous Works to be executed on Item Rate basis

Miscellaneous Works include the works for providing underground ducts encased in concrete to provide electrical power, control, FGDS and PAGA cables to the Industrial Structures along with construction of manholes, other miscellaneous works like rerouting of existing water pipeline, clearing jungle, dismantling & demolition works, supply & laying of interlocking paver blocks, tree cutting etc. all of which shall be executed on item rate basis.

If, during the course of carrying out these Works, the Civil Contractor damages any M&E work, the Civil Contractor shall be responsible for making all repairs at his own cost.The Contractor shall work in Coordination with existing M&E Contractor to ensure conflict free Construction/installation work. Any other work, assigned by CSL in the interest of the project, required to be conducted for project to be made functional and complete in all respect for its handing over to CSL.

3. GENERAL SITE DATA

Ground Level:

The finished ground level for the site shall be +3.0m CD

Water Table:

Highest ground water level for Civil structures to be used in the design shall generally be taken 0.7m to 1.0m below ground level, which is above the HWL. This is based on information from the ground investigation.

4. Geotechnical Investigation

A geotechnical investigation was carried out in Jul-Aug 2023 by EDC Geotechnical Consultants to investigate the ground conditions present on the site of the proposed industrial structures. The Geotechnical Investigation (GI) Report includes results of various tests conducted to determine the Physical and Engineering properties of soil samples collected from the seven boreholes (4 of 60m and 3 of 10m depth).The GI Report produced by EDC Geotechnical Consultants is enclosed at Annexure-32.

Prior to submission of bids, if any additional tests are required, bidders may carry out soil investigation. No cost or time claims on account of soil variation shall be entertained from the Contractor.

5. Foundation for the Structures:

The foundations for Industrial Water tank and Fire Water Tank have to be bored cast in-situ pile foundation. The Contractor shall be responsible for the design of piles for bearing capacity and settlement, its structural design and construction. Contractor shall demonstrate the load carrying capacity of the piles designed by the Contractor by conducting a routine pile load test by kentledge method as per IS 2911: Part 4 (2013) on a test pile sussessfully prior to the installation of working piles. If the pile load test fails, the Contractor shall install another test pile at Contractor's own cost and carry out the routine pile load test again. Payment for the pile load test shall be made only for a successful test and no payment shall be made for a failed test. Contractor can use a working pile as a test pile but the same shall be at Contractor's own risk. No separate payment shall be made for casting of test pile. If the pile load test done on a working pile fails, the Contractor will have to first redo the pile load test and after its suceesfull completion, reinstall the working pile (used as test pile initilally) after making necessary design changes to the overall pile layout.

For structures other than Industrial Water Tank and Fire Water Tank, the Contractor has to construct the piled raft foundations as per the drawings prepared by CSL.

6. Structural Design of Tanks

The Contractor shall carry out, and be responsible for, the full and complete structural design including reinforcement design, grade of concrete of following parts of Fire Water Tank and Industrial Water Tank including but not limited to the following:

a) RCC bearing piles : Design parameters for the bearing piles have to be ascertained based on the equipment loads provided by existing M&E Contractor as well as the dead load of the structure and based on relevant IS codes. The geotechnical investigation report may be refered for ascertaining the soil parametes. Bidders can undertake any further intrusive ground investigation and testing as he requires at the site before submission of price bid in order to confirm the ground conditions and shall determine the exact location and extent of such investigation as deemed necessary. It shall be noted that no claims on account of variation in soil parameters from geotechnical investigation report and actual site consitions or unforeseen geological conditions shall be entertained from the Contractor after award of work.Contractor's design of pile foundations should account for local variability of soil.
b) Piled raft structure including all structural elements therein.
c) RCC side walls incl. lintels etc.
d) RCC roofs of Tanks
e) Grade of concrete, reinforcement design of equipment foundations
f) Access Stairs
g) Pump Room including all structural elements therein

The works/buildings shall be designed to withstand static/dynamic loading (wind/seismic) and the design shall be strictly in accordance with the latest Indian Standard Code of Practices/National Building Code/extant guidelines. The structural analysis and design shall be done by using latest version of software packages e.g. STAAD Pro etc.. The provisions in various BIS Codes shall override the packages output. The structural drawing shall be got vetted from any Govt. Institution before issuance for execution of work at site, cost of which will be borne by the Contractor. Necessary water proofing works should be done to make the Tanks leakage free. The structural design has to be carried out as per the IS codes specified at sl. No. 26 below.

The Contractor shall supply all raw data, design calculations/computer input and output giving specific reference to BIS/NBC, alongwith soft copies.The structural drawing showing the reinforcement details / bar bending schedule shall be prepared as per latest edition of SP: 34 (S&T) & any other latest applicable Indian Standard code. All over-riding conditions prescribed by IS:13920 or any other BIS code shall be taken into account while preparing the structural drawings. The Contractor should submit Design Certificate for both the tanks.

7. As-Built Drawings

On completion of the Works, the Contractor shall submit two sets of "As-Built" drawings, along with soft copy (CAD version and PDF version) to CSL before the submission of the final bill. The "As-Built" drawings should include, pile layout, General Arrangements, layout drawings with dimensions, plans, section etc. and any other relevant drawing as required by CSL.

8. Issue of GFC Drawings by CSL

All the required GFC drawings for construction works of Acetylene Room and Compressor Clusters (2 Nos.) shall be progressively released by CSL. Contractor shall study the GFC drawings and in case of any additional drawings or clarifications required, the same shall be notified to CSL within 10 working days after the receipt of last set of GFC drawings from CSL. Further, no cost or time claims from the Contractor on account of delay in issue of GFC drawings shall be entertained by CSL. In case of any revisions or modifications required to be made based on site conditions and inputs from CSL, the same shall be issued as revisions to already issued GFC drawings within reasonable time after the observations are conveyed for incorporation. No time or cost claims on this account shall be entertained from the Contractor in this regard.

9. PREAMBLE TO THE BILL OF QUANTITIES

INTRODUCTION

i. Data provided in this Tender is tentative. Bidder is advised to ascertain accurate facts and detail from his own due diligence. Obligatory requirements given shall be followed scrupulously in the detailed design of all structures coming under the scope of this Tender. The modality of preparation and submission of design and drawings by the Contractor's and approval by the Engineer-in-Charge is given. The BoQ shall be read in conjunction with the "Conditions of Contract", "Technical Specifications", and "Drawings".

ii. The Bill of Quantities must be read with the Conditions of Contract, Drawings and the Specifications. It is deemed that the Contractor has examined the Drawings, Specifications, Conditions of Contract and visited the Site to get acquainted with the works to be done and the way in which they are to be carried out and all factors affecting the execution of the works and the costs thereof including temporary works if required to complete the works. No claim for lack of knowledge or misinterpretation in any areas of works shall be entertained.

iii. The quantities given in the Bill of Quantities are indicative only. Variation is permitted in quantity of each individual item. The rates quoted shall be firm for such variation up to the limit of 25% in respect of individual items and upto 10% of the Contract Value. In case the variation results in the total Contract Value exceeding the prescribed percentages, the revision of rates, if any, shall be applicable only for that portion of Contract carried out in excess of the permissible percentages. The rate payable shall be determined as given below:

   a. Rates and prices of relevant item in the Delhi Schedule of Rates 2023.

b. Market rates of material 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 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.Whichever is lower, but not less than the rate in the Bill of Quantities.

No claims shall be entertained from the Contractor for any downward variation.

iv. For items not existing in the Bill of Quantities (Extra work), rate payable shall be determined by methods given below and, in the order, given below and whichever is lower shall be paid;

a. Rates and prices of relevant item in the Delhi Schedule of Rates 2023.

b. Market rates of materials and labour, hire charges of plant and machinery used, plus 15% extra for overheads and profits of Contractor. Contractor has to furnish site observed data jointly certified by Contractor, employer 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 Substituted items, rate payable shall be determined as below:

c. 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 work/ Substituted items, rates as proposed by the Employer shall be payable provisionally till such time the rates are finally determined or till such date rates are mutually agreed.

For Industrial Water Tank and Fire Water Tank, Contractor has to execute all works in their footprint area except miscellaneous works like duct & manhole works etc. The lumpsum amount quoted should be inclusive of all works in the footprint area of the Tanks and nothing extra on this account shall be paid.

For other Industrial structures works shall be executed on item rate basis.

The quoted lumpsum amount for Industrial Water Tank and Fire Water Tank should include the cost for the entire piling works including pile design. Contractor has to consider all eventualities while quoting the rates of RCC piles.

10. <u>Stage Payment for Industrial Water Tank and Fire Water Tank</u>

Sl. No.	Stage	Specified limit (*) (Percentage of Contract Price corresponding to each part)
1	Structural Design & Drawings - Preparation	1% of lumpsum amount

	& approval	quouted
2	Completion of Foundation and bottom raft concrete	40% of lumpsum amount quouted
3	Completion of works of Underground Structure	35% of lumpsum amount quouted
4	Completion of Pump Room	20% of lumpsum amount quouted
5	Completion of activities towards final taking Over (This Stage Payment shall be released only after successful testing of tank after filling with water)	4% of lumpsum amount quouted
		100%

The Contractor shall carry out the routine load test at the existing ground level. The cost for building up the test pile to ground level, trimming off to cut-off level after the test shall be included in the quoted lumpsum amount for Fire Water Tank.

Rates shall include labour, materials, tools, plants, appliances, transport, equipment, taxes, duties, levies, water and electric power supply, metering and consumption charges, temporary plumbing, cost of cistern sheds for materials, Contractor's supervision, overheads, profits, general risks or liabilities and all that is necessary for the satisfactory completion of the job. The rates shall be firm and shall not be subject to exchange variations, labour conditions or any conditions whatsoever other than what is approved in the Contract.

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

In case any leakages are noticed during the testing of Tanks the same shall be rectified by the Contractor at no extra cost.

11. EXAMINATION OF WORK BEFORE COVERING-UP

a) No work shall be covered up or put out of view without the approval of CSL and the Contractor shall afford full opportunity to the CSL to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. The Contractor shall give due notice to the CSL wherever any such work or foundation is ready or about to be ready for examination.

b) The Contractor shall uncover any part or parts of the works or make opening in or through the same as CSL may, from time to time, direct and shall reinstate and make good such part or parts to the satisfaction of CSL. The expenses of uncovering, making openings in or through, reinstating and making good the same shall be borne by the Contractor.

c) CSL shall during the progress of the works have power to order the following in writing from time to time of which no extra payment will be made to the Contractor. a) The removal from the site within such time or times as may be specified in the order of any

materials which in the opinion of CSL are not in accordance with the Contract. b) The substitution of proper and suitable materials.

12. CONTRACTOR'S DESIGN OBLIGATIONS

Design Requirement

1. The Contractor shall be deemed to have scrutinised, prior to the Commencement Date, the Design Criteria, Specifications and Drawings and all subordinate and supporting documents. The Tender Documents contains Tender level drawings and specifications.
2. The Engineer-in-Charge shall not be responsible for any error, inaccuracy or omission of any kind in the Design Criteria, Concept, Specifications or the Drawings as originally included in the Contract and shall not be deemed to have given any representation of accuracy or completeness of any data or information, except as stated specifically. In the event of, if finding a discrepancy, difference or conflict between documents, then the resolution, thereof, shall be interpreted and applied to the benefit and in favour of the Engineer-in-Charge.
3. Any data or information received by the Contractor, from the Engineer-in-Charge or otherwise, shall not relieve the Contractor from his responsibility for the full, thorough and complete design of that part of the Works to be designed by the Contractor as required under the Contract and for the execution of the Works.
4. The Contractor shall carry out, and be responsible for, the full and complete design of the Works based on the layout drawings submitted by the existing M&E Contractor and the Geotechnical Investigation Report enclosed in Annexure-32.
5. All Contractors' design documents shall include revision numbering and issue dates.
6. The Contractor holds himself, and his Designers/ structural engineers as having the experience and capability necessary for the design. The Contractor undertakes that the Designers/ structural engineers shall be available to attend discussions with the Employer at all reasonable times during the Contract Period.
7. The Designer/ structural engineer shall be the same entity as proposed by the Contractor at the time of Tendering, unless otherwise approved by the Employer. The Contractor shall furnish Designer's Warranty in the format approved by the Employer.

13. Contractor's Warranty of Design

1. The Contractor shall be fully responsible, for the suitability,adequacy, warranty of integrity, durability and practicality of the Contractor's proposal and design.
2. The Contractor warrants that the Contractor's Proposals and design meet the Employer's Requirements and is fit for the purpose thereof. Where there is any inadequacy, insufficiency, impracticality or unsuitability in or of the Employer's Requirements or any part thereof, the

Contractor's Proposal shall take into account, address or rectify such inadequacy, insufficiency, impracticality or unsuitability at Contractor's own cost.

3. The Contractor warrants that the Works have been or will be designed, manufactured, installed and otherwise constructed and to the highest standards available using proven up-to-date good practice.
4. The Contractor warrants that the Works will, when completed, comply with enactments and regulations relevant to the Works.
5. The Contractor warrants that the design of the Works have taken or will have taken full account of the effects of the intended installation/ execution methods, Temporary Works and Contractor's Equipment.
6. The Contractor shall also provide a Guarantee from the Designer for the design for suitability, adequacy, practicality of design for Employer's Requirements.
7. The Contractor shall indemnify the Employer against any damage, expense, liability, loss or claim, which the Employer might incur, sustain or be subject to arising from any breach of the Contractor's design responsibility and/or warranty set out in this Clause.
8. The Contractor further specifies and is deemed to have checked and accepted full responsibility for the Contractor's Proposal and warrants absolutely that the same meets the Employer's Requirements:

i. Notwithstanding that such design may be or have been prepared, developed or issued by the Employer, any of Contractor's Consultants, his Sub-Contractors and/or his qualified personnel/persons or cause to be prepared, developed or issued by others.

ii. Notwithstanding any warranties, guaranties and/or indemnities that may be or may have been submitted by any other person.

iii. Notwithstanding that the same have been accepted by the Employer.

The Contractor shall be fully responsible for the Plants, Materials, goods, workmanship, preparing, developing and coordinating all design Works to enable that part of the Works to be constructed and/or to be fully operational in accordance with the Contract's requirements.

Apart from the Contractor, the above warranty shall also be applicable for his Designer. This warranty shall be a part of his Sub-Contract with the Designer and should be made available at the time of signing of the Agreement.

No claim for additional payment or extension of time shall be entertained and/or the Contractor shall not be relieved from any obligation/liability under the Contract, for any delay, suspension, impediment to or adverse effect upon the progress of the Works due to any mistake, inaccuracy, discrepancy or omission in or between the Contractor's, the Definitive Design and the final design, or any failure by the Contractor to prepare any Design Data or submit the same to the

Employer in due time and the Contractor shall promptly make good any such defect at his own cost.

14. Design Review

The Contractor shall submit the detailed design (incl. design calculations and drawings) to the TPR for review prior to submitting to the Engineer-in-Charge. The Engineer-in-Charge will review the Contractors Design Documents and may issue a notice of no objection based on the Design concurrence by Third Party Reviewer. The Engineer-in-Charge's review is for general compliance with the criteria, scope of work and intent of the Contract in accordance with the Specifications and the Drawings. The Engineer-in-Charge's review may not cover the Technical or Engineering part of the Contractor's Documents. The Contractor remains solely and totally responsible for the thoroughness and quality of the Contractor's Documents.**Structural Stability Certificate for both the Tanks (incl. Pump House) certified by the above said Third Party shall be submitted prior to Taking Over of the Works.**

Classification of Contractor's Design Documents

Following review of the Contractor's design documents, the Engineer-in-Charge shall reply to the Contractor with a classification of the Contractor's documents as follows:

Classification Category	Definition	Action by Contractor
1	The Contractor's Document is acceptable without comment.	Contractor may proceed with construction.
2	The Contractor's Document is acceptable subject to changes or clarification requested by the Engineer-in-Charge.	The Contractor shall make the changes requested prior to commencement of construction.
3	The Contractor's Document is unacceptable for the reasons given by the Engineer-in-Charge. Construction work shall not commence.	The Contractor shall revise the document and resubmit to the Engineer-in-Charge for further review.

15. General Design Obligations

The Contractor shall carry out, and be responsible for, the design of the Works where stated in the Contract. Design shall be prepared by qualified designers who are Structural Engineers (M-Tech holder), well experienced with fair track record. Unless otherwise stated in the Contract, the

Contractor shall submit to the Engineer-in-Charge for consent the name and particulars of each proposed designer and design Sub-Contractor.

The Contractor warrants that he, his designers and design Sub-Contractors have the experience and capability necessary for the design. The Contractor undertakes that the designers shall be available to attend discussions with CSL at all reasonable times, until the expiry date of the relevant Defects Liability Period.

The Contractor shall indemnify CSL from and against all claims and proceedings on account of infringement (or alleged infringement) of any patent rights, registered designs, copyright, design, trademark, trade name, know-how or other intellectual property rights in respect of the Works.

It shall be the responsibility of the firm to ensure structural stability of the Tanks. The total design of the Tanks shall be done to meet the Tank Capacity and equipment layouts given in the layout drawings by existing M&E Contractor.

i. If at any time, the Contractor makes a change to the design, the Contractor shall re-submit the same for further review and the above procedure shall again be adhered to.
ii. All submissions shall be in electronic format (AutoCAD + working calculation files plus record copy in PDF format) and hardcopy. The design submission shall include detailed design calculations, results / recordings of all investigation work, and detailed drawings.
iii. CSL may, within the review period, give notice to the Contractor that a Contractor's design fails (to the extent stated) to comply with the Contract. If a Contractor's design so fails to comply, it shall be rectified, resubmitted and reviewed again (and, if specified, approved), at the Contractor's cost and time.

The Employer has provided Tender level details in the Tender Document to provide the Contractor with sufficient information so as to clearly understand the Employer’s intent, goals and objectives in execution of the works. The Contractor will be required to adopt the general concepts, as provided, and expand and develop the same to produce complete, thorough, comprehensive and high quality designs, working drawings, and specifications for review and approval of the Employer. While developing the complete and final designs and specifications, the Contractor shall review the concept details, planning and specifications provided by the Employer to become intimately familiar and fully understand the Employer’s intent and also to identify betterments or improvements, if any, which may be considered, and incorporated, to better achieve the Employer’s goals and objectives in providing highly efficient and functional facilities. These betterments, if any, shall be submitted by the Contractor for review and subsequent approval by the Employer prior to the commencement of final design.

16. Design Errors

If errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the Contractor's Documents, they and the Works shall be corrected at the Contractor's cost, notwithstanding any consent or approval.

17. Contractor's Warranty of Design

a. The Contractor shall be fully responsible, for the suitability, stability, adequacy, integrity, durability and practicality of the Contractor's design.

b. The Contractor warrants that the Contractor's design meet the specifications, design parameters and is fit for the work. Where there is any inadequacy, insufficiency, impracticality or unsuitability in or of the specifications or any part thereof, the Contractor's design shall take into account, address or rectify such inadequacy, insufficiency, impracticality or unsuitability at Contractor's own cost.

c. The Contractor warrants that the Works have been or will be designed, manufactured, installed and otherwise constructed and to the highest relevant standards using proven up-to date Engineering practices.

d. The Contractor warrants that the Works will, when completed, comply with enactments and regulations relevant to the Works.

e. The Contractor warrants that the design of the Works have been taken into account or will have to be taken full account of the effects of the intended use of these structures.

f. The Contractor shall also provide a guarantee from the Designer for the design for suitability, adequacy, and practicality of design for Specifications.

g. The Contractor shall indemnify the Employer against any damage, expense, liability, loss or claim, which the Employer might incur, sustain or be subject to arising from any breach of the Contractor's design responsibility and/or warranty set out in this Clause.

h. The Contractor further specifies and is deemed to have checked and accepted full responsibility 'for the Contractor's manner of execution and warrants absolutely that the same meets the Specifications:

i. The Contractor warrants that he, his design firm, designers and design Sub-Contractors, if any, have the experience and capability necessary for producing a complete, thorough and quality design that meets or exceeds all Engineer-in-Charge's requirements and complies with all applicable codes. The Contractor is required to ensure that the key personnel of the design firm shall be available to attend meetings and/or discussions with the Engineer-in-Charge, as may be required by the Engineer-in-Charge, until the expiry of date of the relevant Defects Liability Period.

j. The design drawing shall not be allowed to be copyright without the approval of the CSL and shall be the property of the Employer.

k. The Contractor shall be fully responsible for the Plants, Materials, goods, workmanship, preparing, developing and coordinating all design Works to enable that part of the Works to be constructedand/or to be fully operational in accordance with the Contract's requirements.

l. No claim for additional payment or extension of time shall be entertained and/or the Contractor shall not be relieved from any obligation/liability under the Contract, for any delay,

suspension,impediment to or adverse effect upon the progress of the Works due to any mistake, inaccuracy,discrepancy or omission in the Contractor's design.

m. No review and/or observation of the TPR/ Employer and/or its failure to review and/or convey its observations on any design/ drawings shall relieve the Contractor of its obligations and liabilities under this Contract in any manner nor shall the TPR/ Employer be liable for the same in any manner; and if errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the design/ drawings, they shall be corrected, along with the affected Works, at the Contractor's cost, notwithstanding any Approval granted.

18. Third Party Reviewer (TPR)

The structural design calculations and detailed drawings should be got vetted by any reputed Govt. Institution. Contractor may submit the same set of document to CSL for getting the approval. Comments/corrections by Third party agency/CSL should be incorporated and executed at site at no extra cost to CSL.

19. Third Party Certification

1. All the design calculations and reports shall be duly vetted by reputed Third Party Agencies and accordingly, a certificate shall be enclosed along with each submission for review and approval of the Employer.
2. Mere certification from the Third Party Agencies shall not relieve the Contractor from fulfilling his Contractual obligations. The Contractor is responsible for the successful completion of the Works and the Works shall serve the required design life.

20. Quality Review

a. The Contractor is required to implement a highly effective and thorough QA/QC program. The Contractor will ensure that the final design is complete and thorough and meets all quality standards as contained in the Contractors Quality Management Plan and meets the Engineer-in-Charge's Requirements.

b. Examination and/or approval by the Engineer-in-Charge of any drawings or other documents submitted by the Contractor shall not relieve the Contractor of his obligations, responsibilities or liabilities under the Contract.

c. If the Engineer-in-Charge instructs that further Contractor's Documents are required, the Contractor shall prepare them promptly.

d. Nothing done or omitted by the Engineer-in-Charge shall relieve the Contractor of his duty or responsibilities or liabilities under the Contract.

21. Contractor's Undertaking

The Contractor shall undertake that the design of that part of the Works to be designed by the Contractor will be in accordance with:

a. The Laws, Regulations and Codes of the Country;

b. All documents forming the Contract

The Contractor shall be responsible for the completion of the design of the Works, and when the Works are completed for ensuring, that they are fit for such purposes for which the part or whole is intended as are specified in, or implied by, the Contract. Nothing done or omitted by the Engineer-in-Charge shall relieve the Contractor of his duty or responsibilities or liabilities under the Contract.

22. Technical Standards and Regulations

The design of the Works to be designed by the Contractor shall comply with the country's technical standards, building, construction and environmental laws, laws applicable to the product being produced from the Works and other standards specified in the Engineer-in-Charge's Requirements, applicable to the works, or defined by the applicable laws.

23. Design Error

If errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the Contractor's Documents, they and that part of the Works to be designed by the Contractor shall, subject to the approval of the Engineer-in-Charge, be corrected at the Contractor's cost and time, notwithstanding any consent or approval under this Clause.

24. Requests for Information

Where the Contractor requires additional information or clarification in order to carry out the Works, or where he identifies any ambiguity or inconsistency in the Contract Documents he shall immediately submit to the Engineer-in-Charge a Request for Information (RFI). The response for RFI shall normally be given within seven (7) days after receiving the same.

The Request for Information forms shall be provided with a sequential number or reference to facilitate tracking by the Engineer-in-Charge.

25. Notice to the Engineer-in-Charge

a. Unless specified otherwise elsewhere in this Specification, the Contractor shall give the Engineer-in-Charge not less than 24 hours' notice in writing of the intended time for commencement of any construction activities to enable the Engineer-in-Charge to make his arrangements for the inspection of operations on the Site.

b. The Contractor shall also give the Engineer-in-Charge not less than seven (07) days' notice in writing of the commencement of any preparation, construction or manufacturing activity occurring at the manufacturer's or supplier's site, or at a location not within the manufacturer's or supplier's site, of any article or material to be used in the works, whether by the Contractor or any SubContractor, stating the time and place of the works such that the Engineer-in-Charge may make his arrangements for the supervision or inspection of such works at the manufacturer's or supplier's site.

26. Codes and Standards

The codes and standards stated here below or elsewhere shall be the latest editions. All materials, testing, design and execution shall be in conformity with these codes and standards unless otherwise stated in the specifications. Indian Standards shall generally be followed. In case, any work or item is not covered by the Indian Standards, following standards shall be adopted in order of preference.

1. British Standards

2. American Standards

3. General Standards

Table 2 provides a list of the primary codes and guidelines which will be used for the structural design of the structures. A consistent set of standards will be used for each element of the works, with supplementary codes and guidelines used where additional requirements are needed.

Table 1. Codes and Standards

IS 456: 2000	Plain and Reinforced Concrete – Code of Practice, Fourth Revision
IS 800: 2007	General Construction in Steel – Code of Practice, Third Revision
IS 875 (Part 1): 1987	Code of Practice for Design Loads (Other than Earthquake) for Building and Structures - Part 1, Dead Loads – Unit Weight of Building Materials and Stored Materials, Second Revision Incorporating Amendment No.1, Reaffirmed 1997
IS 875 (Part 2): 1987	Code of Practice for Design Loads (Other than Earthquake) for Building and Structures - Part 2, Imposed Loads, Second Revision, Reaffirmed 1997
IS 875 (Part 3): 1987	Code of Practice for Design Loads (Other than Earthquake) for Building and Structures - Part 3, Wind Loads, Second Revision, Reaffirmed 1997
IS 1893 :1984	Criteria for Earthquake Resistant Design of Structures
IS 1893 (Part 1): 2002	Criteria for Earthquake Resistant Design of Structures - Part 1: General Provisions and Buildings, Fifth Revision
IS 2911 (Part 1/Sec2)	Code of Practice for Design and Construction of Bored Cast In situ Piles
IS 2911 (Part 4)	Load Test On Piles
IS 13920 :1993	Ductile detailing of reinforced concrete structures subjected to seismic forces
IS 6403 :1981	Code of Practice for Determination of Bearing Capacity of Shallow Foundations
EN 1998	Eurocode 8 : Design of structures for Earthquake resistance
IS 3370	Code of Practice for Concrete Structures for the Storage of Liquids
	National Building Code

27. Design Life

The design life of Industrial Water Tank and Fire Water Tank shall be 100 years.

Above design lifeis defined as a period within which the asset will continue to be serviceable for design loads without collapse subject to the regular inspection and preventive maintenance but not the major repairs and rebuilding.

28. Materials

- Grades of concrete shall be minimum M40 for sub structure and super structure.
- Grade of steel shall be thermo-mechanically treated steel Fe500D or above
- Grade of structural steel shall be as per IS:2062 (Grade-A) with minimum thickness of 10 mm
- Grade of Stainless Steel shall be SS 304 or above.

29. Minimum Cover

Clear cover to any reinforcement shall be as mentioned here under but shall not be less than the diameter of such reinforcement.

Table 3: Clear Cover to Structures

Pile	75 mm
Top, bottom & side of footing (if any)	50 mm
Top, bottom & side of footing (if any)	50 mm
Pedestal / column (Below ground or Above ground)	50 mm
Beams	40 mm
Slab	25 mm
Face of walls & grade beam (in contact with soil)	50 mm
Face of walls not exposed to soil	50 mm

30. Loads

Dead Load

Dead loads shall include the weight of all structural and architectural components and other permanently applied external loads. The unit weight of all other materials shall satisfy the requirements of IS: 875: Part1.

Environmental Load

- Wind
  Wind loads shall be considered in accordance with IS 875: Part3.
  - Basic Wind Speed in storm condition : 39 m/s
  - Basic Wind Speed in operating condition : 18 m/s
- Seismic
  Seismic force shall be calculated according to IS 1893. As per IS code, Cochin is under Zone III. Following factors shall be considered in seismic force calculations:
  - Zone factor : 0.16 (Corresponding to seismic zone III)
  - Importance factor : 1.50
  - Response reduction factor : 3

Live Loads

Live loads on the roof/floor of the structures shall be arrived from IS: 875: Part2.

Equipment loads

The details of equipment loads are provided in the general layout drawing prepared by the existing M&E Contractor (Annexures-24 to 28).

Load Combinations

The load combinations shall be in accordance with IS875: Part 5.

Note:

- In addition, load due to earth pressure/surcharge shall be considered as per specific structures requirement
- Underground tank shall be checked for Uplift in empty condition. Minimum factor of safety against uplift shall be 1.2.
- Earth pressure may be arrived based on the GI report enclosed at Annexure-32

Deflection Limits

For steel structures, conform to IS 800: 2007, Clause 5.6.1, Table 6 for reinforced concrete structures, conform to IS 456: 2000, Clause 23.2.

Crack Width Limits

Crack width of all the structural elements shall be calculated wherever necessary as per IS 456: 2000 and limiting Crack width for all structural components below ground and in contact with water shall be 0.2 mm and for structural elements above ground shall be 0.3 mm.

31. Intellectual Property Rights and Royalties

The Contractor shall indemnify the Employer and the Engineer-in-Charge from and against all claims and proceedings on account of infringement (or alleged infringement) of any patent rights, registered designs, copyright, design, trademark, trade name, know-how or other Intellectual Property Rights in respect of the Works, Contractor's Equipment, machines, work method, or Plant, or Materials, or anything whatsoever required for the Works and from and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. The Contractor shall pay all traffic surcharges and other royalties, licence fees, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials, machine, process, systems, work methods, or Contractor's Equipment required for the Works. The Contractor shall, in the event of infringement of Intellectual Property Rights, rectify, modify or replace at his own cost the Works, Plant or materials or anything whatsoever required for the Works so that infringement no more exist or in the alternative shall procure necessary rights/license so that there is no infringement of Intellectual Property Rights.

The Contractor shall be promptly notified of any claim under this Sub- Clause made against the Employer. The Contractor shall, at his cost, conduct negotiations for the settlement of such claim, and any litigation or arbitration that may arise from it. The Employer shall not make any admission which might be prejudicial to the Contractor, unless the Contractor has failed to take over the conduct of the negotiations, litigation or arbitration within a reasonable time after having been so requested. In the event of Contractor failing to act at Engineer-in-Charge's notice, the Employer shall be at full liberty to deduct any such amount of pending claim from any amount due to the Contractor under this Contract or any other Contract

Insofar as the patent, copyright or other intellectual property rights in any Plant, Design Data, plans, calculations, drawings, documents, Materials, know-how and information relating to the Works shall be vested in the Contractor, the Contractor shall grant to the Employer, his successors and assignees a royalty-

free, non- exclusive and irrevocable licence (carrying the right to grant sub-licences) to use and reproduce any of the works, designs or inventions incorporated and referred to in such Plant, documents or Materials and any such know-how and information for all purposes relating to the Works (including without limitation the design, manufacture, installation, reconstruction, Testing, commissioning, completion, reinstatement, extension, repair and operation of the Works),

If any patent, registered design or software is developed by the Contractor specifically for the Works, the title thereto shall vest in the Employer and the Contractor shall grant to the Employer a non-exclusive irrevocable and royalty- free licence (carrying the right to grant sub-license) to use, repair, copy, modify, enhance, adapt and translate in any form such Software for his own use.

If the Contractor uses proprietary software for the purpose of storing or utilising records, the Contractor shall obtain at his own expense the grant of a licence or sub-licence to use such software in favour of the Employer and shall pay such licence fee or other payment as the grantor of such licence may require provided that the use of such software under the licence may be restricted to use relating to the design, construction, reconstruction, manufacture, completion, reinstatement, extension, repair and operation of the Works or any part thereof.

The Contractor's permission referred to above shall be given, inter alia, to enable the Employer to disclose (under conditions of confidentiality

satisfactory to the Contractor) programmes and documentation for a Third Party to undertake the performance of services for the Employer in respect of such programmes and documentation.

If any software is developed under the Contract or used by the Contractor for the purposes of storing or utilising records over which the Contractor or a third Party holds title or other rights, the Contractor shall permit or obtain for the Employer (as the case may require) the right to use and apply that Software free of additional charge (together with any modifications, improvements and developments thereof) for the purpose of the design, manufacture, installation, reconstruction, testing, commissioning. completion, reinstatement, extension, repair, modification or operation of the Works, or any part thereof, for the purpose of any Dispute.

The Employer reserves the right to use other Software on or in connection with the Works.

32. DETAILED TECHNICAL SPECIFICATIONS

A.DISMANTLING AND DEMOLITION WORK

1. General

All materials obtained from dismantling or demolition shall be the property of the Employer unless otherwise specified and shall be kept in safe custody until they are handed over to the Employer's authorised representative. The demolition shall always be well planned before hand and shall generally be done in reverse order of the one in which the structure was constructed. The operations shall be got approved from the Engineer-in-Charge before starting the work. It is necessary to keep noise and dust nuisance to the minimum. All work needs to be done under the direction of Engineer-in-Charge. Helmets, goggle, safety belts etc. should be used whenever required and as directed by the Engineer-in-Charge. The demolition work shall be proceeded in such a way that it causes the least damage and nuisance to the adjoining building and the public. Chisels and cutters may be used carefully as directed. The dismantled

articles shall be removed manually or otherwise, lowered to the ground (and not thrown) and then properly stacked as directed by the Engineer-in-Charge.Disposal location shall be outside CSL premises unless otherwise specified.

The Contractor shall maintain/disconnect existing services, whether temporary or permanent, where required by the Engineer-in-Charge. Temporary barricade should be providing where dismantling is commenced before work starts.

2. Measurements

Taking down walls and independent piers or columns of brick, stone or concrete shall be measured, in cubic meters. All copings, corbels, cornices and other projections shall be included with the wall measurements. In measuring thickness of plastered walls, the thickness of plaster shall be ignored. All steel and iron work shall be measured in kg. The weight shall be computed from standard tables unless the actual weight can readily be determined.

B. EARTHWORK

1. Excavation

The work to be done under this section comprise performance of all work necessary for excavation with shoring, dewatering, pumping including disposing of all surplus excavated material from the site to suitable location as directed by the Engineer-in-Charge. Excavation shall be carried out in any type of soil, gravel, conglomerate, soft rock, boulders, old foundation, hard rock, concrete, asphalt or stone paved surfaces old masonry or concrete (plain or reinforced) encountered within width, length and depths indicated in the drawings. Where directed by the Engineer-in-Charge trees encountered within the work site shall be uprooted as per approved manner and serviceable wooden logs shall be stacked at site / disposed of as directed by the Engineer-in-Charge. Branches of trees etc. shall be disposed of or stacked at site as directed by the Engineer-in-Charge. No permanent work shall be commenced in the excavated area until the foundations pits have been inspected and approved by the Engineer-in-Charge.

The Contractor may use any suitable excavated materials for incorporation in the permanent or temporary works as may be convenient subject to compliance with the specifications. Any obstacles encountered during excavation shall be reported immediately to the Engineer-in-Charge and shall be dealt with as directed by the Engineer-in-Charge. Before the work commences the Contractor shall carry out a survey of the levels of the site and obtain verification by the Engineer-in-Charge of these levels.

The Contractor shall adequately support the sides of excavation as may be necessary to prevent subsidence or movement of the material in which the excavation is being carried out and to ensure the safety of persons and nearby structures. The Contractor shall take all necessary precautions to prevent slips in excavations and shall at his own make good any damage or defect and remove to spoil dumps any surplus material caused by slips.

While execution of works, if so encountered, the Contractor shall provide for the purpose of excavation under water all the necessary dewatering equipment like well points, pumps (including stand byes), pipes, conduits, etc. and make necessary arrangement for proper drainage of the pumped water from the well points and its easy disposal without affecting the site and the adjoining areas. Any permission required for such disposal of water to other areas, shall be taken from the respective authorities by the Contractor at his own cost.

While earthwork excavation is carried out near to any existing structure, utmost care should be taken to avoid any damage to the nearby structure by giving proper shoring etc. No extra claim is admissible on this account. If any damage occurs to the existing structure the same should be rectified at Contractor's cost.

2. Earthwork in Filling and Site Clearing

Filling is to be carried out up to the level as shown in the drawing. Unless otherwise specified, selected excavated earth shall be used for refilling. For general area filling for raising formation level selected earth shall be used as directed by the Engineer-in-Charge. Before filling of such area existing top soil shall be scarified to remove all vegetation and soft or debris already existing. After cleaning of debris etc. the top soil shall be compacted before filling with any new soil. In case the filling earth contains deleterious salts it shall not be used. Approval of filling materials is to be obtained well in advance to commencement of work. All clods of earth shall be broken or removed. Where the excavated material is mostly rock with boulders, the boulders shall be broken into pieces not bigger than 7.5 cm size in any direction mixed with fine materials consisting of decomposed rock, moorum or earth so as to fill up the voids as far as possible and then the mixture used for filling, as approved by the Engineer-in-Charge. However the decision / instructions of the Engineer-in-Charge shall be final.

Compaction of earth filling the degree of compaction achieved shall be good enough to obtain maximum dry density. After the compaction of each layer, the next layer of filling shall not be permitted to be deposited until the Engineer-in-Charge is satisfied that the previous layer has achieved required compaction. The Contractor shall inform the Engineer-in-Charge in writing for inspection after filling and compaction of each layer. If any particular layer fails to meet the required compaction, it shall be re-compacted as directed by the Engineer-in-Charge. Such re-compaction shall be continued till the desired compaction is achieved. The thickness of each compacted layer shall not exceed 150 mm or as approved by Engineer-in-Charge.

The filling after it reaches the required level, shall be dressed and finished as specified to the required alignment, levels, cross sections, dimensions and slopes as shown in the drawing or as directed by the Engineer-in-Charge. No deviation shall generally be allowed from the levels shown in the drawings.

Compaction of Excavated Surfaces

Where instructed by the Engineer-in-Charge the bottom of excavations shall be re-compacted to achieve at least 90-95% of the maximum dry density determined in accordance to IS 2720.

Backfilling around Structures

The Contractor shall obtain the approval of the Engineer-in-Charge before commencing backfilling over or around any structure. Backfilling shall be carried out using approved selected excavated, or imported (not from outside of India), general fill materials and these shall be placed and compacted evenly in layers not exceeding 150 mm in depth or as approved by Engineer-in-Charge. The compaction shall be arranged to achieve 90-95% of the maximum dry density determined in accordance with IS 2720.

C. CAST –IN-PLACE CONCRETE BORED PILE:

Cast-in-place R.C.C piles for Industrial Tank and Fire Water Tank shall be structurally designed and constructed by the Contractor after geeting the structural design vetted by a Third Party.

The Contractor shall prepare particulars of complete construction methods forthe above and submit the same to the Engineer-in-Charge for his approval. The Contractor shall be required to employ an experienced surveyor who shall set up the positions of the piles as shown in pile layout plan with Total Station survey equipment.

Trunk section of pile to be cast shall have longitudinal bars in place bound uptightly and tack welded with spiral members so as to form reinforcement assembly. For the purpose of securing reinforcements in position, tie-hoops shall be inserted at several levels along the entire length of piles and welded to the main reinforcements or any other suitable means. A minium cover of 75mm shall be provided.

Materials for the pile:

Concrete and reinforcements to be used for the piles shall be tested as specified in relevant IS, and the results shall be reported to the Engineer-in-Charge in writing as soon as practicable.

PILE INSTALLATION

Cleaning of Pile bore

Pile bore shall be cleaned by flushing through tremie pipe after placingreinforcement and just before start of concreting. Flushing is to be continued tillpile bore bottom is thoroughly cleaned to make it free from sludge or any foreign matter before and after placing the reinforcement cage.

Concreting

Concreting shall not be done until the Engineer-in-Charge is satisfied that the bearing strata (soil/rock) met with at the termination level of pile. SPT shall be conducted as directed by the Engineer-in-Charge wherever required.

The time interval between the completion of boring and placing of concrete shall not exceed 6 hrs. In case the time interval exceeds 6 hrs the pilebore shall be abandoned. However, the Engineer-in-Charge may allow concreting provided the Contractor extends the pile bore by 0.5 m beyond the proposed depth, and clean the pile bore. The entire cost of all operation and materials for this extra length shall be borne by the Contractor.

Cut off level (COL)

Cut off level of piles shall be as indicated in the approved drawings.

The top of concrete in pile shall be brought above the COL to atleast 1.0 metre to remove all laitance and weak concrete and to ensure good concrete at COL for proper embedment in to pile cap.

When the pile cut off level is less than 1.0 metre below the working level, concrete shall be cast to the piling platform level to permit overflow of concrete for visual inspection. In case COL of pile is more than 1.0 metre below working level then concrete shall be cast to a minimum of 1.0 metre above COL.

Breaking off of Piles

If any pile already cast, requires breaking due to lowering in cut off level or for any other reason, then the same shall be carried out, not before seven days of casting without affecting the quality of existing pile such as loosening, cracking etc. and to the satisfaction of the Engineer-in-Charge.

Preparation of Pile head

The exposed part of concrete above the COL shall be removed/chippedoff and made to a uniform level at COL with a mechanical cutter neatly,but not before seven days of casting of pile and as directed by the Engineer-in-Charge. The projected reinforcement above COL shall be properly cleaned and bent to the required shape and level to be anchored into the pile cap.

Contractor shall observe and comply with the following while installing cast-insitu piles using bentonite suspension.

Bentonite suspension shall be prepared using fresh water and sodium bentonite and shall be mixed properly. Consistency of the drilling mud suspension shall be controlled throughout the boring as well as concreting operations in order to keep the hole stabilized.

Before a pile is concreted the bottom of the bore hole shall be cleared of allloose materials. The bore hole shall be flushed with fresh drilling mud beforeconcreting. The depth of the hole shall be measured with respect to a suitabledatum.

Concreting of bore holes shall start as soon as possible after its completion. The bottom of bore hole shall be cleaned thoroughly before reinforcement cage islowered into the bore hole. Before commencement of concreting the crosssection of the bore hole be checked by lowering a hollow pipe of appropriate diameter or any other means to check the bore hole is clear of the minimal dimension noted in the drawing. Tremie

pipes diameter not less than 200mm shall be used for concreting. Total concreting time should be minimum and the concreting operation shall be carried out as fast as possible so as to ensure good continuousconcrete in the pile shaft. Concreting once commenced shall continue without anyinterruption.

Concrete mix shall have a slump not less than 150mm and the aggregate size shallnot exceed 20mm. Concreting shall be done at such speed that thereinforcement cage is not lifted up by the upward flow of concrete within thehole. The cage of reinforcement shall bekept suspended till completion of concreting of bore hole.

In case the cut off level is the same as the top of the casing, then the concretemay be allowed to overflow till good concrete would be visibly start flowingout of bore hole. It should always be ensured that the tip of the tremie pipe isat least 2 to 3M within concrete to avoid mixing of fresh concrete withbentonite.

Contractor shall transport and dispose off used as well as surplus bentonite slurry/ pile muck outside CSL within 2 days of completion of piling job. Even when the piling work is in progress, used bentonite slurry shall be transported from the site and disposed off as mentioned above. Unused bentonite powder shall also beremoved from the site immediately after completion of the piling work. Use of polymer drilling fluid is also permitted but only with the prior approval of the Enginner-in-Charge.

Tolerance in pile driving:

Allowable tolerance in pile driving is as follows:

a) Deviation of pile center line from the true vertical line shall bewithin 1 degree

b) Tolerance in pile spacing shall be within 5% of the center to centerof pile or 100mm, whichever is lower. If any pile shows deviationexceeding the above limits, additional pile or piles shall be driven atthe discretion of the Engineer-in-Charge at no extra cost.

D. CONCRETE WORK

1. General

This section covers the requirements for furnishing of cement concrete including materials proportioning, batching, mixing, testing, placing, compacting, finishing, jointing, curing and all other work as required for cast-in-place plain and reinforced concrete. Cement concrete shall be composed of cement, fine aggregate, coarse aggregate, water, with or without admixture as approved, proportioned and mixed as specified herein.

For concrete works provisions of IS: 456 (2000) and its amendments shall be followed as general guidance, along with all other relevant Indian Standards, unless otherwise specifically mentioned. Contractor shall deploy mechanized system for production, transportation and placement of concrete to the maximum possible extent.

2. Plant and Equipment

The Contractor shall submit the proposed programme, methods and details of plant and equipment to be used for batching, mixing and placing of concrete to the Engineer-in-Charge, well in advance prior to start of work.

3. Certificates

With each mix design, the Contractor shall submit laboratory test reports on concrete cubes and as well as on ingredients to be used at the actual construction work for approval of the Engineer-in-Charge.

In case the source, brand or characteristic properties of the ingredients are required to be varied during the term of the Contract, a revised laboratory mix design report shall be submitted to the Engineer-in-Charge.

4. Materials

Prior to start of delivery of materials required for cement concrete, the details of recommended suppliers and/or sources of all ingredients for making concrete including cement, fine and coarse aggregates, water and additives including samples thereof shall be submitted by the Contractor for the approval of Engineer-in-Charge.

Material Test Certificates of all materials shall be submitted to the Engineer-in-Charge. Before bringing to the site, all materials for cement concrete shall be got approved by Engineer-in-Charge. All approved samples shall be retained in the office of the Engineer-in-Charge before placing orders for the materials with suppliers. The materials brought on to the works shall conform in every respect to their approved samples.

Fresh samples shall be delivered to the Engineer-in-Charge whenever type or source of any material changes. The Contractor shall check each fresh consignment of materials as it is brought on to the works to ensure that they conform to the specifications and/or approved samples.

The Engineer-in-Charge shall have the option to have any of the materials tested to find whether they are in accordance with specifications. All bills, vouchers and test certificates which in the opinion of the Engineer-in-Charge are necessary shall be produced for his inspection when required.

Any materials which have not been found to conform to the specifications and not approved by the Engineer-in-Charge shall be removed from the site by the Contractor within the time stipulated by the Engineer-in-Charge.

Cement

I. The cement shall be 43 grade, 53 grade Ordinary Portland Cement conforming to IS: 269 or pozzolana cement conforming to IS 1489 or Portland Slag cement conforming to IS 455 unless otherwise approved by the Engineer-in-Charge.

II. Whenever possible all cement of each type shall be obtained each from one constant source throughout the Contract. Cement of different types shall not be mixed with one another.

Different brands of cement, or the same brand of cement from different sources, shall not be used without prior notification and approval of Engineer-in-Charge.

III. The cement shall be supplied packed in bags for the purpose of supply. Packed cement shall be delivered to the site in original sealed bags which shall be labelled with the weight, date of manufacture, name of manufacturer, brand and type. Cement received in torn bags shall not be used. Moreover bags of cement which vary in weight by more than 3% shall not be accepted.

IV. Cement shall be procured only from approved makes specified in the tender document. Samples of cement arranged by the Contractor shall be taken by the Engineer-in-Charge. The minimum quantity of cement specified shall be complied with. For all other items, theoretical requirements of cement as per CPWD data will be followed. It is responsibility of the Contractor to keep the cement in bone dry conditions. The Contractor shall be responsible for the watch and ward and safety of the cement and steel stock. Any cement that the Engineer-in-Charge considers has become stale or unsuitable through absorption of moisture from the atmosphere or otherwise due to improper transport/storage/ handling by the Contractors shall be rejected. With each and every delivery of cement the Contractor shall provide the manufacturer's certificate that the cement conforms to the relevant Indian Standard.

V. All cement shall be fresh when delivered and at ambient atmospheric temperature.

VI. In fair faced elements, the cement used in the concrete for any complete element shall be from a single consignment. All cement for exposed concrete shall be from the same approved source and uniform in colour.

VII. With each and every delivery of cement the Contractor shall provide the manufacturer's certificate that the cement conforms to the relevant Indian Standard.

Aggregates

I. Aggregates from natural sources shall be in accordance with IS: 383. The Contractor shall submit to the Engineer-in-Charge certificates of grading. Sampling and testing shall be carried out as per the relevant Indian Standard or as directed by the Engineer-in-Charge. The aggregates shall be free from salts or other harmful chemical impurities.

II. For fair faced concrete, the Contractor shall ensure that aggregates are free from iron pyrites and impurities which may cause discolouration.

III. Wet aggregate delivered at site shall be kept in storage for at least 24 hours to ensure adequate drainage before being used for concreting.

Fine Aggregates

I. Fine aggregate shall consist of either natural river sand or manufactured sand from natural source in accordance to IS 383. Sands from sea estuaries / bays / river stretches

subject to tidal ingress of sea water shall not be used. It shall be free from clay, loam, earth or vegetable matter and from salt or other harmful chemical impurities. In case impurities cannot be removed by screening process, sand shall be washed and cleaned to the satisfaction of the Engineer-in-Charge. It shall be clean, sharp, strong, and angular and composed of hard siliceous material.

II. Fine sand shall be within the limits of Grading Zone-II of Table IV of IS 383. When the grading falls outside the percentage limits given for sieve other than 600 micron, 300 micron and 150 micron (I.S.) sieve but not more than 5%, it shall be regarded as falling within this Zone. 5 per cent shall be summation of excess on all other sieves. For coarse sand the grading of sand as determined by the method prescribed in IS: 2386 Part I shall be within the limits of Grading Zone III given in Table I. When the grading falls outside the percentage limits given for sieves other than 600 micron, 300 micron and 150 micron (I.S.) sieves but not more than 5 percent, it shall be regarded as falling within this zone. 5 percent can be excess summation on one or more sieves.

The maximum quantity of silt as determined by the Field method shall not exceed 8 percent by volume.

Coarse Aggregate

I. The coarse aggregate shall be crushed stone conforming to IS: 383, having nominal size of 20 mm as per requirements and as approved by Engineer-in-Charge.

II. Coarse aggregate obtained from crushed or broken stone shall be angular, hard, strong, dense, durable, clean and free from soft, friable, thin flat, elongated or flaky pieces.

III. Except where it can be shown to the satisfaction of the Engineer-in-Charge that a supply of properly graded aggregate of uniform quality can be maintained over the period of the works, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in correct proportions as and when required.

Water

I. Water used in the works shall be potable water and free from deleterious materials. Water used for mixing and curing concrete as well as for cooling and/or washing aggregate shall be fresh and clean, free from injurious amounts of oil, salts, acids, alkali, other chemicals and organic matter.

II. Water used for both mixing and curing shall conform to IS: 456. Potable water is generally satisfactory. Water containing any excess of acid, alkali, sugar or salt shall not be used.

III. The pH value of water shall not be less than 6.

IV. Seawater shall not be used for concrete mixing and curing.

V. Water shall be from the source approved by the Engineer-in-Charge.

Admixtures and Additives

I. Chemical admixtures shall conform to IS 9103 and are not to be used unless permitted by the Engineer-in-Charge. In case their use is permitted, the type, amount, chemical property and method of use of any admixture proposed by the Contractor shall be submitted to the Engineer-in-Charge for approval prior to the approval of the same.

II. The Contractor shall further provide the following information concerning each admixture to the Engineer-in-Charge.

- **a)** Normal dosage and detrimental effects if any of under dosage and over dosage.
- **b)** The chemical names of the main ingredients in the admixture.
- **c)** The chloride ion content if any expressed as a percentage by weight of admixture.
- **d)** Whether or not the admixture leads to entrapment of air when used in the manufacturer's recommended dosage.
- **e)** Where two or more admixtures are proposed to be used in any one mix, the manufacturer's written confirmation of their compatibility.

III. In reinforced concrete, the chloride ion of any admixture used shall not exceed 2 percent by weight of the admixture as determined in accordance with IS: 6925 and the total chloride ion in all admixtures used in concrete mix shall not exceed 0.83 percent by weight of cement.

IV. The admixtures shall conform to IS: 9103. The suitability of all admixtures shall be verified by trial mixes.

V. The addition of calcium chloride to concrete containing embedded metal will not be permitted under any circumstances.

VI. Retarding admixtures when used shall be based on ligno sulphonates with due consideration to clause 5.2 and 5.3 of IS: 7861.

VII. Waterproofing admixtures shall comply with IS: 2645.

5. Plant

The Contractor shall obtain the approval of the Engineer-in-Charge for all plant he proposes to use for the manufacture and placing of concrete.

6. Concrete Mix Proportions

Design Mix Concrete

a) For Design Mix Concrete, the mix shall be designed as per any of four methods given in SP: 23 to provide the grade of concrete having the required workability and characteristic strength not less than

appropriate values given in IS: 456.Reference shall also be made to IS 10262 for guidance. The design mix shall in addition be such that it is cohesive and does not segregate during placement and should result in a dense and durable concrete capable of giving the specified finish. For liquid retaining structures, the mix shall also result in watertight concrete. The Contractor shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

b) The minimum cement content for M40 grade concrete shall be 360 kg/cum which shall be inclusive of fly-ash/Granulated Ground Blast Furnace Slag (GGBS) and shall be adopted irrespective of whether the Contractor achieves the desired strength with less quantity of cement. The minimum cement content stipulated above applies to 20 mm nominal maximum size aggregate. For other sizes of aggregate, the minimum cement content shall be changed as per Table 6 of IS: 456. The Contractor's quoted rates for concrete shall provide for the above eventuality and nothing extra shall become payable to the Contractor on this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the Contractor. Cement content not including fly-ash and GGBS in excess of 450kg/m3 should not be used unless special consideration has been given in design to the increased risk of cracking due to shrinkage in thin sections, or to early thermal cracking and to the increased risk of damage due to alkali silica reactions.

c) The declared mix proportion shall be adhered to by the Contractor during the entire construction period. If a change should become necessary or desirable for any reason, the Contractor shall repeat the preliminary tests and submit a comprehensive test report on the revised declared mix proportion, to the satisfaction of the Employer.

d) For designed mix the Contractor shall submit the following for the approval of Engineer-in-Charge.

i. The proportion of cement, coarse aggregate, fine aggregate and water so determined.
ii. The sieve analysis of aggregates, which he proposes to use in the works.
iii. Full details of the tests conducted including cube test results.
iv. All calculations relevant to Mix Design.

e) Well in advance to commencement of concreting work the Contractor shall submit the proposal of mix design and test results from approved laboratory thereof as a report for the approval of the Engineer-In-Charge. With each mix design, the Contractor shall submit laboratory test reports on concrete cubes and as well as on ingredients to be used at the actual construction work for approval of the Engineer in-Charge including mix design calculations stating proportions of all constituent materials, including admixtures, Sieve analysis of aggregates, workability, etc.

f) The minimum frequency of sampling of concrete of each grade shall be in accordance with clause No. 15.2.2 in IS 456:2000.

Nominal Mix Concrete

The minimum cement content for PCC 1:2:4 concrete shall be 320 kg/cum. Mix Design and preliminary tests are not necessary for Nominal Mix Concrete. However, works tests shall be carried out as per IS: 456. Proportions for Nominal Mix Concrete and water cement ratio may be adopted as per Table 9 of IS: 456. However, it will be Contractor's sole responsibility to adopt appropriate nominal mix proportions to achieve the specified characteristic strength. Based on the adopted nominal mixes, aggregates shall be measured by volume. However, cement shall be by weight only. Appropriate correction shall be made for bulking of sand after testing.

Water Cement Ratio

The quantity of water added to the cement and aggregate during mixing shall be such as to produce a concrete having sufficient workability to enable it to be properly compacted to be worked into the corners of the shuttering and around reinforcement. Maximum water cement ratio for nominal mixes shall be as per IS 456.

The Contractor shall ensure concrete workability in accordance with relevant Indian standard and slump test shall be conducted at site as and when required by the Engineer-in-Charge. The slump at the actual location of placing as measured in accordance with the methods laid down is IS: : 1199 shall not be more than the values specified in IS 456 unless otherwise directed by the Engineer-in-Charge.

