E-TENDER DOCUMENT

FOR

Construction of Food Court, Canopy of Dynamotion building, Under Ground Fire Water Reservoir & Pump House at Science City, Kolkata

SCIENCE CITY
(NATIONAL COUNCIL OF SCIENCE MUSEUMS)
J.B.S HALDANE AVENUE
KOLKATA-700046

INSTRUCTIONS TO THE TENDERERS/BIDDERS FOR E-SUBMISSION OF BIDS ONLINE THROUGH E-PROCUREMENT SITE https://eprocure.gov.in/eprocure/app

This tender document has been published on the Central Public Procurement (CPP) Portal (URL: https://eprocure.gov.in/eprocure/app). The tenderers/bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates (DSC). The instructions given below are meant to assist the tenderers/bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal. More information useful for submitting online bids on the CPP Portal may be obtained at: https://eprocure.gov.in/eprocure/app

REGISTRATION

1) Tenderers/bidders are required to enrol on the e-Procurement module of the Central Public Procurement Portal (URL: https://eprocure.gov.in/eprocure/app) by clicking on the link"**Click here to Enrol** "on the CPP Portal. Enrolment is free of Charge.
2) As part of the enrolment process, the tenderers/bidders will be required to choose a unique username and assign a password for their accounts.
3) Tenderers/bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.
4) Upon enrolment, the tenderers/bidders will be required to register their valid Digital Signature Certificate (Class II or Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / TCS / nCode / eMudhra etc.), with their profile.
5) Only one valid DSC should be registered by a tenderers/bidders. Please note that the tenderers/bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.
6) Bidder then logs in to the site through the secured log-in by entering their user ID & password and the password of the DSC / e-Token.

SEARCHING FOR TENDER DOCUMENTS

1) There are various search options built in the CPP Portal, to facilitate tenderers/bidders to search active tenders by several parameters. These parameters could include organization name, location, date, value, etc. There is also an option of '**Advanced Search'** for tenders, wherein the tenderers/bidders may combine a number of search parameters such as organization name, form of contract, location, date, other keywords etc. to search for a tender published on the CPP Portal.
2) Once the tenderers/bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective "My Tenders" folder. This would enable the CPP Portal to intimate the tenderers/bidders through SMS / e-mail in case there is any corrigendum issued to the tender document.
3) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

PREPARATION OF BIDS

1) Tenderer/bidder should take into account any corrigendum published on the tender document before submitting their bids. Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and contents of each of the documents that need to be submitted.
2) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally they can be in PDF / XLS / RAR / DWF formats as mentioned. **Bid documents may be scanned with 100 dpi with black and white option.**
3) To avoid the time and efforts required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the tenderers/bidders. Tenderers/bidders can use "My Space" area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting the bid just by tagging and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

SUBMISSION OF BIDS

1) Tenderer/bidder should log into the site well in advance for bid submission so that he/she uploads the Bid in time i.e. on or before the bid submission time as per the system. Bidder will be responsible for any delay due to other issues.
2) Tenderer/bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.
3) Tenderer/bidder has to select the payment option as "offline" to pay the EMD and enter details of DD/any other accepted instrument.
4) Tenderer/bidder should prepare the TENDER FEE & EMD instrument as per the instructions specified in the tender document. Scanned copy of DD/any other acceptable instrument as mentioned towards EMD & Tender Fee should be uploaded while online submission of the tender and the original should be posted/couriered/given in person to the Tender Processing Section latest by the last date and time of bid submission or as specified in the tender documents. The details of the DD/any other accepted instrument, physically sent, should tally with the details available in the Scanned copy and the data entered during bid submission time otherwise the Tender will be summarily rejected.
5) The Tender Inviting Authority (TIA) will not be held responsible for any sort of delay or the difficulties faced during the submission of bids online by the tenderers/bidders. The bidder should see that the bid documents submitted should be free from virus and if the documents could not be opened, due to virus, during tender opening, the bid is liable to be rejected
6) Tenderers/bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. The price bid has been given as a standard **Rate Quote Sheet (Percentage BoQ Template)** in .xls format with the tender document, which is to be downloaded and to be filled by all the tenderers/bidders. Tenderers/bidders are required to download the **Rate Quote Sheet (Percentage BoQ Template)** file, open it and complete the green colored (unprotected) cells with their respective financial quotes and other details (such as name of the Tenderer/bidder). No other cells should be changed. Once the details have been completed, the tenderer/bidder should save it and submit it online, without changing the filename. If the **Rate Quote Sheet (Percentage BoQ Template)** file is found to be modified by the tenderer/bidder, the bid will be rejected. In e-Tendering, intending tenderer/bidder can quote their rate in figures only. The total amount is generated automatically. Therefore, the rate quoted by the tenderer/bidder in figures shall be taken as correct. The Comparative Statement is also generated automatically by the system. The Comparative Statement and rate quoted by each tenderer/bidder shall be downloaded. **The manual calculation check of tenders/bids and Comparative Statement, shall be final. In case, any discrepancy is noticed, the decision of appropriate NCSM authority shall be final and binding.**
7) The server time (which is displayed on the tender's/bidder's dashboard) will be considered as the standard time for referring the deadlines for submission of the bids by the tenderers/bidders, opening of bids etc. The tenderers/bidders should follow this time during bid submission. The tenderers/bidders are requested to submit the tenders/bids through online e-tendering system to the **Tender Inviting Authority (TIA)** well before the bid submission end date & time (as per Server System Clock).
8) All the documents being submitted by the tenderers/bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128 bit encryption technology. Data storage encryption of sensitive fields is done.
9) The uploaded tender documents become readable only after the tender opening by the authorized tender/bid openers.
10) Upon the successful and timely submission of tenders/bids, the portal will give a successful tender/bid submission message & a tender/bid summary will be displayed with the NIT/tender/bid no. or Name of Work and the date & time of submission of the tender/bid with all other relevant details.
11) The tender/bid summary has to be printed and kept as an acknowledgement of the submission of the bid. This acknowledgement may be used as an entry pass for any tender/bid opening meetings.

ASSISTANCE TO TENDERERS/BIDDERS

1) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the **Tender Inviting Authority (TIA): Director, Science City, J.B.S. Haldane Avenue, Kolkata – 700046. Ph. 033–2285-4343/1572/2607, Fax- 033-2285 9895. Website: www.sciencecitykolkata.org, Email : sctycal@cal.vsnl.net.in**
2) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed call to the 24x7 CPP Portal Helpdesk Ph. **1800-3070-2232.**

NOTICE INVITING e-TENDER
(e-NIT)

No: SCCY-15014/30(343) Dated: 31/08/2018

1. The **Science City, Kolkata** is a constituent unit under the National Council of Science Museums, Kolkata* (*hereinafter referred to as the Museum/Centre)

2. Online e-tenders (Percentage Rate Bid) are hereby invited from reputed and experienced Engineering/Technical contractors capable of carrying out the work of "**Construction of Food Court, Canopy of Dynamotion Building, Under Ground Fire water reservoir & Pump house at Science City, Kolkata"** with excellent finishing quality and having the following eligibility:-

   (i) **3(three)** similar completed works like Piling, Civil, Architecture, Sanitary & Plumbing, Canopy, Underground Water Reservoir & Pump House works etc.(at least one of them should be in Central Government / Central Autonomous Bodies/ State Government / Central Public Sector Undertakings / Reputed Corporate Bodies) each costing not less than 40% of estimated cost.

   OR

   (ii) 2(two) similar completed works like Piling, Civil, Architecture, Sanitary & Plumbing, Canopy, Underground Water Reservoir & Pump House works etc.(at least one of them should be in Central Government / Central Autonomous Bodies/ State Government / Central Public Sector Undertakings / Reputed Corporate Bodies) each costing not less than 60% of the estimated cost.

   OR

   (iii) 1(one) similar completed work like Piling, Civil, Architecture, Sanitary & Plumbing, Canopy, Underground Water Reservoir & Pump House works etc.(at least one of them should be in Central Government / Central Autonomous Bodies/ State Government / Central Public Sector Undertakings / Reputed Corporate Bodies) of aggregate cost not less than 80% of the estimated cost.

   And

   Agencies having valid GST Registration, PAN card & Aadhaar card if, applicable.

3. The place of work would be **at Science City, Kolkata, J.B.S. Haldane Avenue, Kolkata – 700046.**

4. **Important Information &Dates:**

Estimated cost of work	**5,80,90,509/-**
EMD Amount	14,53,000/-
Cost of tender document/tender fee	NIL
Period of completion of work	24 Months
Bid Document Publishing Date & Time	31/08/2018 at 5.00 PM
Bid Document Download Start Date & Time	31/08/2018 from 5.00 PM
Bid Document Download End Date & Time	29/09/2018 upto 6.00 PM
Bid submission Start Date & Time	03/09/2018 from 9.00 AM
Bid submission End Date & Time	29/09/2018 upto 6.00 PM
Bid Opening(Technical) Date & Time	03/10/2018 at 12.00 Noon

5. The intending tenderers/bidders must read the terms and conditions of **Science City, Kolkata** carefully. They should only submit their bid if they consider themselves eligible and if they are in possession of all the documents required.

6. Information and Instructions for tenderers/bidders posted on website shall form a part of the bid document.

7. The bid document consisting of plans, specifications, schedule of quantities of various types of items to be executed and the set of Terms and Conditions of the contract to be complied with and other necessary documents can be seen and downloaded from https://eprocure.gov.in/eprocure/app free of cost.

8. Out of the online bid documents submitted by intending tenderers/bidders, the technical bids of only of those tenderers/bidders shall be opened, who have deposited Earnest Money Deposit as specified duly scanned, uploaded and found in order. And the financial bids of only those tenderers/bidders shall be opened when they uploaded documents are found to be in order.

9. Those contractors not registered on the website mentioned above, are required to get themselves registered beforehand.

10. The intending tenderer/bidder must have valid Class II or Class III Certificates with signing key usage (DSC) to submit the bid.

11. The e-Tenders are invited under two envelopes system. The first electronic envelope will be named as **Technical Envelope** & will contain documents of tenderer's/bidder's satisfying the eligibility conditions, scanned copy of EMD, NIT etc. and the second electronic envelope will be named as **Financial Envelope** containing Rate Quote Sheet. The bidder shall submit **TECHNICAL BID ENVELOPE** and **FINANCIAL BID ENVELOPE** simultaneously. The technical bids will be evaluated first and thereafter financial bids of only the eligible tenderers/bidders shall be opened. These envelopes shall contain one set of the following documents:-

a) **TECHNICAL BID ENVELOPE** shall contain the following documents:

~~i) Scanned copy of Demand Draft/Pay order or Banker`s Cheque of any Nationalised/ Scheduled Bank towards TENDER DOCUMENT FEE in pdf format in favour of **Science City, Kolkata.**~~

ii) Scanned copy of Demand Draft/Pay order or Banker`s Cheque of any Nationalised/ Scheduled Bank towards Earnest Money Deposit (EMD)@2.5% of the tender value in PDF format in favour of **Science City, Kolkata** payable **at Kolkata.**

iii) Scanned copy of Enlistment Order/Registration certificate with appropriate Authority as applicable in PDF format, if any.

iv) Scanned copy of GST Registration Certificate, PAN card in PDF format.

v) Scanned copies of specific WORK EXPERIENCE CERTIFICATES/ WORK COMPLETION CERTIFICATE along with Work Order/Letter of intent issued by Govt. /Semi-Govt. /Autonomous/PSUs and/or Reputed Institution of requisite magnitude with appropriate Authority as per the NIT in PDF format.

vi) Scanned copy of UNDERTAKING (as per Annexure – "A") duly signed with company seal in PDF format which also includes the undertaking that "The physical EMD shall be deposited by me/us with the office of **Science City, Kolkata** payable **at Kolkata** calling the bid before the bid opening date otherwise the department may reject the tender/bid and also take action to withdraw enlistment/debar me/us from further tendering in NCSM or any of its constituent units."

vii) E-tender Document comprising of Schedule of Quantities/Specification and drawings in PDF format (TENDERXXXXX.pdf file) digitally signed.

a) **FINANCIAL BID ENVELOPE** shall contain:

(i) Rate Quote Sheet (Percentage BoQ Template) in XLS format. Bidders may quote their percentage rate in this envelope.

12. E-tenders which do not fulfil any of the above conditions or are incomplete in any respect are liable for summary rejection.

13. The Museum/Centre does not bind itself to accept the lowest e-tender/bid and the right to reject or accept any or all the e-tenders/bids, e-tendered items or schedules received without assigning any reason whatsoever.

14. Canvassing in connection with e-tenders/bids is strictly prohibited and the e-tenders/bids submitted by the e-tenderers/bidders who resort to canvassing will be liable for rejection on that ground alone.

15. E-tenders incorporating additional conditions are liable to be rejected.

16. The E-tenderer(s) must declare in writing that neither he nor any of them is in anyway related to any officer in the National Council of Science Museums, Kolkata, or any of its constituent units as per the format given in **Annexure – "A".**

17. All taxes including GST, Labour Cess, duties etc. on materials, freight & transit Insurance F.O.R. site in respect of this contract will be payable by the successful tenderer. Nothing extra will be payable for increase in such taxes, duties, Labour Cess etc., even if imposed or levied either before or after the e-tenders are opened or during currency of contract.

18. Before submitting the e-tender, the tenderer shall examine all specifications, drawings, conditions of contract and inspect the site if necessary. The e-tender must be balanced in respect of individual items so that the rates quoted shall remain in force even if the quantities deviate (increase or decrease) to any extent before or during the execution of the work. The successful tenderer/bidder shall be paid at their net rate quoted.

19. For the purpose of opening of the e-tenders/bids as described in Clause 11 of the Notice Inviting e-tender it is clarified that only on receiving the **EMD, physically in Science City, Kolkata** before the bid opening date, the **Technical Bid Envelope** will be opened. After the authority is satisfied that the documents in the **Technical Bid Envelope** are in order, the **FINANCIAL BID ENVELOPE** may be opened, subsequently.

20. It may be noted that the Technical Bid Envelope which are not found in order as per Science City, Kolkata requirements may be summarily rejected.

21. Earnest Money is liable to be forfeited if the successful e-tenderer/bidder selected for the work fails to sign the formal agreement within 15 days from the date of issue of Letter of Intent to them by the Museum/Centre.

22. The selected tenderer will be issued a Letter of Intent by the Museum/Centre and given 15 days mobilisation time which shall be counted from the date of issue of the Letter of Intent. Within the mobilisation time the tenderer must scrutinise all the working drawings, CPM/PERT/BAR CHART, specifications, etc. and obtain clarifications from the Architect wherever necessary and submit a revised BAR CHART if required by the Museum/Centre. During the mobilisation time, the tenderer shall also mobilise all their resources including men and materials, obtain the supply of water and electricity necessary for construction, erect a temporary cement godown at site if necessary and sign an Agreement with Museum/Centre in approved format at site on a non-judicial stamp paper of proper denomination. ***The date of commencement of work shall be the date of issue of Letter of Intent***.

23. The validity period of the e-tender shall be at least 03 (Three) months from the date of opening of e-tenders. This period may be extended with mutual consent if the decision regarding issue of Letter of Intent is delayed for any reason.

-x-x-x-

Appendix to NIT

1. SUMMARY CONDITIONS OF CONTRACT

Defect Liability Period	:	One year from the date of virtual completion as certified by the Museum/Centre.
Time for Completion	:	**24 (Twenty four) Months** from the date of Letter of Intent as per NIT Clause 22.
Minimum value of work for Interim Certificate	:	5% of tendered value or less at the discretion of the Museum/Centre but not more than one running bill in a month.
Earnest Money to be deposited with the e-tender	:	14,53,000/-(being 2.5% of the estimated value of the e-tender, rounded off to the nearest hundred).
Liquidated damages for non-completion of work in time (Clause 39d of the general conditions of contract).	:	One percent per week of the total cost of the work awarded subject to a maximum of 10% of gross value of work done or cost of the work awarded whichever is greater.
Liquidated damages for insufficient progress of work (Clause 39c of the general conditions of Contract).	:	Half percent per week of the total cost of the work awarded subject to a maximum of 10% of gross value of work done or cost of the work awarded whichever is greater.

2. RETENTION MONEYFOR INTERIM PAYMENT

Total	**:**	**10% as per following detail-**
i. EMD	:	2.5% of the tender value to be deposited with tender (ref. clause No. 11 of NIT)
ii. Performance guarantee	:	5% of tendered value to be deposited on award of work before signing of agreement through Demand Draft issued by a Nationalised Bank /Certified Cheque from a Nationalised Bank, government security, Bank guarantee bond from a nationalized bank as per format attached/ Fixed deposit receipt issued by nationalized bank. It is to be noted that the Performance guarantee is to be drawn or duly pledged as the case be, in favour of the **SCIENCE CITY** payable at **KOLKATA.**
iii. Retention Money	:	2.5% of the bill value to be deducted from each R.A. Bill during the progress of work.
iv. Period of submitting final bill by the successful tenderer	:	3 months from the date of virtual completion.

3. ESCALATION CLAUSE: As per Clause 30 of the General Conditions of Contract.

4. MATERIALS TO BE ISSUED (for civil works only)

1. Ordinary Portland cement/
   Portland Pozzolana cement
   at Rs…….. per
   metric tonne (in non-returnable bags)

2. Tor Steel Rs…… Per M.T.

   M.S. Round/Bars Rs…… Per M.T.

5. REMARKS (for civil works only)

Cement shall be issued by the Museum/Centre only for in-situ work or per-cast coffer slabs and not for preparing mosaic tiles or any other precast work. No white cement shall be issued by Museum/Centre. Steel rounds from 6 mm diameter and above (and not wire mesh or smaller size) shall be issued only for in-situ RCC work. No steel shall be issued for pre-cast work for non RCC work e.g. grills, window frames, door frames, railings, flats and bars etc. Cement and steel to be delivered by the Museum/Centre at site. It shall be the responsibility of the successful e-tenderer to erect at site an appropriate shed for proper storage of cement with a capacity for three months consumption. The stored cement shall be under double lock-with one key in custody of the successful e-tenderer and the other key in custody of the Museum/Centre so that the storage shed can be opened only in presence of both together. It shall be the responsibility of the successful e tenderer to arrange for electricity and water or any other service required for construction and to arrange for housing of their own staff outside the site.

FORMAT FOR BANK GUARANTEE BOND
(For EMD only)

1. In consideration of the (Name and address of the Museum/Centre) hereinafter called the Museum/Centre having stipulated under clause 10 of the Notice Inviting E-tender No. …….. for the work of (mention name of work as in NIT) at the aforesaid site agreed to accept payment of Earnest Money for due fulfilment of the terms and conditions contained in the said NIT (including appendix) for participation in the e-tender from (Name and address of the prospective e-tenderer) (hereinafter called the prospective e-tenderer) by production of a bank guarantee of (Mention amount of EMD in figure & words) only, we (Name and address of Bank furnishing guarantee (Br. Code ……..) (hereinafter referred to as "The Bank") do hereby undertake to pay to the Museum/Centre an amount not exceeding (mention EMD amount in figure & Words) only against any loss or damage caused to or suffered or would be caused to or suffered by the Museum/Centre by reasons of any breach by the said prospective e-tenderer of any of the terms or conditions contained in the said NIT (including appendix) relating to participation in the e-tender.

2. We, (Name of Bank), do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Museum/Centre stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the Museum/Centre under National Council of Science Museums by reasons of any breach by the said prospective e-tenderer of any of the terms or conditions contained in the said NIT (including appendix) or by reason of the prospective e-tenderer's failure to comply with conditions contained in the said NIT relating to participation in the e-tender. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the bank under this guarantee. However, our liability under this guarantee, shall be restricted to an amount not exceeding (mention amount of EMD in figures and words) only.

3. We, (Name of Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period as mentioned in Clauses 22 and 23 of the said NIT (including appendix) or the period stipulated under clause 24 for deciding the e-tender and that it shall continue to be enforceable till the dues of the Museum/Centre under or by virtue of the said NIT (including appendix) have been fully paid and its claims satisfied or discharged or the Museum/Centre certified that the terms and conditions of the said NIT (including appendix) have been fully and properly honoured and carried out by the said prospective e-tenderer for participation in the e-tender and accordingly discharges the guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before the periods stipulated above, we shall be discharged from all liability under this guarantee thereafter.

4. We, (Name of the Bank) further agree with the Museum/Centre that they shall have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to extend time of deciding the e-tender as may be expedient and to forbear or enforce any of the terms and conditions relating to the NIT (including appendix) and we shall not be relieved from our liability by reason of any such extension being granted to the said proposed e-tenderer for any forbearance, or act of

omission on the part of the Museum/Centre or any indulgence by the Museum/Centre to the said proposed e-tenderer or by any such matter or thing whatsoever which under the law relating to surety.

5. We, (Name of the Bank) lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Museum/Centre in writing.

Dated, the …….. day of ……..…….

For ……..
(Authorised signatory of the Bank with Seal)

FORMAT FOR BANK GUARANTEE BOND *

(For Performance Guarantee only)

1. In consideration of the ……..…….……..

……..……. (hereinafter called "The Museum/Centre") having agreed to exempt …….……..…… ..
……..
(Hereinafter called the "successful e-tenderer' from the demand, under Clause 10 of the Notice inviting E-tender No. …… dated …… and/or the terms and conditions of an Agreement dated …… Made between the Museum/Centre and successful e-tenderer(s) …… for ……(hereinafter called "the said agreement") of Earnest Money/Retention Money for the due fulfilment by the said Contract(s) of the terms and conditions contained in the said NIT or the conditions of (execution of work) or the agreement on production of a bank guarantee of Rs…… (Rupees …… only), We ……..…….(hereinafter referred to as "The Bank") do hereby undertake to pay to the Museum/Centre an amount not exceeding Rs……..…….. against any loss or damage caused to or suffered or would be caused to or suffered by the Museum/Centre by reasons of any breach by the said successful e-tenderer of any of the terms or conditions contained in the said NIT, the conditions of Contract or the Agreement.

2. We, ……. do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Museum/Centre stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the Museum/Centre under National Council of Science Museums by reasons of any breach by the said successful e-tenderer of any of the terms or conditions contained in the said NIT or the conditions of contract or the Agreement or by reason of the successful e-tenderer's failure to perform as per conditions contained the said NIT or the condition of contract or the Agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However our liability under this guarantee shall be restricted to an amount not exceeding Rs……..

Note:
(Bank guarantee bond towards Performance Guarantee as defined under clause 32 of the General Conditions of contract at the time of signing of agreement on award of work acceptable only if furnished by any of the Nationalised Banks.)

3. We, ……..…….. further agree that the guarantee herein contained shall remain in full force and effect during the period as mentioned in Clause 22 of the said NIT read with clause 32 of the conditions of contract, or the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till the dues of the Museum/Centre under or by virtue of the said NIT or the conditions of contract or the Agreement have been fully paid and its claims satisfied or discharged or the Museum/Centre certified that the terms and conditions of the said NIT or the conditions of contract or the Agreement have been fully and properly honoured and carried out by said successful e-tenderer and accordingly discharges the guarantee.

Unless a demand or claim under this guarantee is made on us in writing on or before the ……..

We shall be discharged from all liability under this guarantee thereafter.

4. We, …….. further agree with the Museum/Centre that they shall have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said successful e-tenderer from time to time or to postpone for any time or from time to time any of the powers exercisable by the Museum/Centre against the said successful e-tenderer and to forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said successful e-tenderer for any forbearance, or act of omission on the part of the Museum/Centre or any indulgence by the Museum/Centre to the said successful e-tenderer or by any such matter or thing whatsoever which under the law relating to surety.

5. We, ……..……..lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Museum/Centre in writing.

Dated, the …… day of ……

For ……
(Authorised signatory of the Bank with seal)

FORMAT FOR LETTER OF INTENT*

……. Date…….

(Mention file number)

Sub: Letter of Intent for the work of ……

Dear Sirs,

With reference to your e-tender dated ……..……(and further clarification vide letter number ……..…….. dated ……..…….) # it is intended to award the aforesaid work at the e-tendered amount of Rs……

(Value based on only items of work intended to be awarded for execution)

You are, therefore, requested to sign an agreement as per standard format already printed in the e-tender documents purchased by you while e-tendering for this job. For this purpose, you are requested to send us a non-judicial stamp paper of appropriate value for preparing the contract Agreement within a week from the date of this letter.

You may avail of 15 days mobilisation time from the date of issue of this letter of Intent for mobilising your men, materials and other necessary resources for the construction. During mobilisation period, you are requested to study all the drawings and designs annexed hereto and the Bar-Chart and obtain clarifications from the architect or this office immediately.

Please note that the work has to be completed within ……. weeks/months in which mobilisation time period of 15 days is also included. The date of commencement of work would be reckoned as the date of issue of this letter (as per clause 23 of NIT).

Thanking you,

Yours faithfully,

Sd/-
Sr. Controller of Administration

**** To be issued by the Controller of Administration of the parent Museum/Centre,viz, B.I.T.M, V.I.T.M., NSCM, N.S.C.D., C.R.T.L., National Council of Science Museums, even though the work is to be done in any RSC/SRSC/DSC.***

Letter of intent is to be issued in the letter head of the parent Museums/Centres and a Xerox copy is to be maintained as office copy on which signature of the authorised representative of the successful e-tenderer is to be obtained with date at the time of issue of original letter of intent.# Delete words within brackets if not applicable in specific case.

FORMAT FOR ARTICLES OF AGREEMENT

INSTRUCTIONS (not to be typed in Agreement)

(Articles of Agreement have to be typed on non-judicial stamp paper. The value of the stamp paper varies from state to state and is to be known from the particular place. The stamp paper will be purchased by the successful e-tenderer and the agreement may be typed by the Museum/Centre according to the format.)

ARTICLES OF AGREEMENT made at …….

……
(Place)

this…… day of ……..
(Date) *(Month & Year)*

between the ……

……..
(Name of the parent Museum/Centre)

(under the National Council of Science Museums, a Society registered under the Societies Registration Act of West Bengal, 1961), hereinafter referred to as the Museum/Centre which expression shall include its successors and assigns on the one part and.....

.....
(name of the successful e-tenderer)

trading in the name and style of ……..
……
……
……
(Name and complete address of the successful e-tenderer)

hereinafter referred to as the successful e-tenderer which expression shall include his/their respective heirs, executors, administrators and assigns on the other part.

WHEREAS the Museum/Centre is desirous of getting the work of ……..……
..…… therein done and has caused
(Name of the work)

Notice Inviting E-tender (Including appendix), drawings, schedule of quantities and specifications describing the work and conditions of contract to be prepared by…….
……
……

..……
(Name and address of the Architect).

AND WHEREAS the said NIT (including appendix) drawings as per list attached, specifications and the priced schedule of quantities and conditions of contract have been signed by or on behalf of the parties hereto. AND whereas the Successful e-tenderer has deposited in Cash or Bank Draft/Bank Guarantee a sum of Rupees ……..
……..….
(exact amount in words)

the amount being 2.5% of the estimated value of the e-tender rounded off to the nearest hundred) with the Museum Centre as Initial Security for the due performance of this Agreement as provided in the said conditions. In the case of Bank Guarantee, the period of Bank Guarantee referred to being valid until the defect liability period as specified in e-tender and to be revalidated to required dates as demanded by the Museum/Centre if completion date is extended.

NOW IT IS HEREBY AGREED AND DECLARED BY AND BETWEEN
THE PARTIES HERETO AS FOLLOWS:

1. In consideration of the payments to be made to him as hereinafter provided the successful e-tenderer shall upon and subject to the conditions herein contained execute and complete the work within …….. months from the date of issue of letter of intent (as defined under NIT clauses 5 and 23) and as per the said drawings and such further detailed drawings as may be furnished to him from time to time and described in the said specifications and the said priced schedule of quantities along with the progress of the building work.

2. The Museum/Centre shall pay to the successful e-tenderer such sum as shall become payable hereunder at the time and in the manner specified in the said conditions.

3. Time is the essence of this agreement and the successful e-tenderer shall proceed with the work, throughout the stipulated period of this contract, strictly according to the CPM/PERT/BAR CHART attached herewith and forming a part of this agreement. At any stage during execution, if any work lags behind the target as indicated in the CPM/PERT/BAR CHART for reasons directly attributable to the successful e-tenderer, he shall pay or allow the Museum/Centre to deduct from any money due to him a liquidated damage as per Clause 39 of the conditions of contract.

4. This agreement comprises the work above and all subsidiary works connected therewith, even though such works may not be shown on the drawings, or described in the said specifications or the priced Schedule of Quantities.

5. The Museum/Centre through the Engineer (As defined under clause 2 of General conditions of contract) reserves to itself the right of altering the drawings and of adding to or omitting any item of work or of having portions of the same carried out departmentally or otherwise and such alterations or variations shall not vitiate this agreement.

6. All disputes and differences of any kind whatever except as excluded under Clause 2 of General Conditions of contract appended herewith, arising out of or in connection with the contract on the carrying out of works (Whether during the progress of the work or after their completion and whether before or after the determination, abandonment or breach of the contract) shall be referred to arbitration as per Clause 44 of the said conditions of contract. In case of any legal dispute, other than the arbitration, the court of jurisdiction shall be at the place written in the first line of this agreement.

The provisions of the Arbitration & Reconciliation Act 1996 or any Statutory modification or re-enactment thereof and of the rules made there under for the time being in force shall apply to arbitration proceedings under this clause.

In witness whereof the parties have set their respective hands the day and the year and the place hereinabove written.

Signed by for and on behalf of the Museum/Centre ……..

……
(Administrative Officer)

In the presence of

1. ……
(Finance & Accounts Officer)

Seal

2. ……
(Section Officer/Engineer-in-Charge)

Signed by the said Successful e-tenderer …….

In the presence of

(1)……

Seal

(2)……..

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GENERAL CONDITIONS OF CONTRACT

1. INTERPRETATION

The terms as used in the e-tender documents and agreement and named hereunder shall have the meanings herein assigned to them except where the subject or context otherwise requires:-

"This agreement" shall comprise of the Articles of Agreement along with the Appendix, the Conditions of Contract, the Priced Schedule of Quantities, Specifications and Drawings and CPM/PERT/BAR CHART attached hereto and including those to which only a reference is made herein.

"Work" or "Works" shall mean all work or works defined by Bills of quantities, Drawings, Specifications and such other work or works as the successful e-tenderer may be entrusted with for carrying out under this agreement as per Clause 4 of the Articles of Agreement.

"Museum/Centre" shall mean National Council of Science Museums which shall include the persons for the time being in management of the Society and its assigns.

"Engineer" shall mean the Curator or Technical Officer authorised as such by the Museum/Centre or in the event of his ceasing to be Engineer for the work such other firm or persons as may be appointed by the Museum/Centre as Engineer for this work. (Further elaboration given in Clause 2 below):

"Successful e-tenderer" shall mean …….. and shall include his/their respective heirs, executors, administrators and assigns.

"Site" shall mean the site of the construction works as shown on the site plan attached hereto including any buildings and erection thereon and any other land adjoining these to (Inclusive) as aforesaid allotted by the Museum/Centre for the use of successful e-tenderer.

"Act of Insolvency" shall mean any act of insolvency as defined by the Presidency towns Insolvency Act, or the Provincial Insolvency Act or any Amending Statute.

"Notice in Writing" or "Written Notice" shall mean a notice or communication in written, typed or printed or printed characters sent (unless delivered personally or otherwise proved to have been received) by registered post to the last known private or business address or registered office of the addressee and shall be deemed to have received when in the ordinary course of post it would have been delivered. "Virtual Completion" shall mean that the works carried out are fit for occupation in every respect including removal of scaffolding, plant, surplus material and rubbish and cleaning of dirt from work and site.

Words imputing persons include firms and corporations words imputing the singular only also include the plural and vice versa where the context so requires.

Short headlines are given to each Clause for convenience only and they will not limit the meaning or scope of the Clause in any way.

2. ENGINEER

The plans, agreement and documents above mentioned shall form the basis of this agreement and the decision of the said Engineer or the other Engineer for the time being as mentioned in the said conditions, in reference to all matters or dispute as to material and workmanship shall be final and binding on both the parties.

The term "Engineer" shall mean the firm or person(s) appointed by the Museum/Centre to superintend the work. He/They will receive his/their instruction for the work from the Museum/Centre.

The successful e-tenderer shall afford the said Engineer(s) every facility and assistance for examining the work and materials and for checking and measuring works and materials.

The Engineer or any Authorised Assistant of the Engineer shall have power to give notice to the successful e-tenderer or to his Supervisors of non-approval of any work, or materials, and such work shall be suspended or the use of such materials shall be discontinued. The work from time to time be examined by the Engineer or the Engineer's Assistant but such examination shall not in any way exonerate the successful e-tenderer from the obligation to remedy any defects due to materials or workmanship not in accordance with the contract which may be found to exist at any stage of the work or may appear within the defects liability period mentioned in clause 20.

3. SCOPE OF THE CONTRACT

The successful e-tenderer shall carry out and complete the works in every respect in accordance with this contract and in accordance with the directions of the Engineer and to the satisfaction of the Engineer and the Museum/Centre. The Engineer may from time to time issue further drawings and/or written instructions, detailed directions and explanations in regard to:

(a) The variation or modification of the design, quality or quantity of works for the addition or omissions or substitution of any work.
(b) Any discrepancy in the drawings or between the schedule of quantities and/or drawing and/or specifications.

(c) The removal from the site of any material brought therein by the successful e-tenderer and the substitution of any other materials there from.

(d) The removal and/or re-execution of any works executed by the successful e-tenderer.

(e) The dismissal from the works of any persons employed thereupon.

(f) The opening up for inspection of any work covered up.

(g) The amending and making good of any defects under Clause 20.

The successful e-tenderer shall comply with and duly execute any work comprised in such instructions, detailed directions and explanations, provided always that if the Engineer's instructions involved variations from the priced Schedule of Quantities, such instructions shall be issued by the Museum/Centre and the successful e-tenderer shall take the action stipulated in Clause 34.

If the work shown on any such further drawings or detailed drawings or that may be necessary to comply with any such instructions, directions, or explanations be in the opinion of the successful e-tenderer, extra to that comprised in or reasonably to be inferred from the contract he shall before proceeding with such work, give notice in writing to this effect to the Engineer, and in the event of his not doing so three days before the commencement of such work the successful e-tenderer shall not be entitled to any allowance in respect of any such extra work. But if such notice has been duly given and the Engineer and the successful e-tenderer, fail to agree as to whether or not there is any extra, then if the Engineer decides that the successful e-tenderer is to carry out the said work, the successful e-tenderer shall do so accordingly, and the question whether or not there is any extra and if so, the amount thereof shall failing agreement be settled by the Arbitration as provided in Clause 44 on a reference being made by the successful e-tenderer.

4. SCOPE OF WORK

Even if not specifically mentioned in the schedule of quantities, the successful e-tenderer shall be deemed to have allowed necessary material, labour, tools and plants etc. required for satisfactory completion of the items of work as indicated in drawings and description given in the specifications, which are attached herewith unless the item specifies labour only or otherwise. Rates quoted also apply for work in patches, strips, small or large areas, and for different shapes and in different sizes and in different planes (Horizontal/vertical or inclined).

5. INSPECTION OF SITE

The e-tenderer must visit site before giving e-tender and must get acquainted with the working conditions.

The e-tenderer shall examine all specifications, e-tender conditions and drawings before e-tendering for the works.

The e-tenderer shall obtain all information relating to local regulations, bye-laws, application of any and all laws relating to his work or profession. No additional claims shall be admissible on this account.

6. WATER, ELECTRICITY AND CEMENT GODOWN

The successful e-tenderer shall construct at the site at their own cost temporary cement godown within the mobilisation time as described in NIT Clause 23, of appropriate size suitable for proper and safe storage of 3 months consumption of cement. They will also arrange at their own cost supply of water and electric power at site required by them for construction.

7. SUCCESSFUL E-TENDERER TO PROVIDE EVERYTHING NECESSARY

The successful e-tenderer shall provide everything necessary for the proper execution of the works according to the true intent and meaning of the drawings and specifications and bill of quantities taken together, whether the same may or may not be particularly shown on the drawings or described in the specifications or included in the bill of quantities, provided that the same is to be reasonably inferred there from and if he finds any discrepancy in the drawings, or between the drawings and specifications and bill of quantities, he shall immediately refer the same to the Engineer who shall decide which shall be followed. Figured dimensions shall be followed in reference to scale.

The Successful e-tenderer shall supply, fix and maintain at his cost during the execution of any works, all the necessary centering, scaffolding, staging, planking, timbering, shuttering, shoring, pumping, fencing, boarding, watching and lighting by night as well as by day required for the proper execution and protection of the public and the safety of any adjacent roads, streets, cellars, vaults, eves, pavement, walls, houses, buildings and all erections, matters or thing, and they shall take down and remove any or all such centering, scaffolding, etc. as occasion shall require or when ordered to do so and shall fully reinstate and make good all matters and all things disturbed during the execution of the works to the satisfaction of the Engineer before a Virtual Completion Certificate is issued.

The Successful e-tenderer shall make his own arrangements for laying temporary water and electrical power lines including excavation if necessary so as not to cause any obstructions along locations approved by the Engineer. The water supply lines, hose pipes, electrical lines, underground or overhead etc. belonging to them should not cause damage to the property of the museum/centre including gardens, plants, flowers, hedges, flower pots in the Campus etc. Any expenditure incurred by the museum/centre due to damage so caused shall be debited to the Successful e-tenderer's account. It is their complete responsibility to ensure that the garden area and its approaches and other areas not allocated to them are not encroached upon by their men and materials. They have to provide a fence at their cost to confine the activities of construction, labour and materials, to the construction area as approved by the Engineer or his representative. The

bitumen carpeted road in front of museum/centre's office, Science and Exhibits Laboratory, Stores and Workshop or garden paths and defined areas will not be allowed to be used by their labour, materials, trucks and other modes of transport system. Their labour is not allowed to use Campus grounds for baths, calls of nature etc.

The museum/centre shall on no account be responsible for the expenses incurred by the successful e-tenderer for hired ground or electric power or water obtained from elsewhere.

8. DRAWINGS, DESIGNS ETC.

Contract drawings are diagrammatic but shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the architectural and other service drawings.

Architectural drawings shall take precedence over electrical and other service drawings as to all dimensions.

Successful e-tenderer shall verify all dimensions at site and bring to the notice of the Engineer all discrepancies or deviations noticed. The Engineer's decision shall be final and binding.

All drawings issued by the Museum/Centre are the property of the Architects and shall not be lent, reproduced or used on any other works than intended without the written permission of the Architects.

Large size details and manufacturer's dimensions for materials to be incorporated shall take precedence over small scale drawings.

One complete set of drawings, specifications and schedule of quantities shall be furnished by the Engineer to the successful e-tenderer and the Engineer shall furnish, within such time as he may consider reasonable, one copy of any additional drawing which in his opinion may be necessary for the execution of any part of work. Such copies shall be kept on the works, and the Engineer and his representatives shall at all reasonable times have access to the same and they shall be returned to the Engineer by the successful e-tenderer before the issue of the certificate for the balance of this account under the contract.