7. Concrete Testing

Test Cubes

I. The strength of concrete either in assessing the suitability of the trial mixes or when placed in the works shall be determined from 150mm cubes made, cured, stored, transported and tested in accordance with IS:516 and as specified.

II. Test cubes shall be made as and when required by the Engineer-in-Charge or as per the relevant IS Stipulation.

III. Test cubes shall be made under the direct supervision of the competent person appointed by the Contractor to supervise all stages of the preparation and placing of concrete. They shall be made by the Contractor in the presence of the Engineer-in-Charge and generally from concrete taken at the point of discharge from the mixer and the Contractor shall provide suitable facilities in the form of a hut or other covered protection as agreed with or directed by the Engineer-in-Charge for the storing and curing of the test cubes during the first 24 hours after making them and until they are dispatched to the testing laboratory.

IV. Test cubes shall be marked and dated in such a manner that the trade and the part of the works in which the concrete they represent has been placed can be readily identified.

V. Testing shall be done in the field laboratory with due approval of Engineer-in-Charge or whenever so desired and directed by the Engineer-in-Charge, testing may be carried out in an NABL accredited laboratory or in a Civil Engineering Department of government institutions

or in any other laboratory approved by Engineer-in-Charge and the results shall be submitted promptly by the Contractor to the Engineer-in-Charge without any extra cost.

8. Concrete Production

Ready Mix Concrete (RMC) from outside source shall be allowed subject to the conditions that: (i) written permission shall be obtained from the Engineer-in-Charge, (ii) all quality control measures as stipulated by the Engineer-in-Charge are strictly adhered to by the Contractor at his cost, (iii) all mix calculations shall be submitted by the Contractor for approval of the Engineer-in-Charge & approval obtained, (iv) RMC Batch sheets shall be furnished by the Contractor. The use of blended cement will be permitted for concrete procured from RMC plants.However for PCC or non-structural member concrete weigh batcher can be used at the discretion of Engineer-in-Charge.

9. Concrete Mixing

All concrete in the correct proportion of ingredients approved by the Engineer-in-Charge, whether ordinary or controlled, shall be mixed in an approved mixer for the minimum time necessary to ensure adequate quality and uniform distribution of the materials. The cement and aggregates shall normally be first mixed dry until all particles of aggregate are coated with cement after which the water shall be added along with admixture.

Allowance shall be made for the moisture content of the aggregates when calculating the amount of water to be added for each mix.

The temperature of the aggregate, water and cement when added to the mixer shall be such that the temperature of the concrete at the time of placement is less than 40^{o} C.

Materials for concrete shall be deposited into the drum while it is in rotation. Mixers shall not be loaded beyond their rated capacity and each batch shall be completely discharged from the drum before recharging takes place.

Facilities shall be provided to spray the mixer drum with cool water between batches and on the completion of concreting the drum shall be washed thoroughly. The surface of the mixer drum shall be maintained in a clean condition at all times.

Retempering and/or mixing of concrete which has partially hardened and set will not be permitted under any circumstances.

10. Transporting

The period between mixing the concrete and placing it in the final position shall be kept to a minimum and the delivery of concrete shall be coordinated with the rate of placement to avoid delays in delivery and placement.

Concrete shall be handled from the place of mixing to the place of final deposit by methods which prevent segregation, loss of ingredients and contamination and maintain the required workability.

Should any segregation have occurred in any batches arriving at the place of deposition, such batches shall be rejected and shall not be allowed to use. Where concrete is conveyed by chutes, the chutes shall be made of metal or fitted with metal linings. The approval of the Engineer-in-Charge shall be obtained for the use of chutes more than 3 meters long.

All plant and equipment used in the transportation of concrete shall be thoroughly cleaned before and after each working period and at all changes of concrete mixes.

11. Preparation before Concreting

The inside surface of the forms against which concrete is to be placed shall be clean and free from dried or hardened spattering or coatings of concrete. The forms shall be wetted before placing concrete.

When the work has to be resumed on a surface which has hardened, such surface shall be roughened. It shall then be swept clean and covered with a coating of freshly mixed epoxy based concrete adhesive as per manufacturer's instructions immediately before placing of concrete.

Before any concrete is placed on the sub grade, the sub grade shall be checked and approved for degree of compaction and alignment. The sub grade shall be kept damp ahead of concreting.

Concrete shall not be placed in the works until the Engineer-in-Charge has inspected the formwork, reinforcement, inserts and sleeves if any and given his permission to place concrete.

12. Placing

Concreting of any portion of the works shall be done only in the presence of the Engineer-in-Charge or his representative.

Concreting shall be carried out continuously between construction or expansion joints, shown on the drawings or as agreed with the Engineer-in-Charge. The Contractor shall closely follow the sequence of concreting where such is specified in the drawings or instructed at site. If concreting is interrupted before reaching the predetermined joint an approved construction joint shall be provided after obtaining necessary approval from the Engineer-in-Charge.

Concrete shall be deposited as nearly as is practicable to its final position and shall not be dumped in a large quantity at any point to be run or worked along the formwork manually or with vibrators. Concrete shall not be deposited at a faster rate than it can be placed and compacted. Concrete shall not be placed from a height more than 1.5m.

Concrete shall be thoroughly worked into the forms so that they are entirely filled; reinforcing bars adequately and tightly surrounded and entrained air released from the mass of concrete. Placing shall be carried with the use of vibrators in a manner approved by the Engineer-in-Charge. For members having

thickness more than 300 mm, the concrete shall be placed in layers not greater than 300mm thickness and thoroughly compacted before succeeding layers are placed. Concrete shall be placed in single operation to the full thickness of slabs, beams and similar members. No concrete shall be placed on concrete which has set sufficiently to cause the formation of planes of weakness and where these are likely to occur due to unforeseen circumstances and the procedure to be followed shall be as given earlier of this specification. As far as possible cold joints in concrete shall be avoided.

13. Compaction

Each layer of concrete whilst being deposited shall be compacted by approved methods to form a dense material with all surfaces free from honey combing, air holes or other blemishes. The Contractor shall use mechanical vibration for all concrete and shall take care that internal vibrators shall not be brought into contact with the reinforcement or the formwork.

An adequate number of vibrators shall be used to ensure that compaction of concrete is achieved within 10 minutes of placing. Particular attention shall be given to the compaction of the concrete around the water bars to ensure that no voids or porous areas are left.

Compacting shall cease as soon as excess water appears on the face of concrete. Any water accumulating on the surface of newly placed concrete shall be removed by approved methods and no further concrete shall be placed thereon until such water has been removed.

Notwithstanding the requirements regarding mix design, should it be found that the proportion of water in the mix is such that the laitance forms before compaction (i.e. completion of expulsion of air) is complete and unacceptable; the quantity of water in the mix shall be reduced. Approved admixture/plasticizer shall be used to achieve the necessary workability, as approved by the Engineer-in-Charge and strictly in accordance with manufacturer's instructions. Whenever either of the aforesaid procedures are to be adopted, an additional set of 6 cubes for testing at 7 or 28 days shall be made from the adjusted mix.

The time elapsed between the discharge of the concrete from the mixer and the completion of compaction shall not exceed 30 minutes where concrete admixture is not used.

A sufficient number of spare vibrators of various capacities & types shall be kept readily accessible to the place of deposition of concrete to assure adequate vibration in case of breakdown of those in use.

14. Finish

All concrete surfaces shall have a good, dense finish. Except for slabs the exposed faces of concrete for which form work is not provided shall be smoothed with steel or wooden trowel to provide a finish equal to that face where formwork is provided.

The top surfaces of slabs specified as smooth shall be levelled and trowel led before the concrete begins to set to a smooth finish at levels and falls shown on the drawings. The toweling shall be done at such a time and in such a manner that excess of mortar is not brought to the surface of concrete nor the aggregate

displaced. The top surfaces of concrete slabs specified to receive an integral finish shall be uniformly roughened by deep hacking before the finish is laid.

Immediately after striking the formwork and removing any superficial water, honeycombed areas in normal unfinished concrete shall be inspected by the Engineer-in-Charge and where directed the Contractor shall immediately make it good to the satisfaction of the Engineer-in-Charge. All air holes shall be similarly filled up.

The Contractor shall be responsible for providing an adequate key in concrete where plastering or rendering is specified to be applied.

Hacking of the concrete surface after striking the formwork will be permitted only after 3 days after the concreting is done.

The faces of all fair faced concrete shall be of even colour throughout, free from air bubbles, cracks, honeycombing or other blemishes and will be inspected by the Engineer-in-Charge on report by the Contractor, immediately after the formwork has been struck. Such faces shall not be rubbed down or otherwise repaired to remove any defects or imperfections without the prior permission of the Engineer-in-Charge.

Concrete surface finishes shall accord to the requirements and all instructions by the Engineer-in-Charge with regard to the method of achieving such finishes as implemented.

15. Curing and Protection

Walling or further loading on concrete shall not be permitted for at least 48 hours after it has been placed in position, or for such additional length of time as the Engineer-in-Charge may direct.

Immediately after compaction and completion of any surface finishes, the concrete shall be protected from the evaporation of moisture by means of polythene sheeting, wet hessian or other suitable material kept soaked by spraying. As soon as the concrete has attained a degree of hardening sufficient to withstand surface damage, continuous moist curing shall be implemented and maintained for a period of at least 7 days from the date of placing concrete in case of ordinary Portland cement and at least 10 days where mineral admixtures or blended cements are used.

Method of curing and their duration shall be such that the concrete will have satisfactory durability and strength and members will suffer a minimum distortion, be free from excessive efflorescence and will not cause, by its shrinkage, undue cracking in the works.

The top surfaces of slabs and other horizontal surfaces shall be cured by ponding of water in cement mortar bunds. Steeply sloping and vertical formed surfaces shall be kept completely and continuously wet prior to and during the striking of formwork and thereafter by applying adequate water to the top surfaces and allowing it to pass down between the formwork and the concrete, if required by discharging water through hose pipes and pumps.

The Contractor shall give careful consideration to the curing methods and conditions for fair faced concrete. Components which are specified to have exposed concrete finish shall receive the same curing treatment. Moreover water used for curing shall be clean and free from deleterious materials so as not to discolour the concrete.

All fair faced concrete shall be protected from damage from the time of striking the formwork. All edges and surfaces of such concrete shall be protected from chipping using notched timber or aluminium corner pieces or other suitable covers which shall be maintained in place until the completion of the works.

The Contractor shall be responsible for ensuring all fair faced concrete free of blemishes defect & stains and shall remove all such staining as may occur as soon as possible to the satisfaction of the Engineer-in-Charge.

16. Inserts

The Contractors shall provide pockets/holes to fix all necessary inserts such as U angle post as per drawing at the time of formwork and concreting.

17. Cracks

If any cracks develop in the reinforced cement concrete construction which in the opinion of the Engineer-in-Charge may be detrimental to the strength of the construction, the Contractor shall test the structural element in question. If under these test loads the cracks shall develop further the Contractor shall dismantle the construction, cart away the debris replace the construction and carryout all consequential work thereto.

If the cracks are not detrimental to the stability of the construction in the opinion of the Engineer-in-Charge, the Contractor shall grout the cracks with pneumatically applied mortar or epoxy grout or by other specified treatment as directed by the Engineer-in-Charge. The repair work shall be carried out to the satisfaction of the Engineer-in-Charge. The decision of the Engineer-in-Charge e as to the extent of the liability of the Contractor in the above matter shall be final and binding on the Contractor.

18. Supervision

All concreting work shall be done under strict supervision of qualified and experienced representatives of the Contractor as well as those of the Engineer-in-Charge. The Contractor's supervisor who is in charge of concreting work shall be experienced & skilled in this class of work and shall personally superintend all the concreting operations at all stages.

19. Special attention shall be paid to the following

I. Proportioning, mixing and quality testing of the materials with particular control on the water cement ratio.

II. Laying of material in place and thorough compaction of the concrete to ensure solidity and freedom from voids and honeycombing.

III. Proper curing for the requisite period.

IV. Reinforcement position is not disturbed during concreting and consolidation by vibration.

20. Quality Control

The Engineer-in-Charge reserves the right to make changes in the mix proportions including the increased cement content or/and a change in the Contractor's control procedure, should the quality control during progress of the works prove to be inadequate in his opinion and the Contractor shall carry out the same. Any extra cost due to change in mix proportions shall be deemed to have been included in relevant item rates.

All the concrete work shall be true to level, plumb and square within the acceptable tolerance. The corners, edges and rises in all cases shall be unbroken and finished properly and carefully.

21. Tolerances

The acceptable tolerances for formed concrete surfaces shall be as per relevant Indian standard.

22. Reinforcement Steel

Steel reinforcement will have to be procured by the Contractor from approved makes specified in the Tender document and shall be TMT bars of Fe 500D grade or above (of reputed brands like SAIL, RINL, Tata, JSW, JSPL) conforming to IS 1786. The steel shall be marked or stamped with a private mark for the purpose of identification as may be directed by the Engineer-in-Charge. Steel reinforcement shall be stored in a way as to prevent distortion and corrosion. Bars of different classifications, sizes, and lengths shall be stored separately to facilitate issues in such sizes and lengths as to minimize wastage in cutting from standard lengths. All reinforcement shall be clean and free from loose mill scales, dust, loose rust, coats of paints, oil or other coatings which may destroy or reduce bond.

23. Storage of Steel Reinforcement

It shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion. Steel reinforcement, shall be stored clear of the ground, on rack or otherwise supported, covered in bundles indicating the type, number, size, length, diameter and date of delivery to the site of the bars and fabric reinforcement as per IS: 456 and as directed by the Engineer-in-Charge.

24. Approval of Reinforcement

The Contractor must obtain the approval of the Engineer-in-Charge to the reinforcement fixed in position, before concrete is deposited on the shutters.

25. Formwork General

Formwork shall include all temporary or permanent forms of moulds required for forming the concrete which is cast-in-situ, together with all temporary construction required for their support.

Formwork shall be of rigid construction true to shape and dimensions. It shall be strong enough to withstand the dead and live loads and forces caused by ramming and vibrations of concrete and other incidental loads, imposed upon it during and after casting of concrete. It shall be made sufficiently rigid by using adequate number of ties and braces. Screw jacks or hard board wedges, where required shall be provided to make up any settlement in the form work either before or during the placing of concrete.

Forms shall be so constructed as to be removable in sections in the designed sequence without damaging the surface of concrete or disturbing other sections. All form work should be easy to strip after concreting and form work must be erected with this consideration in mind. Care shall be taken to see that no pieces remain keyed into the concrete. Details of formwork shall be properly designed by the Contractor and relevant drawings together with calculations for strength and deflection shall be submitted to the Engineer-in-Charge for approval before commencement of formwork erection. The completed formwork shall be inspected by the Engineer-in-Charge on receipt of information in this regard from the Contractor, before the reinforcement bars are placed in position.

Formwork surface in contact with concrete (sheathing) shall be of steel or plywood. Approved hard wood section could be used for the framework of shuttering board only. Sheathing for the form work of column shall be of steel with approved thickness .Props used for centering shall be of adjustable steel props without any deformation, damage & crack. Construction joints shall be positioned as instructed by the Engineer-in-Charge.

Before the concreting is started, the props and wedges shall be thoroughly checked to see that these are intact and take suitable action in case these are loose.

The surfaces of timber formwork that would come in contact with concrete shall be well wetted and coated with soap solution, raw linseed oil or form oil of approved material (such as polythene/polyethylene sheets) to prevent adhesion of concrete to formwork.

The formwork shall be so removed as not to cause any damage to concrete due to shock or vibration. The removal of centering and shuttering is to be done to the approval of the Engineer-in-Charge.

26. Minimum Stripping time of Formwork

(Except in case of any special type of form work)

Type of Formwork	**Minimum period before striking formwork**	
	For concrete made using OPC	**For concrete made using cement other than OPC or using Mineral admixtures like fly ash and slag**
Vertical formworks to columns, walls, beams	16-24 hrs	16-24 hrs

Soffit formworks to slabs (Props to be refixed immediately after removal of formwork)	3 Days	7 Days
Soffit formworks to beams (Props to be refixed immediately after removal of formwork)	7 Days	10 Days
Props to slabs		
Spanning up to 4.5m	7 Days	10 Days
Spanning over 4.5m	14 Days	14 Days
Props to beams and arches		
Spanning up to 6m	14 Days	14 Days
Spanning over 6m	21 Days	21 Days

Utmost care shall be taken to provide props. The props shall be provided immediately after stripping each shuttering panel and not after stripping all the panels of the entire slab.

The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slab, beam or such as the case may be together with any live load likely to occur during curing or further construction.

27. Damage to Concrete

The Contractor is to make good at his own expense any injury to the concrete work and any damage caused by or arising from the removal and striking of formworks and supports.

28. Discolouration

Formation of blotches and stains due to detachment of formwork panel from the concrete when adjacent portion in the same lift is still adhering shall not be allowed to occur and for this purpose all shutters shall be struck off at the same time. Use of old and new plywood in the same board or different quality boards or mixing shutter panels of different numbers of uses shall be totally avoided to get rid of discoloration.

29. Ties

Use of ties shall be avoided and as far as possible. Formwork shall be supported mainly by propping against staging erected firmly for the purpose.

30. Clean up

After forms are stripped, all materials to be reused shall be thoroughly cleaned. All nails shall be pulled from the plywood board and no nail shall be bent over by hammering against the face of the material if reuse of forms is planned. Holes bored through sheathing for forms ties shall be plugged by driving in common corks or foamed plastics. Patching plaster may also be used to fill small holes, with approval of

the Engineer-in-Charge. After cleaning and before refixing each formwork either of plywood or metal mould shall be got approved by the Engineer-in-Charge.

31. Internal Vibrators

These should invariably be used. However, vibrators shall not be used for displacing concrete. Overloading the vibrators by placing too much concrete per vibrator, over vibrating by using too many vibrators relative to quantity of concrete shall be avoided. Segregation by excessive vibration or excessive water content should be strictly avoided. Vibrator shall be withdrawn gradually and smoothly, and in a manner which shall not cause suction, voids or air entrapment.

E. MASONRY WORK

Masonry units solid concrete blocks shall conform to the requirements of IS: 2185 (Part 1). The height of the concrete masonry units shall not exceed either its length or six times its width.

The nominal dimensions of concrete block shall be as under or as approved by Engineer-in-Charge.

Length 400, 300

Height 100, 150 mm.

Width 200

Half blocks shall be in lengths of 200, 250 or 300 mm to correspond to the full length blocks. Actual dimensions shall be 10 mm short of the nominal dimensions. The maximum variation in the length of the units shall not be more than + 5mm and maximum variation in height or width of the units shall not be more than + 3mm.

Concrete blocks shall be sound, free of cracks, chipping or other defects which impair the strength or performance of the construction. Surface texture shall be as specified. The faces of the units shall be flat and rectangular, opposite faces shall be parallel and all arises shall be square. The bedding surfaces shall be at right angles to the faces of the block.

The concrete mix used for masonry shall not be richer than one part of cement to six parts of combined aggregates by volume. i.e. (1:6).

Concrete blocks shall be of approved manufacture, which satisfy the limitations in the values of water absorption, drying shrinkage and moisture movement, as specified for the type of block as per relevant IS code. Contractor shall furnish the test certificates and also supply the samples, for the approval of Engineer-in-Charge.

The type of the concrete block, thickness and grade based on the compressive strength for use in load bearing and/or non-load bearing walls shall be as specified in the respective items of work.

The workmanship, shall generally conform to the requirements of IS: 2572 for concrete block masonry Curing of the mortar joints shall be carried out for at least 7 days. The walls should only be lightly moistened and shall not be allowed to become excessively wet.

Sampling and testing shall be in accordance with the relevant Indian standard/as directed by the Engineer-in-Charge.

F. STRUCTURAL STEEL WORK

1. Scope of Work

The work covered by this specification consists of supply, fabrication, painting and erection of structural steel components in accordance with the specifications and the applicable drawings.

2. Materials

The structural steel shall be of standard sections as marked on the drawings and shall be free of scale, blisters, laminations, cracked edges and defects of any sort.

3. Workmanship

I. All workmanship shall be of first class quality in every respect to the greatest accuracy being observed to ensure that all parts will fit together properly on erection.

II. All ends shall be cut true to planes. They must fit the abutting surfaces closely.

III. All butt ends of compression member shall be in close contact through the area of joints.

IV. The base connection shall be provided as shown on drawings and the greatest accuracy of workmanship shall be ensured to provide the best connections.

V. Figured dimensions on the drawings shall be taken.

4. Welding

Welding works shall be carried out by only qualified and experienced welders who shall be periodically tested and graded as per IS 817, IS: 7310 (Part 1) and IS: 7318 (Part 1).

5. Erection and Marking

Erection and fabrication shall be according to IS: 800-1984 Section-11. During erection, the work shall be securely braced and fastened temporarily to provide safety for all erection stresses etc. No permanent welding shall be done until proper alignment has been obtained.

Any parts which do not fit accurately or which are not in accordance with the drawings and specifications shall be liable to rejection and if rejected, shall be at once made good.

Engineer-in-Charge shall have full liberty at all reasonable times to enter the Contractor's premises for the purpose of inspecting the work and no work shall be taken down, painted or dispatched until it has

been inspected and passed. The Contractor shall supply free of charge all labour and tools required for testing of work.

6. Painting

All steelwork shall be protected with a paint system. Before paint is applied, the surface shall be dry and free from dust, dirt, scale and grease. All steel structures shall receive single coat primer (20microns). Primer paint shall be red oxide zinc chromate of approved make. First coat of primer shall be given in shop after fabrication, before dispatch to erection. All paint delivered to the fabrication shop/site shall be ready mixed, in original sealed containers, as packed by the manufacturer. Thinner shall not be permitted for usage unless specifically directed by the Engineer-in-Charge.

G. PLASTERING

1. Scope

This section shall cover external plastering works as shown in the drawings. Before commencing the work sample of works shall be made in accordance with the specifications indicated below and got approved by the Engineer-in-Charge.

1.1 Wall Plastering

Exterior plaster where specified or shown shall be 12 mm thick in one coats (12mm) for masonry and concrete surfaces. It shall be 1:4 cement sand mortar (1 cement: 4 sand).

1.2 Floor plastering

Smooth finishing of the exposed surface of R.C.C. flooring work with 20 mm thick cement mortar 1:4 (1 Cement : 4 fine sand) using hardening compound.After finishing the plastering, the concrete hardener manufactured by M/s.Sika, Pidilite, Fosroc or equivalent @ 4 Kg/m2 shall be spread with in 1 hour and the area to be trowelled smoothly. The area shall be cured for a minimum period of 7 days with ponding of water or using gunny bags., including cost and conveyances of all material, labour and other incidentals etc complete and as per the direction of Engineer-in-Charge, itshall be 1:4 cement sand mortar (1 cement: 4 sand).

2. Scaffolding

Generally scaffolding shall be as mentioned for Masonry work. Stage scaffolding shall be provided for plastering work as per standard practice and as directed by the Engineer-in-Charge. This shall be independent of the walls.

3. Preparation of Surface

Joints of Block work shall be raked-out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scraping. Shuttering imperfections of all concrete shall be roughened by hacking with chisel and all resulting dust and loose particles cleaned and the

surface shall be thoroughly hacked or bush hammered to the satisfaction of the Engineer-in-Charge. The surface shall be thoroughly washed with water, cleaned and kept wet before plastering is commenced. Special approval shall be taken from the Engineer-in-Charge before commencing each plastering work. No cutting of finished plaster shall be allowed under any circumstance. No portion shall be left out initially to be patched up later on.

4. Mixing

The ingredients shall be mixed in specific proportions by volume. The mixing shall be done in a mechanical mixer or by hand mixing on water-tight platform. The cement and sand shall first be mixed thoroughly dry in the mixer. Water shall then be added gradually and wet mixing continued for at least a minute until mortar attains the consistency of a stiff paste and uniform colour. Mortar shall be used within 30 minutes of addition of water. Mortar which has partially set shall not be used and removed from the site immediately.

Water proofing compound of approved make shall be added to the mortar and mixed strictly in accordance with manufacturer's printed instructions unless otherwise specified by the Engineer-in-Charge.

G. PAINTING

1. General

No work under this section shall start without approval from Engineer-in-Charge. The Contractor shall ensure that approval has been obtained for all primer, paints, and oils, for each location/area to be finished and in respect to shades brand & manufacturer for such finishing materials, well in advance to commencement of work.

2. Materials

All materials shall be the best of their kind and of approved manufacture for each item. Painting materials such as shellac, thinner, oils, driers, brushes, rollers etc. shall be of the best approved quality and type. 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 Engineer-in-Charge shall be used. All materials shall be stored in a neat and orderly fashion in one single clean space. Care shall be taken to maintain this place as clean and dust- free as possible.

3. Sealed Containers

Paints of approved shade, brand & manufacturer 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 empty containers shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from Engineer-in-Charge.

4. Specialized Workmen

All work shall be done by the Contractor through specialised skilled workmen experienced in the trade.

5. Work as per Manufacturer's Instructions

All work shall be done strictly as per this specification and manufacturer’s printed instructions. In case these specifications differ in any way from manufacturer's instructions, the latter shall apply.

6. Samples

Before starting work under this section large size samples of all types of coating including preparation of surface shall be made at the site and approval obtained from the Engineer-in-Charge before proceeding with the finishing works. Only after specific approval has been given to the samples, work shall commence. The actual work shall be done as per the approved samples.

7. Preparation

The plastered surfaces shall be allowed to dry out completely. All surfaces to be finished shall be thoroughly brushed and cleaned of mortar drops, dust, dirt, fungi, rust, mill-scale, efflorescence and all other extraneous material. All loose pieces and scales shall be removed by scrapping. Surfaces shall be thoroughly sand-papered to a smooth finish. Further preparation work shall be done as specified under different types of finishes. Before starting painting work all floors shall be washed clean and wiped dry.

8. Finished Surface

All Finished Surface shall be smooth and of even shade to the satisfaction of Engineer-in-Charge.

9. Protection

All work done shall be thoroughly protected from damage at all times by suitable and appropriate methods to the satisfaction of Engineer-in-Charge. All other adjacent areas which may not have received the finish at the same time shall also be thoroughly protected by suitable canvas, paper covering or by some other approved method.

H. ROOFING, CLADDING & DRAINAGE SYSTEM

1. SCOPE

This specification covers the general requirements for supply, delivery, and erection of all precoated sheeting for roofing and side cladding including all accessories and fixtures necessary to provide weather exposed surfaces of roof and building walls for industrial buildings.

2. APPLICABLE CODES & SPECIFICATIONS

The following specifications, standards and codes, including all official amendments and revisions and other specification referred to therein shall be considered as a part of this specification. In all cases the

latest issue/edition revision shall apply. In case of discrepancy between the guidelines given in the codes, & this specification shall govern:

IS: 277	Specification for galvanized steel sheets
IS:12093	Code of practice for laying & fixing of sloped roof covering using plain & corrugated galvanized steel sheets

3. MATERIAL

Precoated sheets shall be procured by the Contractor from approved suppliers of Employer/ Engineer-in-Charge. The colour & shade shall be approved by the Employer/ Engineer-in-Charge. No insulation should be provided for cladding.

The base material shall be cold rolled steel with yield strengths of 345 Mpa or 550 Mpa profiled to suit a purlin spacing as shown on the drawings or as approved by Engineer-in-Charge.

The metallic coating on the substrate shall be 180 grams per sqm zinc mass or 150 grams per sqm zinc+aluminium alloy coating or as approved by Engineer-in-Charge.

The organic coating shall be by coil coating (prepainted) with a polyester coating system applied over a corrosion inhibiting primer or as approved by Engineer-in-Charge. The weathering side shall have a finish coat; a minimum of 20 microns of polyester/SMP/PVF2/XRW/XPD/XSE paint system and the rear side a backing coat in neutral colour nominal minimum 5 microns or as approved by Engineer-in-Charge.

The coating shall be tested in accordance with ASTM or equivalent standards and shall have minimum performance requirements as below or as approved by Engineer-in-Charge. A test certificate from a recognized institute/ manufacturer shall be produced prior to the delivery of the sheets.

SL. NO.	PROPERTY	REQUIREMENT
1	Scratch & Mar resistance	Fair
2	Impact resistance	Greater than 10 Joules
3	Pencil hardness	F minimum
4	Bend test	6 T
5	Heat resistance	Suitable for continuous service upto 100 deg . C
6	Corrosion resistance	
I	Salt spray	No more than (8) density size A blisters, less than 2mm undercutting from a score & no visible loss of adhesion after 1000
II	Humidity resistance	No more than (8) density size A blisters, no visible loss of adhesion after 1000 hrs.
III	QAV weatherometer	A chalk rating of 8-10 after 1000 light hours.
7	Outdoor durability	The sheets in standard colours under normal well washed conditions of exposure should show no cracking, flaking or peeling of the paint film in

		10 years. Colour change during service determined according to ASTM D2244, should not exceed 5 E Hunter lab. Units on light colours
8	Surface spread of flame	Class 1

The sheets shall have a protective film at the time of delivery which shall be removed after erection.

The accessories like flashings, cappings, barge boards etc. shall be of the same material as sheets.

Sealants shall be of silicon non-hardening type.

Screws used for fixing shall be hot dip zinc coated steel, hexahead self drilling screws with EPDM washer & colour heads, colour matched to sheeting.

4.STORAGE OF MATERIAL

Sheets shall be stacked to a height of not more than one metre on firm and level ground, with timber or other packing beneath them.

Materials of same variety and size shall be stacked together.

All materials shall be protected from damage while stored on site preferably in sheltered store. If they are to be placed in an exposed position, they shall be protected from damage by wind and rain by providing a suitable cover.

Contractor shall exercise great care in handling the sheets and accessories. damaged materials shall not be stacked with sound materials. All damaged or rejected materials shall be removed from site immediately. Manufacturers instructions regarding delivery, stacking and storing shall be followed.

5.LAYING

The sheets shall be laid on the purlins/other roof members and side girts as indicated on the approved fabrication drawings or as instructed by Engineer-in-Charge.

Before the actual laying of sheets is started, the purlin spacing and the length of the sheets shall be checked to ensure proper laps and the specified overhang at the eaves. The end lap of the sheets shall always fall over a purlin/side girt.

The bearing surfaces of all purlins /other roof members and side girts shall be in one plane so that the sheets being fixed shall not be required to be forced down to rest on the purlins/ side girts. The finished roof shall present a uniform slope and the lines of corrugations shall be straight and true and the completed work shall present a neat and uniform appearance and be leak proof. For side sheeting, corrugations shall be vertical and in one plane.

The sheets shall be laid with a minimum lap of 150 mm at the ends and 2 ridges of corrugations at each side. In the case of roofs with pitch flatter than 22 degrees, minimum end laps shall be 200 mm. The side laps shall be laid on the side facing away from the prevailing monsoon winds. The minimum lap of sheets with ridges, hips and valleys shall be 200 mm measured at right angles to the line of ridge, hip & valley respectively. The free overhang of the sheets at the eaves shall not exceed 300 mm.

The sheets shall be cut to suit the dimensions or shape of the roof, either along their length or their width or in a slant across their lines of corrugations at hips and valleys. They shall be cut carefully with a straight edge and chiseled to give a smooth and straight finish. The sheets shall not generally be built into gables and parapets. They shall be bent up along their side edges close to the wall and the junction shall be protected by suitable flashing or by a projecting drip course covering the junction by at least 75 mm.

6.FIXING

Sheets shall be secured to the purlins and other roof members by means of self-fixing hexahead screws with EPDM washers. The instructions of the manufactures shall be strictly followed.

Where sheets are laid on tubular purlins, the fixing bolts shall be designed to encompass at least half the tube circumference and precautions should be taken to prevent its rotation.

No bolt shall be nearer than 40 mm to any edge of a sheet or an accessory. Sheets with holes drilled wrongly shall be rejected.

7.GENERAL

All work shall proceed in a diligent and systematic manner. Contractor shall not allow access to any person other than workmen employed for laying and fixing sheeting while the above work is in progress. If, however, it is not possible to keep the area clear, suitable safety measures shall be taken by Contractor during the progress of the work.

Contractor shall use roof ladders or planks while laying and fixing the sheets, to avoid damage to sheets and to provide security to the workmen.

Contractor shall arrange any staging or other temporary structures required for the purpose of installing the roof and side sheeting at his own cost.

At no time shall the sheets or accessories be laid and left unfixed. Temporary fixing /supporting shall not be acceptable. In case of any loss or damage due to infringement of these conditions by Contractor, the same shall be made good by Contractor at no extra cost to Employer.

I. Duct Laying Works

Contractor should ensure watertight jointing of ducts andtemporary sealing of pipe ends. In case any difficulty is experienced during laying/ pulling of cables through the ducts, the Contractor shall clear such difficulties so as to facilitate smooth installation of cables through the ducts.

J. Acceptance Criteria for Routine Pile Load Test

Acceptance criteria in the case of routine pile load test shall be:

10mm total settlement at design verification load (DVL)

18mm total settlement at 1.5 x DVL

K. DI Covers

DI covers shall conform to EN124-2-D400 and should have lifting keys.

33. LIST OF APPROVED MAKES

It will be deemed that the Contractor has priced the respective items on the basis of those approved makes. However, it shall be the prerogative for CSL to choose any particular make among the list as the most appropriate one and the Contractor shall be bound to provide the same without any variation in the Contract rate. Whenever equivalent is specified in the list of approved makes, permission for use of equivalent make shall be subject to Contractor submitting valid regret letters from the makes listed along with the comparison table of properties of proposed make w.r.t specified make. Decision of Engineer-in-Charge on approving equivalent makes shall be final and binding on the Contractor.

Sl. No.	Item	Approved Makes
1	Grey Cement	Ultratech, Coromondal, Malabar, Ramco, Sankar, Gujarat Ambuja, Zuari, Chettinad, Ambuja Cements, Sankar, Zuari
2	Reinforcement Steel	SAIL, Tata, RINL, JSW, Jindal Panther
3	Structural Steel	RINL, SAIL, JSW,Tata, Arcelor Mittal Nippon Steel, Essar
4	Synthetic Enamel Paint/Wall emulsion paint/Primers	Berger, Hempel, Asian, Nerolac, Jotun
5	Water proofing compounds	Pidilite, Fosroc, Sika, Confix, BASF
6	Concrete Admixtures	Fosroc, Sika, BASF
7	Precast Concrete Cover Block	Arpitha Exports, Astra or Equivalent
8	Galvalume Sheet	JSW, TATA, Essar, Everlast
9	White Cement	Birla/Travancore cements/ JK White cements
10	Nuts and Bolts	GKW / Agarwal / TVS / TW / HRS or equivalent
11	Wall putty	JK White / Birla white / Asian paints / Berger

12	PVC/UPVC pipe	Hycount, / Supreme, / Finolex / Prince or equivalent
13	Stainless Steel	OutoKumpu or equivalent
14	Welding rod	Ador / Esab / Philips / Modi
15	Mechanical/Chemical Anchor fasteners	HILTI / Bosch / Fischer
16	Interlock pavers	BasantBeton, / Vyara / Sai / Webro / Archean or equivalent
17	G.I. Pipe	Jindal, Zenith or equivalent
18	Chamber covers	Neco, Electrosteel, Kejriwal, BIC or equivalent
23	Water stops	Hydro tight of water seal India Pvt. Ltd or equivalent
19	Fire doors	Shakti Met-Dor, Matrix, Indigatech or equivalent,
20	Motorised Rolling shutter/Sectional door	Nirmal automation, Avians, Shivsakti, M/s Superstrong (Pune)
21	Glazing Works	Saint Gobain, Asahi float , Modi float
22	Expansion filler board	Supreme industries or equivalent
23	Wood adhesive	Pidlite or equivalent
24	Aluminium sections	Hindalco, JSW,Jindal panther, equivalent
25	Polycarbonate sheets	Sabic, GE
26	G.I. Sheets	TATA Bluescope, Llyods, Kirby,Everest, India Gypsum
27	Ceiling Systems	Armstrong, Saint Gobain, Aerolite, India gypsum
28	Hardware of Door and Windows	Dorma, Dorset
29	HDPE pipe	Supreme, Apollo

34. Time Schedule

Sl. No.	Pre-defined Milestones	Timelines
1	Submission of detailed schedule/ programme of works	Within 21 days from date of Award of Work
2	Submission of detailed structural design and Drawings after vetting	Within 21 days from date of Award of Work
3	Submission of schedule of quantities of Industrial Water Tank & Fire Water Tank	Within 21 days from date of Award of Work
4	Time of Completion	Within 7 months from 21st day of the date of

		issue of Work Order or the date of handing over the site whichever is later.

35. HANDING OVER THE SITE / PHASING OF WORKS

The Contractor shall phase the work as per the site conditions and as decided by the CSL and no claim will be entertained for not handing over the entire area in one stretch.

The work may have to be carried out in phases as approved by CSL from time to time so that the total project work can progress smoothly with least obstruction to the CSL operations and also works of other Contractors/ agencies.

36. DETAILED PROGRAMME OF WORKS

Within 21 days of Award of Work, the Contractor shall submit to the Engineer-in-Charge for his approval a detailed project schedule/ programme in the form of a bar chart or latest Project Management tools to match with the planned completion of the whole job showing the order of procedure and method in which he proposes to carry out the works and shall whenever required by the CSL, furnish further detailed programme and particulars in writing of the Contractor's arrangements (manpower, plant and machinery and all other resources) for carrying out the works and of the equipment and temporary works, which Contractor intends to supply, use or construct as the case may be. Contractor shall also submit a monthly cash flow forecast for the project.

CSLshall, if necessary, modify the programme submitted by the Contractor and approval shall be given by CSLindicating the major milestones. The programme approved by CSL shall be final and binding on the Contractor. The approval by CSL of such programme, or furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the Contract.CSL.

This programme will be required to be updated every month or more frequently as directed by the CSL, based on the actual progress, resource mobilization and other field conditions actually prevailing. During the progress of work, the Contractor shall be required to furnish the resource mobilization plan as required by CSL to keep up the target date of completion.

37. PROGRESS REPORTS

The Contractor shall submit to CSLby the fifth day of every month, a report in a duly approved format showing the progress made, materials procurement status, mobilization of resources, photographs of works in progress etc. during the previous month and works to be executed in the following month.

38. PROGRESS REVIEW MEETING

The purpose of the monthly meeting shall be to review the progress of works, action plan for executing remaining work and assess the arrangements for future work.

The Project Manager deputed by Contractor shall attend the meeting with CSL Project team.

In addition, Quality Walksshall be conducted on a monthly basis focusing on quality assurance and quality control of materials/workmanship/works etc. Contractor shall address all observations/punch list identified during quality walks and shall rectify them at Contractor's own risk and cost within a reasonable timeframe.

39. QUALITY OF MATERIAL AND WORKMANSHIP

All materials and equipment supplied by the Contractor shall be new. They shall be of such design, size and material as to satisfactorily function under the rated conditions of operation and to withstand the environmental conditions at site.

The Contractor's scope of work shall include arranging stage inspections and performance tests as per approved Quality assurance plans.

The Client or their representative shall at all times have access to the works and to the site and to all workshops and places where materials, manufactured articles or machinery are being obtained for the works and the Contractor shall afford every facility or every assistance in obtaining the right to such access. 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 approval as may be required by the Client or his representative.

The cost of making any test as per specifications shall be borne by the Contractor, and the Contractor should arrange for all facilities like meters, instruments as required for carrying out such tests.

All the materials required for this work should conform to relevant BIS Specifications unless otherwise specified. The copies of Purchase Vouchers & Gate Passes should be produced along with the materials. The test certificates, Routine test certificates and acceptance test certificates are also to be submitted.

The Engineer-in-Charge's decision with regard to the quality of the material and workmanship will be final and binding, any material thus rejected shall be immediately removed by the Contractor and replaced by materials as per specifications and standards.

ANNEXURE- 1

DECLARATION BY BIDDER/ CONTRACTOR

NAME OF WORK: CONSTRUCTION OF FIRE WATER TANK, INDUSTRIAL WATER TANK, ACETYLENE ROOM AND COMPRESSOR CLUSTERS (2 Nos.) FOR NEW DRY DOCK PROJECT

1. “I / WE HAVE GONE THROUGH THE TENDER TERMS AND CONDITIONS IN FULL AND UNDERSTAND AND ACCEPT THE SAME AND HEREBY TRULY CONFIRM AND DECLARE THAT THE RATES QUOTED IN THE PRICE BID ARE BASIC RATES AND GST IS SHOWN SEPARATELY. I / WE ALSO CONFIRM THAT COVER B (PRICE BID) DOES 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.”

3. “I/ WE HAVE NOT BEEN BLACKLISTED BY ANY GOVT. DEPT./ COMPANY."

.

Date and Signature:
Name & Designation:
Company seal:

ANNEXURE -2

UNDERTAKING BY BIDDER/ CONTRACTOR

I/We hereby solemnly declare and affirm as follows;

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 hereby undertake to execute the work at our own risk.
3) We shall make available to CSL any additional information it may find necessary or require supplementing or authenticating the Tender.
4) We are not under a declaration of ineligibility issued by CSL 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 2019-2020, 2020-2021, 2021-2022, 2022-2023 and 2023-2024 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 CSL tender document and the one submitted by the tenderer, the CSL document shall prevail.

Date & Signature:

Name & address of the Contractor:

Company seal

ANNEXURE - 3

Name of Work: CONSTRUCTION OF FIRE WATER TANK, INDUSTRIAL WATER TANK, ACETYLENE ROOM AND COMPRESSOR CLUSTERS (2 Nos.) FOR NEW DRY DOCK PROJECT

Details of Bidder

Name of Work :- .....

Tender No. :- .....

1. Name of bidder :- .....
2. Address of bidder :- .....
   .....
   .....
3. Contact Tel number :- .....
4. E-mail address :- .....
5. PAN No :- .....
6. GST Reg. No :- .....

Date : Signature of the bidder

ANNEXURE - 4

POWER OF ATTORNEY

To,
Deputy General Manager (Infra Projects)
Cochin Shipyard Ltd,
Cochin 6820015.
Kerala, India.

Dear Sir,

We ……
……do hereby confirm that Mr./Ms./Mrs……..……
……(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

PRE CONTRACT INTEGRITY PACT

COCHIN SHIPYARD LIMITED

General

This pre-bid pre-contract Agreement (hereinafter called the Integrity Pact) is made on ……..……. day of the month of ……..……., between Cochin Shipyard Ltd (CSL), A Government of India Enterprise under the Ministry of Ports, Shipping & Water Ways having its registered office at Cochin, Kerala, India (hereinafter called the "PRINCIPAL") of the First part and M/s……...…… (hereinafter called the "BIDDER/Seller") of the second part.

WHEREAS the PRINCIPAL proposes to procure ……..…… 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 PRINCIPAL is a Government of India Enterprise.

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

Enabling BIDDERs to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the PRINCIPAL 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 PRINCIPAL

1.1 The PRINCIPAL undertakes that no official of the PRINCIPAL, 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 an advantage in the bidding process, bid evaluation, contracting on implementation process related to the contract.

1.2 The PRINCIPAL will, during the pre-contract stage, treat all BIDDERs alike and will 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 The officials of the PRINCIPAL 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 official(s) is reported by the BIDDER to the PRINCIPAL with full and verifiable facts and the same is prima facie found to be correct by the PRINCIPAL, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the PRINCIPAL 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 PRINCIPAL the proceedings under the contract would not be stalled.

3. <u>Commitments of BIDDERs</u>

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 PRINCIPAL, 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 other advantage, commission, fees, brokerage or inducement to any official of the PRINCIPAL 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 of any other contract with the government for showing or forbearing to show favour or disfavor to any person in relation to the contract of any other contract with the Government.

3.3 BIDDERs of foreign origin shall disclose the name and address of their Indian agents and representatives, if any and Indian BIDDERs shall disclose their foreign principals or associates, if any, in the bid.

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

3.5 The BIDDER further confirms and declares to the PRINCIPAL that the BIDDER is the original manufacturer/ integrator/authorized agent of the stores/equipment/items and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the PRINCIPAL or any of its functionaries, 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 any such 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 PRINCIPAL 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 competition or personal gain, pass on to others, any information provided by the PRINCIPAL 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 PRINCIPAL, or alternatively, if any relative of an officer of the PRINCIPAL has financial interest/stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filing of tender.

The term 'relative' for this purpose would be as defined in section 6 of the Companies Act 1956.

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 or the PRINCIPAL.

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 an amount **NIL** (to be specified in RFP) as Earnest Money as applicable/Security Deposit, with the PRINCIPAL through any of the following instruments:

(i) Bank Draft of Pay Order in favor of CSL.

(ii) A confirmed guarantee by an Indian Nationalized Bank, promising payment of the guaranteed sum to the PRINCIPAL on demand within three working days without any demur whatsoever and without seeking any reasons whatsoever. The demand for payment by the PRINCIPAL 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 if applicable/Security Deposit shall be valid upto the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and the PRINCIPAL, including warranty period.

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 PRINCIPAL to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

5.4 No interest shall be payable by the PRINCIPAL 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 PRINCIPAL 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 PRINCIPAL and the PRINCIPAL 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 PRINCIPAL, and in the case of an Indian BIDDER with interest thereon at 2% above 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% above the LIBOR (London Inter Bank Offer Rate). If any outstanding payment is due to the BIDDER from the PRINCIPAL 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 encash the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the PRINCIPAL, along with interest.

(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 PRINCIPAL resulting from such cancellation/recession and the PRINCIPAL shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.

(vii) To debar the BIDDER from participating in the future bidding processes of CSL for a minimum period as deemed appropriate, which any be further extended at the discretion of the PRINCIPAL.

(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 the contract.

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

(x) Forfeiture of Performance Bond in case of a decision by the PRINCIPAL to forfeit the same without assigning any reason for imposing sanction for violation of this pact.

6.2 The PRINCIPAL 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 PRINCIPAL to the effect that a breach of the provisions of this pact has been committed by the BIDDER shall be binding on the BIDDER. However, the BIDDER can approach the Independent Monitor(s) appointed for the purposes this Pact.

7 Fall Clause

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

8 Independent Monitor

8.1 The PRINCIPAL has appointed Independent Monitor (hereinafter referred to as Monitor) for this Pact in consultation with the Central Vigilance Commission.

Dr. Vinod Bihari Mathur, IFoS (Retd.)
D302, Arborea Luxury Homes,
Tarla Nagal, Near Doon Helidrome,
Dehradun, Uttarakhand - 248001
Mobile: 9412054648
Email: vbm.ddn@gmail.com

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

8.3 The Monitor 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 Monitor has 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 PRINCIPAL.

8.6 The PRINCIPAL 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, unlimited access to his project documentation. The same is applicable to Subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with confidentiality.

8.7 The PRINCIPAL 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 Monitors will submit a written report to the designated Authority of PRINCIPAL /Secretary in the Department/ within 8 to 10 weeks from the date of reference or intimation to him by the PRINCIPAL /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 PRINCIPAL or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER. The BIDDER shall provide necessary information and documents in English and shall extend all possible help of the purpose of such examination/inspection.

10 Law and Place of Jurisdiction

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

10.2 A person signing Integrity Pact shall not approach the Courts while representing the matters to Independent External Monitor and shall await await their decision in the matter.

11 Other Legal Actions

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 extent 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 upto 5 years or the complete execution of the contract to the satisfaction of both the PRINCIPAL 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 Should one or several provisions of this Pact turn out to be invalid; the remainder of this pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

13 The parties hereby sign this Integrity Pact at …….on …….

For & on behalf of PRINCIPAL
Cochin Shipyard Limited
(Office Seal)

For & on behalf of BIDDER
(Office Seal)

Witness

1……

2……..

Witness

1…….

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- 6

PROFORMA OF CONTRACT AGREEMENT

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

THIS AGREEMENT MADE ON …….... 20…… BETWEEN THE DEPUTY GENERAL MANAGER (INFRA PROJECTS), COCHIN SHIPYARD LIMITED, COCHIN-15 on behalf of Cochin Shipyard Limited (hereinafter called the "Engineer-in-Charge") 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-IN-CHARGE is desirous that certain work should be done viz. "CONSTRUCTION OF FIRE WATER TANK, INDUSTRIAL WATER TANK, ACETYLENE ROOM AND COMPRESSOR CLUSTERS (2 Nos.) FOR NEW DRY DOCK PROJECT" and had accepted the tender by the Contractor for the execution and completion 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 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) Work Order with accepted priced Tender Schedule
   b) Bid clarifications and post bid correspondences (if any)
   c) Addendum and Corrigendum to Tender Documents issued by CSL (if any)
   d) Conditions of Contract issued by CSL
   e) Drawings of the Tender Documents issued by CSL
   f) Signed Tender Documents submitted by the Contractor
3. In consideration of the payment to be made by the Deputy General Manager (Infra Projects) to the Contractor (hereinafter called the Contractor) hereby covenants with the Deputy General Manager (Infra Projects) to execute and complete the work in conformity in all respects, with the provisions of Contract.
4. The Deputy General Manager (Infra Projects) hereby covenants to pay the Contractor the Contract price, in consideration of the execution and completion of the work at the time and in the manner prescribed by the Contract.
5. In witness whereof the parties hereto 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 Deputy General Manager (Infra Projects), Cochin Shipyard Limited, Kochi-15 affixed and Deputy General Manager (Infra Projects) has signed.

For Cochin Shipyard Limited,

Signed & Sealed by Contractor: -

In the presence of: -

ANNEXURE-7

FORM OF BANK GUARANTEE TOWARDS EMD

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

This deed of GURANTEE made on …….day of ……Two thousand ……..……. Between CSL on the one part and ……..…….. (Name and address of the bank) of the other part is as follows:-

In consideration of the CSL having allowed M/s…….(hereinafter 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 CSL on demand at Cochin 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 CSL or in entering into an agreement as required by the CSL 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 CSL. 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 CSL or any neglect indulgence or forbearance by the CSL.

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 CSL 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 three 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 three 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 Deputy General Manager (Infra Projects), CSL as to whether the occasion or the ground has arisen for the demand of the surety form Bank shall be final. The CSL 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 CSL 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 whereof we have hereunto set our hand and seal this.

……..……day of…….. .

……Two thousand and ……..

Place:

Date:

ANNEXURE- 8

PROFORMA OF BANK GUARANTEE FOR PERFORMANCE GUARANTEE

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

Guarantee No……..
Amount of Guarantee Rs.…….
Guarantee Cover From……
Last Date of Lodgment of Claim……

1. In consideration of the Cochin Shipyard Limited (hereinafter called CSL) having agreed to exempt……(hereinafter called "The said Contractor(s)" from the demand, under the terms and condition of an Agreement between CSL and ……for the execution of the work of ……..as per work order No……dated….. (hereinafter called "the said agreement") of Performance guarantee 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 for Rs ……(Rupees…….only)
We……..(Name of Bank) (hereinafter referred to as "the Bank) at the request of……Contractor(s) do hereby undertake to pay to CSL 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 may be 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 hereunder to vary any of the terms and conditions of the said Contract or 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 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 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 - 9

PROFORMA OF BANK GUARANTEE FOR MOBILISATION ADVANCE

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

Guarantee No……..

Amount of Guarantee Rs.…….

Guarantee Cover From……

Last Date of Lodgment of Claim……

1. In consideration of Cochin Shipyard Limited (hereinafter called "CSL") which expression shall include all their successors and assignees having agreed to pay Mobilisation 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 CSL 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 CSL 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 thereof 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 not withstanding 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 CSL (Awarder) as to whether the Contractor has made any default or defaults and the amounts to which CSL 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, not withstanding 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 hereunder to vary any of the terms and conditions of the said Contract or 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 CSL (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 but for this provision, have effect of so relieving us.
8. This guarantee shall not in anyway 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 suretyship 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 CSL (Awarder) 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 -10

PROFORMA OF BANK GUARANTEE FOR

SECURITY DEPOSIT

(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 Cochin Shipyard Limited (hereinafter called CSL) having agreed to exempt……(hereinafter called "The said Contractor(s)" from the demand, under the terms and condition of an Agreement between CSL and ……for the execution of the work of ……..as per work order No……dated……. (hereinafter called "the said agreement") of Security Deposit for the due fulfilment by the said Contractor(s) of the terms and conditions contained in the said agreement, on production of a Bank Guarantee for Rs……(Rupees…….only)
   We……..(Name of Bank) (hereinafter referred to as "the Bank) at the request of……Contractor(s) do hereby undertake to pay to CSL 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 may be 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 hereunder to vary any of the terms and conditions of the said Contract or 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 anyway 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 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 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-11

FINANCIAL DETAILS OF BIDDER

Sl. No.	Financial Year	Annual Turnover	Net Worth
1	2021-22		
2	2022-23		
3	2023-24		
Sl. No.	Financial Year	Profit After Tax	
1	2019-20		
2	2020-21		
3	2021-22		
4	2022-23		
5	2023-24		
Certificate from the Statutory Auditors: Name of Authorised Signatory: Designation: Name of firm: (Signature of the Authorised Signatory) Seal of firm			

Note: The bidder shall furnish either Net Worth or Financial Capability/ Solvency Certificate

Signature of the Contractor

ANNEXURE - 12

FORMAT OF FINANCIAL CAPABILITY/ SOLVENCY CERTIFICATE

Certified that to the best of our knowledge and information……, a customer of our bank, is respectable and can be treated as capable for executing the work upto a limit of Rs.…… (Rs……..).

It is clarified that this certificate is issued without any guarantee or responsibility on the bank or any of the officers.

Signature

Name & Designation of the Officer

Bank Seal
Date

Note: This certificate may be issued on the letter head of the bank and addressed to the Deputy General Manager (Infra Projects), Cochin Shipyard Ltd

ANNEXURE – 13

DETAILS OF PAST EXPERIENCE OF BIDDERS FOR SIMILAR WORKS

Sl. No.	Name & Location of Project	Owner's Complete address including Phone No. with contact Person	Value of Contract	Duration of Contract			Details of work including major items of work involved	Reference No. & Date of letter of intent & completion certificate enclosed
				Commencement date	Scheduled completion date	Actual completion date		

Note: Attested/ notarized copy of work completion certificate for Similar Works where experience is being claimed should be submitted.

Signature of Tenderer

ANNEXURE -14

LIST OF KEY PERSONNEL FOR THE EXECUTION OF WORK

Sl. No.	Name	Designation	Qualification	Experience

The data on their experiences should be supplied in separate sheets using Performa in Annexure-15 for each candidate.

Candidates with more than 60 years will not be permitted to work inside CSL

Signature of Tenderer

ANNEXURE - 15

CANDIDATE SUMMARY

Name of Applicant	

Position		Candidate	
		Prime □	Alternate □
Candidate Information	Name of Candidate		
	Date of Birth		
	Professional Qualifications		
Present Employment	Name of Employer		
	Address of Employer		
	Contact Officer		
	Telephone		
	Job Title of Candidate		
	Years with present Employer		

Summarise Professional Experience over the last 20 years, in reverse chronological order. Indicate particulars of technical and managerial experience relevant to the project.