Museum/Centre will make all efforts to give all drawings, designs; decision etc. from time to time and the successful e-tenderer shall make timely requests for the same. No claim whatsoever shall however be entertained for compensation for the delay in supply of drawings, designs, decisions, running payments, etc. from the Successful e-tenderer. Drawings shown at the time of issue of e-tenders and forming part of the contract shall indicate scope of work and drawings issued subsequently during the execution of work shall be deemed to be drawings elaborating the basic scheme. If any detailed drawings show an item for execution, which in the opinion of the successful e-tenderer is not covered under

the items of the contract, he shall immediately refer it to the Engineer, for final decision. Decision of the Engineer as to whether it is an extra item or not or whether it is covered by contracts and if not what extra rate should be paid shall be final and binding on both the parties to the contract i.e. Museum/Centre and the Successful e-tenderer.

9. REFERENCE DRAWINGS & SHOP DRAWINGS

Reference Drawings

The Successful e-tenderer shall maintain one set of all drawings issued to him as reference drawing. These shall not be used at site.

All corrections, deviations and changes made at the site shall be shown on these reference drawings for incorporation in the completion drawings. All changes to be made shall be initiated by the Engineer.

Shop Drawings

The Successful e-tenderer at his own cost shall submit to the Engineer as well as to the Architect four copies of shop drawings related to structural steel work, Aluminium door/window, bar bending schedule, Electrical work, Air conditioning work etc. for approval.

10. SCHEDULE OF RATES AND SPECIFICATIONS

Specifications as attached herewith shall be applicable. However, the e-tenderer shall include in his rates all such items of work which are not specifically included in the e-tender schedule but are required to be executed to complete the works in accordance with the drawings, specifications etc. The Museum/Centre is not bound to follow the practice and mode of measurements followed by other departments.

11. ERROR IN SCHEDULE OF QUANTITIES, IF ANY

Should any error appear in the bill of quantities, other than the E-tenderer's prices and calculation, it shall be rectified by the Engineer after informing the Museum/Centre. Such variation shall constitute a deviation of the contract and shall be dealt with as hereinafter provided.

12. NOMENCLATURE OF ITEM

Nomenclatures of the items of works mentioned in the priced schedule are only a brief description of the work. The work shall have to be executed in accordance with the specifications for the work to the satisfaction of the Engineer of the work. Any omission in description will not absolve the successful e-tenderer from his responsibilities to complete the work in a satisfactory manner.

13. METRIC UNITS

The bills of quantity indicate the unit of Metric system. The mode of measurement of different items of work shall be as per details contained in specification and special conditions, with the equivalent of the units mentioned therein in Metric System.

14. CPWD/PWD SPECIFICATIONS AND I S CODES

CPWD/PWD specifications & relevant I.S. Code of practice shall be applicable, for all items of work.

15. ORDER OF PRECEDENCE

If any discrepancy is noticed between the conditions and specifications, drawing etc. the following would be the order of precedence:

(a) Schedule of Quantities.

(b) Notice Inviting E-tender (NIT)

(c) General Conditions of Contract (GCC)

(d) Drawings and notes thereon.

(e) Specifications for General Building (civil works) Sanitary and Plumbing, Electrical Installation, Air-conditioning, Acoustic Treatment, Furniture making and/or Wood Panelling, Elevators and Escalators, etc.

(f) CPWD/PWD Specifications & I.S. codes.

16. SETTING OUT WORK ETC.

(a) The successful e-tenderer at his own expense shall set out the works and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions and alignment of all parts thereof. If at any time any error shall appear during the progress of any part of the work, the Successful e-tenderer shall at his own expense rectify such error if called upon to the satisfaction of the Engineer.

(b) All soil, filth, or other matter of an offensive nature taken out of any trench, sewer, drains, cesspool or any other place shall not be deposited on the surface, but shall be at once carted away by the Successful e-tenderer to some pit or place to be provided by him.

17. MATERIALS

All materials used for this work shall be conforming to the Specifications.

As far as practicable materials shall conform to the latest Indian Standards as amended upto-date. All materials used on the project shall be approved by the Engineer before use.

Successful e-tenderer may be required to purchase such materials of particular make or from a particular source if in the opinion of Engineer the same is necessary and is required for the proper and reasonable compliance of the specifications and in the interest of better quality of work. The fittings and accessories to be used in the work shall be presented for approval well in advance. Approved fittings shall be kept in the office of the Engineer in a mounted lockable board, to be approved by the successful e-tenderer.

(a) Storage of Materials

All materials shall be stored in a proper manner protected from natural elements so as to avoid contamination and deterioration.

Successful e-tenderer's store shall be open to inspection by the Engineer at all reasonable hours.

Locations of stores and storage yards shall be approved by the Engineer prior to construction or occupation.

Successful e-tenderer shall take adequate protection of the materials against fire and other calamities.

All watch and ward staff for his work shall be appointed and maintained by the Successful e-tenderer at his own expense.

b. Inspection and Testing of Materials

The Successful e-tenderer at his own expense shall make all necessary arrangements for carrying out tests on materials as required by the Engineer. He shall also be required to produce manufacturer's test certificates for the materials supplied by him whenever required by the Engineer. The tests carried out shall be as per the relevant Indian Standards in approved laboratories. The Museum/Centre reserves the right to appoint the testing authorities.

18. FAULTY MATERIALS AND WORK

(a) The Engineer shall during the progress of the work has power to order in writing from time to time the removal from the work, within such reasonable time or times as may be specified in the order, to any materials and/or

workmanship which in the opinion of the Engineer are not in accordance with the specifications or the instructions of the Engineer. The substitution of proper materials or any workmanship and the removal and proper re-execution of any work executed with materials or workmanship not in accordance with the drawings and specifications or instructions shall have to be forthwith carried out by the Successful e-tenderer at his own cost upon receiving such order. In case of default on the part of the Successful e-tenderer to carry out such order the Museum/Centre shall have the power to employ any other persons to carry out the same and all the expenses consequent thereon or incidental thereto shall be borne by the Successful e-tenderer and shall be recovered from them by the Museum/Centre from any money due to or that may become due to the Successful e-tenderer or from the amount of retention money.

(b) In lieu of rectifying the work not done in accordance with the contract the Engineer may, with the consent of the Museum/Centre allow such work to remain, and in that case may make allowance for the difference in value together with such further allowance for damage to the Museum/Centre as in their opinion may be reasonable.

Provided always that nothing in this clause shall relieve the Successful e-tenderer from his liability to execute the works in all respect in accordance with those terms and upon and subject to the conditions of this contract or from his liability to make good all defects.

19. ACCESS

The Museum/Centre or its representatives shall at all reasonable time have free access to the works and/or to the workshops factories or other places where materials are being prepared or constructed for the contract and also to any place where materials are lying or from which they are being obtained and the Successful e-tenderer shall give every facility to them for inspection, examination and testing of the materials and workmanship. Except the representative of Public Authorities and those mentioned above, no person shall be allowed on the works at any time without the prior written permission of the Engineer or the Museum/Centre.

If any work is to be done at a place other than the site of works the Successful e-tenderer shall obtain prior written permission of the Engineer for doing so.

20. DEFECT LIABILITY PERIOD AND DEFECTS AFTER COMPLETION

Defect Liability, Period shall be one year from the date of virtual completion of work, as certified by the Museum/Centre. Any defect, shrinkage or other faults, which may appear within the defect liability period, in the opinion of the Engineer, arising from materials or workmanship not in accordance with the contract or from failure to take due precautions, shall upon the directions in writing of the engineer and within such reasonable time as shall be specified therein be amended and made good by the Successful e-tenderer at his own cost. In case of default, the

Museum/Centre may employ and pay any other person/persons to amend and make good such defect, shrinkage or other faults and all damage, loss and expenses consequent thereon or incidental thereto shall be made good and borne by the Successful e-tenderer.

Such damage, loss and expenses shall be recoverable from the Successful e-tenderer by the Museum/Centre or may be deducted by them from any money due or that may become due to the Successful e-tenderer. The Museum/Centre may also in lieu of such amendments deduct from any money due to the Successful e-tenderer, a sum to be determined by the Engineer equivalent to the cost of amending such works, and in the event of the amount retained under Clause 32 (the amount held as retention money) being insufficient, recover the balance from the Successful e-tenderer, together with expenses the Museum/Centre may have incurred in connection therewith. The Successful e-tenderer shall remain liable under the provisions of this clause notwithstanding the signing by the Engineer of any certificate or the passing of any bills.

21. OPENING OF WORK

(a) All works under or in course of execution or executed in pursuance of the contract shall at all times be open to the supervision of the Museum/Centre, Engineer or their representatives.

(b) The Successful e-tenderer shall notify the Engineer in writing immediately after the trenches or excavations, as shown in the drawings, are executed or as soon as any ground is cut into which from unexpected causes, appears to need immediate attention. After notifying the Engineer he shall await instructions which shall be given within seven days of receipt of such notice. If the Successful e-tenderer puts in, any part of the foundations before he has notified the Engineer and received instructions, he shall be liable to reinstate all work that may subsequently at any time, be damaged on account of any defect or insufficient foundations. The Successful e-tenderer shall at the request of the Engineer, within such time as indicated by the Engineer, shall open up for inspection any other work and should the Successful e-tenderer refuse or neglect to comply with such request, the Museum/Centre through the Engineer may employ other workmen to open up the same. If the work has been covered up in contravention of Engineer's instructions, or if on being opened up, be found not in accordance with the drawings and specifications or the instructions of the Engineer, the expenses of opening up and covering it up again, whether done by the Successful e-tenderer or such other workmen shall be borne by or be recoverable from the Successful e-tenderer or may be deducted from any money due or which may become due to the Successful e-tenderer or from the amount held as retention money. If the work has not been covered up in contravention of such instructions, and be found in accordance with said drawings and specifications or instructions, the expenses aforesaid shall be borne by the Museum/Centre and shall be added to the contract sum provided always that in the case of foundations or of any other urgent work so opened up and requiring immediate

attention, the Engineer shall within seven days after receipt of written notice from the Successful e-tenderer that the Work has been so opened, make or cause to make the inspection thereof and at the expiration of such time if such inspection shall not so have been made, the Successful e-tenderer may cover the same and shall not be required to open it up again, except at the expense of the Museum/Centre.

22. WORK IN SUBSOIL WATER/RAIN WATER/WATER

If during execution of work, sub-soil water is met with, or water enters the working space due to rains or any other cause, the Successful e-tenderer shall do dewatering using pumps or manual labour and also carry out additional work consequent thereupon, including shoring, strutting, work in liquid mud, sludge etc. without extra payment.

23. HEIGHTS

Successful e-tenderer's rates shall include lifts upto all heights given in drawings or as required during execution. They should satisfy themselves for correctness and allow for variation if necessary. Nothing extra will be paid for additional lifts except where special items for lifts exist in schedule. E-tenderer shall include in his e-tender rates allowance for works at extra heights required for double or multiple staging, tall centering, scaffolding etc. for all items including extra labour if any. If any deviation from the contract drawings in respect of height is noticed by the e-tenderer in any subsequent working drawing issued to him during continuance of the works that must be brought to the notice of the Engineer (in writing) sufficiently before commencing execution of the work. The decision of the Engineer as to whether this will be an extra item or not or whether the Successful e-tenderer is entitled to get any extra payment or not for execution of this extra height will be final and binding.

24. SCAFFOLDING, CENTERING & SHUTTERING

The Successful e-tenderer shall use external scaffolding to ensure true line in vertical and horizontal planes. Centring, shuttering and scaffolding required for execution of this work may vary from single floor height to multifloor heights, which may require multiple staging, scaffolding, centring and shuttering. Since the payments will be made to the successful e-tenderer at net quoted rates, irrespective of the heights involved the e-tenderers must see and study the drawings carefully before e-tendering their rates.

25. GLAZING

If glass of required thickness is not available in the market the successful e-tenderer shall have to use next higher thickness available without any extra payment. Rate for glazing shall include for providing and fixing either clear or frosted glass as shown in drawings or as directed by the Engineer.

26. WOOD WORK

Sizes mentioned in schedule of quantity or in drawings are the finished sizes.

Successful e-tenderer shall allow necessary increase in sizes for planning required. In case the sizes of wooden members fixed are less than the one shown in the drawing schedule of quantity allowing for tolerance, payment will be made for actual size used at site. The rate quoted shall also include the allowance for curved or tapered or any other shape of the wooden member.

Wherever the wooden member abutts against masonry/RCC work, all the unexposed surfaces of wood work shall be required to be treated with two coats of suitable antitermite paint. E-tenderer's rates shall include application of two coats of antitermite paint.

27. SITE CLEARANCE AND CLEAN UP

The Successful e-tenderer shall, from time to time clear away all debris and excess materials accumulated at the site.

After all fixtures, equipment and appliances have been installed and commissioned, they shall clean up the same and remove all plaster, paints, stains, stickers and other foreign matter of discolouration leaving the construction in ready to use condition.

On completion of all works they shall demolish all temporary storages put up by them, remove all surplus materials and leave the site in a broom clean condition.

28. RATES

The rates quoted by the Successful e-tenderer shall be paid at net rates. He should include in his rates allowance for increase or decrease in the prices due to market fluctuation. He shall not be entitled to any separate amount on account of **GST, other taxes, Labour Cess, duties etc**. which are in force or will be enforced or enhanced by Government or local bodies during contract period or after e-tendering. Accepted e-tender rates shall not be changed due to changes in wages of labour either. Enhancement in rates shall be allowed on e-tender rates only as provided for in the Escalation Clause, given in Clause 30.

29. QUANTITIES

All the quantities given in schedule of quantities are provisional.

The e-tenderers shall be deemed to have given Balanced Rates for each item, irrespective of the quantities given. Also irrespective of variation in quantities to any extent the e-tenderer shall be paid at accepted contract rates only. Museum/Centre reserves the right to increase or decrease quantities to any extent.

30. ESCALATION CLAUSE

Payments for variation in prices and wages (escalation) will be admissible as per following details.

(i) Material Escalation: The increase in price of all materials beyond quoted rates will be compensated by the department as per formula given below:

$Vm = 70/100 \times (0.85v - (C+S) \times (WI - WI_0 / WI_0)$
Where:

Vm - Variation in materials cost i.e. increase or decrease in the amount in rupees to be paid or recovered.

V - Value of work done excluding advances on material, if any during the period under reckoning.

C - Cost of cement used in the work

S - Cost of Steel used in the Work

(Value of (C+S) shall be put in the formula if these materials are issued by the museum/centre). (Otherwise if cement and steel are not issued by the Museum/Centre, the value of (C+S) shall be taken as Zero).

WI - Average All India Wholesale Price Index for all commodities for the period under reckoning as published in the RBI Bulletin

WI_0 - Average All India Wholesale Price Index for all Commodities during the month of opening of the e-tender as published in the RBI Bulletin.

(ii) Labour Escalation: Increase in the cost of labour beyond quoted rates will be compensated by the museum/centre as per formula given below:

$VL = 30/100 \times (0.85V - (C+S) \times I - I_0 / I_0$
Where:

VL - Variation in labour cost i.e. increase or decrease in the Amount in rupees to be paid or recovered.

V, C & S - As stated under (I) above.

I - Average All India Consumer Price Index Number for Industrial Workers declared by Labour Bureau, Government of India, as published in RBI Bulletin during the period under reckoning.

I_0 - Average All India Consumer Price Index Number for Industrial Workers declared by Labour Bureau, Government of India, as published in RBI Bulletin during the month of opening of e-tender.

No Claims for other escalation on any account whatsoever will be entertained.

The amount of escalation will be calculated monthly for the work done in that particular month and will be paid for quarterly. Escalation is not permissible on successful e-tenderer's overhead and profit that explains the term 0.85V.

Ceiling on amount due to escalation – In no case total amount of escalation, to be paid for the entire work will exceed 20% of the total cost of the work based on the e-tendered rate.

31. SECURED ADVANCE

(a) The Successful e-tenderer shall not be entitled to be paid for the materials brought to site, which remains unused or unfixed. The Engineer, with the concurrence of the Museum/Centre may pay an advance upto 85% of the cost of such material as calculated from the respective e-tender item. When in any certificate, of which the Successful e-tenderer has received payment the value of material at site has been included, such materials shall become the property of the Museum/Centre but the Successful e-tenderer shall be liable for any loss or damage to any such material. They shall furnish an indemnity bond in the prescribed form along with their claim for advance against materials brought to site for *bonafide* use in specific items under the schedule of quantities.

(b) The secured advance so paid shall be adjusted in the running account bills as and when the materials are used subject to wastage.

(c) If the specification or schedule of quantities of the work provided use of any special description of materials to be supplied by the Museum/Centre or it is required that the Successful e-tenderer shall use certain stores to be provided by the Museum/Centre, such materials and stores and the price to be charged therefore as hereinafter mentioned, being so far as practicable for the inconvenience of the Successful e-tenderer but not so as in any way to control the meaning or effect of this contract, the Successful e-tenderer may be supplied with such materials and stores as and when required from time to time to be used by him for the purpose of

the Contract only, and the value of the full quantity of material and stores supplied at the rates specified in the said schedule appendix memorandum may be set off or deducted from any sum then due or thereafter to become due to the Successful e-tenderer under the contract or otherwise, or from the retention money or against the sale proceeds thereof, if the same is held up in Government Securities, the same or sufficient portion thereof being in this case sold for the purpose. All materials supplied to the Successful e-tenderer by the Museum/Centre shall remain absolute property of the Museum/Centre. The Successful e-tenderer shall be fully responsible for their storage and maintenance and shall not on any account remove those from the site of the work. The material shall at all times be open to inspection by the Engineer and/or the Museum/Centre. At the time of the completion of work or termination of the contract, or even earlier if so required by the museum/centre, the same shall be returned to them. The successful e-tenderer shall not be entitled to return any such material unless the same is, in the opinion of the Engineer of the Museum/Centre in perfectly good condition; and shall have no claim for compensation on account of any such materials so supplied to him as aforesaid being unused by him or for any wastage in or damage to any such materials.

(d) Owing to restriction in obtaining certain materials from the market, the Museum/Centre may undertake to supply certain materials at specified rates as stated in the appendix. In case of delay in supply of these materials by the Museum/Centre, the Successful e-tenderer is required to keep himself in touch with the day to day position regarding the supply of such materials from the Museum/Centre and to adjust the progress of the work in a manner that his labour do not remain idle, nor thereby lodge any claim due to or arising out of delay in obtaining such materials. No claim whatsoever shall be entertained by the Museum/Centre on account of delays in supply of these materials.

(e) The Successful e-tenderer shall ensure that only the required quantities of materials are got issued and the surplus quantities of materials, if in good condition, shall be taken by the Museum/Centre at the rates fixed in the Appendix.

(f) Essentiality Certificates/Permits/Recommendation Letters for materials available at controlled rates etc. would be given by the Museum/Centre, if required by the successful e-tenderer. It will, however, be their responsibility to obtain materials against the certificates or otherwise, and no claim on this account or any extension of time for completion of works will be entertained by the Museum/Centre. The Successful e-tenderer shall use materials thus procured exclusively in this work and for misuse, if any, he shall be solely responsible.

32. RETENTION MONEY

This shall mean and be 10% of the total cost of work awarded or the gross value of the work as paid for against this contract whichever is greater including the initial earnest money of 2.5%, performance guarantee of 5% and balance shall be recovered from the running bills and to be deposited through Demand Draft issued by a Nationalised Bank/Certified Cheque from a Nationalised Bank, government security, Bank guarantee bond from a nationalized bank as per format attached/ Fixed deposit receipt issued by nationalized bank. It is to be noted that the performance guarantee is to be drawn or duly pledged as the case be, in favour of the **SCIENCE CITY** payable at **KOLKATA.**

The successful e-tenderer shall have to extend the Bank Guarantee period, from time to time at least three weeks before the expiry of a Bank Guarantee to cover the defects liability period, reckoned from the date of virtual completion. In case they fail to extend the Bank Guarantee at least three weeks before its expiry, it shall be considered a breach of contract on the part of the successful e-tenderer and hence, the Museum/Centre shall be free to demand the Guarantee money from the Bank. 50% of the retention money will be refunded to the successful e-tenderer after six months of virtual completion of work and after the successful e-tenderer has rectified all the defects pointed out to him.

33. AUTHORITIES, NOTICES AND PATENTS

The successful e-tenderer shall confirm to the provision of any Act of the Legislature relating to the works, the Regulations and Bye-Laws of any corporations and of any electric and other Companies and/or authorities with whose systems the structure is proposed to be connected, and shall, before making any variation from the drawings or specifications that may be necessitated by so conforming, give to the Engineer written notice, specifying the variation proposed to be made, and the reason for making it, and apply for instructions thereon. If compliance with this clause involves any extra work not included in this contract, he shall specify these items of work and the allowance or extra payment required on their account. In case he shall not, within seven days, received such instructions, shall proceed with the work, conforming to the provision and/or regulation of bye-laws in question.

The amount claimed as an extra or whether there is an extra or not shall be decided by the Engineer and will be subject to arbitration clause if so required.

The successful e-tenderer give all notices required by the said regulations or bye-laws to be given to any authority and pay to such authority or to any public office all fees that may be properly chargeable in respect of the works and lodge the receipts with the bill.

The successful e-tenderer shall indemnify the Museum/Centre against all claims in respect of patent rights, and shall defend all action arising from such claims and shall himself pay all royalties, licence fees, damages, cost and charges of all and every sort that may be legally incurred in respect thereof.

34. DEVIATIONS

The successful e-tenderer may when authorise and when directed, in writing by the Engineer with the approval of the Museum/Centre add or omit or vary the works shown upon the drawings, or described in the specifications, or included the bill of quantities, but they shall make no addition, omission or variation without such authorisation or direction. A verbal authority direction by the Engineer shall, if confirmed by him in writing within seven days, be deemed to have been given in writing.

No claim for an extra shall be allowed unless it shall have been executed under the provisions of Clause 33 or by the authority of the Engineer with the concurrence of the Museum/Centre as therein mentioned. Any such extra if herein referred to, as an authorised extra shall be governed by Clause 35. No variation i.e. additions or substitutions shall vitiate the contract.

35. PRICE FOR DEVIATIONS

Deviations shall be valued at the net rates contained in the E-tenderers' original e-tender or where the same may not apply direct at rates analogous to the prices therein contained. If the altered, additional or substituted work included any class of work for which no rate is specified in the contract, then the Successful e-tenderer shall within seven days of the date of receipt of the order to carry out the work, inform the Engineer with a copy to the Museum/Centre the rate which he intents to charge for such class of work with proper analysis. In the event of his not doing so, within a reasonable time before the commencement of such work, he shall not be entitled to any allowance or payment in respect of any such extra work. When such notice has been duly given, the Engineer with the consent of the Museum/Centre may agree to such a rate but if the Engineer does not agree to this rate, the Engineer may cancel his order to carry out such class of work and arrange for it to be carried out departmentally or through any other agency or in such a manner as he may consider advisable or he may decide that the Successful e-tenderer shall carry out such items of work and in such case he shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him according to such rate or rates as shall be fixed by the Engineer which will, however be subject to the Arbitration Clause.

However, in respect of the rates for extra/new items, if there are any, the opinion of the Engineer as to whether it is an extra item or not, and if so, what rates should be paid shall be final and binding on the successful e-tenderer shall be derived from contract items so far as applicable and the rates which cannot be derived from contract will be fixed on the basis of actual cost of materials and

labour, plus 15% as successful e-tenderers' overheads and profits on all trades except on the cost of materials supplied departmentally.

Successful e-tenderer shall not claim any idle and remobilization charge for interim delay due to late decision by the Museum/Centre. Such legitimate interim delays shall however be considered for extension of time, if any.

Furthermore, they shall submit analysis of rates with justifications for claiming extra on any deviation item at least 45 days prior to the probable date of execution of the referred item.

36. MEASUREMENTS

In case of dispute between the successful e-tenderer and the Museum/Centre as to under which item a particular work is to be measured the decision of the Engineer shall be final and binding on both the parties to the contract. If for any items, the mode of measurements is not specified the decision of the Engineer about the mode of measurement shall be final and binding on both the parties to the contract.

37. PREPARATION OF RUNNING AND FINAL BILLS

Minimum value of work for interim certificate shall be 5% of tendered value (or less at discretion of the Museum/Centre) but not more than one running bill in a month.

75% advance bill against work done but unmeasured and adjustable fully in the next running bill may be certified by the Engineer, at his discretion in the interest of the work.

The Engineer or his representative shall take measurements in presence of Successful e-tenderer's representative and record them in the Measurement Book from time to time and shall prepare abstract for running and final bill, including recovery statements. The bill abstract shall be prepared on standard CPWD form on the basis of abstract of quantities prepared by the Engineer in triplicate. The Successful e-tenderer should sign the bill and Measurement Book with the remark "Measurement and bill accepted". However, in the final bill, the successful e-tenderer shall have to certify – "The bill is accepted in full and final settlement of all claims and demands against this work".

In case a large amount is blocked in the final bill pending technical/audit check, advance upto the extent of 75% of net final bill amount may be paid to the successful e-tenderer, with the approval of the Engineer at his direction even after the completion date is over.

The recovery from Running Account Bills for the materials issued by the Museum/Centre shall be made on the basis of the quantity consumed in the work as assessed by the Engineer, giving a due allowance for wastage. The Successful e-tenderer shall submit once a month a statement showing the materials

received, consumed and the balanced carried over to the subsequent month so that a watch could be maintained on the material.

38. CERTIFICATES AND PAYMENTS

(a) The Engineer may from time to time intimate in writing to the Successful e-tenderer that he requires the works to be measured and they shall attend or send qualified agent to assist the Engineer or the Engineer's representative in taking such measurements, and calculations and to furnish all particulars or to give all assistance required by the Engineer. Should they not attend or neglect or omit to send such agent then the measurement taken by the Engineer or approved by him shall be taken to be correct measurements of the work unless objected to within one month of their being recorded in the measurement book or books. Such measurements shall be taken in accordance with the mode of measurements mentioned in the specifications.

(b) The Successful e-tenderer or his agents may at the time of measurement take such notes of measurements as they may require.

(c) The Engineer or his authorised representative will issue on the basis of necessary measurement interim valuation certificates to the Successful e-tenderer in respect of items of work, rates for which exist in the priced schedule of quantities or have been subsequently agreed upon between the parties, and shall send the measurement books and the valuation certificates to the Museum/Centre. The Successful e-tenderer shall be entitled under these certificates of the Engineer to payments, within 15 days from the date of each certificate, unless objected as provided in sub-clauses (a) & (b) at the rate of maximum 90% of the value of work so executed and the balance being retained towards retention money. The engineer shall issue such certificates within fifteen days of notice from the Successful e-tenderer provided measurements have been taken and the value of the work done since last payment exceeds the amount stated in the appendix and not more than one certificate is required in a month, provided always that the issue by the Engineer of any certificate during the progress of the work or after their completion shall not have any effect as a certificate of satisfaction or relieve the Successful e-tenderer from his liability under Clause 20 and 21. Provided all defects are removed and the retention money is not forfeited or has not become liable to be forfeited under this contract, 50% of the amount under retention money shall be refunded without interest after six months from the date of virtual completion of the works and the balance after the defect liability period is over or the final bill is passed for payment whichever is later.

(d) All intermediate payments shall be recorded as payments by way of advance against the final payment only and not as payment for work actually done and completed. The final bill shall be submitted by the Successful e-tenderer within 3 months of the date fixed for completion of

the work. The measurement of the work taken by the Engineer or his representatives after one week's notice to the Successful e-tenderer shall be final and binding on him unless objected to within one month of their being recorded in the measurement books.

(e) The Museum/Centre may in consultation with the Engineer, but absolutely at his discretion, make an advance payment on account, which will be merged in the next intermediate payment, based on measurements.

(f) Advance for materials brought to site: The Successful e-tenderer shall execute a bond in favour of the Museum/Centre in the prescribed format attached hereto for each advance or intermediate payment received by him. If the Successful e-tenderer commits any default in the terms of the said bond and he fails to pay the bond amount, the Museum/Centre shall have the power to:

(i) Seize and utilise the said materials or any part thereof for the completion of the works.

(ii) Remove and sell by public auction the materials seized or any part thereof, and out of the proceeds of the sale, retain all sums repayable to the Museum/Centre together with interest thereon at the rate prescribed by Govt. of India from time to time for capital outlays.

(iii) Deduct all or any part of moneys owing from out of the retention money or any other sum or sums due to the Successful e-tenderer under this agreement.

(g) The Successful e-tenderer agrees that before final payment shall be made on the contract, he will sign and deliver to the Museum/Centre either in the measurement books or otherwise as required, a valid release and discharge certificate from any and all claims and demands whatever from the Museum/Centre for all matters arising out of or connected with the contract.

39. TIME AND DAMAGES FOR NON-COMPLETION OF WORK IN TIME

(a) All the construction works shall progress strictly as per the enclosed CPM/PERT/BAR CHART. If however, the Successful e-tenderer desires some minor modifications in the same he may apply to the Museum/Centre within mobilisation time and before execution of the agreement indicating the reasons for which changes are required. The Museum/Centre may after scrutiny, agree to the modifications suggested if the reasons cited by the successful e-tenderer are considered valid. The decision of the Museum/Centre in this respect will be final and binding. The modifications, if any, are to be incorporated in the CPM/PERT/BAR CHART and this will form a part of the agreement.

(b) The starting time specified for carrying out of the work as entered in the CPM/PERT/BAR CHART shall be reckoned from the date of issue of the Letter of Intent. The date of completion or such date as is duly extended under Clause 40 shall be strictly observed by the Successful e-tenderer. The work shall, throughout the stipulated period of the contract, be proceeded with all diligence (Time being deemed to be the essence of this Contract) by the successful e-tenderer strictly according to the CPM/PERT/BAR CHART which is a part of this agreement.

(c) At any stage during the execution of the work if the work lags behind the target indicated in the CPM/PERT/BAR CHART for reasons directly attributable to the Successful e-tenderer, he shall be liable to pay as agreed liquidated damages equivalent to half percent of the total cost of work awarded every week for the period the work lags behind the CPM/PERT/BAR CHART subject to a maximum of 10% of the total value of work, awarded or gross value of work done, whichever is greater.

(d) In the event of Successful e-tenderer's inability to complete the construction work by the scheduled date of completion, the Museum/Centre shall have the right to terminate the contract as per Clause 42 or allow the successful e-tenderer to continue and complete the work within specific date. In the latter case, during the period of continuation, the successful e-tenderer shall pay as agreed liquidated damage equivalent to one per cent of the total cost of work awarded for every week that the work remains unfinished subject to a maximum of 10% of the total value of work awarded or gross value of work done, whichever is greater.

40. EXTENSION OF TIME

If the successful e-tenderer shall desire an extension of time for completion of the work on the grounds of his having been unavoidably hindered in its execution and for reasons not attributable to him on the following grounds:-

(a) by reason of any exceptionally inclement weather like Cyclone, severe flood etc., normal monsoon shall not be considered a valid reason for extension of time,
(b) by reason of proceedings taken or threatened by, or legal disputes with adjoining or neighbouring owners,
(c) due to delay in the work of other agencies or tradesman engaged or nominated by the museum/centre: if such delay is directly responsible for delay in execution of this work,
(d) by reason of any general strike or lockout affecting the building made, strike or any kind of labour trouble in successful e-tenderer's own organisation shall not be a valid reason for extension,
(e) in the event of delay in execution of work wholly attributable to delay in supply of drawings by Architect or Museum/Centre in spite of request from the successful e-tenderer well in advance, he shall apply in writing to the

Engineer within seven days of the date of the hindrance on account of which he desires such extensions as aforesaid and the engineer, with the consent of the Museum/Centre may if reasonable ground be shown therefore allow such extension of time, if any, be necessary or proper.

(f) In case of the total value of the work exceeds the total value of the e-tender owing to deviation in quantities or extra items, the successful e-tenderer will be entitled to ask for extension of time in proportion to the increased value of work. Increase in value of work due to escalation as per Clause 30 shall not be a valid reason for extension of time.

(g) The successful e-tenderer hereby agrees that extension of time requested for by him and granted by the Museum/Centre shall be treated as an extension of time allowed to them without any claim for compensation or damages for any reasons whatsoever including those for which the extension is granted.

If an extension of time is granted by the Museum/Centre for reasons of delay not attributable to the successful e-tenderer as indicated above then the escalation clause will remain in force and the successful e-tenderer will be entitled to receive extra payments for variation in prices and wages subject to the ceiling limit of 20% of the total value of work as indicated in Clause 30.

However the museum/centre in the interest of work is, allows any extension of time for reasons of delay directly attributable to the successful e-tenderer, the escalation clause (Clause 30 of conditions of contract) will not remain in force during such extended period.

41. SUSPENSION OF WORK BY THE SUCCESSFUL E-TENDERER

If the successful e-tenderer suspends the works without obtaining extension of time or in the opinion of the Engineer neglects or fails to proceed with due diligence in executing his part of the contract or if he makes default more than once in the manner mentioned in Clause 20 above the Museum/Centre or the Engineer shall have power to give notice in writing to the successful e-tenderer requiring that the works be proceeded with reasonable speed and output must be commensurate with the CPM/PERT/BAR CHART. Such notice shall specify the act of default on the part of the successful e-tenderer. After such notice has been given the Successful e-tenderer shall not be at liberty to remove from the site of work or from any ground continuous thereto any plant or materials belonging to him which had been placed thereon for the purpose of the work, and the Museum/Centre shall have a lien upon all such plants and materials to subsist from the date of such notice being given, until the notice have been complied with. Provided always that such lien shall not under any circumstances subsist after the expiration of thirty one days from the date of such notice being given, unless the Museum/Centre has entered upon and taken possession of the works and site

and of all such plants and materials until the works have been completed under the power hereinafter conferred upon it. If the Museum/Centre exercises the above power it may engage any other agency to complete the works or finish the works departmentally and exclude the successful e-tenderer, his agents and servants from entry upon or access to the same except that the successful e-tenderer or any one person appointed in writing by him and accepted by the Museum/Centre may have access at all reasonable times during the progress of works to inspect, survey and measure the works. Such written appointments marked with Museum/Centre's consent or a copy thereof shall be delivered to the Engineer before the person so appointed comes to the works. The Museum/Centre shall take such steps as, in the opinion of the Engineer may be reasonable and necessary for completing the works without undue delay & expense, using for that purpose the plants and materials above mentioned, in so far as they are suitable and adopted to such use. Upon the completion of the works the Engineer shall certify the amount of expenses properly incurred, consequent on the incidental to the default of the successful e-tenderer as aforesaid, in completing the works by other persons. Should the amount so certified as the expenses properly incurred, including Museum/Centre's overhead if the works were carried out departmentally, be less than the amount which would have been due to the Successful e-tenderer upon the completion of the works by him, the difference shall be paid to the Successful e-tenderer by the Museum/Centre. Should the amount of the former exceed the later, the difference shall be paid by the Successful e-tenderer to the Museum/Centre. The Museum/Centre shall not be liable to make any further payment or compensation to the Successful e-tenderer for or on account of the proper use of the plants for the completion of the works under provisions hereinbefore contained other than such payment as is included in the contract price. After the works have been so completed by persons other than the successful e-tenderer under the provisions hereinafter contained, the Museum/Centre shall give notice to the Successful e-tenderer of such completion and may require him from time to time, before and after such completion, to remove his plants and likewise all such materials as aforesaid as may not have been used in the completion of the works, from the site. If such plants and materials are not removed within such reasonable time, the Museum/Centre may remove and sell the same, holding the proceeds, less the cost of the removal and sell, to the credit of the successful e-tenderer. The Museum/Centre shall not be responsible for any loss sustained by the successful e-tenderer from the sale of plants in the event of the successful e-tenderer not removing it after notice, or for any damage thereto or deterioration thereof in any event.

42. DETERMINATION OF CONTRACT BY THE MUSEUM/CENTRE

If the successful e-tenderer goes into liquidation, whether voluntary or compulsory or shall make an assignment or a composition for the benefit of the greater part, or shall enter into a Deed of Agreement with its creditors or if the Receiver of the Successful e-tenderer shall be unable, within fourteen days after notice to him requiring him to do so, to show to the reasonable satisfaction of the Museum/Centre that he is liable to carry out and fulfil the contract and if so required by the Museum/Centre to give reasonable security therefore or if the

successful e-tenderer shall suffer execution to be issued or shall suffer any payment under this contract to be attached by or on behalf of any of the creditors or the Successful e-tenderer or shall assign, charge or encumber this charge or encumber this contract thereunder or shall neglect or shall fail to proceed to perform all or any of the act, matters or things by the contract, to be observed and performed by the successful e-tenderer for three clear days after written notice shall have been given the successful e-tenderer in manner, matter hereinafter mentioned, requiring the successful e-tenderer to observer perform the same or shall use improper material or workmanship in carrying on the works or shall in the opinion of the Engineer not exercised such due progress as stipulated in the enclosed CPM/PERT/BAR CHART forming part of this contract which would enable the works to be completed within the time agreed upon or shall abandon the contract, then, and in any of said cases, the Museum/Centre may notwithstanding any previous waiver, determine the contract by a notice in writing in which case the retention money (including the earnest money and the initial security deposit) and whether paid in one sum or deducted by instalment shall stand forfeited and be absolutely at the disposal of the Museum/Centre. The Successful e-tenderer shall have no claim or compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made advances on account of or with a view to the execution of the work or the performance of the contract. The successful e-tenderer shall not be entitled to recover or be paid any sum for any work actually performed under the contract unless and until the Engineer will have certified in writing the performance of such work and the value of work payable in respect thereof and the successful e-tenderer shall only be entitled to be paid the value so certified. The certificate of the Engineer shall be based on measurements taken by him or under his supervision and with due notice to the Successful e-tenderer and on rates in the priced schedule or as subsequently communicated by the Engineer with the approval of the Museum/Centre, under this agreement except for arithmetical errors, shall be final and conclusive. The Successful e-tenderer must remove his plant, materials, scaffolding etc. from the site within 10 days (ten days) of the receipt of the notice from the Museum/Centre after which they will vest in the Museum/Centre who may, dispose them off as per Clause 41 by sale or auction on account of and at the risk of the successful e-tenderer who will have no claim for loss or compensation on this account.

43. TERMINATION OF CONTRACT BY SUCCESSFUL E-TENDERER

If payment of the amount payable by the Museum/Centre under the certificate of interim payment issued by the Engineer in accordance with clause 38 shall be in arrears and unpaid for sixty days after notice in writing requiring payment of the amount shall have been given by the Successful e-tenderer to the Museum/Centre in manner hereinafter mentioned or if works be stopped for six months under the order of the Museum/Centre for any reason not connected with any default on the part of the Successful e-tenderer or by any injunction or other order of any court of law made for any reasons not connected with any such default on the part of the successful e-tenderer then and in any of the said cases the successful e-tenderer shall be at liberty to terminate the contract by notice in writing to the Museum/Centre and he shall be entitled to recover from the

Museum/Centre payment for all works executed and for useful materials (but not plants) purchased for the purpose of the contract and is brought to the site. In arriving at the amount of such payment, the net rates contained in the successful e-tenderer's e-tender shall be followed, or where the same may not apply, rates proportional to the prices therein contained. Rates for materials may be determined by the Engineer on actual vouchers produced by the successful e-tenderer and/or prevailing market rates at the discretion of the Engineer. The Successful e-tenderer shall not be entitled to recover or be paid any sum for any work actually performed under the contract, unless and until the Engineer has certified in writing the performance of such work and the value payable in respect thereof and the successful e-tenderer shall only be entitled, to be paid the value so certified. The certificate of the Engineer shall be based on measurements taken by him or under his supervision after due notice to the successful e-tenderer and shall be final and conclusive except for arithmetical errors. The successful e-tenderer must remove his plant, materials, scaffolding etc. from the site within ten days or such time as may be extended by the Museum/Centre in writing, from the receipt of the notice from the Museum/Centre after which they will vest in the Museum/Centre who may dispose them off as per Clause 42 by sale or auction on account of and at the risk of the successful e-tenderer who will have no claim for loss or compensation on this account.

44. ARBITRATION

(a) Except where otherwise provided in the contract all questions and disputes relating to the meaning of the specifications, design, drawing, and instructions hereinbefore mentioned and so to any question, claim right, matter or thing whatsoever, in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the works, or the execution of the same whether arising during the progress of the work or after the completion or abandonment thereof but excluding disputes on material and workmanship as per Clause 17 & 18 which is binding on both parties, shall be referred to the sole arbitration of a person nominated by the Director General, National Council of Science Museums and if the former is unable or unwilling to act to the sole arbitration, of some other person appointed by the Director General, NCSM willing to act as such arbitrator. The submission shall be deemed to be submission to Arbitration under the meaning of the Arbitration & Reconciliation Act, 1996 or any statutory modification or re-enactment thereof for the time being in force. The award of arbitrator so appointed shall be final, conclusive and binding on all parties to this contract.

(b) It is agreed that the Successful e-tenderer shall not delay the carrying out of the work by reasons of any reference to arbitration and shall proceed with the work with all due diligence and shall, until the decision of arbitration, abide by the decision of the Engineer duly conveyed to him.

(c) The Arbitrator(s) may from time to time with the consent of the parties, extend the time for making and publishing the award.

45. COMPENSATION

All sums payable by way of compensation or liquidated damage under any of these conditions shall be considered as reasonable compensation to be applied to the use of Museum/Centre without reference to the actual loss or damage sustained and whether or not any damage shall have been sustained.

46. WORK ON HOLIDAYS

Successful e-tenderer shall not carry out work on any Government holidays except with the permission of the Engineer. The contract period will be inclusive of such holidays.

47. WORK SUPERVISOR AND FOREMAN

The Successful e-tenderer shall keep a qualified and experienced Engineer for supervision of works to ensure best quality work. He shall also give all necessary personal superintendence during the execution of the works and as long thereafter as the Engineer may consider necessary until the expiration of the 'Defect Liability Period' stated in Clause 20 above. The Successful e-tenderer shall also during the whole time, the works are in progress, employ competent Foreman approved by the Engineer whose qualification must conform to the requirements specified by the Engineer. In special cases he shall be constantly in attendance of the building while the men are at work. Any directions, explanations, instruction or notices given by the Engineer to such Foreman shall be held to be given to the Successful e-tenderer.

48. DISMISSAL OF WORKMEN ETC.

The Successful e-tenderer shall on the request of the Engineer immediately dismiss from the works any person employed thereon who may, in the opinion of the Engineer be unsuitable or incompetent or who may in the opinion of the Museum/Centre or the Engineer misconduct himself and such person shall not be again employed or allowed on the works without the written permission of the Engineer and/or the Museum/Centre.

49. ASSIGNMENT OR SUBLETTING OR BRIBES

(a) This contract shall not be assigned or sublet without the written approval of the Museum/Centre. If the Successful e-tenderer shall assign or sublet this contract, or attempts to do so or become insolvent or commence insolvency proceedings or make any composition with his creditors or attempt to do so, or if any bribe, gratuity, gift, loan, pre-requisite award, reward or advantage pecuniary or otherwise, shall either directly or indirectly be given, promised or offered by the Successful e-tenderer, any of his servants or agents to any officer of the Museum/Centre or to persons who shall become in any way directly or indirectly interested in the Contract, the Museum/Centre may thereupon by notice in writing rescind

the contract and the retention money of the Successful e-tenderer shall thereupon stand forfeited and be absolutely at the disposal of the Museum/Centre, and the same consequences shall ensure as if the contract had been rescinded under Clause 42 thereof and (in addition) the Successful e-tenderer shall not be entitled to recover or to be paid for any work therefore actually performed under the contract.

(b) The whole of the works including the contract shall be executed by the Successful e-tenderer and he/they shall not directly or indirectly transfer or assign or underlet the contract or any part, share or interest therein nor shall he take a new partner without the written consent of the Museum/Centre and no subletting shall relieve the Successful e-tenderer from the full and entire responsibility of the contract or from active superintendence of the works during the progress.

50. OTHER PERSONS ENGAGED BY MUSEUM/CENTRE

The Museum/Centre reserves the right to use the premises and any portion of the site for the execution of any work not included in this contract, which he may desire to have carried out by other persons, and the successful e-tenderer shall allow all reasonable facilities for the execution of such work, but is not required to provide any plant or materials for the execution of such works except by special arrangement with the Museum/Centre.

51. OTHER AGENCIES AND PROVISIONAL SUMS

(a) The Successful e-tenderer is to afford all reasonable facilities to all other agencies, sub-agencies, specialists, merchants, tradesman and others who may at any time be appointed by the Engineer with the consent of the Museum/Centre for executing any work or supplying any goods relating to the constructions, servicing, equipping or furnishing of the building under construction or in the compound. In case of delay in completion of his work due to other agencies' work, the Successful e-tenderer shall only have a right to ask for extension of time but no other claim on this or any other account shall be entertained by the Museum/Centre.

(b) If any provisional sum is included in the bill of quantities they are to be deducted wholly if not required or in part the Museum/Centre reserves to itself the right to appoint any agency to do the work allowed for in provisional sums and the successful e-tenderer shall not have any right to claim any profits on this account.

52. LABOUR WAGES AND REGULATIONS

Notwithstanding any contained in the conditions of this contract the Successful e-tenderer shall comply with the provision of the contract labour (Regulation & Abolition) Act 1970 and various rules framed there under by different State Government, in respect of all labourers directly or indirectly employed by the

Successful e-tenderer in the works through labour contracts or otherwise the Successful e-tenderer shall be considered as “Principal Employer”.

The Successful e-tenderer agrees to grant Provident Fund benefits in accordance with Employees Provident Fund Act 1962 and Scheme there under to his workers. The successful e-tenderer shall pay not less than “fair wages” to labourers engaged by him on the work. No labour below the age of fourteen years shall be employed. The successful e-tenderer shall at his own expense provide or arrange for provision of footwear for any labour doing cement mixing work.

53. INSURANCE FOR DAMAGE TO PERSONS AND PROPERTY

(a) The Successful e-tenderer shall be responsible for all injury to persons, animals or things and for all damages to property, structural and decorative, whether such injury or damage arise from carelessness or accident or in any way connected wherewith. This clause shall be held to include, *interalia*, any damage due to causes as aforesaid to buildings (whether immediately adjacent or otherwise) and to roads, streets, footpaths, bridges or ways as well as all damage caused to the buildings and works forming the subject of this contract by the inclemency of weather. The Successful e-tenderer indemnifies the Museum/Centre and holds him harmless in respect of all expenses arising from such injury or damage to persons or property aforesaid and also in respect of any claim made in respect of injury or damages consequent upon such claim.

(b) The successful e-tenderer shall reinstate all damage of every sort mentioned in this clause, so as to deliver up the whole of the contract works complete and perfect in every respect and so as to make good and otherwise satisfy all claims for damage as aforesaid to the property or third parties.

(c) The Successful e-tenderer also indemnifies the Museum/Centre against all claim which may be made upon the Museum/Centre during the currency of this contract by any employee or representative of an Employee of the agency, or any sub-agency, employed by him, for any injury to or loss of life or such employees, or for compensation payable under any law for the time being in force to any workman or to the representative of any deceased or incapacitated workmen.

(d) The Successful e-tenderer also indemnifies the Museum/Centre in respect of any costs, charges and/or expenses, including legal costs as between Solicitor and client, occurring out of any award of compensation and/or damages consequent upon such claims.

(e) The Museum/Centre shall be at liberty and is hereby empowered to deduct the amount of any damages, compensation cost, charges and/or expenses

arising or ascertaining from or in respect of any such claim and/or damages as aforesaid from any sum, or sums due to, or become due to the Successful e-tenderer.

54. NOTICE

Notice for the Museum/Centre, the Engineer or the Successful e-tenderer may be served personally or sent by registered post addressed to the office of the Museum/Centre or the last known place of business of the Engineer and the Successful e-tenderer or in the case of the successful e-tenderer also be being left on the works. Any notice sent by registered post shall be deemed to be served at the time when in the ordinary course of post it would be delivered.

55. APPOINTMENT OF APPRENTICES AS PER APPRENTICES ACT

The Successful e-tenderer shall during the currency of the contract when called upon by the Engineer engage and also ensure engagement by sub-agencies and other employed by the successful e-tenderer with the works such number of apprentices in categories mentioned below and for such periods as may be required by the Engineer. The Successful e-tenderer shall train them as required under the Apprentices Act 1961 and the Rules made thereunder and shall be responsible for all obligations of the Museum/Centre under the said act including the liability to make payments to apprentices as required under the said Act.

(a) **In Respect of Civil works**

(i)	Brick Layer	: One apprentice for every 7 person engaged in this category
(ii)	Building Construction	: One apprentice for every 7 persons engaged in this category
(iii)	Carpenter	: One apprentice for every 7 persons engaged in this category
(iv)	Surveyor	: One apprentice for every 14 persons engaged in this category

(b) **In respect of Sanitary and Water Supply**

Plumber		: One apprentice for every 2 persons engaged in this category

(c) **In respect of Electrical Works**

Wireman	:	One apprentice for every 7 persons engaged in this category

The Successful e-tenderer shall comply with the provision of Apprentices Act 1961 and Rules and Orders issued hereunder from time to time.

If the Successful e-tenderer fails to do so, his failure will be deemed to be a breach of contract and the Museum/Centre reserves the right to cancel the contract. The Successful e-tenderer also shall be liable to any pecuniary liability arising on account of any violation by him of the provisions of the Act.

~~56. CEMENT & STEEL (for civil works only)~~

~~Steel and Cement shall be supplied by the Museum/Centre to the Successful e-tenderer as stated in appendix to the NIT. If for any reason cement and steel is not available, the Successful e tenderer shall procure the same and complete the work in time after due intimation of the same to the Engineer. The quantities brought by the Successful e-tenderer would be replenished to the Successful e-tenderer at issue rates given in appendix when received, during or after completion of work but before payment of final bill. It shall be the Successful e-tenderer's sole responsibility to ensure that the quality of cement so brought conforms to required standard as specified and support this with Test Certificate for such consignments brought by him and allowed on the works by the Engineer. If steel of required diameters is not available but the Successful e tenderer could get substituted diameters by exchanging available diameters, in the interest of work, such an exchange would be authorised with the permission of the Engineer but without any extra cost to Museum/Centre. Successful e tenderer's rates shall be deemed to have been based on issue rates of cement and steel given in the appendix sheet of e tender and they shall have to use materials issued departmentally as per appendix.~~

~~Successful e-tenderer shall not refuse to receive marginal excess of cement and steel, quantities over and above as shown in the phased programme, if required so as and approved by the Engineer and such storage shall be without any extra cost to the Museum/Centre.~~

~~Receipt of cement and steel from the Museum/Centre's store should be carried out in quickest possible time by the Successful e-tenderer as a bulk supply, once the issue of stores is commenced at site, and without hampering the progress of the work at site.~~

~~Receipt of stores will include submitting indent in duplicate to the Museum/Centre at least two days prior to intended date of receipt. No stores shall be issued on Sundays and Holidays.~~

57. REGARDING WEIGHT OF MATERIALS SUPPLIED BY THE MUSEUM/CENTRE (for civil works only)

When cement is issued in bags, 5% variation in its weight shall be deemed to have been allowed for loss in handling. Each bag shall be deemed to weigh 50 Kg. The successful e-tenderer shall ensure that the correct quantity and only good quality cement is used on the works.

For reinforcement steel (mild or tor rounds, the weight for issue purpose and recoveries of cost thereof, shall be the actual weight i.e. R.R (Railway Receipt) weight or mill scale weight if supplied by wagon direct or truck weigh bridge weight recorded at producer's works or suppliers stockyard if delivery is by road.

If steel is issued from the Museum/Centre's store the successful e tenderer should arrange for necessary labour for weighment and shifting, loading etc. without any extra cost to the Museum/Centre. Steel may, alternatively, be issued by measurement of lengths (for which labour will be arranged by the successful e-tenderer, at his cost) multiplied by standard coefficients. However, the cost of issued steel will be recovered on the basis of weights indicated in the R.R. (Railway Receipt) or weigh-bridge challans issued by the concerned authority owning the weigh-bridge. Cost of recoveries of steel will be on the basis of weight recorded on the approved Weigh bridge challan irrespective of the method of measurement of steel on the works. It shall be the sole responsibility of the Successful e-tenderer to use appropriate diameter of rods for reinforcement in different structural components in accordance with the drawings and any damage to the structural members for non conformation to specifications and drawings shall be made good by the successful e-tenderer without any extra cost to the Museum/Centre. Since payment for steel would be made on basis of standard co-efficient on length, the successful e-tenderer should ensure that each dia of rods issued conform to standard co efficient, and in case it is not, he should at once report to the Engineer and get standard co efficient established for specific diameter and specific quantity. Weight of steel shall be measured correct to three decimal places. Standard co efficient will be established in presence of (a) Successful e tenderer's representative (b) stores officer or his representative (c) the Engineer.

Steel issued by the Museum/Centre as stated in appendix sheet shall mean mild steel rounds and tor steel to be used exclusively for RCC works. Steel for holdfasts, squares, flats, etc. are to be procured by the Successful e tenderer.

58. RETURN OF STEEL (for civil works only)

While receiving the surplus steel back from the successful e tenderer after the end of the project, the Museum/Centre shall not accept cut pieces less than 3 meters of length. The Successful e-tenderer should take care while cutting rod that the wastage is minimum i.e. he should cut required lengths in such a way that maximum steel is used out of quantity supplied or as directed at site by the

~~Engineer. Variation over 5% will be allowed by the Engineer, if he is satisfied about abnormal wastage.~~

~~59. CEMENT CONSUMPTION (for civil works only)~~

~~If the actual consumption of cement is more (upto 5% over theoretical consumption) or less (upto 5% below theoretical consumption) no additional recovery shall be made from the Successful e-tenderer. If the actual consumption exceeds 5% over the theoretical consumption, successful e-tenderer shall have to return the surplus cement issued over 5% allowable margin and if he fails to do so, recovery for excess cement shall be made at issue rate or market prevailing on completion date whichever is higher in lieu of issue rate. If however the Engineer is satisfied that excess cement over 5% has actually been used in the work including rectification and dismantled work, and that it has not been removed by the successful e-tenderer from site nor used wastefully, he may allow excess over 5% by waiving recovery at higher rate and his decision in this regard shall be final and binding. If the cement used is less than 5% and the work is of acceptable standard, recovery for cement less used shall be made at issue rates + 15% successful e-tenderer's overheads and profits after allowing 5% variation. C.P.W.D. Cement constants will be used for calculating theoretical cement consumption. 10% excess of cement consumption on handmixed concrete, if handmixing is permitted by the Engineer due to any reason, shall not be recovered from the successful e-tenderer, unless such consumption is due to the successful e-tenderer's faulty equipment.~~

60. CONCEALED R.C.C. BEAMS/LINTELS (for civil works only)

If in R.C.C. slab extra bars or steel cage is provided to act as a lintel or beam over an opening, the same will be measured as slab and not as beam/lintel. If in case of R.C.C. wall, extra bars or steel cage is provided to act as a lintel or beam over an opening, the same will be measured as wall and not as lintel/beam. R.C.C. column integrated in shear wall shall be measured as wall if of same thickness, and as R.C.C. column if its thickness is more than that of shear wall.

61. PROJECTION (for civil works only)

Slab projection from the face of wall/column shall be measured under item R.C.C. work in slabs and not under item R.C.C. work in chajjas.

62. DRIP GROOVE (for civil works only)

The Successful e-tenderer shall provide drip groove at all ends of slabs/lintels/beams, if required, to protect rain water from entering inside the boundary of the structure, within quoted rates of R.C.C. work.

63. PLASTERING ON RCC SURFACE (for civil works only)

Wherever R.C.C. surface are to be plastered to bring it in line with the brick and/or stone wall plaster of the same mix, payment for such plaster, will be made under the item of plastering only irrespective of the fact whether there is any increase due to odd or even surface of brick or stone work below and/or adjoining it.

64. M.S. REINFORCEMENT (for civil works only)

Rate quoted for placing in position and fabrication of mild steel/ribbed tor/TMT steel reinforcement should include for straightening and cleaning including removing the rust of the bars at works site, cutting, cranking, hooking hoisting at required levels, cost of providing binding wire of 18 to 20 SWG etc. complete and no separate payment will be made on this account. Payment for reinforcement, however, to be considered on the basis of measurement as per drawing plus standard laps actually provided at site, plus chairs and spacing bars allowed by the Engineer.

65. BRICK WORK (for civil works only)

Rate shall include for tapering of bricks over column footings, over walls, steps, etc. and for exposed brick work, or any other work. Rate for brick work also includes work in pillars and small horizontal courses.

66. BRICK WORK(S) HEIGHTS/DEPTHS (for civil works only)

The height or width of foundation steps and superstructures will be measured as per actuals. The successful e-tenderer shall use suitable bricks and adjust the thickness of mortar joints to make up the widths or heights as per drawings, with due regard to size of brick available.

67. EARTHWORK

The measurements of earthwork in trenches for foundation, sewer lines etc. shall be made according to the section of trenches shown on the drawing. The successful e-tenderer shall include in his rate excavating for stepping and slopping back, working space for workmen as found necessary on account of condition of soil. Excavation so made in excess shall not be measured & paid for.

FORMAT FOR
BOND FOR SECURED ADVANCES AGAINST SUPPLY OF MATERIALS

KNOW ALL MEN by these presents that I/WE …… ……. do hereby bind myself/ourselves, my/our respective heirs, executors, administrators and assigns to pay to the…….. ……. ……..……und er the National Council of Science Museums a Society registered under the Societies Registration Act, 1961 (hereinafter called 'The Museum/Centre') on demand a sum of Rs …….. (Rupees ……..... …… ……. only).

Dated this ……day of ……two thousand and ……only).

WHEREAS by an agreement dated……for work of ……...……the Museum/Centre has agreed in its discretion to allow advance on security of materials belonging to me/us and brought by me/us to the site of the works undertaken by me/us for construction purposes.

AND WHEREAS the Museum/Centre has agreed to advance to me/us a sum of Rs…….(Rupees…… ……only).

on the security of materials shown in the schedule below and the said Museum/Centre has granted advance of Rs……... ……..……

NOW THE CONDITIONS OF THE SAID WRITTEN OBLIGATION IS THAT IN THE EVENT OF THE SAID BOUNDEN

(a) not using the sum advanced for expediting the execution of the works under the said contract.

(b) offering as security properly, not absolutely his own property or encumbered in any manner.

(c) not acting in accordance with the terms of the agreement for the execution of the work.

(d) failing to make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the materials which shall remain in the site of the said works in his own custody and at his responsibility, open to inspection by the Museum/Centre or any officer authorised in that behalf.

(e) using the materials or any part thereof in such a manner as to be damaged or deteriorated in a greater degree than is due to usual wear and tear thereof.

(f) removing the said materials from the site of works except with the written permission of the Museum/Centre or any officer authorised in that behalf.

(g) failing to repay the advance in full before receiving payment of the price payable to him for the said work under the terms and the provision of the said agreement.

(h) defaulting in the performance or observance in any respect of any of the terms and the provisions of the agreement.

(i) or committing a breach in any manner whatsoever of any other terms of the contract or default in repayment of the money

AND upon his making such payment the above written obligation shall be void and of no effect, otherwise, it shall be and remain in full force and vital.

Provided always that it is hereby agreed and declared the decision of the Museum/Centre as to whether the said ……has or has not performed the obligations and observed the conditions hereinbefore recited shall be final and binding on the successful e-tenderer.

Signed by the above bounden
……

in the presence of

(1) ……

(2) ……

Annexure – "A"

(Format for Declarations & Undertaking to be typed on bidder agency's letterhead and to be submitted in Part–I (TECHNICAL ENVELOPE) of the e-tender document)

DECLARATION -1

This is to certify that neither I/we/any of us is in anyway related to any employee in the National Council of Science Museums, Kolkata, or any of its constituent units.

Date: (Signature of the tenderer)
with company seal/rubber stamp

Place:

DECLARATION -2

I/We hereby declare that I/we have not quoted any extra condition along with the Part-II (FINANCIAL ENVELOPE) of the e-tender.

Date: (Signature of the tenderer)
with company seal/rubber stamp

Place:

UNDERTAKING

This is to certify that I/we have carefully gone through the drawings/specifications, etc. given in the e-tender document & have clearly understood the site working conditions, time schedule given and have accordingly quoted my balanced rates after going through all details.

I/we hereby give an undertaking that I/we shall carryout the work strictly as per the given specifications, and shall complete the same within the stipulated time frame.

I/We also undertake that the physical EMD instrument in favour of **Science City** payable at **Kolkata** shall be deposited by me/us with the office of Science City, Kolkata inviting the e-tender before the bid opening date otherwise the Science City inviting the e-tender may reject the bid and also take action to withdraw my/our enlistment or debar me/us from further tendering in National Council of Science Museums or its constituent units.

Date: (Signature of the tenderer)
with company seal/rubber stamp

Place:

Science City

(National Council of Science Museums)
J.B.S. Haldane Avenue
Kolkata – 700046.
Fax: (022) 2285-9895

Information of contractors for "Construction of Food Court, Canopy of Dynamotion Building, Underground Fire water reservoir & Pump House at Science City, Kolkata"

(All information should be given in the following format with complete details)

1.	Name of the Firm	:	
2.	Type of Firm (Whether proprietorship or partnership or Ltd. Co.)	:	
3.	Full Postal Address	:	
4.	a) Telephone No(s).	:	
	b) Fax No(s).	:	
	c) Email ID	:	
5.	Description of major prestigious Civil construction, Piling works, etc. carried out in the **last 5 years** in Govt. /Semi-Govt./Autonomous organizations/ PSUs(Attach photocopies of the **work orders & completion certificates etc. and photographs)**	:	
6.	Whether the agency has specific experience in following types of works. Please provide details of works carried out with clients name, cost of work, completion period, testimonials etc. a. Frame structure for multi storied RCC building b. Sanitary & plumbing work with name of Associate, if the agency does not have in-house facility c. Piling work d. Underground Reservoir & Pump House construction. e. Water proofing work with name of Associate, if the agency does not have in-house facility f. Structural Glazing works.	:	

	g. Canopy works.		
7.	Present assignments if any (Submit supporting documents)	:	

8.	Technical staff employed and their qualifications	:	
9.	List of Mechanical & Electrical equipment owned by the firm such as Concrete mixture, Vibrators etc.		
10.	Does the firm possess knowledge of the following & if so, give details A) BAR Chart B) RMC work		
11.	Will the firm submit a performance guarantee if required.		
12.	Copies of the Income Tax return for the last three years & copy of the Permanent Account Number (PAN) Card may be enclosed.	:	
13.	GST Registration No.	:	
14.	Submit bank reference/ Solvency certificate from the bank (Nationalised) that the firm is capable of under taking said construction work.		

Certified that the information furnished above are true to the best of my/our knowledge. It is hereby declared that I/we will abide by the decision of Science City, Kolkata regarding finalization of tender.

Signature with Office Seal & Date

N.B: Attested copies of credentials/testimonials must be uploaded on CPP portal.

TECHINICAL SPECIFICATIONS

FOR

CIVIL AND ARCHITECTURE

TABLE OF CONTENT
(CIVIL WORK)

1. **PROPERTIES, STORAGE AND HANDLING OF COMMON BUILDING MATERIALS.**

2. **PILING WORK**

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4. **CEMENT CONCRETE PLAIN OR REINFORCED.**

5. **ANTI-TERMITE TREATMENT.**

6. **MASONRY AND ALLIED WORKS.**

7. **FINISH TO MASONRY AND CONCRETE.**

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12. **GLASS AND GLAZING**

13. **PAINTING, WHITE WASHING AND POLISHING, ETC.**

14. **ROOF WATER PROOFING, INSULATION AND ALLIED WORKS.**

15. **WATER SUPPLY.**

16. **DRAINAGE AND SANITATION.**

1.0 TECHNICAL SPECIFICATION
FOR
PROPERTIES, STORAGE AND HANDLING OF
COMMON BUILDING MATERIALS

1.00.00 SCOPE

The scope of this Section is to specify the properties, storage and handling of common building materials unless otherwise mentioned in drawings or schedule of items.

2.00.00 MATERIALS

a) Bricks

Bricks for general masonry work shall conform to IS:1077-(latest revision) and for face brick work shall conform to the specifications in IS:2691-(latest revision).

Bricks for general masonry work shall be of first class (Class-A) quality, well burnt, of uniform size, shape and colour, free from cracks, flaws or free lime and emit clear ringing sound when struck. Fractured surface shall show uniform texture, free from grits, lumps, boles, etc. Compressive strength shall be 50 Kg. / sq cm minimum for face bricks. Water absorption after 24 hours immersions shall not exceed 15% by weight for common bricks and 12% for face bricks. Dimensional tolerance shall not exceed 8% of the size shown in drawings for common bricks and 3% for face bricks. All bricks shall have rectangular faces and sharp straight edges. Maximum permissible chipping for face bricks shall be 6 mm at the edges and 10 mm for corners. The bricks shall show no effloresce after soaking in water and drying in shade.

Full masonry with 100 mm thick AAC blocks as per CPWD specification

b) Cement

Cement used shall be ordinarily Portland Cement conforming to Code for ordinary cement in IS:269 (latest revision) and shall be fresh when delivered. The Contractor shall submit the manufacturer's certificate for each consignment of cement procured to the Engineer. If the cement is procured by the Owner and issued to the Contractor, the Contractor shall satisfy himself at the time of taking delivery that the quality, quantity and freshness of cement are up to the specified standards. No complain later on regarding the cement supplied by the Owner shall be entertained and all rectification work on this account shall be done by the Contractor at his own expense. If at any time, the Engineer feels that the cement being used by the Contractor is not up to specification, he may stop the work and send the samples of the cement to a testing laboratory for standard tests and all expenses incurred thus shall be borne by the Contractor. The Contractor shall also have no claim for this type of suspension of work.

c) Coarse Aggregates

Coarse aggregates shall be as per IS:383 (latest edition), consisting of hard, strong and durable pieces of crushed stone and shall be free from organic or clay coatings and other impurities like disintegrated stones, soft flaky particles etc. and any other material liable to affect the strength, durability or appearance of concrete.

Aggregates other than crushed stone conforming to the provisions of specification may be used if permitted by the Engineer.

Washing of aggregates by approved means shall be carried out, if desired by the Engineer.

Grading of coarse aggregates shall generally conform to IS:383 (latest revision) and shall be such as to produce a dense concrete of the specified proportions and strength and of consistency that will work readily into position without segregation.

d) Sand

Sand shall be hard, durables, clean and free from adherent coatings or organic matter and shall not contain clay balls or pellets. The sand shall be free from impurities such as iron pyrites, alkalis, salts, coal, mica or other laminated materials in such forms or quantities as to affect adversely the hardening, strength, durability or appearance of mortar, plaster or concrete or to cause corrosions to any metal in contact with such mortar, plaster or concrete. All sand shall be properly graded. Unless otherwise directed by the Engineer all sand shall pass through IS Sieve No. 240 and 15 to 35% of and for masonry mortar and 5 to 50% of sand for plaster shall pass through IS Sieve No. 30. Sand for concrete shall conform to IS:383 (latest revision).

e) Water

Water shall be clean, fresh and free from organic matters, acids or soluble salts and other deleterious substances which may cause corrosion, discolouration, efflorescence etc.

f) Reinforcement

Reinforcement steel shall be clean and free from loose mill scales, dust, loose rust, oil and grease or other coatings which may impair proper bond. Structural steel shall conform to IS:76 (latest revision). Mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement shall conform to IS:432 (latest revision). Cold twisted steel bars shall conform to IS:1786 (latest revision). Hexagonal wire netting shall conform to IS:3150 (latest revision). All steel bars including and above 10 mm diameter shall be of tested quality. All wire netting shall be galvanized.

3.00.00 STORAGE AND HANDLING OF MATERIALS

a) Bricks

Bricks shall not be dumped at site. They shall be stacked in regular tiers, even as they are unloaded, to minimize breakage and defacement of bricks. Bricks selected for different situation of use in the work shall be stacked separately.

b) Cement

The cement shall be stored above the ground level in perfectly dry and watertight sheds. The bags shall be stacked in a manner so as to facilitate removal or first in first out basis. Any material considered defective by the Engineer shall not be used by the Contractor and shall be removed from the site immediately.

c) Coarse and Fine Aggregates

Aggregates shall be stored on brick soling or an equivalent platform so that they do not come in contact with dirt, clay, grass or any other injurious substances at any stage. Aggregate of different size shall be kept in separate stacks. If so desired by the Engineer aggregate from different sources shall be stacked separately with proper care to prevent intermixing.

d) Reinforcement

Reinforcement bars shall be stored off the ground and under cover if so desired by the Engineer. If necessary, a coat of cement wash shall be given to the bars to guard against rusting.

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2.0 TECHNICAL SPECIFICATION

FOR

FOR UNIFORM DIA. BORE CAST-IN-SITU RCC PILES

SPECIFIC REQUIREMENTS FOR UNIFORM DIA. BORE CAST-IN-SITU RCC PILES OF CIVIL/STRUCTURAL WORKS

1.0 SCOPE OF WORK

1.1 The work covers the installation & testing of straight shaft Auger cast-in-situ piles under civil/structural works tender .

1.2 The work involves but not limited to the following:

a) Construction of 500mm uniform diameter straight shaft RCC **BORE cast-in situ.** The approximate length of piles below cut-off level and approximate number of piles are as follows:

	Type of Pile	Dia of Piles (mm)	Approx. nos	Approx. length below cut-off level (m)
1.0	BORE cast- in-situ	500	60	14.35

b) Carrying out of Initial load tests as specified on the test piles specifically installed for the purpose and Routine load tests as specified on randomly selected job piles selected by Engineer-in-charge.

2.0 AVAILABLE INFORMATION

From the available soil report, it is revealed that subsoil at this location is predominantly non-plastic sandy silt with clay followed by non-plastic silty sand with gravel up to the termination depth of borehole (maximum 30.0m depth). Thin layer of low to medium plastic silty clay has been noticed between the above non-plastic layers of varying thickness.

Tenderer shall be deemed to have satisfied himself in every respect with regard to the subsoil conditions prevailing at proposed site and any claim (in terms of time & cost) emanating from local variation of data of subsoil condition shall not be entertained by the owner / EIL.

3.0 REQUIREMENTS

3.1 All work shall be carried out in accordance with the specifications enclosed herewith and contractor shall ensure minimum requirements as laid down hereunder:

3.2 Pile Type

The piles shall be 500 mm uniform dia straight shaft RCC Auger Cast-in-situ piles.

3.3 SAFE LOAD CARRYING CAPACITY

Tenderer shall guarantee the following minimum safe load capacities for the Piles.

Sl. No.	MODE	SAFE LOAD CAPACITY IN TONNES
I	Vertical Compression	29
II	Uplift	20
III	Lateral	3.4

* Pile capacity is as per envisaged loading.

The pile capacities shall be established at site by carrying out load test on test piles and job piles as per requirements of relevant EIL / Indian standards.

NOTE: The above capacity may be increased by 25% under Wind/seismic conditions.

3.4 TERMINATION OF PILES

Piles are designed with pile tip resting in dense to very dense silty sand / sandy silt layer and founding strata of piles shall be established by conducting SPT at 12.0m, 13.50m & at termination depth of pile at few pile locations (at least 1 in 10 nos of pile.) as per direction of Engineer-in-charge. The depth / level of termination depth in all cases shall be certified by Engineer-in-charge.

4.0 MATERIALS

4.1 Materials shall conform to EIL specification no. 6-74-0006 enclosed and forming a part of the tender.

4.2 Concrete

The concrete shall have a minimum strength of 25 N/mm^2 at 28 days. The cement for concrete shall be Ordinary Portland / Portland Pozzolana / Portland Slag cement Having minimum cement content not be less than 400 kg/m^3 with slump and water- cement ratio of 0.45 as per IS:456 and IS:10262. The allowable slump shall be as per relevant latest revision of IS codes (IS: 2911 Part I/Sec.2) (latest revision). The Engineer-in-charge may allow marginal adjustment in water/cement ratio to obtain concrete of good workability. The other concrete specifications shall be as per relevant clauses of Design, Construction & Installation of Bored cast-in-situ piles (EIL Specification No. 6-74-0011) forming part of this tender.

4.3 Reinforcement

Reinforcement shall conform to IS:1786 (latest revision). The reinforcement in the pile shall consist of the following:

a) Longitudinal Reinforcement:

Reinforcement shall be 6 nos. 16mm dia bars up to 6.0m below C.O.L and thereafter 3 nos. 16 mm dia bars 3 nos. 12 mm dia bars up to termination length of pile.

b) Stirrups

Laterals shall be of 8mm dia high strength deformed bars of grade Fe 500 conforming to IS 1786 (latest revision) at 150mm c/c preferably in the form of lateral ties.

c) Spacer

Spacers shall be of 16 mm dia high strength deformed bars of grade Fe500 conforming to IS 1786 (latest revision) and shall be provided at an interval of 1.50m.

d) Cover

Clear cover to reinforcement shall be 50 mm.

5.0 INSTALLATION

5.1 Installation of piles shall be carried out in accordance with the pile lay out drawings which shall be available to the contractor at the time of execution of work.

5.2 **Cut-off level of the piles shall correspond to those given in the working drawings**.

5.3 To ensure dense and sound concrete up to cut-off level, concreting shall extend 900 mm above cut-off level. However, no extra payment shall be made for this and quoted rates shall be inclusive of this.

5.4 The reinforcement cage shall essentially consist of a single segment. If, for any reason, the reinforcement cage is made up of more than one segment, the bars shall be assembled before lowering either by welding or by providing necessary laps as per IS:456 (latest revision).

5.5 The vertical reinforcement shall project 50 times its diameter above the cut -off level.

5.6 Pile shall be constructed by continuous mud circulation technique and the concrete shall be placed by tremie. All precautions for obtaining clean and sound pile shaft shall be strictly observed.

5.7 For tremie concreted piles, a sample of drilling fluid shall be taken from the base of the borehole by means of an approved sampling device in the first few piles and at suitable interval of piles thereafter. Concreting shall not proceed if density of fluid exceeds 1250 kg/m^3. The sand content in the fluid shall not exceed 7 percent.

6.0 MEASUREMENT OF PILES

6.1 **The piles shall be measured and paid for the actual pile length from pile tip to the cut off level**, given in the working drawings or as indicated by the Engineer-in- charge. No extra payment shall be made for empty boring. However, pile length up to 0.9 m above cut-off level shall be considered in reconciliation of cement quantities.

6.2 **Payment for routine load tests which shows unsatisfactory results shall not be made**.

6.3 Piles showing unsatisfactory results shall be treated as defective piles. Defective piles shall be removed or left in place and replaced by additional piles as directed by Engineer-in-charge at no additional cost & time to the owner.

6.4 Reaction piles, if required for the purpose of conducting load tests on piles shall not be paid extra. Quoted rate for tests shall be inclusive of this. However, for routine lateral and uplift tests, if required, job piles may be used as reaction piles.

7.0 PILE TESTING

7.1 Initial Load Test

i) Prior to commencement of the job piling, initial load tests shall be done.

ii) The tenderer shall be allowed to proceed with job piling only after successful completion of the initial tests to the satisfaction of the Engineer-in-charge.

Test load shall be 2 times the design load or up to failure. Location of the test piles shall be indicated on working drawings by the Engineer-in-charge. The no. of such tests is given in the schedule of quantities.

7.2 Routine Load Test

Routine load tests shall be carried out up to one and half times the design load. The piles for the test shall be randomly selected by the Engineer-in-charge. The no. of routine load tests is mentioned in the schedule of quantities.

7.3 Pile Load Test Details

i) For pile load tests, the test set up shall be as per IS: 2911 Part IV (latest revision) and "Specifications for testing of concrete piles", EIL standard no.6-74-0013.

ii) All testing shall be done by Direct method of loading in successive increments, as per the relevant clauses of IS 2911 Part IV (latest revision) and EIL Standard no.6-74-0013.

iii) Each stage of loading shall be maintained till the rate of movement is less than 0.2 mm per hour.

iv) Test shall be carried but at the cut-off level.

7.4 Maximum Test Loads

a) Initial pile load tests: Load corresponding to a total settlement of 10% of the pile diameter or two times the safe load whichever occurs earlier.

b) Routine vertical load test: Load corresponding to 12mm settlement or one and half times the safe load which ever occurs earlier.

NOTE : Kentledge load shall be at least 25% higher than the Maximum test loads.

7.5 Criteria for Assessment of Safe Loads

7.5.1 Safe vertical load on single pile shall be the least of the following;

i) Two thirds of the final load at which the total settlement attains a value of 12

mm. ii) 50% of the final load at which the total settlement equals to 10% of the piles dia.

7.5.2 Safe lateral load on single pile shall be least of the following:

i) 50% of the final load at which the total lateral displacement equals to 12mm.

ii) Final load corresponding to the total displacement of 5 mm.

7.6 A full record of pile load test results shall be submitted in triplicate to the Engineer-in- Charge immediately on completion of each test. The record shall also include the plots of load-settlement (for various stages of loads) characteristics of pile and also the interpretation of the pile load test curve as per criteria for safe loads as mentioned in EIL Standards. Spec. 6-74-0013. Any special observations shall be duly recorded / explained by the contractor.

SPECIFICATION NO.	TITLE OF SPECIFICATION
6-74-0006	Standard Specification for Materials for
6-74-0011	Standard Specification for Construction and installation of RCC Auger Cast-in-
6-74-0013	Standard Specification for Testing of Concrete Piles.