From	To	Company / Project / Position / Relevant Technical and Managerial Experience

Signature of Tenderer

ANNEXURE -16

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

Description of Equipment/Machinery	**Make**	**Year of Manufacture**	**Capacity**

Signature of Tenderer

ANNEXURE –17

CRETERIA FOR EVALUTION OF THE PERFORMANCE OF CONTRACTORS FOR PREQUALIFICATION

	Attributes	**Evaluation**
(a)	Financial strength (30 marks)	
	Average annual turnover (15 marks) Financial Capability/ Solvency OR (10 marks) Net worth	1. 50% marks for minimum eligibility criteria 2. 100% marks for twice the minimum eligibility criteria or more In between (1) & (2) on pro-rata basis
	Profit After Tax (5 marks)	1. 100% marks for positive profit after tax
(b)	Experience in similar Class of works (40 marks)	
		1. 50% marks for minimum eligibility criteria 2. 100% marks for twice the minimum eligibility criteria or more In between (1) & (2) on pro-rata basis
(c)	Personnel and Establishment (Max. 15 marks)	
	1. Structural Engineer (with M-Tech) 3 marks for each up to Max. 3 marks 2. Graduate Engineer 2 marks for each up to Max. 6 marks 3. Diploma holder Engineer 1.5 marks for each up to Max. 3 marks 4. ITI Supervisory/Foreman 1 mark for each up to Max. 3 marks	
(d)	Plant & Equipments (Max. 15 marks)	
	1. Hopper Mixer 1 mark for each up to Max. 2 marks 2. Truck/Tippers/Transit mixer 1 mark for each up to Max. 2 marks 3. Shuttering Material 1 mark for each 125 sqm up to Max.2 marks 4. Excavator 1 mark for each up to Max. 2 marks 5. Vibration Compactor 1 mark for each up to Max. 2 marks 6. Concrete Cube Testing Machine 1 marks for each up to Max. 1 mark 7. Pile Rig 1 mark for each up to Max. 2 marks 8. Shoring sheet pile Materials 1 mark for each up to Max. 2 marks	

ANNEXURE-18

Electronic Payment Mandate Form

(Mandate for receiving payments through RTGS/NEFT Cochin Shipyard Ltd)

1)	Name of Individaual / firm / Company *											
2)	Address *											
	Mobile / Phone No *											
3)	Vendor Code (if available)											
4)	Permanent Account Number(PAN)											--
5)	Particulars of Bank Account											
	a. Name of the Bank *											
	b. Name of the Branch *											
	c. Branch Code											
	d. City Name											
	e. Branch Telephone No. *											
	f. Bank IFSC Code *											
	g. 9-Digit MICR Code										--	--
	h. Type of the Account(S.B,Current or Cash Credit) with code (010/011/013) *				--	--	--	--	--	--	--	--
	i. Account Number (as appearing on the cheque book) *											
6)	Email ID *											

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

I / We hereby declare that the particulars given above are correct and complete.

(.....)

Authorised Signatory

* **Details are compulsory for making the NEFT payment.**

NEFT forms without cancelled cheque will not be accepted.

ANNEXURE – 19

CONSTRUCTION OF FIRE WATER TANK, INDUSTRIAL WATER TANK, ACETYLENE ROOM AND COMPRESSION CLUSTERS (2 Nos.) FOR NEW DRY DOCK PROJECT

SAFETY CODE FOR CONTRACTORS

(To be signed on all pages by the Contractor)

GENERAL SAFETY RULES

1. These safety rules have been promulgated for the guidance of the Contractor. These rules in no way relieve a Contractor form his obligation under various statutory rules and regulations.
2. The Contractor before stating any work in the CSL premises will be issued with these rules and he is expected to give a declaration that he receives one copy of the CSL Safety Rules for Contractors and will comply with the rules laid therein.
3. CSL reserves its right to suspend work in the event of the Contractor not complying with rules of instructions with regarding to Safety practices for which no claim of any kind will be entertained.
4. To ensure the safe conduct of safety operation a representative of the Contractor should maintain appropriate Contract with office-in-charge of the work as may be necessary to acquaint himself with any changed conditions of other matters relating to the safety performance.
5. All regulations code and ordinance of the Government of India, Government of Kerala, and local Municipal, Corporation regarding safety will be applicable to the Contractor.
6. The principal Contractor is responsible for observance of these rules by his sub-Contractors. Only employees acceptable to CSL should not employed for the operation of any type of equipments. Contractor's employees should not enter the areas where the nature of Contracted work does not require their presence.
7. All accident occurring to Contractors personal must be reported promptly and immediately by the Contractor or his agent to the Chief safety offer (Indl. Relations) in additional to the officer-in-charge of the work and this should be followed by an incident-accident report in the form prescribed by the company. In the case of electrical accidents, report should be made in accordance with Rule 44 Annexure of Indian Electricity Rules 1956 and the form shall be in accordance with Annexure XIII to the Indian Electricity Rule 1956. The report should be furnished to the resident Electrical Engineer within 8 hours of occurrence of electrical accident immediately on occurrence

of electrical accident; the operator in the main receiving station should be informed on the phone and necessary instruction taken from him.

8. The Contractor should ensure that they are complying with all the regulations under the Indian Electricity Act and relevant rules when they consume electricity.
    a) All power cables used shall be armoured cables.
    b) HRC fuses should be used in all fuse/switch fuse units.
    c) Double earthing shall be provided for all equipments, switch boards, etc.
    d) Overhead power lines are to be restricted to the minimum possible and should be attached to a GI. Guy wire by means real insulations.
    e) No wire carrying electrical current is to be laid on working floors areas.
    f) Surplus wire kept bundled at the end of supply line shall be neatly done and secured properly.
    g) Earthing points should not be extended by looping.
    h) Electrical insulations, wiring etc. are to be got done only through a licensed electrical Contractor holding valid license issued by the electrical inspector of Kerala.
9. Electric switches or circuits, unless wholly owned solely used by the Contractor should not be opened or closed unless authorized by the Officer-in-charge of CSL.
10. The storage, handling and use of hazardous materials must be approved by the Safety Officer.
11. The Contractor should be responsible for the cleanliness of the job site.
12. The Contractors should take precautions to prevent tripping hazards caused by hoses and welding lines etc.
13. The Contractor should ensure that adequate fire extinguishing arrangements are provided for their equipments.
14. Contractor's workmen should obey all signs and special rules regarding smoking and fire prevention.
15. In the event of fire the contactors should notify to the Inspector, CISF, and Safety Officer, at once giving the exact location and nature of fire. At the same time he should start operations to extinguish or control the fire until assistance arrives.
16. Where property is exposed to the hazards of fire, open fires will not be permitted.
17. Gas or oil fired heaters must not be placed close to an inflammable material. Their burners must be adjusted and maintained so that there is no risk of accidental fire nor of the omission or smoke or fumes.
18. Inflammable liquids must be handled in safe cans or containers approved y CSL and shall be stored, in the locations acceptable to CSL. All such containers must be clearly labeled.
19. Tarpaulin used should be of flame proof type.

20. The area beneath over head work should be "roped off and signs" Danger-Man working above should be placed to warn the men moving below.
21. Excavation should be protected by adequate covering and visible warning lights should be placed both during day and night to warn approaching traffic. Precautions should be taken to prevent "cave-ins": of the excavations.
22. Proper and adequate timber shoring and bracing should be provided to prevent sliding or slipping of loose or unstable soil, rock or other materials.
23. Under cuttings of trenches and other excavations should be avoided.
24. Excavated materials should be put away from the edges of the excavated trench to avoid slipping of the excavated materials into the trench.
25. The Contractors working in man holes or pits below the ground level must acquaint himself and advise his employees of the hazards of gas or liquid level and take proper precautions.
26. Open manholes must be protected by adequate barricade, Man hole covers should be replaced promptly when work is suspended.
27. Only qualified employees under the supervision of a qualified supervisor should be allowed to use oxy-acetylene equipment.
28. Cylinders should be secured in upright position.
29. Electric welding should be done only by qualified welders under the supervision of qualified supervisor.
30. Welder should use adequate personal protective equipments while working.
31. Arc welding should be done only after shielding the location.
32. Arc welding equipments should be properly earthed. While welding it should be ensured that no equipment forms part of the ground return.
33. Contractors should ensure that First Aid boxes are provided at work spot and should ensure proper medical care of injured persons.
34. Contractors should ensure that all the employees are equipped with proper protective equipments for the work they are entrusted with.
35. All the employees of the Contractors should wear approved safety helmets depending on the work they are engaged in.
36. When the Contractor’s employees are exposed to the movement of cranes, the Contractor’s supervisor should consult with the Officer-in-charge before sending his men on the job.
37. When the Contractor’s employees are exposed to the movement of crane he should provide watchmen for the protection o his employees.
38. Only qualified and authorised employees should be allowed to operate the mobile cranes and other hoisting equipments.
39. Only qualified and authorised persons should be allowed to drive the vehicle in the yard.

40. All traffic rules, signs and speed limits must be observed by all the employees of the Contractor.
41. Contractors should not park their vehicle in such a way be a hindrance to the smooth flow of traffic in the yard.
42. While working at heights adequate scaffolding or staging should be used.
43. While working at heights the workman should wear safety belts with adequate life lines.
44. Scaffoldings should be of a sound material securely fastened and should be capable of supporting 4 times the combined weight of men and material who may be working on them.
45. Wooden planks used in scaffoldings should not be less than 10" wide, 2" thick should not extend beyond the outer supports by more than 12" nor less than 6".
46. Guarding and the boards should be installed in all scaffolding which are 10" or more in height.
47. Workmen in charge of working squad are responsible for the safe loading and use of ropes, chains, cables slings, jacks, skids and other hosting and lifting apparatus. In no case such equipments should be used unless and until the man in charge is satisfied that it is fee from defects and are safe for use.
48. Before operating cranes, derrick or hoi stick or hoisting equipment, the operator should sound a warning and he should accept signals only from one person for starting the work of raising, lowering and swinging loads.
49. The Operator should stop immediately all operation on receiving signals from any one.
50. No workman should move near the cable under tension and within the angle formed by the ropes or cables.
51. When anyone is found in the danger zone the Hoist operator should never place tension on rope or cable.
52. Care must be taken to see that cable chains and other hoisting equipments are not unduly stressed by improper use.
53. All ropes, cables, chains, slings, etc. should be discarded when they were worm out or deteriorated to the point where their safe use may be doubtful.
54. Chains and wire ropes should not be spliced or joined.
55. New links should be inserted by competent persons.
56. Wire ropes or cables should not be allowed to kink.
57. When applying U. Bolts and clips to cables, adequate number should be used.
58. Hooks, rings and other fittings used on chains or cables should be of the carrying capacity higher than that of the chain or cable.
59. Natural and synthetic fiber ropes should be properly cared and the following precautions should be taken.
    a) Rope should not pass over sharp edges, pads should be used to protect the fibres.

b) Rope should not be dragged on the ground unnecessarily using to small sheaves, should be avoided.
c) Rope should not be permitted to slip on which drum or moving drums.
d) Kinked ropes should not be used.
e) Do not tie knots where splices should be used.
f) Ropes should not be allowed to soak in oil and exposed to acid or other corrosive substances, they should wash and dried.
g) Rope should not be allowed to expose to weather unnecessarily.
h) When drying excessive hear should not be used.

60. Adequate precautions should be taken during welding or gas cutting against hazards such as electric shocks, burns, fumes fires, explosion and arc eyes.
61. Gauntlet gloves should be worn while or gas cutting.
62. Outer cloth worn should be free from oil or grease.
63. Goggles or welder's helmets should be worn during welding.
64. Barriers should be erected to protect other persons in the vicinity from rays or electric arcs or welding flames.
65. Goggles should be worn while chipping the welding slag.
66. Adequate ventilation should be provided while welding or cutting in confined spaces.
67. When welding or gas cutting in elevated positions, precautions should be taken to prevent sparks of hot metal slag falling out to the people or to the flammable material below.
68. Before welding or cutting a pipe, tank or container, which carried flammable material, it should be thoroughly cleaned and gas freed and if necessary, 'Hot Work Certificate' from the Controller of Explosive should be obtained.
69. Loitering around operating units is prohibited at all times.
70. Bringing intoxicants into the yard is strictly forbidden. Likewise entering the yard under the influence of intoxicants is a offence.
71. Jumping on off trucks, automobiles or other moving vehicle is prohibited. Men should wait until the vehicle stops before attempting to enter or leave.
72. In confined spaces workers shall be protected with air line respirators with tight fitting rubber, mask (especially for painting etc.)
73. It shall be considered hazardous to carry out gas cutting or welding work within 15-20 feet from the place where paint is being applied.
74. The following works to be done through “Permit to work – on Instalment”
    a) Work at height /fragile roof.
    b) Excavation /Trenches opening
    c) Work on gas line
    d) Work on crane track/rail track

75. All scaffolding more than 2m height to the certified by S&F Department before boarded to scaffold.
76. All workers employed with asphaltic materials, cement shall be provided with personal protective equipments (PPE).
77. Works like welding, cutting, concreting breading, grinding, and painting shall be provided with protective goggles/eye shields.
78. When workers are employed in sewage/manhole, septic tank etc;
    a) The area shall be cordoned with warning boards.
    b) Presence of toxic gases should be tested and oxygen availability to be ensured using suitable means.
    c) Safety belt shall be provided to the works.
    d) No smoking or opening claims shall be allowed near manholes.
    e) The waste/malba obtained from the manhole/drains shall be removed immediately.
    f) Air blowers should be used for flow of fresh air.
    g) The workers engaged for cleaning the manholes/sewers should be properly rained before allowing working in the manhole.

WORKING AT HEIGHT

1. All work beyond 2.5m height shall be carried only with permit to work (PTW)
2. Staging should be erected and inspected for all works beyond 2.5m heights.
3. Full body hardness to be worn by the individual working at height and should be attached to a strong point.
4. No loose items like harmer, spanners etc should be kept on staging planks.
5. In case of high risk work special procedure may be drawn up and approved for working.
6. Working at height using rope access ladder system shall be approved by CSL.
7. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.

EXCAVATION

1. All excavation shall be carried out only after getting PTW.
2. Suitable fencing should be erected around the place of work.
3. Sign board should be provided.
4. Excavated materials shall be placed within 1.5m of the edges of the excavation and shall be removed immediately.

5. Cutting shall be done from top to bottom and no undermining and under cutting shall be done.
6. The size of the excavation shall be stepped back to be suitable slop to secure the edges from collapse.
7. Necessary shoring/protection to safe guards the sides from collapse.

DEMOLITION

1. Area adjacent to the work site shall be either close or protected.
2. No electric cable shall remain charged.
3. PTW shall be obtained before commencement of work.

WELDING

1. Welding equipment should be rectifier, inspected & certified by competent authority.
2. Welding cable should be continuous with proper insulation, no joints are permitted.
3. The equipment should be earthed to the nearest point.
4. The welding holder should be ISI mark.
5. Welding gloves should be compulsorily used.
6. Proper welding shield and safety helmets may be used.
7. The Welding plant should be connected to authorised electrical points with ELCB & MCB
8. Qualified /certified /experienced welders should only carry out welding jobs.
9. After work the equipment, supply points to be switched off and cable to be secured.
10. No welding should be carried out at unsafe/moist area and PTW be obtained at all applicable area.

GAS CUTTING

1. The hoses used should be as per Industrial colour coding (Acetylene-Maroon, Oxygen-blue).
2. The hoses should be tested and should have validity.
3. No joints are permitted and in any unavoidable situation they should be more than 3 meter away secured and no additional joints permitted.
4. The cuttogen used should be standard with flash back arrestor fitted.
5. The hose should be connected to the manifold first and then to the cutting torch.
6. The entrapped air in acetylene should be blown, with care to avoid accumulation at work place.
7. PTW to be obtained on all applicable areas.

8. No cutting is permitted near to painting and flammable materials.
9. On completion of work the manifold should be closed and cutting torch disconnected and hoses disconnected from manifold.
10. The hoses disconnected from manifold should be pulled out from place of work and kept in the safe area after rolling.
11. The hose should be painted at every 5 meter with Contractor/company name.
12. In case of usage of cylinders, the cylinders should be kept in upright condition.
13. Only experienced/certified workers should be engaged with cutting work.
14. The nozzle selected should be on the basis of the job.
15. Correct pressure to be used for cutting.

INSTRUCTION FOR TAKING POWER SUPPLY FROM CSL

1. Contractor requiring power connection should submit their request in the proper format to the Resident Electrical Engineer (REE) though their licensed electrical Contractor and with the approval of the Engineer-in-Charge.
2. The connection will be energise only after completion report and inspection by the REE and found the connections are proper.
3. The work shall be commenced only after getting approval from Residential Electrical Engineer.
4. During the course of work, periodic inspection by the REE or his representatives, defects, unsafe practices etc reported shall be rectified immediately after stopping the work. Failure to carry out the instruction will lead to disconnected. Qualified electrician /supervisor having competency license/certificate issued by Kerala State Licensed Board shall be made available as directed by the Engineer-in-Charge.
5. For non observance of the above safety practices, rules and regulations and due to the resultant accidents the defaulting consumers liable to be subjected to the normal procedures of punitive actions as envisaged in the Indian Electricity Rules/Indian Electricity Act and elsewhere.
6. Overalls shall be supplied by the Contractor to their workmen with their names written.
7. When the work is done near any place where there is risk of drowning, all necessary equipments should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the course of the work.
8. Use of hoisting machines and tackle including their attachment, anchorage and support shall conform to the following standards or conditions:-
    a) The machine shall be tested and certified by the competent authority.
    b) Operated shall be properly qualified and experienced.
    c) Safe working load shall be properly written neat the hoisting machine.

d) All moving parts, belts etc shall be secured with cover/guars.

9. Notwithstanding the above clause, there is nothing in these to exempt the Contractor from the operations of any other Act or Rule in force in the Republic of India.

10. All the safety codes, manual of CSL and instruction issued to the Contractor while issuing PTW, tool box talk and site direction by Chief Safety Officers and its representatives shall be fully complied by the Contractor.

ELECTRICAL CONNECTION

1. All equipment used should be inspected by CSL and certified.
2. The power supply should be through ELCB & MCB.
3. No loose wires should be used for connection.
4. The equipment cord should not be tempered with and any extension of cable should be done through proper extension board only.
5. No guard/ shield should be removed from electrical equipments.
6. When not in use, the cables and equipments may be secured properly.
7. All single phase connection should have one earthing and 3 phase with 2 earthing.
8. Power cable termination required for drawing direct power from CSL EW Switch Boards/ CSL permanent installations to be carried out by CSL authorized electricians only.
9. Temporary Electrical installations with Valid Load Center (LC) number only are to be used inside yard premises. LC number will be allotted by the REE for the Electrical installations with necessary & sufficient safety gadget (ELCB+MCB). For obtaining the LC number, details of the JB/Extension Board and the Electrical equipment intended for connection are to be submitted by the sub Contractor, through a Licensed Electrical Contractor, as per the format available with the REE. The REE shall provide the LC number, valid for year after confirming the safety measures incorporated in the installation.

ENTRY/EXIT PROCEDURE

1. Pre-Requisites

The following documents are mandatory for issue of entry passes for work inside the yard:

a) ESIC Declaration/ Personal data form (CSL approved format)
b) PF nomination form (CSL approved format)
c) Age Proof Certificate (School Certificate or valid Indian Passport)
d) Police Clearance certificate in original or copy of passport issued within 6 months from the date of engagement of worker.
e) Medical Certificate issued by a qualified Doctor (MBBS) – in Shipyard prescribed

format.

f) Savings A/c Passbook with IFS code.

g) Aadhar.

h) Election ID.

i) EPF (Declaration form) (CSL approved format)

2. **Procedure**

a) Issue of Entry pass to Contract workman/ Supervisor/ Representative

i. The Contractor shall submit an application in the prescribed format along with all supporting documents mentioned for issuing entry pass. The application shall be duly recommended by concerned HOD of work awarding Department. The application shall be submitted to welfare section 7 days prior to attending HSE Induction training.

ii. The newly hired workman/Supervisor/ Representative shall undergo HSE Induction Training conducted by S&F Department on every Tuesday (Hindi) and Wednesday (Malayalam).

iii. Permission for entry to attend HSE Induction training can be obtained by sending Email to Sannidhi gate from concerned work awarding department.

iv. On receipt of list of persons who have successfully completed HSE Induction training from S&F Department, Assess Control Card (ACC) No. will be issued to each workmen/Supervisor/ Representative.

b) Issue of Entry Pass to Workman/ Supervisor/ Representative through Contractors directly registered with ESIC/ EPF

The procedure for issue of entry passes to Workman/ Supervisor/ Representative through Contractors possessing individual ESIC/EPF Registration number will be same as mentioned. However, the following documents may be mandatory:

i. PF Nomination

ii. Savings A/c Passbook and IFS Code

iii. Aadhar

In such cases the details of ESI/ EPF of the worker shall be mentioned in the personal Bio data form and necessary ESI/EPF Challan and ECR should be submitted to welfare section by 5th of every month, as having remitted the contributions in respect of the workman/ Supervisor/ Representatives (Attendance sheet to be marked "ESI/EPF DIRECT")

c) Issue of Workman/ Supervisor/Representative exempted from ESI/EPF Coverage.

If any Workman/ Supervisor/Representative is exempted from ESI/EPF owing to "above wage limit" (₹ 15000/- PM for EPF and ₹ 21000/- PM for ESI), a copy of Employees Compensation Package (Preferably covering medical treatment expenses also) taken in respect of the Workman/ Supervisor/Representative

engaged for work in CSL, shall be submitted to welfare section along with joint declaration signed by the worker, Contractor/ Contracting firm and duly counter signed by concerned HOD.

d) Issue of Entry Pass to Service Engineer.

i. Based on the E-mail from concerned work awarding department, entry will be permitted to service engineers for part time work or for a period upto 6 days on production of valid ID proof subject to attending a preliminary safety awareness programme arranged at Sannidhi gate. In case of part time work, work awarding department shall clearly specify the periodicity of the work for incorporating same in the entry pass.

ii. If the Service Engineers requires entry pass for more than 6 days, he/she shall attend HSE Induction training conducted by S&F Dept. and submit relevant document as mentioned.

OTHER CONDITIONS

1. Entry will be permitted strictly to Workman/ Supervisor/ Representative aged below 60 years only. No entry will be permitted to any person above 60 years under any circumstances.

   a) Details of Workman/ Supervisor/Representative available in Aadhar (Name, DOB, Gender etc) should exactly match with the details given in Age proof certificate of the Workman/ Supervisor/Representative. In case of any correction in the above particulars, the same has to be done before attending the HSE Induction Training.

   b) Contractor shall submit attendance of all the Workman/ Supervisor/Representative engaged by them including newly hired Workman/ Supervisor/Representative by 5th of every month in variably failing which necessary justification shall be obtained and any penalty/ interest/ fine charged by statutory authority will be borne by the Contractor.

   c) No entry will be permitted without attending HSE Induction training conducted by S&F Dept.

   d) No passes will be issued for Workman/ Supervisor and Contractor if the above guidelines are not complied in all aspects.

   e) Safety violation if found the Contractor will be liable fine as per the Contract OR cancellation of Contract as decided by the competent authority.

   f) The above directions shall be read with the other existing rules.

SECURITY INSTRUCTIONS

1. Cochin Shipyard Limited is an ISPS code compliant Port Facility and is required to maintain the security level declared by the Government of India form time to time. The premises of Cochin Shipyard Limited are a, Prohibited Area, under the official secrets Act. All Contractor and their personnel are bound to comply with security instructions/orders of the Shipyard issued from time to time.
2. Contractor / workers should submit details furnished in CSL formats, Aadhaar, Police Clearance Certificate (PCC), Medical Fitness Certificate, Vaccination Certificate, Insurance copy, Safety Department Clearance and other documents as required by CSL along with application to get entry pass.
3. All Contractors and Contract workmen should have valid entry pass sued by CSL or accepted as equivalent by the CSL and they shall enter the yard through Sannidhi Gate.
4. All movements of all persons entering through Sannidhi Gate should be recorded in the Access Control System at the gate.
5. 100% chechking and frisking if all Contractor/Contract workmen entering into yard will be done.
6. All vehicles entering CSL shall have vehicle entry pass either conspicuously on the vehicles or endorsed in the entry pass. Vehicles carrying materials shall have material entry pass. Such material carrying vehicles shall be permitted entry to factory area by the Blue Security or production of material pass. All Contractors and their workmen shall keep their personal vehicles in the parking area neat Sannidhi gate.
7. All persons engaged for various works in CSL through Contractors should produce the following documents prior to issuing their entry passes;
    a) Attested copy of any of the documents mentioned below:
        i. Photo identity card issued by Government bodies.
        ii. Electoral identify card with clear and address particulars.
        iii. Driving licence with photo and address particulars
        iv. Passport /attested copy of passport with photo and address particulars.
        v. Police clearance certificate with photo and address particulars.

    No person above 60 years shall be permitted entry into the yard for any work except otherwise specially permitted by the occupier of the factory.

    b) Police clearance certificate of not less than six months old to the effect that the concerned person is staying in the area of jurisdiction of the certificate issuing Police Station and that the person s not involved in any criminal offences as per the records available.
    c) Application and decoration for enrolling under Employees‟ Provident Fund ESI Scheme. Three passport size photograph of the individuals and two copies of family photographs of the member.
    d) Safety awareness Programme attendance certificate issued by CSL.
    e) Medical fitness Certificate by any Registered Medical Practitioner in the

prescribed format.

8. Mobile phone with camera is strictly prohibited inside the Shipyard. No Contract workmen shall use mobile phone at factory area.

QUALITY, HEALTH, SAFETY & ENVIRONMENT (QHSE) POLICY OF CSL TO BE COMPLIED BY THE CONTRACTOR.

1. CSL implemented an Integrated Management System (IMS) consisting of Environmental Management System (EMS), Occupational Health and Safety Management System (OHSMS) and the Quality Management System (QMS) within the yard. As part of implementation of IMS, Contractors shall comply with the following measures related to the Quality, Health, Safety &Environment (QHSE) policy of CSL.
   a) Meeting or exceeding customer requirements.
   b) Assuring quality of the products and service.
   c) Preventing occupational ill health & injuries.
   d) Enduring safe work sites.
   e) Conserving natural resources.
   f) Preventing /Minimizing air, water & land pollution
   g) Handling and disposal of hazardous wastes safely.
   h) Complying with and statutory & regulatory and other requirements.
   i) Development skills and motivating employees.
2. Occupational Health, safety & Environmental requirements of CSL shall include the following.
   a) The Contractor (or a sub-Contractor performing work on behalf of the Contractor) is deemed to comply with the occupational Health, Safety and Environmental policy of the company and also to all operational controls/standard operating procedures and shall undertake the work in total compliance with requirements of the established Integrated Management (IMS) of the company.
   b) The Contractor shall undertake the work in total compliance with all applicable legal/statutory requirements related to Occupational Health, Safety and Environment effect in the state of Kerala.
   c) It is the sole responsibility of the Contractor to assure that any sub-Contractor/s who shall perform works in company lands/facilities/worksites on behalf of the contactor, is also following all requirement related to the Integrated Management System f the company and the Health /Safety/Environmental Rules effective in the state of Kerala
   d) The Contractor shall provide/implement and operate/practise all Occupational Health, Safety and Environmental Management measures/facilities, for their period of Contract, in their activities/at their work sites, which shall be required according to the IMS of the company or that required by the Health

/Safety/Environmental Rules established and effective in the state, at their own cost.

e) If any Contractor filed to comply with or violated any clause/requirements of Occupational Health /Safety/Environmental Rules effective in the state, in their activities it at work sites and the same shall be exposed to the Government or any competent authorities upon inspections, the Contractor shall be solely responsible for all liabilities caused by his/her action and shall be responsible for paying the penalty and taking stipulated corrective actions insisted by the authorities within the specified time, their own cost. Any liability to the company in this regard needs to be compensated by the Contractor.

f) Upon completion of the work, Contractor shall clear the area and shall not leave any Occupational Health /Safety/Environmental liabilities to the company, from their activities at the worksites.

g) Any clarification related to IMS requirements of the yard, may be obtained by the Contractor from the authorized representative of the Contract, prior to the commencement of work.

PART NO : 08	**R&R POLICY**
SEC NO :01	**REWARDS AND REPRIMAND (R&R) POLICY**
SUB SEC :	NIL

REWARDS AND REPRIMAND (R&R) POLICY

1.0 PURPOSE

The procedure is called R&R policy in general and the purpose of this procedure is:

- To establish & institutionalize a HSE Reward & Reprimand with respect to HSE performance across the yard.
- To recognize achievements, accomplishments, & ideas that contributes to the objectives of the organization.
- Also, to establish a process in adherence to acceptable HSE standards of conduct by following a graded approach to discipline & behavior modification of all staff in CSL including CSL Staff and Subcontractors and their staff.
- To initiate action against the HSE violators.

2.0 SCOPE

- This procedure is applicable to all the Officers, supervisors, employees, trainees, on contract & sub-contractor and their staff working at Cochin Shipyard Ltd.

3.0 OBJECTIVE

- This procedure tends to serve as a guide to constantly motivate people and prevent unsafe acts in every area of the organization.
- We expect managers to consider employees as individuals. Therefore, each case in which disciplinary action becomes necessary will require individual analysis and decision making where all unique circumstances must be taken into account and appropriately reflected in the progressive disciplinary action taken.
- While for most cases a staged approach to discipline is desirable, in case of incidents which are serious in nature or involving violation of core values, appropriate action proportional to the act would be necessary.

4.0 REWARDS & REPRIMAND

4.1 GENERAL

Safety culture of CSL mirrors the values, attitudes, perceptions, competencies, and behaviours of its workforce. It serves as an embodiment of our dedication to health, safety, and environment while also highlighting the effectiveness of its management systems. Observable behaviour of individuals and the perception of employees towards health, safety, and environment are significantly impacted by these systems and frame work.

Nurturing a robust Safety culture in CSL involves **Enabling and Enforcing**. Enabling encompasses creation of an environment that empowers and motivates individuals to prioritize safety and health. Enforcing, on the other hand deals with compelling to adhere to safety standards / SOPs as well as consequential actions against non-adherence to these standards / SOPs.

4.2 PROCEDURE

It has been decided that CSL shall implement a Reward and Reprimand policy (R&R) towards enabling and enforcing of safety systems and procedures with hierarchy of controls such as Elimination, Substitution, Engineering controls, Administrative controls and use of appropriate PPEs. In general, for rewards **CSL / SMS / S&F / Form No 8.1 A** shall be used and for reprimand **CSL / SMS / S&F / Form No 8.1 B** (V/I FORM) shall be used. Both forms are appended with this document. The details of the rewards and reprimand for each categories are summarised in the table given below:

1A	**PPE - Rewards**		
	Type of Noteworthy actions	**CSL**	**Sub-Contractors**
	Promoting use of Job Specific PPEs.	Reward during monthly PEP talk by presenting small gifts/ certificates of appreciation decided by HoD.	Reward during monthly PEP talk by presenting small gifts/ certificates of appreciation decided by HoD.
	Introduction of new PPE specific to the job/ area.	Recommend for Yearly HSE Rewards as decided by a committee consisting of Occupier, Factory Manager and CSO. Citation to be presented in the event of Safety Day celebrations.	Recommend for Yearly HSE Rewards as decided by a committee consisting of Occupier, Factory Manager and CSO. Citation to be presented in the event of Safety Day celebrations.
1B	**PPE - Reprimand**		
	Type of Deviations	**CSL**	**Sub-Contractors**
	Nonuse of basic PPES / Nonuse of job specific PPEs / Use of Damaged PPEs	**a. Observation of Deviation** The concerned officer/supervisor shall brief the defaulter the need for wearing PPEs and enforce the same. If any deviation noticed by S&F department, violation form (V/I FORM) shall be issued to the defaulter. The respective Supervisor/Officers hall conduct Safety Briefing for the closure.	**a. Observation of Deviation** The concerned sub contractor shall brief the defaulter the need for wearing PPEs and enforce the same. If any deviation noticed by CSL, violation form(V/I FORM)shall be issued by Executing Officer/S&F Department and impose a fine of Rs.10,000.00 on the contractor and conduct safety Briefing by the respective Officer/ Supervisor.
1C		**b. Incident due to non compliance.** Issue Form (V/I FORM) by S&F Department to the concerned HoD. The HoD shall issue a memo seeking explanation to the Officer, supervisor and workers responsible for the incident. If explanation is found unsatisfactory, charge sheet to be issued to the Officer, supervisor and staff.	**b. Incident due to non compliance.** Issue form (V/I FORM) by Executing Officer/HoD/S&F Department to the contractor. The registration of firm(s) involved shall be suspended by Executing Officer / HoD and entry pass issued to the workers involved shall also be cancelled. HoD shall issue show cause notice to the contractor and if the explanation by the contractor is unsatisfactory, contract registration shall be cancelled or suspension of registration can be revoked by imposing a fine of Rs.1,00,000/-

2A	**Administrative Controls – Rewards**		
	Type of Noteworthy actions	**CSL**	**Sub-Contractors**
	Exemplary work on Safety	Safety employee of the month shall be decided by the HoD. A small gifts/ certificates of appreciation will be presented by HoD.	Safety employee of the month shall be decided by the HoD. A small gifts/ certificates of appreciation will be presented by HoD.
	Introduction of new methods/actions for creating a safe work area.	Recommend for consideration of safety award of year decided by a committee consisting of Occupier, Factory Manager and CSO. Citation to be presented in the event of Safety Day celebrations.	Recommend for safety award of the year decided by a committee consisting of Occupier, Factory Manager and CSO. Citation to be presented in the event of Safety Day celebrations.
	Best performing FSR	Best FSR of the month/quarter decided by HoD	Best FSR of the month/quarter decided by HoD.
		Best FSR Award of the year decided by a committee consisting of Occupier, Factory Manager and CSO. Citation to be presented in the event of Safety Day celebrations.	Best FSR Award of the year decided by a committee consisting of Occupier, Factory Manager and CSO. Citation to be presented in the event of Safety Day celebrations.
	Best performing HSE Coordinator	Best HSE Coordinator of the year as decided by a committee consisting of Occupier, Factory Manager and CSO. Citation to be presented in the event of Safety Day celebrations.	NA.
2B	**Administrative Controls - Reprimand**		
	Type of Deviations	**CSL**	**Sub-Contractors**
	Category 1 Deviation (High potential) / Category 2 Deviation (Medium potential) / Category 3 Deviation (Low potential) (Pls see the Annexure 1 – Type of Category 1,2,3 Deviations)	**a. Observation of Deviation** The concerned officer/supervisor shall brief the defaulter the need for adhering to SOPs and enforce the same. If any deviation noticed by S&F department, violation form (V/I FORM) shall be issued to the defaulter. Section head shall conduct Mass Safety Briefing within two days for Officers, Supervisors and Workers. Works shall be suspended till the briefing in case of Category 1 Deviation	**a. Observation of Deviation** The concerned sub-contractor shall brief the defaulter the need for adhering to SOPs and enforce the same. Issue form (V/I FORM) by S&F Department/Executing Officer and impose a fine for Rs.25,000/- for Category 1, Rs. 10,000/- for Category 2 and Rs. 5000/- for Category 3 deviations. Conduct Mass Safety Briefing by the respective AGM within two days for sub-contractors supervisors &their workers. Works shall be suspended till the payment of fine in case of Category 1 Deviation.
2C		**b. Incident due to non-compliance.** Issue Form (V/I FORM) by S&F Department to the concerned	**b. Incident due to non-compliance.** Issue form (V/I FORM) by Executing Officer/HoD/S&F Department to the contractor. The registration of firm(s) involved shall be suspended or

		HoD. The HoD shall issue a memo seeking explanation to the Officer, supervisor and workers responsible for the incident. If explanation is found be unsatisfactory, charge sheet to be issued to the Officer, supervisor and staff. HoD shall conduct Mass Safety Briefing for Officers, Supervisors and Workers Works shall be suspended till the issue of memo in the case of Category 1 Deviation Recurrence of the same deviation will entail initiating disciplinary action as per the service rules.	cancellation of registration from CSL decided by Executing Officer/HoD and entry pass issued to the workers involved shall also be cancelled. HoD shall issue show cause to contractor. If explanation is unsatisfactory, contract registration shall be cancelled or suspension can be revoked by imposing a fine of Rs.1,00,000.00**.** Recurrence of the same deviation will entail cancellation of contract registration.
3A	**Engineering Controls – Rewards**		
	Type of Noteworthy	**CSL**	
	Arranged new engineering controls in a proactive way	Recommend officer and team for CMD award as recommended by awards committee. Nomination for the same shall be recommended by a committee consisting of Occupier, Factory Manager and CSO.	
3B	**Engineering Controls – Reprimand**		
	Type of Deviations	**CSL**	
	Not reinstating the engineering controls after repeated notification	Initiate disciplinary action for non-compliance.	
	Substitution & Elimination – Rewards		
	Type of Noteworthy		**CSL**
4A	**Substitution->**Replace the hazards, Replacement of Asbestos sheet, Introduced new ventilation system, Improvisation of Scaffold system, adopting new blasting methods, introducing LOTO, carbon neutral initiatives, digital or green initiatives, industry 4.0 etc		Recommend officer and team for CMD award as recommended by awards committee. Nomination for the same shall be recommended by a committee consisting of Occupier, Factory Manager and CSO.
4B	**Elimination->** Physically remove the hazards, Net zero initiatives, introduce new excellence models, 6S & 5R models etc		

Note:

a) *Copy of Form (V/I FORM) to personal file after closure for CSL worker cases*
b) *Occupier shall take a final call within two day in case of incidents happened.*
c) *Closure of the Form (V/I FORM) within two days.*
d) *All cases of violation / Incident, form (*V/I FORM*)) will be issued immediately after the occurrence of deviation of SOP or incident.*
e) *This policy is applicable to all works in CSL factory.*

- The monthly HSE rewards will also be factored for recommending Yearly HSE Rewards on Safety Day celebrations / CMD award.
- HoDs are to ensure that inclusion of a clause in all **tenders / work orders** issued contractors to the effect that the R&R policy of CSL is binding on them**.**
- In case of any doubt or interpretation of any provision of this R&R policy decision of the Occupier shall be final and binding.

5.0 TYPES OF DEVIATION

Category 1 Deviation (High potential)	Category 2 Deviation (Medium Potential)	Category 3 Deviation (Low Potential)
1. Work Permit / NCS Violations a. Performing work without valid permit / NCS b. Deviating from approved PTW/ JSA **2. Safe to Work Certifications** a. Unauthorise entry into confined spaces or compartments b. Using unsafe or not certified scaffold. **3. Violation relating to Gas Management** a. Gas leaks Down Stream b. Gas leaks Up Stream c. Gas management system – Down Stream d. Gas management system – Up Stream **4. Violations relating to tools and equipment's** a. Use of untested hoses and electrical tools/Equipment's b. Substandard use of Electrical Fittings/connections c. Violation of Statutory requirements – Lifting tools and tackles etc **5. Unsafe work methods** a. Fishing from dock and quays b. Unsafe lifting methods c. Dangerous or rash act likely to cause serious injury to himself or others d. Use of 230 V hand lamp e. Driving / Cycling using	1. Failure to observe safety signboards 2. Failure to provide life buoys or life jackets when working near or over water. 3. Not switched off Equipment's/machineries after use 4. Throwing or dumping of hazardous materials to work spaces/environment 5. Overloading or improper use of lifting appliance / equipment. 6. Placing / leaving materials on scaffolds. 7. Tampering with electrical fitting or appliances 8. Throwing or dropping objects from heights 9. Improper use of ladders or platforms 10. Use of unsafe tools, machinery or equipment in the yard. 11. Unauthorised use of yard's equipment in the yard 12. Unsafe use of cylinders 13. Working without Basic and Job Specific PPEs 14. Use of non tested eyes hooks or eye hooks without round weld 15. Use of Extended loads without red flag and Banksman with Florescent jacket 16. Failure to used proper electrical plugs / connectors (eg. Heavy duty industrial type).	1. Parking bicycle / vehicle in prohibited areas 2. Jaywalking 3. Not deployed safety officers by the firm as per the norm. Fine per day basis 4. Contractors not submitted the revised HSE plan in January of every year those who employees 20 and more workers 5. No tags on the tested items **If items are not catered or needs clarifications, The decision of CSO is final. This list will be updated time to time by S&F Department**

Category 1 Deviation (High potential)	Category 2 Deviation (Medium Potential)	Category 3 Deviation (Low Potential)
mobile Phone f. Dangerous or unsafe driving g. Driving vehicles more than 20 Km/hr h. Failure to provide guard rails, fencing or cover to prevent falling of persons i. No guards and handle on grinding machine, failure to use guards j. Unauthorised use of equipment's/ vehicles k. Unsafe movement of material handling equipments.	17. Failure to maintain proper housekeeping at skids/shops/onboard vessel – for Supervisor/Sub-con/Project Manager/Officer in charge of vessel 18. Deviation of SOP(General) **If items are not catered or needs clarifications, The decision of CSO is final. This list will be updated time to time by S&F Department.**	
6. Unsafe Behaviours a. Tampering with fire protection / rescue equipment / Safety systems b. Failure to comply with safety instruction /advice from supervisor or Superiors / S&F staff c. Failure to Instruct and Comply SOPs by the Supervisor d. Wilfully causing to himself any illness, injury or disability e. Smoking inside CSL		
If items are not catered or needs clarifications, The decision of CSO is final. This list will be updated time to time by S&F Department.		

6.0 RECORDS

a) CSL / SMS / S&F / Form No 8.1 A
b) CSL / SMS / S&F/ Form No 8.1 B (V/I FORM)
c) Reprimand actions are recorded in concerned personal file / performance report of contractor.
d) Ref: SFY/10/15/2024

SL. NO.	INITIAL REVISION WITH DATE	LATEST REVISION WITH DATE	AMENDMENT DETAILS IN BRIEF
1	Revision A00, APR 2020	Revision A01, FEB 2024	Process update with reference to circular SFY/10/15/2024 - Rewards and Reprimand Policy – Safety dated 16/02/2024, CSL / SMS / S&F / Form No 8.1 A Rev 01(Safety Reward Form) – Revised form in order to incorporate details of rewards other than FSR / Safe Person of Month.

Digitally signed by SALEEN A
Date: 2024.04.12 14:12:33 +05'30'

कोचीन शिपयार्ड लिमिटेड
Cochin Shipyard Limited

SAFETY REWARD FORM

1.	**Initiating Department:** **BEST FSR / Safety Person of the Month / *Others(Tick applicable)*** **Others :**	**Month:** **Date:**
	Name: **Code No/Pc No:/ Acc no:** **Section:** **Area:** **Employer:**	
2.	**Description of the Safe Behavior/Exemplary act from the individual:**	

Expectations from Best FSR	**Expectations from Safety Person of the Month**
Reporting of Safety Suggestions implemented in the section	Participation in HSE activities
Involvement in Safety Promotional Activities	Raising HSE Observations
Participation in Safety(Corrective action monitoring & Implementation)	Active role in implementing HSE Kaizens and HSE Suggestions
Timeline accuracy and completeness of weekly report	Participation/Conducting HSE Trainings/Toolbox Talks
Working together with FSRs of other Department/sections to achieve better HSE results	Reporting near misses
Any other as the case may be	Any other as the case may be

3.

	Name	**Designation**	**Signature**
Recommendation(FSR/Safety Committee Member)			
Approval(Section Head)			
Issue (HOD)			
Distribution (HSE Coordinator)			

Violation

COCHIN SHIPYARD LTD

FORM FOR REPORTING SAFETY VIOLATION / INCDIENT AND ITS CLOSURE (V / I Form)

Incident

REPORTING PART

Violation / Incident No: **Previous violation/Incident ref no:** **Work Suspension: Yes / No (Cat 1)**

☐**Incident** ☐**Violation**	**Company Name**:

Type and Category of Violation / Incident			
PPE	☐Non use of basic PPEs	☐Non use of job specific PPEs	☐Use of Damaged PPEs
Administrative Controls	☐High / Category 1	☐Medium / Category 2	☐Low / Category 3
ENGG	☐Not reinstating the engineering controls after repeated notification		

Date & Time:	Location:	Department:
Name of Supervisor: Mobile Number:	Name of CSL Officer: Mobile Number:	

Details of Staff involved					
Sl. No	**Name**	**Code/PC No.**	**Sl. No**	**Name**	**Code/PC No.**

Narration of Incident / Violation:

Name of S&F Staff	**Designation**	**Code No.**	**Signature**

CLOSURE

Attachments: (as Applicable)	**CSL Staff:** ☐ Memo with reply along with HOD comments ☐ Safety Briefing Photo with Attendance ☐ Other	**Subcontractors:** ☐ Amount paid receipt ☐ Safety Briefing Photo with Attendance ☐ Firm suspension letter ☐ Termination of staff letter ☐ Show cause to Contractor with reply ☐ Other .....

Corrective & Preventive action initiated by the concerned person/ supervisor:

Name of Supervisor: Mobile Number: Code Number/PC No.
Signature. of Supervisor

Comments of company owner/ site in charge (for Sub - contractors only):

Name :.....Signature.....

Comments of concerned CSL Officer:

Name:..... Code Number.....Designation:.....Signature:.....

Comments of concerned DGM/AGM:

Name:..... Code Number .....Designation:.....Signature:.....

Remarks of concerned CSL Safety officer:

Name:.....Designation:.....Signature:.....

Closing of the report by Chief Safety Officer:

Name :.....Signature.....

ANNEXURE-21

INDENTURE FOR SECURED ADVANCES

This indenture made on the …… day of …….. 20…….. between M/S…….. (hereinafter called the Contractor which expression shall where the context so admits or implies be deemed to include his executors administrators and assigns) of the one part and ……, COCHIN SHIPYARD LIMITED, COCHIN-15 on behalf of Cochin Shipyard Limited (hereinafter called the Engineer-in-Charge which expression shall where the context so admits or implies be deemed to include his successors in office and assigns) of the other part. Whereas by an agreement dated …… (hereinafter called the said agreement) the Contractor has agreed and whereas the Contractor has applied to the…… that he may be allowed advances on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges) and whereas the …….. has agreed to advance to the Contractor the sum of Rupees …….. only on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advances for the said works signed by the Contractor on ……. and the ……. has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works. Now this indenture witnessed that in pursuance of the said agreement and in consideration of the sum of Rupees …… only on or before the execution of these presents paid to the Contractor by the …… (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid the Contractor doth hereby covenant and agree with the……. and declare as follows: -

1. That the said sum of Rupees ……. only so advanced by the ……. to the Contractor as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the Contractor in or towards expediting the execution of the said works and for no other purpose whatsoever.
2. That the materials detailed in the said Account of Secured Advances which have been offered to and accepted by the ……. as security are

absolutely the Contractor's own property and free from encumbrances of any kind and the Contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor indemnifies CSL against all claims to any materials in respect of which an advance has been made to him as aforesaid.

3. That the materials detailed in the said Account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the……. and in the term of the said agreement.
4. That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and on his own responsibility and shall at all times be open to inspection by the …….. or any officer authorized by him. In the event of the said materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same as required by the……..
5. That the said materials shall not on any account be removed from the site of the said works except with the written permission of the ……. Or an officer authorized by him on that behalf.
6. That the advances shall be repayable in full when or before the Contractor receives payment from the …… of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the …….. will be at liberty to make a recovery from the Contractor's bill for such payment by deducting there from the value of the said materials then actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.
7. That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the …… shall immediately on the happening of such default be repayable by the Contractor to the ……. together with interest thereon at twelve per cent per annum from the date or respective dates of such advance or

advances to the date of repayment and with all costs charges, damages and expenses incurred by the …… in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the …….. to repay and pay the same respectively to him accordingly.

8. That the Contractor hereby charges all the said materials with the repayment to the ……. of the said sum of Rupees …… only and any further sum or sums advanced as aforesaid and all costs charges, damages and expenses payable under these presents provided always and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whenever the covenant for payment and repayment herein before contained shall become enforceable and the money owing shall not be paid in accordance therewith the …….. may at any time thereafter adopt all or any of the following courses as he may deem best :-

    a. Seize and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion and the amount due in respect of advances under these presents and crediting the Contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor he is to pay same to the…… on demand.
    b. Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable or payable to the ……. under these presents and pay over the surplus (if any) to the Contractor.
    c. Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.

9. That except in the event of such default on the part of the Contractor as aforesaid interest on the said advance shall not be payable.
10. That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been herein before expressly provided for the same shall be referred to the Chairman, Cochin Shipyard whose decision shall be final. In witness whereof the said

parties by the order and under the direction of the Chairman, Cochin Shipyard Ltd have hereunto set their respective hands the day and year first above written.

Signed, sealed and delivered by

the said Contractor

For Cochin Shipyard Limited,

……

In the presence of: -

1.

2.

PRE-BID QUESTIONNAIRE

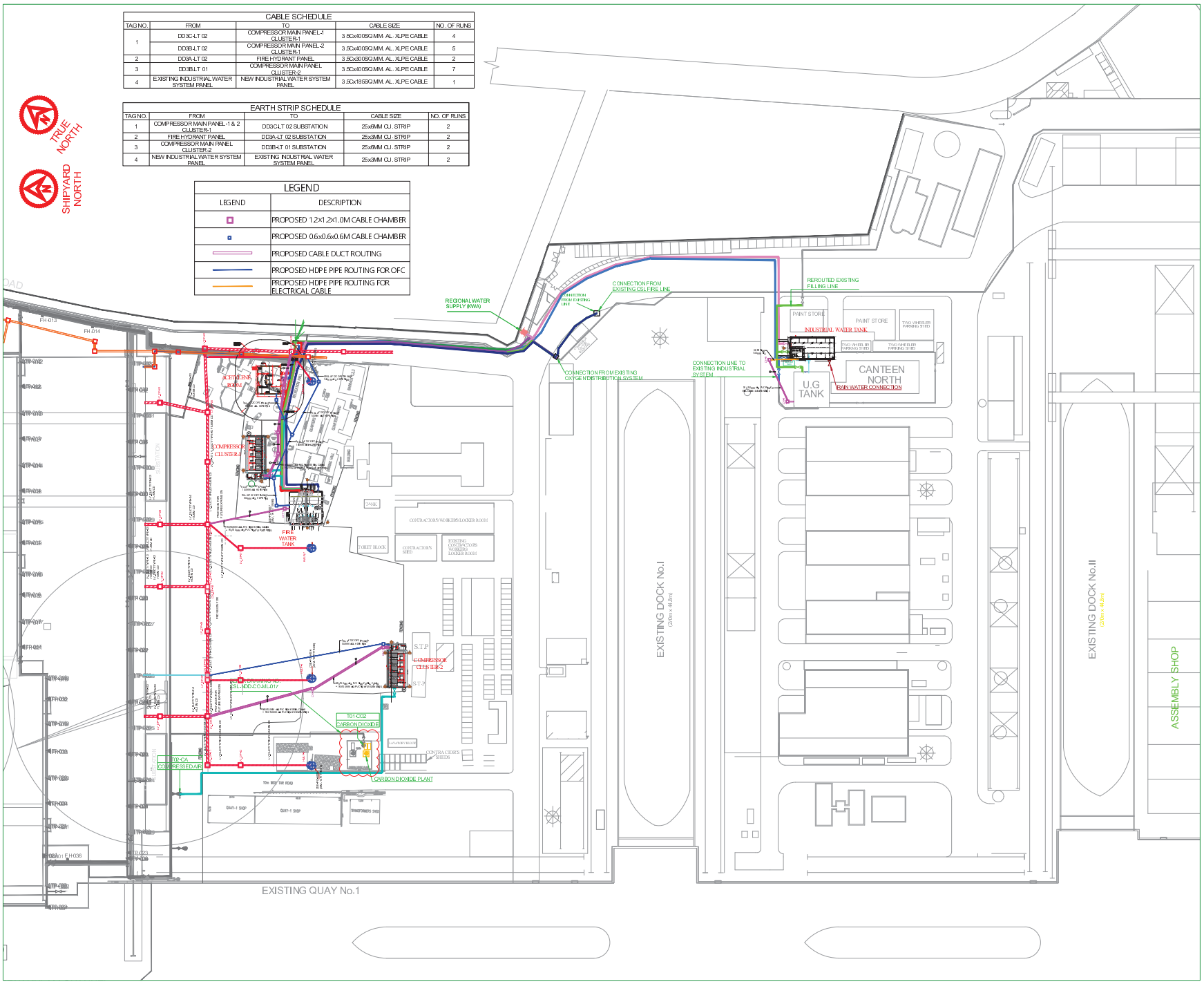
Sl. No.	Reference Clause No.	Page No.	Description	Tenderer Query	CSL Reply

Date, Name & Signature of Bidder

CABLE SCHEDULE				
TAG NO.	FROM	TO	CABLE SIZE	NO. OF RUNS
1	DD3C-LT 02	COMPRESSOR MAIN PANEL-1 CLUSTER-1	3.5Cx400SQ.MM. AL. XLPE CABLE	4
	DD3B-LT 02	COMPRESSOR MAIN PANEL-2 CLUSTER-1	3.5Cx400SQ.MM. AL. XLPE CABLE	5
2	DD3A-LT 02	FIRE HYDRANT PANEL	3.5Cx300SQ.MM. AL. XLPE CABLE	2
3	DD3B-LT 01	COMPRESSOR MAIN PANEL CLUSTER-2	3.5Cx400SQ.MM. AL. XLPE CABLE	7
4	EXISTING INDUSTRIAL WATER SYSTEM PANEL	NEW INDUSTRIAL WATER SYSTEM PANEL	3.5Cx185SQ.MM. AL. XLPE CABLE	1

EARTH STRIP SCHEDULE				
TAG NO.	FROM	TO	CABLE SIZE	NO. OF RUNS
1	COMPRESSOR MAIN PANEL-1 & 2 CLUSTER-1	DD3C-LT 02 SUBSTATION	25x6MM CU. STRIP	2
2	FIRE HYDRANT PANEL	DD3A-LT 02 SUBSTATION	25x3MM CU. STRIP	2
3	COMPRESSOR MAIN PANEL CLUSTER-2	DD3B-LT 01 SUBSTATION	25x6MM CU. STRIP	2
4	NEW INDUSTRIAL WATER SYSTEM PANEL	EXISTING INDUSTRIAL WATER SYSTEM PANEL	25x3MM CU. STRIP	2

LEGEND	
LEGEND	DESCRIPTION
	PROPOSED 1.2x1.2x1.0M CABLE CHAMBER
	PROPOSED 0.6x0.6x0.6M CABLE CHAMBER
	PROPOSED CABLE DUCT ROUTING
	PROPOSED HDPE PIPE ROUTING FOR OFC
	PROPOSED HDPE PIPE ROUTING FOR ELECTRICAL CABLE



CIVIL TENDER-DRAWING

M & E CONTRACTOR

Urulungal Labour Contract Cooperative Society Ltd.
P.O.Machappally College,Vatakara, Kozhikode, Kerala. 673102
Phone: +91 496 2514042, 2514042,
Website: www.ulcsltd.com
E mail: vtal-tvgal@ulcsltd.com

APPROVED BY: SR

DRAWN BY: NM	SCALE : 1:100	SHEET SIZE : A1
CHECKED BY: AA	DATE : 25.04.2024	

PROJECT NO :

DRG.NO:
IL/CSLINFRA-NDD-239-2023/CAS/EX/R4

SHEET. NO : 01

PROJECT NORTH

REV.NO.