8.0 SCOPE OF SUPPLY

All materials (consumable / non consumable like **cement, reinforcement etc.)** required to complete the piling works shall be supplied by the contractor.

2.0 TECHNICAL SPECIFICATION

FOR

EARTHWORK IN EXCAVATION

1.1.0.0 SCOPE

This specification covers excavation in all types of soil, soft and decomposed rock not requiring blasting and rocks requiring blasting, shorting, dewatering, filling around foundations and to grade, compaction of fills and approaches, protective fencing, lighting etc. relevant to structures and locations covered under the scope of this contract.

1.1.2.0.0 GENERAL

1.1.2.1.0 Work to be provided for by the Contractor

The work to be provided for by the Contractor, unless specified otherwise, shall include but not be limited to the following :

a) Furnish all labour, supervision, services including facilities as required under statutory labour regulations, materials, scaffolds, equipment, tools and plants, transportation etc. required for the work.

b) Prepare and submit working drawings showing the approaches, slopes, berms, shoring, sumps for dewatering, including drains and outfall for drainage, space for temporary stacking of soils, disposal area, fencing etc. and all other details as may be required by the Engineer.

c) To carry out sampling and testing and submit to the Engineer, results of soil compaction tests if required by the Engineer to assess the degree of compaction.

d) Construction, maintenance and removal after completion of Magazine of proper capacity as well as design for storing of explosives required for blasting work to be carried out under the scope of this tender.

1.1.2.2.0 Work to be provided for by others

No work under this specification will be provided by any agency other than the Contractor unless specifically mentioned elsewhere in the Contract.

1.1.2.3.0 Codes and Standards

All works under this specification, unless specified otherwise, shall conform to the latest revision and/or replacement of the following or any other Indian Standard Specifications and Codes of Practice. In case any particular aspect of work is not covered specifically by Indian Standard Specification any other standard practice as may be specified by the Engineer shall be followed :

IS:3764 (latest revision)	:	Indian Standard for Safety Code for Excavation work
IS:1200 (latest revision)	:	Indian Standard Method of Measurement of Building and Civil Engineering work, Part-I, Earthwork
IS:4701 (latest revision)	:	Indian Standard Code of Practice for Earth work on Canals.
IS:2720 (Part-II) (latest revision)	:	Determination of Moisture Content.

IS:2720 (Part-VII) (latest revision)	:	Determination of Moisture Content / using Light Compaction
IS:2720 (Part-XIV) (latest revision)	:	Determination of Density Index (Relative Density) of cohesionless soils
IS:2720 (Part-XXVIII) (latest revision)	:	Determination of Dry Density of soils, in place, by sand replacement methods.

1.1.2.4.0 Conformity with Designs

The Contractor is to carry out the work as per the drawings issued to him and/or Contractor's drawings which are approved by the Engineer and/or the Engineer's instruction.

1.1.2.5.0 Materials to be used

1.1.2.5.1 General

All materials required for the work shall be of best commercial variety and approved by the Engineer.

1.1.2.5.2 Borrow Material

Borrow material required for back-filling shall be excavated from approved locations and levels and shall consist of material, approved by the Engineer, free from roots, vegetation, decayed organic matter, harmful salts and chemicals, free from lumps and clods. If specified, clean graded sand free from harmful and deleterious material from approved quarries, shall be used as fill material.

1.1.2.6.0 Quality Control

The Contractor shall establish and maintain quality control for the various aspects of the work, method, materials and equipment used. The quality control operation shall include but not be limited to the following items of work:

a) Lines, Levels and Grades:	i)	Periodic Surveys
	ii)	Establishment of markers, boards etc.
b) Back-filling:	i)	Checking the quality of fill material
	ii)	Checking moisture content of the backfill
	iii)	Checking the degree of compaction

1.1.2.7.0 Information regarding site conditions

Surface and Sub-surface data regarding the nature of soil, rock, sub-soil water etc. shown on drawing or otherwise furnished to the contractor shall be taken as a guidance only and variation there from shall not affect the terms of the contract. The contractor must satisfy himself regarding the character and volume of all work under this contract and expected surface, sub-surface and/or sub-soil water to be encountered. He must also satisfy himself about the general conditions of site and ascertain the existing and future construction likely to come up during the execution of the contract so that he may plan for a realistic programme of execution.

1.1.3.0.0 EXECUTION

1.1.3.1.0 Setting Out

Within 15 days of award of Contract, the Contractor will prepare and submit to the Engineer, detailed drawings of the excavation work as proposed to be executed by him showing the dimensions as per drawings and specification adding his proposals of slopes, shoring, approaches, dewatering sumps, berms etc. On receiving the approval from the Engineer with modifications and corrections, if necessary the contractor will set out the work from the control points furnished by the Engineer and fix permanent points and markers will be fixed at intervals prescribed by the Engineer and checked by the Engineer and certified by him after which the Contractor will proceed with the work. Engineer shall be provided with necessary men, material and instructions for such checking. It should be noted that this checking by the Engineer prior to start of the work will in no way absolve the Contractor of his responsibility of carrying out the work to true lines and levels and grades as per drawing and subsequent corrections, if necessary, free of cost to the Owner in case any errors are noticed in the Contractor's work at any stage.

1.1.3.2.0 Initial Levels

Initial levels of the ground either in a definite grid pattern or as directed by the Engineer will be taken by the Contractor jointly with the Engineer over the original ground prior to starting actual excavation work and after setting out. These initial levels will be used for preparing cross-sections for volume measurement or for cross-checking the depths obtained from tape measurement.
All records of levels, measurements etc. and also any drawing, cross section etc. made therefrom, shall be jointly signed by the authorized representative of the contractor and the engineer before the commencement of work and they shall form the basis of all payments in future.

1.1.3.3.0 Clearing & Grubbing, etc.

The area to be excavated or filled shall be cleared out of fences, trees, logs, stumps, bush, vegetation, rubbish, slush, etc. and levelled up. Trees upto 300 mm girth shall be uprooted. Trees above 300 mm girth to be cut, shall be approved by the Engineer and then marked. Felling of trees shall include taking out roots up to 600 mm. below ground level or 150 mm below formation level whichever is lower. After the tree is cut and roots taken out the pot-holes formed shall be filled with good earth in 250 mm layers and consolidated unless directed by the Engineer otherwise. The trees shall be cut in suitable pieces as instructed by the Engineer.

Before earthwork is started, all the soils and unserviceable materials and rubbish shall be burned or removed from the site to approved disposal areas as may be specified. Ash shall be spread or removed. Useful materials, saleable timber, firewood, etc. shall be the property of the Owner and shall be stacked properly at the worksite in a manner as directed by the Engineer.

1.1.3.4.0 Classification

All earthwork shall be classified under the following categories:

No distinction will be made whether the material is dry or wet.

1.1.3.4.1 Ordinary Soil

This shall comprise vegetable or organic soil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose moorum, a mixture of these and similar material which yields to the ordinary application of pick and shovel, rake or other ordinary digging implement. Removal of gravel or any other nodular material having diameter in any one direction not exceeding 75 mm occurring in such strata shall be deemed to be covered under this category.

1.1.3.4.2. Hard Soil

This shall include :

i) Stiff heavy clay, hard shale, or compact moorum requiring grafting tool or pick or both and shovel, closely applied.

ii) Gravel and cobble stone having maximum diameter in any one direction between 75 and 300 mm.

iii) Soling of roads, paths, etc. and hard core.

iv) Macadam surfaces such as water bound, and bitumen / tar bound.

v) Lime concrete, stone masonry in lime mortar and brick work in lime / cement mortar, below ground level.

vi) Soft conglomerate, where the stones may be detached from the matrix with picks. and

vii) Generally any material which requires the close application of picks, or scarifies to loosen and not affording resistance to digging greater than the hardest of any soil mentioned in (i) and (vi) above.

1.1.3.4.3 Soft and Decomposed Rock

This shall include:

i) Limestone, sandstone, laterite, hard conglomerate or other soft or disintegrated rock which may be quarried or split with crowbars.

ii) Unreinforced cement concrete which may be broken up with crowbars or picks and stone masonry in cement mortar below ground level.

iii) Boulders which do not require blasting having maximum diameter in any direction of more than 300 mm found lying loose on the surface or embedded in river bed, soil, talus, slope wash and terrace material of dissimilar origin.

iv) Any rock which in dry state may be hard, requiring blasting, but which when wet becomes soft and manageable by means other than blasting.

1.1.3.5.0 EXCAVATION FOR FOUNDATIONS AND TRENCHES

1.1.3.5.1 General

All excavations shall be done to the minimum dimensions as required for safety and working facility. Prior approval of the Engineer shall be obtained by the Contractor, in each individual case, for the method he proposes to adopt for the excavations including dimensions, side slopes, shoring, dewatering, disposal, etc. This approval, however, shall not in any way make the Engineer responsible for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner.

All excavation in open cuts shall be made true to line, slopes and grades shown on the drawing or directed by the Engineer. No material shall project within the dimension of minimum excavation lines marked. Boulders projecting out of the excavated surface shall be removed, if in the opinion of the Engineer they are likely to be a hindrance to the workers.

Method of excavation shall be in every case subject to the approval of the Engineer and the Contractor shall ensure the stability and safety of the excavation, adjacent structures, services and works.

The Contractor shall have full responsibility of the stability of the excavation and safety of the workmen. If any slip occurs, the Contractor shall remove all slipped material from the excavated pit.

All loose boulders, semi-detached rocks, not directly in excavation but so close to the area to be excavated as to be liable, in the opinion of the Engineer, to fall or otherwise endanger the workmen, equipment of the work, etc., shall be stripped off and removed away from the areas of excavation. The method used shall be such as not to shatter or render unstable or unsafe the portion which was originally sound and safe. Any materials not requiring removal as contemplated in the work, but which, in the opinion of the Engineer, is later to become loose or unstable shall also be promptly and satisfactorily removed as directed by the Engineer.

Prior to starting the excavation, the ground level at the location shall be checked jointly with the Engineer.

The rough excavation may be carried up to a maximum depth of 150 mm above the final level. The balance shall be excavated with special care. If directed by the Engineer, soft and undesirable spots shall be removed even below the final level. The extra excavation shall be filled up as instructed by the Engineer and the Contractor shall be paid for the extra excavation and the filling at the appropriate item rates.

If the excavation is done to a depth greater than that shown on the drawing, or directed by the Engineer, due to the Contractor's fault, the excess depth shall be filled up to the required level at the latter's cost (with cement concrete not leaner than 1:4:8 ordinary concrete or richer) as directed by the Engineer in each individual case.

In formation of rock requiring blasting, those overcuts which are unavoidable will be made up by ordinary cement concrete 1:2:4 which will be paid for under appropriate rate, provided this overcut is not due to negligence of the contractor. The decision of the Engineer as to the admissibility of such overcut for payment will be final. All excavated materials such as hard rock, boulders, bricks, dismantled concrete blocks, etc. shall be stacked separately as directed by the Engineer and shall be the property of the Owner.

1.1.3.5.2 Excavation in Ordinary Soil, Hard Soil and Soft & Decomposed Rock

The excavation in ordinary soil, hard soil, soft and decomposed rock will be carried out as per the approved proposal, modified and corrected where necessary by the Engineer. The work will be carried out in a workmanlike manner without endangering the safety of nearby structures / services or works and without causing hindrance to other activities in the area. As the excavation reaches the required dimensions, lines, levels and grades, the work will be checked by the Engineer thoroughly and the balance work will be carried out carefully to avoid any over-excavation. On completion, the work will be finally checked and approved by the Engineer. In certain cases, where deterioration of the ground, upheaval, slips, etc. are expected, the Engineer may order to suspend the work at any stage and instruct the Contractor to carry out the balance work just before the foundation work of the structure can be started. No extra will be paid to the Contractor for such unavoidable temporary suspension of work.

1.1.3.5.3 Disposal

The excavated soils will be disposed of in any or all the following manners :-

(a) By using it for backfilling straightway

(b) By stacking it temporarily for use in backfilling at a later date during execution of the Contractor

(c) i) By either spreading, or

ii)Spreading and compacting at designated filling areas and/or disposal areas

(d) By selecting the useful material and stacking it neatly in areas designated by the Engineer for use in backfilling by some other agency.

The rate for excavation in soil should include the cost of filling and compaction in case (c) (ii). The rate for excavation in rock should include the cost of disposal as per (d).

1.1.3.5.4 Disposal of Surplus

All surplus material from excavation shall be carried away from the excavation site to designated disposal area selected by the Engineer.

All good and sound rock excavated from the pits and all assorted materials of dismantled structures shall be the property of the Owner and if the Contractor wants

to use it, he shall have to obtain it from the Engineer at a mutually agreed rate for the same.

All sound rock and other assorted materials like excavated bricks etc. shall be stacked separately and shall be measured in stacks deducting 30% volumetric measure for voids.

1.1.3.5.5 Protection

The Engineer shall be notified by the Contractor as soon as the excavation is expected to be completed within a day so that it may be inspected by him at the earliest. Immediately after approval of the Engineer, the excavation must be covered up in the shortest possible time. But, in no case the excavation shall be covered up or worked on before approval and measurement by the Engineer.

Excavated material shall be placed beyond 1.5 metres from the edge of the pit or trench or half the depth of the pit or trench whichever is more or further away if directed by the Engineer.

Excavation shall not be carried out below the foundation level of structure close by until required precautions have been taken.

Adequate fencing is to be made enclosing the excavation.

The Contractor shall protect all underground services exposed by excavation. The Contractor shall also divert all surface drains, etc. affected by the excavation to maintain the working area neat and clear

1.1.3.5.6 Dealing with Surface Water

All working areas shall be kept free of surface water as far as reasonably practicable. Works in the vicinity of cut areas shall be controlled to prevent the ingress of surface water.

No works shall commence until surface water streams have been properly intercepted, redirected or otherwise dealt with.

Where works are undertaken in the monsoon period, the contractor may need to construct temporary drainage systems at his own cost to drain surface water from working areas.

1.1.3.5.7 Dewatering

All excavations shall be kept free of water and slush. Grading in the vicinity of excavations shall be controlled to prevent surface water running into excavated areas. The Contractor shall remove by pumping or other means approved by the Engineer any water inclusive of rain water and subsoil water accumulated in excavation and keep the trench dewatered until the construction of foundation structure and backfilling are complete in all respects (except where such dewatering would need installation of well points or deep wells for which separate payment will be made). Sumps made for dewatering must be kept clear of the foundations. Method of pumping shall be approved by the Engineer but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping.

If necessary, the Engineer may direct the Contractor to continue dewatering beyond his original or extended contract period in which case he will be paid separately for dewatering as per terms mentioned elsewhere under payment and measurement, provided the Contractor has completed all the work satisfactorily.

1.1.3.5.8 Timber Shoring

Timber Shoring made out of approved quality of timber shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench and the type of timbering shall be determined by the Engineer. It shall be the responsibility of the Contractor to take all necessary steps to prevent the sides of trenches and pits from collapsing.

1.1.3.5.8.1 Close Timbering

Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'polling boards'. These shall be of minimum 250 x 40 mm. sections as directed by the Engineer. The boards shall generally be placed in position vertically in pairs, one board on each side of cutting, and shall be kept apart by horizontal wales of strong wood at maximum 1.2 metres spacing, cross strutted with bellies or as directed by the Engineer. The length of the bally struts shall depend on the width of the trench or pit.

In case where the soil is very soft and loose, the boards shall be placed horizontally against the sides of the excavation and supported by vertical wales, which shall be strutted to similar timber pieces on the opposite face of the trench or pit. The lowest board supporting the sides shall be taken into the ground. No portion of the vertical side of the trench or pit shall remain exposed, so that the earth is not liable to slip out.

The withdrawal of the timber shall be done very carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber. No claim shall be entertained for any timber which cannot be withdrawn and is lost or buried.

1.1.3.5.8.2 Open Timbering

In the case of open timbering, the entire surface of the side of trench pit is not required to be covered. The vertical board of minimum 250 mm width and minimum 40 mm depth shall be spaced sufficiently apart to leave unsupported strips of maximum 500 mm. average width. The detailed arrangement, sizes of the timber and the distances apart shall be subject to the approval of the Engineer. In all other respects, specification for close timbering shall apply to open timbering.

1.1.3.6.0 Treatment of Slips

The Contractor will take all precaution to avoid high surcharges and provide proper surface drainage to prevent flow of water over the sides. These precautions along with proper slopes, berms, shoring and control of ground water should cause no slips to occur. If however slips do occur due to causes beyond the control of the Contractor, the same shall be removed by him and payment shall be made to him on appropriate item rate of earthwork. Slips caused due to negligence of the Contractor will be cleared and back-filled later by him at his own expenses.

1.1.3.7.0 Back-filling

1.1.3.7.1 General

The material used for backfilling shall consist of material, approved by the Engineer obtained directly from nearby areas where excavation work by the same agency is in progress, from temporary stacks of excavated soils or from borrow pits from selected areas designated by the Engineer. The material shall be free from lumps and clods, roots and vegetation, harmful salts and chemicals, organic materials, etc.

In certain locations, the Engineer may direct sand fillings. The sand should be clean, well graded and be of quality normally acceptable for use in concrete.

1.1.3.7.2 Filling and Compaction in Pits and Trenches around Structures

As soon as the work in foundations has been accepted and measured, the spaces around the foundation structures in pits and trenches shall be cleared all debris, brick bats, mortar droppings, etc., and filled with earth in layers not exceeding 250 mm. in loose thickness each layer being watered, rammed and properly compacted to achieve a dry density of not less than 90% of proctor's dry density at optimum moisture content as per IS-2720 (Part-VII) (latest revision) where backfilling with cohesive soil and sandy sift containing high percentage of silt. For backfilling with sand having little or no silt, each layer shall be compacted to relative density of 75% as per IS-2720 part XIV (latest revision). Earth shall be rammed with approved mechanized compaction machine. Usually, no manual compaction shall be allowed unless specifically permitted by the Engineer. The final surface shall be trimmed and leveled to proper profile as shown in the drawing are as desired by the Engineer.

Since the degree of compaction depends on the moisture content of the soil, a close watch should be kept on it and corrections done to optimize the moisture content.

1.1.3.7.3 Plinth Filling

The plinth shall be filled with earth in layers not exceeding 250 mm. in loose thickness, watered and compacted as stated under clause no. 1.1.3.7.2 with approved compaction machine or manually, if specifically permitted by the Engineer. When the filling reaches the finished level, the surface shall be flooded with water for at least 24 hours, allowed to dry and then rammed and compacted, in order to avoid any settlement at a later stage. The finished level of the filling shall be trimmed to the slope intended to be given to the floor.

1.1.3.7.4 Filling in Trenches for Water Pipes and Drains

Earth used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not bigger than 150 mm. size in any direction, mixed with fine material consisting of disintegrated rock, moorum or earth as available, so as to fill up the voids as far as possible and then the mixture used for filling. The types of bedding and pipe surround material shall be as specified in the drawings.

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed.

Where the trenches are excavated in soil, the filling shall be done with earth on the sides and top of pipes in layers not exceeding 150 mm. watered, rammed and compacted taking care that no damage is caused to the pipe below. Filling of

trenches shall be carried out simultaneously on both sides of the pipe in such a manner that unequal pressures do not occur.

In case of excavation of trenches in rock, the filling up to a depth of 300 mm. or the diameter of the pipe whichever is more, above the crown of pipe or barrel shall be done with fine material such as earth, moorum, disintegrated rock or ash according to the availability at site. The remaining filling shall be done with rock filling of boulders of size not exceeding 150 mm. mixed with fine material as available to fill up the voids, watered, rammed and compacted.

1.1.3.7.5 Filling in Disposal Area

Surplus material from excavation which is not required for backfilling will be disposed of in designated disposal areas. The soils shall not be dumped haphazardly but should be spread in layers approximately 250 mm. thick when loose and compacted with the help of compacting equipment. In wide areas rollers will be employed and compaction done to the satisfaction of the Engineer at the optimum moisture content which shall be checked and controlled by the Contractor.

In certain cases the Engineer may direct disposal without compaction which can be done by tipping the soils from a high bench neatly maintaining always a proper level and grade of the bench.

1.1.3.8.0 Approaches and Fencing

The Contractor should provide and maintain proper approaches for workmen and for inspection. The roads and approaches around the excavated pits should be kept clear at all times so that there is no hindrance to the movement of men, material and equipment of various agencies connected with the Project. Sturdy and elegant fencing is to be provided around the top edge of the excavation as well as the bottom of the fill at the surplus disposal area where dumping from a high bench is in progress.

1.1.3.9.0 Lighting

Full scale area lighting is to be provided if night work is permitted or directed by the Engineer. If no night work is in progress, red warning lights should be provided at the corners of the excavated pit and the edges of the fill.

1.1.4.0.0 TESTING AND ACCEPTANCE CRITERA

1.1.4.1.0 Excavation

On completion of excavation, the dimensions of the pits will be checked as per the drawings after the pits are completely dewatered the work will be accepted after all undercuts have been set right and all over excavations filled back to required lines, levels and grades by placing ordinary concrete of 1:4:8 proportion and/or richer and/or by compacted earth, as directed by the Engineer, at the Contractor's cost. The choice of grade of concrete will be a matter of unfettered discretion of the Engineer. Over excavated ion of the sides will be made good free of cost by the Contractor while carrying out the back-filling. The excavation work will be accepted after the above requirements are fulfilled and all temporary approaches encroaching inside the required dimension of the excavation have been removed.

1.1.4.2.0 Back-filling

The degree of compaction shall be sufficient to achieve a dry, density of not less than 90% of proctor's dry density at optimum moisture content as per IS-2720 (Part-vii)

(latest revision) or a relative density of 75% as per IS-2720 (Part-xiv) (latest revision) as applicable depending on the nature of backfilling material as stated in clause no. 1.1.3.7.2 of this specification. The work of back-filling will be accepted after the Engineer is satisfied with the degree of compaction achieved.

1.1.5.0.0 INFORMATION TO BE SUBMITTED

1.1.5.1.0 With Tender

Details of Equipment proposed to be used for excavation, back-filling and compaction have to be submitted along with the tender.

1.1.5.2.0 After Award

After award of the Contract the successful tenderer shall submit the following for approval and adoption :

(a) Within 30 days of Award of the Contract, the Contractor shall submit a detailed programme of the work as proposed to be executed giving completion dates of excavation of the various foundations and the time required for back-filling and compaction after completing the foundation for structures. In case the Earthwork Contractor is also the agency for the foundation work, the Earthwork programme is to be connected with the foundation programme. The programme should also show how the excavation and back-filling quantities will be balanced, minimizing temporary stacking of soils. It is to be noted that the Engineer even after initial approval of the programme, may instruct to enhance or retard the progress of work during the actual execution, in order to match with the progress of foundations without attracting any claims from the Contractor. The initial programme being submitted by the Contractor should have sufficient flexibility to take care of such reasonable variations.

(b) Within 15 days of award, the Contractor shall submit drawings showing details of slopes, shoring approaches, sump pits, dewatering lines, fencing etc. for approval of the Engineer for adoption.

1.1.6.0.0 RATES

The rates for the items shall include cost of all materials consumed in the works, hire charges of materials tools and plant cost of labour, insurance, all transport, taxes, royalties, security and safety arrangements, supervision, profit etc. The rates of excavation shall also include the cost of dewatering (except where such dewatering would need installation of well points or deep wells for which separate payment will be made) and stacking the excavated soils properly within a lead of 30 M. unless otherwise mentioned in the Schedule of Items.

The Contractor will have to give a rebate if the excavated earth is directly used for back-filling.

Where back-filling is to be done with sand, it shall be of good quality from quarries approved by the Engineer. The rate shall include all operations including the cost of sand.

In case the Contractor is required to continue dewatering of the excavated pits beyond the period of the contract, original or extended, he will be paid separately for it as per

the schedule of items only for the period beyond the final terminal date of the contract. The rate will be complete in all respects including the cost of consumables, if any.

1.1.7.0.0 MEASUREMENTS

1.1.7.1.0 Clearing and Grubbing

No separate measurement shall be done for this items for the purpose of payment in general except for cutting of trees having girth more than 30 cm. and works connected to this.

1.1.7.2.0 Excavation

Actual quantity of excavation required and approved by the Engineer shall be measured in Cum. No extra shall be paid for keeping the excavations dewatered as required for completion of the structure to come in. Necessary disposal of the soils as described in the schedule of items shall be included in the quoted rate.

1.1.7.3.0 Shoring

The actual effective area of shoring as approved by the Engineer shall be measured in Sqm. All planks, walling, verticals, struts, props and all other materials as required for the shoring and subsequent safe dismantling and removal shall be included in the rates quoted.

1.1.7.4.0 Back - filling

1.1.7.4.1. With Assorted Earth from Excavation for Foundations, Trenches etc.

Actual quantity of consolidated backfill shall be measured in Cum The cost of lead, lift, etc. shall be as per schedule of items and included in the rate quoted.

1.1.7.4.2 With Earth from borrow pits and stacks

Actual quantity of consolidated back-filling or actual quantity of excavation in the borrow pits, or the excavated volume of the stack with a deduction of 30% for voids, in case filling is done by earth from stack whichever is less, shall be paid in Cum. The lead, lift, etc. as mentioned in the Schedule of Items shall be included in the rates quoted.

1.1.7.4.3 Sand filling

Actual quantity of consolidated sand filling shall be measured in Cum. The rate shall include cost of sand and all necessary works for execution of the items.

1.1.7.5.0 Leads and Lifts

The leads for excavation and / or back-filling will be measured between the centroid of the actual disposal area and that of the plan of the pit. The distance between these two points will be measured along the shortest practicable haulage path as decided by the Engineer.

Lifts will be measured vertically between the average ground level from where the pit excavation was started and the bottom level of the excavated pit. Level lines corresponding to the stages where lifts become payable will be drawn on the cross

section of the pit and the volumes of excavation contained between these horizontal planes will be computed and paid according to the corresponding rates.

1.1.7.6.0 Dewatering

Dewatering for work beyond the Contract period original or extended will be measured on the basis of horse power - hour which will be obtained by multiplying the estimated requirement of horse power required to run the pumps or actually employed, whichever is less, by the actual hours run approximated to the nearest half hour.

3.0 TECHNICAL SPECIFICATION

FOR

CEMENT CONCRETE

(PLAIN OR REINFORCED)

TECHNICAL SPECIFICATION
FOR
CEMENT CONCRETE
(PLAIN OR REINFORCED)

1.1.0.0 SCOPE

1.1.1.0 General

This specification covers all the requirements, described hereinafter for general use of Plain and Reinforced Cement Concrete work in Structures and locations**,** cast-in-situ or precast, and shall include all incidental items of work not shown or specified but reasonably implied or necessary for the completion of the work.

1.1.2.0 This specification shall also apply to the extent it has been referred to or applicable with the special requirements of structures covered in SCOPE of IS: 456 (latest revision).

1.1.3.0 IS: 456 (latest revision) shall form a part of this specification and shall be complied with unless permitted otherwise. For any particular aspect not covered by this Code, appropriate IS Code, specifications and/or replacement by any International Code of practice as may be specified by the Engineer shall be followed. All codes and Standards shall conform to its latest revisions. A list of IS codes and Standards is enclosed hereinafter for reference.

1.2.0.0 GENERAL

1.2.1.0 Work to be provided for by the Contractor

The work to be provided for by the Contractor, unless otherwise specified shall include but not be limited to the following :

a) Furnish all labour, supervision, services including facilities as may be required under statutory labour regulations, materials, forms, templates, supports, scaffolds, approaches, aids, construction equipment, tools and plants, transportations, etc. required for the work.

b) Except where it is excluded from the Scope of Contract, Contractor shall prepare progressively and submit for approval detailed drawings and Bar Bending Schedules for reinforcement bars showing the positions and details of spacers, supports, chairs, hangers etc.

c) Design and prepare working drawings of formworks, scaffolds, supports, etc. and submit for approval.

d) Submit for approval shop drawings for various inserts, anchors, anchor bolts, pipe sleeves, embedment, hangers, openings, frames etc.

e) Submit for approval detailed drawings of supports, templates, hangers, etc. required for installation of various embedment like inserts, anchor bolts, pipe sleeves, frames, joint seals, frames, openings etc.

f) Submit for approval detailed schemes of all operations required for executing the work, e.g. Material handling, Concrete mixing, Placement of concrete, Compaction, curing services, Approaches, etc.

g) Design and submit for approval concrete mix designs required to be adopted on the job.

h) Furnish samples and submit for approval results of tests of various properties of the following :

i) The various ingredients of concrete
ii) Concrete
iii) Embedment
iv Joint seals

i) Provide all incidental items not shown or specified in particular but reasonably implied or necessary for successful completion of the work in accordance with the drawings, specifications and Schedule of Items.

j) For supply of certain materials normally manufactured by specialist firms, the Contractor may have to produce, if directed by the Engineer, a guarantee in approved pro forma for satisfactory performance for a reasonable period as may be specified, binding both the manufacturers and the Contractor, jointly and severally.

1.2.2.0 Work by Others

No work under this specification will be provided by any agency other than the Contractor unless specifically mentioned elsewhere in the contract.

1.2.3.0 Information to be submitted by the Tenderer

1.2.4.1 With Tender

The following technical information are required with the tender :

a) Source & arrangement of processing of aggregates proposed to be adopted.

b) Type of plant and equipment proposed to be used.

c) Names of firms, if any, with which association is sought for to execute the special items of work in the contract.

d) Types of formwork proposed to be used.

1.2.4.2 After Award

The following information and data including samples where necessary, shall be submitted by the Contractor progressively during the execution of the contract.

a) Programme of Execution and Requirement of Materials

Within 30 days of the award of contract, the Contractor will submit a Master Programme for completion of the work giving month wise requirements of materials, particularly mentioning in details the materials which are to be supplied by the Owner and for the procurement of which the help of the Owner is required as per the terms and conditions of the Contract. In case the Contractor proposes to take on hire any machineries or tools and plants from the Owner, the detailed phased out programme of such hire is also to be submitted.

This Master Programme may have to be reviewed and updated by the Contractor, quarterly or at more frequent intervals as may be directed by the Engineer depending on the exigencies of the work.

Detailed day to day programme of every month is to be submitted by the Contractor before the end of the previous month.

b) Samples

Samples of the following materials and any other materials proposed to be used, shall be submitted as directed by the Engineer, in sufficient quantities free of cost, for approval. Approved samples will be preserved by the Engineer for future reference. The approval of the Engineer shall not, in any way, relieve the Contractor of his responsibility of supplying materials of specified qualities :

i) Coarse and fine aggregates.

ii) Admixtures.

iii) Plywood for Formwork.

iv) Embedded and anchorage materials as may be desired by the Engineer.

v) Joint sealing strips and other waterproofing materials.

vi) Joint filling compounds.

vii) Foundation quality Rubber Pads

c) Design Mix

Design mix as per Clauses 2.1.2.1.0 (g) and 2.1.3.4.0 of this specification giving proportions of the ingredients, sources of aggregates and cement, along with accompanying test results of trial mixes as per relevant I.S. is to be submitted to the Engineer for his approval before it can be used on the works.

d) Detail Drawings and Bar Bending Schedules

Detailed working drawings and Bar Bending Schedules in accordance with Clause 2.1.2.1.0 (b) and 2.1.3.16.1 of this specification.

e) Detailed Drawings and Designs of Formworks to be used

Detailed design data and drawings of standard formworks to be used as per Clause 2.1.2.1.0 (c).

f) Detailed Drawings for Templates and Temporary Supports for Embedment

As per Clause 2.1.2.1.0 (e).

g) Mill Test Reports for Cement & Reinforcing Steel

Mill Test Reports for Cement and Reinforcing Steel in case these materials are supplied by the Contractor.

h) Inspection Reports

Inspection Reports in respect of Formwork and Reinforcement and any other item of work as may be desired by the Engineer in accordance with Clause 2.1.2.4.0 of this specification.

i) Test Reports

Reports of tests of various materials and concrete as required under Clause 2.1.4.0.0 : SAMPLING & TESTING of this specification.

j) Any other data which may be required as per this specification.

1.2.5.0 Conformity with Design

The Contractor will prepare check lists in approved pro forma which will be called 'Pour Cards'. These Pour Cards will list out all items of work involved. The Contractor will inform the Engineer, sufficiently in advance, whenever any particular pour is ready for concreting. He shall accord all necessary help and assistance to the Engineer for all checking required in the pour. On satisfying himself that all details are in accordance to the drawings and specifications, the Engineer will give written permission on the same 'Pour Card' allowing the Contractor to commence placement of concrete. Details of all instructions issued by the Engineer and the records of compliance by the Contractor, deviations allowed by the Engineer and any other relevant information will be written on accompanying sheets attached to the Pour Cards. These sheets, termed as 'Progress Cards' will be prepared by the Contractor on approved pro forma. The Pour Cards along with accompaniments will be handed over to the Engineer before starting placement of concrete. One of the mix designs developed by the Contractor as per the I.S. Specifications and established to the satisfaction of the Engineer by trial mixes shall be permitted to be used by the Engineer, the choice being dictated by the requirements of designs and workability. The methods of mixing, conveyance, placement, vibration, finishing, curing, protection and testing of concrete will be as approved or directed by the Engineer.

1.2.5.1 Materials to be used

1.2.6.0 General Requirement

All materials whether to be incorporated in the work or used temporarily for the construction shall conform to the relevant IS Specifications unless stated otherwise and be of best approved quality.

1.2.6.1 Cement

Generally, cement shall be 33 grade ordinary Portland Cement conforming to IS:269 (latest revision). In special cases, any of the following type of cement may be permitted or directed to be used by the Engineer.

a) 43 Grade ordinary Portland Cement conforming to IS-812 (latest revision)

b) 53 Grade ordinary Portland Cement conforming to IS-1769 (latest revision)

c) Rapid hardening Portland Cement conforming to IS-8041 (latest revision)

d) Portland Slag Cement conforming to IS-455 (latest revision)

e) Hydrophobic Cement conforming to IS-8043 (latest revision)

f) Low heat Portland Cement conforming to IS-12600 (latest revision)

g) Sulphate Resisting Portland Cement conforming to IS-12330 (latest revision)

1.2.6.2 Aggregates

Aggregates shall be natural or crushed gravel or crushed rock and free from deleterious material. It shall comply with the requirements of IS-383 (latest revision). All fine and coarse aggregate shall be tested for susceptibility to Alkali Silicate reaction in a laboratory approved by the Engineer.

a) Coarse Aggregate
Aggregate of sizes ranging between 4.75 mm and 150 mm will be termed as Coarse Aggregate. Only Coarse Aggregate from approved quarries and conforming to IS:383 (latest revision) will be allowed to be used on the works. Aggregates shall be washed to make it free from deleterious materials, if necessary.

The grading of coarse aggregates by sieve analysis shall be as per IS:383 (latest revision). If by the analysis the deficiency of a particular grain size is found, which could affect the density of the concrete. The Engineer may ask the contractor to avoid such quantities of aggregate of the particular size or and such quantity of aggregate of any particular size to achieve the required grading as per IS:383 (latest revision).

b) Fine Aggregate

Aggregate smaller than 4.75 mm and within the grading limits and other requirements set in IS:383 (latest revision) is termed as Fine Aggregate or Sand. Only Fine Aggregate from approved sources and conforming to the above IS Specification will be allowed to be used on works.

In certain cases there may be two types of sand, one very fine and the other very course. In such cases, the two types shall be combined to meet the requirements of a particular zone of IS:383 (latest revision). In all cases, the preferred zone is Zone-II.

In certain cases crushed stone sand may be added to natural sand in order to achieve the required grading.

Crushed stone sand alone may be used only with the approval of the Engineer.

1.2.6.3 Water

Water for use in Concrete shall be clear and free from injurious oils, acids, alkalis, organic matter, salt, silts or other impurities. Normally potable water is found to be suitable. Generally, IS:3550 (latest revision) will be followed for routine tests. In case of doubt, the acceptance test for water shall be as per IS: 3025 (latest revision), and Table-I of IS:456 (latest revision).

In case of doubt regarding development of strength, the suitability of water for making concrete shall be ascertained by compressive strength and initial setting time tests as per method of tests in accordance with the requirements of latest revisions of IS:516 and IS:4031 respectively. The PH value of water shall generally be not less than 6.

1.2.6.4 Admixture

Only admixture of approved quality will be used when directed or permitted by the Engineer. The different types of admixtures which may be necessary to satisfy the concrete mix and the design requirement shall be as per the following I.S. Standards:

IS: 2645 (latest revision) - Integral cement water proofing compound

IS: 9103 (latest revision) - Indian standard specification for Admixtures for concrete

or equivalent American Codes (ASTM C 494 and ASTM C 260) or British Codes (BS 5075, ... 1 to 3) and may be one of the following :

a) Accelerating admixtures :

Set accelerating admixtures like “Sigunit Powder” or “Sigunit LN 10” or approved equivalent.

b) Retarding admixtures :

Modified ligno sulphonate based set retarding concrete admixture like “Plastiment R” or approved equivalent.

c) Water reducing admixtures :

Plasticizer of approved make on forming IS 9103 or ASTM-C-494-86 or BS 5075.

d) Air entraining admixtures :

Modified ligno sulphonate base air entraining concrete admixture like “FLOMO AEP” or surface - active agents like “Sika Aer” or approved equivalent.

e) Water proofing admixtures :

Modified ligno - sulphonate based waterproofing admixture like “Plastocrete Super” or approved equivalent.

However, the contractor shall furnish following technical information about the admixture (along with the manufacturer’s Catalogue) which he is planning to use in different areas within the scope of work for the approval of the Engineer :

i) Type of admixture

ii) Mix proportion and mode of application in concrete / mortar

iii) Manufacturer’s specification and necessary quality assurance certificates (mainly on chloride and sulphate content, PH value, infra red analysis and solid content).

1.2.6.5 Reinforcement

Reinforcement shall be as per relevant IS Specification as mentioned in the Contract/ Drawing/ Instructions. All bars above 10 mm dia. shall be of tested quality.

1.2.7.0 Storage of Materials

1.2.7.1 General

All materials shall be so stored as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work. Any material, which has deteriorated or has been damaged or is otherwise considered defective by the Engineer, shall not be used for concrete and shall be removed from site immediately, failing which, the Engineer shall be at liberty to get the materials removed and the cost incurred thereof shall be realized from the Contractor's dues. The Contractor shall maintain up-to-date accounts of receipt, issue and balance (stack wise) of all materials. Storage of materials shall conform to IS:4082 (latest revision).

1.2.7.2 Cement

Sufficient space for storage, with open passages between stacks, shall be arranged by the Contractor to the satisfaction of the Engineer.

Cement shall be stored off the ground in dry, leak proof, well-ventilated ware-houses at the works in such a manner as to prevent deterioration due to moisture or intrusion of foreign matter.

Cement shall be stored in easily countable stacks with consignment identification marks. Consignments shall be used in the order of their receipts at site. Sub-standard or partly set cement shall not be used and shall be removed from the site, with the knowledge of the Engineer, as soon as it is detected.
Different types of cement shall be clearly marked with the type and different types of cement shall not be intermixed.