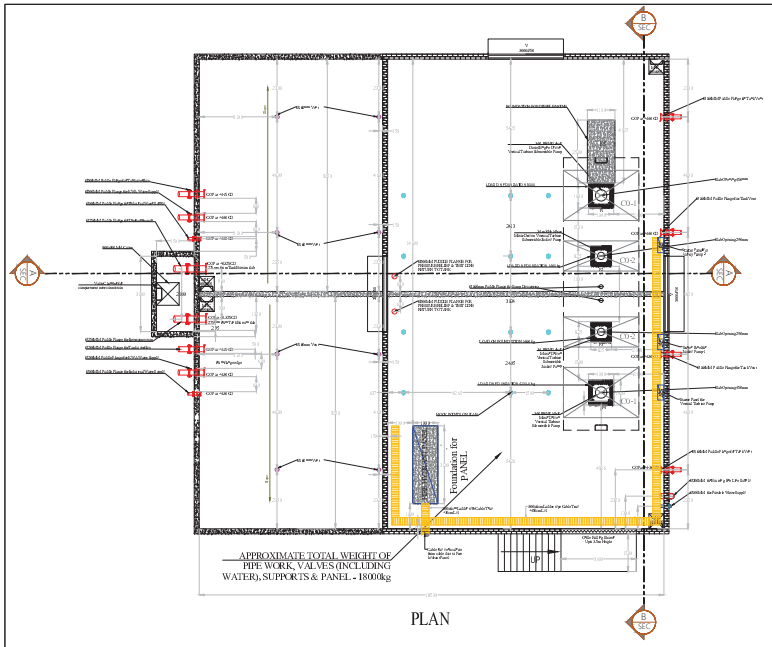
R0	R1	R2	R3	R4

PROJECT TITLE

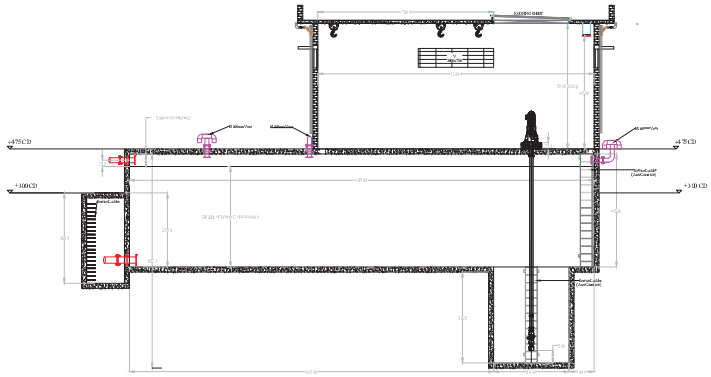
Turnkey design, supply, installation, testing and commissioning of Mechanical and Electrical works to provide various services for New Dry Dock Project

JOB TITLE

General External Layout



PLAN



SECTION A - A

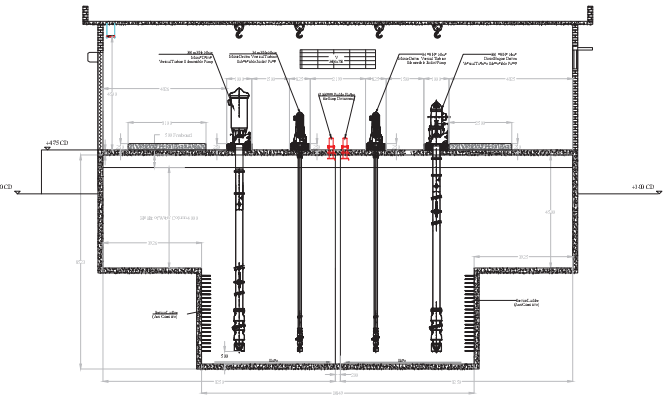
ROOF CUT OUT DIMENSIONS

SL NO	ABBREVATION	DIMENSIONS (MM)
1	CO-1	3000X2000
2	CO-2	3000X1200

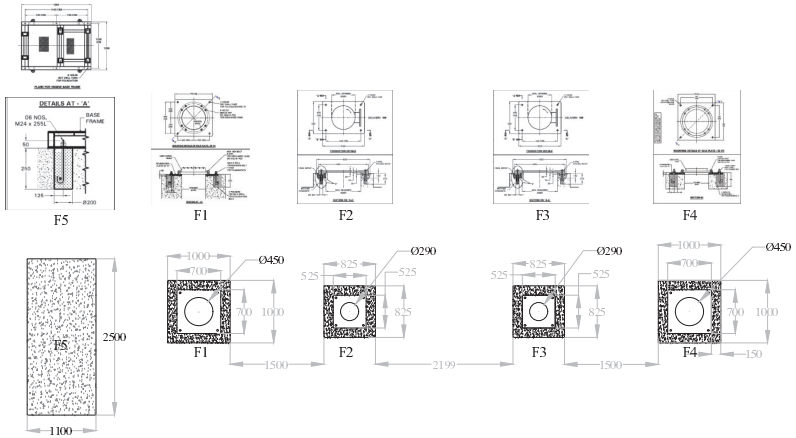
LEGENDS	
IMAGE	DESCRIPTION
	LADDER TYPE CABLE TRAY

CABLE DETAILS

FROM	TO	CABLE SIZE	NO. OF RUNS	LENGTH IN M	WEIGHT IN KG/M	TOTAL WEIGHT IN KG
FIRE PANEL	VERTICAL TURBINE PUMP PANEL	3.5C-240 SQ.MM. AL. XLPE CABLE	2	28	4	224
FIRE PANEL	JOCKEY PUMP-1	3.5C-6 SQ.MM. AL. XLPE CABLE	1	30	1.15	35
FIRE PANEL	JOCKEY PUMP-2	3.5C-6 SQ.MM. AL. XLPE CABLE	1	34	1.15	39
		30x6CM LADDER TYPE CABLE TRAY	1	40	4.06	166
TOTAL WEIGHT IN KG						464



SECTION B - B



FOUNTATION DETAILS

CIVIL TENDER DRAWINGS

GENERAL NOTES:

1. The drawing is issued for the purpose of tendering the civil-related works for the Fire Water Pump House and Tank, as per the requirements outlined in the Work Order INFRA/NDD/239/2023 dated December 1st, 2023.

2. All dimensions are in millimeters unless otherwise specified.

3. Lifting Hooks capacity - 500 Kg
.

4. Pump Weight
   a, Electric Fire Pump
   Total Dynamic Weight on Foundation - 4230 Kg(Approx).
   Static Weight on Foundation due to Pump and Motor - 3200 Kg(Approx).
   b, Diesel Driven Fire Pump
   Dynamic Load on Foundation due to Pump & Engine Set - 5300 Kg (Approx).
   Static Load on Foundation due to Pump & Gear Box - 4050 Kg (Approx).
   c, Jockey Pump
   Dynamic Load on Foundation due to Pump & Motor Set - 1460 Kg (Approx)
   Static Load on Foundation due to Pump & Motor Set - 1107 Kg (Approx)

CLIENT:

COCHIN SHIPYARD LIMITED
A GOVERNMENT OF INDIA ENTERPRISE
A MINIRATNA COMPANY UNDER THE MINISTRY OF PORTS, SHIPPING AND WATERWAYS

M & E CONTRACTOR

Uralungal Labour Contract Cooperative Society Ltd.
AN ISO 9001:2008 ORGANISATION
P.O Madappally College,Vatakara, Kozhikode,Kerala- 673102
Phone: +91 496 25 14042, 251640E,
Website: www.ulcsltd.com
E-mail: uralungal@ulcsltd.com

APPROVED BY: SCJ

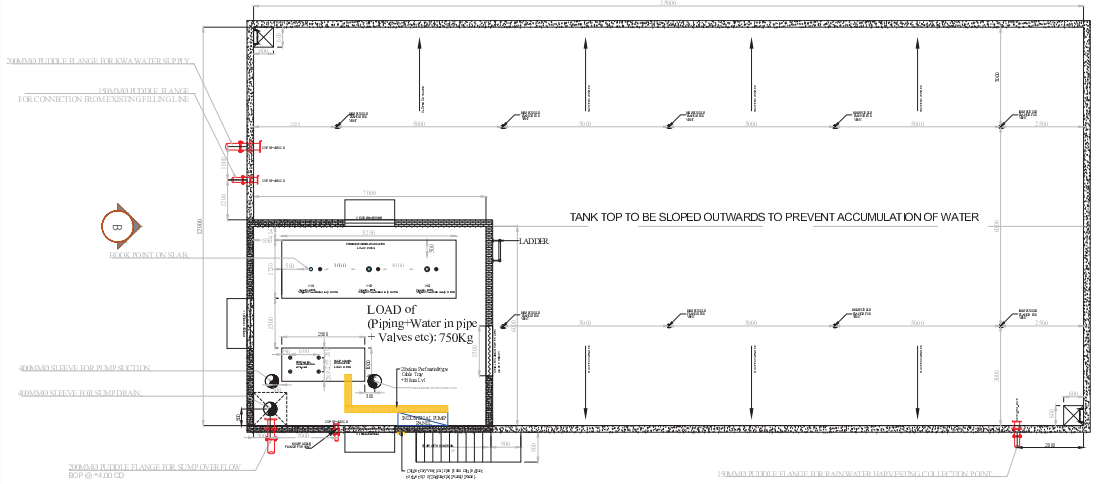
DRAWN BY: A A	SCALE : 1:100 / SHEET SIZE : A1
CHECKED BY: S B	DATE : 29.03.2024
	PROJECT NO :
	DRG.NO: UL/CSL/INFRA-NDD-239-2023/FPS/CTD/R3
	SHEET. NO : 01
PROJECT NORTH	REV.NO. R0 / R1 / R2 / R3

PROJECT TITLE

Turnkey design, supply, installation, testing and commissioning of Mechanical and Electrical works to provide various services for New Dry Dock Project

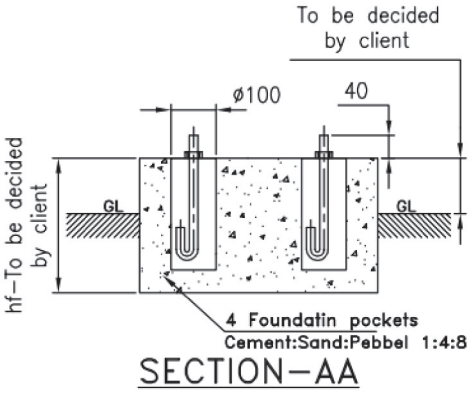
JOB TITLE

General Civil Layout Drawing for FIRE WATER PUMP HOUSE AND TANK

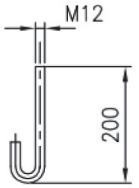


PLAN

NOTE :
Pits can't be considered below Foot Valve because of all water will have some settlements whether KWA(even though KWA have sufficient treatment system, but the supply lines are minimum 30+ years old without any flushing) or not. The settlements will be settling inside the pits & pump will discharge these settlements to endpoint during operation.



SECTION–AA



J–Bolt Details

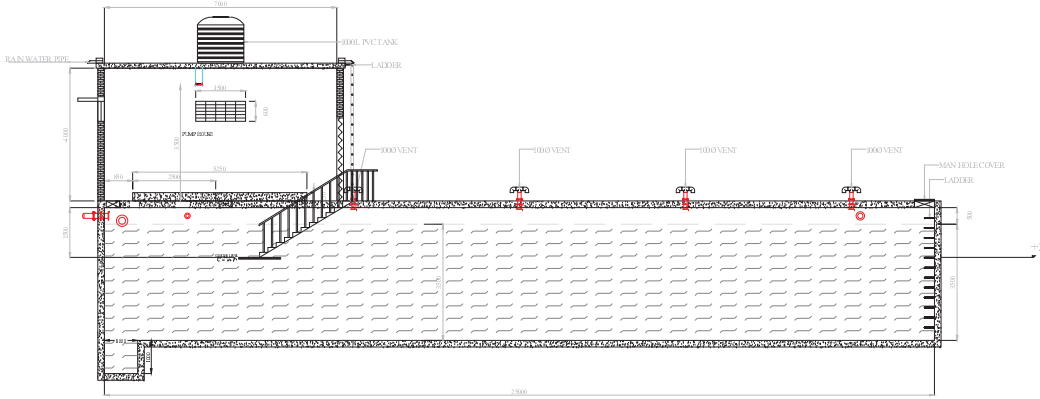
FOUNDATION DETAILS

LEGENDS

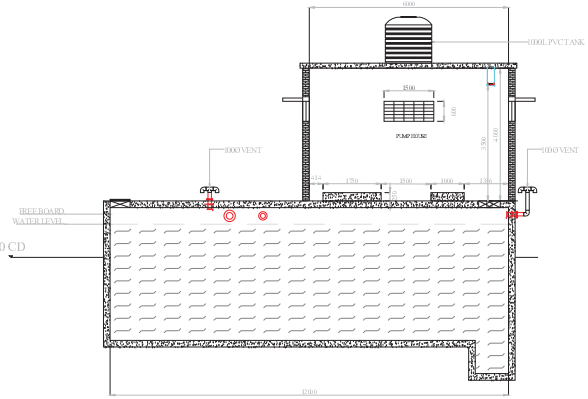
IMAGE	DESCRIPTION
	PERFORATED TYPE CABLE TRAY

CABLE DETAILS

FROM	TO	CABLE SIZE	NO. OF RUNS	LENGTH IN M	WEIGHT IN KG/M	TOTAL WEIGHT IN KG
INDUSTRIAL PUMP PANEL	PUMP SKID PANEL	3.5Cx95SQ.MM. AL. XLPE CABLE	1	9	1.85	16.6
		PERFORATED TYPE CABLE TRAY	1	9	3.64	32.7
TOTAL WEIGHT IN KG						49.3



ELEVATION-A



ELEVATION-B

CIVIL TENDER DRAWINGS

GENERAL NOTES:

1. The drawing is issued for the purpose of tendering the civil-related works for the Industrial Water Pump House and Tank, as per the requirements outlined in the Work Order INFRA/NDD/239/2023 dated December 1st, 2023.
2. All dimensions are in millimeters unless otherwise specified.
3. Lifting Hook Capacity - 1500 Kg.

CLIENT:

COCHIN SHIPYARD LIMITED
A GOVERNMENT OF INDIA ENTERPRISE
A MINIRATNA COMPANY UNDER
THE MINISTRY OF PORTS, SHIPPING AND WATERWAYS

M & E CONTRACTOR

Unlungal Labour Contract Cooperative Society Ltd.
AN ISO 9001:2008 ORGANISATION
P.O Madappally College,Vatakara, Kozhikode, Kerala. 673102
Phone: +91 496 25 14 042, 25 16 402.
Website: www.ulccsltd.com
E-mail: unlungal@ulccsltd.com

APPROVED BY: SCJ

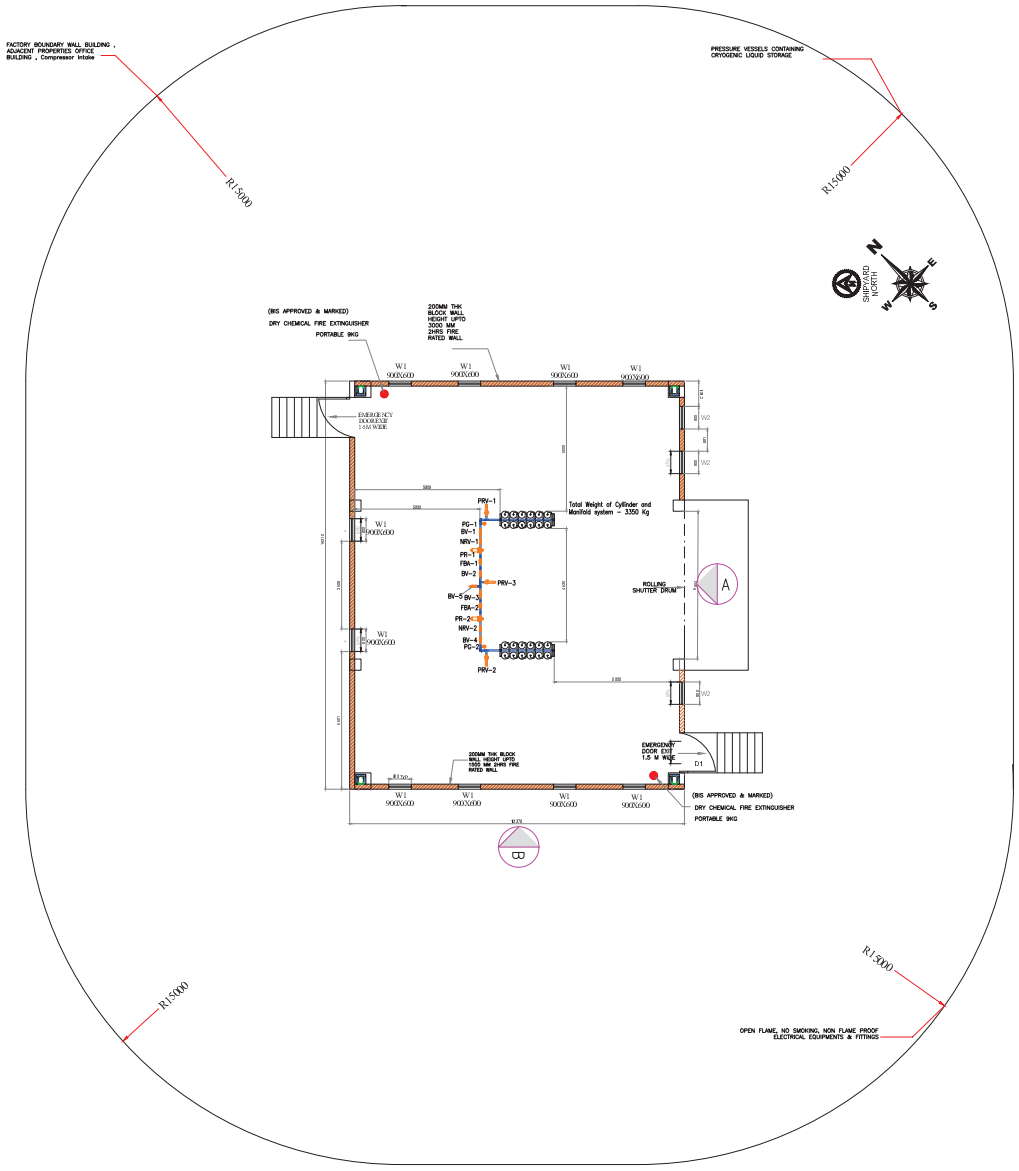
DRAWN BY: VK	SCALE : 1:75	SHEET SIZE : A1
CHECKED BY: AMP	DATE : 01.04.2024	
	PROJECT NO :	
	DRG.NO:	
	UL/CSL/INFRA-NDD-239-2023/IWS/CT/DR3	
PROJECT NORTH	SHEET. NO : 01	
	REV.NO.	
	R0 R1 R2 R3	

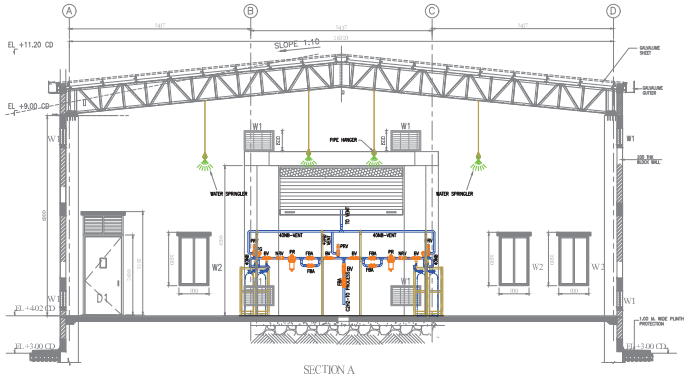
PROJECT TITLE

Turnkey design, supply, installation, testing and commissioning of Mechanical and Electrical works to provide various services for New Dry Dock Project

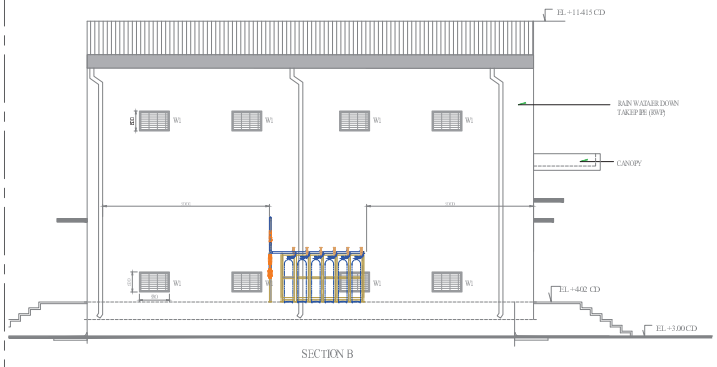
JOB TITLE

General Civil Layout Drawing for INDUSTRIAL WATER PUMP HOUSE AND TANK





SECTION A



SECTION B

Notes:

1. Water Sprinkler Located nozzle Water to spray directed towards the cylinders at the velocity shall meet 10 liter/min. per every sq. mtr area.
2. Quantity of water storage shall be for 2 hrs. fire fighting
3. 15 Meters from the building wall to the nearest electrical or transformed yard, Compressor intake, factory boundary wall, office building, assembly area, any other plant building, oxygen cylinder manifold or storage area.
4. The Flooring constructed of anti spark construction.
5. The electrical installation can be explosion proof.
6. All windows and doors should be of flameproof.(Wooden window and all not accepted.)

ABBREVIATIONS:	
BV	Ball Valve
PRV	Pressure Relief Valve
PG	Pressure Gauge
NRV	Non Return Valve
PR	Pressure Regulator
FBA	Flash Back Arrestor

CIVIL TENDER-DRAWING

Safety Requirements for Acetylene Storage:

1. All Cylinders, when in use and storage, shall be secured using chains or nesting to protect them from falling or being knocked over.
2. Procedures (including checklists) shall be in place to verify the integrity of the grounding system at the time of installation and shall be re-verified annually as part of the unit inspection.
3. Acetylene system shall be grounded.
4. Building that contain acetylene supply systems shall be constructed of non combustible materials.
5. where Acetylene supply systems are stored indoors, the area shall be ventilated, and also prevent unauthorized personnel.
6. A minimum of two Exits (mean of egress) shall be provided and open directly to outside.
7. No smoking or open flames allowed 25feet from the installation boundary.
8. High pressure Acetylene gauges inlet shall be equipped with Flashback Arrester.
9. Proper Warning signages shall be displayed at site clearly visible from all directions.
10. All system components shall be compatible with acetylene and the solvent (acetone or DMF)
11. A complete Sprinkler system shall be provided for inside storage room.
12. Dry chemical spray shall be positioned in the acetylene storage room.
13. At the time of maintenance only non sparking tools should be used.
14. Quick shutt-off provision shall be provided for system
15. Pressure Safety Valve shall be provided in the manifold & Vent shall be connected to Flame Arrester
16. Acetylene system shall be purged and inerted prior to starting up any system.
17. Lockout / Tagout procedures shall be followed where required
18. The total weight of cylinders and manifolds is 3350 kilograms.

CLIENT:

COCHIN SHIPYARD LIMITED
A GOVERNMENT OF INDIA ENTERPRISE
A MINIRATNA COMPANY UNDER THE MINISTRY OF PORTS, SHIPPING AND WATERWAYS

M & E CONTRACTOR

Uralungal Labour Contract Cooperative Society Ltd.
P.O.Madappally, College,Vattakara, Kozhikode, Kerala. 673102
Phone: +91 496 251 4042, 251 6402,
Website : www.ulcsltd.com
Email: ulcsngo@ulcsltd.com

PIPING CONTRACTOR

CCD TECHNICAL SOLUTIONS PVT. LTD.
No. 37/38, Natesan Nagar, Ayanambakkam, Chennai - 600 095.
Telephone : + 91 44 2956 5994, email: sales@ccdtechnical.com

APPROVED BY: SR

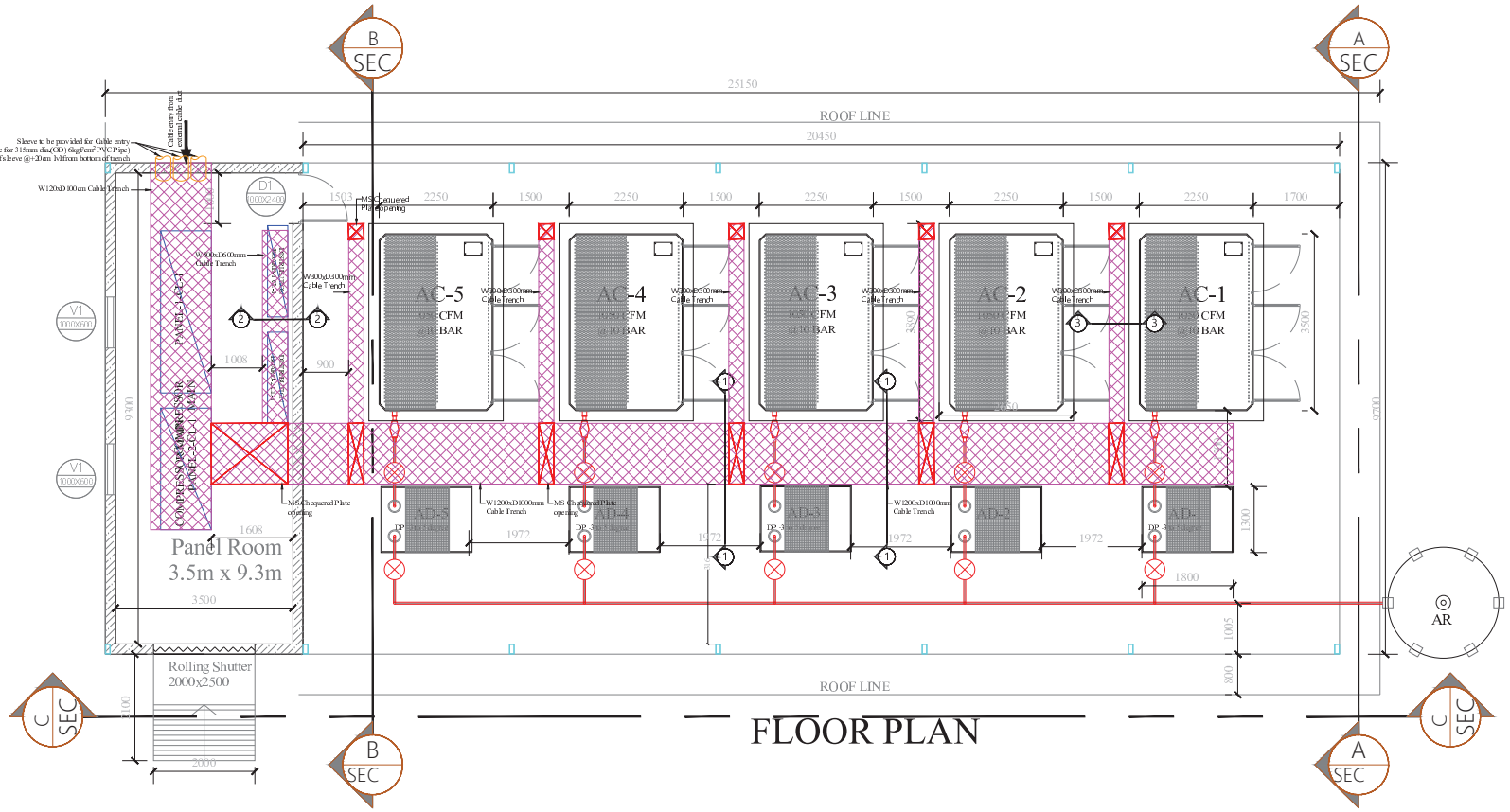
DRAWN BY: NM	SCALE : 1:100	SHEET SIZE : A1
CHECKED BY: AA	DATE : 01.04.2024	
	PROJECT NO :	
	DRG.NO:	
	UL/CSL/INFRA-NDD-239-2023/ACT/CTD/R3	
	SHEET. NO : 02	
	REV.NO.	R0 | R1 | R2 | R3

PROJECT TITLE

Turnkey design, supply, installation, testing and commissioning of Mechanical and Electrical works to provide various services for New Dry Dock Project

JOB TITLE

General Civil Layout Drawing for ACETYLENE ROOM



FLOOR PLAN

General Notes

1. The drawing is issued for the purpose of tendering the civil related works for the compressor cluster 1 and 2, as per the requirements outlined in the Work Order INFRA/NDD/239/2023 dated December 1st, 2023

2. All Dimensions are in millimeters unless otherwise specified.

3. No lifting arrangements or hooks have been incorporated for the compressor room, as mobile cranes will be utilized for the erection and maintenance of the compressors and equipment.

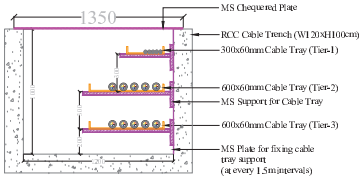
4. Proper flashing must be provided to prevent any leakage issues

5. Please ensure that the steel columns are placed between the compressors, as obstacle-free crane access is required in the side directions.

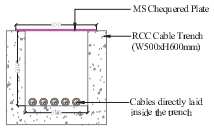
LEGENDS	
IMAGE	DESCRIPTION
	CABLE TRENCH WITH MS CHEQUERED PLATE COVER
	MS CHEQUERED PLATE OPENING

Short Form	Full Form	WT (T)
AC	Air Compressor	6
AD	Air Dryer	1
AR	Air Receiver	14

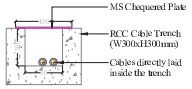
Note :- Air Receiver Hydro Testing Weight has been shared, normal operating weight 4 T.



SECTION: 1-1

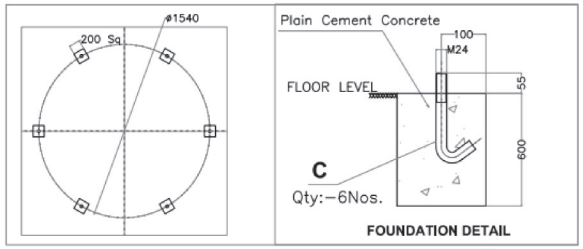


SECTION: 2-2



SECTION: 3-3

FOUNDATION DETAILS OF AIR RECEIVER



CIVIL TENDER-DRAWING

CLIENT:

COCHIN SHIPYARD LIMITED
A GOVERNMENT OF INDIA ENTERPRISE
A MINIRATNA COMPANY UNDER
THE MINISTRY OF PORTS, SHIPPING AND WATERWAYS

M & E CONTRACTOR

Uralungal Labour Contract Cooperative Society Ltd.
P.O Madappally College, Vatakara, Kozhikode, Kerala, 673102
Phone: +91 496 2514042, 2516402,
Website: www.ulcsltd.com
Email: uralungal@ulcsltd.com

APPROVED BY: SR

DRAWN BY: NM	SCALE : 1:100	SHEET SIZE : A1
CHECKED BY: AA	DATE : 01.04.2024	

PROJECT NO :

DRG.NO:
UL/CSL/INFRA-NDD-239-2023/CAS/CTD/R3

SHEET. NO : 01

PROJECT NORTH

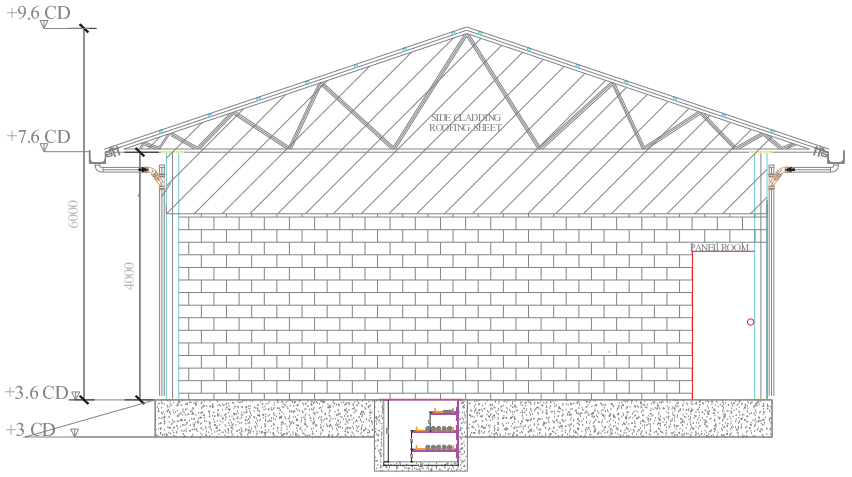
REV.NO.
R0 | R1 | R2 | R3

PROJECT TITLE

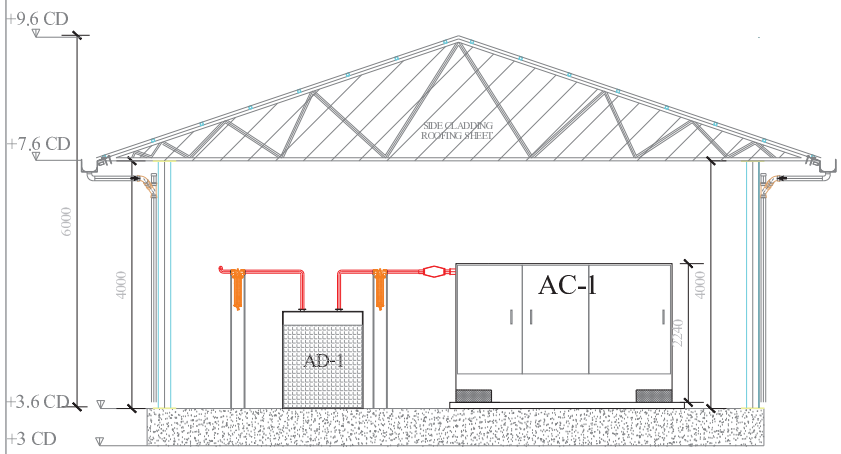
Turnkey design, supply, installation, testing and commissioning of Mechanical and Electrical works to provide various services for New Dry Dock Project

JOB TITLE

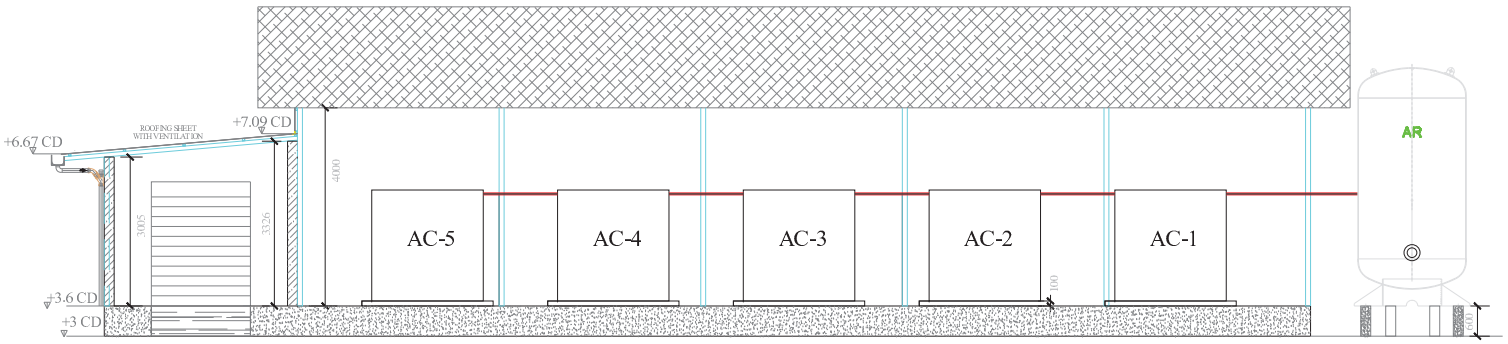
General Civil Layout Drawing for COMPRESSOR ROOM CLUSTER 1



SECTION B-B



SECTION A-A



SECTION C-C

CIVIL TENDER-DRAWING

1.The drawing is issued for the purpose of tendering the civil related works for the compressor cluster 1 and 2, as per the requirements outlined in the Work Order INFRA/NDD/239/2023 dated December 1st, 2023

2.All Dimensions are in millimeters unless otherwise specified.

3.No lifting arrangements or hooks have been incorporated for the compressor room, as mobile cranes will be utilized for the erection and maintenance of the compressors and equipment.

4. Proper flashing must be provided to prevent any leakage issues

CLIENT:

COCHIN SHIPYARD LIMITED
A GOVERNMENT OF INDIA ENTERPRISE
A MINIRATNA COMPANY UNDER
THE MINISTRY OF PORTS, SHIPPING AND WATERWAYS

M & E CONTRACTOR

Unalungal Labour Contract Cooperative Society Ltd.
P.O.Mankavu(By College),Vattakara, Kozhikode, Kerala. 673 302
Phone: +91 495 2514042, 2516402.
Website: www.ulcsltd.com
E-mail: unalungal@ulcsltd.com

APPROVED BY: SR

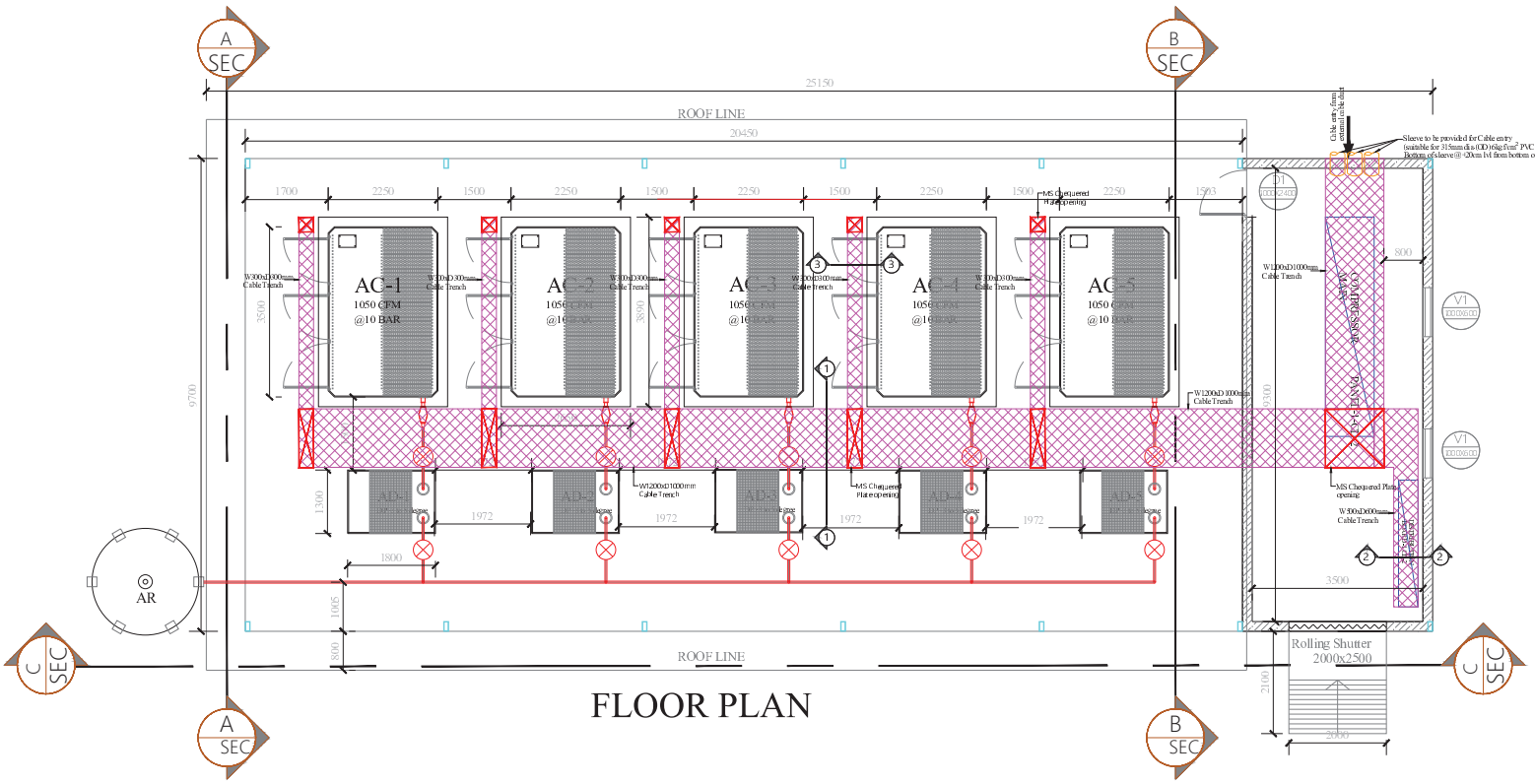
DRAWN BY: NM	SCALE : 1:100 / SHEET SIZE : A1
CHECKED BY: AA	DATE : 01.04.2024
	PROJECT NO :
	DRG.NO:
	UL/CSL/INFRA-NDD-239-2023/CAS/CTD/R3
	SHEET. NO : 02
	REV.NO. R0 / R1 / R2 / R3

PROJECT TITLE

Turnkey design, supply, installation, testing and commissioning of Mechanical and Electrical works to provide various services for New Dry Dock Project

JOB TITLE

General Civil Layout Drawing for COMPRESSOR ROOM CLUSTER 1



FLOOR PLAN

General Notes

1.The drawing is issued for the purpose of tendering the civil related works for the compressor cluster 1 and 2, as per the requirements outlined in the Work Order INFRA/NDD/239/2023 dated December 1st, 2023

2.All Dimensions are in millimeters unless otherwise specified.

3.No lifting arrangements or hooks have been incorporated for the compressor room, as mobile cranes will be utilized for the erection and maintenance of the compressors and equipment.

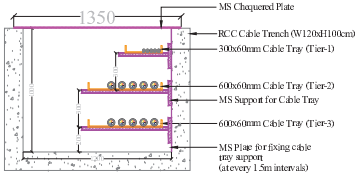
4.Proper flashing must be provided to prevent any leakage issues

5. Please ensure that the steel columns are placed between the compressors, as obstacle-free crane access is required in the side directions.

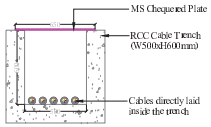
LEGENDS	
IMAGE	DESCRIPTION
	CABLE TRENCH WITH MS CHEQUERED PLATE COVER
	MS CHEQUERED PLATE OPENING

Short Form	Full Form	WT (T)
AC	Air Compressor	6
AD	Air Dryer	1
AR	Air Receiver	14

Note :- Air Receiver Hydro Testing Weight has been shared, normal operating weight 4 T.



SECTION: 1-1



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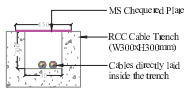
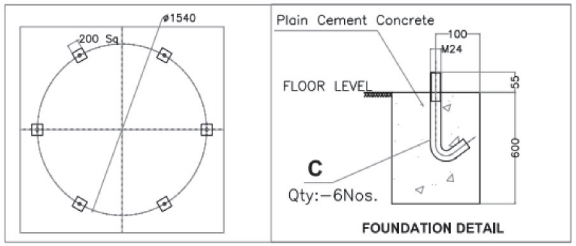


SECTION: 3-3

FOUNDATION DETAILS OF AIR RECEIVER



CIVIL TENDER-DRAWING

CLIENT:

COCHIN SHIPYARD LIMITED
A GOVERNMENT OF INDIA ENTERPRISE
A MINIRATNA COMPANY UNDER THE MINISTRY OF PORTS, SHIPPING AND WATERWAYS

M & E CONTRACTOR

Unalungal Labour Contract Cooperative Society Ltd, AN ISO 9001:2008 ORGANISATION
P.O Machapally College,Vattakunu, Kozhikode, Kerala. 673 102
Phone :+91 496 2514042, 2516402,
Website: www.ulcesltd.com
E-mail: unalungal@ulcesltd.com

APPROVED BY: SR

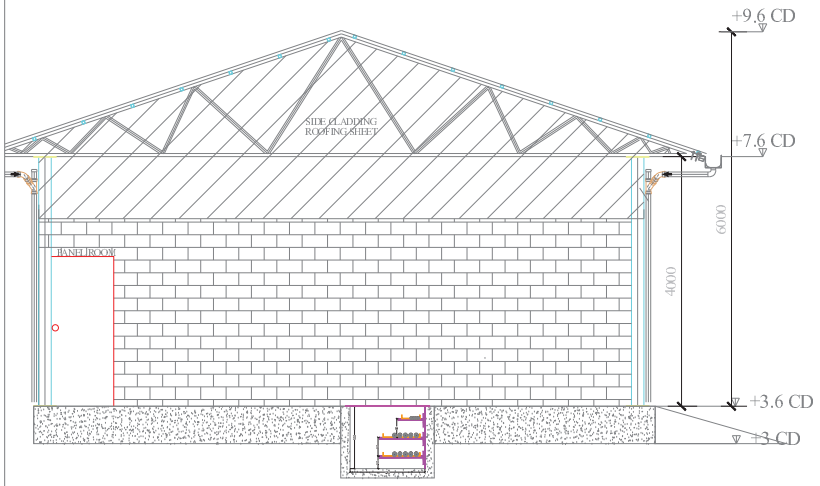
DRAWN BY: NM	SCALE : 1:100	SHEET SIZE : A1
CHECKED BY: AA	DATE : 01.04.2024	
	PROJECT NO :	
	DRG.NO:	
	CL/CSL/INFRA-NDD-239-2023/CAS/CTD/DS	
	SHEET. NO : 01	
PROJECT NORTH	REV.NO. R0 R1 R2 R3	

PROJECT TITLE

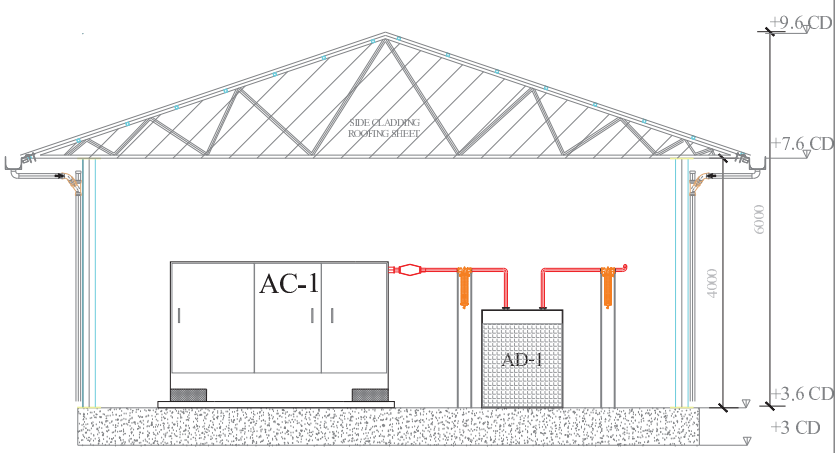
Tumkey design, supply, installation, testing and commissioning of Mechanical and Electrical works to provide various services for New Dry Dock Project

JOB TITLE

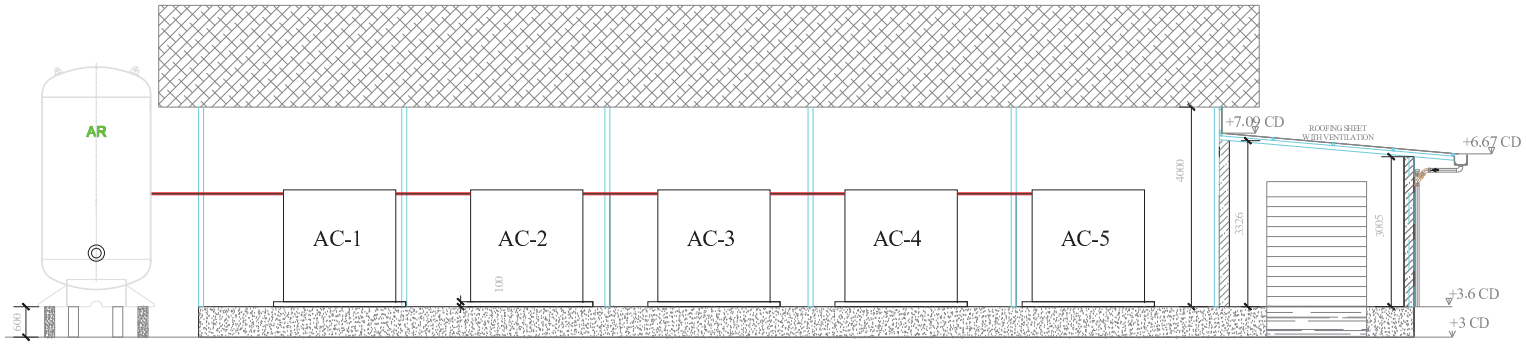
General Civil Layout Drawing for COMPRESSOR ROOM CLUSTER 2



SECTION B-B



SECTION A-A



SECTION C-C

CIVIL TENDER-DRAWING

1.The drawing is issued for the purpose of tendering the civil related works for the compressor cluster 1 and 2, as per the requirements outlined in the Work Order INFRA/NDD/239/2023 dated December 1st, 2023

2.All Dimensions are in millimeters unless otherwise specified.

3.No lifting arrangements or hooks have been incorporated for the compressor room, as mobile cranes will be utilized for the erection and maintenance of the compressors and equipment.

4. Proper flashing must be provided to prevent any leakage issues

CLIENT:

COCHIN SHIPYARD LIMITED
A GOVERNMENT OF INDIA ENTERPRISE
A MINIRATNA COMPANY UNDER
THE MINISTRY OF PORTS, SHIPPING AND WATERWAYS

M & E CONTRACTOR

Unlungal Labour Contract Cooperative Society Ltd.
P.O Mankopally College,Vattakara, Kozhikode, Kerala. 673102
Phone: +91 496 2514042, 2516402,
Website: www.ulcsltd.com
E-mail: unlungal@ulcsltd.com

APPROVED BY: SR

DRAWN BY: NM	SCALE : 1:100	SHEET SIZE : A1
CHECKED BY: AA	DATE : 01.04.2024	
	PROJECT NO :	
	DRG.NO:	
	UL/CSL/INFRA-NDD-239-2023/CAS/CTD/R3	
	SHEET. NO : 02	
	REV.NO.	
	R0 R1 R2 R3	

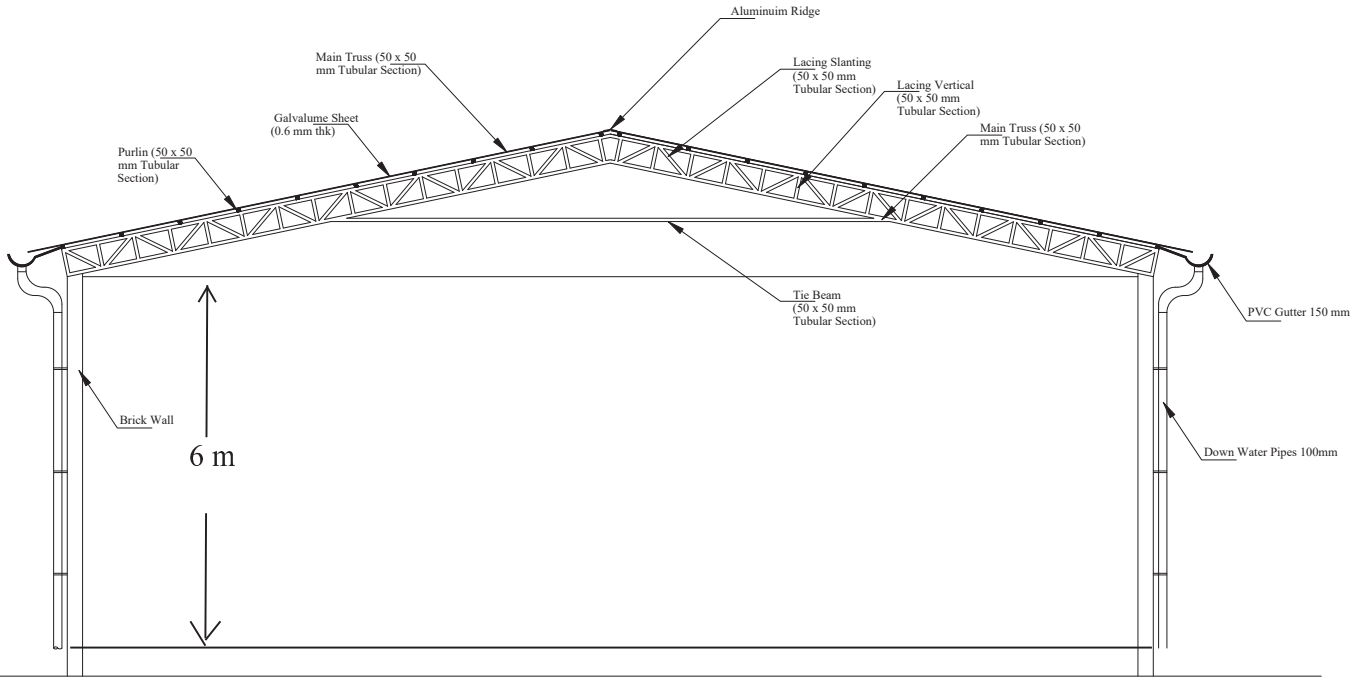
PROJECT TITLE

Turnkey design, supply, installation, testing and commissioning of Mechanical and Electrical works to provide various services for New Dry Dock Project

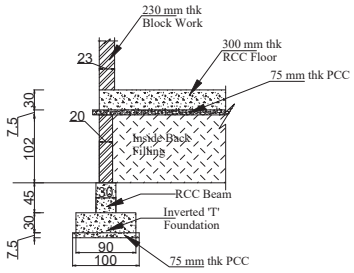
JOB TITLE

General Civil Layout Drawing for COMPRESSOR ROOM CLUSTER 2

ANNEXURE-29



Acetylene Room



Typical Foundation Cross Section for Acetyene Station

All Dimensions are in cm

COCHIN SHIPYARD LIMITED
COCHIN - 682 015

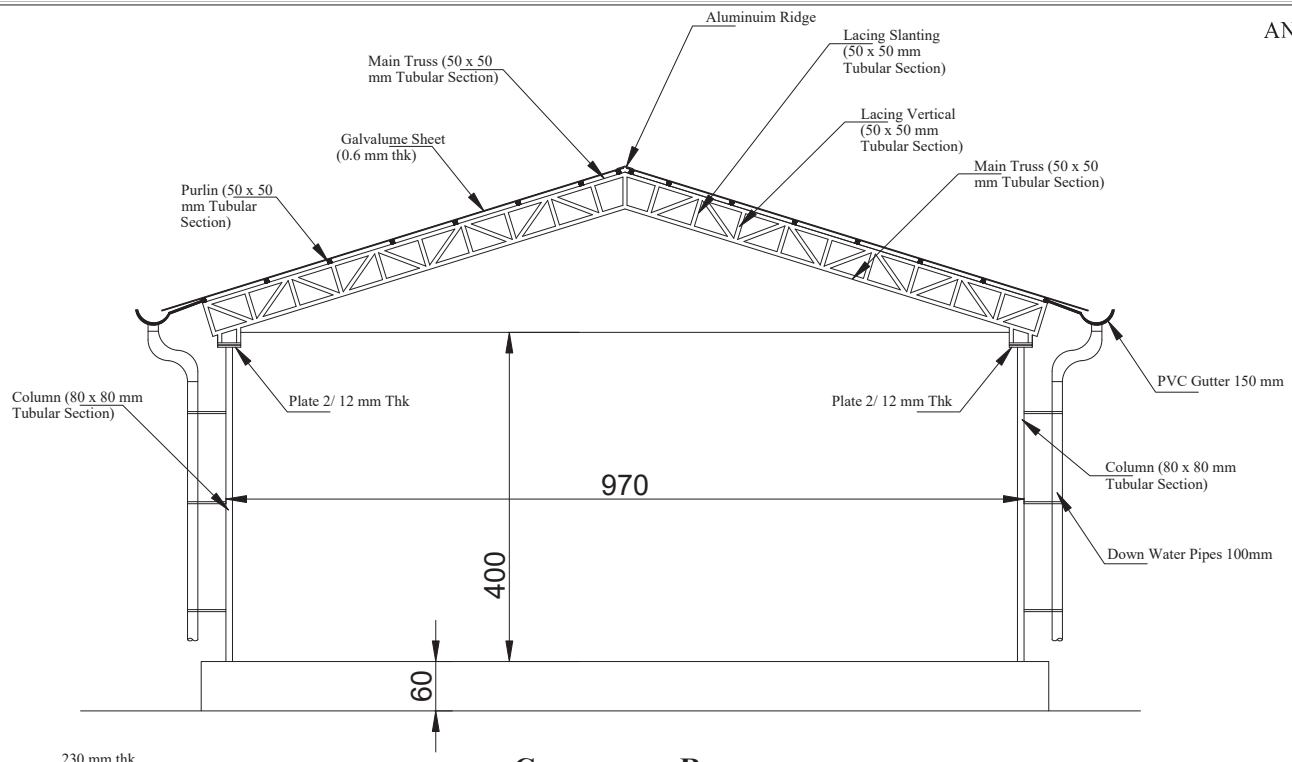
DGM (IP)	MATHEWS. P. A.
AGM (IP)	DHANNYA .K. K.
M (IP)	ARAVIND.V
CHECKED	ARAVIND.V
DRAWN	ANTONY JOSEPH

Acetylene Room

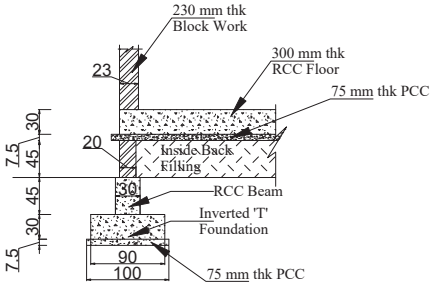
DATE : 21-10-2024	SCALE: NTS	DWG NO:	INFRA/ NDD/278/2024

SHEET NO:

ANNEXURE-30



Compressor Room



Typical Foundation Cross Section for Compressor Cluster 01 and 02

All Dimensions are in cm

COCHIN SHIPYARD LIMITED COCHIN - 682 015			
DGM (IP)	MATHEWS. P. A.	**Compressor Room**	
AGM (IP)	DHANNYA .K. K.		
M (IP)	ARAVIND.V		
CHECKED	ARAVIND.V		
DRAWN	ANTONY JOSEPH	INFRA/ NDD/278/2024	
DATE : 21-10-2024	SCALE: NTS	DWG NO:	SHEET NO:

Construction of Fire Water Tank, Industrial Water Tank, Acetylene Station and Compressor Clusters (2 Nos.) for the New Dry Dock Project

Tentative List of Items of Work of Industrial Water Tank & Fire Water Tank

INDUSTRIAL WATER TANK

Sl. No	Description of work
1	Boring, providing and installation bored cast in-situ reinforced cement concrete piles of appropriate diameter and Nos. (based on the Geotechnical Investigation Report provided along with the Tender and the equipment loads specified by existing M&E Contractor) of grade M40 of specified diameter, to carry safe working load not less than specified, excluding the cost of steel reinforcement but including boring, driving upto required strata, bentonite drilling fluid, MS temporary casing,hydraulic rig as required, positioning, concreting, removing temporary casing, dressing the pile upto cut-off level, levelling the surrounding ground upto required level including muck disposal ourside CSL Complex with all its lifts and leads and as directed etc. complete (length of pile for payment shall be measured up to the bottom of pile cap)
2	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means in all kinds of soil including dressing of sides and ramming of bottoms, including cost and conveyance of all equipment, labour, dewatering upto 3m depth and other incidental etc. all complete as directed by Engineer-In-Charge. Temporary sheet piles as shoring for excavation shall be measured and paid separately.
a	0-1.5m
b	1.5-3m
c	3-4.5m
3	Dewatering for excavations below 3 meter depth, including pumping out water, mud water as required, including cost and conveyances of labour, materials, machineries and other incidentals etc. complete as per the direction of Engineer in-charge
4	Supplying and installing temporary sheet piles as shoring for excavation as per the directions of Engineer-in-charge, including cost and conveyance of all materials, labour and machineries for installation, removal etc.complete as per the directions of Engineer-in-charge.
a	Sheetpile 3 meter long

Sl. No	Description of work
5	Backfilling with available earth (excluding rock) in trenches, layer should not exceed 15cm, including compacting each layer by rolling/ plate compactor/ ramming and watering, including cost and conveyance of all labour, materials and other incidentals etc. all complete as per drawing and direction of engineer in-charge
6	Disposal of excavted earth (unsuitable for backfilling and surplus earth), dismantled/demolished materials, waste materail encountered during excavation, from CSL site by mechanical transporting, including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of engineer in-charge
7	Providing and laying plain cement concrete 1:2:4 using 20mm down graded broken stones including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of Engineer-in-Charge
8	Providing and casting Reinforced cement concrete of grade M40 with 20mm downgraded coarse aggregate in required slope and position including cost of shuttering, de-shuttering, compacting with mechanical vibrators, hacking, curing, scaffolding, all equipment, labour, pumping, incidental expenses but excluding cost of reinforcement, complete as directed by Engineer in-charge.
a	All works up to plinth level
b	Columns
c	Slab, beams and lintel
d	Walls
9	Supplying, cleaning, cutting, bending, supporting, binding with doube ply of 22 SWG soft annealed wire and placing in position high yield strength deformed TMT reinforcement bars conforming to IS:1786 of grade Fe 500D or more of approved make on/at all levels and locations as per drawings, including handling and transport complete for all RCC works including supplying and & placing concrete cover block, all equipment, labour, incidental expenses complete as directed by Engineer in-charge

Sl. No	Description of work
10	Providing and laying 200mm thick concrete block in cement mortar 1:5 using approved quality blocks, including cost and conveyance of all labour, material, scaffolding, raking of joints, curing and other incidentals etc complete as per Engineer in-charge
11	Plastering with CM 1:4, 12mm thick in one coat floated hard and trowelled smooth at all heights and locations for masonry and concrete surfaces including scaffolding, chipping, hacking and cleaning the concrete surface, finishing, making bands, grooves, curing, including cost and conveyance of all materials, labour, other incidentals etc. complete as per the directions of Engineer-In-Charge.
12	Supplying and applying one coat of approved matching primer and two coats of Anti Algal/Fungal, Weather proof, Exterior paint of approved colour, shade and make at all heights including cost and coveyance of all materials, labour, scaffolding, cleaning and preparing the surface by removing the dust, fungus, algae and efflorescence, including filling the dents, cracks and holes with matching putty, sealer and other incidentals etc complete and as directed by Engineer in-charge
13	Supplying, fabricating and erecting in position built up tubular sections conforming to IS 4923 of required size and thickness (tubular, square or rectangular hollow tubes etc) for trusses, columns etc as per the approved drawings, including cost and conveyance of all materials, cutting, hoisting, fixing in position, welding electrodes and consumables, hire charges of welding equipment, bolts, nuts and washers ,closing the ends, drilling holes and applying two coat of synthetic enamel paint over a priming coat of Zinc chromate primer, etc complete as directed by the Engineer-In-Charge.
14	Supplying, jointing and fixing unplasticised Rigid PVC rain water pipes 110 mm diameter connecting to the drain through walls by clamping with necessary MS plates at sufficient intervals including cost and conveyance of all materials, labour other incidentals etc. complete and as per the direction of Engineer-in-Charge
15	Providing, jointing and fixing unplasticised Rigid PVC moulded fittings/accessories, including cost and conveyance of all materials, labour other incidentals etc.complete and as per the direction of Engineer-in-Charge
a	110mm bend

Sl. No	Description of work
16	Supplying and fixing D.I. cover with frame for manholes of size 600 X 600 (heavy duty), including cost and conveyance of all labour material and other incidentals etc. complete ans as per the direction of Engineer-in-Charge
17	Supplying and fixing 18G rolling shutters of approved make with including painting with two coats of synthetic enamel paint over two coats of zinchromite primer, made of 80x1.25mm M.S. laths interlocked together through their entire length and joined together at the end by the end locks mounted on specially, designed pipes shaft with brackets, rolling shutter gear, top cover, side guides and arrangement for inside and outside locking with push and pull operation and two numbers of Godrej pad locks on each rolling shutter etc. including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge
18	Providing and fixing ball bearing for rolling shutters including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge
19	Supplying and fixing in position super profile aluminium fixed ventilators with powder coated aluminium grill, including all fixtures like stainless steel screws, beadings etc, including cost and conveyance of all materials, all labour, other incidentals etc. complete. as per the direction of Engineer-in-Charge
20	Providing and Placing in position suitable PVC water stops Serrated with central bulb 225 mm wide for construction/ expansion joints between two RCC members and fixing the same with reinforcement suitably including cost and conveyance of all materials, labour, other incidentals etc complete and as per the direction of Engineer-in-Charge.
21	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment to RCC structures like water tanks, roof slabs, prepared as per the specification and recommendations of the manufacturer and applying the same on the surface with the help of synthetic fibre brush. The operation shall be carried out after scrapping and properly cleaning the surface to remove loose particles with wire brushes. The rate shall be including cost and conveyances all material, labour and other incidentals etc complete as per the direction of Engineer in-charge.
a	Vertical surface
b	Horizontal surface

Sl. No	Description of work
22	Supplying and applying black anti-corrosive bitumastic paint of approved brand and manufacture to give an even shade to the concrete surfaces where comes direct contact with earth, including cost and conveyances of all amterial, labour and other incidentals etc. complete. as per the direction of the Engineer-in-charge.
23	Providing and fixing stainless steel (Grade 304) hand rail and balusters made of Hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, i/c fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size,all hire charges of tools and plants, welding equipment, cost of electrodes, other consumables, all labour for fixing the handrails to the step and landing, all overhead charges,other incidentals etc. complete (for payment purpose only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.) as directed by Engineer-in -charge.
24	Providing and laying 60mm thick factory made cement concrete interlocking paver block made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with M sand, locking edges with concrete including cost and conveyance of all materials, all labour, other incidentals etc. all complete as per the direction of Engineer-in-charge

FIRE WATER TANK

Sl. No	Description of work
1	Boring, providing and installation bored cast in-situ reinforced cement concrete piles of appropriate diameter and Nos. (based on the Geotechnical Investigation Report provided along with the Tender and the equipment loads specified by existing M&E Contractor) of grade M40 of specified diameter, to carry safe working load not less than specified, excluding the cost of steel reinforcement but including boring, driving upto required strata, bentonite drilling fluid, MS temporary casing,hydraulic rig as required, positioning, concreting, removing temporary casing, dressing the pile upto cut-off level, levelling the surrounding ground upto required level including muck disposal ourside CSL Complex with all its lifts and leads and as directed etc. complete (length of pile for payment shall be measured up to the bottom of pile cap)
2	Carrying out the routine vertical load testing of pile at initial stage in accordance with IS 2911 (Part IV) of load capacity of 1.5 times of design load, including intallation of loading platform by Kentledge method and preparation of pile head or construction of test cap and dismantling of test cap after test etc. complete as per specification and the direction of Engineer in-charge.
3	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means in all kinds of soil including dressing of sides and ramming of bottoms, including cost and conveyance of all equipment, labour, dewatering upto 3m depth and other incidental etc. all complete as directed by Engineer-In-Charge. Temporary sheet piles as shoring for excavation shall be measured and paid separately.
a	0-1.5m
b	1.5-3m
c	3-4.5m
d	4.5-6m
e	6-7.5m
f	7.5-9m
4	Dewatering for excavations below 3 meter depth, including pumping out water, mud water as required, including cost and conveyances of labour, materials, machineries and other incidentals etc. complete as per the direction of Engineer in-charge

Sl. No	Description of work
5	Supplying and installing temporary sheet piles as shoring for excavation as per the directions of Engineer-in-charge, including cost and conveyance of all materials, labour and machineries for installation, removal etc.complete as per the directions of Engineer-in-charge.
a	Sheetpile 3 meter long
b	Sheetpile 5 meter long
6	Backfilling with available earth (excluding rock) in trenches, layer should not exceed 15cm, including compacting each layer by rolling/ plate compactor/ ramming and watering, including cost and conveyance of all labour, materials and other incidentals etc. all complete as per drawing and direction of engineer in-charge
7	Disposal of excavted earth (unsuitable for backfilling and surplus earth), dismantled/demolished materials, waste materail encountered during excavation, from CSL site by mechanical transporting, including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of engineer in-charge
8	Providing and laying plain cement concrete 1:2:4 using 20mm down graded broken stones including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of Engineer-in-Charge
9	Providing and casting Reinforced cement concrete of grade M40 with 20mm downgraded coarse aggregate in required slope and position including cost of shuttering, de-shuttering, compacting with mechanical vibrators, hacking, curing, scaffolding, all equipment, labour, pumping, incidental expenses but excluding cost of reinforcement, complete as directed by Engineer in-charge.
a	All works up to plinth level
b	Columns
c	Slab, beams and lintel
d	Walls

Sl. No	Description of work
10	Supplying, cleaning, cutting, bending, supporting, binding with doube ply of 22 SWG soft annealed wire and placing in position high yield strength deformed TMT reinforcement bars conforming to IS:1786 of grade Fe 500D or more of approved make on/at all levels and locations as per drawings, including handling and transport complete for all RCC works including supplying and & placing concrete cover block, all equipment, labour, incidental expenses complete as directed by Engineer in-charge
11	Providing and laying 200mm thick concrete block in cement mortar 1:5 using approved quality blocks, including cost and conveyance of all labour, material, scaffolding, raking of joints, curing and other incidentals etc complete as per Engineer in-charge
12	Plastering with CM 1:4, 12mm thick in one coat floated hard and trowelled smooth at all heights and locations for masonry and concrete surfaces including scaffolding, chipping, hacking and cleaning the concrete surface, finishing, making bands, grooves, curing, including cost and conveyance of all materials, labour, other incidentals etc. complete as per the directions of Engineer-In-Charge.
13	Supplying and applying one coat of approved matching primer and two coats of Anti Algal/Fungal, Weather proof, Exterior paint of approved colour, shade and make at all heights including cost and coveyance of all materials, labour, scaffolding, cleaning and preparing the surface by removing the dust, fungus, algae and efflorescence, including filling the dents, cracks and holes with matching putty, sealer and other incidentals etc complete and as directed by Engineer in-charge
14	Supplying, fabricating and erecting in position built up tubular sections conforming to IS 4923 of required size and thickness (tubular, square or rectangular hollow tubes etc) for trusses, columns etc as per the approved drawings, including cost and conveyance of all materials, cutting, hoisting, fixing in position, welding electrodes and consumables, hire charges of welding equipment, bolts, nuts and washers ,closing the ends, drilling holes and applying two coat of synthetic enamel paint over a priming coat of Zinc chromate primer, etc complete as directed by the Engineer-In-Charge.

Sl. No	Description of work
15	Supplying and fabricating structural steel work conforming to IS 226/2062 including erecting in position, aligning the erected structures in line and level, bolting or welding wherever required as per approved drawing, cost and conveyance of all materials, labour, accessories, hire charge of tools and plants, welding equipment, cost of electrodes and applying two coat of synthetic enamel paint over a priming coat of Zinc chromate primer, etc complete as directed by the Engineer-In-Charge (provision of bolt holes to be made as required at no extra cost) as required including providing chequered plate wherever required as per drawing all complete.
16	Providing & fixing at all heights, levels and locations coloured finish Galvalume Roofing/ Cladding sheets of thickness 0.60 mm, troughed profile of good formability and corrosion resistance including minimum end overlaps and appropriate side laps. The profile sheets shall be fixed to truss members in slope or required pitch or curvature with Hex cap headed self drilling/tapping Stainless steel screws 50 mm long with EPDM seal washer etc. all including cost and conveyance of labour, scaffolding and other incidentals etc. complete as per directions of the Engineer-In-Charge. (Cost of truss/frame work shall be paid separately).
17	Supplying, jointing and fixing unplasticised Rigid PVC rain water pipes 110 mm diameter connecting to the drain through walls by clamping with necessary MS plates at sufficient intervals including cost and conveyance of all materials, labour other incidentals etc. complete and as per the direction of Engineer-in-Charge
18	Providing, jointing and fixing unplasticised Rigid PVC moulded fittings/accessories, including cost and conveyance of all materials, labour other incidentals etc.complete and as per the direction of Engineer-in-Charge
(a)	110mm bend
19	Supplying and fixing D.I. cover with frame for manholes of specified size (heavy duty), including cost and conveyance of all labour material and other incidentals etc. complete and as per the direction of Engineer-in-Charge
(a)	600 X 600 mm square cover
(b)	900 X 900 mm square cover
20	Supplying and fixing 18G rolling shutters of approved make with including painting with two coats of synthetic enamel paint over two coats of zinchromite primer, made of 80x1.25mm M.S. laths interlocked together through their entire length and joined together at the end by the end locks mounted on specially, designed pipes shaft with brackets, rolling shutter gear, top cover, side guides and arrangement for inside and outside locking with push and pull operation and two numbers of Godrej pad locks on each rolling shutter etc. including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge
21	Providing and fixing ball bearing for rolling shutters including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge
22	Extra for providing mechanical device chain and crank operation for operating rolling shutters including cost and conveyance of all materials, labour, other incidentals etc. complete as per the directions of Engineer-In-Charge.

Sl. No	Description of work
23	Supplying and fixing in position super profile aluminium fixed ventilators with powder coated aluminium grill, including all fixtures like stainless steel screws, beadings etc, including cost and conveyance of all materials, all labour, other incidentals etc. complete. as per the direction of Engineer-in-Charge
24	Providing and Placing in position suitable PVC water stops Serrated with central bulb 225 mm wide for construction/ expansion joints between two RCC members and fixing the same with reinforcement suitably including cost and conveyance of all materials, labour, other incidentals etc complete and as per the direction of Engineer-in-Charge.
25	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment to RCC structures like water tanks, roof slabs, prepared as per the specification and recommendations of the manufacturer and applying the same on the surface with the help of synthetic fibre brush. The operation shall be carried out after scrapping and properly cleaning the surface to remove loose particles with wire brushes. The rate shall be including cost and conveyances all material, labour and other incidentals etc complete as per the direction of Engineer in-charge.
a	Vertical surface
b	Horizontal surface
26	Supplying and applying black anti-corrosive bitumastic paint of approved brand and manufacture to give an even shade to the concrete surfaces where comes direct contact with earth, including cost and conveyances of all amterial, labour and other incidentals etc. complete. as per the direction of the Engineer-in-charge.
27	Providing and fixing stainless steel (Grade 304) hand rail and balusters made of Hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, i/c fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size,all hire charges of tools and plants, welding equipment, cost of electrodes, other consumables, all labour for fixing the handrails to the step and landing, all overhead charges,other incidentals etc. complete (for payment purpose only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.) as directed by Engineer-in -charge.
28	Providing and laying 60mm thick factory made cement concrete interlocking paver block made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with M sand, locking edges with concrete including cost and conveyance of all materials, all labour, other incidentals etc. all complete as per the direction of Engineer-in-charge

REPORT ON SOIL INVESTIGATION WORK FOR THE PROPOSED INDUSTRIAL STRUCTURES AT COCHIN SHIPYARD, ERNAKULAM

CLIENT

GEOTECHNICAL CONSULTANTS:

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JOB NO: EDC/23-24/GI/017

REPORT ON SOIL INVESTIGATION WORK FOR THE PROPOSED INDUSTRIAL STRUCTURES AT COCHIN SHIPYARD, ERNAKULAM

Chief Engineer	Er. AVS Chakravarti	
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REPORT ON SOIL INVESTIGATION WORK FOR THE PROPOSED INDUSTRIAL STRUCTURES AT COCHIN SHIPYARD, ERNAKULAM

PROJECT NO: EDC / 23-24 /GI / 017

Prepared for: ***Cochin Shipyard Ltd***

Issue	**Report status**	**Date**
01	Issued as final	22nd August 2023

CONTENTS

Client:

1. INTRODUCTION

Cochin Shipyard Ltd is planning to augment the facilities by constructing some Industrial Structures within CSL premises at Ernakulam. As a part of the project, it was decided to conduct geotechnical investigation at the site for various structures and the work was entrusted to M/s Engineers Diagnostic Centre (P) Ltd, Cochin. It was proposed to take seven boreholes at the site. The field works for the geotechnical investigation is being carried out from 07th to 28th July. This report consists of details of field works and lab tests conducted.

The scope of work for this investigation included performing site reconnaissance, drilling and sampling of seven boreholes, conducting geotechnical field and laboratory testing, and preparing geotechnical report. The primary purpose of these activities is to collect subsurface information at the site.

The results of various tests conducted to determine the physical and engineering properties of soil samples collected from the seven boreholes (4 of 60m and 3 of 10m depth) are appended in this report.

2. SCOPE OF WORK

Scope of work for the geotechnical investigations consists of:

a. Drilling bore holes at seven locations as instructed by the client.
b. Conducting standard penetration tests (SPT) in bore holes at regular intervals and collection of disturbed/undisturbed samples.
c. Conducting laboratory tests on disturbed and undisturbed samples for physical and engineering properties of soil.
d. Submitting a geotechnical report providing foundation design and recommendation for the proposed building.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION AND METHODOLOGY

Boring was done in accordance with the provisions of IS 1892-1979, using rotary calyx rig technique which is mechanically operated. Boreholes were penetrated through the sandy and clayey layers and the boreholes were advanced up to depth of 60.00m.

While drilling through the top soil layers sodium bentonite slurry was circulated in order to prevent the sides from caving. Standard penetration tests (SPT), were taken at various depth using standard split spoon sampler, the sets being driven by 63.5Kg hammer as per IS 2131-1981 giving a free fall of 750mm. The number of blows required to penetrate the first 15cm is for seating' and is not considered for assessing strength characteristics. The summation of the number of blows for second and third sets of 15cm each are termed as SPT value and designated as 'N'. Results were recorded and graphically represented in the log of bore hole.

Soil samples were collected in plastic bags for visual inspection and classification of strata from all the layers as recorded in log sheet of borehole.

In soft clayey soils, undisturbed samples in MS tube of 100mm dia and 450 mm length were collected to conduct certain test for engineering parameter.

3.2. ANALYSIS OF VARIOUS LABORATORY TESTS CONDUCTED

Samples obtained from specified samplers were tested for the following index as well as strength properties to classify the strata to various soil groups as per unified soil classification IS: 1498-1970 and IS:2720.

3.2.1 Moisture Content {IS: 2720 (Part II) - 1973}

The natural moisture content of all the soil samples brought from the site was determined as prescribed in IS: 2720. For many soils, the water content will be an extremely important index used for establishing the relationship between the way a soil behaves and its properties. The consistency of a fine-grained soil largely depends on its water content. The

water content is also used in expressing the phase relationships of air, water, and solids in a given volume of soil.

3.2.2 Grain Size Distribution {IS: 2720 (Part IV) - 1985}

Both sieve analysis and Hydrometer analysis were conducted on different samples and the findings are tabulated. Since particle diameters typically span many orders of magnitude for natural sediments, in order to conveniently describe wide ranging data sets, the base to logarithmic (phi) scale was used to represent grain size information for sediment distribution. A tabular classification of grain sizes in terms of units and other commonly used measurement scales is included for purposes of comparison.

3.2.3 Specific Gravity {IS: 2720 (Part III)- 1980}

The specific gravity of soil particles was determined by using pycnometer or density bottle. Specific gravity is the ratio of the mass of unit volume of soil at a stated temperature to the mass of the same volume of gas-free distilled water at the same stated temperature. The specific gravity of a soil is used in the phase relationship of air, water, and solids in a given volume of the soil.

3.2.4 Atterberg Limits {IS: 2720 (Part V & VI)- 1980}

These tests were carried out on clay fraction (size < 75 microns) for all disturbed and undisturbed samples. The test results include liquid limit, plastic limit and plasticity index of the soil samples tested. These tests were conducted as per IS: 2720, Parts V & VI.

3.2.5 Triaxial Test on UDS {IS: 2720 (Part XI)- 1993}

Triaxial shear strength test on soil measures the mechanical properties of the soil. In this test, soil sample is subjected to stress, such that the stress resulted in one direction will be different in perpendicular direction. The material properties of the soil like shear resistance, cohesion and the dilatancy stress is determined from this test

3.2.6 Direct Shear Test {IS: 2720 (Part XII)- 1986}

Direct shear test or Box shear test is used to determine the shear strength of the soil. It is more suitable for cohesionless soils.

3.3 Details of Boreholes

BH No.	Field Work Dates		Termination Depth (m)	Ground Water Depth (m)	DMS Coordinates	
	Start	End			N	E
TBH 01	07.07.2023	14.07.2023	60.00	0.75	9°57'34.06''	76°17'11.65''
TBH 02	11.07.2023	24.07.2023	60.00	0.74	9°57'33.93''	76°17'11.65''
TBH 03	21.07.2023	28.07.2023	60.00	0.75	9°57'26.44''	76°17'18.52''
TBH 04	15.07.2023	20.07.2023	55.00	0.74	9°57'27.07''	76°17'20.01''
SBH 01	19.07.2023	21.07.2023	15.00	0.70	9°57'30.6''	76°17'9.66''
SBH 02	07.07.2023	08.07.2023	10.00	0.75	9°57'34.83''	76°17'12.2''
SBH 03	10.07.2023	10.07.2023	10.00	0.72	9°57'35.47''	76°17'12.67''

4. FINDINGS

- **BOREHOLE NO: TBH 01 (60.00m)**

In TBH 01, the top 3.50m comprises of loose silty sand (greyish) having SPT value of 7 to 9. Below this stiff silty clay with sand (greyish) was noted up to a depth of 5.00m with a SPT value of 14. This was followed by soft silty clay (greyish) having S.P.T value of 4 extending up to depth of 6.50m. From 6.50m to 9.50m stiff silty clay (greyish) having S.P.T value of 14 was noted. Below this soft silty clay (greyish) was noted with a SPT value of 3 up to a depth of 12.50m. This was followed by medium stiff silty clay (greyish) having S.P.T value of 6 to 7 extending up to depth of 15.50m. From 15.50m to 19.00m stiff silty clay (greyish) having S.P.T value of 10 to 15 was noted. Below this medium stiff silty clay(greyish) having S.P.T value of 6 was noted extending up to depth of 21.00m. This was followed by soft silty clay (greyish) having S.P.T value of 3 extending up to depth of 22.00m. From 22.00m to 25.50m loose clayey sand (brownish) having S.P.T value of 6 was noted. Below

this very stiff silty clay with sand(brownish-lateritic) was noted with a SPT value of 28 to 29 up to a depth of 32.00m. From 32.00m to 35.00m dense silty sand (brownish grey-lateritic) having S.P.T value of 33 was noted. Below this very stiff silty clay with sand (blackish) having S.P.T value of 29 was noted extending up to depth of 38.00m. This was followed by dense silty sand (greyish) having S.P.T value of 49 extending up to depth of 41.00m. From 41.00m to 44.00m very dense silty sand (blackish) having S.P.T value of 58 was noted. Below this very dense silty sand (light greyish) was noted with a SPT value of >100 up to a depth of 50.00m. This was followed by dense to very dense silty sand (blackish) having S.P.T value of 42 to >50 extending up to depth of 56.00m. Below this dense to very dense silty sand (greyish) having S.P.T value of 40 to 64 extending up to termination of borehole TBH 01 at 60.00m. Water table was noted at a depth of 0.75m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: TBH 02 (60.00m)**

In TBH 02, the top 3.50m comprises of medium dense sand (greyish) having SPT value of 13 to 19. Below this loose silty sand (greyish) was noted up to a depth of 8.00m with a SPT value of 5 to 8. This was followed by medium stiff to stiff clay (greyish) having S.P.T value of 4 to 10 extending up to depth of 23.00m. From 23.00m to 29.00m medium stiff clay (brownish grey - lateritic) having S.P.T value of 8 was noted. Below this dense silty sand (greyish) was noted with a SPT value of 43 up to a depth of 31.00m. This was followed by very dense clay (greyish - lateritic) having S.P.T value of 59 extending up to depth of 35.0m. From 35.00m to 38.00m Decayed Wood having S.P.T value of 36 was noted. Below this medium dense silty sand (greyish) having S.P.T value of 18 was noted extending up to depth of 41.00m. This was followed by hard clay with sand (greyish) having S.P.T value of 44 extending up to depth of 50.00m. From 50.00m to 58.00m very dense silty sand (greyish) having S.P.T value greater than 50 was noted. Below this dense to hard clay with decayed wood (blackish) having S.P.T value of 59 extending up to termination of borehole TBH 02 at 60.00m. Water table was noted at a depth of 0.74m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: TBH 03 (60.00m)**

In TBH-03, the top 6.50m comprises of medium dense sand (greyish) having SPT value of 10 to 30. Below this medium dense sand (greyish) was noted up to a depth of 6.50m with a

SPT value of 52. This was followed by loose silty sand (greyish) having S.P.T value of 10 extending up to depth of 11.50m. From 11.50m to 32.00m stiff to very stiff clay (greyish) having S.P.T value of 10 was noted. Below this very stiff clay (brownish- lateritic) having S.P.T value of 27 upto a depth of 38.00m. This was followed by stiff to very stiff clay (greyish) having S.P.T value of 15 extending up to depth of 44.00m. From 44.00m to 47.00m very dense silty sand (greyish) having S.P.T value of >100 was noted. Below this very dense sand with silt (greyish) having S.P.T value of >100 upto a depth of 52.00m. This was followed by hard clay with sand (greyish) having S.P.T value of 48 extending up to depth of 56.00m. From 56.00m to 58.00m hard clay with sand (blackish) having S.P.T value of 44 was noted. Below this hard clay with sand (blackish) was noted up to a depth of 60.00m with a SPT value of 49 extending up to termination of borehole TBH - 03 at 60.00m. Water table was noted at a depth of 0.75m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: TBH 04 (55.00m)**

In TBH-4, the top 4.00m comprises of dense to very silty sand (greyish) having SPT value of 30 to >100. This was followed by loose silty sand (greyish) having S.P.T value of 36 extending up to depth of 10.00m. From 10.00m to 16.00m medium stiff to stiff clay (greyish) having S.P.T value of 7 was noted. Below this stiff to very stiff clay with sand (greyish) having S.P.T value of 15 upto a depth of 23.00m. This was followed by stiff clay (greyish) having S.P.T value of 13 extending up to depth of 29.00m. From 29.00m to 32.00m stiff clay with sand (greyish) having S.P.T value of 14 was noted. Below this very stiff clay (greyish) having S.P.T value of 20 upto a depth of 38.00m. This was followed by very stiff clay with sand (greyish) having S.P.T value of 17 extending up to depth of 40.00m. From 40.00m to 44.00m hard clay with sand (greyish) having S.P.T value of 43 was noted. Below this dense to very dense silty sand (greyish) was noted up to a depth of 54.00m with a SPT value of >100 upto a depth of 54.00m. From 54.00m dense silty sand (greyish) having S.P.T value of 40 was noted extending up to termination of borehole TBH-4 at 55.00m. Water table was noted at a depth of 0.74m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: SBH 01 (15.00m)**

In SBH-01, the top 2.00m comprises of gravel (greyish) having SPT value of 56. Below this very soft clay with sand (greyish) was noted up to a depth of 3.50m with a SPT value of 2. This was followed by very soft clay (greyish) having S.P.T value of 1 extending up to depth of 7.00m. From 7.00m to 8.50m soft clay with sand (greyish) having S.P.T value of 3 was noted. Below this medium stiff to stiff clay (greyish) having S.P.T value of 8 extending up to termination of borehole SBH-01 at 15.00m. Water table was noted at a depth of 0.70m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: SBH 02 (10.00m)**

In SBH-02, the top 5.00m comprises of medium dense sand (greyish) having SPT value of 12 to 18. Below this very soft silty clay (greyish) was noted up to a depth of 10.00m with a SPT value of 2 to 3 extending up to termination of borehole SBH-02 at 10.00m. Water table was noted at a depth of 0.75m from ground level in the borehole during the time of investigation.

- **BOREHOLE NO: SBH 03 (10.00m)**

In SBH-03, the top 4.00m comprises of medium dense sand (greyish) having SPT value of 22. Below this very loose silty sand (greyish) was noted up to a depth of 5.00m with a SPT value of 3. This was followed by very loose silty sand with clay (greyish) having S.P.T value of 3 extending up to depth of 8.00m. From 8.00m to 9.50m loose silty sand (greyish) having S.P.T value of 9 was noted. Below this medium stiff silty clay (greyish) was noted with a SPT value of 5 extending up to termination of borehole SBH-03 at 10.00m. Water table was noted at a depth of 0.72m from ground level in the borehole during the time of investigation.

Based on borehole details for each structure, the suggestion on type of foundation are given in Annexure

Client:

ANNEXURE -1

TBH-01 & TBH-02

FIRE WATER TANK

1.1 DESIGN CONSIDERATION FOR FOUNDATION SYSTEM

It is understood from the client that the structure proposed is a ground based fire water tank of about 1400m^3 capacity. From the borelogs and lab results of the soil samples in areas of TBH 01 and TBH 02, it can be understood that the soils in the shallow depths are predominantly sandy in nature followed by soft clay. The SPT N values indicate the soft nature of these soils, which induces immediate settlements due to the load from the structure.

For the proposed fire water tank in areas of TBH 01 and TBH 02, raft foundation at a depth of 1.00m below the ground level shall be provided in the silty sandy strata. Bearing capacities of raft foundation proposed at 1.00m depth are worked out for shear criteria and settlement criteria as per relevant IS codes. The values are as given in the table below:

Depth of Footing (m)	Width of Footing (m)	Bearing Capacity by Shear (T/m^2)	Bearing Capacity by Settlement (T/m2)
1.00	6.00	3.50	6.00

Note: the lower of the two values is taken as the safe bearing capacity

Typical Calculations of Bearing Capacity of Borehole TBH-01 are given below.

Foundation Shape and Dimensions

Type of Foundation	*Width (B), m*	*Depth (D), m*
Raft	6.00	1.00

Subsurface Strata

Corrected SPT N value	9	
Effective cohesion (c′)	0	
c′ considering local shear failure	0.0	kPa
Effective angle of shearing resistance (ϕ′)	26°	
ϕ′ considering local shear failure	18.0	
Unit weight above founding level	8	kN/m^3
Unit weight below founding level	8	kN/m^3

Depth of ground water table below GL	0.0	m
Water table correction factor (W')	0.5	

Shape Factors		Depth Factors#			Bearing Capacity Factors		
			General	Local		General	Local
s_c	1.30	d_c	1.00	1.00	N_c	22.25	13.11
s_γ	0.80	d_γ	1.00	1.00	N_γ	12.54	4.07
s_q	1.20	d_q	1.00	1.00	N_q	11.85	5.26

#When strata above founding level is not as good as strata below, depth factors should be taken as 1.0

Net Ultimate Bearing Capacity

$$q_u = cN_c s_c d_c + \gamma D(N_q - 1)s_q d_q + 0.5\gamma B N_\gamma s_\gamma d_\gamma W'$$

Net ultimate bearing capacity - General Shear ($q_{un(gen)}$) = 224.6 kPa

Net ultimate bearing capacity - Local Shear ($q_{un(loc)}$) = 80.0 kPa

Net ultimate bearing capacity - Intermediate Shear (q_{un}) = 72.8 kPa

Safe Bearing Capacity

Recommended factor of safety = 2.5

Net safe bearing capacity = 37.1 kPa

Recommended net safe bearing capacity = 3.50 t/m^2

For heavily loaded structure, bored cast in situ D.M.C. piles with adequate anchorage into very stiff silty clay at a depth of about 30.00m may be provided. Suitable precaution has to be adopted in order to prevent the sides from caving while boring through medium dense sand layer.

Pile Diameter	Axial Capacity (T)	Uplift Capacity (T)
50cm	60	50

60cm	80	60
70cm	100	70
80 cm	120	90

Typical Calculations of Pile Capacity of Borehole TBH-01 are given below.

As per IS-2911, Part 1, Sec II, the ultimate load carrying capacity (Q_u) is given by

$Qu = Re_u + Rf_u$

Where Re_u = Ultimate base resistance

Rf_u = Ultimate shaft resistance

End bearing resistance, Re may be calculated from the following

$Re = Ap (½ D \gamma N\gamma + Pd Nq) + Ap Nc Cp$---- (1)

Where

Ap = Cross Sectional area of pile toe m^2

D = Pile diameter in m

γ = Effective unit weight of soil at pile toe kgf/cm^3

Pd = Effective overburden pressure at pile toe in kgf/cm^2

$N\gamma$ and Nq = Bearing capacity factors based on angle of internal friction at pile toe

Nc = Bearing Capacity factor taken as 9 for clay and

Cp = Average cohesion at pile tip (from unconsolidated undrained test)

And as per IS-2911, Part 1, Sec II, the frictional capacity of pile is given by

$Rf = \Sigma K Pdi \tan\delta As + \alpha C^- As$ ---- (2)

Where,

α = reduction factor

C = Average cohesion of pile throughout the embedded length

(From unconsolidated undrained test)

As = Surface Area of pile shaft, m^2

K = Coefficient of earth pressure

Pdi = Effective overburden pressure for the layer kgf/cm^2

δ = Angle of wall friction between pile and soil

The depth of pile is likely to be about 30.00m in the areas of TBH-01. The load capacity of pile will be the summation of the friction developed from the very loose to loose sand/medium dense sand, soft clay/stiff/very stiff sandy clay strata and hard sandy clay strata.

Shear parameters used for deriving the pile capacity of pile in the area of TBH-01 is

Table 1: Shear parameters and frictional capacity of 600mm dia pile in areas of TBH01

z_T (m)	z_B (m)	H (m)	*Description and Classification*	*SPT* N_c	γ (kN/m^3)	ϕ'	c_u (kPa)	*Frictional Capacity*
0	3.5	3.5	Loose Silty Sand(Greyish)	8	17	27	-	4.115
3.5	5	1.5	Stiff Silty Clay With Sand (Greyish)	14	17	-	90	10.173
5	6.5	1.5	Soft Silty Clay (Greyish)	4	15	-	25	3.532
6.5	9.5	3	Stiff Silty Clay (Greyish)	14	17	-	90	20.347
9.5	12.5	3	Soft Silty Clay (Greyish)	3	15	-	18	7.121
12.5	15.5	3	Medium Stiff Silty Clay (Greyish)	6	16	-	35	9.891
15.5	19	3.5	Stiff Silty Clay (Greyish)	12	17	-	70	18.463

19	21	2	Medium Stiff Silty Clay (Greyish)	6	16	-	35	6.594
21	22	1	Soft Silty Clay (Greyish)	3	15	-	18	2.373
22	25.5	3.5	Loose Clayey Sand (Brownish)	6	17	28	-	21.036
25.5	30	4.5	Very Stiff Silty Clay With Sand (Brownish - Lateritic)	28	18.5	-	185	48.324

Hence the safe capacity of pile based on soil strength criteria works out to be

Q_{safe} = (Rub + Ruf(1) +Ruf(2) + Ruf(3) + Ruf(4) + Ruf(5) + Ruf(6) + Ruf(7)+ Ruf(8) + Ruf(9) + Ruf(10) + Ruf(11))/ 2.5

= (50.02+4.115+10.173+3.532+20.347+7.121+9.891+18.463+6.594+2.373+21.036+48.324)/2.5

= 80.798 Tonnes**, Say 80 Tonnes**

The Uplift capacity of pile based on soil strength criteria works out to be

Q_{safe} = (Ruf(1) +Ruf(2) + Ruf(3) + Ruf(4) + Ruf(5) + Ruf(6) + Ruf(7)+ Ruf(8) + Ruf(9) + Ruf(10) + Ruf(11)) / 3

= (4.115+10.173+3.532+20.347+7.121+9.891+18.463+6.594+2.373+21.036+48.324)/3

= 50.657 Tonnes

Self-weight of pile = π /4 x 0.6 x 0.6 x 30x 1.5 = 12.717Tonnes

Uplift capacity of pile = 50.657+ 12.717 = 63.375 Tonnes, **Say 60Tonnes**

Hence the safe uplift capacity of the pile of 600mm dia can be taken as 60Tonnes.

Hence the safe carrying capacity of the pile in the very stiff clayey strata will be governed by the soil strength criteria and the safe capacity of 600mm dia pile can be taken as 80 Tonnes.

1.2 SUMMARY & RECOMMENDATIONS:

For the proposed fire water tank in areas of TBH 01 and TBH 02, raft foundation at a depth of 1.00m below the ground level shall be provided in the silty sandy strata. Bearing capacities of raft foundation proposed at 1.00m depth are worked out for shear criteria and settlement criteria as per relevant IS codes. The values are as given in the table below:

Depth of Footing (m)	Width of Footing (m)	Safe Bearing Capacity (T/m2)
1.00	6.00 x 6.00	3.50

For heavily loaded structure, bored cast in situ D.M.C. piles with adequate anchorage into very stiff silty clay at a depth of about 30.00m may be provided. Suitable precaution has to be adopted in order to prevent the sides from caving while boring through medium dense sand layer.

Pile Diameter	Axial Capacity (T)	Uplift Capacity (T)
50cm	60	50
60cm	80	60
70cm	100	70
80 cm	120	90

If during piling it is observed that the soil profiles from piling operations are not consistent with the bore logs, it may be immediately reported and designs revised if necessary.

Recommendations are based on the assumption that the soil profile found in the boreholes and samples tested are indicative of the entire plot area. Any deviation in soil profile other than those noted in the boreholes tested, should immediately be referred to the consultant and proper modification should be implemented.

The foundation execution is recommended under strict technical supervision.

For ENGINEERS DIAGNOSTIC CENTRE (P) LTD.,

A. V.S CHAKRAVARTI
M. Tech, M.I.G.S., M.I.C.I
CHIEF ENGINEER

GEOTECHNICAL INVESTIGATION WORK FOR FIRE WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 07.07.2023
Bore Hole No	: TBH 01	Boring Completed	: 14.07.2023
Type of Boring	: ROTARY DRILLING	Water level	: 0.75m
Termination Depth	: 60.00 m	Location	: KOCHI

DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm			SPT " N "	Remarks
							15cm	15cm	15cm		
0.00		SM - SP	Loose Silty SAND (Greyish)	3.50	1.50	1.50- 1.95	5	4	5	9	
					3.00	3.00- 3.45	8	3	4	7	
3.50		CI	Stiff Silty CLAY with Sand (Greyish)	1.50	4.50	4.50- 4.95	11	9	5	14	
5.00		CH	Soft Silty CLAY (Greyish)	1.50	6.00	6.50- 6.95	1	2	2	4	
6.50		CH	Stiff Silty CLAY (Greyish)	3.00	7.50	7.50- 7.95	2	3	11	14	
9.50		CH	Soft Silty CLAY (Greyish)	3.00	9.00	9.00- 9.45	UDS Slipped				
12.50		CH	Medium Stiff Silty CLAY (Greyish)	3.00	10.50	10.50- 10.95	1	1	2	3	
15.50		CH	Stiff Silty CLAY (Greyish)	3.50	12.00	12.00- 12.45	UDS Collected				
19.00		CH	Medium Stiff Silty CLAY(Greyish)	2.00	13.50	13.50- 13.95	1	3	3	6	
21.00		CH	Soft Silty CLAY (Greyish)	1.00	15.00	15.00- 15.45	2	2	5	7	
22.00					16.50	16.50- 16.95	2	4	6	10	
					18.00	18.00- 18.45	5	7	8	15	
					20.00	20.00- 20.45	1	2	4	6	
					22.00	22.00- 22.45	1	1	2	3	

GEOTECHNICAL INVESTIGATION WORK FOR FIRE WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 07.07.2023
Bore Hole No	: TBH 01	Boring Completed	: 14.07.2023
Type of Boring	: ROTARY DRILLING	Water level	: 0.75m
Termination Depth	: 60.00 m	Location	: KOCHI

DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
		SC	Loose Clayey SAND (Brownish)	3.50	24.00	24.00-24.45	2	2	4	6	
					26.00	26.00- 26.45	UDS Failed				
25.50											
		CH	Very Stiff Silty CLAY with Sand (Brownish-Lateritic)	6.50	28.00	28.00- 28.45	7	14	15	29	
					30.00	30.00- 30.45	5	10	18	28	
32.00											
		SM	Dense Silty SAND (Brownish Grey-Lateritic)	3.00	33.00	33.00- 33.45	7	15	18	33	
35.00											
		CI	Very Stiff Silty CLAY with Sand (Blackish)	3.00	36.00	36.00- 36.45	12	13	15	29	
38.00											
		SM	Dense Silty SAND (Greyish)	3.00	39.00	39.00- 39.45	13	21	28	49	
41.00											
		SM	Very Dense Silty SAND (Blackish)	3.00	42.00	42.00- 42.45	19	26	32	58	
44.00											

GEOTECHNICAL INVESTIGATION WORK FOR FIRE WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 07.07.2023
Bore Hole No	: TBH 01	Boring Completed	: 14.07.2023
Type of Boring	: ROTARY DRILLING	Water level	: 0.75m
Termination Depth	: 60.00 m	Location	: KOCHI

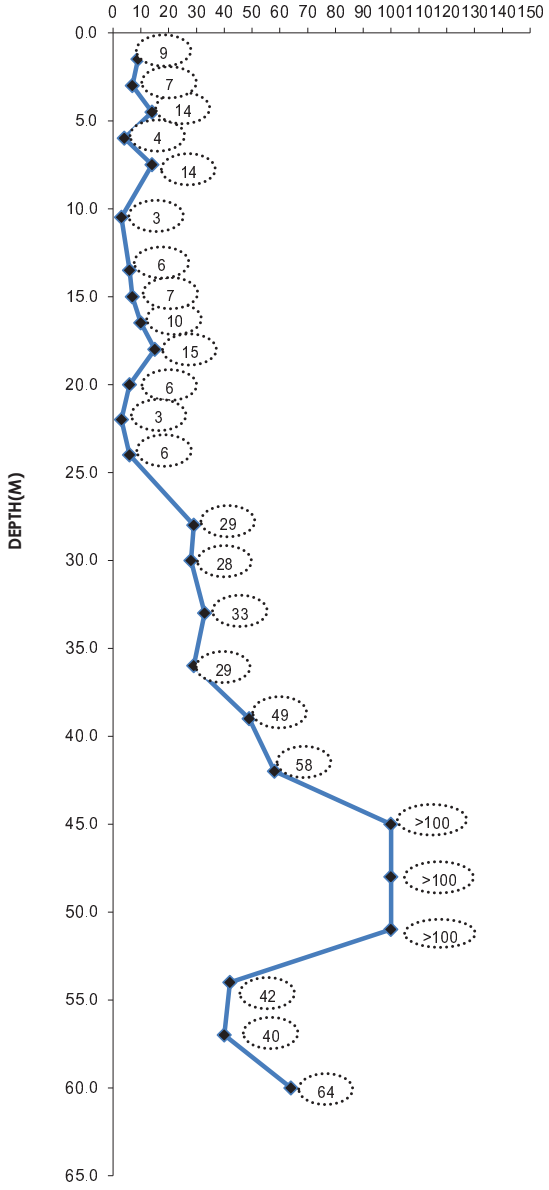
DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm			SPT " N "	Remarks
							15cm	15cm	15cm		
		SM	Very Dense Silty SAND (Light Greyish)	6.00	45.00	45.00- 45.45	29	48	52	>100	Balance= 10cm
					48.00	48.00- 48.45	48	50	-	>100	Balance= 28cm
50.00											
		SM	Dense to Very Dense Silty SAND (Blackish)	6.00	51.00	51.00- 51.45	28	38	-	>100	
					54.00	54.00- 54.45	11	17	25	42	
56.00											
		SM	Dense to Very Dense Silty SAND (Greyish)	4.00	57.00	57.00- 57.45	18	19	21	40	
60.00					60.00	60.00- 60.45	17	26	38	64	

BOREHOLE TERMINATED AT 60.00M

PROJECT : GEOTECHNICAL INVESTIGATION WORK AT COCHIN SHIPYARD

	ENGINEERS DIAGNOSTIC CENTRE (P) LTD	Bore Hole No	: TBH01	Boring Started	: 07.07.2023
		Type of Boring	: Rotary	Boring Completed	: 14.07.2023
		Termination Depth	: 60.00m	Ground water table	: 0.75 m

GRAPHICAL REPRESENTATION OF N VALUE



BORE HOLE TERMINATED AT 60.00 M

SOIL TESTING LABORATORY

ENGINEERS DIAGNOSTIC CENTRE PVT. LTD

TC-9851

TEST REPORT

Test Report No	: EDC/23-24/TRN-081	**Issue Date & Time**	05.08.2023, 2.00 pm	**Page No**	: 1 of 2

Customer Details EDC Pvt Ltd

Project Name* COCHIN SHIP YARD

e- mail ID

Sampling performed by : Customer

Sample received on : 12.07.2023, 10:00 am

Condition of the sample : Satisfactory

Period of Testing : 15.07.2023 - 2.08.2023

Testing Temperature : 27^0 C

Test conducted at : Engineers Diagnostic Centre (P) Ltd,41/1210, Vadakumthala Building, Arangath Cross Road, Pullepady, Cochin-682018

Test Results : Refer page 2

Deviations (if any) : Nil

* - Details provided by the customer

Note:

1)This test report shall not be reproduced without approval of this laboratory.

2) All the components of this test report shall be recognized as a portion of the complete report. The results provided relate only to the items tested. The results provided apply only to the samples as received.

3) Any correction in this report invalidates the report.