1.2.7.3 Aggregates

Aggregates shall be stored on planks or steel plates or on concrete or masonry surface. Each size shall be kept separated with wooden or steel or concrete or masonry bulk-heads or in separate stacks and sufficient care shall be taken to prevent the material at the edges of the stock piles from getting intermixed. Stacks of fine and coarse aggregates shall be kept sufficiently apart with proper arrangement of drainage. The aggregates shall be stored in easily measurable stacks of suitable depths as may be directed by the Engineer.

1.2.8.0 Reinforcement

Reinforcing steel shall be stored consignment-wise and size wise off the ground and under cover, if desired by the Engineer. It shall be protected from rusting, oil, grease and distortions. If necessary, the reinforcing steel may be coated with cement wash before stacking to prevent scale and rust at no extra cost to the Owner. The stacks shall be easily measurable. Steel needed for immediate use shall only be removed from storage.

1.3.0.0 Quality Control

Contractor shall establish and maintain quality control for different items of work and materials as may be directed by the Engineer to assure compliance with contract requirements and maintain and submit to the Engineer records of the same. The quality control operation shall include but not be limited to the following items of work :

a) Admixture : Type, quantity, physical and chemical properties that affect strength, workability and durability of concrete

		For air entraining admixtures, dosage to be adjusted to maintain air contents within desirable limits.
b) Aggregate	:	Physical, chemical and mineralogical qualities. Grading, moisture content and impurities
c) Water	:	Impurities tests.
d) Cement	:	Tests to satisfy relevant IS Specifications (only association with Owner's tests, if the supply is made by Owner).
e) Formwork	:	Material, shapes, dimensions, lines, elevations, surface finish, adequacy of form, ties, bracing and shoring and coating.
f) Reinforcement	:	Shapes, dimensions, length of splices, clearances, ties and supports. Quality and requirement of welded splices. Material tests or certificates to satisfy relevant IS : Specification (If Contractor's supply).
g) Grades of concrete	:	Usage and mix design, testing of all properties
h) Batching and Mixing	:	Types and capacity of plant, concrete mixers and transportation equipment
i) Joints	:	Locations of joints, water stops and filler materials. Dimension of joints, quality and shape of joint material and splices.
j) Embedded and: Anchorage Items		Material, shape, location, setting.
k) Placing	:	Preparation, rate of pouring, weather limitations, time intervals between mixing and placing and between two successive lifts, covering over dry or wet surfaces, cleaning and preparation of surfaces on which concrete is to be placed, application of mortar / slurry for proper bond, prevention of cold joint, types of chutes or conveyors.
l) Compaction	:	Number of vibrators, their prime mover, frequency and amplitude of vibration, diameter and weight of vibrators, duration of vibration, hand-spreading, rodding and tamping.
m) Setting of base: and Beaming plates		Lines, elevations and bedding mortar.
n) Concrete Finishes	:	Repairs of surface defects, screening, floating, steel trowelling and brooming, special finishes.
o) Curing	:	Methods and length of time.

Copies of records and tests for the items noted above, as well as, records of corrective action taken shall be submitted to the Engineer for approval as may be desired.

1.3.0.1 INSTALLATION

All installation requirements shall be in accordance with IS:456 and as supplemented or modified herein or by other best possible standards where the specific requirements mentioned in this section of the specification do not cover all the aspects to the full satisfaction of the Engineer.

1.3.1.1 Washing and Screening of Aggregates

Washing and screening of coarse aggregates shall be carried out to remove fines, dirt or other deleterious materials approved means as desired by the Engineer.
Washing of fine aggregate shall not be allowed, Fire aggregates shall be screened only to remove dirt or other deleterious materials.

However, all washing and screening of aggregates shall be carried out by approved means to ensure compliance with the aggregate specification.

1.3.2.0 Admixture

All concrete shall be designed for normal rate of setting and hardening at normal temperature. Variations in temperature and humidity under different climatic conditions will affect the rate of setting and hardening, which will, in turn, affect the workability and quality of the concrete. Admixtures may be permitted to be used in accordance with IS:456 (latest revision) to modify the rate of hardening, to improve workability or as an aid to control concrete quality. The Engineer reserves the right to require laboratory test or use test data, or other satisfactory reference before granting approval. The admixture shall be used strictly in accordance with the manufacturer's direction and/or as directed by the Engineer.

1.3.3.0 Grades of Concrete

Concrete shall be in any of the grades designated in IS:456 (latest revision). Grade of concrete to be used in different parts of work shall be as shown on the drawing or as per the Engineer's instructions. In case of liquid retaining structures, IS:3370 (latest revision) will be followed.

1.3.4.0 Proportioning and Works Control

1.3.4.1 General

Proportioning of ingredients of concrete shall be made by any of the two following methods as directed by the Engineer.

a) With preliminary tests by designing the concrete mix. Such concrete shall be called "Design Mix Concrete".

b) Without preliminary tests adopting nominal concrete mix. Such concrete shall be called "Nominal Mix Concrete".

As far as possible, design mix concrete shall be used on all concrete works. Nominal mix concrete, in grades permitted in accordance with IS:456 (latest revision), may be used if shown on drawings or approved by the Engineer. In all cases the proportioning of ingredients and works control shall be in accordance with IS:456

(latest revision) and shall be adopted for use after the Engineer is satisfied regarding its adequacy and after obtaining his approval in writing.

1.3.4.2 Mix Design Criteria

Concrete mixes will be designed by the Contractor to achieve the strength, durability and workability necessary for the job, by the most economical use of the various ingredients. In general, the design will keep in view the following considerations :

a) Consistent with the various other requirements of the mix, the quantity of water should be kept at the lowest possible level.

b) The nominal maximum size of course aggregate shall be as large as possible within the limits specified.

c) The various fractions of coarse and fine aggregates should be mixed in such a proportion as to product the best possible combined internal grading giving the densest and most workable mix.

d) Chemical admixtures may be used to modify the rate of hardening, to improve workability (maintaining low water cement ratio) or as an aid to control concrete quality.

e) The finished concrete should have adequate durability in all condition, to withstand satisfactorily the weather and other destruction agencies which it is expected to be subjected to in actual service.

The requirement of adequate structural strength is catered for by the choice of proper grade of concrete by the Engineer. The Contractor will strictly abide by the same in his design of concrete mix installation.

Notwithstanding anything mentioned in various tables given in IS:456 (latest revision) giving specific values and degrees of workability for different condition of concrete placing, minimum cement content and maximum water cement ratio for concrete exposed to sulphate attack and for concrete to ensure durability under different condition of exposure, strength requirement for different grades of concrete, proportion for nominal mix concrete, the following tables in the specification are included. For identical condition if values given in the tables shown herein below are different from those mentioned in IS:456 (latest revision), the values as indicated in the table shown herein below shall prevail.

Various trials shall be given by the contractor with specific cement content on each trial. In some cases, plasticizers and other admixtures may be necessary to achieve the desired results.

TABLE - 1

Grade of Concrete	Specific Characteristic Compressive strength of 15 cm Cube at 28n days conducted in accordance with IS:516 (latest revision) (All values in N/Sq.MM)
M-10	10
M-15	15
M-20	20
M-25	25

M-30	30
M-35	35
M-40	40

Note - 1 : Nominal mix concrete of proportions 1:4:8 or 1:3:6 may be used as lean concrete for simple foundations for masonry walls, below the reinforced concrete foundations and mass filling. These mixes need not be designed.

Note - 2 : Grades of concrete lower than M-20 shall not be used in reinforced concrete.

T A B L E - II

MIX PROPORTIONS (BY WEIGHT) EXPECTED TO GIVE DIFFERENT DEGRESS OF WORKABILITY WITH DIFFERENT VALUES OF WATER - CEMENT RATIO (FOR GUIDANCE) CEMENT / TOTAL AGGREGATE RATIOS

WORKABILITY	WATER/CEMENT AGGREGATE RATIO	RATIO BY WEIGHT OF CEMENT TO GRAVEL CRUSHED STONE		RATIO BY WEIGHT OF CEMENT TO AGGREGATE	
		20MM SIZE	38MM SIZE	20MM SIZE	38MM SIZE
Very	0.4	1:4.8	1:5.3	1:4.5	1:5.0
Low	0.5	1:7.2	1:7.7	1:6.5	1:7.4
Slump	0.6	1:9.4	1:10	1:7.8	1:9.6
0-25mm	0.7	1:10	1:12	1:8.7	1:10.6
Low	0.4	1:3.9	1:7.7	1:6.5	1:7.4
Slump	0.5	1:5.5	1:10	1:7.8	1:9.6
0-25mm	0.6	1:6.8	1:12	1:8.7	1:10.6
	0.7	1:8.0			

	WATER/ AGGREGATE RATIO	RATIO BY WEIGHT OF CEMENT TO GRAVEL CRUSHED STONE		RATIO BY WEIGHT OF CEMENT TO AGGREGATE	
		20 MM Size	38 MM Size	20 MM Size	38 MM Size
Very low Slump 0-25mm	0.4	1:4.8	1:5.3	1:4.5	1:5.0
	0.5	1:7.2	1:7.7	1:6.5	1:7.4
	0.6	1:9.4	1:10	1:7.8	1:9.6
	0.7	1:10	1:12	1:8.7	1:10.6
Low Slump 25-50mm	0.4	1:3.9	1:4.5	1:3.5	1:4.0
	0.5	1:5.5	1:6.7	1:5.0	1:5.5
	0.6	1:6.8	1:7.4	1:6.3	1:7.0
	0.7	1:8.0	1:8.5	1:7.4	1:8.0
Medium Slump 50-100mm	0.4	1:3.5	1:3.8	1:3.1	1:3.6
	0.5	1:4.8	1:5.7	1:4.2	1:5.0
	0.6	1:6.0	1:7.3	1:5.2	1:6.2
High Slump 100-175mm	0.4	1:3.2	1:3.5	1:2.9	1:3.3
	0.5	1:4.4	1:5.2	1:3.9	1:4.6
	0.6	1:5.4	1:6.7	1:4.7	1:5.7
	0.7	1:6.2	1:7.4	1:5.5	1:6.5

NOTE: 1 Notwithstanding anything mentioned above, the Cement/Total aggregate ratio is not to be increased beyond 1:9.0 without specific permission of the Engineer.

NOTE: 2 It should be noted that such high aggregate cement ratios will be required for concretes of very low slump and high water-cement ratios which may be required to be used in mass concrete work only.

NOTE: 3 The above figures are for guidance only, the actual cement/aggregate ratios are to be worked out from the specific gravities of coarse aggregate and sand being used and from trial mixes.

1.3.5.0 Strength Requirements

The strength requirements of both design mix and nominal mix concrete where ordinary Portland Cement or Portland Blast furnace slag cement is used, shall be as per Table - 2 of IS:456 (latest revision). All other relevant clauses of IS:456 (latest revision) shall also apply.

1.3.6.0 Minimum Cement Content

The minimum cement content for each grade of concrete shall be as shown below :

T A B L E - III

MINIMUM CEMENT CONTENT SPECIFIED
FOR DIFFERENT GRADES OF CONCRETE

Grade of Concrete	Minimum Cement Content/Cu.M. of Finished Concrete
M-15	260 Kg
M-20	300 Kg
M-25	300 Kg
M-30	320 Kg
M-35	340 Kg
M-40	360 Kg

The minimum cement contents mentioned above are for average conditions and for 20 mm size aggregate. For 40 mm size aggregate the cement content may be reduced. In case the cement content can be conduced due to continuous and consistent favourable conditions, on account of better quality of cement control, or by the addition of suitable plasticizer / super plasticizers, then the Engineer may instruct lower cement content, and the Contractor shall abide by the stipulations laid down hereunder :

a) The Contractor shall design the mixes for 10% (Ten per cent) higher strength over and above those specified in Table-I under Clause 2.1.3.4.0, for the various grades of concrete and different slump requirements.

b) Sufficient number of trial mixes (to be decided by the Engineer) will be taken at the laboratory for the various designs and graphs of w/c ratio Vs crushing strengths at various ages will be plotted.

c) All tests will be done in presence of the Engineer who shall be the final authority to decide upon the adoption of any revised minimum cement content. The Contractor will always be responsible to produce quality concrete of the required grade as per the acceptance criteria of IS:456 (latest revision).

d) The Engineer will always have the unquestionable right to revise the minimum cement content as decided above, if, in his opinion, there is any chance of deterioration of quality on account of use of lower cement content or any other reason.

In case there is a downward revision of the minimum cement content from that specified in the contract, the particular unit rate of concrete will be reduced by an amount equal to the cost of cement saved, calculated at the issue rate. The relevant cost of wastage and handling on the cement saved, which is inherent in the total cost of structure, will not be deducted from the unit rate and will thus pass on to the Contractor.

1.3.7.0 Water-Cement Ratio

The choice of water-cement ratio in designing a concrete mix will depend on -

a) The requirement of strength.

b) The requirement of durability.

1.3.7.1 Strength Requirement

In case of "Design Mix Concrete", the water-cement ratio of such value as to give acceptable test results as per IS:456 (latest revision) , will be selected by trial and error. The values of water-cement ratios for different grade and mix designs will have to be established after conducting sufficiently large number of preliminary tests in the laboratory to the satisfaction of the Engineer. Frequent checks on test will have to be carried out and the water-cement ratios will be revised if the tests produce unsatisfactory results. Notwithstanding anything stated above the Contractor's responsibility to produce satisfactory test results and to bear all the consequences in case of default remains unaltered.

In case of nominal mix concrete, the maximum water-cement ratio for different grades of concrete is specified in Table-3 of IS:456 (latest revision) and no tests are necessary. The acceptance test criteria for nominal mix concrete shall be as per IS:456 (latest revision).

1.3.7.2 Durability Requirement

Tables 19 and 20 of IS:456 (latest revision) give the maximum water-cement ratio permissible from the point of view of durability of concrete subjected to adverse exposure to weather, sulphate attacks, and contact with harmful chemicals. Impermeability may also be an important consideration.

Whenever the water-cement ratio dictated by Durability consideration is lower than that required from strength criterion, the former shall be adopted.

However, water-cement ratio, from the point of view of durability as well as from strength consideration, should meet the requirement given in Table No. IV.

In general the water cement ratio between 0.4 and 0.45 will be desirable to satisfy the durability requirement and from the consideration of impermeability of concrete. The contractor may propose lower water cement ratio as mentioned above by addition of a suitable plasticizer / super plasticizer. However, the contractor has to propose specifically along with field trails in the event of lower cement content if found suitable along with a plasticizer. It will be preferable to use Melamine based plasticizer

TABLE - IV
MAXIMUM PERMISSIBLE WATER/CEMENT RATIOS
FROM DURABILITY CONSIDERATIONS FOR
DIFFERENT TYPES OF STRUCTURES AND DEGREES
OF EXPOSURE USING ORDINARY PORTLAND CEMENT

Exposure Conditions		
Severe wide range of temperature. Fre- quent alterations of or arid freezing and thawing (use Air Entrained concrete only)	Mild Temperature rarely below freezing or rainy or arid	
Type of Structure	At the water line or within the range of fluctuating water level or spray	At the water line or within the range of fluctuating water level or spray

	In Air		In Air	
	In fresh water	In sea water or in contact with Sulphate (concentration more than 0.2 P.C.)	In fresh water	In sea water or in contact with Sulphate (concentration more than 0.2

Thin sections such as tailings curbs sills ledges, ornamental or Architectural concrete reinforced concrete piles, pipes and all sections with less than 1" concrete cover to reinforcement. Moderate sections such as Retaining walls, abutments, piers, girders, beam.		0.49	0.44	0.40		0.53	0.49	0.40	
Exterior portion of heavy mass sections		0.58	0.49	0.44		*	0.53	0.44	
Concrete deposited by Tremies under water		0.58	0.49	0.44		*	0.53	0.44	
Concrete slabs laid on ground						*			
Concrete which will later be protected by enclosure or backfill but which may be exposed to freezing and thawing for several years before such protec-tion is offered.		0.53	-	-		*	-	-	
Concrete protected from the water interiors of buildings, concrete below ground which is free from sulphate attacks .		-	-	-		*	-	-	

NOTE: * Water/Cement ratios should be selected on basis of strength and workability requirements.

3.8 Workability

The degree of workability necessary to allow the concrete to be well consolidated and to be worked into the corners of formwork and around the reinforcement and embedments and to give the required surface finish shall depend on the type and nature of structure and shall be based on experience and tests. The usual limits of consistency for various types of structures are given below

TABLE - V
LIMITS OF CONSISTENCY

Degree of Workability	Slump in mm with Standard Code as per IS: 199(Latest Revision)		Use for which concrete is sutiable
	Min	Max	
Very Low	**0**	**25**	Blinding concrete; Shallow sections; Pavements using pavers.
Low	**25**	**75**	Uncongested wide and shallow sructures .Large mass concrete structures with heavy compaction equipments
Medium	**50**	**100**	Deep but wide R.C.C. structures with congestion or reinforcement and inserts, beams, walls, columns
Medium	**75**	**100**	Slip form work; Pumped Concrete.
High	**100**	**150**	Very narrow and deep R.C.C. struc- tures with congestion due to reinforcement and inserts; Trench fills; In-situ piling

NOTE : (Notwithstanding anything mentioned above, the slump to be obtained for work in progress shall be as per direction of the Engineer)

With the permission of the Engineer, for any grade of concrete, if the water has to be increased in special cases, cement shall also be increased proportionately to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete. No extra payment will be made for this additional cement.

The workability of concrete shall be checked at frequent intervals by slump tests. Alternatively where facilities exist or if required by the Engineer, the compacting factor test in accordance with IS:199 (latest revision) and Clause 6 of IS:456 (latest revision) shall be carried out.

1.3.9.0 Size of Coarse Aggregates

The maximum size of coarse aggregates for different locations shall be as follows unless otherwise directed by the Engineer :

Very narrow space	-	12	mm
Reinforced concrete except foundation	-	20	mm
Ordinary Plain concrete and Reinforced concrete foundations	-	40	mm
Mass concrete	-	80	mm
Mass concrete in very large structure	-	150	mm

Grading of coarse aggregates for a particular size shall conform to relevant I.S. Codes and shall also be such as to produce a dense concrete of the specified

proportions, strength and consistency that will work readily into position without segregation.

Coarse aggregate will normally be separated into the following sizes and stacked separately in properly designed stockpiles :

150 mm to 80 mm, 80 mm to 40 mm, 40 mm to 20 mm and 20 mm to 5 mm. In certain cases it may be necessary to further split the 20 mm to 5 mm fraction into 20 mm to 10 mm and 10 mm to 5 mm fractions.

This separation of aggregates in different size fractions is necessary so that they may be remixed in the desired proportion to arrive at a correct internal grading to produce the best mix.

1.3.10.0 Mixing of Concrete

Concrete shall always be mixed in mechanical mixer unless specifically approved by the Engineer for concrete to be used in unimportant out of the way locations in small quantities. Water shall not normally be charged into the drum of the mixer until all the cement and aggregates constituting the batch are already in the drum and mixed for at least one minute. Mixing of each batch shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency, but in no case shall mixing be done for less than 2 (two) minutes and at least 40 (forty) revolutions after all the materials and water are in the drum. When absorbent aggregates are used or when the mix is very dry, the mixing time shall be extended as may be directed by the Engineer. Mixers shall not be loaded above their rated capacity as this prevents thorough mixing.
The entire contents of the drum shall be discharged before the ingredients for the next batch are fed into the drum. No partly set or remixed or excessively wet concrete shall be used. Such concrete shall be immediately removed from site. Each time the work stops, the mixer shall be thoroughly cleaned and when the next mixing commences, the first batch shall have 10% additional cement at no extra cost to the Owner to allow for loss in the drum.

Regular checks on mixer efficiency shall be carried out as directed by the Engineer as per IS:4634 (latest revision) on all mixers employed at site. Only those mixers whose efficiencies are within the tolerances specified in IS: 1791 (latest revision) will be allowed to be employed.

Ingredients for design mix concrete shall be measured by weight. For small jobs portable Swing weigh Batchers conforming to IS: 277 (latest revision) may be used.

Batching plant conforming to IS:4925 (latest revision) shall be used for large jobs. The accuracy of the measuring equipment shall be within q 2% of the quantity of cement, water or total aggregates being measured and within 5% of the quantity of any admixture being used. The batching equipment shall be fitted with an accurate mechanism for weighing separately the cement, fine aggregate and coarse aggregate. Water may be measured by volume or by weight. All measuring equipment should be maintained in a clean serviceable condition and their accuracy shall be checked periodically.

Mechanical / Electrical control shall be provided on the mixing equipment to ensure the batch cannot be discharged until approved mixing time has elapsed and the entire batch shall be discharged before the mixer is recharged.

Where admixtures are employed, separate containers and measuring devices shall be used.

For minor concreting works, batching by volume according to specific weight may be permitted by the Engineer. In that case the whole bags of cement shall be used and gauge boxes used for measuring aggregates.

When hand mixing is permitted by the Engineer, it shall be carried out on a water-tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. In case of hand-mixing, 10% extra cement shall be added to each batch at no extra cost to the Owner.

1.3.1.0 Conveying Concrete

Concrete shall be handled and conveyed from the place of mixing to the place of laying as rapidly as practicable by approved means and placed and compacted in the final position before the initial setting of the cement starts. Concrete should be conveyed in such a way as will prevent segregation or loss of any of the ingredients. For long distance haulage, agitator cars of approved design will be used. If, in spite of all precautions, segregation does occur during transport, the concrete shall be properly re-mixed before placement. During very hot or cold weather, if directed by the Engineer, concrete shall be transported in deep containers which will reduce the rate of loss of water by evaporation or loss of heat. If necessary, the container may have to be covered and insulated. Conveying equipment for concrete shall be well maintained and thoroughly cleaned before commencement of concrete mixing. Such equipment shall be kept free from set concrete.

1.3.12.0 Placing and Compacting Concrete

Where specifically covered, the relevant I.S. Code will be followed for the procedure of surface preparation, placement, consolidation, curing, finishes, repairs and maintenance of concrete. if, however, there is no specific provision in the relevant I.S. Code for any particular aspect of work, any other standard Code of practice, as may be specified by the Engineer, will be adopted. Concrete may have to be placed against the following types of surfaces :

a) Earth foundation
b) Rock foundation
c) Formwork
d) Construction joint in concrete or masonry

The surface on or against which concrete is to be placed has to be cleaned thoroughly. Rock or old construction joint has to be roughened by wire brushing, chipping, sand blasting or any other approved means for proper bond. All cuttings, dirt, oil, foreign and deleterious material, laitance, etc. are to be removed by air water jetting or water at high pressure. Earth foundation on which direct placement of concrete is allowed, will be rammed and consolidated as directed by the Engineer such that it does not crumble and get mixed up with the concrete during or after placement, before it has sufficiently set and hardened.

Formwork, reinforcement, preparation of surface, embedment, joint seals etc., shall be approved in writing by the Engineer before concrete is placed. As far as possible, concrete shall be placed in the formwork by means approved by the Engineer and shall not be dropped from a height or handled in a manner which may cause segregation. Any drop over 1500 mm shall have to be approved by the Engineer.

Rock foundation or construction joint will be kept moist for at least 72 hours prior to placement. Concrete will be placed always against moist surface but never on pools of water. In case the foundation cannot be dewatered completely, special procedure and precaution, as directed by the Engineer will have to be adopted.

Formwork will be cleaned thoroughly and smeared lightly with form oil or grease of approved quality just prior to placement.

A layer of mortar of thickness 12 mm of the same or less W/C ratio and the same proportion as that of the concrete being placed and cement slurry will be spread thoroughly on the rock foundation or construction joint prior to placement of concrete. The cost of application of such cement slurry and mortar will be deemed to be included in the unit rate of concrete.

After concrete has been placed, it shall be spread, if necessary and thoroughly compacted by approved mechanical vibration to maximum subsidence without segregation and thoroughly worked around shape. Vibrators shall not be used for pushing concrete into adjoining areas. Vibrators must be operated by experienced workmen and the work carried out as per relevant IS Code of Practice. In thin members with heavy congestion of reinforcement or other embedment, where effective use of internal vibrator is, in the opinion of the Engineer, doubtful, in addition to immersion vibrators the contractor may have to employ form vibrators conforming to IS:4656 (latest revision). For slabs and other similar structures, the contractor will additionally employ screed vibrator as per IS:2506 (latest revision). Hand tamping may be allowed in rare cases, subject to the approval of the Engineer. Care must be taken to ensure that the inserts, fixtures, reinforcement, and formwork are not displaced or distorted during placing and consolidation of concrete.

The rate of placement of concrete shall be such that no cold joint is formed and fresh concrete is placed always against green concrete which is still plastic and workable. No concrete shall be placed in open, during rains. During rainy season, no placement in the open is to be attempted unless sufficient tarpaulins or other similar protective arrangement for completely covering the still green concrete from rain is kept at the site of placement. If there has been any sign of washing of cement and sand, the entire affected concrete shall be removed immediately. Suitable precautions shall be taken in advance to guard against rains before leaving the fresh concrete unattended. No accumulation of water shall be permitted on or around freshly laid concrete.

The size of the concrete pours must be carefully considered prior to commencement to ensure the structural elements are poured in on continuous shift to avoid cold joints.

Slabs, beams and similar members shall be poured in one operation, unless otherwise instructed by the Engineer. Moulding, throating, drip course, etc., shall be poured as shown on the drawings or as directed by the Engineer. Holes shall be provided and bolts, sleeves, anchors, fastenings or other fixtures shall be embedded in concrete as shown on the drawings or as directed by the Engineer. Any deviation therefrom shall be set right by the Contractor at his own expense as instructed by the Engineer.

In case the forms or supports get displaced during or immediately after the placement and bring the concrete surface out of alignment beyond tolerance limits, the Engineer may direct to remove the portion and reconstruct or repair the same at the Contractor’s expense.

The Engineer shall decide upon the time interval between two placements of concrete of different ages coming in contact with each other, taking in consideration the degree of maturity of the older concrete, shrinkage, heat dissipation and the ability of the older concrete to withstand the load imposed upon it by the fresh placement.

Once the concrete is deposited, consolidated and finished in its final position, it shall not be distributed.

1.3.13.0 Construction Joints and Cold Joints

1.3.13.1 Construction Joints

It is always desirable to complete any concrete structure by continuous pouring in one operation. However, due to practical limitation of methods and equipment and certain design considerations, construction joints are formed by discontinuing concrete at certain predetermined stages. These joints will be formed in a manner specified in the drawings/Instruction. Vertical construction joints will be made with rigid stop-board forms having slots for allowing passage of reinforcement rods and any other embedment and fixtures that may be shown. Next stage concrete shall be placed against construction joint as per clause 2.1.3.12.0. For water retaining structures and leak proof buildings suitable and approved water stops may be installed at the construction joints as per Clause 12.4 of IS:456 (latest revision).

Where the location of the joints are not specified, it will be in accordance with the following :

a) In a column, the joint shall be formed 75 mm below the lowest soffit of the beam framing into it.

b) Concrete in a beam shall preferably be placed without a joint, but if provision of a joint is unavoidable, the joint shall be vertical and within the middle third of the span.

c) A joint in a suspended floor slab shall be vertical and within the middle third of the span and at right angles to the principal reinforcement.

d) Feather-edges in concrete shall be avoided while forming a joint.

e) A construction joint should preferably be placed in a low-stress zone and at right angles to the direction of the principal stress.

f) In case the Contractor proposes to have a construction joint anywhere to facilitate his work, the proposal should be submitted well in advance to the Engineer for study and approval without which no construction joint will be allowed.

1.3.13.2 Cold Joint

An advancing face of a concrete pour, which could not be covered by fresh concrete before expiry of initial setting time (due to an unscheduled stoppage or delay on account of breakdown in plant, inclement weather, low rate of placement or any other reason), is called a cold joint. The Contractor should always remain vigilant to avoid cold joints.

If, however, a cold joint is formed due to unavoidable reasons, the following procedure shall be adopted for treating it :

a) If the concrete is so green that it can be removed manually and if vibrators can penetrate the surface without much effort, fresh concrete can be placed directly against the old surface. The old concrete should be covered by fresh concrete as quickly as possible and the joint thoroughly and systematically vibrated.

b) In case concrete has hardened a bit more than (a) but can still be easily removed by a light hand pick, the surface will be raked thoroughly and the loose concrete removed completely without disturbing the rest of the concrete in depth. A rich mortar layer 12 mm in thickness, will be placed on the cold joint fresh concrete shall be placed on the mortar layer and the joint will be thoroughly and systematically vibrated penetrating the vibrator deep into the old layer of concrete.

c) In case the concrete at the joint has become so stiff that it cannot be remoulded and mortar or slurry does not rise in spite of extensive vibration, the joint will be left to harden for at least 12 - 24 hrs. It will then be treated as a regular construction joint, after cutting the concrete to required shape and preparing the surface as described under clause 2.1.3.12.0.

1.3.14.0 Repairs, Finishes and Treatment of Concrete surfaces.

1.3.14.1 Adequate and sound concrete surfaces, whether formed or unformed, can be obtained by employing a concrete mix of proper design, competent formwork, appropriate methods of handling, placing and consolidation by experienced workmen.

Unsound concrete resulting from improper mix design, incompetent methods, equipment and formwork, poor workmanship and protection will not be accepted and will have to be dismantled, removed and replaced by sound concrete at the Contractor's cost. The Engineer may, at his sole discretion, allow to retain concrete with minor defects provided the Contractor is able to repair it by approved methods at no extra cost to the Owner. All concrete work shall be inspected by the Contractor immediately after the forms are removed and he will promptly report occurrence of any defects to the Engineer. All repair works will be carried out as per the instructions and in the presence of the Engineer or his representative. Generally, repair work will consist of any or all of the following operations :

a) Sack rubbing with mortar and stoning with carborundum stone.

b) Cutting away the defective concrete to the required depth and shape.

c) Cleaning of reinforcement and embedment. It may be necessary to provide an anti-corrosive coating on the reinforcement.

d) Roughening by sand blasting or chipping.

e) Installing additional reinforcement/welded mesh fabric.

f) Dry packing with stiff mortar.

g) Plastering, guniting, shotcreting etc.

h) Placing and compacting concrete in the void left by cutting out defective concrete.

i) Grouting with a cement sand slurry of 1:1 mix.

j) Repairing with a suitable mortar either cement or resin modified mortar

k) Polymer modified patching and adhesive repair mortar for beams and columns.

3.14.2 Finishing Unformed Surface

The requirement of finishes of formed surfaces are given separately under Clause 2.1.3.20.7 of this specification. The Contractor is to include in his quoted rate for concrete, the provision of normal finishes in unformed surfaces which can be achieved by screeding, floating, trowelling etc., as and where required by the Engineer without any extra cost to the Owner. A few typical and common cases of treatment of concrete surface are cited below :

a) Floor

Whenever a non-integral floor finish is indicated, the surface of reinforcement concrete slab shall be struck off at the specified levels and slopes and shall be finished with a wooden float fairly smooth removing all laitance. No over trowelling, to obtain a very smooth surface, shall be done as it will prevent adequate bond with the subsequent finish. If desired by the Engineer, the surface shall be scored and marked without any extra cost to the Owner to provide better bond.

Where monolithic finish is specified or required, concrete shall be compacted and struck off at the specified levels and slopes with a screed, preferably a vibrating type and then floated with a wooden float. Steel trowelling by hand or by rotary power float is then started after the moisture film and shine have disappeared from the surface and after the concrete has hardened enough to prevent excess of fines and water to rise to the surface but not hard enough to prevent proper finishing of aberrations. Steel trowelling properly done will flatten and smoothen sandy surface left by wooden floats and produce a dense surface free from blemishes, ripples and trowel marks. A fine textured surface that is not slick and can be used where there is likelihood of spillage of oil or water can be obtained by trowelling the surface lightly with a circular motion after initial trowelling keeping the steel trowel flat on the surface.

To provide a better grip the Engineer may instruct marking the floor in a regular geometric pattern after initial trowelling.

b) Beams, Columns & Walls

If on such or any other concrete structure it is intended to apply plaster or such concrete surfaces against which brickwork or other allied works are to be built, the Contractor shall hack the surface adequately as soon as the form is stripped off so that proper bond can develop. Pattern, adequacy and details of such hacking shall meet with the approval of the Engineer, who shall be informed to inspect such surfaces before they are covered up.

1.3.15.0 Protection and Curing of concrete

Newly placed concrete shall be protected by approved means from rain, sun and wind. Concrete placed below the ground level shall be protected against contamination from falling earth during and after placing. Concrete placed in ground containing deleterious substances, shall be protected from contact with such ground,

or with water draining from such ground, during placing of concrete and for a period of at least three days or as otherwise instructed by the Engineer. The ground water around newly poured concrete shall be kept to an approved level by pumping out or other adequate means of drainage to prevent floatation or flooding. Steps, as approved by the Engineer, shall be taken to protect immature concrete from damage by debris, excessive loadings, vibration, abrasion, mixing with earth or other deleterious materials, etc. that may impair the strength and durability of the concrete.

As soon as the concrete has hardened sufficiently, it shall be covered either with sand, hessian, canvas or similar materials and kept continuously wet for at least 14 (fourteen) days after final setting. Curing by continuous sprinkling of water will be allowed if the Engineer is satisfied with the adequacy of the arrangements made by the Contractor.

If permitted by the Engineer, curing compound like “ANTISOLE (WP)” or approved equivalent may be used for prevention of premature water loss in concrete and thereby effecting curing of concrete. This type of curing compound shall be sprayed on newly laid concrete surfaces to form thin film barrier against premature water loss without disturbances to normal setting action. The curing compound shall comply with ASTM requirements for acceptance.

The curing compound shall be applied following the final finishing operation and immediately after disappearance of water sheen from concrete surface. It is important not to apply the curing compound when standing water is still present on concrete.

The contractor shall arrange for the manufacturer’s supervision at no extra cost to the owner.
The Contractor shall remain extremely vigilant and employ proper equipment and workmen under able supervision for curing. The Engineer’s decision regarding the adequacy of curing is final. In case any lapse on the part of the Contractor is noticed by the Engineer, he will inform the Contractor or his supervisor verbally or in writing to correct the deficiency in curing. If no satisfactory action is taken by the Contractor within 3 (three) hours of issuance of such instruction, the Engineer will be at liberty either to employ sufficient means through any agency to make good the deficiency and recover the cost thereof from the Contractor, or pay for the part where adequate curing was noticed at a reduced rate, entirely at the discretion of the Engineer.

1.3.16.0 Reinforcement

Mild steel round bars, cold twisted and deformed bars as medium tensile or high yield strength steel, plain hard drawn steel wire fabric etc., will be used as reinforcement as per drawings and directions.

In an aggressive environment an anti-corrosive coating on the reinforcement may be provided as per IS:9077 (latest revision), as shown on the drawing or as directed by the Engineer.

1.3.16.1 Bar Bending Schedules

The Contractor shall submit to the Engineer for approval Bar Bending Schedules with working drawings in triplicate, showing clearly the arrangements proposed by the Contractor to match available stock of reinforcing steel, within one month of receipt of the Letter of Intent or of the receipt of the relevant design drawings, whichever is later. Upon receipt of the Engineer’s final approval of the Bar Bending Schedule and drawings, the Contractor shall submit six (6) prints of the final drawings with one reproducible print after incorporating necessary modifications or corrections, for final record and distribution. Approval of such detailed drawings by the Engineer shall not

relieve the Contractor of his responsibility for correctness nor of any of his obligations to meet the other requirements of the Contract.

1.3.16.2 Cleaning

All steel for reinforcement shall be free from loose scales, oil, grease, paint or other harmful matters immediately before placing the concrete.

1.3.16.3 Cutting and Bending of Reinforcement

Unless otherwise specified, reinforcing steel shall be bent in accordance with the procedure specified in IS:2502 (latest revision) or as approved by the Engineer. Bends and shapes shall comply strictly with the dimensions corresponding to the approved Bar Bending Schedules. Bar Bending Schedules shall be rechecked by the Contractor before any bending is done.

No reinforcement shall be bent when already in position in the work, without approval of the Engineer, whether or not it is partially embedded in concrete. Bars shall not be straightened in a manner that will injure the material. Rebending can be done only if approved by the Engineer. Reinforcing bars above 16 mm diameter shall be bent by machine or other approved means producing a gradual and even motion. Bars of 16 mm or below may be bent by hand. All the bars shall be cold bent unless otherwise approved. Bending hot at a cherry-red heat (not exceeding 845 Deg. C) may be allowed under very exceptional circumstances except for bars whose strength depends on cold working. Bars bent hot shall not be cooled by quenching.

Reinforcing bars, whether high yield or mild steel shall be cut using either hand held shears, guillotines or foot operated pneumatic cutters. Cutting bars using cold chisels may be allowed by the Engineer at exceptional cases.

1.3.16.4 Placing in position

All reinforcements shall be accurately fixed and maintained in position as shown on the drawings by such approved and adequate means like mild steel chairs and /or concrete spacer blocks irrespective of whether such supports are payable or not. Bars intended to be in contact at crossing points, shall be securely tied together at all such points by No. 20 G annealed soft iron wire or by tack welding in case of Bar larger than 25 mm dia., as may be directed by the Engineer. Binders shall tightly embrace the bars with which they are intended to be in contact and shall be securely held. The vertical distance between successive layers of bars shall be maintained by provision of mild steel spacer bars. They should be spaced such that the main bars do not sag perceptibly between adjacent spacers. Before actual placing, the Contractor shall study the drawings thoroughly and inform the Engineer in case he feels that placement of certain bars is not possible due to congestion. In such cases he should not start placing any bar before obtaining clearance from the Engineer.

1.3.16.5 Welding

Normal bond laps in reinforcement may be placed by lap or butt welding reinforcement bars, if asked by the Engineer, under certain conditions. The work should be done with suitable safeguards in accordance with relevant Indian Standards for welding of mild steel bars used in reinforced concrete construction as per the latest revisions of IS:2751 and IS:456. Welded mesh fabrics conforming to IS:1566 (latest revision) may also be used if specified in the Schedule of Items and Drawings.

1.3.16.6 Control

The placing of reinforcements shall be completed well in advance of concrete pouring. Immediately before pouring. The reinforcement shall be examined by the Engineer for accuracy of placement and cleanliness. Necessary corrections as directed by him shall be carried out. Laps and anchorage lengths of reinforcing bars shall be in accordance with IS:456 (latest revision), unless otherwise specified. If the bars in a lap are not of the same diameter, the smaller will guide the lap length. The laps shall be staggered as far as practicable and as directed by the Engineer. Arrangements for placing concrete shall be such that reinforcement in position do not have to bear extra load and get disturbed.

The cover for concrete over the reinforcements shall be as shown on the approved drawings unless otherwise directed by the Engineer. Where concrete blocks are used for ensuring the cover and positioning reinforcement, they shall be made of mortar not leaner than one (1) part cement to two (2) parts sand by volume and cured in a pond for at least fourteen (14) days. The type, shape, size and location of the concrete blocks shall be as approved by the Engineer.

1.3.17.0 Cold Weather Concreting

When conditions are such that the ambient temperature may be expected to be 4.5 Deg. C or below during the placing and curing period, the work shall conform to the requirement of Clause 13 of IS:456 (latest revision) and IS:7861 (Part-II) (latest revision).

1.3.18.0 Hot Weather Concreting

When depositing concrete in very hot weather, the Contractor shall take all precautions as per IS:7861 (Part-I) (latest revision) and stagger the work to the cooler parts of the day to ensure that the temperature of wet concrete used in massive structures does not exceed 38 Deg. C while placing. Positive temperature control by precooling, post cooling or any other method, if required, will be specified and paid for separately.

1.3.19.0 Concreting under water

When it is necessary to deposit concrete under water it shall be done in accordance with the requirements of clause 13 of IS: 456 (latest revision).

1.3.20.0 FORM WORK

1.3.20.1 General

If it is so desired by the Engineer, the contractor shall prepare, before commencement of actual work, designs and working drawings for formwork and centering and get them approved by the Engineer. The formwork shall conform to the shape, grade, lines, levels and dimensions as shown on the drawings.

Materials used for the formwork inclusive of the supports and centering shall be capable of withstanding the working load and remain undistorted throughout the period it is left in service. All supports and scaffolds should be manufactured from structural or tubular steel except when specifically permitted otherwise by the Engineer.

The centering shall be true to vertical, rigid and thoroughly braced both horizontally and diagonally. Rokers are to be used where forms are to support inclined members.

The forms shall be sufficiently strong to carry without undue deformation, the dead weight of the concrete as a liquid as well as the working load, in case the Contractor wishes to adopt any other design criteria, he has to convince the Engineer about its acceptability before adopting it. Whether the concrete is vibrated, the formwork shall be strong enough to withstand the effects of vibration without appreciable deflection, bulging, distortion or loosening of its components. The joints in the formwork shall be sufficiently tight to prevent any leakage of slurry or mortar.

To achieve the desired rigidity, the bolts, spacer blocks, tie wires and clamps as approved by the Engineer shall be used but they must in no way impair the strength of concrete or cause stains or marks on the finished surface. Where there are chances of these fixtures being embedded, only mild steel or concrete of adequate strength shall be used. Alternatively, except in case of water retarding structures through rods and the tie bolts shall be sleeved with PVC conduits to allow retraction of the ties on removal of the shutters. Where required, the annulus of the conduits will be fitted with expanding mortar to seal the void. Bolts passing completely through liquid retaining walls / slabs for the purpose of securing and aligning the formwork shall not be used.

The formwork shall be such as to ensure a smooth uniform surface free from honeycombs, air bubbles, bulges, fins and other blemishes. Any blemish or defect found on the surface of the concrete must be brought to the notice of the Engineer immediately and rectified free of charge as directed by him.

For exposed interior and exterior concrete surfaces of beams, columns and wall, plywood or other approved form shall be thoroughly cleaned and tied together with approved corrosion-resistant devices. Rigid care shall be exercised in ensuring that all column forms are plumb and true and thoroughly cross braced to keep them so. All floor and beam centering shall be crowned not less than 8 mm in all directions for every 5 meters span. Unless specifically described on the drawings or elsewhere to the contrary, beveled forms 25 mm by 25 mm shall be fixed in the form-work at all corners to provide chamfering of the finished concrete edges without any extra charge. The formwork should lap and be secured sufficiently at the lift joints to prevent bulges and offsets.

Temporary openings for cleaning, inspection and for pouring concrete shall be provided at the base of vertical forms and at other places, where they are necessary and as may be directed by the Engineer. The temporary openings shall be so formed that they can be conveniently closed when required, during pouring operations without leaving any mark on the concrete.

1.3.20.2 Cleaning and Treatment of Forms

All parts of the forms shall be thoroughly cleaned of old concrete, wood shavings, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish, loose concrete, chippings, shavings, saw dust etc. shall be scrupulously removed from the interior of the forms before concrete is poured. Compressed air jet and / or water jet along with wire brushes, brooms etc. shall be used for cleaning. The inside surface of the formwork shall be treated with approved non-staining oil based shutter release agent like “Separal / Sika form oil / siparol concentrate” or approved equivalent it is placed in position. Care shall be taken that oil or other compound does not come in contact with reinforcing steel or construction joint surfaces. They shall not be allowed to accumulate at the bottom of the formwork. The oiling of the formwork will be inspected just prior to placement of concrete and redone wherever necessary.

1.3.20.3 Design

The formwork shall be so designed and erected that the forms for slabs and the sides of beams, columns and walls are independent of the soffits of beams and can be removed without any strain to the concrete already placed or affecting the remaining formwork. Removing any props or re propping shall not be done except with the specific approval of the Engineer. If formwork for column is erected for the full height of the column, one side shall be left open and built up in sections, as placing of concrete progress. Wedges, spacer bolts, clamps or other suitable means shall be provided to allow accurate adjustment and alignment of the formwork and to allow it to be removed gradually without jarring the concrete.

The design of formwork shall take into account all vertical and lateral loads that the forms will carry or be subjected to during the construction progress. Besides weight and pressures of reinforced concrete and weight of the forms themselves, the design shall consider loading due to unsymmetrical placement of concrete; impact from dumping of concrete; movement of men and construction equipment; wind action and any other imposed load during construction. The contractor shall assess the magnitude of vertical live load to be taken for design of formwork duly considering his method, sequence and rate of pour of concrete. However, minimum design vertical live load to be considered shall be 750 kg/Sqm excluding weight of concrete

1.30.20.4 Inspection of Forms

Casting of Concrete shall start only after the formwork has been inspected and approved by the Engineer. The concreting shall start as early as possible within 3 (three) days after the approval of the formwork and during this period the formwork shall be kept under constant vigilance against any interference. In case of delay beyond three days, a fresh approval from the Engineer shall be obtained.

1.3.20.5 Removal of Forms

Before removing any formwork, the Contractor must notify the Engineer well in advance to enable him to inspect the concrete if he so desires.

The Contractor shall record on the drawing or in any other approved manner, the date on which concrete is placed in each part of the work and the date on which the formwork is removed therefrom and have this record checked and countersigned by the Engineer regularly. The contractor shall be responsible for the safe removal of the formwork and any work showing signs of damage through premature removal of formwork of loading shall be rejected and entirely reconstructed by him without any extra cost to the Owner. The Engineer may, however, instruct to postpone the removal of formwork if he considers it necessary.

Forms for various types of structural components shall not be removed before the minimum periods specified herein and the removal after the minimum periods shall also be subject to the approval of the Engineer in each case

TABLE-VI
SCHEDULE OF REMOVAL OF FORMWORK

	Ordinary Portland Cement Concrete					Rapid Hardening Portland Cement Concrete			
Part of Structure	Temperature Deg.C					Temperature Deg.C			
	Above48 Deg	48 Deg 28 Deg	28 Deg 5 Deg	Below 5 Deg	Above 48 Deg	48 Deg 28 Deg	28 Deg 5 Deg	Below 5 Deg	
	Days	Days	Days	Days	Days	Days	Days	Days	
a) Column& Walls	2	1	1	Do not Remove Forms until site cured. Test specimen as developed at least 50% of the specified 28 days strength	1	1	1	Do not Remove Forms until site cured. Test specimen as developed at least 50% of the specified 28 days strength	
b)Beam Sides	3	2	3		2	1	1		
c)Slabs, 125	18	7	8		7	4	5		
d)Slabs, 125thick									
e)Slabs over 125 thick and soffit of minor beams	18	14	16		12	8	9		
f) Soffit of the main beam	24	21	7		14	18	12		

Wherever exposed surfaces of concrete can be effectively sealed to prevent loss of water, the periods specified for temperature above 40 Deg. C can be reduced to those of the temperature range of 20 Deg. C to 40 Deg. C subject to approval of the Engineer.

Construction joints in beams, if required to be provided, will be located at the middle /\ of span according to clause 2.1.3.13.1(b) of this specification. In such cases, however, entire span of beam shall have to be kept supported by formwork till its removal for the portion of beam, cast at a later date, is due and so approved by the Engineer.

If any type of cement other than ordinary Portland cement and Rapid hardening Portland cement is used the time of removal of forms shall be revised as approved by the Engineer such that the strength of this cement at the time of removal of forms match with strength of Portland cement at the time of removal of form as mentioned above. This has to be supported by regular tests.

1.3.20.6 Tolerance

The formwork shall be so made as to produce a finished concrete, true to shape, lines, levels, plumb and dimensions as shown on the drawings subject to the following tolerances unless otherwise specified in this Specification or drawings or directed by the Engineer :

For -	a)	Sectional dimension	-	± 5 mm
	b)	Plumb	-	1 in 1000 of height
	c)	Levels	-	± 3 mm before any deflection has taken place

The tolerance given above are specified for local aberrations in the finished concrete surface and should not be taken as tolerances for the entire structure taken as a whole or for the setting and alignment of formwork, which should be as accurate as possible to the entire satisfaction of the Engineer. Any error, within the above tolerance limits or any other as may be specially set up by the Engineer, if noticed in any lift of the structure after stripping of forms, shall be corrected in the subsequent work to bring back the surface of the structure to its true alignment.

1.3.20.7 Re-use of Forms

Before re-use, all forms shall be thoroughly scraped, cleaned, joints and planes examined and when necessary repaired, and inside surface treated as specified hereinbefore. Formwork shall not be used / re-used if declared unfit or unserviceable by the Engineer.

1.3.20.8 Classification

Generally, the “ordinary” class formwork shall be used unless otherwise directed by the Engineer:

a) Ordinary : These shall be used in places where ordinary surface finish is required and shall be composed of steel and / or approved good quality partially seasoned timber.

4.0 TECHNICAL SPECIFICATION
FOR
ANTI-TERMITE TREATMENT

1.00.00 SCOPE

The scope of work is to set up a chemical barrier against attack by subterranean termites while the building is under construction.

2.00.00 EXECUTION

2.01.00 General

All work shall in general be executed as specified in IS: 6313 Part II-1981 (latest revision) and as per approved specification of the agency having special know-how for the job.

All necessary work to ensure uniform distribution and proper penetration of treatment of treating solution shall be done according to the instruction of the Engineer.

Soil treatment shall not be done when it is raining or when the soil is wet with rain or subsoil water. Once formed, the treated soil barrier shall not be disturbed.

2.02.00 Chemicals and Rate of Application

Any of the following chemicals (conforming to relevant Indian Standards) in water emulsion shall be applied by pressure pumps, uniformly over the area treated.

Chemicals		**Concentration by Weight, Percentage**
Chlorpyrifos Emulsifiable (IS 8944 - 1978) (latest revision)	:	1.0
Heptachlor Emulsifiable Concentrate (IS: 6439 - 1978) (latest revision)	:	0.5
Chlordane Emulsifiable Concentrate (IS: 2682 - 1984) (latest revision)	:	1.0

2.02.01 Treatment of Column Pits, Wall Trenches and Basement Excavations

Foundations, basements etc. may either be fully enveloped by the chemical barrier or the treatment may start 500 mm below ground level. The bottom surface and sides of excavation (up to a height of about 300 mm) for column pits, walls trenches and basements shall be treated with chemicals
at the rate of 5 litres / $M^{2\ of}$ surface area. Backfills around columns, walls etc. shall be treated at the rate of 7.5 litres / M^2 of the vertical surface. Chemical treatment shall be done in stages following the compaction of earth in layers. The treatment shall be carried out after the ramming operation is done by rodding the earth at 150 mm centres close to the wall surface and spraying the chemicals in the specified dose.

2.02.02 Treatment of Top Surface of Plinth Filling

Holes 50 mm to 75 mm deep at 150 mm centres both ways shall be made with crowbars on the surface of compacted plinth fill. Chemical emulsion at the rate of 5 litres / M^2 of surface shall be applied prior to laying soling or sub-grade. Special care shall be taken to maintain continuity of the chemical barrier at the junction of vertical and horizontal surfaces.

2.02.03 Treatment of Soil Surrounding Pipes, Wastes and Conduits

Special care shall be taken at the points where pipes and conduits enter the building and the soil shall be treated for a distance of 150 mm and a depth of 75 mm at the point where they enter the building.

2.02.04 Treatment of Expansion Joints

These shall receive special attention and shall be treated in a manner approved by the Engineer.

2.02.05 Treatment at Junction of the Wall and the Floor

Special care shall be taken to establish continuity of the vertical chemical barrier on inner wall surfaces from ground level up to the level of the filled earth surface.

A small channel 30 x 30 mm shall be made at all the junctions of wall and columns with the floor. Rod holes made in the channel up to the ground level 150 mm apart and the chemical emulsion poured along the channel at the rate of 7.5 litres per square meter of the vertical wall or column surface. The soil should be tamped back into place after this operation.

3.00.00 ACCEPTANCE CRITERIA

The Contractor shall give a 10-year service guarantee in writing supplemented by a separate and unilateral guarantee from the specialized agency for the job to keep the building free of termites for the specified period at no extra cost to the owner.

4.00.00 RATES

Rates shall be of complete work per unit area as stated in the Schedule.

5.00.00 METHOD OF MEASUREMENT

Complete work of anti-termite treatment shall be measured for plinth area treated

This includes treatment, to foundations, walls, trenches, basements, plinth, buried pipes, conduits etc. The extended portions of foundation

and like beyond plinth limit shall be the part of complete work and no extra payment shall be made.

6.00.00 I.S. CODE

Relevant code applicable for this Specification.

IS: 6313 (Part-II) 1981 (latest revision): Code of Practice of Anti-Termite Measures in Buildings

Pre-constructional chemical treatment measures.

5.0 TECHNICAL SPECIFICATION
FOR
MASONRY AND ALLIED WORKS

1.00.00 SCOPE

This specification covers furnishing, installation, repairing, finishing, curing, protection, maintenance and handing over of masonry and allied works for use in structures and locations covered under the scope of the Contract.

2.00.00 INSTALLATION

2.01.00 Soling

2.01.01 Brick Soling

The ground shall be dressed, consolidated by ramming or by light rolling and a 12 mm thick cushion of sand laid. On the sand cushion the bricks shall be laid with fine joints and placed firmly in position by hammering with wooden mallet. The surface shall be free from undulations. The 'frog' side shall be on the underside. The joints shall be broken the in all direction and bricks cut as required. The pattern of laying and number of layers shall be as per Schedule of Item. Orientation shall be as desired by the Engineer. After laying of each layer of bricks sand shall be spread over and worked into the joints to pack the bricks tight.

2.01.02 Stone Soling

The stones for soling shall be selected on the basis of thickness of soling specified in the Schedule of Items. The larger stones shall be laid and the gaps filled by smaller stones. The interstices shall then be firmly packed with sand by flooding with water.

2.02.00 Brick Edging

Excavation shall be done close to the brick dimensions and in perfect alignment. Bricks shall be firmly placed by hammering with wooden mallets and sides and joints packed firmly with earth so that the edging is not disturbed easily. Alignment and level shall be acceptable to the Engineer.

2.03.00 Masonry

2.03.01 General

All masonry work shall be true to lines and levels as shown on drawings. All masonry shall be tightly built against structural members and bonded with dowels, inserts etc. as shown on drawings.

2.03.02 Mortar

Mix for mortar shall be specified in the Schedule of Items.

When lime is used hydrated lime shall be mixed with water to form putty and stored with care to prevent evaporation for at least 24 hours before

use. Quick lime shall be slaked with enough water to make a cream, passed through a No. 10 sieve and stored avoiding evaporation for seven days before use.

Lime putty and sand in proper proportion shall be mixed on a watertight platform with necessary addition of water and thoroughly ground in a mortar mill. This mix shall be transferred to a mechanical mix, required quantity of cement added and the content mixed for at least 3 minutes. Mixtures of lime putty and sand may be stored avoiding drying out. For cement sand mortar cement and sand in requisite proportions shall be mixed dry in a mechanical mixer and then water added and mixed further. Minimum quantity of water shall be added to achieve working consistency.

Surplus mortar droppings from masonry, if received on surface free from dirt may be mixed with fresh mortar if permitted by the Engineer who may direct addition of additional cement without any extra payment. No mortar, which has stood for more than half an hour, shall be used.

2.03.03 Brick Masonry

Bricks shall be soaked by submergence in clean water for at least two hours in approved vats before use. Bricks shall be laid in English bond unless specified otherwise. Broken bricks shall not be used. Cut bricks shall be used if necessary to complete bond or as closers. Bricks shall be laid with frogs upwards over full mortar beds. Bricks shall be pressed into mortar and tapped into final position so as to embed fully in mortar. Inside faces shall be buttered with mortar before the next bricks is placed and pressed against it. Thus all joints between bricks shall be fully filled with mortar.

Mortar joints shall be kept uniformly 10 mm thick. All joints on face shall be raked to minimum 10 mm depth using raking tool while the mortar is still green to provide bond for plaster or pointing. Where plaster or pointing is not provided, the joints shall be struck flush and finished immediately. Brickworks two bricks thick or more shall have both faces in true plane. Brickwork of lesser thickness shall have one selected face in true plane.

2.03.04 Exposed Brickwork

Brickwork in superstructures, which is not covered by plaster, shall be as shown on drawing and executed by especially skilled mason. Courses shall be truly horizontal and vertical joints truly vertical. Wooden straight edges with brick course graduations and position of windowsills and lintels shall be used to control uniformity of brick courses. Masons must check workmanship frequently with plumb, spirit level, rule and string. All brickwork shall be cleaned at the end of days work. If face bricks are specified in the Schedule of Item, the brickwork shall be in composite bricks, with face bricks on the exposed face and balance in routine bricks, but maintaining the bond fully. Where face bricks are not specified, bricks for the exposed face shall be specially selected from routine bricks. All exposed brickwork on completion of work shall be rubbed down,

washed clean and pointed as specified. Where face bricks are used carborandum stone shall be used for rubbing down.

2.03.05 Reinforced Brickworks

Reinforcements shall be as specified in the Schedule of Items. All reinforcements shall be thoroughly cleaned and fully embedded in mortar. Where M.S. bars are used as reinforcement, these shall be lapped with dowels if left in R.C. Columns or welded to steel stanchions.

2.03.06 Stone Masonry

Stones shall be thoroughly soaked before laying. Stones shall be laid on their natural quarry beds. Individual stones shall be fitted with mallet and properly wedged to reduce thickness of mortar joints. Thickness of joint shall be not less than 8 mm and not greater than 25 mm. Al least two stones shall run the full width of the wall for every square meter of surface area.

2.03.07 Exposed Stonework

Stonework, which is to be kept exposed, shall be as shown on drawing or described in the Schedule of Items. Especially especially skilled mason shall execute it. Stones used for exposed face shall be specially selected. All exposed stone faces shall be kept clean and free from mortar and pointed up neatly as the work proceeds in a manner called for in the drawings or the Schedule of Items or instructions. A sample wall,10sq.m. In area shall be built and approved by the Engineer and all works shall match with this sample.

2.03.08 Hollow and Solid concrete block Masonry

Hollow and solid concrete block shall conform to the requirement of I.S 2185. Hollow concrete block shall be sound, free from broken edges; free from cracks, honeycombing and other defects, which may give a defective work, impaired the required strength.

Dimensional stability: concrete masonry units shall be made of proper sizes and shape to suit the construction need and shall be in neutral of the following sizes:

The nominal size of concrete block /solid concrete block.

Length:	400,500,600.
Height	200,100
Width	50,75,100,150,200,250,300.

In addition block shall be manufactured in half-length of correspondence to full length. Maximum tolerance of length shall be (±) 5mm and in height &with shall be ± 3mm.

The average crushing strength shall be determined as per I.S 2185 and shall be of Load bearing wall density of block shall be not less than 1500 kg /mm^3 and minimum average compressive strength of units shall be 3.5 to 7 N/mm^3 and minimum strength of individual unit shall be 2.8 to 5.6 for block density less than 1500 kg /mm^3 but not less than 1000 kg /mm^3 average compressive strength of units shall be 2.0 to5 N/mm^3 and minimum strength of individual unit shall be 1.6 to 4.0 N/mm^3

For non load bearing wall block density shall be not less than 1000kg / mm^3 and minimum average compressive strength of units shall be1.5 N/mm^3 and minimum strength shall be 1.2 N/mm^3

2.03.09 Composite Masonry

Where stonework facing with brick masonry backing is specified the bond between them shall be achieved by bond stones of dimensions and frequency as desired by the Engineer.

2.03.10 Clay fly ash brickwork

Clay fly ash bricks shall conform to the requirement of IS: 13757 – 1993. The bricks shall be sound, compact and uniform in shape and colour. Bricks shall have smooth rectangular faces with sharp and square corners. Bricks shall be hand or machine moulded and shall be made from the admixture of suitable soils and fly ash in optimum soils fly ash in optimum proportion refer IS: 217- 1991.

The bricks shall be free from visible cracks, flaws, warpage, module of free lime and organic matter, the brick shall be hand or machine moulded. The bricks shall have frog of 100 mm in length 40 mm in width and 10 to 20 mm deep of one of its flat sides. It made by extension process may not be provided with frogs.

Fly ash conform to grade 1 or 2 of IS : 3812-1981.

2.03.10.01 Classification

Burnt clay fly ash bricks shall have class designation of 10 . This means that average compressive strength shall not be less than 10 N/ mm2

2.03.10.02 Dimension

(a) The standard modular size of clay building fly ash bricks shall be as follows

Length mm	Width mm	Height mm
190	90	90
190	90	40

(b) The following non- modular sizes of the bricks shall be as follows

(i)	230	15	75
(ii)	290	10	70
(iii)	230	10	30

Preferred size shall be item b (i)

Physical Requirements

(a) Compressive strength

The bricks when tested in accordance with the procedure laid down in IS 3495 (part I) : 1992 shall have a minimum average compressive strength Of varies classes as mentioned in IS 13757.

(b) Water absorption

The bricks when tested in accordance with the procedure laid down in IS 3495 (part 2) : 1992 after immersion of cold water for 24 hrs. water absorption shall not be more than 20 percent by weight up to class 12.5 and 15 percent by weight for higher class

(c) Efflorescence
The bricks when tested in accordance with the procedure laid down in IS 3495 (part 3) : 1992 the rating of efflorescence shall not be more than "moderate" up to class 12.5 and slight for higher classes.

Other requirement of burnt clay fly ash bricks may be taken from IS-13757: 1993

2.03.1 Expansion & Separation Joints

Location of joints shall strictly be as shown on drawings or as instructed by the Engineer. Expansion joints shall be as shown on drawings and specified in the Schedule of Items. Expansion joint filler boards and shall meet the approval of the Engineer.

Separation joints shall be with standard waterproof paper or with alkathene sheets about 1 mm in thickness. Length and sealing of laps shall be to the satisfaction of the Engineer.

2.03.12 Moldings, Cornices, Drip Course

These shall be made as shown in drawings. Bricks or stone shall be cut and dressed as required. If no subsequent finish is envisaged, these shall be rubbed to correct profile with carborandum stone.

2.03.13 Curing

Masonry shall be cured by keeping it wet for seven days from the date of laying. In dry weather at the end of days work top surface of masonry shall be kept wet by ponding.

2.03.14 Embedding of fixtures

All fixtures shall generally be embedded in mortar and masonry units shall be cut as required.

2.03.15 Encasing of Structural Steel

This shall be done by building masonry work round flanges, webs etc. and filling the gap between steel and masonry by minimum 12 mm thick mortar. Encased members shall be wrapped with chicken wire mesh when shown on drawings or instructed by the Engineer.

The minimum lap in chicken wire mesh shall be 50 mm.

2.04.00 Damp Proof Course

Unless otherwise specified Damp-proof course shall be 40 mm or as per schedule thick 'artificial stone' in proportion 1:1-1/2:3 cement sand stone-chips (10 mm down) with admixture of a waterproofing compound as approved by the Engineer. The percentage of admixture shall be as per manufacturer's specifications but not less than 2% by weight of cement. The top surface shall be double chequered and cured by ponding for seven days.

2.05.00 Damp Proof Membrane

Damp proof treatment using fiber or Hessian base bitumen felt shall be 6, 8 or 10 course treatment as specified in IS: 1609. The number of courses shall be as mentioned in the Schedule of Items. Sequence or work shall be as directed by the Engineer. Extreme care shall be taken to prevent damage to felt during and after laying. The Contractor shall be obliged, at his own expense, to rectify any leakage appearing within 5 years of installation by removing and renewing the coats at the point of leakage.

Where shown on drawing, damp proof membrane with one layer bitumen paper or one layer alkathene sheet shall be laid with minimum 150mm lap under slabs on grade.

3.00.00 RATES

Rates shall be unit rates for the complete work as detailed out in the Specification unless any particular portion is specifically excluded in the Schedule of Items.

4.00.00 METHOD OF MEASUREMENT

4.01.00 Soling

Soling of different types as enumerated in the Schedule of Items shall be measured on actual area basis. Deductions shall not be made for areas less than 0.1 Sq.M.

4.02.00 Brick Edging

Edging shall be measured on running length unless included in other relevant items.

4.03.00 Masonry

4.03.01 Thickness of brick walls shall be measured in nominal brick sizes.

4.03.02 for masonry work exceeding 150 mm in thickness, actual volume of work shall be measured and deductions for openings, lintels, sills, conduit ducts, pipes etc. shall be made. No opening less than 0.1 Sq.M. in area shall however be deducted.

4.03.03 No deductions shall be made for embedded fixtures nor any extra be paid for the mortar used for fixing or for necessary cutting of bricks.

4.03.04 for encasing of steel beams, columns etc. The sizes as shown on drawings shall be measured and deductions made for the volume of encased steel.

4.03.05 No extra payment shall be made for cutting of masonry units.

4.03.06 Walls 150 mm in thickness or less shall be measured for actual area of works and deductions made as in Clause 5.1.4.3.2.

4.03.07 Exposed brickwork using selected ordinary brick or face bricks for the exposed face shall be measured in area as an extra over the ordinary brickwork if so provided in the Schedule of Items. It shall be measured by volume including the composite backing if so provided in the Schedule. Deductions shall be made as described in Clause 5.1.4.3.2.

4.03.08 Reinforcements shall be measured and paid separately under relevant items in the schedule unless included in the items for masonry work.

Laps in wire mesh reinforcements shall not be measured. Reinforcing mesh shall be measured on actual area basis. Reinforcing bars shall be measured by weight.

The weight shall be arrived at on the basis of sectional weights as per I.S. No extra shall be paid for necessary modifications of existing dowels, if any, to tie up with the Contractor's work.

4.03.09 Exposed Stonework

Exposed Stonework using selected stone for exposed face shall be measured in area as an extra over ordinary stonework if so provided in the Schedule of Items. Deductions shall be made as described in Clause 5.1.4.3.2.

4.03.10 Composite Masonry

Composite masonry shall be measured for volume including backing if so provided in the Schedule of Items. If not, brickwork and stonework shall be measured separately and paid under relevant items.

4.03.1 Expansion and Separation Joints

Joints shall be measured for length or area for the complete work as shown on drawings including filler boards, sealant strips, sealing compounds, painting, cover etc. If so provided in the Schedule of Items unless any particular work is specifically excluded from the item.

4.03.12 Mouldings, Cornice, Drip Course

Mouldings, cornice, drip course unless indicated specifically under separate items shall be considered to be included in masonry items. However, cut in bricks or stone shall be neglected in measurements.

4.03.13 Embedded Fixtures

Inserts etc..Shall be measured by weight or by number and paid separately under relevant item in the Schedule of Items.

4.04.00 Damp Proofing

Damp proofing shall be measured and paid in net area. No deductions shall however be made for openings less than 0.1 sq. M. in area. No separate payment shall be made for preparation of base, formworks and additive for cast-in-situ damp proofing unless specified otherwise.

5.00.00 I.S. CODES

Some of the important relevant codes for this section are: -

IS: 127: Recommendations for dimensions and workmanship Of natural building stones for masonry work.

I.S 2185 Code Practice for hollow concrete block.

IS: 1597:	Code of Practice for Construction of stone Masonry.
IS: 1609:	Code of Practice for laying Damp-proof treatment Using bitumen felts.
IS: 712:	Code of Practice for Brickwork.
IS: 750:	Code of Practice for preparation and use of Masonry Mortar.
IS: 5134:	Bitumen Impregnated Paper & Board.

6.0 TECHNICAL SPECIFICATION
FOR
FINISH TO MASONRY AND CONCRETE

1.00.00 SCOPE

This Specification covers furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over of finishing items for masonry and concrete. This shall also include the work to be done to make the surface suitable for receiving the finishing treatment.

Before commencing finishing items the Contractor shall obtain the approval of the Engineer regarding the scheduling of work to minimize damage by other trades. He shall also undertake normal precaution to prevent damage or disfiguration to work of other trades or other installation.

2.00.00 INSTALLATION

2.01.00 Preparation of Surface

All joints in masonry walls shall be raked out to a depth of at least 10 mm with a hooked tool made for the purpose while the mortar is still green. Walls shall be brushed down with stiff wire brush to remove all loose dust from joints and thoroughly washed with water. All laitance shall be removed from concrete to be plastered.

For all types of flooring, skirting and dado work, the base cement concrete slab or masonry surface shall be roughened by chipping and cleaned of all dirt, grease or loose particles by hard brush and water. The surface shall be thoroughly moist to prevent absorption of water from the base course. Any excess of water shall be mopped up.

At any point, the level of base shall be lower than the theoretical finished floor level by the thickness of floor finish. Any chipping or filling to be done to bring the base in the required level shall be brought to the notice of the Engineer and his approval shall be taken regarding the method and extent of rectification work required.

Prior to commencement of actual finishing work, the approval of the Engineer shall be taken as to the acceptability of the base.

2.02.00 Plastering

2.02.01 Mortar

Mortar for plastering shall be as specified in the Schedule of Items.

For sand cement plaster, sand and cement in the specified proportion shall be mixed dry on a watertight platform and minimum water added to achieve working consistency.

For lime gauged plaster, lime putty or hydrated lime and sand in the required proportion shall be mixed on a watertight platform with necessary addition of water and thoroughly ground in mortar mill. This mix shall then be transferred to a mechanical mixer to which the required quantity of cement is added and mixed for at least 3 minutes.

No plaster, which has stood for more than half an hour, shall be used; plaster that shows tendency to become dry before this time shall have water added to it.

2.02.02 Application of Plaster

Plaster, when more than 12 mm thick, shall be applied in two coats - a base coat followed by the finishing coat. Thickness of the base coat shall be sufficient to fill up all unevenness in the surface; no single coat, however, shall exceed 12 mm in thickness. The lower coat shall be thicker than the upper coat; the overall thickness of the coats shall not be less than the minimum thickness shown on the drawings. The undercoat shall be allowed to dry and shrink before applying the second coat of plaster. The undercoat shall be scratched or roughened before it is fully hardened to form a mechanical key. The method of application shall be thrown on rather than applied by trowel.

To ensure even thickness and true surface, patches of plaster about 100 mm to 150 mm square or wooden screed 75 mm wide and of the thickness of the plaster, shall be fixed vertically about 2000 mm to 3000 mm apart, to act as gauges. The finished wall surface shall be true to plumb, and the Contractor shall, without any extra cost to the Owner, make up any irregularity in the brickwork with plaster.

All vertical edges of brick pillars, door jambs etc. shall be chamfered or rounded off as directed by the Engineer.All drips, grooves, mouldings and cornices as shown on drawing or instructed by the Engineer shall be done with special care to maintain true lines, levels and profiles. After the plastering work is completed, all debris shall be removed and the area left clean. Any plastering that is damaged shall be repaired and left in good condition at the completion of the job.

2.02.03 Finish

Generally, the standard finish shall be used unless otherwise shown on drawing or directed by the Engineer. Wherever any special treatment to the plastered surface is indicated, the work shall be done exactly as shown on the drawings, to the entire satisfaction of the Engineer regarding the texture, colour and finish.

a) Standard Finish

Wherever punning is indicated, the interior plaster shall be finished rough. Otherwise the interior plaster shall generally be finished to a smooth surface. The exterior surface shall generally be finished with a wooden float.

b) Neat Cement Finish

Immediately after achieving a true plastered surface with the help of a wooden straight edge, the entire area shall be uniformly treated with a paste of neat cement at the rate of one (1) kg. Per Sq.M. or as per schedule and rubbed smooth with a trowel.

c) Coloured Plaster Finish

This shall be done in the same way as specified in clause 6.1.2.2.2 but using coloured cement in place of ordinary cement. When coloured

plastering is specified in more than one coat, the topcoat only shall be made with coloured cement.

Coloured cement shall be either ready mixed material or may be obtained by mixing pigments and cement at site, as approved by the Engineer. The pigments to be mixed with cement shall conform to Appendix-A of IS: 214 latest edition.

Samples of colouring material shall be submitted to the Engineer for approval and material procured, shall conform in all respects to the approved samples, which shall remain with the Engineer. All coloured cement and/or pigments shall be stored in an approved manner in order to prevent deteriorations.

d) Pebble-dash Finish

Mortar of required thickness consisting of 1 part cement and 4 parts sand by volume shall be applied in the usual manner as described under plastering clause 6.1.2.2.2. While the mortar is still plastic small pebbles or crushed stone of size generally from 10 mm to 20 mm as approved by the Engineer shall be thrown on the plastered surface. The aggregate shall be lightly tapped into the mortar with a wood float or the flat end of a trowel, in order to ensure satisfactory bond between the dashing and the mortar.

e) Rough-Cast Finish

A wet plastic mix of 3 parts coloured cement 6 parts sand and 4 parts aggregate by volume (gravel or crushed stone of size from 6 mm to 12 mm as approved by the Engineer) shall be thrown on to the wall by means of a plaster's trowel and left in the rough condition.

f) Scraped Finish

Ordinary plaster as described under Clause 6.1.2.2.2 after being levelled and allowed to stiffen for a few hours, shall be scraped with a steel straight edge to remove the surface skin. The pattern shall be as approved by the Engineer

g) Textured Finish

Mortar consisting of 1 part cement and 3 parts sand by volume shall be applied in a manner as specified under "Plastering" Clause 6.1.2.2.2. Ornamental treatments in the form of horizontal or vertical rib texture fan texture etc. shall be applied by means of suitable tools to the freshly applied plastered surface, as approved by the Engineer.

2.02.04 Curing

All plastered surfaces after laying, shall be watered, for a minimum period of seven days, by an approved method, and shall be protected from excessive heat and sunlight by suitable approved means. Moistening shall commence, as soon as the plaster has hardened sufficiently and not susceptible to damage. Each individual coat of plaster shall be kept damp continuously, for at least two days, and then dried thoroughly, before applying the next coat.

2.03.00 Pointing to Masonry

All joints of brickwork shall be raked out to a depth of 10 mm with a hooked tool made for the purpose while the mortar is still green. The brickwork shall then be brushed down with a stiff wire brush, so as to remove all loose dust from the joints and thoroughly washed with water. Mortar consisting of 1 part cement and 3 parts clean, sharp, well graded sand by volume shall be pressed carefully into the joints and finishes with suitably tools to shape as shown on the drawings. Any surplus mortar shall be scraped off the wall face leaving the surface clean.

The pointed surface shall be kept wet for at least three days for curing.

2.04.00 Plaster with Metal Lath

The supports, hangers, brackets, cleats etc. shall be as shown on drawings and/or as approved by the Engineer. These shall have a coat of prime paint before and another coat of approved paint after erection.

The metal lath shall be expanded metal, with 12 mm x 38 mm mesh, 16 BG thick and 3 mm wide strands. Side laps shall be minimum 12 mm and end laps 25 mm minimum. The plastering shall be minimum 20 mm thick measured from the back of lath and applied in two layers. The mortar for plastering shall consist of 1 part cement, 1/2 part lime and 4 parts sand by volume, or 1 part cement and 4 parts sand by volume mixed as specified in plastering, Clause 6.1.2.2.1. The application, finish etc. shall be as specified under relevant clause above. Where called for in the Schedule of Items, a 2 mm Plaster of Paris punning shall be applied over plaster as a finishing coat to give perfectly smooth and even finish.

2.05.00 Lime Punning

For plastered surfaces, where an even smooth surface is specified, lime punning with 5 parts of shell lime properly slaked, strained and aged, mixed with 1 part clean, washed, sieved, fine sand by volume shall be done. The thickness of lime punning shall be not less than 2 mm and more than 3 mm. The plastered surface shall be saturated with water before application of the lime punning. The punning shall be applied by skilled workman and given a smooth and even finish free from undulations, cracks etc. and to the satisfaction of the Engineer.

2.06.00 Plaster of Paris Punning

Plastered surfaces, where specified shall be finished with Plaster-of-Paris punning. The material shall be from approved manufacturers and approved by the Engineer. The thickness of the punning shall be 2 mm and shall be applied by skilled workmen. The finish shall be smooth, even and free from undulation, cracks etc.

Before bulk work is taken in hand, a sample of punning shall be done on roughly 10 Sq.M. area and approval of the Engineer taken. The work shall then be taken in hand as per approved sample.

2.07.00 Stone Facing

Stone facing where specified shall be done as shown on design drawings and approved shop drawings. The stone shall be as specified on drawings and/or

schedule of items. Samples of stone shall be submitted to the Engineer for approval and then bulk purchase made. The Contractor shall submit three copies of shop drawing for the Engineer's approval before commencing the work.

The thickness of facing stone shall be not less than 25 mm unless otherwise specified on drawings.

The stone slabs shall be cut and finished to sizes as per pattern shown on drawings. They shall be fastened to wall with suitable noncorrodable anchorage as approved by the Engineer. Where mild steel clamps, stays etc. are used for anchorage, they shall be galvanised (weight of zinc coating shall not be less than 700 gms per square meter of surface) to prevent rust stains developing on the finished surface. There shall be at least 12 mm gap between the stone and masonry, which shall be filled up and packed by a mortar of 1 part cement and 3 parts of sand by volume. After the mortar is set and cured for at least four days, the exposed surface shall be rubbed and polished as approved by the Engineer. The completed surface shall be neat, or uniform texture and acceptable to the Engineer.

Where pointing is specified on drawings it shall be done by mortar as specified on drawings and/or Schedule of Items.

3.00.00 ACCEPTANCE CRITERIA

Finish to masonry and concrete shall fully comply with the Specifications, approved samples and instructions of the Engineer with respect to lines, levels, thickness, colour, texture, pattern and any other special criteria as mentioned in the body of the specification or as shown on drawings.

4.00.00 RATES

Rates shall be for the complete work as detailed out in the specification unless any particular portion is specifically excluded in the Schedule of Items.