4) Laboratory is not responsible for the validity of data or information provided by the requester

For Soil Testing Laboratory
Engineers Diagnostic Centre (P) Ltd

Tested By:

Mr. Afsal M Y
Lab Technician

Approved By:

Mr. Aravindan S
Quality Manager

Operations Office Laboratory Address: Engineers Diagnostic Centre (P) Ltd, Nikhil Tower, Pullepaddy Cross Road, Cochin-682018;Mob: 9388080509; E-mail: edclab2018@gmail.com ; Website: www.edcpltd.com

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TC-9851

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 15.07.2023

ULR No: TC985123000000081F

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / TBH 01 / 1.50	Silty SAND (Greyish)	SP	3	2	22	63	11		20				2.64
23-24 / TRN-081 / TBH 01 / 3.00	Silty SAND (Greyish)	SM	8	2	6	61	23		30				2.63
23-24 / TRN-081 / TBH 01 / 4.50	Silty CLAY of int. plasticity with Sand (Greyish)	CI	0	1	2	41	47	9	37	40	12	28	2.59
23-24 / TRN-081 / TBH 01 / 6.00	Silty CLAY of high plasticity (Greyish)	CH	0	0	0	10	56	34	94	124	40	84	2.54
23-24 / TRN-081 / TBH 01 / 7.50	Silty CLAY of high plasticity (Greyish)	CH	0	0	0	17	52	32	86				
23-24 / TRN-081 / TBH 01 / 10.50	Silty CLAY of high plasticity (Greyish)	CH	0	0	0	19	49	33	90	119	39	80	2.55
23-24 / TRN-081 / TBH 01 / 16.50	Silty CLAY of high plasticity (Greyish)	CH	0	0	0	5	57	38	78	125	41	84	
23-24 / TRN-081 / TBH 01 / 20.00	Silty CLAY of high plasticity (Greyish)	CH	0	0	0	1	49	49	75				
23-24 / TRN-081 / TBH 01 / 24.00	Clayey SAND (Brownish)	SC	1	4	43	30	10	11	14				2.63
23-24 / TRN-081 / TBH 01 / 28.00	Silty CLAY of high plasticity with Sand (Brownish-Lateritic)	CH	0	0	10	32	35	23	19	75	29	46	2.58

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TC-9851

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 15.07.2023

ULR No: TC985123000000081F

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / TBH 01 / 33.00	Silty SAND (Brownish Grey-Lateritic)	SM	0	1	9	42	29	19	21				2.60
23-24 / TRN-081 / TBH 01 / 36.00	Silty CLAY of high plasticity with Sand (Blackish)	CI	0	1	13	25	42	20	24	49	10	39	2.58
23-24 / TRN-081 / TBH 01 / 39.00	Silty SAND (Greyish)	SM	2	7	62	14	14		17				2.63
23-24 / TRN-081 / TBH 01 / 42.00	Silty SAND (Blackish)	SM	6	2	19	41	19	13	62				
23-24 / TRN-081 / TBH 01 / 48.00	Silty SAND (Light Greyish)	SM	0	0	15	60	26		23				2.64
23-24 / TRN-081 / TBH 01 / 51.00	Silty SAND (Blackish)	SM	3	15	58	11	13		26				
23-24 / TRN-081 / TBH 01 / 57.00	Silty SAND (Greyish)	SM	0	0	15	46	24	15	22				

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

SOIL TESTING LABORATORY

TEST REPORT

Determination of Triaxial Compression Test
IS 2720 - Part 11 :1993 (Reaff:2021)

Test Report No	EDC/23-24/TRN-081	

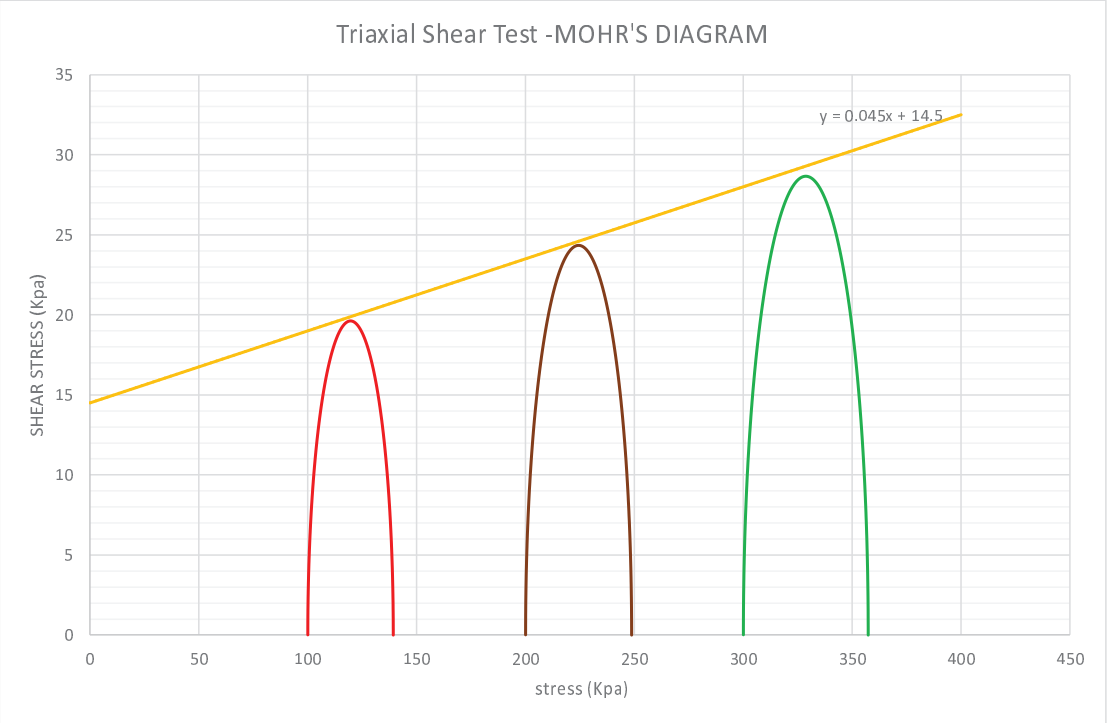
Laboratory Information

Date of Testing	26/07/23	
Lab Temperature	27	

Sample Details

Sample ID	**TRN 081/TBH 01/ 12.00 mts**	Type of Sample : UNDISTRUBED

Type of Test	**UU**
Rate of strain	1.25 mm/min



			Cohesion ,C	**14.5**	**(kPa)**	
			Friction Angle ,φ	**2.6**	**(deg)**	
Sample No	**Bulk Denity (g/cc)**	**Cell Pressure (Kpa)**	**Compressive Stress at failure (Kpa)**	**Strain at Failure (Kpa)**	**Moisture content**	**Dry Density (g/cc)**
1	2.041	100	39.24	5.84	0.59	1.284
2	2.033	200	48.68	6.58	0.56	1.303
3	2.039	300	57.31	8.97	0.58	1.290

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Direct Shear Test
IS 2720 - Part 13 :1993 (Reaff:2021)

Test Report No EDC/23-24/TRN-81

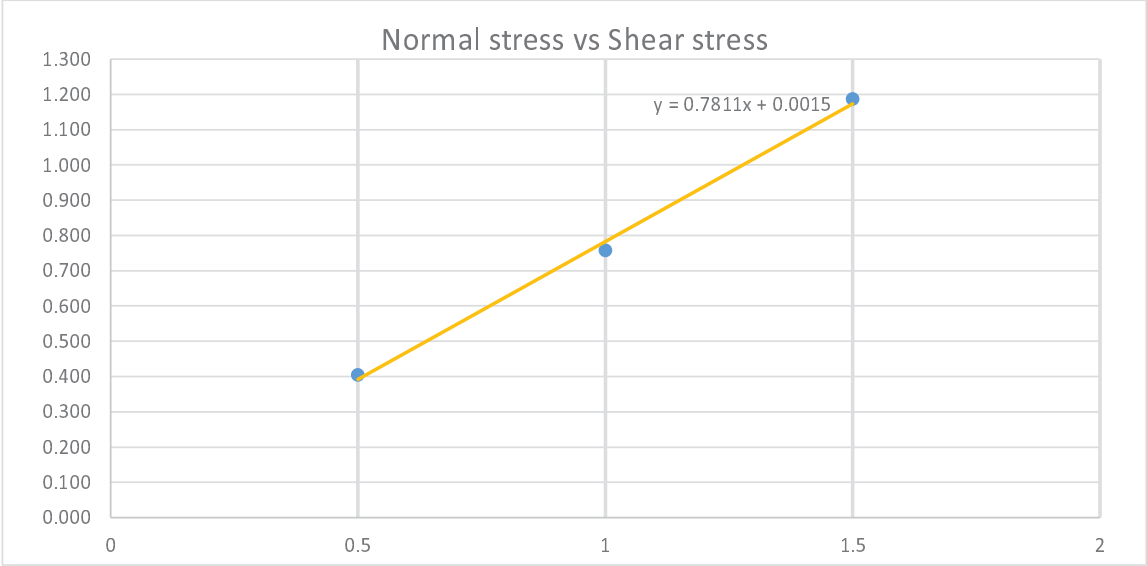
Laboratory Information

Date of Testing 14/07/2023
Lab Temperature 26

Sample Details

Sample id : TRN 81/TBH 01/39.00 mts Sample Type UDS-Remoulded

Length (cm)	6
Height (cm)	2.50
Bulk Density(g/cc)	2.34
Dry Density(g/cc)	1.98



Angle of Internal friction,φ **37.99 (deg)**
Cohesion ,C **0.00 (kPa)**

GEOTECHNICAL INVESTIGATION WORK FOR FIRE WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 11.07.2023
Bore Hole No	: TBH 02	Boring Completed	: 24.07.2023
Type of Boring	: ROTARY DRILLING	Water level	: 0.74m
Termination Depth	: 60.00 m	Location	: KOCHI

DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
0.00		SP	Medium Dense SAND (Greyish)	3.50	1.50	1.50- 1.95	3	6	13	19	
					3.00	3.00- 3.45	4	3	10	13	
3.50		SM	Loose Silty SAND (Greyish)	4.50	4.50	4.50- 4.95	1	3	5	8	
					6.00	6.50- 6.95	4	2	3	5	
					7.50	7.50- 7.95	UDS Collected				
8.00		CH	Medium Stiff to Stiff CLAY (Greyish)	14.00	9.00	9.00- 9.45	3	4	6	10	
					10.50	10.50- 10.95	2	3	5	8	
					12.00	12.00- 12.45	2	4	6	10	
					13.50	13.50- 13.95	UDS Collected				
					15.00	15.00- 15.45	1	2	2	4	
					16.50	16.50- 16.95	Vane Shear Test				
					18.00	18.00- 18.45	UDS Collected				
					20.00	20.00- 20.45	2	2	3	5	
22.00					22.00	22.00- 22.45	2	4	5	9	

GEOTECHNICAL INVESTIGATION WORK FOR FIRE WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 11.07.2023
Bore Hole No	: TBH 02	Boring Completed	: 24.07.2023
Type of Boring	: ROTARY DRILLING	Water level	: 0.74m
Termination Depth	: 60.00 m	Location	: KOCHI

DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
23.00		CH	Medium Stiff to Stiff CLAY (Greyish)	1.00							
					24.00	24.00-24.45	UDS Collected				
		CH	Medium Stiff CLAY (Brownish Grey - Lateritic)	6.00	26.00	26.00- 26.45	4	3	5	8	
					28.00	28.00- 28.45	UDS Collected				
29.00											
31.00		SM	Dense Silty SAND (Greyish)	2.00	30.00	30.00- 30.45	12	20	23	43	
		CH	Very Dense CLAY(Greyish - Lateritic)	4.00	33.00	33.00- 33.45	23	28	31	59	
35.00											
38.00			Decayed Wood	3.00	36.00	36.00- 36.45	9	17	19	36	
		SM	Medium Dense Silty SAND (Greyish)	3.00	39.00	39.00- 39.45	6	7	11	18	
41.00											
		CH	Hard CLAY with Sand (Greyish)	3.00	42.00	42.00- 42.45	12	21	23	44	
44.00											

GEOTECHNICAL INVESTIGATION WORK FOR FIRE WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 11.07.2023
Bore Hole No	: TBH 02	Boring Completed	: 24.07.2023
Type of Boring	: ROTARY DRILLING		0.74m
Termination Depth	: 60.00 m	Location	: KOCHI

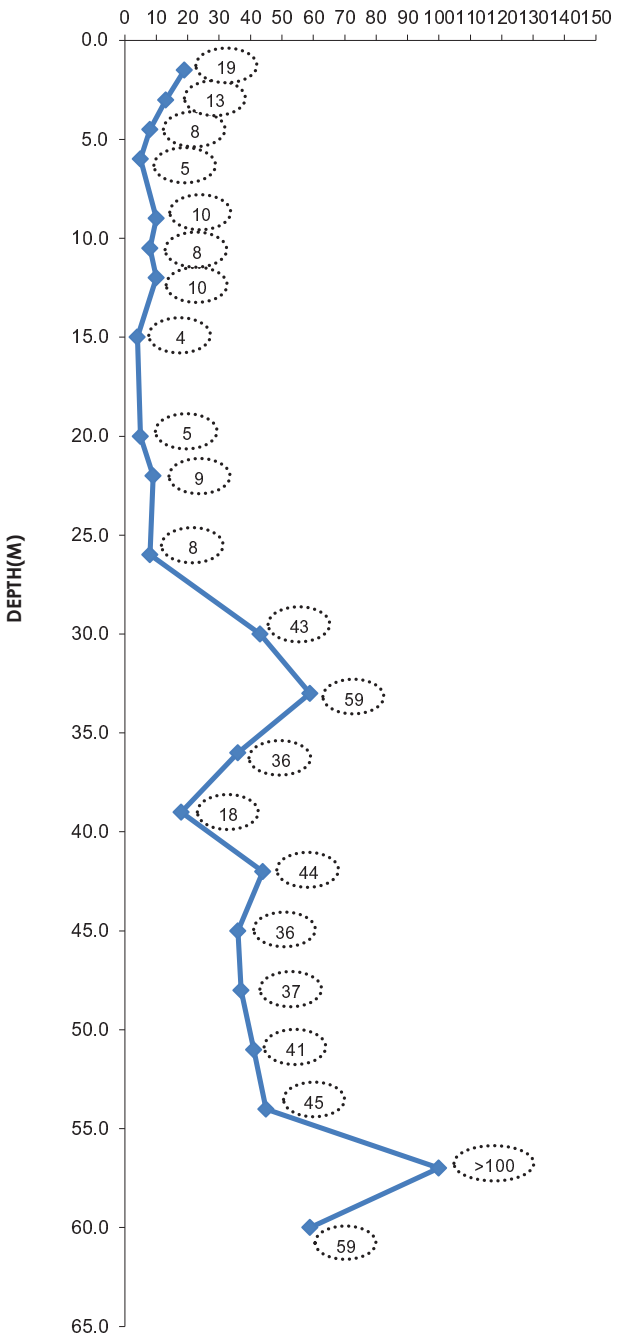
DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
					45.00	45.00- 45.45	10	14	22	36	
		CH	Hard CLAY with Sand (Greyish)	6.00	48.00	48.00- 48.45	12	18	19	37	
50.00					51.00	51.00- 51.45	15	18	23	41	
		SM	Very Dense Silty SAND (Greyish)	8.00	54.00	54.00- 54.45	14	19	26	45	
58.00					57.00	57.00- 57.45	32	-	-	>100	
		CH	Hard CLAY with Decayed Wood (Blackish)	2.00	60.00	60.00- 60.45	18	21	38	59	
60.00											

BOREHOLE TERMINATED AT 60.00M

PROJECT : GEOTECHNICAL INVESTIGATION WORK AT COCHIN SHIPYARD

	ENGINEERS DIAGNOSTIC CENTRE (P) LTD	Bore Hole No	: TBH02	Boring Started	: 11.07.2023
		Type of Boring	: Rotary	Boring Completed	: 24.07.2023
		Termination Depth	: 60.00m	Ground water table	: 0.74 m

GRAPHICAL REPRESENTATION OF N VALUE



BORE HOLE TERMINATED AT 60.00 M

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TC-9851

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 21.07.2023

ULR No: TC985123000000081F

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / TBH 02 / 1.50	Poorly-graded SAND (Greyish)	SP	2	1	14	75	9		21				2.66
23-24 / TRN-081 / TBH 02 / 4.50	Silty SAND (Greyish)	SM	0	0	2	59	23	16	30				2.61
23-24 / TRN-081 / TBH 02 / 9.00	CLAY of high plasticity (Greyish)	CH	0	0	0	14	55	31	37	79	21	58	2.54
23-24 / TRN-081 / TBH 02 / 15.00	CLAY of high plasticity (Greyish)	CH	0	0	0	3	58	39	99	135	41	94	
23-24 / TRN-081 / TBH 02 / 22.00	CLAY of high plasticity (Greyish)	CH	0	0	0	2	47	51	75	122	37	85	
23-24 / TRN-081 / TBH 02 / 26.00	CLAY of high plasticity (Brownish Grey-Lateritic)	CH	0	4	11	12	43	30	32	89	20	69	2.58
23-24 / TRN-081 / TBH 02 / 30.00	Silty SAND (Greyish)	SM	0	0	29	50	10	11	18			0	2.63
23-24 / TRN-081 / TBH 02 / 33.00	CLAY of high plasticity (Greyish-Lateritic)	CH	0	0	1	49	25	25	16	70	12	58	2.59
23-24 / TRN-081 / TBH 02 / 36.00	DECAYED WOOD		-	-	-	-	-	-	64			0	
23-24 / TRN-081 / TBH 02 / 39.00	Silty SAND (Greyish)	SM	0	0	13	38	31	18	39			0	2.60

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 21.07.2023

ULR No: TC985123000000081F

TC-9851

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / TBH 02 / 42.00	CLAY of high plasticity with Sand (Greyish)	CH	0	0	0	28	39	33	38	89	24	65	2.56
23-24 / TRN-081 / TBH 02 / 48.00	CLAY of high plasticity with Sand (Greyish)	CH	0	0	0	21	57	22	42	74	25	49	2.56
23-24 / TRN-081 / TBH 02 / 51.00	Silty SAND (Greyish)	SM	6	1	19	45	22	6	37				2.63
23-24 / TRN-081 / TBH 02 / 57.00	Silty SAND (Greyish)	SM	0	6	53	21	20		17				2.63
23-24 / TRN-081 / TBH 02 / 60.00	CLAY of high plasticity with Decayed Wood (Blackish)	CH	0	0	0	19	46	36	37	90	28	62	2.55

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Triaxial Compression Test
IS 2720 - Part 11 :1993 (Reaff:2021)

Test Report No	EDC/23-24/TRN-081	

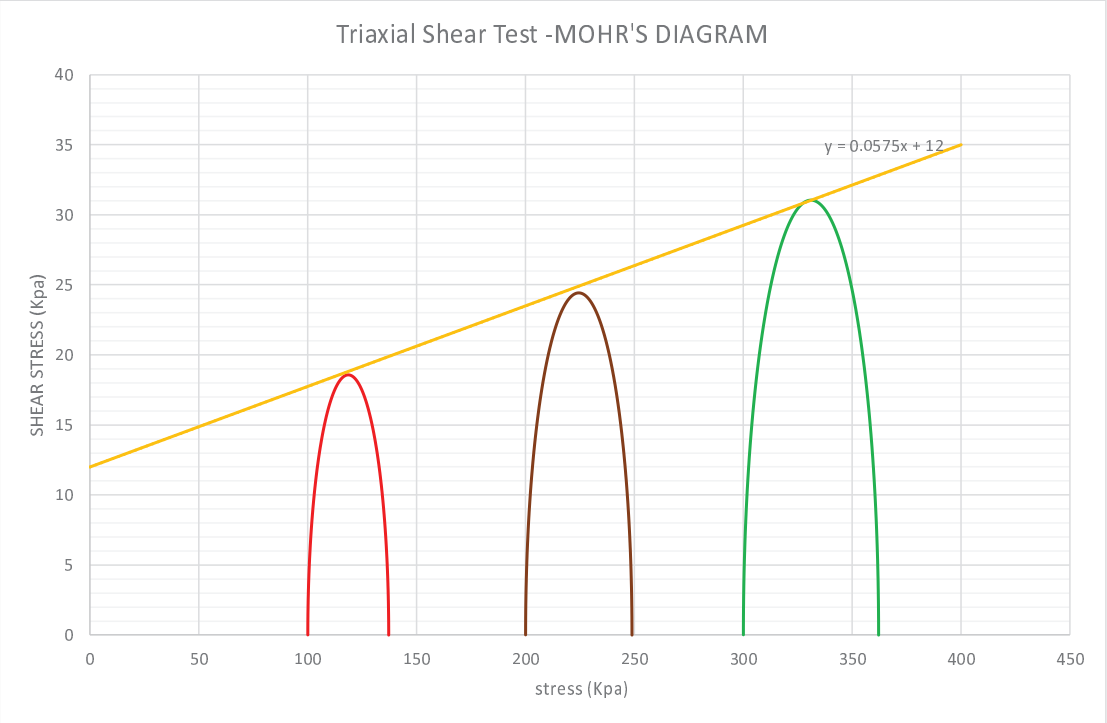
Laboratory Information

Date of Testing	15/07/23	
Lab Temperature	26	

Sample Details

Sample ID	**TRN 081/TBH 02/ 7.50 mts**	Type of Sample : UNDISTRUBED

Type of Test	**UU**
Rate of strain	1.25 mm/min



			Cohesion ,C	**12**	**(kPa)**		
			Friction Angle ,φ	**3.3**	**(deg)**		
Sample No	**Bulk Denity (g/cc)**	**Cell Pressure (Kpa)**	**Compressive Stress at failure (Kpa)**	**Strain at Failure (Kpa)**	**Moisture content**	**Dry Density (g/cc)**	
1	2.080	100	37.15	5.92	0.72	1.209	
2	2.091	200	48.85	6.58	0.7	1.230	
3	2.073	300	62.09	8.97	0.71	1.212	

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Triaxial Compression Test
IS 2720 - Part 11 :1993 (Reaff:2021)

Test Report No	EDC/23-24/TRN-081	

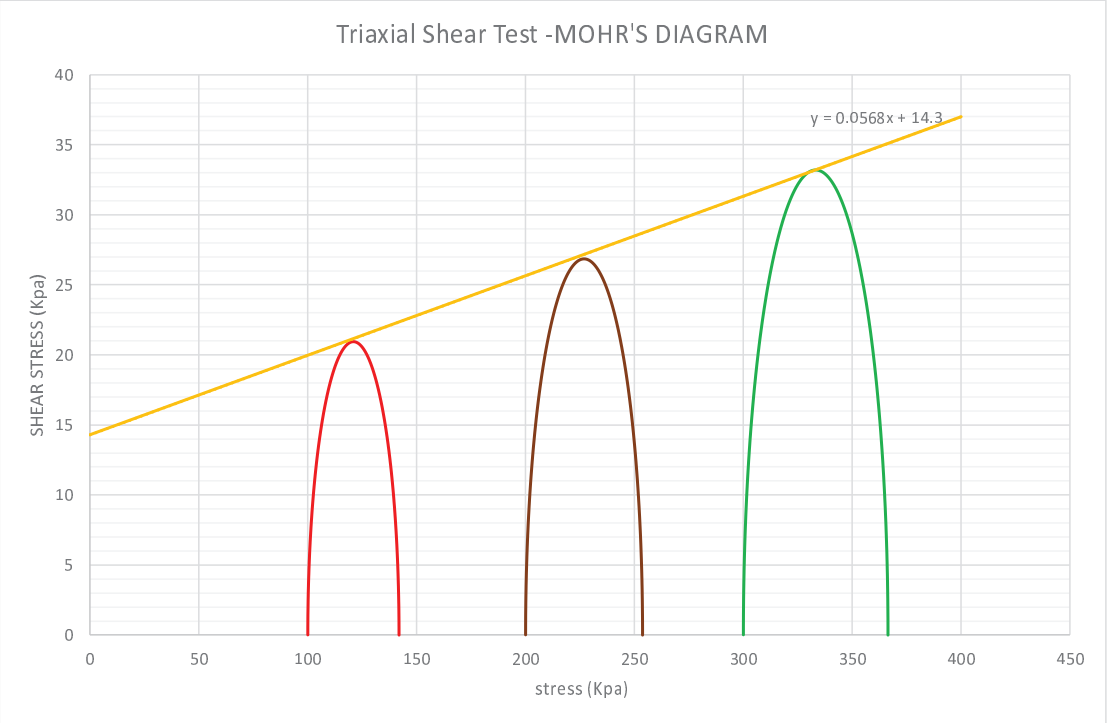
Laboratory Information

Date of Testing	18/07/23	
Lab Temperature	26	

Sample Details

Sample ID	**TRN 081/TBH 02/ 13.50 mts**	Type of Sample : UNDISTRUBED

Type of Test	**UU**
Rate of strain	1.25 mm/min



			Cohesion ,C	**14.3**	**(kPa)**	
			Friction Angle ,φ	**3.3**	**(deg)**	
Sample No	**Bulk Denity (g/cc)**	**Cell Pressure (Kpa)**	**Compressive Stress at failure (Kpa)**	**Strain at Failure (Kpa)**	**Moisture content**	**Dry Density (g/cc)**
1	2.012	100	41.89	5.70	0.53	1.315
2	2.009	200	53.71	6.25	0.56	1.288
3	1.996	300	66.39	8.64	0.58	1.263

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Triaxial Compression Test
IS 2720 - Part 11 :1993 (Reaff:2021)

Test Report No	EDC/23-24/TRN-081	

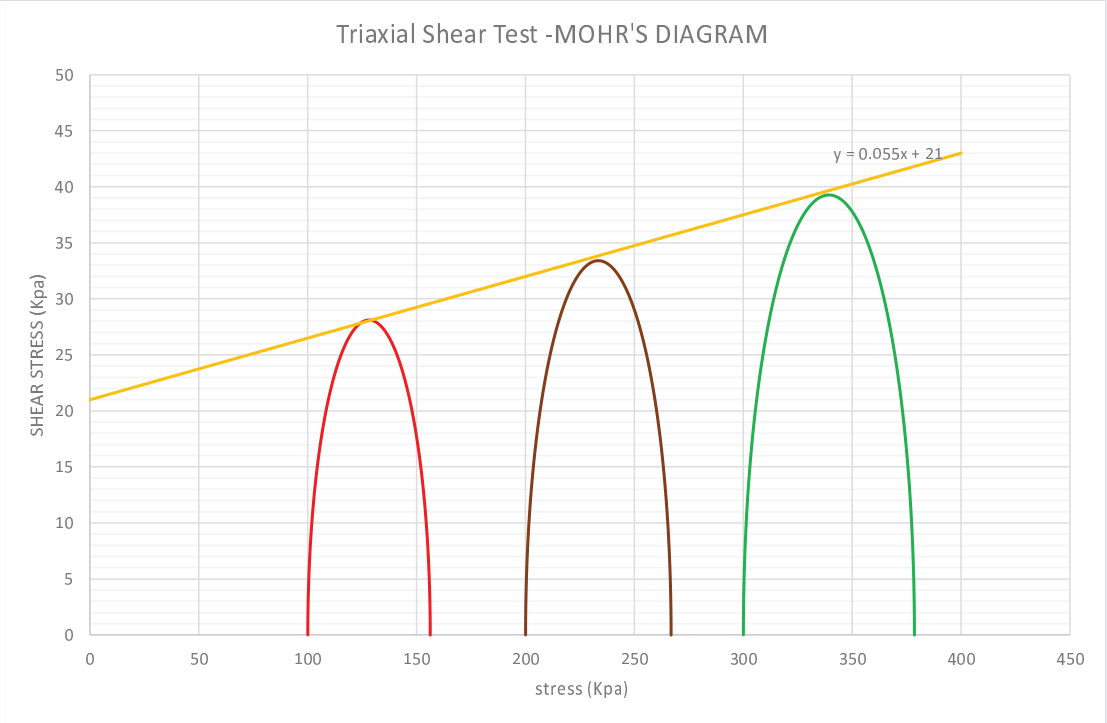
Laboratory Information

Date of Testing	19/07/23	
Lab Temperature	26	

Sample Details

Sample ID	**TRN 081/TBH 02/ 24.00 mts**	Type of Sample : UNDISTRUBED

Type of Test	**UU**
Rate of strain	1.25 mm/min



Cohesion ,C	**21**	**(kPa)**
Friction Angle ,φ	**3.1**	**(deg)**

Sample No	Bulk Denity (g/cc)	Cell Pressure (Kpa)	Compressive Stress at failure (Kpa)	Strain at Failure (Kpa)	Moisture content	Dry Density (g/cc)
1	2.041	100	56.22	5.84	0.68	1.215
2	2.038	200	66.81	6.41	0.66	1.227
3	2.050	300	78.53	8.97	0.67	1.228

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Direct Shear Test
IS 2720 - Part 13 :1993 (Reaff:2021)

Test Report No EDC/23-24/TRN-81

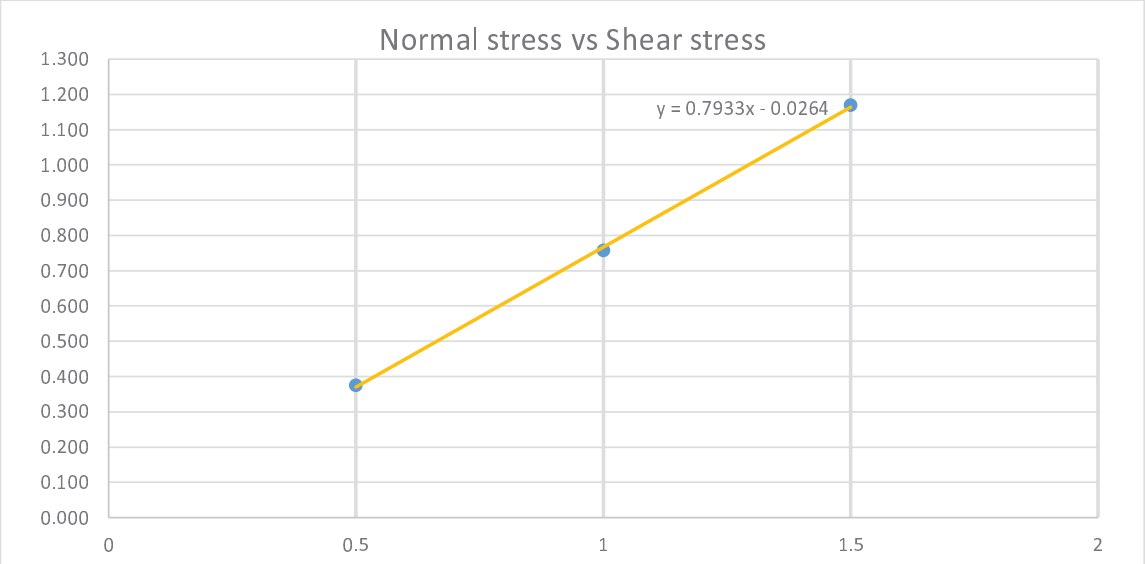
Laboratory Information

Date of Testing 20/07/2023
Lab Temperature 26

Sample Details

Sample id : TRN 81/TBH 02/54.00 mts Sample Type Remoulded

Length (cm)	6
Height (cm)	2.50
Bulk Density(g/cc)	2.28
Dry Density(g/cc)	1.80



Angle of Internal friction,φ **38.43 (deg)**
Cohesion ,C **0.00 (kPa)**

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

IN-SITU VANE SHEAR TEST

Test No.	**: 01**	**Test Date**	**: 12.07.2023**
Bore Hole No.	: TBH 02	**Location**	**: CSL**
Test Depth	: 16.50m	Dia of Vane	: 50 mm
Type of Soil	: Clay	Height of Vane	: 100 mm

Depth of Vane Tip			TEST WITH VANE IN UNDISTURBED SOIL	TEST WITH VANE IN REMOULDED SOIL
	Min	Deg		
	0.0	0	0.00	0.00
	0.5	3	0.04	0.03
	1.5	9	0.04	0.04
	2.0	12	0.05	0.06
	2.5	15	0.06	0.10
	3.0	18	0.06	0.10
	3.5	21	0.06	0.12
	4.0	24	0.07	0.14
	4.5	27	0.07	0.14
Time	5.0	30	0.06	0.08
	5.5	33	0.04	0.08
	6.0	36	0.02	0.10
	6.5	39	0.07	0.12
	7.0	42	0.14	0.13
	7.5	45	0.13	0.15
	8.0	48	0.11	0.16
	8.5	51	0.11	0.17
	9.0	54	0.24	0.14
	9.5	57	0.52	0.08
	10.0	60	0.69	0.10
		Torque (kgcm)	22.1	
		Shear Strength (kg/cm2)	0.375	
		Cohesion (kg/cm2)	0.187	

Avg. deflection of Dial Gauge = 0.69/0.002

= 345

From Graph, Torque = 264 kgcm

$$S = \frac{3 * M * 1000}{11\ D\hat{}3}$$

$$= \frac{3*264*1000}{11*50*50*50}$$

= 0.576 Kg/cm2

C = S/2

= 0.0673/2

= 0.288 Kg/cm2

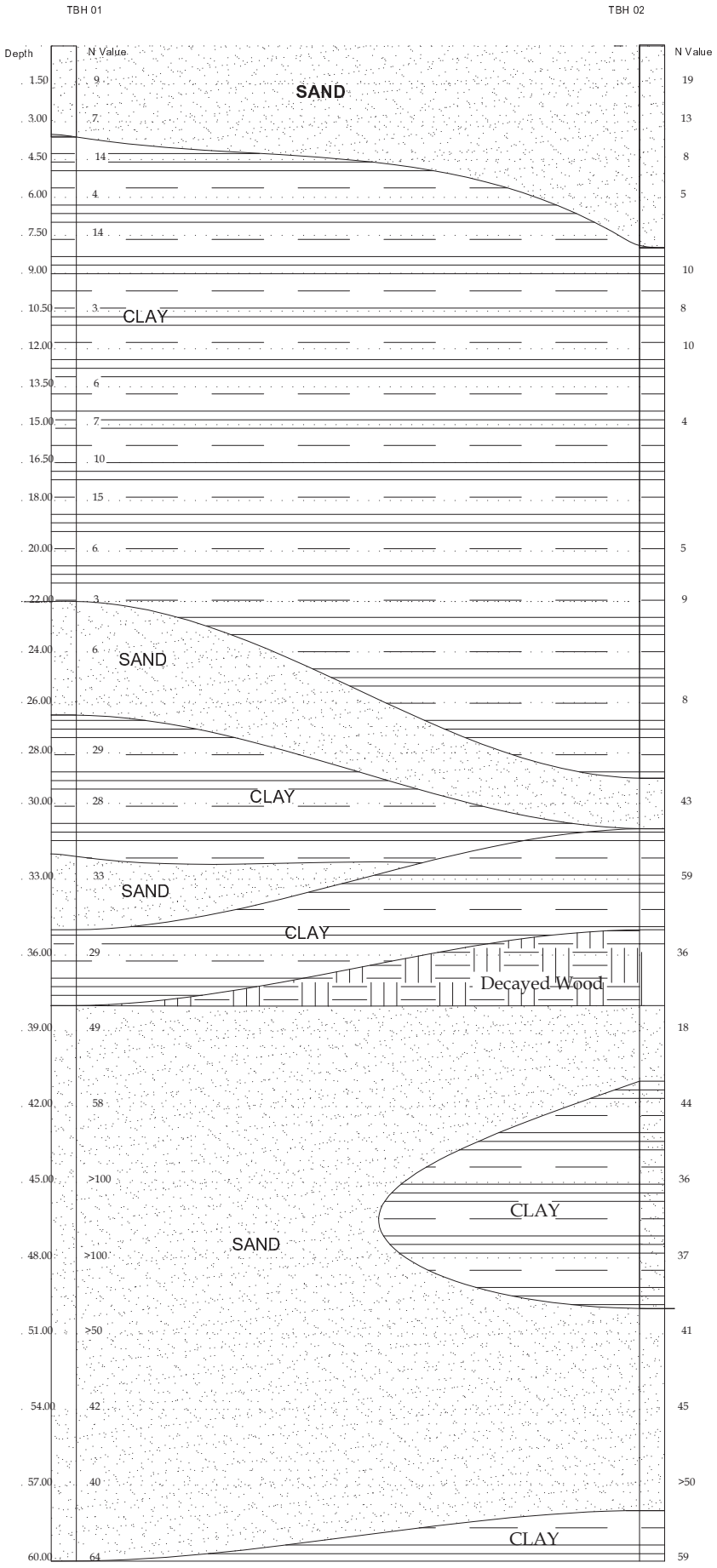
= 28.8 KPa

Notes:

1. The torque applicator shall be provided with speed control, so that the rate of rotation may be maintained at 0.1*/sec
2. For remoulded condition, rotate the vane rapidly through a minimum of 10 revolutions.
3. Allow a minium peroid of five minute after insertion of the vane blade into the soil before turning.

For Client **For Engineers Diagnostic Centre**

CROSS-SECTIONAL PROFILE



Client:

EDC
ENGINEERS DIAGNOSTIC CENTRE

ANNEXURE -2

TBH-03 & TBH-04

INDUSTRIAL WATER TANK

2.1. DESIGN CONSIDERATION FOR FOUNDATION SYSTEM

It is understood from the client that the structure proposed is a ground based industrial water tank of about 1000m^3 capacity. From the borelogs and lab results of the soil samples in areas of TBH 03 and TBH 04, it can be understood that the soils in the shallow depths are predominantly sandy in nature. The SPT N values indicate the soft nature of these soils, which induces immediate settlements due to the load from the structure.

For the proposed Industrial Water Tank in areas of TBH 03 and TBH 04, raft foundation at a depth of 1.00m below the ground level shall be provided in the silty sandy strata. Bearing capacities of raft foundation proposed at 1.00m depth are worked out for shear criteria and settlement criteria as per relevant IS codes. The values are as given in the table below:

Depth of Footing (m)	Width of Footing (m)	Bearing Capacity by Shear (T/m^2)	Bearing Capacity by Settlement (T/m2)
1.00	6.00	7.00	11.00

Note: the lower of the two values is taken as the safe bearing capacity

Typical Calculations of Bearing Capacity of Borehole TBH-03 are given below.

Foundation Shape and Dimensions

Type of Foundation	*Width (B), m*	*Depth (D), m*
Raft	6.00	1.00

Subsurface Strata

Corrected SPT N value	27	
Effective cohesion (c′)	0	
c′ considering local shear failure	0.0	kPa
Effective angle of shearing resistance (ϕ′)	25°	
ϕ′ considering local shear failure	17.3	

Client:

EDC ENGINEERS DIAGNOSTIC CENTRE

Unit weight above founding level	8	kN/m^3
Unit weight below founding level	8	kN/m^3
Depth of ground water table below GL	0.8	m
Water table correction factor (W′)	0.5	

Shape Factors		***Depth Factors#***			***Bearing Capacity Factors***		
			General	***Local***		***General***	***Local***
s_c	1.30	d_c	1.00	1.00	N_c	20.72	12.54
s_γ	0.80	d_γ	1.00	1.00	N_γ	10.88	3.67
s_q	1.20	d_q	1.00	1.00	N_q	10.66	4.90

#When strata above founding level is not as good as strata below, depth factors should be taken as 1.0

Net Ultimate Bearing Capacity

$$q_u = cN_c s_c d_c + \gamma D(N_q - 1)s_q d_q + 0.5\gamma B N_\gamma s_\gamma d_\gamma W'$$

Net ultimate bearing capacity - General Shear ($q_{un(gen)}$) = 197.2 kPa

Net ultimate bearing capacity - Local Shear ($q_{un(loc)}$) = 72.6 kPa

Net ultimate bearing capacity - Intermediate Shear (q_{un}) = 178.5 kPa

Safe Bearing Capacity

Recommended factor of safety = 2.5

Net safe bearing capacity = 71.4 kPa

Recommended net safe bearing capacity = 70.0 kPa

Recommended net safe bearing capacity = 7.0 t/m^2

For heavily loaded structure, bored cast in situ D.M.C. piles with adequate anchorage into very stiff silty clay at a depth of about 30.00m may be provided. Suitable precaution has to be adopted in order to prevent the sides from caving while boring through medium dense sand layer.

Pile Diameter	Axial Capacity (T)	Uplift Capacity (T)
50cm	60	50
60cm	75	60
70cm	90	80
80 cm	105	90

Typical Calculations of Pile Capacity of Borehole TBH-03 are given below.

As per IS-2911, Part 1, Sec II, the ultimate load carrying capacity (Q_u) is given by

$Qu = Re_u + Rf_u$

Where Re_u = Ultimate base resistance

Rf_u = Ultimate shaft resistance

End bearing resistance, Re may be calculated from the following

$Re = Ap (½ D \gamma N\gamma + Pd Nq) + Ap Nc Cp$---- (1)

Where

Ap = Cross Sectional area of pile toe m^2

D = Pile diameter in m

γ = Effective unit weight of soil at pile toe kgf/cm^3

Pd = Effective overburden pressure at pile toe in kgf/cm^2

$N\gamma$ and Nq = Bearing capacity factors based on angle of internal friction at pile toe

Nc = Bearing Capacity factor taken as 9 for clay and

Cp = Average cohesion at pile tip (from unconsolidated undrained test)

And as per IS-2911, Part 1, Sec II, the frictional capacity of pile is given by

$Rf = \Sigma K Pdi \tan\delta As + \alpha C^- As$ ---- (2)

Where, α = reduction factor

C = Average cohesion of pile throughout the embedded length

(From unconsolidated undrained test)

As = Surface Area of pile shaft, m^2

K = Coefficient of earth pressure

Pdi = Effective overburden pressure for the layer kgf/cm^2

δ = Angle of wall friction between pile and soil

The depth of pile is likely to be about 30.00m in the areas of TBH-03. The load capacity of pile will be the summation of the friction developed from the very loose to loose sand/medium dense sand, soft clay/stiff/very stiff sandy clay strata and hard sandy clay strata.

Shear parameters used for deriving the pile capacity of pile in the area of TBH-03 is

Table 1: Shear parameters and frictional capacity of 600mm dia pile in areas of TBH03

z_T (m)	z_B (m)	H (m)	*Description and Classification*	*SPT* N_c	γ (kN/m^3)	ϕ'	c_u (kPa)	*Frictional Capacity*
0	6.5	6.5	Medium Dense SAND (Greyish)	19	18	33	-	14.678
6.5	10	3.5	Very Dense SAND with Silt (Greyish)	52	20	40	-	26.458
10	11.5	1.5	Loose Silty SAND (Greyish)	10	28	28	-	8.353
11.5	30	18.5	Stiff to Very Stiff CLAY (Greyish)	10	17	-	60	111.88

Hence the safe capacity of pile based on soil strength criteria works out to be

Q_{safe} = (Rub + Ruf(1) +Ruf(2) + Ruf(3) + Ruf(4))/ 2.5

= (29.39+14.678+26.458+8.353+111.88)/2.5

= 76.305 Tonnes**, Say 75 Tonnes**

The Uplift capacity of pile based on soil strength criteria works out to be

Q_{safe} = (Ruf(1) +Ruf(2) + Ruf(3) + Ruf(4)) / 3

= (14.678+26.458+8.353+111.88)/3

= 53.790 Tonnes

Self-weight of pile = π /4 x 0.6 x 0.6 x 30x 1.5 = 12.717Tonnes

Uplift capacity of pile = 53.790 + 12.717 = 66.508 Tonnes, **Say 60Tonnes**

Hence the safe uplift capacity of the pile of 600mm dia can be taken as 60Tonnes.

Hence the safe carrying capacity of the pile in the very stiff clayey strata will be governed by the soil strength criteria and the safe capacity of 600mm dia pile can be taken as 75 Tonnes.

2.2. SUMMARY & RECOMMENDATIONS:

For the proposed Industrial Water Tank in areas of TBH 03 and TBH 04, raft foundation at a depth of 1.00m below the ground level shall be provided in the silty sandy strata. Bearing capacities of raft foundation proposed at 1.00m depth are worked out for shear criteria and settlement criteria as per relevant IS codes. The values are as given in the table below:

Depth of Footing (m)	Width of Footing (m)	Safe Bearing Capacity (T/m2)
1.00	6.00 x 6.00	7.00

For heavily loaded structure, bored cast in situ D.M.C. piles with adequate anchorage into very stiff silty clay at a depth of about 30.00m may be provided. Suitable precaution has to be adopted in order to prevent the sides from caving while boring through medium dense sand layer.

Pile Diameter	Axial Capacity (T)	Uplift Capacity (T)
50cm	60	50
60cm	75	60
70cm	90	80
80 cm	105	90

If during piling it is observed that the soil profiles from piling operations are not consistent with the bore logs, it may be immediately reported and designs revised if necessary.

Recommendations are based on the assumption that the soil profile found in the boreholes and samples tested are indicative of the entire plot area. Any deviation in soil profile other than those noted in the boreholes tested, should immediately be referred to the consultant and proper modification should be implemented.

The foundation execution is recommended under strict technical supervision.

For ENGINEERS DIAGNOSTIC CENTRE (P) LTD.,

A. V.S CHAKRAVARTI
M. Tech, M.I.G.S., M.I.C.I
CHIEF ENGINEER

GEOTECHNICAL INVESTIGATION WORK FOR INDUSTRIAL WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 21.07.2023
Bore Hole No	: TBH 03	Boring Completed	:
Type of Boring	: ROTARY DRILLING	Water level	:
Termination Depth	: 60.00 m	Location	: KOCHI

DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
0.00		SP	Medium Dense SAND (Greyish)	6.50	1.50	1.50- 1.95	6	8	16	24	
					3.00	3.00- 3.45	7	13	17	30	
					4.50	4.50- 4.95	4	9	3	12	
					6.00	6.50- 6.95	5	8	2	10	
6.50		SP-SM	Very Dense SAND with Silt (Greyish)	3.50	7.50	7.50- 7.95	26	30	23	53	
					9.00	9.00- 9.45	13	26	26	52	
10.00		SM	Loose Silty SAND (Greyish)	1.50	10.50	10.50- 10.95	3	4	6	10	
11.50		CH	Stiff to Very Stiff CLAY (Greyish)	10.50	12.00	12.00- 12.45	2	3	5	8	
					13.50	13.50- 13.95	3	3	3	6	
					15.00	15.00- 15.45	UDS Collected				
					16.50	16.50- 16.95	2	2	4	6	
					18.00	18.00- 18.45	Vane Shear Test				
					20.00	20.00- 20.45	3	4	6	10	
22.00					22.00	22.00- 22.45	4	6	7	13	

GEOTECHNICAL INVESTIGATION WORK FOR INDUSTRIAL WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 21.07.2023
Bore Hole No	: TBH 03	Boring Completed	:
Type of Boring	: ROTARY DRILLING	Water level	:
Termination Depth	: 60.00 m	Location	: KOCHI

DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
					24.00	24.00-24.45	UDS Collected				
		CH	Stiff to Very Stiff CLAY (Greyish)	10.00	26.00	26.00- 26.45	3	6	8	14	
					28.00	28.00- 28.45	4	4	12	16	
					30.00	30.00- 30.45	UDS Collected				
32.00					33.00	33.00- 33.45	10	10	15	25	
		CH	Very Stiff CLAY (Brownish - Lateritic)	6.00	36.00	36.00- 36.45	12	11	18	29	
38.00					39.00	39.00- 39.45	5	8	9	17	
		CH	Stiff to Very Stiff CLAY (Greyish)	6.00	(Greyish) 42.00	42.00- 42.45	6	6	8	14	
44.00											

GEOTECHNICAL INVESTIGATION WORK FOR INDUSTRIAL WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 21.07.2023
Bore Hole No	: TBH 03	Boring Completed	:
Type of Boring	: ROTARY DRILLING		0.75m
Termination Depth	: 60.00 m	Location	: KOCHI

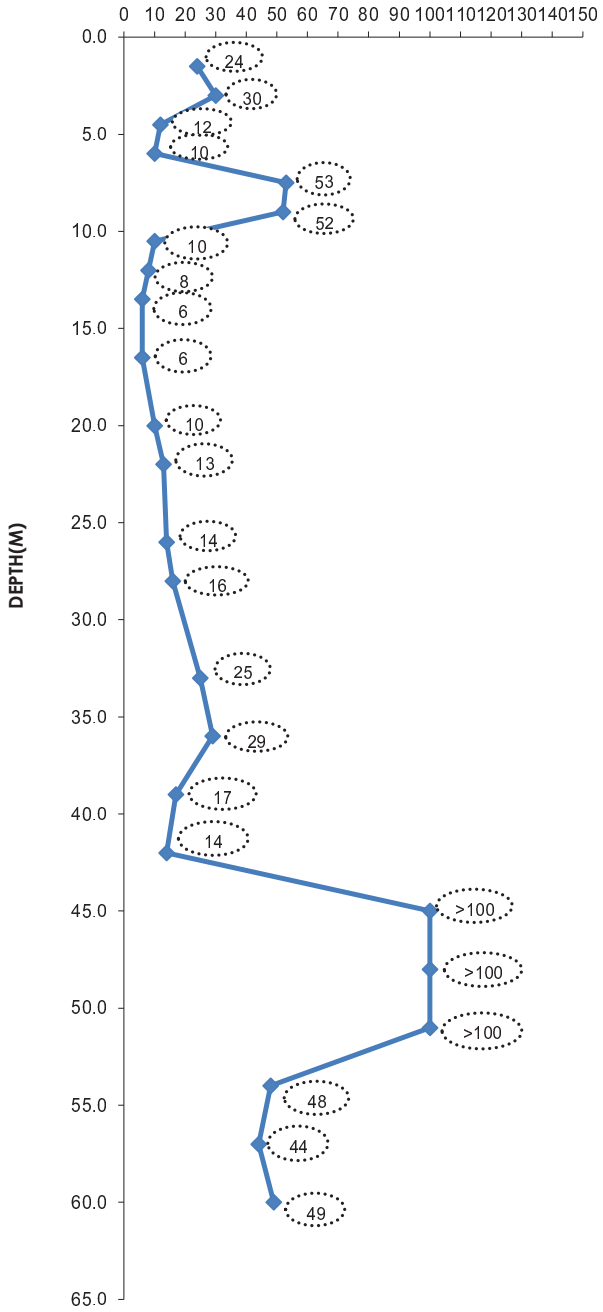
DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
					45.00	45.00- 45.45	15	45	50	>100	Balance= 8 cm
		SM	Very Dense Silty SAND (Greyish)	3.00							
47.00					48.00	48.00- 48.45	50	48	-	> 100	Balance= 16 cm
		SP-SM	Very Dense SAND with Silt (Greyish)	5.00	51.00	51.00- 51.45	48	50	-	> 100	Balance= 20 cm
52.00											
		CH	Hard CLAY with Sand (Greyish)	4.00	54.00	54.00- 54.45	12	22	26	48	
56.00											
		CH	Hard CLAY with Sand (Blackish)	2.00	57.00	57.00- 57.45	8	18	26	44	
58.00											
		CH	Hard CLAY with Sand(Blackish)	2.00	60.00	60.00- 60.45	11	21	28	49	
60.00											

BOREHOLE TERMINATED AT 60.00M

PROJECT : GEOTECHNICAL INVESTIGATION WORK AT COCHIN SHIPYARD

ENGINEERS DIAGNOSTIC CENTRE (P) LTD	Bore Hole No	: TBH 03	Boring Started	: 21.07.2023
	Type of Boring	: Rotary	Boring Completed	: 28.07.2023
	Termination Depth	: 60.00m	Ground water table	: 0.75 m

GRAPHICAL REPRESENTATION OF N VALUE



BORE HOLE TERMINATED AT 60.00 M

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 31.07.2023

ULR No: TC985123000000081F

TC-9851

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / TBH 03 / 1.50	Poorly-graded SAND (Greyish)	SP	0	0	12	85	3		22				2.66
23-24 / TRN-081 / TBH 03 / 7.50	Poorly-graded SANDwith Silt (Greyish)	SP-SM	0	0	8	79	12		26				
23-24 / TRN-081 / TBH 03 / 10.50	Silty SAND (Greyish)	SM	0	1	3	77	19		37				
23-24 / TRN-081 / TBH 03 / 12.00	CLAY of high plasticity (Greyish)	CH	0	0	0	8	44	48	96	128	39	89	2.54
23-24 / TRN-081 / TBH 03 / 16.50	CLAY of high plasticity (Greyish)	CH	0	0	0	1	42	58	74	132	42	90	
23-24 / TRN-081 / TBH 03 / 20.00	CLAY of high plasticity (Greyish)	CH	0	0	0	5	57	38	85	120	35	85	2.55
23-24 / TRN-081 / TBH 03 / 26.00	CLAY of high plasticity (Greyish)	CH	0	0	0	3	60	37	108	139	44	95	
23-24 / TRN-081 / TBH 03 / 33.00	CLAY of high plasticity (Brownish-Lateritic)	CH	0	0	0	2	53	45	51	90	25	65	2.56
23-24 / TRN-081 / TBH 03 / 39.00	CLAY of high plasticity (Greyish)	CH	0	0	4	32	42	22	30	74	20	54	2.57
23-24 / TRN-081 / TBH 03 / 45.00	Silty SAND (Greyish)	SM	0	1	35	37	20	7	20			0	2.63

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 31.07.2023

ULR No: TC985123000000081F

TC-9851

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / TBH 03 / 48.00	Poorly-graded Sand with Silt (Greyish)	SP-SM	0	3	73	12	11		2				2.65
23-24 / TRN-081 / TBH 03 / 54.00	CLAY of high plasticity with Sand (Greyish)	CH	0	1	7	35	39	18	79	105	32	73	2.59
23-24 / TRN-081 / TBH 03 / 57.00	CLAY of high plasticity with Sand (Blackish)	CH	0	0	0	29	46	25	37	70	30	40	2.56
23-24 / TRN-081 / TBH 03 / 60.00	CLAY of high plasticity with Sand (Blackish)	CH	0	0	0	28	49	23	30				

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

SOIL TESTING LABORATORY

TEST REPORT

Determination of Triaxial Compression Test
IS 2720 - Part 11 :1993 (Reaff:2021)

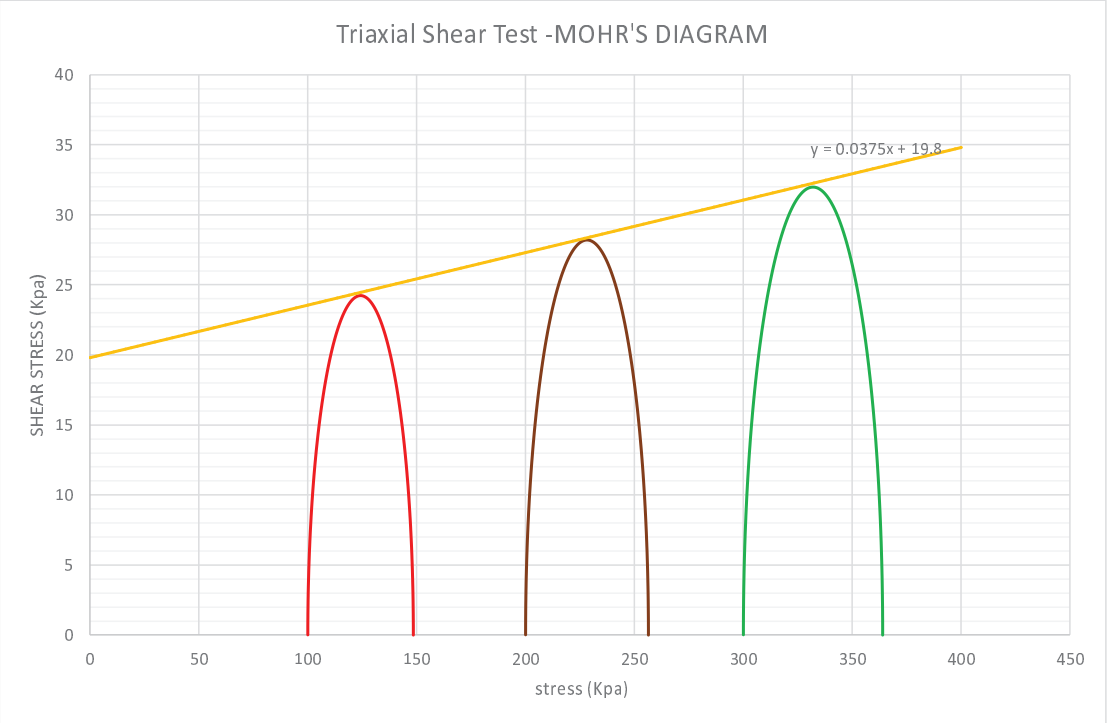
Test Report No	EDC/23-24/TRN-081	

Laboratory Information

Date of Testing	3/8/2023	
Lab Temperature	27	

Sample Details

Sample ID	**TRN 081/TBH 03/ 15.00 mts**	Type of Sample : UNDISTRUBED	
		Type of Test	**UU**
		Rate of strain	1.25 mm/min



			Cohesion ,C	**19.8**	**(kPa)**	
			Friction Angle ,φ	**2.1**	**(deg)**	
Sample No	**Bulk Denity (g/cc)**	**Cell Pressure (Kpa)**	**Compressive Stress at failure (Kpa)**	**Strain at Failure (Kpa)**	**Moisture content**	**Dry Density (g/cc)**
1	2.013	100	48.46	5.70	0.54	1.307
2	2.049	200	56.40	6.58	0.56	1.313
3	2.010	300	63.95	8.75	0.56	1.288

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Direct Shear Test
IS 2720 - Part 13 :1993 (Reaff:2021)

Test Report No EDC/23-24/TRN-81

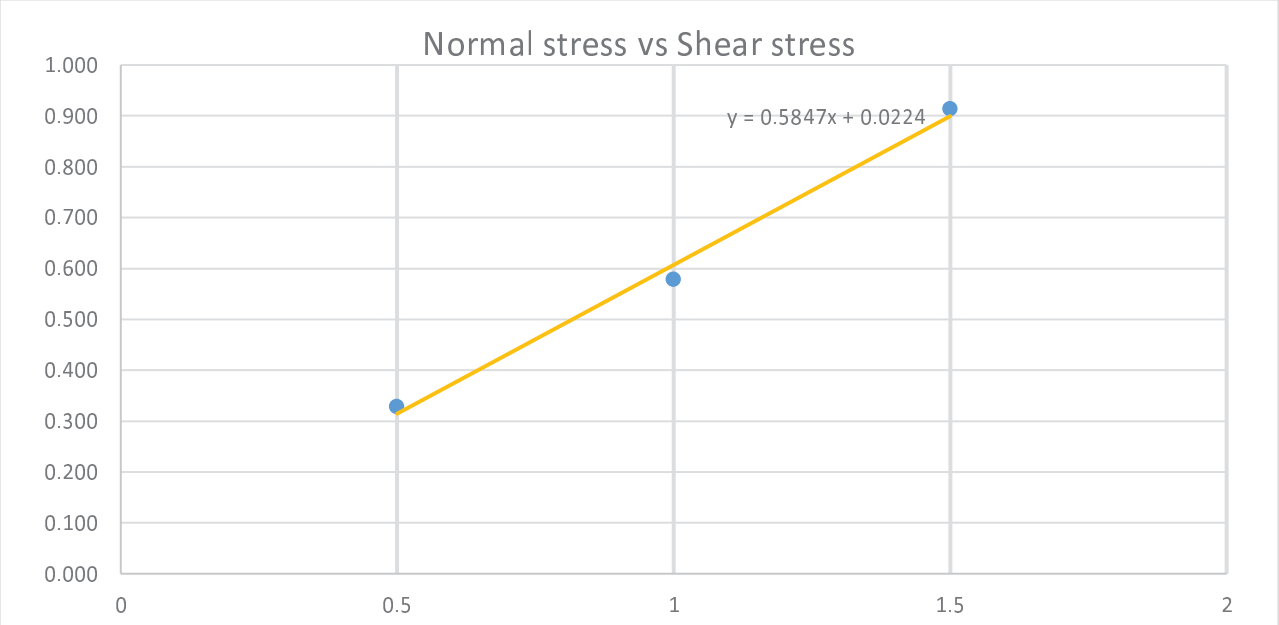
Laboratory Information

Date of Testing	2/8/2023
Lab Temperature	26

Sample Details

Sample id : TRN 81/TBH 03/24.00 mts Sample Type UDS - Remoulded

Length (cm)	6
Height (cm)	2.50
Bulk Density(g/cc)	2.32
Dry Density(g/cc)	1.81



Angle of Internal friction,φ **30.31 (deg)**
Cohesion ,C **2.19 (kPa)**

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Direct Shear Test
IS 2720 - Part 13 :1993 (Reaff:2021)

Test Report No EDC/23-24/TRN-81

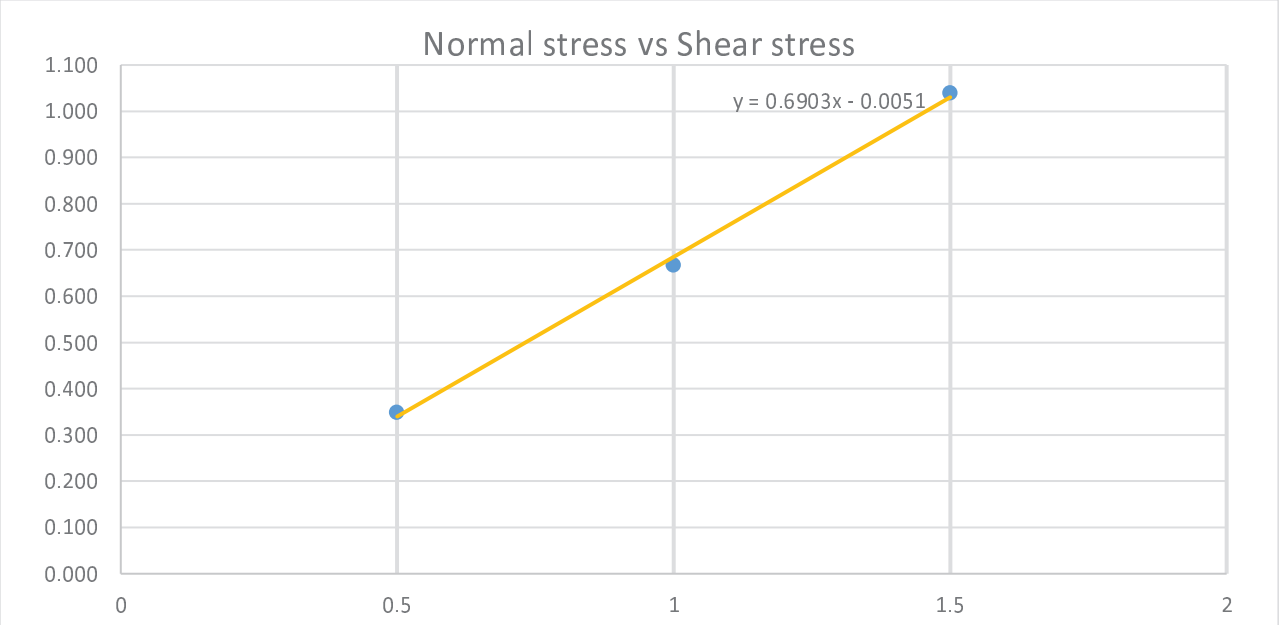
Laboratory Information

Date of Testing	2/8/2023
Lab Temperature	26

Sample Details

Sample id : TRN 81/TBH 03/48.00 mts Sample Type Remoulded

Length (cm)	6
Height (cm)	2.50
Bulk Density(g/cc)	2.27
Dry Density(g/cc)	1.91



Angle of Internal friction,φ **34.62 (deg)**
Cohesion ,C **0.00 (kPa)**

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

IN-SITU VANE SHEAR TEST

Test No.	**: 01**	**Test Date**	**: 25.07.2023**
Bore Hole No.	:TBH 03	**Location**	**: CSL**
Test Depth	: 18.00m	Dia of Vane	: 50 mm
Type of Soil	: Clay	Height of Vane	: 100 mm