5.00.00 METHOD OF MEASUREMENT

a) All surface finish shall be measured on actual area laid. No deductions shall be made for openings, pipes, and sleeves etc. upto 0.1 Sq.M. in area.

b) Unless separate item is provided for special corner or edge finish, drip course, grooves, mouldings, curbs etc. these shall not be measured separately. Where separate item is provided in the Schedule of Items, such work shall be measured for length.

c) No separate payment shall be made for finishing round openings, sleeves, pipes, etc. No separate payment shall be made for formwork, templates etc. required for achieving true lines and profiles as shown on drawing.

d) Finishes applied integrally with walls, floors, steps and ceilings shall be measured separately and paid under relevant items.

e) Any reinforcement incorporated in the finish shall be measured and paid separately under relevant items.

f) Unless otherwise mentioned in the Schedule of Items, hangers, supports and laths for lath plastering shall be measured and paid separately under relevant items.

6.00.00 I. S. CODE

Important relevant code for this Section: -

a) IS: 1661: Code of practice for cement and cement-lime plaster finish on walls and ceilings.

b) IS: 4101: Code of practice for external facings and veneers.

7.0 TECHNICAL SPECIFICATION

FOR

FLOOR FINISHES AND ALLIED WORKS

TECHNICAL SPECIFICATION

FOR

FLOOR FINISHES AND ALLIED WORKS

SCOPE

This specification covers supply, installation, finishing, curing, testing, protection, maintenance till handing over various types of floor finishes and allied items of work as listed below :

a) In Situ Finishes

i) Terrazzo finish

ii) Patent Stone

b) Tiled Finishes

i) Terrazzo tile

ii) Chequered tile

iii) Glazed tile

iv) Ceramic tile (mat finish)

v) Stone slab

1.1.0.1 Base

The base to receive the finish is covered under other relevant specifications.

1.1.0.2 Sequence

Commencement, scheduling and sequence of the finishing work shall be planned in detail and must be specifically approved by the Engineer in view the activities of other agencies working in that area. However, the Contractor for the finishing items shall remain fully responsible for all normal precautions and vigilance to prevent any damage whatsoever till handing over.

1.2.0.0 INSTALLATION

1.2.0.1 Special Materials

Materials required for individual finishing items are specified under respective items. In general, all such materials shall be as per relevant I.S. Codes where available. In all cases these materials shall be of the best quality available indigenously, unless specified otherwise.

The materials for finishing items must be procured from well-reputed specialised manufacturers and on the basis of approval of samples by the Engineer. The

materials shall be ordered, procured and stored well in advance to avoid compulsion to use substandard items to maintain in the construction schedule**.**

1.2.0.2 Workmanship

Only workers specially experienced in particular items of finishing work shall be engaged, where such workers are not readily available, with the Engineer's permission, experienced supervisors recommended by the manufacturer shall be engaged. In particular cases where the Engineer so desires the Contractor shall get the finishing items installed by the manufacturer.

1.2.0.3 Preparation of the Base Surface

The surface to be treated shall be thoroughly examined by the Contractor. Any rectification necessary shall be brought to the notice of the Engineer and his approval shall be taken regarding method and extent of such rectification work.

For all types of flooring, skirting, dado and similar locations, the base to receive the finish shall be adequately roughened by chipping, raking out joints an cleaning thoroughly all dirts, grease etc. with water and hard brush and detergent if required, unless otherwise directed by the manufacturer of any special finishing materials or specifically indicated in this specification under individual item.

To prevent of water from the finishing treatment the base shall be thoroughly soaked with water and all excess water mopped up.

The surface shall be done dry where adhesives are used for fixing the finishes.

Prior to commencement of actual finishing work the approval of the Engineer shall be taken as per the acceptability of the surface.

1.2.1.0 In Situ Finishes

a) Thickness

Unless otherwise specified the total thickness of the finish shall be minimum 40 mm or as per schedule of item for horizontal and 25 mm or as per schedule of item for vertical surface of which the topping shall (not less than 10 mm) while the topping shall be of uniform thickness the underbed may vary in thickness to provide necessary slopes. The vertical surface shall project out 6 mm from the adjacent plaster or other finishes. Necessary cutting into the surface receiving the finish shall be done to accommodate the specified thickness.

All junctions of vertical with horizontal shall be rounded neatly to uniform radius off 25 mm.

b) Mix

i) Under bed

The underbed for floors and similar horizontal surfaces shall consist of a mix of 1 part cement, 2 parts coarse sand and 4 parts 10 mm down graded stone chips by volume. For vertical and similar surfaces the mix

shall consist of 1 part cement to 3 parts coarse sand by volume.

ii) Topping

For the topping cement, screened through a fine mesh and red oxide of iron pigment powder similarly screened shall be dry mixed thoroughly in right proportions to produce the desired colour when laid. The mix shall then be prepared with 1 part cement (mixed with pigment) and 3 parts coarse sand by volume. The whole quantity required for each visible area shall be prepared in one batch to ensure uniform colour.

c) Laying

The under bed shall be laid in panels of mixing area 5 Sq.M. each and no side shall be more than 2.5 along. For outdoor locations the maximum area shall be 2.0 Sq.M. The forms for the panels shall have perfectly aligned edges to the full depth of the total thickness of finish. If specified aluminium or glass dividing strips shall be used.

The panels shall be laid in alternate bays or in chequered board pattern. No panel shall be cast in contact with another already laid until the contraction of the latter has taken place. The under bed shall be laid, compacted, levelled and brought to proper grade with a screed or float. The topping shall be placed after about 24 hours while the under bed is still somewhat 'green' but firm enough to receive the topping. The surface of the under bed shall be roughened for better bonding. The topping shall be rolled for horizontal areas and thrown and pressed for vertical areas to extract all superfluous cement and water to achieve a compact dense mass fully bonded with the under bed. The topping shall then be levelled up by trowelling and finished smooth with a slurry made with already prepared cement and pigment mixture. About 2.0 kg. of the mixture shall be consumed/per sq.m. for horizontal surface, and 1.0 kg. for vertical surface. The surface shall be cured for seven days by keeping it moist.

d) Polishing

About 36 hours after laying when the surface has hardened sufficiently it shall be polished with polishing stone till a smooth shiny surface to the satisfaction of the Engineer, is achieved. The finish shall be washed and cleaned just before handing over.

1.2.1.1 Terrazo Finish : In Situ

It shall consist of an under bed and a topping laid over an already laid and matured concrete base.

a) Thickness

Unless otherwise specified the total thickness of the finish shall be minimum 40 mm for horizontal and 25 mm or as per schedule of items for vertical surface of which the topping shall be not less than 10 mm or as per schedule of items. While the topping shall be of uniform thickness the underbed may vary in thickness to provide necessary slopes. The vertical surface shall project cut 6 mm from the adjacent plaster or other finish.

Necessary cutting into the surface receiving the finish shall be done to accommodate the specified thickness.

All junctions of vertical with horizontal shall be rounded neatly to uniform radius of 25 mm.

b) Mix

i) Under bed

The under bed for floors and similar horizontal surfaces shall consist of a mix of 1 part cement, 1.½ parts sand and 3 parts stone chips by volume. For vertical surfaces the mix shall consist of 1 part cement to 3 parts sand by volume. The sand shall be coarse. The stone chips shall be 10 mm down well graded. Only sufficient water to be added to give a workable consistency.

ii) Topping

The mix for the topping shall be composed of cement, colour pigment, marble dust and marble chips. Proportions of the ingredients shall be such as to produce the terrazzo of colour texture and pattern approved by the Engineer. The cement shall be white or grey or a mixture of the two to which pigment shall be added to achieve the desired colour. To 3 parts of this mixture 1 part marble powder by volume shall be added and thoroughly mixed dry. To 1 part of this mix 1 to 1½ parts of marble chips by volume shall be added and thoroughly mixed dry again.

The pigment must be stable and nonfading. It must be very finely ground. The marble powder shall be from white marble and shall be finer than IS Seive No. 30. The size of marble chips may be between 1 mm to 20 mm.

Sufficient quantity to cover each visible area shall be prepared in one lot to ensure uniform colour. Water to make it just workable shall be added to a quantity that can be used up immediately before it starts to set.

c) Laying

The underbed shall be laid in panels. The panels shall not be more than 5 Sq.M. in area of which no side shall be more than 2.5 M long. For exposed locations the maximum area of a panel shall be 2.0 Sq.M. The panel shall be laid in alternate bays or chequered board pattern. No panel shall be cast in contact with another already laid until the latter has contracted to the full extent.
Dividing strips made of aluminium or glass shall be used for forming the panels. The strips shall exactly match the total depth of underbed plus topping.

After laying, the underbed shall be levelled compacted and brought to proper grade with a screed or float. The topping shall be laid after about 24 hours while the underbed is still somewhat “green” but firm enough to receive the topping. A slurry of the mixture of cement and pigment already made shall be spread evenly and brushed in just before laying the topping.

The topping shall be rolled for horizontal areas and thrown and pressed for vertical areas to extract all superfluous cement and water and to achieve a compact dense mass fully bonded with the under bed. The surface of the topping shall be trowelled over, pressed and brought to a smooth dense surface showing a minimum 75% area covered by marble chips in a even pattern of distribution.

d) Curing

The surface shall be left for curing for about 12 to 18 hours and then cured by allowing water to stand on the surface or by covering with wet sack for four days.

e) Grinding and Polishing

When the surface has sufficiently hardened it shall be watered and ground evenly with rapid cutting coarse grade (no. 60) grit blocks, till the marble chips are exposed and the surface is smooth. Then the surface shall be thoroughly washed and cleaned. A grout with already prepared mixture of cement and pigment shall be applied to fill up all pinholes. The surface shall be cured for 7 days by keeping it moist and then ground with fine grit blocks (no. 120). It shall again be cleaned with water, the slurry applied again to fill up any pinholes that might have appeared and allowed to be cured again for 5 days. Finally, the surface is ground a third time with very fine grit blocks (no. 320) to get smooth surface without any pinhole. The grinding shall be done by a suitable machine. Where grinding machine can not be used hand grinding may be allowed when the first rubbing shall be with carborundum stone of coarse grade (no. 60), second rubbing with medium grade (no. 80) and final rubbing and polishing with fine grade (no. 120).

The surface shall be cleaned with water, dried and covered with soil free, clean sawdust if directed by the Engineer. The final polishing shall be postponed till before handing over if desired by the Engineer. Just before handing over the surface shall be dusted with oxalic acid at the rate of 0.33 gm. per. sq.m. water sprinkled on to it and finished by buffing with felt or hessian bobs. The floor shall be cleaned with soft moist rag and dried. However, all excess wax polish to be wiped off and the surface to be left glossy but not slippery.

1.2.1.2 Granolithic Finish

Granolithic finish shall either be laid monolithically over base concrete or separately over hardened base concrete.

a) Thickness

The finish shall be average 20 mm and minimum 12 mm thick, unless specified otherwise.

b) Mix

The mix shall consist of 1 part cement : 1 part coarse sand : 2 parts coarse aggregate by volume. The coarse aggregate shall be very hard like granite

and well graded between 6 mm and 12 mm. Minimum quantity of water to get workability shall be added.

c) Laying of Monolithic Topping

The concrete base shall be laid as per specification "Cement Concrete" and levelled upto the required grade. The form shall remain sufficiently protruding to take the finish.

Within about 3 hours of laying the base while it is still fully "green" the topping shall be laid evenly to proper thickness and grade. If considered necessary the surface of the base shall roughened by wire brushing. Unless manual operation is permitted by the Engineer, mechanical vibrators of suitable design shall be used to press the topping firmly and work vigoraously and quickly to secure full bond with concrete base.

The laitance brought to the surface during compression shall be removed carefully without disturbing the stone chips. The surface shall then be lightly trowelled to remove all marks. When sufficiently set, hand trowelling shall be done to secure a smooth surface without disturbing the stonechips.

For large areas the laying shall be in panels of maximum 25 Sq.M. area. The panels shall be laid in chequered board pattern.

d) Laying of Topping Separately on Hardened Base.

The base concrete shall be prepared as stated in clause 7.1.2.0.3 and a slurry of neat cement applied just prior to laying the granolithic concrete mix (1:1:2). The method of compaction etc. shall be same as for monolithic topping.

e) Curing

Immediately after laying, the finish shall be protected against rapid drying. As soon as the surface had hardened sufficiently, it shall be kept continuously moist for at least 10 days by means of wet gunny bags or pounding of water on the surface. The floor shall not be exposed to heavy traffic during this period.

f) Grinding

If grinding is specified, it shall start only after the finish has fully set. Clause 7.1.2.1.3 (c) shall be followed. However, the ultimate polish required shall be decided upon by the Engineer.

g) Finishing

Where specified, sodium silicate or magnesium or zinc silicon fluoride treatment shall be done. The number of coats to be applied shall be as

specified in the Schedule of Items. The concentration and method of application of the solutions shall be as specified in IS:5491.

1.2.1.3 Patent Stone

It shall consist of an underbed and a topping laid on an already laid and matured concrete base.

a) Thickness

The patent stone finish shall have thickness as stipulated under clause 7.1.2.1.2 (a) except that the topping shall be 6 mm thick.

b) Mix

i) Underbed

The mix shall be as stipulated under clause 7.1.2.1.3 (b).

ii) Topping

The mix for the topping shall consist of 1 part cement and 1 part fine sand by volume.

c) Laying

The Patent Stone finish, including the underbed shall be laid in alternate bays or in chequered board pattern. No panel shall be as in contact with another already laid till the contraction of the latter has already taken place.

The maximum area of each panel shall be 3 Sq.M. of which no side shall be more than 2 M long.

A cement grout shall be applied and worked into the surface to receive the finish, the under bed then laid, compacted and levelled to proper grade with a screed or float. The topping shall be applied evenly on the under bed while it is not fully set but firm enough and rolled and pressed to get full bond. The topping shall trowelled to a dense finish to the satisfaction of the Engineer. All trowel marks shall be mopped out with a soft cloth to give a clean smooth surface.

After the surface is sufficiently set, the finished floor shall be kept moist for 7 days for curing. If desired the finish shall be polished as directed by the Engineer.

1.2.1.4 Metallic Hardener Like “Ironite” Finish

This will consist of a topping (incorporating iron particles) to bond with concrete base while the latter is “Green”.

a) Thickness

Unless otherwise specified the metallic hardener finish shall be of 12 mm depth.

b) Material

The hardening compound shall be uniformly graded iron particles free from non-ferrous metal impurities, oil, grease, sand soluble alkaline compounds or other injurious materials. When desired by the engineer, actual samples shall be tested.

c) Mix

Proportion of the metallic hardener shall be as specified or as indicated by the manufacturer. However, in absence of any such direction 1 part metallic hardener shall be mixed dry with 4 parts cement, by weight. To this mixture 6 mm nominal size stone chips shall be added in proportion of 1 part cement (mixed with hardener) to 2 parts of stone chips by volume and uniformly mixed. Minimum quantity of water shall be added to make it workable.

d) Laying

The concrete floor shall be laid as per specification "Cement Concrete" and levelled upto the required grade. The forms, if any shall remain sufficiently projecting to take the finish. The surface shall be roughened by wire brush as soon as possible.

The finish shall be laid while the concrete underbed is still very "green" within about 3 hours of laying of the latter. The finish shall be of uniform thickness and even dense surface without trowel marks, pin holes etc. This topping layer shall be pressed firmly and worked vigorously and quickly to secure full bond with the concrete base. Just when the initial set starts the surface shall be finished smoothened with steel trowel.

The finished floor shall be cured for 7 days by keeping it wet.

1.2.1.5 Chemical Resistant in Situ Finish

Chemical resistant in situ finish shall be an epoxy resin with suitable filler material over a primer or called for in the Schedule of Items. The minimum thickness shall be 6 mm. About its performance the Engineer shall have to be fully satisfied by test results and examination of similar treatment already in existence. The Contractor shall get it done by a specialised manufacturer, get guarantee of performance from the organisation and pass it on to the Owner in addition to his own guarantee.

1.2.2.0 Tiled Finish

These shall include finish tiles, stone slabs and similar manufactured or natural items over already laid and matured base of concrete or masonry by means of an under bed or an adhesive layer

1.2.2.1 Terrazzo Tile Finish

The finish will consist of manufacture terrazzo tile and an under bed.

a) Thickness

The total thickness including the under bed shall be minimum 40 mm for floors 30 mm for walls unless otherwise specified.

The skirting, dado and similar vertical surfaces shall project out 6 mm uniformly from the adjacent plaster or other wall finishes. The necessary cutting into the surface receiving the tiled finish, to accommodate the specified thickness shall be done.

b) Tiles : Terrazzo

The tiles shall, unless specifically permitted in special cases be machine made under quality control in a shop. The tile shall be pressed hydraulically to a minimum of 140 Kg. per Sq Cm.

Each tile shall bear on its back permanent and legible trade mark of the manufacturer. All angles of the tiles shall be right angles all arises sharp and true, colour and texture of the wearing face uniform throughout. Maximum tolerance allowance length and breadth shall be $\pm$ 1 mm and the thickness $\pm$ 3 mm. Face of the tile shall be plane, free from pin holes and other blemishes.

The tiles shall be composed of a backing and topping. The topping shall be of uniform thickness not less than 10 mm.

The total thickness including the topping shall be as specified but not less than 20 mm in any case.

The backing shall be composed of 1 part ordinary grey cement and 3 parts of stone chips by weight mixed with water.

The topping shall be as specified under clause 7.1.2.1.3 (b).

The tile shall be cured at the shop for at least 14 days before delivery to the site. First grinding shall be given to the tiles at the shop before delivery. Tiles shall be packed properly to prevent damage during transit and storage. The tiles must be carefully stored to prevent staining by damp, rust, oil, and grease or other chemicals.

Tiles made in each batch shall be kept and used separately so that colour of each area of the floor may remain uniform.

The manufacturer shall supply along with the tiles the grout mix containing cement and pigment in exact proportions as used in topping of the tiles. The containers for the grout mix shall be suitably marked to relate it to the particular type and batch of tiles.

c) Mix : Underbed

The under bed for floor and similar horizontal surfaces shall be 1 part lime putty : 1 part surkhi : 2 parts coarse sand by weight mixed with sufficient

water to form a stiff workable mass. For skirting and dado and all vertical surfaces it shall be about 12 mm thick and composed of 1 part cement and 3 parts coarse sand by weight.

d) Laying

The under bed mortar shall be evenly spread and brought to proper grade and consolidated to a smooth surface. The surface shall be roughened for better bond. Before the underbed had time to set and while it is still fairly moist but firm, cement shall be hand dusted over it or a cement slurry applied and the tiles shall immediately be placed upon and firmly pressed by wooden mallet on to the underbed until it achieves the desired level. The tiles shall be kept soaked for about 10 minutes just before laying. The joints between tiles shall be as close as possible and not more than 1.5 mm wide.

Special care shall be taken to check the level of the surface and the lines of the joints frequently so that they are perfect.

When tiles are required to be cut to match the dimensions these shall be sawn and edges rubbed smooth. The location of cut tiles shall be planned in advance and approval of the Engineer taken.

At the junction of horizontal surface with vertical surface the tiles on the former shall enter at least 12 mm under the latter.

After fixing, the floor shall be kept moist and allowed to mature undisturbed for 7 days. Heavy traffic shall not be allowed.

If desired dividing strips as specified under Clause 7.1.2.1.3 (c) may be used for dividing the work into suitable panels.

c) Grinding and Polishing

Procedure shall be same as Clause 7.1.2.1.3 (e) 2. Grinding shall not commence earlier than 14 days after laying of tiles.

1.2.2.2 Chequered Tile Finish

The finish shall consist of manufactured grey or coloured cement tiles or terrazzo tiles with chequered face and an under bed laid over concrete or brick surface.

a) Thickness

Thickness shall be same as in clause 7.1.2.1.3(a)

b) Tiles : Chequered

The tiles shall have chequers not less than 2.5 cm. c/c and not more than 5 cm c/c, Depth of grooves shall be not less than 5 mm. The grooves shall be uniform and straight.

The tiles shall conform to clause 2.2.1 (b) except that these may have the topping in terrazzo or plain grey cement or colour pigment added to cement as specified.

c) Underbed

As per clause 7.1.2.2.1 (c).

d) Laying

As per clause 7.1.2.2.1 (d)

e) Grinding and Polishing

As per clause 7.1.2.1.3 (e) except that the tiles shall be ground and polished by hand after laying taking special care in polishing the grooves properly and uniformly.

1.2.2.3 Glazed Tiles Finish

This finish shall be composed of glazed earthenware tiles with an underbed laid over a concrete or masonry base.

a) Thickness

The total thickness shall be between 20 mm and 25 mm including the under bed.

The tile finish on vertical surface shall project out 6 mm uniformly from the adjacent plaster or other wall finishes. The necessary cutting into the surface receiving the finish, to accommodate the specified thickness shall be done.

b) Tiles : Glazed

The tiles shall be of earthenware, covered with glaze white or coloured, plain or with designs, of 150 mm x 150 mm nominal sizes and 10 mm thick unless otherwise specified. The tolerance shall be $\pm$ 1.5 mm for length and breadth and $\pm$ 0.5 mm for thickness specials like internal and external angles, beads, covers, cornices, corner pieces etc. shall match. The top surface of the tiles shall be glazed with a gloss or matt unfading stable finish as desired by the Engineer. The tiles shall be flat and true to shape. The colour shall be uniform and fractured section shall be fine grained in textures, dense and homogeneous. The tiles shall be strong and free from flaws like cracks, craze, specks, crawlings, etc. and other imperfections. The edge and the underside of the tiles shall be completely free from glaze and the underside shall have ribs or indentations for better anchorage with the fixing mortar.

The coloured tiles, when supplied, shall preferably come from one batch to avoid difference in colour.

c) Mix : Underbed

The mix for the under bed shall consist of 1 part cement and 3 parts coarse sand by weight mixed with sufficient water or any other mix if specified.

d) Laying

Same as clause 7.1.2.2.1 (d).

e) Finishing

The joints shall be cleaned and flush pointed with white cement and cured for 7 days by keeping it wet. The surface shall be cleaned with soap or suitable detergent, washed fully and wiped with soft cloth to prevent scratching before handing over.

1.2.2.4 Tesserae Finish (Mosaic etc.)

This finish consists of manufactured vitreous, glass, ceramic or similar hard small pieces set in an under bed over a concrete or masonry surface, already laid.

a) Thickness

The total thickness including the under bed shall be between 16 mm and 25 mm.

b) Tesserae Finish

These shall usually be 6 mm thick small piece of ceramic vitreous china, tinted glass or similar hard wearing, strong and durable material in desired shapes and sizes and patterns.

The supply shall come in the desired pattern in full or sections conveniently for handling, stuck to pieces of strong thick paper on the surface to be exposed. The gum used for this purpose must be water soluble and non-staining. The sections shall be properly marked to avoid mistakes and master drawing shall be available at the site for guidance.

c) Mix : Under bed

Same as clause 7.1.2.1.3 (b) (i)

d) Laying

The specification for laying if given by the manufacturer of the item shall be followed provided it is approved by the Engineer. Otherwise clause 7.1.2.2.1(d) shall generally be followed. However, instead of grey cement the slurry shall be made with white cement to fix the panels. The paper mounted patterns in sections shall be carefully placed and pressed in position true to lines and levels. Earliest possible the paper shall be peeled off and surface examined and cleaned, joints flush pointed with white cement and cured for 7 days by keeping it wet.

1.2.2.5 Chemical Resistant Tiled Finish

This shall include all varities of special tiles used for specific chemical resistance function and an under bed over already laid concrete or masonry.

a) Tiles

The chemical resistant tiles as detailed in the Schedule of items shall be of the best indigenous manufacture unless otherwise specified and shall be resistant to the chemical described in the Schedule of Items. The tiles shall have straight edges, uniform thickness, plain surface, uniform nonfading colour and textures.

Glazed tiles if permitted to act as chemical resistant finish shall be considered under clause 7.1.2.2.3.

Usually the chemical resistant tiles shall not absorb water more than 2% by weight. The tiles shall have at least compression strength of 700 Kg/Cm2. The surface shall be abrasion resistant and durable.

b) Laying

The mortar used for setting or for under bed the tiles shall be durable and strong. The grout which shall be to the full depth of tile shall have equal chemical resistant properties. Joints shall be pointed if so desired. The setting and fixing shall be according to the manufacturer's specification approved by the Engineer.

1.2.2.6 Rubber, Vinyl or Vinyl Asbestos Tiles Finish

This shall include various types of tiles manufactured from rubber, vinyl, etc. set with a adhesive on concrete or masonry base. An under bed may be required to secure desirable surface and grade.

a) Thickness

The thickness of the tiles shall be mentioned in the Schedule or in drawing.

b) Tiles

Unless otherwise desired the tiles shall be squares of approved dimensions. The tolerance in dimensions shall be $\pm$ 1.5 mm.

The face of the tiles shall be free from porosity, blisters, cracks, embedded foreign matters or either physical defects which affect appearance or serviceability. All edges shall be cut true and square. The colour shall be nonfading and uniform in appearance, insoluble in water and resistant to alkalies, cleaning agents and usual floor polishes.

Each tile shall be marked on the back legibly and indelibly with manufacturer's trade mark, the thickness, sizes, batch number and date of manufacture.

Tiles shall be delivered securely packed and stored in clean, dry well ventilated place at a temperature near about to that the tiles shall be called upon to stand ultimately.

Adhesive to be used for sticking the tiles shall be approved by the tile manufacturer. The adhesive shall have a short drying time and long life in addition to toughness.

c) Mix : Underbed

The under bed where required to make up the specified thickness or to give the required grade or to get the right type of surface shall be composed of 1 part like putty : 1 part cement : 4 parts coarse sand mixed with just sufficient water to make it workable.

d) Laying

The tiles shall be kept in the room to be tiled for at least 24 hours to bring them to the same temperature as the room. For air conditioned space, the air-conditioning shall be completed before tiling is taken up.

The surface to receive this finish shall be firm even textured but not too smooth, without undulations and other deficiencies. If an under bed is laid the same shall be cured for at least 7 days by keeping it moist and then fully dried.

The surface shall be thoroughly cleaned. All loose dust particles shall be removed. Oil and grease if any shall be completely cleaned by use of detergent.

The adhesive shall be applied to fully dry surface in desired thickness uniformly. The adhesive shall also be applied to the backs and edges of the tiles and allowed to surface dry. The tiles shall be placed neatly on the surface exactly to the approved pattern and set with a suitable tool. If the edges tend to curl, weights are to be used to keep the edges down. Special care shall be taken to avoid formation of air pockets under the tiles. The joints shall be very fine. Any adhesive squeezed out through the joints shall be removed immediately.

e) Finishing

If any adhesive mark is there on the surface a soft cloth soaked in solvent shall be used to wipe it off. The surface shall be cleaned with soft soap, dried and polished with an approved type of polish just before handing over.

1.2.2.7 Store Slab Finish : Marble, Stone and Similar Fine Grained Stone

a) Thickness

The under bed shall be minimum 12 mm and average 20 mm thick. The slabs may be 25 mm, 30 mm or 40 mm thick as specified.

b) Stone Slab

The stone slabs shall be made from selected stock which are hard, sound, homogeneous and dense in texture and free from flaws. Angles and

edges shall be true, square, free from chipping and surface shall be plane. The slabs shall preferably be machine cut to the required dimensions. Tolerance of ± 5 mm in dimensions and ± 2 mm in thickness will be allowed. Unless specified the slabs shall be minimum 300 mm x 300 mm.

The stone slabs shall come from specific regions and in specified quality with top surface fine chisel dressed. All sides shall also be fine chisel dressed to the full depth to allow finest possible joints.

The slabs shall be delivered to the site well protected against damages and stored in dry place under cover.

c) Mix : Underbed

Same as clause 7.1.2.2.1 (c).

d) Laying

The sides and top surface of the slabs shall be machine rubbed or table rubbed with coarse sand stone and washed clean before laying.

The under bed mortar shall be evenly spread and brought to proper level on the area under each slab. The slab shall be laid over the under bed, pressed and tapped down with wooden mallet to the proper level. The slab shall then be lifted and the under bed corrected as necessary and allowed to stiffen a little. Next, a thick cement slurry shall be spread over the surface. The edges of the slab shall be buttered with slurry of cement, grey/white/mixed with pigment matching the colour of the stone slabs. The slab shall be gently laid and tapped with wooden mallet to bed properly to a very fine joint and to the required level. All surplus cement slurry shall be removed and the surface mopped clean with wet soft cloth. The laid finish shall be cured for 7 days by keeping it wet.

e) Polishing, Finishing

Fine chiselling shall be done to remove the slight undulations that usually exist at the joints. The polishing and finishing shall be done as specified under clause 7.1.2.1.3 (e). However, the joints shall be so fine in the case of stone slabs that grouting shall not be called for.

1.2.2.8 Stone Slab Finish : Sand Stone and Similar Coarse Grained Stone Finish

Generally clause 7.1.2.2.7 shall be followed except that the workmanship and finish shall not be fine as which are explained hereunder.

The slabs shall be rough chiselled or fine chiselled as specified. Tolerance may be allowed upto ± 6 mm for rough finish, but no sharp unevenness and shall be allowed. For fine chiselling the unevenness shall be limited to ± 2 mm. The sides shall be chisel dressed at least to half slab depth so that the maximum deviation from straight line shall be within 25 mm. Beyond this depth the edge may be slightly splayed.

The joint thickness shall be kept limited to 5 mm in case of rough finish and 3 mm in case of fine finish unless wider joints are specified. The joints shall be grouted with white or coloured cement.

1.3.0.0. ACCEPTANCE CRITERIA

The finish shall be checked specially for :

a) Level, Slope, Plumb as the case may be

b) Pattern and Symmetry

c) Alignment of joints, dividing strip etc.

d) Colour, texture

e) Surface finish

f) Thickness of joints

g) Details at edges, junctions etc.

h) Performance

i) Precautions specified for durability

1.4.0.0 RATES

Rates shall be for the complete finishing work including necessary forms, under bed, sticker and preparation of the surface including cutting and chipping to receive the finish but exclusive of the base unless specially included in Contract.

The dividing strips in case of in situ terrazzo finish shall be included in the rates. Similarly, indentations, laying in desired patterns and in panels shall be inclusive in the rates.

All necessary cutting tiles, slabs, etc. cost of specials if any shall be included in the rates. No extra shall be paid for rounding corners and edges. Unless specifically mentioned otherwise, same rates will apply to floor, skirting, dado, treads, nosings, etc.

1.5.0.0 METHOD OF MEASUREMENT

The finished surface shall be measured for area. Any opening less than 0.1 Sq.M. (and 0.05 Sq.M. in case of marble finish only) shall not be taken into account neither any extra shall be paid for it.

For terrazzo finish, either in situ or tiled shall be paid at the same rate unless mentioned separately in the schedule of items.

Except in case of in situ terrazzo finish and unless mentioned in the Schedule dividing strips shall be measured in length.

1.6.0.0 I.S. CODES

Important relevant codes for this section :

IS : 777	:	Glazed earthenware tiles
IS : 196	:	Code of practice for laying bitumen mastic flooring.
IS : 197	:	Code of practice for laying of rubber floors
IS : 1237	:	Cement concrete flooring tiles
IS : 1443	:	Code of practice for laying and finishing of cement concrete flooring tiles.
IS : 214	:	Code of practice for laying in situ terrazzo floor.
IS : 3461	:	PVC asbestos floor tiles
IS : 4860	:	Specification for acid resistant bricks
IS : 5518	:	Code of practice for laying of flexible PVC sheet and tile flooring.
IS : 5491	:	Code of practice for laying in situ granolithic floor topping.

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8.0 TECHNICAL SPECIFICATION
FOR
CARPENTRY AND JOINERY

1.00.00 SCOPE

This shall include supply, fitting and fixing of timber frames to doors and windows with M S holdfasts, paneled or flush doors, windows, shutters, partitions, wall paneling, pelmets, shelves, furniture, etc. as shown in drawings, including a prime coat of approved paint, varnish, or fixing of decorative plastic laminate where called for in the schedule. This shall also include the supply and fixing of all hardware and fixtures shown in drawing or specified in the "Schedule of Fixtures".

2.00.00 INSTALLATION

2.01.00 Materials

a) Timber

Unless otherwise specified, all timber shall be best quality well seasoned C P teakwood free from large or loose, knots cracks or other defects. Where specified, timber shall be treated with approved wood preservative before use. Before starting the carpenter's work, the Tendered shall have the rough timber approved by the Engineer.

b) Plywood

Plywood shall be commercial quality or with decorative surface veneer. Unless specifically permitted otherwise, the adhesive used in plywood shall be phenol formaldehyde resin of B W R grade conforming to IS: 848.

c) Decorative Laminated Plastic Sheets

The colour, pattern, finish and texture shall be approved by the Engineer and the bulk supply procured in sheet sizes which will ensure the least number or joints in one surface.

d) Flush Doors

Flush doors shall be hollow or solid core doors with commercial or decorative faces and hardwood edges. The core for solid core doors shall be of block board or wood particleboard. Manufacturer's literature and test certificates shall be submitted for the approval of the Engineer. The Contractor shall give a guarantee that the adhesive used is phenol formaldehyde of BWR grade, conforming to IS: 848. The thickness shall be as specified in the "Schedule of Items".

e) Panel Doors

Panel door shall be of teakwood shutter frame unless otherwise noted and panels with teakwood/commercial ply/teakwood

particleboard as per “Schedule of Items”. Other considerations shall be as mentioned in item (d) above.

f) Fibre Reinforced Polymer (FRP) Door Frame

The polymer shall be either thermoplastic or thermoset resin, such as polyester, isopolyester , vinylester , epoxy or phenolic base. The fibre moulded skins may be of glass or other synthetic (carbon or aramid) or natural (jute or coir) or other reinforcing materials.

The door frame may be divided into two parts : (a) Frame without core (b) Frame with core.

FRAME WITHOUT CORE : These types of frames shall have Intermitted stiffness for rigidly and will have provision for hinge Fixing including anchors.

FRAME WITH CORE : Such composite frames will be fitted with inner core in addition to all the features mentioned for frame without core .

Testing of above materials shall be done as per IS: 4020 door testing performance criteria

g) Fibre Reinforced Polymer (FRP) Door Shutter

The polymer shall be either thermoplastic or thermoset resin, such as polyester, isopolyester , vinylester , epoxy or phenolic base. The fibre moulded skins may be of glass or other synthetic (carbon or aramid) or natural (jute or coir) or other reinforcing materials.

Sandwich core to impart monolithic composite structures approved by department of science and technology or similar competent authority.

Testing of above materials shall be done as per IS: 4020 door testing performance criteria.

h) Fixtures

Fixtures for doors, windows, furniture, etc. shall be as shown on drawing or specified in the “Schedule of Fixtures”.

2.02.00 Workmanship

2.02.01 General

Skilled carpenters as per details shown on drawing or instructed by the Engineer shall do the work.

Framing timber and other work shall be close-fitting with proper wood joinery, accurately set to required lines or levels and rigidly secured in

place. The surface of frames etc. that will come in contact with masonry after fixing shall be given two coats of approved paint before fixing. Mastic caulking shall be done after fixing external door and window frames. Special care shall be taken to match the grain of timber or plywood, which will be subsequently polished. Screwing or nailing will not be permitted to the edge of plywood and particleboard. The edge of all plywood, block board and particle board shall be finished with teakwood lipping unless otherwise shown on drawings.

Fixing for frames and partitions shall generally be with 40 mm x 6 mm x 300 mm long MS holdfasts bifurcated at end and grouted with 1:2:4 cement concrete. The gap between masonry and external door and window frame shall be caulked with polysulphide mastic. M. S. grills or guard bars shall be provided to windows where called for in the drawings or schedule of items.

2.02.02 Finish

All carpentry work after finishing shall be sand papered smooth. Prime coat paint shall be given after inspection of the Engineer to all surfaces other than those, which shall be subsequently polished or covered with laminated plastic sheet.

2.02.03 Surface Treatment

When shown on drawings or called for in Schedule, decorative ply or laminated plastic sheets shall be bonded under pressure to the surface to be finished. The adhesive used shall be of approved brand and brought to site in sealed containers. The rate of application and the length of time for which the pressure is to be applied shall be as per the manufacturer's instructions. The edge of sheets shall be protected by teak lipping or bevelled as shown on drawings.

3.00.00 ACCEPTANCE CRITERIA

3.01.00 Door and Window Frames

All frames shall be square and flat at the time of delivery and shall be checked for dimensions and corner angles. After fixing they shall be on a fine vertical plane. All external door and window frames shall be caulked with mastic.

3.02.00 Door and Window Shutters

Shall be of proper size, shape and design and free of warp. When fixed to frames, these shall operate smoothly without jamming and all latching or locking devices shall engage properly without undue pressure.

3.03.00 Partitions, Paneling, Pelmets, Furniture, etc.

3.03.01 General

These shall conform to drawings in all details. No unsightly nail marks etc. shall be permitted. Plywood grains shall be matched to give a uniform and pleasing appearance.

3.03.02 Partition

Shall be checked for rigidity of fixing, plumb and horizontal as well as vertical alignment.

3.03.03 Pelmets

Shall be checked for rigidity of fixing and adequate clearance of fixture.

3.03.04 Cupboard Shutters

Shall operate smoothly without jamming and locks, bolts and double ball catches shall engage securely. Single ball catches shall not be used.

3.03.05 Drawers

Shall operate smoothly and have backstops to prevent them from being pushed too far. Locks shall engage securely.

3.03.06 Loose Furniture

When placed on a level surface tables tops etc. shall be horizontal and the pieces stand stably on legs or supports.

4.00.00 RATES

Rates shall be unit rates including preservatives, shop coats, primers varnishing, polishing etc. against items mentioned in Schedule. No separate payment will be made for fixing caulking etc. unless separately provided for in Schedule.

5.00.00 METHOD OF MEASUREMENT

5.01.00 Door and Window Frames, Handrails etc.

Woodwork in frames handrails etc. shall be measured for the volume of timber used, i.e. the minimum theoretical rectangular section from which the shape can be obtained multiplied by the length of timber required. In computing the length, timber required for tennons, scarves, embedding to walls over the finished length shall be added. Mitred pieces shall be measured along the longest length.

5.02.00 Holdfasts

Shall be measured for actual number used.

5.03.00 Door and Window Shutters

Shall be measured for actual outer area of shutters for different thickness and types described in Schedule.

5.04.00 Glass and Glazing

Shall be measured and paid separately under relevant items.

5.05.00 Fittings and Fixtures

Shall be measured separately in actual numbers used for different sizes and types described in Schedule.

5.06.00 M S Grills and Guard Bars

Shall be measured and paid separately under relevant items.

5.07.00 Partitions, Paneling, etc.

Shall be measured for actual area excluding door shutters. Door shutters shall be measured and paid separately under relevant items.

5.08.00 Pelmet, Shelves, etc.

Shelves shall be measured for actual area of finished surface. Pelmets shall be measured for length of different types enumerated in the Schedule.

5.09.00 Furniture

Shall be measured for actual number of each type.