Depth of Vane Tip			TEST WITH VANE IN UNDISTURBED SOIL	TEST WITH VANE IN REMOULDED SOIL
	Min	Deg		
	0.0	0	0.00	0.00
	0.5	3	0.11	0.02
	1.5	9	0.13	0.04
	2.0	12	0.12	0.08
	2.5	15	0.10	0.08
	3.0	18	0.10	0.06
	3.5	21	0.05	0.05
	4.0	24	0.05	0.07
	4.5	27	0.07	0.03
Time	5.0	30	0.07	0.05
	5.5	33	0.09	0.07
	6.0	36	0.13	0.10
	6.5	39	0.13	0.11
	7.0	42	0.13	0.06
	7.5	45	0.07	0.07
	8.0	48	0.06	0.03
	8.5	51	0.39	0.08
	9.0	54	0.46	0.08
	9.5	57	0.46	0.09
	10.0	60	0.48	0.09
		Torque (kgcm)	22.1	
		Shear Strength (kg/cm2)	0.375	
		Cohesion (kg/cm2)	0.187	

Avg. deflection of Dial Gauge = .48/0.002

= 240

From Graph, Torque = 161.8 kgcm

$$S = \frac{3 * M * 1000}{11\ D^3}$$

$$= \frac{3*161.8*1000}{11*50*50*50}$$

= 0.353 Kg/cm2

C = S/2

= 0.353/2

= 0.176 Kg/cm2

= 17.65 KPa

GEOTECHNICAL INVESTIGATION WORK FOR INDUSTRIAL WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 15.07.2023
Bore Hole No	: TBH 04	Boring Completed	:
Type of Boring	: ROTARY DRILLING	Water level	:
Termination Depth	: 55.00 m	Location	: KOCHI

DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
0.00		SM	Dense to Very Silty SAND (Greyish)	4.00	1.50	1.50- 1.95	12	14	16	30	
					3.00	3.00- 3.45	30	25	-	> 100	
4.00					4.50	4.50- 4.95	4	4	6	10	
		SM	Loose Silty SAND (Greyish)	6.00	6.00	6.50- 6.95	U D S Collected				
					7.50	7.50- 7.95	-	-	-	> 100	
					9.00	9.00- 9.45	30	-	-	> 100	
10.00					10.50	10.50- 10.95	1	2	3	5	
		CH	Medium Stiff to Stiff CLAY (Greyish)	6.00	12.00	12.00- 12.45	U D S Collected				
					13.50	13.50- 13.95	3	4	5	9	
					15.00	15.00- 15.45	U D S Collected				
16.00					16.50	16.50- 16.95	4	6	8	14	
		CH	Stiff to Very Stiff CLAY with Sand (Greyish)	6.00	18.00	18.00- 18.45	Vane Shear Test				
					20.00	20.00- 20.45	6	8	8	16	
22.00					22.00	22.00- 22.45	U D S Collected				

GEOTECHNICAL INVESTIGATION WORK FOR INDUSTRIAL WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 15.07.2023
Bore Hole No	: TBH 04	Boring Completed	:
Type of Boring	: ROTARY DRILLING	Water level	:
Termination Depth	: 55.00 m	Location	: KOCHI

DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
23.00		CH	Stiff to Very Stiff CLAY with Sand (Greyish)	1.00							
					24.00	24.00-24.45	3	6	8	14	
					26.00	26.00- 26.45	U D S Collected				
		CH	Stiff CLAY (Greyish)	6.00	28.00	28.00- 28.45	3	5	7	12	
29.00					30.00	30.00- 30.45	5	6	8	14	
		CH	Stiff CLAY with Sand (Brownish- Grey)	2.00							
32.00					33.00	33.00- 33.45	5	8	12	20	
		CH	Very Stiff CLAY (Brownish - Lateritic)	4.00	36.00	36.00- 36.45	U D S Collected				
38.00					39.00	39.00- 39.45	6	8	9	17	
40.00		SM	Very Stiff CLAY with Sand (Greyish)	3.00							
					42.00	42.00- 42.45	14	20	23	43	
		CH	Hard CLAY with Sand (Greyish)	4.00							
44.00											

GEOTECHNICAL INVESTIGATION WORK FOR INDUSTRIAL WATER TANK AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 15.07.2023
Bore Hole No	: TBH 04	Boring Completed	: 0.75m
Type of Boring	: ROTARY DRILLING	Location	: KOCHI
Termination Depth	: 55.00 m		

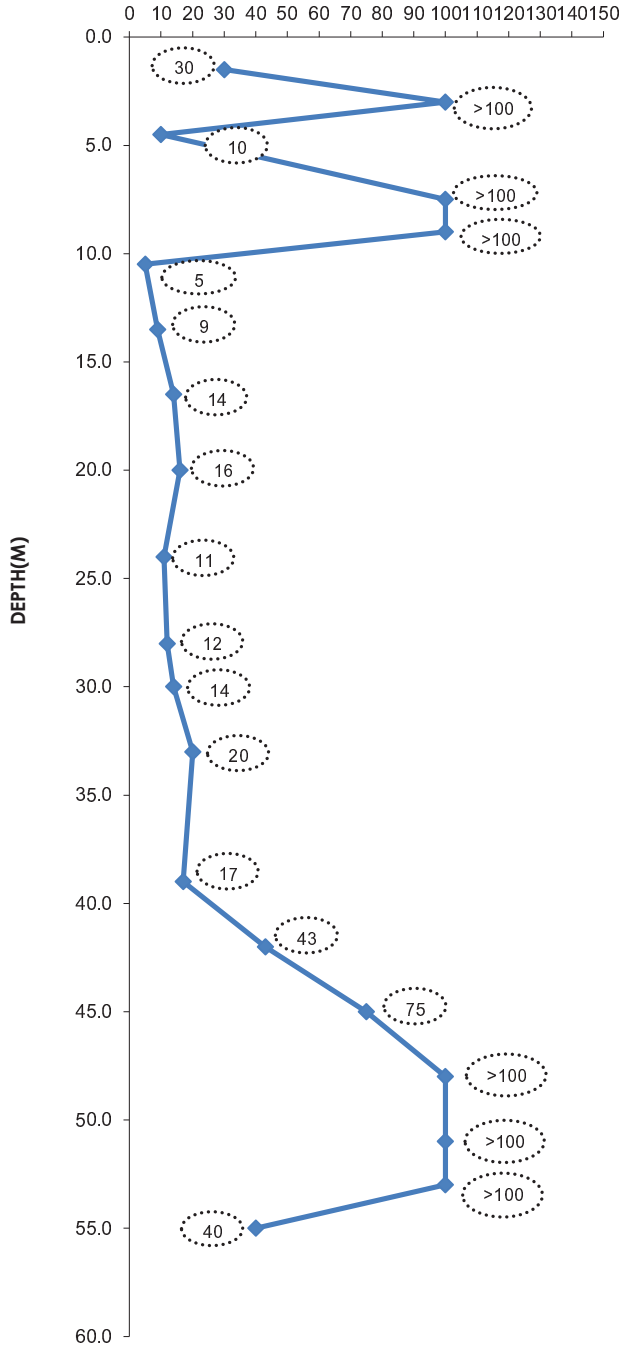
DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
					45.00	45.00- 45.45	20	35	40	75	Balance= 8 cm
		CH	Dense to Very Dense Silty SAND (Greyish)	6.00	48.00	48.00- 48.45	35	48	23	> 100	Balance= 8 cm
52.00					51.00	51.00- 51.45	52	-	-	> 100	Balance= 32 cm
		SM	Very Dense Silty SAND (Greyish)	8.00	53.00	53.00- 53.45	50	50	-	> 100	Balance= 22 cm
54.00											
55.00		SM	Dense Silty SAND (Greyish)	8.00	55.00	55.00- 55.45	12	18	22	40	

BOREHOLE TERMINATED AT 55.00M

PROJECT : GEOTECHNICAL INVESTIGATION WORK AT COCHIN SHIPYARD

ENGINEERS DIAGNOSTIC CENTRE (P) LTD	Bore Hole No	: TBH 04	Boring Started	: 15.07.2023
	Type of Boring	: Rotary	Boring Completed	: 20.07.2023
	Termination Depth	: 55.00m	Ground water table	: 0.74 m

GRAPHICAL REPRESENTATION OF N VALUE



BORE HOLE TERMINATED AT 55.00 M

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TC-9851

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 31.07.2023

ULR No: TC985123000000081F

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / TBH 04 / 1.50	Silty SAND (Brownish)	SM	3	2	31	49	14		16				2.64
23-24 / TRN-081 / TBH 04 / 3.00	Silty SAND (Brownish)	SM	7	3	23	53	14		19				
23-24 / TRN-081 / TBH 04 / 4.50	Silty SAND (Greyish)	SM	0	1	7	64	23	5	37				2.63
23-24 / TRN-081 / TBH 04 / 7.50	Silty SAND (Greyish)	SM	0	0	11	74	14		23				
23-24 / TRN-081 / TBH 04 / 10.50	CLAY of high plasticity (Greyish)	CH	0	0	0	4	57	38	95	125	39	86	2.54
23-24 / TRN-081 / TBH 04 / 16.50	CLAY of high plasticity with Sand (Greyish)	CH	0	0	0	24	58	18	83				2.56
23-24 / TRN-081 / TBH 04 / 24.00	CLAY of high plasticity (Greyish)	CH	0	0	0	8	48	44	79	118	34	84	2.55
23-24 / TRN-081 / TBH 04 / 28.00	CLAY of high plasticity (Greyish)	CH	0	0	0	6	64	30	92				
23-24 / TRN-081 / TBH 04 / 30.00	CLAY of high plasticity with Sand (Brownish Grey)	CH	0	0	0	16	62	22	38	84	29	55	2.55
23-24 / TRN-081 / TBH 04 / 33.00	CLAY of high plasticity (Brownish-Lateritic)	CH	0	0	0	3	60	37	41	90	33	57	2.54

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TC-9851

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 31.07.2023

ULR No: TC985123000000081F

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / TBH 04 / 39.00	CLAY of high plasticity with Sand (Greyish)	CH	0	0	7	23	48	22	29	75	22	53	2.56
23-24 / TRN-081 / TBH 04 / 45.00	Silty SAND (Greyish)	SM	0	1	70	16	13		17				2.64
23-24 / TRN-081 / TBH 04 / 51.00	Silty SAND (Greyish)	SM	0	21	46	17	16		37				
23-24 / TRN-081 / TBH 04 / 53.00	Poorly-graded SAND (Greyish)	SM	2	18	55	15	10		14				
23-24 / TRN-081 / TBH 04 / 55.00	Silty SAND (Greyish)	SM	0	0	29	32	22	16	29				2.61

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Triaxial Compression Test
IS 2720 - Part 11 :1993 (Reaff:2021)

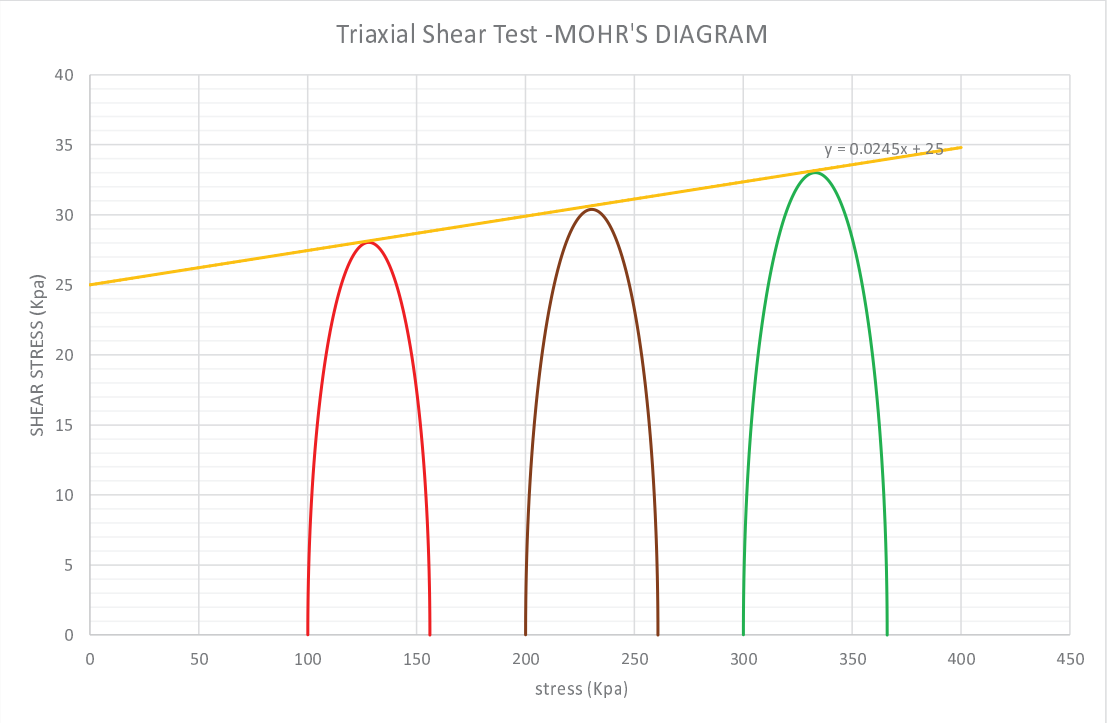
Test Report No	EDC/23-24/TRN-081	

Laboratory Information

Date of Testing	6/8/2023	
Lab Temperature	27	

Sample Details

Sample ID	**TRN 081/TBH 04/ 26.00 mts**	Type of Sample : UNDISTRUBED	
		Type of Test	**UU**
		Rate of strain	1.25 mm/min



			Cohesion ,C	**25**	**(kPa)**	
			Friction Angle ,φ	**1.4**	**(deg)**	
Sample No	**Bulk Denity (g/cc)**	**Cell Pressure (Kpa)**	**Compressive Stress at failure (Kpa)**	**Strain at Failure (Kpa)**	**Moisture content**	**Dry Density (g/cc)**
1	2.042	100	56.06	5.84	0.48	1.380
2	2.049	200	60.77	6.58	0.52	1.348
3	2.035	300	66.02	8.86	0.53	1.330

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Direct Shear Test
IS 2720 - Part 13 :1993 (Reaff:2021)

Test Report No EDC/23-24/TRN-81

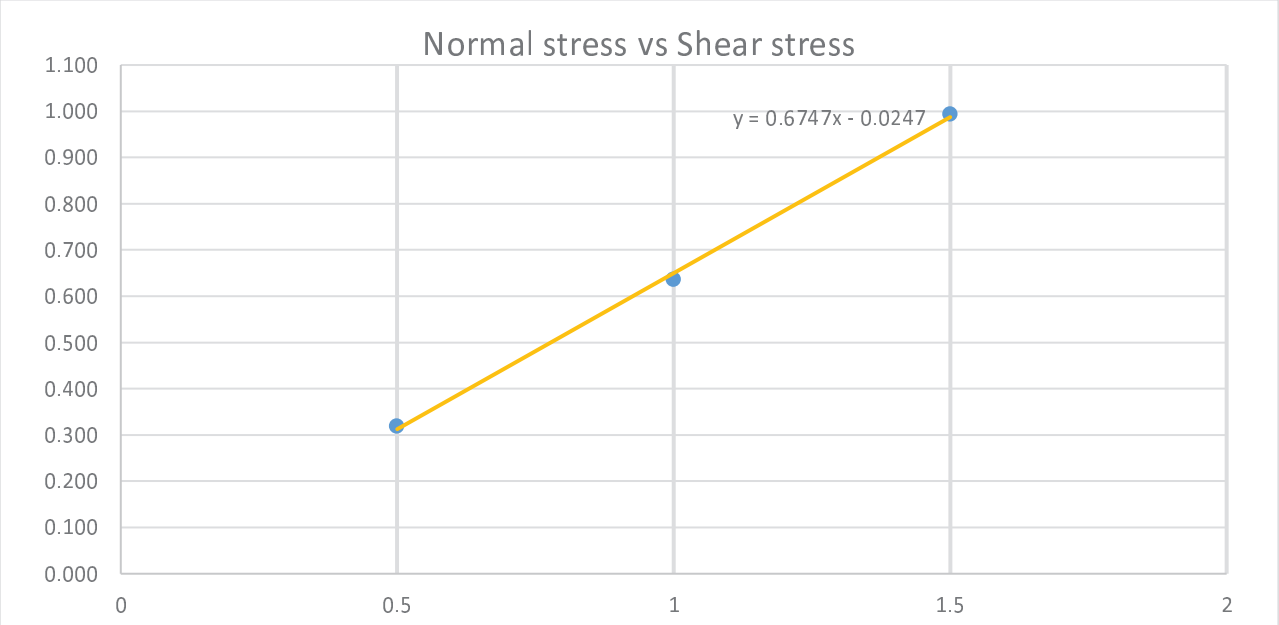
Laboratory Information

Date of Testing	3/8/2023
Lab Temperature	26

Sample Details

Sample id : TRN 81/TBH 04/48.00 mts Sample Type Remoulded

Length (cm)	6
Height (cm)	2.50
Bulk Density(g/cc)	2.23
Dry Density(g/cc)	1.74



Angle of Internal friction,φ **34.01 (deg)**
Cohesion ,C **0.00 (kPa)**

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

IN-SITU VANE SHEAR TEST

Test No.	**: 01**	**Test Date**	**: 17.07.2023**
Bore Hole No.	: TBH 04	**Location**	**: CSL**
Test Depth	: 18.00m	Dia of Vane	: 50 mm
Type of Soil	: Clay	Height of Vane	: 100 mm

	Depth of Vane Tip		TEST WITH VANE IN UNDISTURBED SOIL	TEST WITH VANE IN REMOULDED SOIL
	Min	Deg		
	0.0	0	0.00	0.00
	0.5	3	0.11	0.05
	1.5	9	0.23	0.04
	2.0	12	0.28	0.04
	2.5	15	0.38	0.04
	3.0	18	0.39	0.04
	3.5	21	0.43	0.04
	4.0	24	0.51	0.06
	4.5	27	0.55	0.06
Time	5.0	30	0.64	0.07
	5.5	33	0.86	0.08
	6.0	36	0.9	0.08
	6.5	39	0.9	0.08
	7.0	42	1.11	0.09
	7.5	45	1.1	0.10
	8.0	48	1.12	0.16
	8.5	51	1.09	0.12
	9.0	54	1.15	0.20
	9.5	57	1.18	0.23
	10.0	60	1.23	0.22
		Torque (kgcm)	22.1	
		Shear Strength (kg/cm2)	0.375	
		Cohesion (kg/cm2)	0.187	

Avg. deflection of Dial Gauge = 1.23/0.002

= 615

From Graph, Torque = 527.55 kgcm

$$S = \frac{3 * M * 1000}{11\ D\hat{}3}$$

$$= \frac{3*527.55*1000}{11*50*50*50}$$

= 1.151Kg/cm2

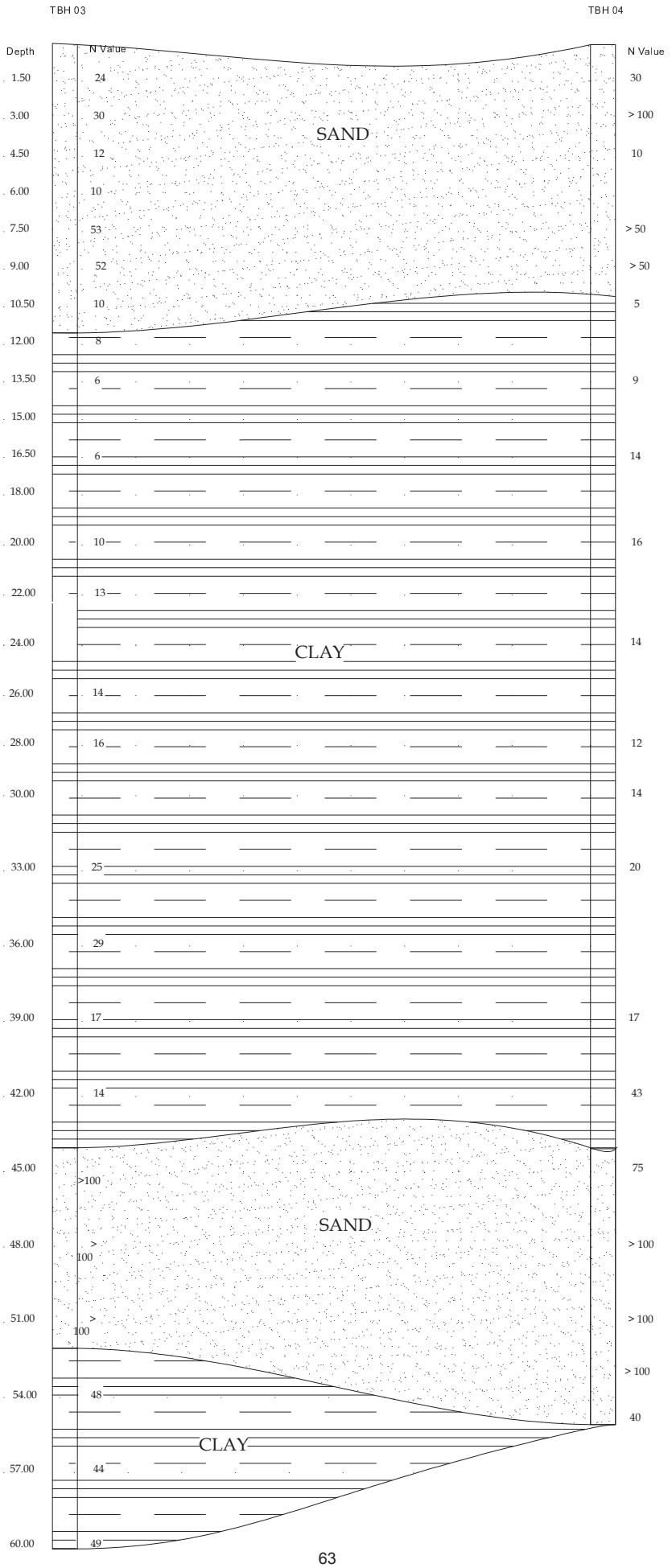
C = S/2

= 1.151/2

= 0.575 Kg/cm2

= 57.55 KPa

CROSS-SECTIONAL PROFILE



Client:

ANNEXURE -3

SBH-01

COMPRESSOR CLUSTER 2

3.1. DESIGN CONSIDERATION FOR FOUNDATION SYSTEM

From the borelogs and lab results of the soil samples in areas of SBH 01, it can be understood that the soils in the shallow depths are predominantly clayey in nature.

For the proposed Compressor clusters-2 in the areas of SBH 01, raft foundation at a depth of 1.00m below the ground level shall be provided in the silty sandy strata. Bearing capacities of raft foundation proposed at 1.00m depth are worked out for shear criteria and settlement criteria as per relevant IS codes. The values are as given in the table below:

Depth of Footing (m)	Width of Footing (m)	Bearing Capacity by Shear (T/m^2)	Bearing Capacity by Settlement (T/m2)
1.00	6.00	8.00	5.00

Note: the lower of the two values is taken as the safe bearing capacity

Foundation Shape and Dimensions

Type of Foundation	*Width (B), m*	*Depth (D), m*
Raft	6.00	1.00

Subsurface Strata

Corrected SPT N value	30	
Effective cohesion (c′)	0	
c′ considering local shear failure	0.0	kPa
Effective angle of shearing resistance (ϕ′)	26	
ϕ′ considering local shear failure	18.0	
Unit weight above founding level	8	kN/m^3
Unit weight below founding level	8	kN/m^3
Depth of ground water table below GL	0.8	m
Water table correction factor (W′)	0.5	

Shape Factors		Depth Factors#			Bearing Capacity Factors		
			General	Local		General	Local
s_c	1.30	d_c	1.00	1.00	N_c	22.25	13.11
s_γ	0.80	d_γ	1.00	1.00	N_γ	12.54	4.07
s_q	1.20	d_q	1.00	1.00	N_q	11.85	5.26

#When strata above founding level is not as good as strata below, depth factors should be taken as 1.0

Net Ultimate Bearing Capacity

$$q_u = cN_c s_c d_c + \gamma D(N_q - 1)s_q d_q + 0.5\gamma B N_\gamma s_\gamma d_\gamma W'$$

Net ultimate bearing capacity - General Shear ($q_{un(gen)}$) = 224.6 kPa

Net ultimate bearing capacity - Local Shear ($q_{un(loc)}$) = 80.0 kPa

Net ultimate bearing capacity - Intermediate Shear (q_{un}) = 224.6 kPa

Safe Bearing Capacity

Recommended factor of safety = 2.5

Net safe bearing capacity = 89.8 kPa

Recommended net safe bearing capacity = 8.00 t/m^2

For heavily loaded structure, under reamed piles with adequate anchorage into medium stiff clayey strata at a depth of about 15.00m may be provided. Suitable precaution has to be adopted in order to prevent the sides from caving while boring through medium dense sand layer.

Under-reamed Pile Diameter	Axial Capacity (T)
40cm	15
50cm	20

Typical Calculations of Pile Capacity of Borehole SBH-01 are given below.

As per IS-2911, Part 3, the ultimate load carrying capacity (Q_u) is given by

Qu = Ap.Nc.Cp + Aa.Nc.C'a + C'a.A's + α.Ca.As

Where

Qu = ultimate load capacity of pile, in kN

Ap = cross-sectional area of pile tip, in m^2

Nc = bearing capacity factor, may be taken as 9

Cp = average cohesion at pile tip, in kN/m^2

Aa = π/4 (Du^2 – D^2) where Du and D are the under-reamed and shaft diameter, in m, respectively

C'a = average cohesion of soil around the under-reamed bulbs, in kN/m^2

α = adhesion factor layer depending on the consistency of soil =1

Ca = average cohesion of the soil along the pile shaft, in kN/m^2

As = surface area of the shaft (to be taken above under-reamed bulb), in m^2

A's = surface area of the cylinder circumscribing the under-reamed bulbs, in m^2.

Qu = Ap.Nc.Cp + Aa.Nc.C'a + α.Ca.As

= (0.196*9*65) + (1.030*9*20) + (1*19*21.9)

= 716.16 kN =71.6 T

$\mathbf{Q_{safe}}$ = 71.6/3 = 23.86 T ~ 20 T

Hence the safe carrying capacity of the under-reamed pile in the strata will be governed by the soil strength criteria and the safe capacity of 500mm dia under-reamed pile can be taken as 20 Tonnes.

3.2. SUMMARY & RECOMMENDATIONS:

For the proposed Compressor clusters-2 in the areas of SBH 01, raft foundation at a depth of 1.00m below the ground level shall be provided in the silty sandy strata. Bearing capacities of raft foundation proposed at 1.00m depth are worked out for shear

criteria and settlement criteria as per relevant IS codes. The values are as given in the table below:

Depth of Footing (m)	Width of Footing (m)	Safe Bearing Capacity (T/m2)
1.00	6.00 x 6.00	5.00

For heavily loaded structure, under reamed piles with adequate anchorage into medium stiff clayey strata at a depth of about 15.00m may be provided. Suitable precaution has to be adopted in order to prevent the sides from caving while boring through sand layer.

Under-reamed Pile Diameter	Axial Capacity (T)
40cm	15
50cm	20

If during piling it is observed that the soil profiles from piling operations are not consistent with the bore logs, it may be immediately reported and designs revised if necessary.

Recommendations are based on the assumption that the soil profile found in the boreholes and samples tested are indicative of the entire plot area. Any deviation in soil profile other than those noted in the boreholes tested, should immediately be referred to the consultant and proper modification should be implemented.

The foundation execution is recommended under strict technical supervision.

For ENGINEERS DIAGNOSTIC CENTRE (P) LTD.,

A. V.S CHAKRAVARTI
M. Tech, M.I.G.S., M.I.C.I
CHIEF ENGINEER

GEOTECHNICAL INVESTIGATION WORK FOR COMPRESSOR CLUSTER AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 19.07.2023
Bore Hole No	: SBH 01	Boring Completed	: 21.07.2023
Type of Boring	: ROTARY DRILLING	Water level	: 0.70 m
Termination Depth	: 10.00 m	Location	: KOCHI

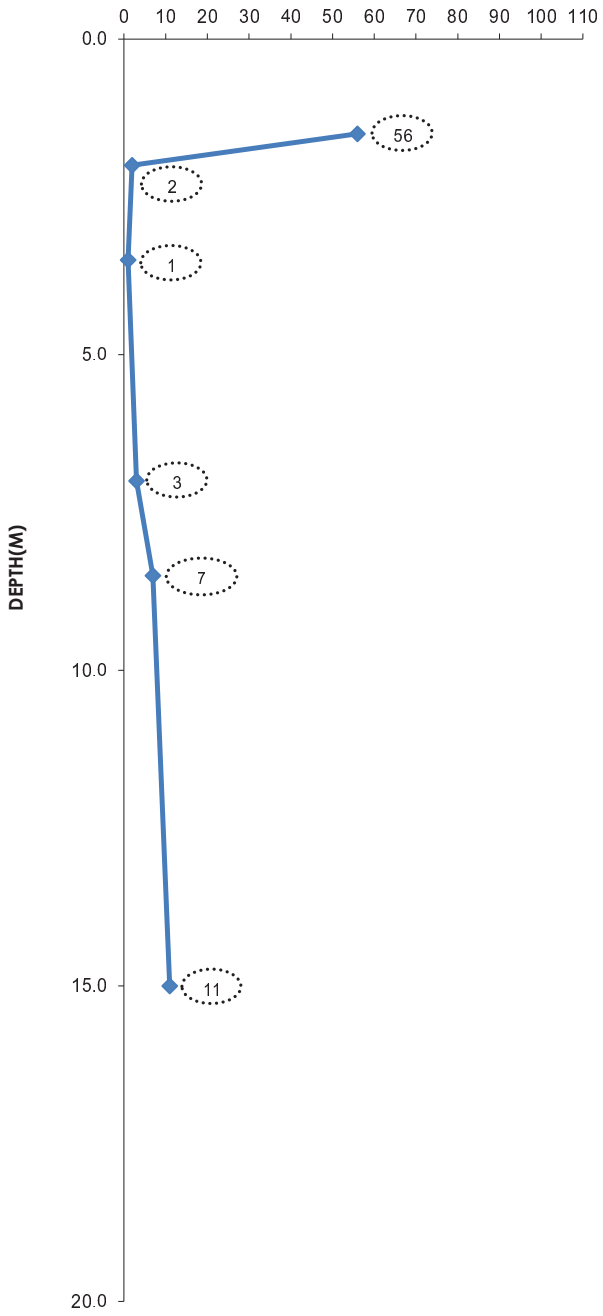
DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
0.00		GP	GRAVEL (Greyish)	2.00	1.50	1.50- 1.95	12	22	34	56	
2.00		CH	Very Soft CLAY with Sand (Greyish)	1.50	3.00	3.00- 3.45	1	1	1	2	
3.50		CH	Very Soft CLAY (Greyish)	3.50	4.50	4.50- 4.95	1	0	1	1	
					6.00	6.50- 6.95	UDS Collected				
7.00		CH	Soft CLAY with Sand (Greyish)	1.50	7.50	7.50- 7.95	1	1	2	3	
8.50		CH	Medium Stiff to Stiff CLAY(Greyish)	6.50	9.00	9.00- 9.45	2	3	4	7	
					10.50	10.50- 10.95	UDS Collected				
					12.00	12.00- 12.45	Vane Shear Test				
					13.50	13.50- 13.95	UDS Collected				
15.00					15.00	15.00- 15.45	3	4	7	11	

BOREHOLE TERMINATED AT 15.00M

PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR WATER TANK AT COCHIN SHIPYARD

	ENGINEERS DIAGNOSTIC CENTRE (P) LTD	Bore Hole No	: SBH 01	Boring Started	: 19.07.2023
		Type of Boring	: Rotary	Boring Completed	: 21.07.2023
		Termination Depth	: 15.00 m	Ground water table	: 0.70 m

GRAPHICAL REPRESENTATION OF N VALUE



BORE HOLE TERMINATED AT 15.00 M

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 31.07.2023

ULR No: TC985123000000081F

TC-9851

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / SBH 01 / 1.50	GRAVEL (Greyish)		71	8	7	9	6		17				
23-24 / TRN-081 / SBH 01 / 3.00	CLAY of high plasticity with Sand (Greyish)	CH	0	0	6	28	47	19	65	82	27	55	2.57
23-24 / TRN-081 / SBH 01 / 4.50	CLAY of high plasticity (Greyish)	CH	0	0	0	3	52	44	90	128	39	89	2.54
23-24 / TRN-081 / SBH 01 / 7.50	CLAY of high plasticity with Sand (Greyish)	CH	2	1	14	29	34	21	77	90	30	60	2.59
23-24 / TRN-081 / SBH 01 / 9.00	CLAY of high plasticity (Greyish)	CH	0	0	0	4	46	50	104	139	43	96	2.54
23-24 / TRN-081 / SBH 01 / 15.00	CLAY of high plasticity (Greyish)	CH	0	0	0	2	57	41	106				

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

SOIL TESTING LABORATORY

TEST REPORT

Determination of Triaxial Compression Test
IS 2720 - Part 11 :1993 (Reaff:2021)

Test Report No	EDC/23-24/TRN-081	

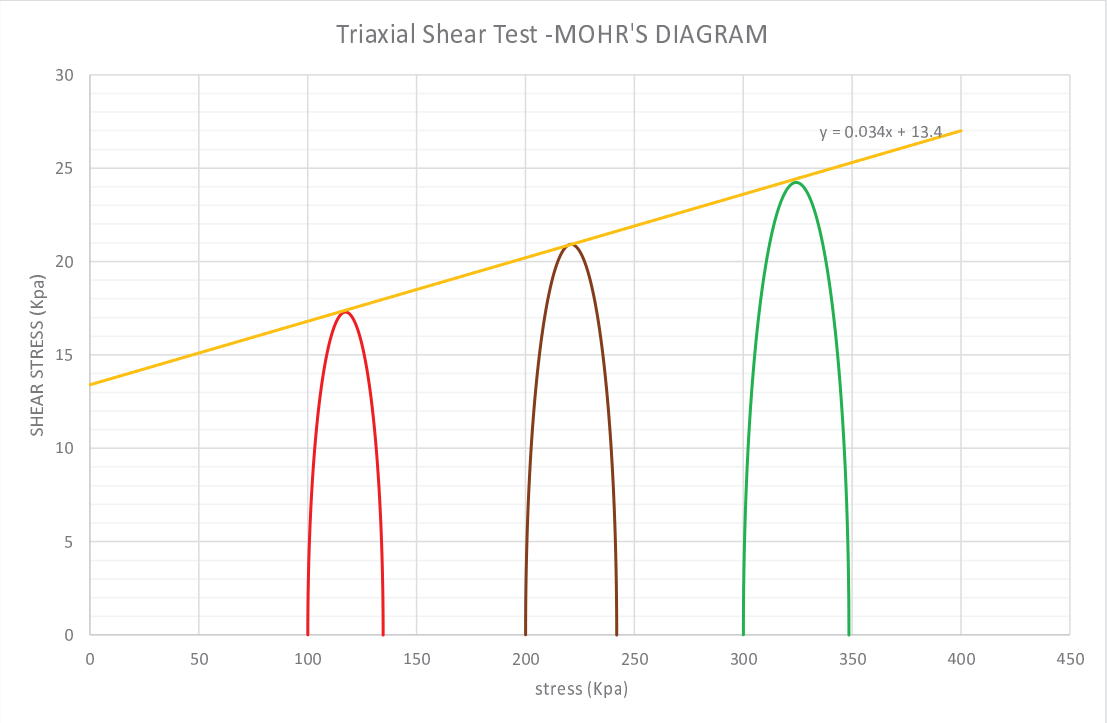
Laboratory Information

Date of Testing	7/8/2023	
Lab Temperature	27	

Sample Details

Sample ID	**TRN 081/SBH 01/ 10.50 mts**	Type of Sample : UNDISTRUBED

Type of Test	**UU**
Rate of strain	1.25 mm/min



			Cohesion ,C	**13.4**	**(kPa)**	
			Friction Angle ,φ	**1.9**	**(deg)**	
Sample No	**Bulk Denity (g/cc)**	**Cell Pressure (Kpa)**	**Compressive Stress at failure (Kpa)**	**Strain at Failure (Kpa)**	**Moisture content**	**Dry Density (g/cc)**
1	2.050	100	34.59	5.77	0.48	1.385
2	2.045	200	41.84	6.49	0.45	1.410
3	2.035	300	48.46	8.86	0.46	1.394

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

IN-SITU VANE SHEAR TEST

Test No.	**: 01**	**Test Date**	**: 21.07.2023**
Bore Hole No.	: SBH 01	**Location**	**: CSL**
Test Depth	: 12.00m	Dia of Vane (mm):	50
Type of Soil	: Clay	Height of Vane	: 100 mm

Depth of Vane Tip			TEST WITH VANE IN UNDISTURBED SOIL	TEST WITH VANE IN REMOULDED SOIL
	Min	Deg		
	0.0	0	0.00	0.00
	0.5	3	0.04	0.19
	1.5	9	0.05	0.05
	2.0	12	0.05	0.11
	2.5	15	0.03	0.10
	3.0	18	0.01	0.25
	3.5	21	0.00	0.33
	4.0	24	0.05	0.45
	4.5	27	0.09	0.52
Time	5.0	30	0.17	0.56
	5.5	33	0.21	0.56
	6.0	36	0.27	0.59
	6.5	39	0.3	0.67
	7.0	42	0.32	0.67
	7.5	45	0.34	0.72
	8.0	48	0.39	0.76
	8.5	51	0.44	0.79
	9.0	54	0.48	0.82
	9.5	57	0.5	0.86
	10.0	60	0.52	0.88
		Torque (kgcm)	22.1	
		Shear Strength (kg/cm2)	0.375	
		Cohesion (kg/cm2)	0.187	

Avg. deflection of Dial Gauge = 0.52/0.002

= 260

From Graph, Torque(kgcm) = 181

$$S = \frac{3 * 181 * 1000}{11\ D^3}$$

$$= \frac{3*181*1000}{11*50*50*50}$$

= 0.394 Kg/cm2

C = S/2

= 0.394/2

= 0.197 Kg/cm2

= 19.7 KPa

Client:

ANNEXURE -4

SBH-02

COMPRESSOR CLUSTER 1

4.1. DESIGN CONSIDERATION FOR FOUNDATION SYSTEM

From the borelogs and lab results of the soil samples in areas of SBH 02, it can be understood that the soils in the shallow depths are predominantly sand in nature.

For the proposed Compressor clusters-1 in the areas of SBH 02, raft foundation at a depth of 1.00m below the ground level shall be provided in the silty sandy strata. Bearing capacities of raft foundation proposed at 1.00m depth are worked out for shear criteria and settlement criteria as per relevant IS codes. The values are as given in the table below:

Depth of Footing (m)	Width of Footing (m)	Bearing Capacity by Shear (T/m^2)	Bearing Capacity by Settlement (T/m2)
1.00	6.00	3.00	3.50

Note: the lower of the two values is taken as the safe bearing capacity

Foundation Shape and Dimensions

Type of Foundation	*Width (B), m*	*Depth (D), m*
Raft	6.00	1.00

Subsurface Strata

Corrected SPT N value	12	
Effective cohesion (c′)	0	
c′ considering local shear failure	0.0	kPa
Effective angle of shearing resistance (ϕ′)	24°	
ϕ′ considering local shear failure	16.5	
Unit weight above founding level	8	kN/m^3
Unit weight below founding level	8	kN/m^3
Depth of ground water table below GL	0.0	m
Water table correction factor (W′)	0.5	

Shape Factors	***Depth Factors#***			***Bearing Capacity Factors***		
		General	***Local***		***General***	***Local***

s_c	1.30	d_c	1.05	1.04	N_c	19.32	12.00
s_γ	0.80	d_γ	1.03	1.02	N_γ	9.44	3.30
s_q	1.20	d_q	1.03	1.02	N_q	9.60	4.56

#When strata above founding level is not as good as strata below, depth factors should be taken as 1.0

Net Ultimate Bearing Capacity

$$q_u = cN_c s_c d_c + \gamma D(N_q - 1)s_q d_q + 0.5\gamma B N_\gamma s_\gamma d_\gamma W'$$

Net ultimate bearing capacity - General Shear ($q_{un(gen)}$) =	177.7	kPa
Net ultimate bearing capacity - Local Shear ($q_{un(loc)}$) =	67.4	kPa
Net ultimate bearing capacity - Intermediate Shear (q_{un}) =	78.4	kPa

Safe Bearing Capacity

Recommended factor of safety =	2.5	
Net safe bearing capacity =	31.4	kPa
Recommended net safe bearing capacity =	3.00	t/m^2

For heavily loaded structure, under reamed piles with adequate anchorage into strata at a depth of about 10.00m may be provided. Suitable precaution has to be adopted in order to prevent the sides from caving while boring through medium dense sand layer.

Under-reamed Pile Diameter	Axial Capacity (T)
40cm	4
50cm	6

Typical Calculations of Pile Capacity of Borehole SBH-02 are given below.

As per IS-2911, Part 3, the ultimate load carrying capacity (Q_u) is given by

Qu = Ap.Nc.Cp + Aa.Nc.C'a + C'a.A's + α.Ca.As

Where

Qu = ultimate load capacity of pile, in kN

Ap = cross-sectional area of pile tip, in m^2

Nc = bearing capacity factor, may be taken as 9

Cp = average cohesion at pile tip, in kN/m^2

Aa = π/4 (Du2 – D2) where Du and D are the under-reamed and shaft diameter, in m, respectively

C'a = average cohesion of soil around the under-reamed bulbs, in kN/m2

α = adhesion factor layer depending on the consistency of soil =1

Ca = average cohesion of the soil along the pile shaft, in kN/m^2

As = surface area of the shaft (to be taken above under-reamed bulb), in m^2

A's = surface area of the cylinder circumscribing the under-reamed bulbs, in m^2.

Qu = Ap.Nc.Cp + Aa.Nc.C'a

= (0.196*9*18) + (1.030*9*18)

= 198.612 kN =19.86 T

$\mathbf{Q_{safe}}$ = 19.86/3 = 6.6 T ~ 6T

Hence the safe carrying capacity of the under-reamed pile in the strata will be governed by the soil strength criteria and the safe capacity of 500mm dia under-reamed pile can be taken as 6 Tonnes.

4.2. SUMMARY & RECOMMENDATIONS:

For the proposed Compressor clusters-1 in the areas of SBH 02, raft foundation at a depth of 1.00m below the ground level shall be provided in the silty sandy strata. Bearing capacities of raft foundation proposed at 1.00m depth are worked out for shear criteria and settlement criteria as per relevant IS codes. The values are as given in the table below:

Depth of Footing (m)	Width of Footing (m)	Safe Bearing Capacity (T/m2)
1.00	6.00 x 6.00	3.00

For heavily loaded structure, under reamed piles with adequate anchorage into strata at a depth of about 10.00m may be provided. Suitable precaution has to be adopted in order to prevent the sides from caving while boring through medium dense sand layer.

Under-reamed Pile Diameter	Axial Capacity (T)
40cm	4
50cm	6

If during piling it is observed that the soil profiles from piling operations are not consistent with the bore logs, it may be immediately reported and designs revised if necessary.

Recommendations are based on the assumption that the soil profile found in the boreholes and samples tested are indicative of the entire plot area. Any deviation in soil profile other than those noted in the boreholes tested, should immediately be referred to the consultant and proper modification should be implemented.

The foundation execution is recommended under strict technical supervision.

For ENGINEERS DIAGNOSTIC CENTRE (P) LTD.,

A. V.S CHAKRAVARTI
M. Tech, M.I.G.S., M.I.C.I
CHIEF ENGINEER

GEOTECHNICAL INVESTIGATION WORK FOR COMPRESSOR CLUSTER AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 07.07.2023
Bore Hole No	: SBH 02	Boring Completed	: 08.07.2023
Type of Boring	: ROTARY DRILLING	Water level	: 0.74m
Termination Depth	: 10.00 m	Location	: KOCHI

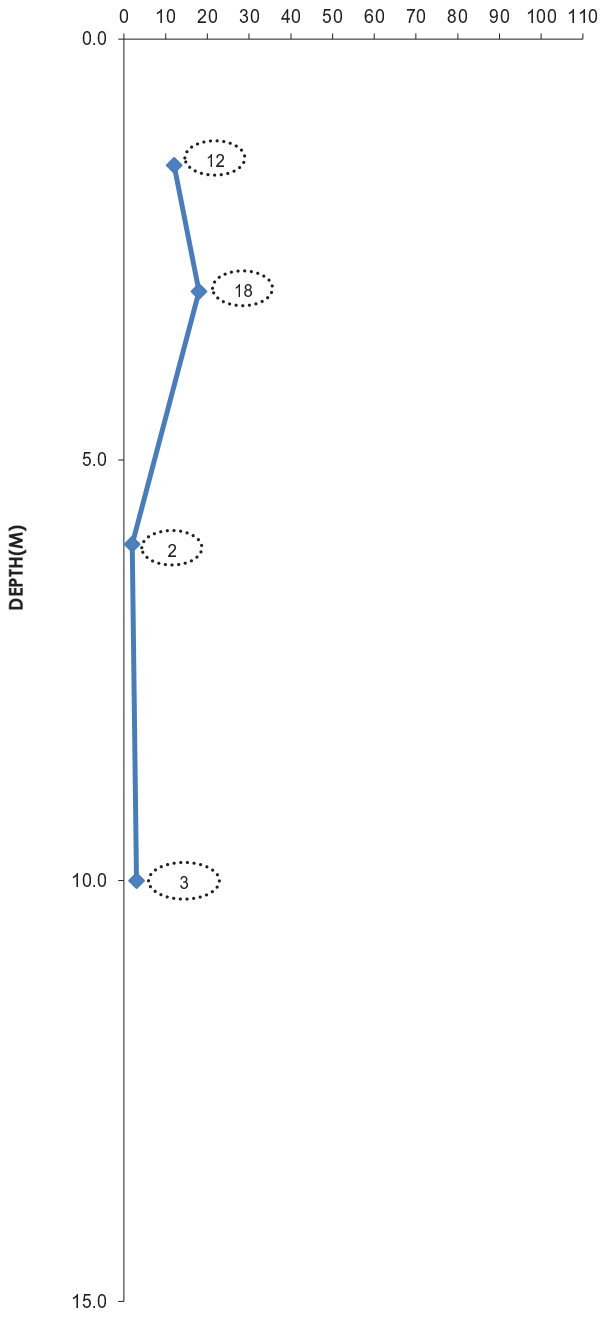
DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm 15cm	15cm	15cm	SPT " N "	Remarks
0.00		SP	Medium Dense SAND (Greyish)	5.00	1.50	1.50- 1.95	4	5	7	12	
					3.00	3.00- 3.45	8	8	10	18	
					4.50	4.50- 4.95	UDS Collected				
5.00					6.00	6.50- 6.95	1	1	1	2	
		CH	Very Soft Silty CLAY (Greyish)	5.00	7.50	7.50- 7.95	UDS Collected				
					9.00	9.00- 9.45	Vane Shear Test				
10.00					10.00	10.00- 10.45	1	1	2	3	

BOREHOLE TERMINATED AT 10.00M

PROJECT : GEOTECHNICAL INVESTIGATION WORK FOR WATER TANK AT COCHIN SHIPYARD

	ENGINEERS DIAGNOSTIC CENTRE (P) LTD	Bore Hole No	: SBH 02	Boring Started	: 07.07.2023
		Type of Boring	: Rotary	Boring Completed	: 08.07.2023
		Termination Depth	: 10.00 m	Ground water table	: 0.75 m

GRAPHICAL REPRESENTATION OF N VALUE



BORE HOLE TERMINATED AT 10.00 M

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TC-9851

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 15.07.2023

ULR No: TC985123000000081F

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / SBH 02 / 1.50	Poorly-graded SAND (Greyish)	SP	10	0	41	44	5		20				2.66
23-24 / TRN-081 / SBH 02 / 6.00	Silty CLAY of high plasticity (Greyish)	CH	0	0	6	24	49	21	81	118	39	79	2.54
23-24 / TRN-081 / SBH 02 / 10.00	Silty CLAY of high plasticity (Greyish)	CH	0	0	0	2	47	51	105	138	44	94	

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Direct Shear Test
IS 2720 - Part 13 :1993 (Reaff:2021)

Test Report No EDC/23-24/TRN-81

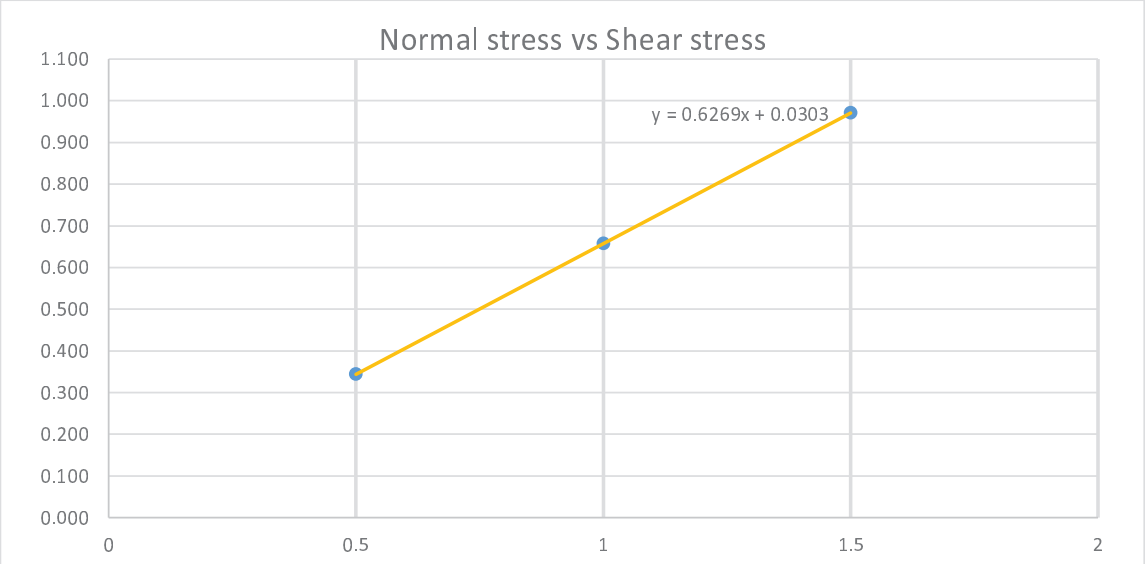
Laboratory Information

Date of Testing 25/07/2023
Lab Temperature 26

Sample Details

Sample id : TRN 81/SBH 02/4.50 Sample Type UDS-Remoulded

Length (cm)	6
Height (cm)	2.50
Bulk Density(g/cc)	2.31
Dry Density(g/cc)	1.83



Angle of Internal friction,φ **32.09 (deg)**
Cohesion ,C **0.00 (kPa)**

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

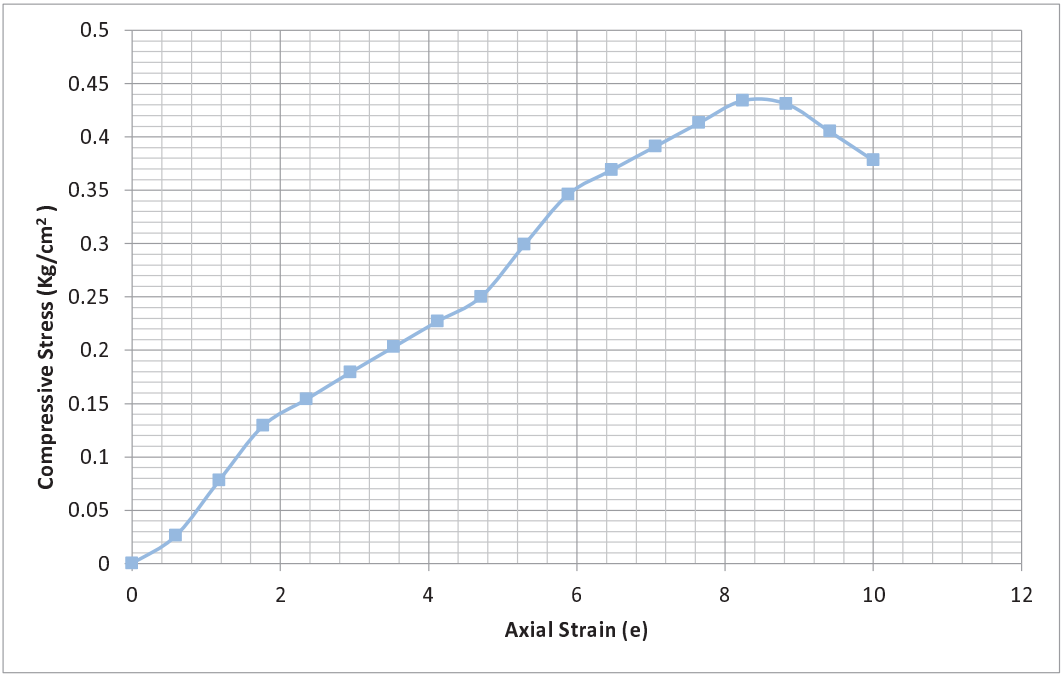
Determination of Unconfined Compressive Strength
IS 2720 - Part X :1991

Laboratory Information

Date of Testing	21.07.2023
Lab Temperature	27

Sample Details

Sample ID	TRN-081/SBH 02/-7.50m	Sample Type	UDS
Initial Diameter of soil specimen, cm	3.8		
Initial Length of soil specimen, cm	8.5		
Initial Area of specimen, cm²	11.34		
Initial Volume of specimen, cm3)	96.39		
Wet density (g/cc)	1.58		
Dry density (g/cc)	1.57		



Unconfined compressive Strength	**:**	**0.434**	**Kg/cm2**
Undrained Shear Strength (Cohesion)	**:**	**0.217**	**Kg/cm2**

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

SOIL TESTING LABORATORY

TEST REPORT

Determination of Triaxial Compression Test
IS 2720 - Part 11 :1993 (Reaff:2021)

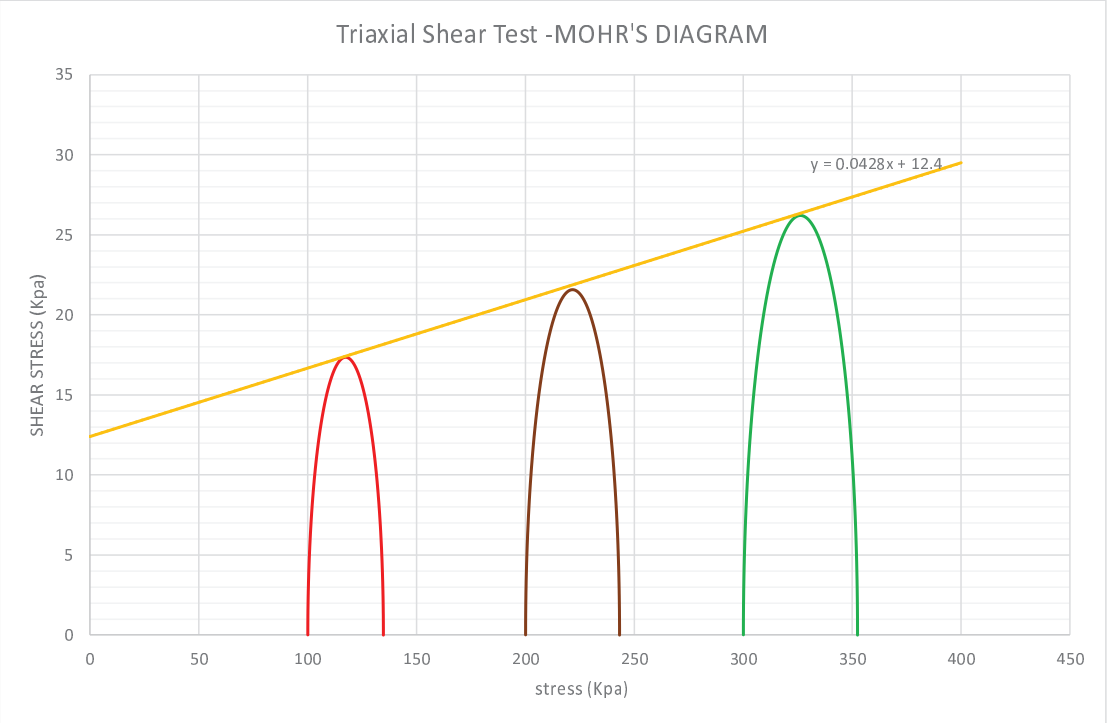
Test Report No	EDC/23-24/TRN-081	

Laboratory Information

Date of Testing	14/07/23	
Lab Temperature	26	

Sample Details

Sample ID	**TRN 081/SBH 02/ 7.50 mts**	Type of Sample : UNDISTRUBED	
		Type of Test	**UU**
		Rate of strain	1.25 mm/min



			Cohesion ,C	**12.4**	**(kPa)**	
			Friction Angle ,φ	**2.5**	**(deg)**	
Sample No	**Bulk Denity (g/cc)**	**Cell Pressure (Kpa)**	**Compressive Stress at failure (Kpa)**	**Strain at Failure (Kpa)**	**Moisture content**	**Dry Density (g/cc)**
1	2.061	100	34.71	5.77	0.65	1.249
2	2.042	200	43.14	6.25	0.61	1.268
3	2.003	300	52.41	8.86	0.63	1.229

Client:

ANNEXURE -5

SBH-03

ACETYLENE STATION

5.1. DESIGN CONSIDERATION FOR FOUNDATION SYSTEM

From the borelogs and lab results of the soil samples in areas of SBH 03, it can be understood that the soils in the shallow depths are predominantly dense sandy in nature.

For the proposed Acetylene station, footing shall be provided in the shallow depths. Bearing capacities for footing at 1.00m depth is worked out for shear criteria and settlement criteria. The values are as given in the table below:

Type of footing	Width (m)	Depth (m)	Bearing Capacity By Shear (T/m²)	Bearing Capacity by Settlement(T/m²)
ISOLATED	1.00	1.00	8	10
	1.50		8	10

Typical Calculations of Bearing Capacity of Borehole SBH-03 are given below.

Foundation Shape and Dimensions

Type of Foundation	*Width (B), m*	*Depth (D), m*
Raft	6.00	1.00

Subsurface Strata

Effective cohesion (c')	0	kPa
Effective angle of shearing resistance (ϕ')	33	
Unit weight above founding level	8	kN/m^3
Unit weight below founding level	8	kN/m^3
Depth of ground water table below GL	0.0	m
Water table correction factor (W')	0.5	

Shape Factors		*Depth Factors#*		*Bearing Capacity Factors*	
s_c	1.30	d_c	1.00	N_c	38.64
s_γ	0.80	d_γ	1.00	N_γ	35.19

s_q	1.20		d_q	1.00		N_q	26.09

#When strata above founding level is not as good as strata below, depth factors should be taken as 1.0

Net Ultimate Bearing Capacity

$$q_u = cN_c s_c d_c + \gamma D(N_q - 1)s_q d_q + 0.5\gamma BN_\gamma s_\gamma d_\gamma W'$$

Net ultimate bearing capacity (q_{un}) = 297.2 kPa

Safe Bearing Capacity

Recommended factor of safety = 2.5

Net safe bearing capacity = 118.9 kPa

Recommended net safe bearing capacity = 100.0 kPa

Recommended net safe bearing capacity = 10.00 T/m^2

5.2. SUMMARY & RECOMMENDATIONS:

From the borelogs and lab results of the soil samples in areas of SBH 03, it can be understood that the soils in the shallow depths are predominantly dense sandy in nature.

For the proposed Acetylene station in the area of SBH 03, footing shall be provided in the shallow depths. Bearing capacities for footing at 1.00m depth is worked out for shear criteria and settlement criteria. The values are as given in the table below:

Type of footing	Width (m)	Depth (m)	Bearing Capacity (T/m2)
ISOLATED	1.00	1.00	8
	1.50		8

Client:

Recommendations are based on the assumption that the soil profile found in the boreholes and samples tested are indicative of the entire plot area. Any deviation in soil profile other than those noted in the boreholes tested, should immediately be referred to the consultant and proper modification should be implemented.

The foundation execution is recommended under strict technical supervision.

For ENGINEERS DIAGNOSTIC CENTRE (P) LTD.,

A. V.S CHAKRAVARTI
M. Tech, M.I.G.S., M.I.C.I
CHIEF ENGINEER

5. REFERENCES

1) Foundation Analysis And Design, J.E Bowels, Mcgraw Hill Publication
2) Soil Mechanics And Foundation Engineering, K.R Arora, Standard Publishers Distributors, Fourth Edition,1997
3) Soil Mechanics in Engineering Practice, 2nd Edition, Terzaghi K and Peck R.B, John Willey and Sons, 1967.
4) IS: 6403-1981, Code Of Practice For Determination of Bearing Capacity Of Shallow Foundation.
5) Foundation Manual, N.V Nayak, 1996.
6) Foundation Design and Construction, M.J Tomlinson, Viewpoint Publishers.
7) IS 2911 (PART1/SECTION 2)-1979, Code of Practice for Design and Construction of Pile Foundation.

GEOTECHNICAL INVESTIGATION WORK FOR ACETYLENE STATION AT COCHIN SHIPYARD

EDC ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Client	: CSL	Boring Started	: 10.07.2023
Bore Hole No	: SBH 03	Boring Completed	: 10.07.2023
Type of Boring	: ROTARY DRILLING	Water level	: 0.72m
Termination Depth	: 10.00 m	Location	: KOCHI

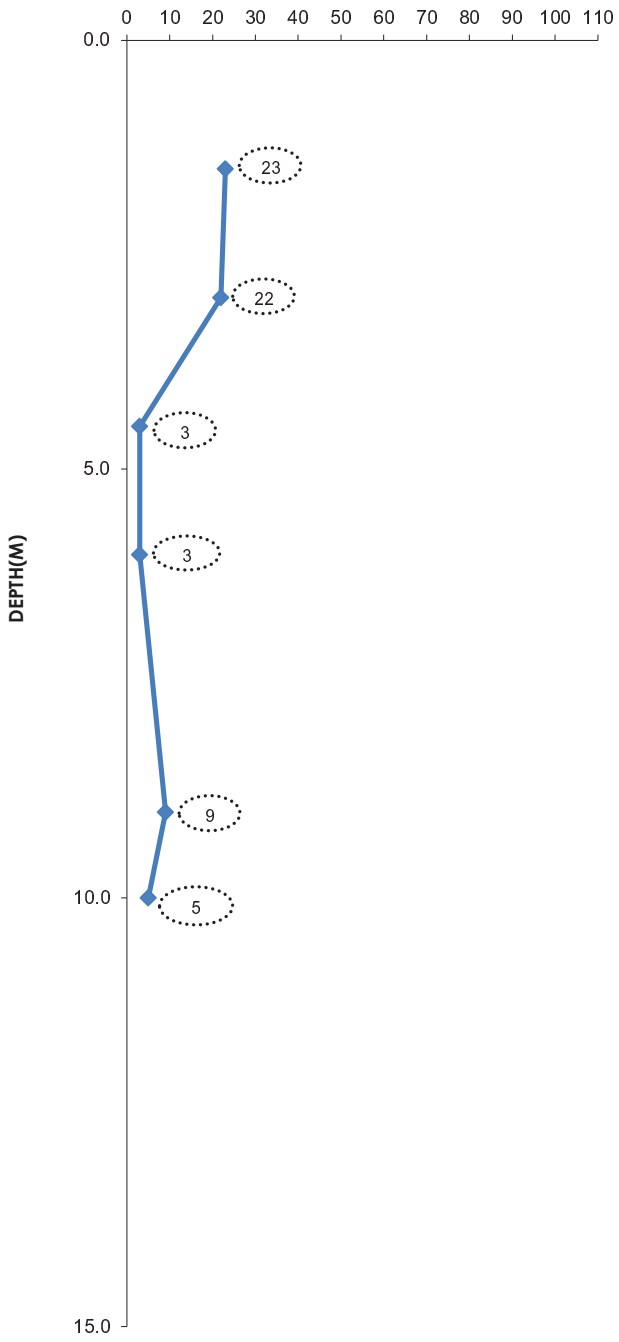
DEPTH	SOIL TYPE	GROUP SYMBOL	DESCRIPTION OF STRATA	THICKNESS OF STRATA	DEPTH in m	Test Depth	BLOWS/15cm			SPT " N "	Remarks
							15cm	15cm	15cm		
0.00		SP	Medium Dense SAND (Greyish)	4.00	1.50	1.50- 1.95	5	10	13	23	
					3.00	3.00- 3.45	10	12	10	22	
4.00					4.50	4.50- 4.95	1	1	2	3	
5.00		SM	Very Losse Silty SAND (Greyish)	1.00	6.00	6.50- 6.95	1	2	1	3	
		SM	Very Loose Silty SAND with Clay (Greyish)	3.00	7.50	7.50- 7.95	UDS Collected				
8.00					9.00	9.00- 9.45	4	4	5	9	
9.50		SM	Loose Silty SAND (Greyish)	1.50	10.00	10.00- 10.45	2	2	3	5	Vane Shear Test
10.00		CH	Medium Stiff Silty CLAY (Greyish)	0.50							

BOREHOLE TERMINATED AT 10.00M

PROJECT : GEOTECHNICAL INVESTIGATION WORK COCHIN SHIPYARD

	ENGINEERS DIAGNOSTIC CENTRE (P) LTD	Bore Hole No	: SBH 03	Boring Started	: 10.06.2023
		Type of Boring	: Rotary	Boring Completed	: 10.06.2023
		Termination Depth	: 7.80m	Ground water table	: 0.72 m

GRAPHICAL REPRESENTATION OF N VALUE



BORE HOLE TERMINATED AT 10.00 M

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

TEST REPORT

Test Report No: EDC/23-24/TRN-081 Test Date 15.07.2023

ULR No: TC985123000000081F

TC-9851

SAMPLE ID	SOIL DESCRIPTION	Group Symbol (IS:1498-1970)	SOIL PARAMETERS										
			GRAIN SIZE ANALYSIS (%) Method: IS 2720 (Part 04):1985, RA - 2015				HYDROMETER ANALYSIS Method: IS 2720 (Part 4) 1985, RA - 2015		NMC (%) Method:IS 2720 (Part 2): 1973, RA 2015	ATTERBERGS LIMIT (%) Method: IS 2720 (Part 5):1986, RA 2015			SPECIFIC GRAVITY Method: IS 2720 (Part 3/ Sec1) 1980, RA 2016
			Gravel %	SAND %			FINES %			Liquid Limit %	Plastic Limit %	Plasticity Index %	
				Course %	Med %	Fine %	Silt %	Clay %					
23-24 / TRN-081 / SBH 03 / 1.50	Poorly-graded SAND (Greyish)	SP	8	1	26	54	10		21				2.65
23-24 / TRN-081 / SBH 03 / 3.00	Poorly-graded SAND (Greyish)	SP	0	0	13	75	12		20				
23-24 / TRN-081 / SBH 03 / 4.50	Silty SAND (Greyish)	SM	0	0	5	63	27	5	37				2.62
23-24 / TRN-081 / SBH 03 / 6.00	Silty SAND with Clay (Greyish)	SM	0	0	1	55	26	17	45				
23-24 / TRN-081 / SBH 03 / 9.00	Silty SAND (Greyish)	SM	4	1	2	49	35	9	41				2.60
23-24 / TRN-081 / SBH 03 / 10.00	Silty CLAY of high plasticity (Greyish)	CH	0	0	0	2	43	55	99	130	42	88	2.54

TESTED BY:

Mr. AFSAL M Y

CHECKED AND APPROVED BY:

Mr. ARAVINDAN S

ENGINEERS DIAGNOSTIC CENTRE (P) LTD
SOIL TESTING LABORATORY

TEST REPORT

Determination of Direct Shear Test
IS 2720 - Part 13 :1993 (Reaff:2021)

Test Report No EDC/23-24/TRN-81

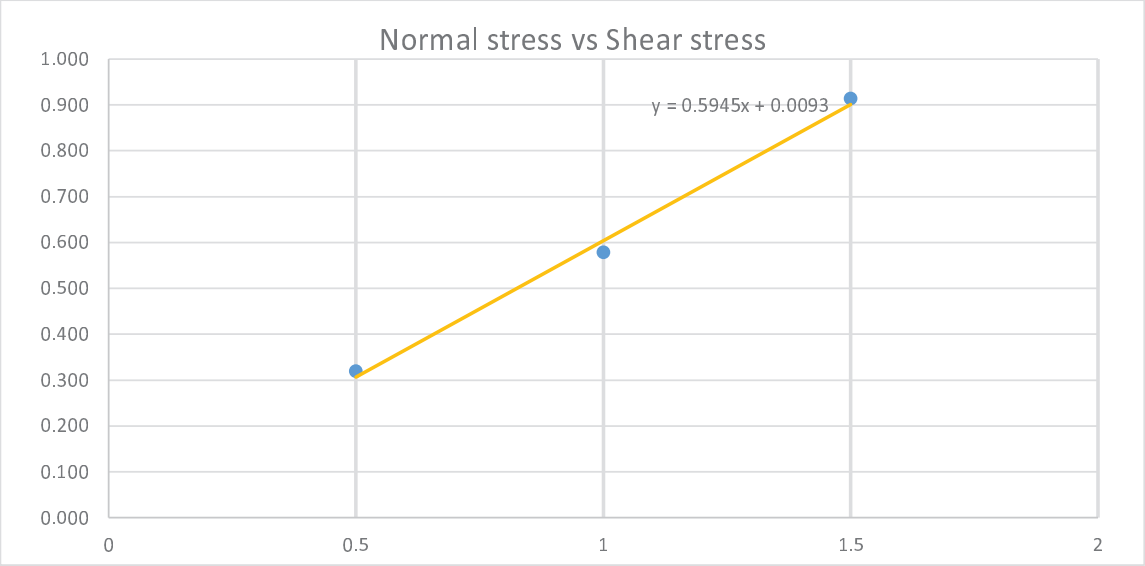
Laboratory Information

Date of Testing 25/07/2023
Lab Temperature 26

Sample Details

Sample id : TRN 81/SBH 03/7.50 Sample Type UDS-Remoulded

Length (cm)	6
Height (cm)	2.50
Bulk Density(g/cc)	2.34
Dry Density(g/cc)	1.76



Angle of Internal friction,φ **30.73 (deg)**
Cohesion ,C **0.00 (kPa)**

ENGINEERS DIAGNOSTIC CENTRE (P) LTD

IN-SITU VANE SHEAR TEST

Test No.	**: 1**	**Test Date**	**: 10.07.2023**
Bore Hole No.	: SBH 03	**Location**	**: CSL**
Test Depth	: 10.00m	Dia of Vane	: 50 mm
Type of Soil	: Clay	Height of Vane	: 100 mm

Depth of Vane Tip			TEST WITH VANE IN UNDISTURBED SOIL	TEST WITH VANE IN REMOULDED SOIL
	Min	Deg		
	0.0	0	0.00	0.00
	0.5	3	0.1	0.04
	1.5	9	0.11	0.10
	2.0	12	0.12	0.13
	2.5	15	0.11	0.12
	3.0	18	0.10	0.10
	3.5	21	0.10	0.06
	4.0	24	0.10	0.04
	4.5	27	0.09	0.04
Time	5.0	30	0.09	0.04
	5.5	33	0.09	0.05
	6.0	36	0.11	0.06
	6.5	39	0.2	0.10
	7.0	42	2.18	0.12
	7.5	45	2.25	0.14
	8.0	48	2.22	0.15
	8.5	51	2.18	0.11
	9.0	54	2.18	0.07
	9.5	57	2.18	0.06
	10.0	60	2.22	0.04
		Torque (kgcm)	22.1	
		Shear Strength (kg/cm2)	0.375	
		Cohesion (kg/cm2)	0.187	

Avg. deflection of Dial Gauge = 2.22/0.002

= 1110

From Graph, Torque = 171.5 kgcm

$$S = \frac{3 * M * 1000}{11 D^3}$$

$$= \frac{3*171.5*1000}{11*50*50*50}$$

= 2.203 Kg/cm2

C = S/2

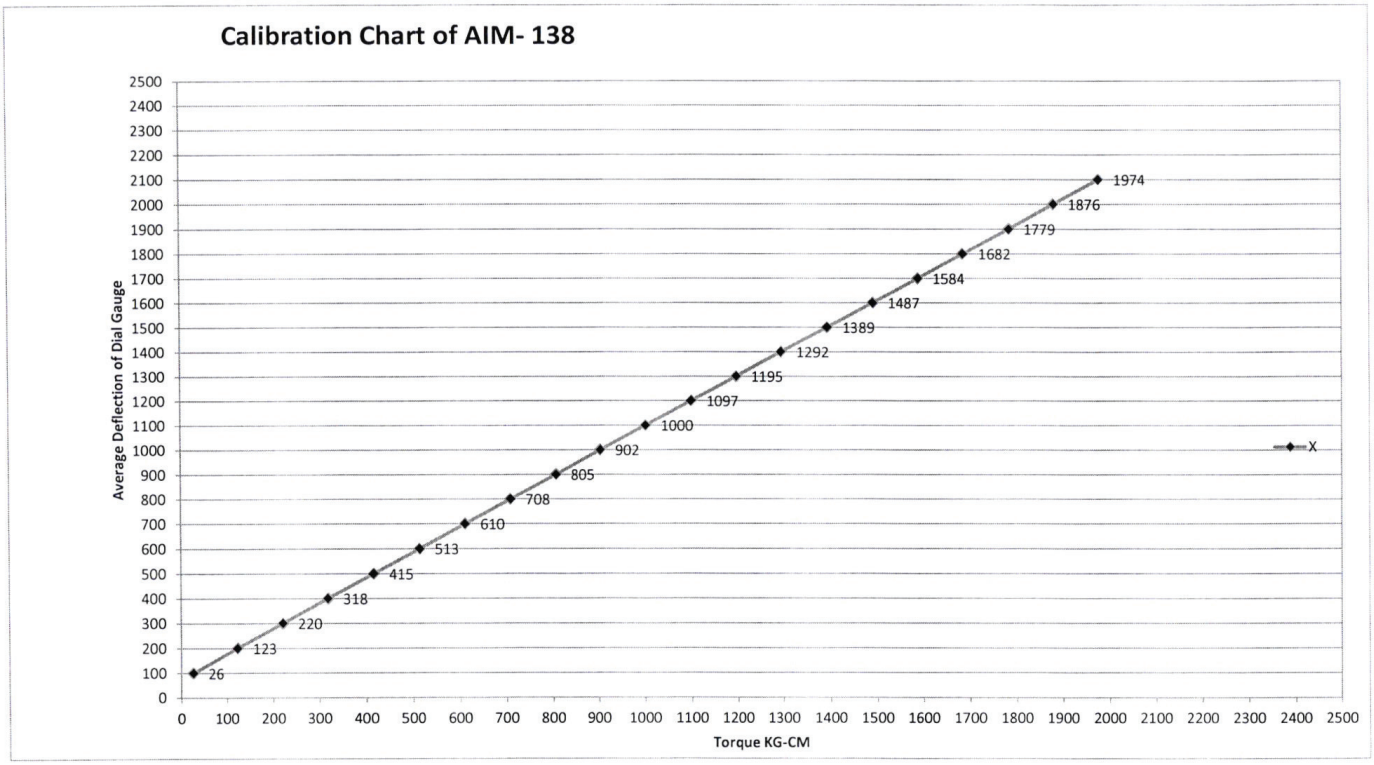
= 2.203/2

= 1.101 Kg/cm2

= 110 KPa

ANNEXURE – 6

CALIBRATION CHART FOR VANE SHEAR


Calibration Chart of AIM- 138
Average Deflection of Dial Gauge
Torque KG-CM
X
26
123
220
318
415
513
610
708
805
902
1000
1097
1195
1292
1389
1487
1584
1682
1779
1876
1974

ANNEXURE – 7
CHEMCAL TEST RESULT

SOIL TESTING LABORATORY
ENGINEERS DIAGNOSTIC CENTRE (P) LTD

Chemical Test Result on Water Samples

Sl no	BH NO	PH at 270c IS 3025 (Part32):1988, Reaff.2017	Chloride (mg/l) IS 3025 (Part32):1988, Reaff.2014	Sulphate(mg/l) IS 3025 (Part32):1986, Reaff.2014
1	TBH01	7	56.72	-
2	TBH02	7	28.36	-
3	TBH03	7	31.196	-
4	SBH01	7	113.44	-

Chemical Test Result on Soil Samples

Sl no	BH NO	PH at 270c IS 3025 (Part32):1988, Reaff.2017	Chloride (mg/l) IS 3025 (Part32):1988, Reaff.2014	Sulphate(mg/l) IS 3025 (Part32):1986, Reaff.2014
1	TBH01/1.50m	7	25.524	-
2	TBH02/3.00m	7	31.196	-
3	TBH03/4.50m	7	58.138	-
4	SBH01/3.00m	7	226.88	-

ANNEXURE – 8
LOCATION SKETCH

BOREHOLE LOCATION SKETCH		
BH NO	NORTHING	EASTING
TBH-01	9° 57' 34.06''	76° 17' 11.65''
TBH-02	9° 57' 33.93''	76° 17' 11.65''
TBH-03	9° 57' 26.44''	76° 17' 18.52''
TBH-04	9° 57' 27.07''	76° 17' 20.01''
SBH-01	9° 57' 30.6''	76° 17' 9.66''
SBH-02	9° 57' 34.83''	76° 17' 12.2''
SBH-03	9° 57' 35.47''	76° 17' 12.67''

COCHIN SHIPYARD LIMITED
INFRA PROJECTS DEPARTMENT
CONSTRUCTION OF FIRE WATER TANK, INDUSTRIAL WATER TANK,
ACETYLENE STATION AND COMPRESSOR CLUSTERS (2 NOS.) FOR NEW DRY DOCK PROJECT
TENDER SCHEDULE/ BILL OF QUANTITIES

Sl. No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
PART-1 : COMPRESSOR CLUSTER-1					
1	Earth work in excavation up to 1.50 meter depth by mechanical means (Hydraulic excavator)/manual means in all kinds of soil including dressing of sides and ramming of bottoms, including cost and conveyance of all equipment, labour, dewatering and other incidental etc. all complete as directed by Engineer-In-Charge.	368.00	m3		
2	Supplying and filling with M sand / moorum in layers inside plinth under floors, including compacting each layer by rolling/ plate compactor/ ramming and watering, and dressing etc complete, including cost and conveyance of all labour, materials, equipments and other incidentals etc. as per the direction of Engineer-in-Charge.	98.00	m3		
3	Backfilling with available earth (excluding rock) in trenches in layers including compacting each layer by rolling/ plate compactor/ ramming and watering, including cost and conveyance of all labour, materials and other incidentals etc. all complete as per drawing and direction of Engineer-in-Charge	268.00	m3		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
4	Disposal of excavated earth (unsuitable for backfilling and surplus earth), dismantled/demolished materials, waste material encountered during excavation, from CSL site by mechanical transporting, including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of Engineer-in-Charge	100.00	m3		
5	Providing and laying plain cement concrete 1:2:4 using 20mm down graded broken stones including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of Engineer-in-Charge	35.00	m3		
6	Providing and casting Reinforced cement concrete of grade M40 with 20mm downgraded coarse aggregate in required slope and position including cost of shuttering, de-shuttering, compacting with mechanical vibrators, hacking, curing, scaffolding, all equipment, labour, pumping, incidental expenses but excluding cost of reinforcement, complete as directed by Engineer in-Charge.				
(a)	All works up to plinth level	158.00	m3		
(b)	Columns	1.50	m3		
7	Supplying, cleaning, cutting, bending, supporting, binding with doube ply of 22 SWG soft annealed wire and placing in position high yield strength deformed TMT reinforcement bars conforming to IS:1786 of grade Fe 500D or more of approved make on/at all levels and locations as per drawings, including handling and transport complete for all RCC works including supplying and & placing concrete cover block, all equipment, labour, incidental expenses complete as directed by Engineer in-charge	32.00	T		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
8	Providing and laying 200mm thick concrete block in cement mortar 1:5 using approved quality blocks, including cost and conveyance of all labour, material, scaffolding, raking of joints, curing and other incidentals etc complete as per Engineer in-charge	32.00	m3		
9	Plastering with CM 1:4, 12mm thick in one coat floated hard and trowelled smooth at all heights and locations for masonry and concrete surfaces including scaffolding, chipping, hacking and cleaning the concrete surface, finishing, making bands, grooves, curing, including cost and conveyance of all materials, labour, other incidentals etc. complete as per the directions of Engineer-In-Charge.	157.00	m2		
10	Supplying and applying one coat of approved matching primer and two coats of Anti Algal/Fungal, Weather proof, Exterior paint of approved colour, shade and make at all heights including cost and coveyance of all materials, labour, scaffolding, cleaning and preparing the surface by removing the dust, fungus, algae and efflorescence, including filling the dents, cracks and holes with matching putty, sealer and other incidentals etc complete and as directed by Engineer in-charge	157.00	m2		
11	Supplying, fabricating and erecting in position built-up tubular sections conforming to IS 4923 of required size and thickness (tubular, square or rectangular hollow tubes etc) for trusses, columns etc as per the approved drawings, including cost and conveyance of all materials, cutting, hoisting, fixing in position, welding electrodes and consumables, hire charges of welding equipment, bolts, nuts and washers ,closing the ends, drilling holes and applying two coat of synthetic enamel paint over a priming coat of Zinc chromate primer, etc complete as directed by the Engineer-In-Charge.	4.50	T		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
12	Supplying and fabricating structural steel work conforming to IS 226/2062 including erecting in position, aligning the erected structures in line and level, bolting or welding wherever required as per approved drawing, cost and conveyance of all materials, labour, accessories, hire charge of tools and plants, welding equipment, cost of electrodes and applying two coat of synthetic enamel paint over a priming coat of Zinc chromate primer, etc complete as directed by the Engineer-In-Charge (provision of bolt holes to be made as required at no extra cost) as required including providing chequered plate wherever required as per drawing all complete.	3.50	T		
13	Providing & fixing at all heights, levels and locations coloured finish Galvalume Roofing/ Cladding sheets of thickness 0.60 mm, troughed profile of good formability and corrosion resistance including minimum end overlaps and appropriate side laps. The profile sheets shall be fixed to truss members in slope or required pitch or curvature with Hex cap headed self drilling/tapping Stainless steel screws 50 mm long with EPDM seal washer etc. all including cost and conveyance of labour, scaffolding and other incidentals etc. complete as per directions of the Engineer-In-Charge. (Cost of truss/frame work shall be paid separately).	320.00	m2		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
14	Supplying and fixing in position coloured finish Galvalume plain sheet ridge capping of 0.6mm thk or nearest available thickness and 600mm width with a minimum overlap of 150mm at ends, including cost and conveyance of all materials, cost of Hex cap headed self drilling/tapping Stainless steel screws 50 mm long with EPDM seal washer, labour, all leads and lifts, other incidentals etc complete as per the direction of Engineer-In-Charge.	35.00	m		
15	Supplying, jointing and fixing unplasticised Rigid PVC rain water pipes 110 mm diameter connecting to the drain through walls by clamping with necessary MS plates at sufficient intervals including cost and conveyance of all materials, labour other incidentals etc. complete and as per the direction of Engineer-in-Charge	74.00	m		
16	Providing, jointing and fixing unplasticised Rigid PVC moulded fittings/accessories, including cost and conveyance of all materials, labour other incidentals etc.complete and as per the direction of Engineer-in-Charge				
(a)	110mm coupler	15.00	Nos		
(b)	110mm Shoe	15.00	Nos		
(c)	110mm bend	29.00	Nos		
17	Supplying and fixing in position to line and level UPVC rain water gutter of 220mm height supported on gutter hanger including cost and conveyance of all materials, all accessories, hire charges of tools & plants, welding or bolting, all labour, cost of welding electrodes, other consumables, cost of bolts, nuts & washers, other incidentals etc. complete as per the direction of Engineer-in-charge	59.00	m		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
18	Supplying and fixing 18G rolling shutters of approved make with including painting with two coats of synthetic enamel paint over two coats of zinchromite primer, made of 80x1.25mm M.S. laths interlocked together through their entire length and joined together at the end by the end locks mounted on specially, designed pipes shaft with brackets, rolling shutter gear, top cover, side guides and arrangement for inside and outside locking with push and pull operation and two numbers of Godrej pad locks on each rolling shutter etc. including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge	5.50	m2		
19	Providing and fixing ball bearing for rolling shutters including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge	2.00	Nos		
20	Extra for providing grilled rolling shutters manufactured out of 8 mm dia M.S. bar instead of laths as per approved design including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge (area of grill to be measured).	1.00	m2		
21	Supplying, fabricating and fixing in position powder coated fully glazed aluminium single shutter openable door with outer frames sections 63.5x38.1mm, door top 50X 44.5 ,door bottom 100 X 44.5, door vertical 50X 44.5, door divider 50X 44.5 or nearest available size of approved make fixing with dash fasteners of required dia and size and sections shall be smooth, rust free,straight, mitred and jointed mechanically wherever required including cleat angle including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with silicon sealent, aluminium door gear,aluminium glazing clip etc as required with superior quality powder coated aluminium sections,fully glazed with 5mm plain glass fixed with EDPM beading ,including all fixtures like hinges, aluminium extruded section body tubular type universal hydraulic door closer, Brass cupboard lock 6 levers, ,Powder coated Aluminium handles 125 mm with plate 175 x 32 mm, beadings , cost and conveyance of all materials, all labour, other incidentals etc. complete as per the direction of Engineer-in-Charge	3.00	m2		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
22	Supplying and fixing in position super profile aluminium fixed ventilators with powder coated aluminium grill, including all fixtures like stainless steel screws, beadings etc, including cost and conveyance of all materials, all labour, other incidentals etc. complete. as per the direction of Engineer-in-Charge	1.50	m2		
23	Providing and laying 60mm thick factory made cement concrete interlocking paver block made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with M sand, locking edges with concrete including cost and conveyance of all materials, all labour, other incidentals etc. all complete as per the direction of Engineer-in-charge	83.00	m2		
				TOTAL AMOUNT EXCLUDING GST (A)	
PART-2 : COMPRESSOR CLUSTER-2					
24	Earth work in excavation up to 1.50 meter depth by mechanical means (Hydraulic excavator)/manual means in all kinds of soil including dressing of sides and ramming of bottoms, including cost and conveyance of all equipment, labour, dewatering and other incidental etc. all complete as directed by Engineer-In-Charge.	372.00	m3		
25	Supplying and filling with M sand / moorum in layers inside plinth under floors, including compacting each layer by rolling/ plate compactor/ ramming and watering, and dressing etc complete, including cost and conveyance of all labour, materials, equipments and other incidentals etc. as per the direcion of engineer in-charge.	98.00	m3		
26	Backfilling with available earth (excluding rock) in trenches in layers including compacting each layer by rolling/ plate compactor/ ramming and watering, including cost and conveyance of all labour, materials and other incidentals etc. all complete as per drawing and direction of engineer in-charge	271.00	m3		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
27	Disposal of excavted earth (unsuitable for backfilling and surplus earth), dismantled/demolished materials, waste materail encountered during excavation, from CSL site by mechanical transporting, including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of engineer in-charge	101.00	m3		
28	Providing and laying plain cement concrete 1:2:4 using 20mm down graded broken stones including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of Engineer-in-Charge	35.00	m3		
29	Providing and casting Reinforced cement concrete of grade M40 with 20mm downgraded coarse aggregate in required slope and position including cost of shuttering, de-shuttering, compacting with mechanical vibrators, hacking, curing, scaffolding, all equipment, labour, pumping, incidental expenses but excluding cost of reinforcement, complete as directed by Engineer in-charge.				
(a)	All works up to plinth level	158	m3		
(b)	Columns	1.5	m3		
30	Supplying, cleaning, cutting, bending, supporting, binding with doube ply of 22 SWG soft annealed wire and placing in position high yield strength deformed TMT reinforcement bars conforming to IS:1786 of grade Fe 500D or more of approved make on/at all levels and locations as per drawings, including handling and transport complete for all RCC works including supplying and & placing concrete cover block, all equipment, labour, incidental expenses complete as directed by Engineer in-charge	32.00	T		
31	Providing and laying 200mm thick concrete block in cement mortar 1:5 using approved quality blocks, including cost and conveyance of all labour, material, scaffolding, raking of joints, curing and other incidentals etc complete as per Engineer in-charge	32.00	m3		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
32	Plastering with CM 1:4, 12mm thick in one coat floated hard and trowelled smooth at all heights and locations for masonry and concrete surfaces including scaffolding, chipping, hacking and cleaning the concrete surface, finishing, making bands, grooves, curing, including cost and conveyance of all materials, labour, other incidentals etc. complete as per the directions of Engineer-In-Charge.	158.00	m2		
33	Supplying and applying one coat of approved matching primer and two coats of Anti Algal/Fungal, Weather proof, Exterior paint of approved colour, shade and make at all heights including cost and coveyance of all materials, labour, scaffolding, cleaning and preparing the surface by removing the dust, fungus, algae and efflorescence, including filling the dents, cracks and holes with matching putty, sealer and other incidentals etc complete and as directed by Engineer in-charge	158.00	m2		
34	Supplying, fabricating and erecting in position built up tubular sections conforming to IS 4923 of required size and thickness (tubular, square or rectangular hollow tubes etc) for trusses, columns etc as per the approved drawings, including cost and conveyance of all materials, cutting, hoisting, fixing in position, welding electrodes and consumables, hire charges of welding equipment, bolts, nuts and washers ,closing the ends, drilling holes and applying two coat of synthetic enamel paint over a priming coat of Zinc chromate primer, etc complete as directed by the Engineer-In-Charge.	4.50	T		
35	Supplying and fabricating structural steel work conforming to IS 226/2062 including erecting in position, aligning the erected structures in line and level, bolting or welding wherever required as per approved drawing, cost and conveyance of all materials, labour, accessories, hire charge of tools and plants, welding equipment, cost of electrodes and applying two coat of synthetic enamel paint over a priming coat of Zinc chromate primer, etc complete as directed by the Engineer-In-Charge (provision of bolt holes to be made as required at no extra cost) as required including providing chequered plate wherever required as per drawing all complete.	3.50	T		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
36	Providing & fixing at all heights, levels and locations coloured finish Galvalume Roofing/ Cladding sheets of thickness 0.60 mm, troughed profile of good formability and corrosion resistance including minimum end overlaps and appropriate side laps. The profile sheets shall be fixed to truss members in slope or required pitch or curvature with Hex cap headed self drilling/tapping Stainless steel screws 50 mm long with EPDM seal washer etc. all including cost and conveyance of labour, scaffolding and other incidentals etc. complete as per directions of the Engineer-In-Charge. (Cost of truss/frame work shall be paid separately).	320.00	m2		
37	Supplying and fixing in position coloured finish Galvalume plain sheet ridge capping of 0.6mm thk or nearest available thickness and 600mm width with a minimum overlap of 150mm at ends, including cost and conveyance of all materials, cost of Hex cap headed self drilling/tapping Stainless steel screws 50 mm long with EPDM seal washer, labour, all leads and lifts, other incidentals etc complete as per the direction of Engineer-In-Charge.	35.00	m		
38	Supplying, jointing and fixing unplasticised Rigid PVC rain water pipes 110 mm diameter connecting to the drain through walls by clamping with necessary MS plates at sufficient intervals including cost and conveyance of all materials, labour other incidentals etc. complete and as per the direction of Engineer-in-Charge	74	m		
39	Providing, jointing and fixing unplasticised Rigid PVC moulded fittings/accessories, including cost and conveyance of all materials, labour other incidentals etc.complete and as per the direction of Engineer-in-Charge				
a	110mm coupler	15.00	Nos		
b	110mm Shoe	15.00	Nos		
c	110mm bend	29.00	Nos		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
40	Supplying and fixing in position to line and level UPVC rain water gutter of 220mm height supported on gutter hanger including cost and conveyance of all materials, all accessories, hire charges of tools & plants, welding or bolting, all labour, cost of welding electrodes, other consumables, cost of bolts, nuts & washers, other incidentals etc. complete as per the direction of Engineer-in-charge	59	m		
41	Supplying and fixing 18G rolling shutters of approved make with including painting with two coats of synthetic enamel paint over two coats of zinchromite primer, made of 80x1.25mm M.S. laths interlocked together through their entire length and joined together at the end by the end locks mounted on specially, designed pipes shaft with brackets, rolling shutter gear, top cover, side guides and arrangement for inside and outside locking with push and pull operation and two numbers of Godrej pad locks on each rolling shutter etc. including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge	5.50	m2		
42	Providing and fixing ball bearing for rolling shutters including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge	2.00	Nos		
43	Extra for providing grilled rolling shutters manufactured out of 8 mm dia M.S. bar instead of laths as per approved design including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge (area of grill to be measured).	1.00	m2		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
44	Supplying, fabricating and fixing in position powder coated fully glazed aluminium single shutter openable door with outer frames sections 63.5x38.1mm, door top 50X 44.5 ,door bottom 100 X 44.5, door vertical 50X 44.5, door divider 50X 44.5 or nearest available size of approved make fixing with dash fasteners of required dia and size and sections shall be smooth, rust free,straight, mitred and jointed mechanically wherever required including cleat angle including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with silicon sealent, aluminium door gear,aluminium glazing clip etc as required with superior quality powder coated aluminium sections,fully glazed with 5mm plain glass fixed with EDPM beading ,including all fixtures like hinges, aluminium extruded section body tubular type universal hydraulic door closer, Brass cupboard lock 6 levers, ,Powder coated Aluminium handles 125 mm with plate 175 x 32 mm, beadings , cost and conveyance of all materials, all labour, other incidentals etc. complete as per the direction of Engineer-in-Charge	3.00	kg		
45	Supplying and fixing in position super profile aluminium fixed ventilators with powder coated aluminium grill, including all fixtures like stainless steel screws, beadings etc, including cost and conveyance of all materials, all labour, other incidentals etc. complete. as per the direction of Engineer-in-Charge	1.26	Sq.m		
46	Providing and laying 60mm thick factory made cement concrete interlocking paver block made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with M sand, locking edges with concrete including cost and conveyance of all materials, all labour, other incidentals etc. all complete as per the direction of Engineer-in-charge	83.00	m2		
				TOTAL AMOUNT EXCLUDING GST (B)	

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
PART-3:ACETYLENE STATION					
47	Earth work in excavation up to 1.50 meter depth by mechanical means (Hydraulic excavator)/manual means in all kinds of soil including dressing of sides and ramming of bottoms, including cost and conveyance of all equipment, labour, dewatering and other incidental etc. all complete as directed by Engineer-In-Charge.	112.00	m3		
48	Supplying and filling with M sand / moorum in layers inside plinth under floors, including compacting each layer by rolling/ plate compactor/ ramming and watering, and dressing etc complete, including cost and conveyance of all labour, materials, equipments and other incidentals etc. as per the direcion of engineer in-charge.	211.00	m3		
49	Backfilling with available earth (excluding rock) in trenches in layers, including compacting each layer by rolling/ plate compactor/ ramming and watering, including cost and conveyance of all labour, materials and other incidentals etc. all complete as per drawing and direction of engineer in-charge	84.00	m3		
50	Disposal of excavted earth (unsuitable for backfilling and surplus earth), dismantled/demolished materials, waste materail encountered during excavation, from CSL site by mechanical transporting, including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of engineer in-charge	27.00	m3		
51	Providing and laying plain cement concrete 1:2:4 using 20mm down graded broken stones including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of Engineer-in-Charge	20.00	m3		
52	Providing and casting Reinforced cement concrete of grade M40 with 20mm downgraded coarse aggregate in required slope and position including cost of shuttering, de-shuttering, compacting with mechanical vibrators, hacking, curing, scaffolding, all equipment, labour, pumping, incidental expenses but excluding cost of reinforcement, complete as directed by Engineer in-charge.				
(a)	All works up to plinth level	94.00	m3		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
(b)	Columns	7.00	m3		
(c)	Slab, Beam, Lintel	5.00	m3		
53	Supplying, cleaning, cutting, bending, supporting, binding with doube ply of 22 SWG soft annealed wire and placing in position high yield strength deformed TMT reinforcement bars conforming to IS:1786 of grade Fe 500D or more of approved make on/at all levels and locations as per drawings, including handling and transport complete for all RCC works including supplying and & placing concrete cover block, all equipment, labour, incidental expenses complete as directed by Engineer in-charge	21.00	T		
54	Providing and laying 200mm thick concrete block in cement mortar 1:5 using approved quality blocks, including cost and conveyance of all labour, material, scaffolding, raking of joints, curing and other incidentals etc complete as per Engineer in-charge	85.00	m3		
55	Plastering with CM 1:4, 12mm thick in one coat floated hard and trowelled smooth at all heights and locations for masonry and concrete surfaces including scaffolding, chipping, hacking and cleaning the concrete surface, finishing, making bands, grooves, curing, including cost and conveyance of all materials, labour, other incidentals etc. complete as per the directions of Engineer-In-Charge.	449.00	m2		
56	Supplying and applying one coat of approved matching primer and two coats of Anti Algal/Fungal, Weather proof, Exterior paint of approved colour, shade and make at all heights including cost and coveyance of all materials, labour, scaffolding, cleaning and preparing the surface by removing the dust, fungus, algae and efflorescence, including filling the dents, cracks and holes with matching putty, sealer and other incidentals etc complete and as directed by Engineer in-charge	446.00	m2		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
57	Supplying, fabricating and erecting in position built up tubular sections conforming to IS 4923 of required size and thickness (tubular, square or rectangular hollow tubes etc) for trusses, columns etc as per the approved drawings, including cost and conveyance of all materials, cutting, hoisting, fixing in position, welding electrodes and consumables, hire charges of welding equipment, bolts, nuts and washers ,closing the ends, drilling holes and applying two coat of synthetic enamel paint over a priming coat of Zinc chromate primer, etc complete as directed by the Engineer-In-Charge.	4.00	T		
58	Supplying and fabricating structural steel work conforming to IS 226/2062 including erecting in position, aligning the erected structures in line and level, bolting or welding wherever required as per approved drawing, cost and conveyance of all materials, labour, accessories, hire charge of tools and plants, welding equipment, cost of electrodes and applying two coat of synthetic enamel paint over a priming coat of Zinc chromate primer, etc complete as directed by the Engineer-In-Charge (provision of bolt holes to be made as required at no extra cost) as required including providing chequered plate wherever required as per drawing all complete.	0.50	T		
59	Providing & fixing at all heights, levels and locations coloured finish Galvalume Roofing/ Cladding sheets of thickness 0.60 mm, troughed profile of good formability and corrosion resistance including minimum end overlaps and appropriate side laps. The profile sheets shall be fixed to truss members in slope or required pitch or curvature with Hex cap headed self drilling/tapping Stainless steel screws 50 mm long with EPDM seal washer etc. all including cost and conveyance of labour, scaffolding and other incidentals etc. complete as per directions of the Engineer-In-Charge. (Cost of truss/frame work shall be paid separately).	230.00	m2		
60	Supplying and fixing in position coloured finish Galvalume plain sheet ridge capping of 0.6mm thk or nearest available thickness and 600mm width with a minimum overlap of 150mm at ends, including cost and conveyance of all materials, cost of Hex cap headed self drilling/tapping Stainless steel screws 50 mm long with EPDM seal washer, labour, all leads and lifts, other incidentals etc complete as per the direction of Engineer-In-Charge.	14.00	m		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
61	Supplying, jointing and fixing unplasticised Rigid PVC rain water pipes 110 mm diameter connecting to the drain through walls by clamping with necessary MS plates at sufficient intervals including cost and conveyance of all materials, labour other incidentals etc. complete and as per the direction of Engineer-in-Charge	74.00	m		
62	Providing, jointing and fixing unplasticised Rigid PVC moulded fittings/accessories, including cost and conveyance of all materials, labour other incidentals etc.complete and as per the direction of Engineer-in-Charge				
a	110mm coupler	11.00	Nos		
b	110mm Shoe	11.00	Nos		
c	110mm bend	42.00	Nos		
63	Supplying and fixing in position to line and level UPVC rain water gutter of 220mm height supported on gutter hanger including cost and conveyance of all materials, all accessories, hire charges of tools & plants, welding or bolting, all labour, cost of welding electrodes, other consumables, cost of bolts, nuts & washers, other incidentals etc. complete as per the direction of Engineer-in-charge	28.00	m		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
64	Supplying and fixing 18G rolling shutters of approved make with including painting with two coats of synthetic enamel paint over two coats of zinchromite primer, made of 80x1.25mm M.S. laths interlocked together through their entire length and joined together at the end by the end locks mounted on specially, designed pipes shaft with brackets, rolling shutter gear, top cover, side guides and arrangement for inside and outside locking with push and pull operation and two numbers of Godrej pad locks on each rolling shutter etc. including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge	28.00	m2		
65	Providing and fixing ball bearing for rolling shutters including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge	2.00	Nos		
66	Extra for providing grilled rolling shutters manufactured out of 8 mm dia M.S. bar instead of laths as per approved design including cost and conveyance of all materials, all labours, other incidental etc. complete as per the direcion of Engineer-in-Charge (area of grill to be measured).	6.00	m2		
67	Extra for providing mechanical device chain and crank operation for operating rolling shutters including cost and conveyance of all materials, labour, other incidentals etc. complete as per the directions of Engineer-In-Charge.	28.00	m2		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
68	Supplying, fabricating and fixing in position powder coated fully glazed aluminium single shutter openable door with outer frames sections 63.5x38.1mm, door top 50X 44.5 ,door bottom 100 X 44.5, door vertical 50X 44.5, door divider 50X 44.5 or nearest available size of approved make fixing with dash fasteners of required dia and size and sections shall be smooth, rust free,straight, mitred and jointed mechanically wherever required including cleat angle including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with silicon sealent, aluminium door gear,aluminium glazing clip etc as required with superior quality powder coated aluminium sections,fully glazed with 5mm plain glass fixed with EDPM beading ,including all fixtures like hinges, aluminium extruded section body tubular type universal hydraulic door closer, Brass cupboard lock 6 levers, ,Powder coated Aluminium handles 125 mm with plate 175 x 32 mm, beadings , cost and conveyance of all materials, all labour, other incidentals etc. complete as per the direction of Engineer-in-Charge	8.00	m2		
69	Supplying and fixing in position fully glazed super profile aluminium sliding window with powder coated aluminium heavy sliding shutters using following sizes or nearest available size 63.5x31.75mmx 1.5mm or nearest available size for frames, 38.10x16mm x 1.5mm or nearest available size for shutter interlock, vertical and horizontal and plain glass 4 mm thick including all fixtures like hinges, locking arrangements, stainless steel screws,handles, beadings etc, cost and conveyance of all materials, all labour, other incidentals etc. complete and as per the direction of Engineer-in-Charge	5.00	m2		
70	Supplying and fixing in position super profile aluminium fixed ventilators with powder coated aluminium grill, including all fixtures like stainless steel screws, beadings etc, including cost and conveyance of all materials, all labour, other incidentals etc. complete. as per the direction of Engineer-in-Charge	12.50	m2		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
71	Smooth finishing of the exposed surface of R.C.C. flooring work with 20 mm thick cement mortar 1:4 (1 Cement : 4 fine sand) using Hardening compound. After finishing the plastering, the concrete hardener manufactured by M/s.Sika, Pidilite, Fosroc or equivalent @ 4 Kg/m2 shall be spread with in 1 hour and the area to be trowelled smoothly. The area shall be cured for a minimum period of 7 days with ponding of water or using gunny bags., including cost and conveyances of all material, labour and other incidentals etc complete and as per the direction of Engineer-in-Charge	229.00	m2		
72	Providing and fixing stainless steel (Grade 304) hand rail and balusters made of Hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, i/c fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size,all hire charges of tools and plants, welding equipment, cost of electrodes, other consumables, all labour for fixing the handrails to the step and landing, all overhead charges,other incidentals etc. complete (for payment purpose only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.) as directed by Engineer-in -charge.	194.00	Kg		
73	Providing and laying 60mm thick factory made cement concrete interlocking paver block made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with M sand, locking edges with concrete including cost and conveyance of all materials, all labour, other incidentals etc. all complete as per the direction of Engineer-in-charge	67.00	m2		
				TOTAL AMOUNT EXCLUDING GST (C)	

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
PART-4:INDUSTRIAL WATER TANK					
74	Construction of Industrial Water Tank including but not limited to installation of piles, installing temporary sheet piles, earthwork excavation, dewatering, disposal of excavated earth, laying PCC (1:2:4), providing RCC M40 with reinforcement steel of grade FE500D or more, providing concrete block, plastering, applying primer and antifungal paint, fabricating and erecting built up tubular sections, supplying jointing and fixing PVC rain water pipes, rigid PVC moulded fixing, supplying and fixing DI covers, supplying and fixing 18G rolling shutters, providing ball bearing for rolling shutters, supplying and fixing aluminium fixed ventilators, providing and placing water stops, waterproofing for RCC structures, supplying and applying anticorrosive bitumastic paint, backfilling, providing and fixing stailness steel handrail and balusters, providing and laying 60mm cement concrete interlocking paver block etc. complete as directed by Engineer-in-Charge.	1.00	LS		
				TOTAL AMOUNT EXCLUDING GST (D)	
PART-5:FIRE WATER TANK					
75	Construction of Fire Water Tank including but not limited to installation of piles, carrying out routine vertical load testing of pile, installing temporary sheet piles, earthwork excavation, dewatering, disposal of excavated earth, laying PCC (1:2:4), providing RCC M40 with reinforcement steel of grade FE500D or more, providing concrete block masonry wall, plastering, applying primer and antifungal paint, fabricating and erecting built up tubular sections, supplying and fabricating structural steel, providing and fixing galvalume roofing sheet, supplying jointing and fixing PVC rain water pipes, rigid PVC moulded fixing, supplying and fixing DI covers, supplying and fixing 18G rolling shutters, providing ball bearing for rolling shutters, providing mechanical chain and crank operation, supplying and fixing aluminium fixed ventilators, providing and placing water stops, waterproofing for RCC structures, supplying and applying anticorrosive bitumastic paint, backfilling, providing and fixing stailness steel handrail and balusters, providing and laying 60mm cement concrete interlocking paver block etc. complete as directed by Engineer-in-Charge.	1.00	LS		
				TOTAL AMOUNT EXCLUDING GST (E)	

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
PART-5:MISCELLANEOUS ITEMS					
76	Dismantling cement concrete manually/mechanical means including disposal of materials including cost and conveyance of all materials, all labour, other incidentals etc all complete and as per instruction by the Engineer-in-charge	69.00	m3		
77	Dismantling steel work in single sections including dismembering and handing over to CSL including cost and conveyance of all materials, all labour, other incidentals etc all complete and as per instruction by the Engineer-in-charge	1641.00	kg		
78	Demolishing brick work manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material including cost and conveyance of all materials, all labour, other incidentals etc all complete and as per instruction by the Engineer-in-charge	11.00	Cum		
79	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish etc and shifting to a location within CSL site including cost and conveyance of all materials, all labour, other incidentals etc all complete and as per instruction by the Engineer-in-charge	446.00	Sq.m		
80	Dismantling and stacking fencing posts or struts and handing over chain links to CSL including all earth work and dismantling of concrete etc. in base of T' or 'L' iron or pipe including cost and conveyance of all materials, all labour, other incidentals etc all complete and as per instruction by the Engineer-in-charge	163.00	Sq.m		
81	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means in all kinds of soil including dressing of sides and ramming of bottoms, including cost and conveyance of all equipment, labour, dewatering upto 3m depth and other incidental etc. all complete as directed by Engineer-In-Charge. Temporary sheet piles as shoring for excavation shall be measured and paid separately.				

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
(a)	0-1.5m	1441.00	m3		
(b)	1.5-3m	196.00	m3		
82	Supplying and filling with M sand in layer not exceeding 15cm below manholes/chambers, ramming and dressing etc complete, including cost and conveyance of all labour, materials, equipments and other incidentals etc. as per the direcion of engineer in-charge.	38.00	m3		
83	Backfilling with available earth (excluding rock) in trenches in layers, including compacting each layer by rolling/ plate compactor/ ramming and watering, including cost and conveyance of all labour, materials and other incidentals etc. all complete as per drawing and direction of engineer in-charge	1305.00	m3		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
84	Disposal of excavted earth (unsuitable for backfilling and surplus earth), dismantled/demolished materials, waste materail encountered during excavation, from CSL site by mechanical transporting, including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of engineer in-charge	332.00	m3		
85	Providing and laying plain cement concrete 1:2:4 using 20mm down graded broken stones including cost and conveyance of all material, labour for mixing, laying, consolidating, curing etc complete and as per the direction of Engineer-in-Charge	51.00	m3		
86	Providing and casting Reinforced cement concrete of grade M40 for pipe duct banks and manholes with 20mm downgraded coarse aggregate in required slope and position including cost of shuttering, de-shuttering, compacting with mechanical vibrators, hacking, curing, scaffolding, all equipment, labour, pumping, incidental expenses but excluding cost of reinforcement, complete as directed by Engineer in-charge.				
(a)	All works up to plinth level	281.00	m3		
87	Supplying, cleaning, cutting, bending, supporting, binding with doube ply of 22 SWG soft annealed wire and placing in position high yield strength deformed TMT reinforcement bars conforming to IS:1786 of grade Fe 500D or more of approved make on/at all levels and locations as per drawings, including handling and transport complete for all RCC works including supplying and & placing concrete cover block, all equipment, labour, incidental expenses complete as directed by Engineer in-charge	56.00	T		
88	Supplying and fixing D.I. cover with frame for manholes of specified size (heavy duty), including cost and conveyance of all labour material and other incidentals etc. complete and as per the direction of Engineer-in-Charge				

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
(a)	600 X 600 mm rectangular cover	9.00	Nos		
(b)	900 x 900 mm rectangular cover	6.00	Nos		
89	Supplying, laying and jointing various size diamter uPVC pipes of Class 1 (IS:4985-2000) of approved quality through cable duct embedding in concrete, including cost of all fittings, materials, labour, sundries etc. complete as per the direction of the Engineer-in-charge.				
(a)	160mm dia	1901.00	m		
(b)	110mm dia	251.00	m		
90	Providing and laying 60mm thick factory made cement concrete interlocking paver block made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with M sand, locking edges with concrete including cost and conveyance of all materials, all labour, other incidentals etc. all complete as per the direction of Engineer-in-charge	226.00	m2		

Sl.No.	Description of Work	Quantity	Unit	Rate (in Rupees) (Both in Words and Figures)	Amount (in Rupees) (Both in Words and Figures)
91	Rerouting of feeder line using GI pipe of 150mm dia to existing Industrial water tank with 150mm GI gate valve, including cost and conveyance of all material , labour and other incidentals etc. complete and as per direction of Engineer-in-Charge	95.00	m		
92	Felling trees of girth (measured at a height of 1m above ground level) including cutting of trunks and branches, removing the roots and stacking of serviceable material and disposal of unserviceable material including cost and conveyance of all material , labour and other incidentals etc. complete and as per direction of Engineer-in-Charge	6.00	No		
				TOTAL AMOUNT EXCLUDING GST (F)	
				GRAND TOTAL EXCLUDING GST(A+B+C+D+E+F)	
				GST @ 18%	
				TOTAL AMOUNT INCLUDING GST	

Signature:
Name & Address of the Contractor:
Date:

Sd/-
Deputy General Manager (Infra Projects)
Cochin Shipyard Limited