6.00.00 IS CODES

Some of the important relevant Codes for the Sections are:

IS: 4021	-	Timber door, window and ventilator frames
IS: 1003	-	Timber paneled and glazed shutters.
IS: 2191	-	Wooden flush door shutter (Cellular and hollow core type)
IS: 702	-	Wooden flush door shutters (Solid core type)

9.0 TECHNICAL SPECIFICATION
FOR
METAL DOORS, WINDOWS, VENTILATORS, LOUVRES, ETC.

1.00.00 SCOPE

The work in general shall consist of supplying and/or erecting and installing of all metal doors, windows, ventilators, louvres, glazed partitions, etc. as shown on drawings with all materials complete excluding supply of glass and glazing. The scope of work shall also include the assembly and the Owner from the store at site shall supply erection of all doors, windows, louvres, glazed partitions, etc. for which fabricated materials. Supplying and/or fixing of all door and window accessories and hardware are also included in the scope.

2.00.00 INSTALLATION

2.01.00 Materials

Steel sections used for fabrication of doors, windows etc. shall be standard rolled steel sections specified in IS: 1038 and IS: 1361 or as specified in drawing and schedules.

Steel sheets for frames, shutters, louvre blades etc. shall be of gauge mentioned in drawings and schedules.

Aluminium sections for fabricating doors, windows, partitions, etc. shall be extruded sections conforming to IS: 1948 and 1949 or as manufactured by Indian Aluminium Company Limited or approved equivalent. The alloy used shall conform to IS Designation HE 9-WP of IS: 733.

Hardware and fixtures shall be as specified in "Schedule of Fixtures" and the best quality from approved manufacturers shall only be used. The Tenderer shall specifically state the particular manufacturer's materials he proposes to use. "Schedule of Fixtures" is for the purpose of stating the minimum requirement and improper alignment or faulty operation due to inadequate strength of hardware or fixture shall entirely be the Contractor's responsibility.

All hardware and fixtures shall be able to withstand repeated use. Door closers shall conform to IS: 3564 and shall be suitable for doors weighing 61-80 Kg. unless otherwise stated in schedule. Each closer shall be guaranteed against manufacturing defect for one year and any defect found within this period shall be rectified or the closer replaced free of charge. Concealed door closers shall be either floor mounted or transom mounted, suitable for installation with metal doors. It shall conform to the performance requirements & endurance test stated in IS: 3564 Appendix-A.

The Contractor shall submit samples of each type of hardware to the Engineer. The approved samples shall be retained by the Engineer for comparison of bulk supply. The samples shall be returned to the Contractor towards the end for incorporation in the job.

The mastic for caulking shall be of best quality from a manufacturer approved by the Engineer. In general, the mastic for fixing of metal frames shall be as per IS: 1081 and/or as approved by the Engineer.

2.02.00 Fabrication

2.02.01 Steel Doors, Windows, Ventilators, Louvres, etc.

a) Door Frames

Frames shall be fabricated from 16 G sheets. They shall be mortised, reinforced, drilled and tapped for hinges and lock and bolt strikes. Where necessary, frames shall be reinforced for door closers. Welded construction with mitered corners shall be used. Rubber door silencers shall be furnished for the striking jamb. Loose "T" masonry anchors shall be provided. Frames shall finish flush with floor and adjustable floor anchors shall be supplied. Frames shall be brought to site with floor ties/weather bars installed in place.

b) Double Plate Flush Door Shutters

Door shutters shall be 45 mm thick, completely flush design and shall comprised of two outer sheets or 18 G steel sheets, rigidly connected and reinforced inside with continuous vertical 20 G stiffeners, spot welded in position at not more than 150 mm on centers.

Both edges of doors shall be joined and reinforced full height by steel channels placed immediately inside and welded to the door faces. Top and bottom of doors shall be reinforced horizontally as shown on drawing by steel channels running full width of door. Doors shall not have more than 2.5 mm clearance at jambs and heads, shall have proper level on lock stiles and rails to operate without binding, and shall be reinforced at corners to prevent sagging or twisting. Pairs or double doors shall have meeting stile edges beveled or rebated. Where shown on drawing or called for in the schedule of items the doors shall be sound deadened by filling the inside voids with mineral wool or other suitable approved materials.

Doors shall be mortised, reinforced, drilled and tapped in shop for hinges, locks and bolts. They shall also be reinforced for closers, push-plates and other surface hardware where necessary. Any drilling and tapping required for surface hardware shall be done at site. Where shown in drawing, provision shall be made for fixing glazing, vision panels, louvres etc. glazing mouldings shall be of 18 G steel or extruded aluminium sections with profiles shown in drawing and suitable for fixing 6 mm glass. Louvres blades shall be V or Z shaped and made out of 16 G sheets.

c) Single Sheet Door Shutters

Single sheet doors shall be made from best quality 18 G mild steel sheets and shall present a flush surface on the outside. The inside shall be stiffened with semi-tubular edge and central

stiffening rail, which shall convey the lock and other furniture. The frames shall be made from best quality 16 G mild steel sheets.

Wherever required as shown on drawings, provisions for fixing glass panes, louvres, etc. shall be made.

The manufacturing shall be done as specified in 9.1.2.2.1.b "Double Plate Flush Door Shutters".

d) Sliding Doors

Sliding doors shall be either double plate or single plate construction as called for in drawings and schedules made out of 18 gauge steel sheets with adequate stiffeners. The Contractor shall specify the weight of the door in his shop and submit the manufacturer's catalogue of the sliding gear he proposes to use. Where shown on drawings or call for in the Schedule of Items, the Contractor shall make provision for openings to the door for monorail beams. Doors shall close positively to exclude rainwater from seeping in. When called for in schedule, sliding doors shall withstand specified wind loads without buckling or jamming. The door shall slide freely under all ambient conditions.

e) Door Threshold

Door threshold shall be provided as shown on drawing. Doors without threshold shall have bottom tie of approved type.

f) Steel Windows, Sashes, and Ventilators etc.

These shall conform in all respects to IS: 1038 and IS: 1361 latest editions and as shown on drawings. The details as called for in the above codes shall be applicable for coupling mullions, transoms, weather bars, pivot arrangements for ventilators, etc. or as shown on drawings or called for in the Schedule of Items.

All welds shall be dressed flush on all exposed and contact surfaces.

Where composite unit openings are shown on drawings, the individual window units shall be joined together with requisite transoms and mullions as shown on drawings. All windows shall be outside glazed fixed with putty or metal glazing beads as shown on the drawings and/or specified under Schedule of Items. Where aluminium glazing beads are specified they shall be extruded aluminium channel 9.5 mm x 9.5 mm x 1.6 mm (Indal Section No. 709) unless otherwise shown on drawings. Aluminium beads shall be given one coat of zinc chromate primer before fixing to windows.

2.02.02 Aluminium Door, Windows and Frames

Extruded sections shall have a minimum 3 mm wall thickness. All sections shall be approved by the Engineer before fabrication is taken up.

Doors, frames, mullions, transom etc. shall be anodized in a bath of sulphuric acid to provide a clear coating of minimum 0.6 mm thickness. The anodized materials shall then be sealed by immersing in boiling water for 15 minutes. A protective transparent coating shall be applied to the sections before shipment from the factory.

All work shall be fitted and shop assembled to a first class job and ready for erection. Shop joints shall be made to hairlines and then welded or braced by such method as will produce a uniform colour throughout the work. Work on the above, other than described, shall be carefully fitted and assembled with neat joints with concealed fasteners. Wherever possible, joints shall be made in concealed locations and on edges of doors. Field connections of all work may be made with concealed screws or other approved type of fasteners. Glazing beads shall be snap fit type without visible screws and shall be of sizes to accommodate 6 mm thick glazing. All work shall be adequately braced and reinforced as necessary for strength and rigidity.

2.03.00 Shop Coat or Paint

The shop paint for steel doors, windows, etc. shall be best lead or zinc chromate primer paint from approved manufacturer. All surfaces shall be thoroughly cleaned of rust, grease, loose mill scales etc. and given one coat of shop paint. Portions like mullions, transoms etc. that will be inaccessible after assembly of units shall be given an extra coat of paint before assembly.

Where called for in the Schedule of Items all steel doors, windows, etc. shall be hot dip galvanised to give a coating weight of 1-1/2 - 2 Oz per sft. One coat zinc chromate primer coat shall then be applied as shop paint.

Portions of aluminium frame which come in contact with masonry construction shall before shipment from workshop be protected with a heavy coat of alkali paint. Aluminium coming in contact with other incompatible metals shall be coated with zinc chromate primer.

2.04.00 Handling & Storage of Fabricated Material

All metal doors, windows, etc. shall be packed and crated properly before dispatch to ensure that there will be no damage to the fabricated materials. Loading into wagons and trucks shall be done with all care to ensure safe arrival of materials at site in undamaged condition.

When taking delivery of items supplied by Owner, the Contractor shall satisfy himself that the items supplied are upto the specified standard. Any defect detected shall promptly be brought to the notice of the Engineer.

All metal doors, windows, etc. shall be stored under cover in a way to prevent damage or distortion. Special care shall be taken to prevent staining of aluminum products by rust, mortar, etc.

2.05.00 Assembly & Erection at Site

In general, the fixing of steel doors, windows, ventilators, louvres, etc. shall conform to IS: 1081 and as shown on drawings. The Contractor shall assemble and install all steel doors, windows, sashes, fixed metal louvres, etc. including transoms and mullions for composite units in respective places as shown on drawing keeping proper lines and levels, and in approved workman like manner to give trouble free and leak-proof installations. The installation shall be done according to the instructions of the manufacturer, and/or as approved by the Engineer. If required by the Engineer, the installation shall have to be carried out under the supervision of the manufacturer's staff. The Contractor shall take every precaution against damage of the components during installation. Necessary holes, chases, etc. required for fixing shall be made by the Contractor and made good again as per original, after installation without any extra charge.

After installation of steel doors, windows, etc. all abrasions to shop-coat of paint shall be retouched and made good with the same quality of paint used in shop coat.

All coupling mullions, transoms, frames, etc. in contact with adjacent steel and other members, shall be well bedded in mastic. The Contractor shall bring to the site the mastic cement in original sealed containers of manufacturer and shall apply it as per the instructions. For all frames supplied by either the Owner or the Contractor mastic shall be supplied by the Contractor and caulking done properly as per drawings, specifications and as per instructions of the Engineer.

Door shutters, partitions hardware fixtures etc. shall be fixed only after major equipments have been installed in rooms.

Wherever required nylon cords of approved quality shall be supplied along with pivoted sashes and shall be of adequate length to terminate one metre from the floor. Loose ends of cords shall end in metal or plastic pull as approved by the Engineer.

3.00.00 ACCEPTANCE CRITERIA

3.01.00 For Fabricated Items

a) Overall dimensions shall be within $\pm$ 1.5 mm of the size shown on drawings.

b) Mullions, transoms etc. shall be in one length and permissible deviations from straightness shall be limited to $\pm$ 1.5 mm from the axis of the member.

c) Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed 1.5 mm. For double leaf doors, the gap at the meeting stiles shall not be more than 1.5 mm.

d) Door leaves shall be undercut where shown on drawings.

e) Doors, windows, frames, etc. shall be on a true planes, free from warp or buckle.

f) All welds shall be dressed flush on exposed and contact surfaces.

g) Correctness of location and smoothness of operations of all shop installed hardware and fixtures.

h) Provisions for hardware and fixtures to be installed at site.

I) Glazing beads shall be cut with mitered corners.

j) Glazing clips, fixing devices etc. shall be supplied in adequate numbers.

k) Shop coats shall be properly applied.

l) Exposed aluminium surfaces shall be free from scratches, stains and discolouration. Anodised surfaces shall present a uniform and pleasing look.

3.02.00 For Installed Items

a) Installations shall be at correct location, elevation and in general on a true vertical plane.

b) Fixing details shall be strictly as shown on drawings.

c) Assembly of composite units shall be strictly as per drawings with mastic caulking of transoms and mullions, gaskets, weather strips etc. complete.

d) All frames on external walls shall be mastic caulked to prevent leakage through joint between frames and masonry.

e) All openable section shall operate smoothly without jamming.

f) Locks, fasteners, etc. shall engage positively. Keys shall be non-interchangeable.

g) Cutting to concrete or masonry shall be made good and all abrasions to shop paint shall be touched up with paint of same quality as shop paint.

h) Aluminium doors, windows, etc. shall be free from scratches stain or discolouration.

4.00.00 INFORMATION TO BE SUBMITTED

4.01.00 With Tender

a) Names of manufacturers for doors, windows, etc.

b) Manufacturer's catalogue for all hardware and fixtures proposed to be used.

4.02.00 After Award

a) Before starting fabrication of all metal doors, windows, etc. the Contractor shall submit detailed fabrication drawings to the Engineer for approval. The fabrication shall be started only after approval of drawings.

b) He shall submit a programme of work to be done for the approval of the Engineer.

c) Before bulk supply, he shall submit for the approval of the Engineer samples of all bought out items and samples of each type of fabricated items. The samples shall be retained by the Engineer for comparison of bulk supply and returned to the Contractor towards the end for final incorporation in the job.

5.00.00 RATES

Rates shall be unit rates for items described in schedule.

6.00.00 METHOD OF MEASUREMENT

a) Supply and installation of doors shall be measured in number of each type used. The types shall be as shown on drawings and described in Schedule of Items.

b) Supply of windows shall be measured in number of each type of unit used either single or in combination.

c) Installation including assembly and erection of windows shall be measured in number of types of combinations mentioned in the Schedule of Items.

d) Supply and installation of louvres shall be measured for area of opening in which the louvre is to be installed.

e) Supply of mullions and transoms shall be measured for net length of different types shown on drawings and described in Schedule. In computing the length, the length required for embedding in concrete or masonry shall not be considered. No extra payment shall be made for end or cover plates.

f) Vision panels, louvres to doors and insulation between door faces shall be measured for actual area and paid separately over the basic rate doors.

g) Glazing beads, weather stripping, fixing devices etc. shall not be measured separately but shall be included in the supply rate of respective items.

h) And curing or grouting to concrete and masonry or welding and drilling to steel required for installation shall be included in the installation rate. No separate payment shall be made for caulking and jamming or frames or making good to concrete or masonry.

I) Glass and glazing shall be measured and paid under relevant items.

j) Door and window fixtures, locks, door closures etc. shall be measured in actual numbers use.

7.00.00 I.S. CODES

Following are some of the important I.S. Codes as relevant to this section:

Steel doors, windows and ventilators	-	IS: 1038
Steel windows for industrial buildings	-	IS: 1361
Aluminium doors windows and ventilators	-	IS: 1948
Aluminium windows for industrial buildings	-	IS: 1949
Steel doorframes	-	IS: 4351
Code of practice for fixing and glazing of Metal (steel and aluminium) doors, windows, And ventilators.	-	IS: 1081

10.0 TECHNICAL SPECIFICATION
FOR
THE FIRE RATED DOOR

Providing and fixing of Hollow metal fire rated doors as per IS 3614 part-1 & part-2 for stability and integrity. Pressed Galvanized steel confirming to IS 277 with the following specification. Recommended fire door shall have doors tested at CBRI or ARAI for maximum rating of 2hrs with vision panel. Test certificates should be available for vision liters /panels as part of the fire door assembly. Independent glass test certificates will not be accepted. Manufacturer test certificate shall cover doors both single and double leaf and all doors supplied should be within the tested specimen, deviation in specification and sheet thickness other than what is mentioned in the test certificates are not allowed. Proper label confirming the type of door and the hourly rating is mandatory.

Door frame shall be double rebate profile of size 143 x 57 mm made out of 1.60mm (16gauge) minimum thick galvanized steel sheet. Frames shall be Mitered and field assembled with self-tabs. All provision should be mortised, drilled and tapped for receiving appropriate hardware. Rubber door silencers should be provided on the striking jamb. Frames should be provided with back plate bracket
and anchor fasteners for installation on a finished plastered masonry wall opening. Once frame installed should be grouted with cement & sand slurry necessary for fire doors on the clear masonry opening.

Door leaf shall be 46mm thick fully flush double skin door with or without vision lite. Door leaf shall be manufactured from 1.2mm (18guage) minimum thick galvanised steel sheet. The internal construction of the door should be rigid reinforcement pads for receiving appropriate hardware. The infill material shall be resin bonded honeycomb core. All doors shall be factory prepped for receiving appropriate hardware and provided with necessary reinforcement for hinges, locks, and door closers. The edges should be interlocked with a bending radius of 1.4mm. For pair of doors astragals has to be provided on the meeting stile for both active and inactive leaf. Vision lite wherever applicable should be provided as per manufacturers recommendation with a beeding and screws from inside. The glass should be 6mm clear borosilicate fire rated glass of relavant rating of the door.

All doors and frames shall be finished with polyurethane aliphatic grade paint of approved colour. The door leaf and frame shall have passed minimum 250 hours of salt spray test.

Rate should include supply and installation of door and hardware set as mentioned in the door and hardware schedule.

2Hrs Fire Rated Door Double leaf of od desired size With vision panel with hardware set for each leaf as follows:

Ball bearing butt hinge 4" x 3" x3 mm in SSS
Mortice sash lock 50mm BS, 20mm sq for end strip, SSS 1"
6 pin EP cyl. L=70mm both side keys in SNP (1 each)
Tubular lever handle with roses and esc. SSS (1 each)
Door closer spring size 3 with standard arm, CE marked
Concealed flush bolt body with rod, Length - 265mm , Vision panel of 6mm thick borosilicate Fire Rated clear glass of size 200mm (W) x 300mm (H), Self-adhesive side roll (Ceramic Tape) as required.

11.0 TECHNICAL SPECIFICATION
FOR
PAINTING, WHITE WASHING AND POLISHING ETC.

1.00.00 SCOPE

This specification covers painting, white washing, varnishing, polishing etc. of both interior and exterior surfaces of wood work, masonry, concrete plastering, plaster of paris, punning false ceiling, structural and other miscellaneous steel items, rain water down comer, floor and roof drains, soil, waste and service water pipes, and other ferrous and non-ferrous metal items as shown on drawings, schedule or as directed by the Engineer.

Copper, bronze, chromium plate, nickel, stainless steel, aluminium and monel metal shall generally not be painted or finished except if otherwise specified.

The painting Contractor shall inspect the work of others prior to the application of paint. If surface to be finished cannot be put in suitable condition for painting by customary preparatory methods, the painting contractor shall notify the Engineer in writing or assume responsibility for and rectify unsatisfactory finishing that results.

Before commencing painting, the painting contractor shall obtain the approval of the Engineer in writing regarding the schedule of work to minimize damage, disfiguration or staining by other trades. He shall also undertake normal precautions to prevent damage, disfiguration or staining to work of other trades or other installations.

2.00.00 INSTALLATION

2.01.00 Materials

Materials shall be highest grade products or well-known approved manufacture and shall be delivered to the site in original sealed containers, bearing brand name, manufacturer's name and colour shade, with labels intact and seals unbroken. All materials shall be subject to inspection, analysis and approved by the Engineer. It is desired that materials of one manufacturer only shall be used as far as possible and paint or one shade is obtained the same manufacturing batch. All paint shall be subject to analysis from random samples taken at site from painters bucket, if so desired by the Engineer.

All prime coats shall be compatible to the material of the surface to be finished as well as to the finishing coats to be applied.

All unspecified materials such as shellac, turpentine or linseed oil shall be of the highest quality available and shall conform to the latest IS standards. All such materials shall be made by reputable recognised manufacturers and shall be approved by the Engineer.

All colour shall be as per painting schedule and tinting and matching shall be done to the satisfaction of the Engineer. In such cases, where samples are required, they shall be executed in advance with the specified materials for the approval of the Engineer.

a) White Washing

Shall be done from pure shell lime or fat lime, or a mixture of both as instructed by the Engineer, and shall conform to IS: 712 latest edition. Samples of lime shall be submitted to the Engineer for approval, and lime as per approved sample shall be brought to site in unslaked condition. After slaking, it shall be allowed to remain in a tank of water for two days and then stirred up with a pole, until it attains the consistency of thin cream. 100grams of gum to 6 litres of white wash water and a little quantity of indigo or synthetic ultramarine blue shall be added to the lime.

b) Dry Distemper

Shall be made from suitable pigments, extenders, lime proof tinters, water soluble binders etc. and shall conform to IS: 427.

c) Oil Bound Washable Distemper

Shall be of oil emulsion type, containing suitable preservatives and shall conform to IS: 428.

d) Waterproof Cement Paint

Shall be made from best quality white cement and lime resistant colours with accelerators, waterproofing agents and fungicides. The paint shall conform to IS: 5410.

e) Acrylic Emulsion Paint

Shall be water-based acrylic copolymer emulsion with rutile titanium dioxide and other selected pigments and fungicide. It shall exhibit excellent adhesion to plaster and cement surface and shall resist deterioration by alkali salts. The paint film shall allow the moisture in wall to escape without peeling or blistering. The paint, after it is dried, shall be able to withstand washing with mild and water without any deterioration in colour, or without showing flaking, blistering or peeling.

f) Synthetic Enamel Paint

Shall be made from synthetic resins and drying oil with rutile titanium dioxide and other selected pigments to give a smooth, hard, durable and glossy finish to all exterior and interior surfaces. White and pastel shades shall resist yellowing and darkening with aging. The paint shall conform to IS: 2932 and IS:2933.

g) Aluminium Paint

Shall be in two pack containers and shall resist weathering. The paint shall conform to IS: 2339.

h) Shall be best quality alkyd varnish suitable for brushing over the tint of paint or light natural wood and shall not darken or yellow with age.

i) French Polish

Shall be made from best quality shellac, denatured spirit and other suitable alcohol soluble ingredients and made by a well known approved manufacturer. The material shall conform to IS: 348.

French polish shall not be used on bare wood. It shall only be used as finishing coat on wood after the wood is pretreated with a liquid wood filler conforming to IS: 345 is applied and rubbed out.

2.02.00 Storage

The contractor shall arrange for safe and proper storage of all materials and tools. The storage space if allotted within the building shall be adequately protected from damage, disfigurement and stains. Paint shall be kept covered at all times and mixing shall be done in suitable containers. All necessary precautions shall be taken by the contractor to prevent fire.

2.03.00 Preparation of Surface

Before starting the work the contractor shall obtain the approval of the Engineer regarding the soundness and readiness of the surface to be painted on.

2.03.01 Wood

All surfaces shall be free from dirt and loose or peeling paints. The surface shall be rubbed down smooth. All nails and screws shall be sunk below the surface and filled with putty after applying an under coat. Small knots that do not justify cutting and sap streaks shall be covered with minimum 2 coats of pure shellac coating applied thinly and extended 25 mm beyond the area. All large, loose or resinous knots shall be removed and filled with sound wood. All work shall be done as per IS: 2338.

2.03.02 Masonry, Concrete and Plastered Surface

Surface shall be free from all oil, grease, efflorescence, mildew, loose paint or other foreign and loose materials. Masonry cracks shall be cleaned out and patch filled with mortar similar to the original surface and uniformly textured. Where this type of re-surfacing may lead to the finishing paint being different in shade from the original surfaces, the resurfaces area shall be treated with minimum one coat of cement primer which should be continued to the surrounding area for a distance of minimum 100 mm.

Surface with mildew or efflorescence shall be treated as below :

a) Mildew

All mildewed surfaces shall be treated with an approved fungicide such as ammoniacal wash consisting of 7g of copper carbonate dissolved in 80 ml. liquor ammonia and diluted to 1 litre with water or 2.5 percent magnesium silicofluoride solution and allowed to dry thoroughly before paint is applied.

2.03.03 Metal

All metal surface shall be absolutely clean, dry and free from wax, grease or dried soap films. In addition, all steel and iron surfaces shall be free from rust, surfaces shall be cleaned by mechanical power tools to remove mill scales unless otherwise approved by the Engineer for exposed chemical resistant paints, surfaces shall be blast cleaned to near white metal. All galvanised iron surfaces shall be pretreated with a compatible primer according to the manufacturer's direction. Any abrasion in shop coat shall be touched up with the same quality of paint as the original coat.

2.04.00 Application

2.04.01 General

The method of application shall be as recommended by the manufacturer. In case of selection of special shades and colour (not available in standard shades) the Contractor shall mix different shades and prepare test panels of minimum size 1 meter square as per instruction of the Engineer and obtain his approval prior of application of finishing paints.

Proper tools and implements shall be used. Scaffoldings if used shall be independent of the surface to be painted to avoid shade differences of the freshly repaired anchor holes.

Painting shall be done by skilled labours in a workmanlike manner. All materials shall be evenly applied so as to be free of sags, runs, crawls or other defects. All coats shall be of proper consistency. In case of application by brush, no brush marks shall be visible. The brushes shall be clean and in good condition before application of paint.

All priming undercoats for painting shall be applied by brush only and rollers spray equipments etc. shall not be used.

No work shall be done under conditions that are unsuitable for production of good results. No painting shall be done when plastering is in progress or is drying. Application of paint which seals the surfaces to moisture shall only be done after the moisture on and below the surface has dried out.

All coats shall be thoroughly dry before succeeding coat is applied. Coats of painting as specified are intended to cover surfaces perfectly. In case the surface is not covered properly by applying the specified number of coats, further coats shall be applied by the Contractor when so desired by the Engineer.

All primers and undercoats shall be tinted to approximate the colour of the finishing coats. Finished coats shall be of exact colour and shade as per

approved samples and all finish shall be uniform in colour and texture. All parts of mouldings and ornaments shall be left clean and true to finish.

Painting on ferrous metal surface shall be done as per IS: 1477 (Part 1 & 2). The total dry thickness of the film should not be less than 120 micron.

2.04.02 White Washing

The surface where white washing is to be applied shall be cleared of all loose materials and dirt. All holes and irregularities of the surface shall be filled up with lime putty and shall be allowed to dry up before application of the lime solution.

One coat of whitewash shall consist of one stroke from top downwards, another from bottom upwards over the first stroke and another from left to right before the previous one dries up. Second coat shall be applied and in case the Engineer f eels that one or more coats are required the contractor shall do so without any extra cost to the owner. No brush marks shall show on the finished surface.

2.04.03 Dry Distemper

New plastered surface shall be allowed to dry for at least two months. New lime or lime cement plastered surface shall be washed with a solution of 1 part vinegar to 12 parts water or 1:50 sulphuric acid solution and for 24 hours after which the wall shall be thoroughly washed with clean water. For cement plastered surface, the surface shall be washed with a solution of 100 gms. of zinc sulphate to 1 litre of water and then allowed to dry.

Dry distempering shall be done as per manufacturer's instruction. In applying the distempers the brush should first be applied horizontally and immediately crossed off perpendicularly. Brushing shall not be continued too long as otherwise brush marks may result.

2.04.04 Oil bound Washable Distemper

The distemper shall be applied after surface is primed with an alkali resistant primer and followed by minimum two coats of oil bound washable distemper all as per manufacturer's instruction.

2.04.05 Waterproof Cement Paint

Surface to be coated with cement paint shall be washed and brushed down. As soon as the moisture has disappeared, the surface shall be given one coat of paint. Care shall be taken so that the paint does not dry out too rapidly. After 4 to 6 hours, the water shall be sprinkled over the surface to assist curing and prevent cracking. After the first coat has dried (24 to 48 hours) the second coat shall be applied in a similar manner. The finished surface shall be kept moist by occassional sprinkling with water for seven days after painting.

2.04.06 Acrylic Emulsion Paint

Lime gauged cement plastered surfaces shall not be painted for at least one month after plastering. A sample patch shall be painted to check alkali reaction if so desired by the Engineer. Painting shall be strictly as per manufacturer's specification.

2.04.07 Synthetic Enamel Paint

Shall be applied on properly primered surface. Subsequently coat shall not be applied till the previous coat is dry. The previous shall be lightly sand papered for better adhesion of subsequent coats.

2.04.08 Aluminium Paint

The paint, supplied in two pack containers shall be mixed and applied strictly as per manufacturer's direction. When more than one coat of paint is required or indicated, the next coat shall only be applied after the previous coat become hard dry.

2.04.09 Clear Synthetic Varnish

The varnish shall be applied on wood surface after (a) filling, (b) staining and (c) sealing operations are carried out. The application of a combination of filler and stain shall not be permitted.

For the finishing coats of varnish, the surface shall be allowed to dry and be rubbed down lightly, wiped off and allowed to dry. Careful attention to cleanliness is required for varnishing. All dust and dirt shall be removed from the surface as well as from the neighbour hood. Damp atmosphere and draughts shall be avoided and exposure to extreme heat or cold and dampness shall not be allowed.

The varnish shall be applied liberally with a brush and spread evenly over a portion of the surface with light strokes to avoid fronthing. It shall be allowed to flow on while the next section is being laid on excess varnish shall then be scrapped off the brush and the first section be crossed, recrossed and then laid off lightly. The varnish once it has began to set, shall not be retouched. In case of any mistake in application, the varnish shall be removed and the work started afresh.

The varnish shall be minimum of two coats, with the first coat being a flatting varnish. This shall be allowed to dry hard and be flatted down before applying the next coat. Sufficient time must be allowed between coats to get a hard dry surface before next coat is applied. All work shall be as per relevant IS Code.

2.04.10 French Polish

All unevenness of the surface shall be rubbed down to smoothness with sand paper and the surface shall well dusted. The pores in the wood shall be filled up with a paste of whiting in water or methylated spirit with a suitable pigment like burnt sienna or amber.

After application of the filler paste, the french polish shall be applied with a pad of woolen cloth covered by a fine cloth. The pad shall be moistened with polish and rubbed hard on the surface in a series of overlapping

circles so that the polish is sparingly but uniformly applied over the entire area to give an even surface. A trace of linseed oil may be used on the pad for case of application. The surface shall be allowed to dry before further coats are applied in the same manner. To finish off, the pad shall be covered with a fresh piece of clean fine cloth, slightly damped with methylated spirit and rubbed lightly and quickly with circular motions to leave the finished surface with a uniform texture and high gloss.

2.04.1 Chemical Resistant Paint

For chemical resistant paints, epoxy, chlorinated rubber or vinyl butyl paint system shall be used manufacturer's recommendation regarding the paint system exposed to moderately severe corrosive condition and subject to acid/alkali spillage and fumes, shall be followed.

2.04.12 Epoxy coating/painting

On the clean surface of concrete after properly drying of the following system is to be adopted as per manufacturers specification:

One coat of primer of following proportion to be applied over clean and dried concrete surface by brush application.

ARALDITE GY 250 - 100 Parts by weight

HARDENER HY 840 - 50 Parts by weight

Over the primer, the uneven surface of concrete should be filled with levelling putty as mentioned above. The cost of putty is included in the item rate without fixing prior limit to consumption of putty. Two top coats of the protective treatment to be applied over the prepared smooth surface in the following proportion.

ARALDITE GY 250 - 100 Parts by weight

HARDENER HY 830 - 45 Parts by weight

HARDENER BY 850 -15 Parts by weight

SILICA FLOUR - 20 Parts by weight

FLOW CONTROL - 2 Parts by weight
AGENT

Pigment may be added if desired by Engineer. The first top coat is applied over the primer and is left to reach a tack free state. At this stage, the final top coat is applied.

2.05.00 Protection

Furniture and other movable objects, equipments, fittings and accessories shall be moved, protected and replaced upon completion of work. All stationary equipments shall be well covered so that no paint can fall on

them. Work finished by other agencies shall be well protected. All protections shall be done as per instructions of the Engineer.

2.06.00 Cleaning up

In addition to provisions in general conditions the Contractor shall, upon completion of painting etc. remove all marks and make good surfaces, where paint has been spilled, splashed or splattered, including all equipment, fixtures, glass, furniture, fittings etc. to the satisfaction of the Engineer.

3.00.00 ACCEPTANCE CRITERIA

a) All painted surfaces shall be uniform and pleasing in appearance.

b) All varnished surfaces shall be of uniform texture and high glossy finish.

c) The colour, texture etc. shall match exactly with those of approved samples.

d) All stains, splashes and splatters of paints and varnishes shall be removed from surrounding surfaces.

4.00.00 RATES

Rates shall be unit rates for complete items described in the Schedule of Items. No extra payment will be made for preparation of surface before painting or for cleaning up after the work is complete.

5.00.00 METHOD OF MEASUREMENT

a) All structural steel work whose any or all faces are to be painted shall be measured and paid in weight of steel unless otherwise specified in the Schedule of Items.

b) Painting or whitewashing to concrete or masonry shall be measured and on the area painted. For measurement of openings whose jambs, sills, soffits etc. are to be painted the following procedure shall be followed :

i) For openings upto 0.5 sq.m. but not exceeding 3.0 sq.m. each deductions shall be made for half the area of openings and no additions shall be made for jambs, sills, etc.

ii) For openings exceeding 0.5sq.m. but not exceeding 3.0 sq.m. each deductions shall be made for half the area of openings, and no additions shall be made for jambs, sills etc.

iii) For openings exceeding 3.0sq.m. each, deductions shall be made for the whole area, and additions shall be made for the jambs, sills soffits, reveals etc.

c) For openings, pipes, sleeves etc. whose sides are not finished no deductions shall be made for openings etc. upto 0.1 sq.m. in area each and full deductions shall be made for all openings above 0.1 sq.m. in area each.

d) No extra shall be paid for painting etc. done around openings, sleeves, pipes, ducts, inserts, etc.

e) No extra payment shall be made for painting, etc. on wall features such as grooves, ducts, beads, projections, cornices, etc. unless give different finish or otherwise specified in the "Schedule of Items". The actual area of the features shall be girthed and included in the wall measurements.

f) For painting of uneven surfaces in doors, windows, ventilators, louvres, guardbars, ballustrades, gratings, railings, gates, etc. equivalent plain areas shall be measured as given in Clause 17.2 (Table II) of IS:1200.

g) Corrugated surfaces shall be measured flat as fixed and not girthed. The quantities as measured shall be multiplied by the following factors to get equivalent plain area :

i) Corrugated steel sheets - shall be multiplied by 1.14.

ii) Corrugated asbestos sheets with large corrugations shall be multiplied by 1.20

iii) Semi-corrugated asbestos cement sheets shall be multiplied by 1.10.

iv) Any other non-standard corrugated surfaces shall be measured as decided by the Engineer.

h) For painting pipes for sanitary and plumbing work, measurement shall be made on actual work done in R.M. for different diameters. Measurements shall be along the central lines of pipes laid. No deductions or additions shall be made for valves, fittings, etc.

i) Unless specifically stated on the schedule of items, all painting, varnishing or polishing of wood shall be measured and paid on the area treated. For measurement of uneven surfaces, equivalent Main area shall be measured as per Clause 17.2 (Table II) of IS: 1200.

6.00.00 I. S. CODE

Important relevant IS Codes for this Sections are listed below :

IS:348 : Specification for French Polish

IS:427	:	Specification for Distemper, dry colour as required.
IS:428	:	Specification for Distemper oil emulsion, colour as required.
IS:1477 (I & II)	:	Code of Practice for painting of ferrous metal in buildings.
IS:2338 (I & II)	:	Code of Practice for finishing of wood and wood based materials.
IS:2339	:	Specification for Aluminium Paints for general purposes in dual containers.
IS:2395	:	Code of Practice for painting concrete, masonry and plaster surface.
IS:2932	:	Specification for enamel, synthetic, exterior, type-I.
IS:5410	:	Specification for cement paint, colour as required.

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11.0 TECHNICAL SPECIFICATION
FOR
GLASS AND GLAZING

TECHNICAL SPECIFICATION
FOR
GLASS AND GLAZING

1.00.00 SCOPE

The work in general shall consist of supplying and fixing all glass and glazing including all clips, putty, mastic cement etc. wherever required as shown on drawings and specifications, supply of metal glazing beads and neoprene gaskets shall not be included in this scope.

This shall also include the fixing of all glass and glazing supplied by the Owner at his site stores.

1.01.00 INSTALLATION

1.01.01 General

The Contractor shall supply and install all glass and glazing as required for various doors, windows, sashes, ventilators and fixed louvers, miscellaneous glazing and partitions from approved manufacturer, shall have uniform refractive index and free from flaws, specks and bubbles. The glass shall be brought to site in the original packing from the manufacturer and cut to size at site.

Materials

a)

b) Clear glass shall be float glass and shall be at least 4 mm thick. for windows and for doors shall be minimum 5mm thick. or as indicated in doors' and windows schedule.

d) Obscure glass shall have a cast surface in one side.

f) In general, the putty shall conform to IS : 400 and be of best quality from approved manufacturer. It shall be brought to site in the manufacturer's original packing. Quick setting putty glass is used where it shall be non-setting type.

g) EPDM gaskets with snap-fit glazing shall be fixed as per manufacturer's instructions and shall sit snugly against glass to give a leak proof installation.

1.02.00 Glazing, Setting and Finish

All glazing clips, bolts, nuts, putty, mastic cement etc. as required shall be supplied by the Contractor.

All glass shall be thoroughly cleaned before putting in position. Each glass pane shall be held in place by special glazing clips of approved type. As specified in relevant I.S. Codes, four glazing clips shall be provided per glass pan, except for large panes where six or more clips shall be used as per Engineer's instructions. All holes that may be necessary for holding the clips glazing heads and all other attachments shall be drilled by the Contractor.

Glass panes shall be set without springing, and shall be bedded in putty and back puttied, except where moulding or gasket are specified, putty, mastic cement etc. shall be smoothly finished to the even line and figured glass shall be set with smooth side out.

Where glass will be supplied by Owner, the Contractor shall cut it to size and fix them in the same as specified above.

Necessary glazing clips, putty, mastic cement etc. shall be supplied by the Contractor. The Contractor shall be responsible for damage of glass supplied by the Owner, during handling, transportation, fixing etc. maximum wastage allowance shall be 5%.

After completion of glazing work, the Contractor shall remove all dirt stains, excess putty etc. clean the glass panes and leave the work in perfectly acceptable condition. All broken cracked or damaged glass shall be replaced by new ones at the Contractor's own cost.

1.03.00 ACCEPTANCE CRITERIA

a) All installation shall be free from cracked, broken or damaged glass. Edges of large panes of thicker glass and heat absorbing glass shall be inspected carefully for chipped, cracked or underground edges.

b) Glazing shall be carefully done to avoid direct contact with metal frames.

c) All glass shall be embedded in mastic or fixed by EPDM gaskets to give a leak proof installation.

d) At completion, the panes shall be free from dirt, stains, excess putty etc. to the complete satisfaction of the Engineer.

1.4.0.0 RATES

a) Rates shall be unit rates for supply and / or installation of different kinds of glass mentioned in the Schedule of Items.

b) No separate payment shall be made for glazing clips, mastic cement, putty, nails etc. for drilling holes in frames for inserting glazing clips.

c) No separate payment shall be made for cutting of glass to require size, edge finishing etc. if the glass is supplied by the Contractor.

d) Payment shall be made for cutting of glass to required size edge finishing etc. if the glass is supplied by the Owner.

e) No separate payment shall be made for cleaning the glass after installation.

1.5.0.0 METHOD OF MEASUREMENT

a) All supply and / or installation of glass shall be measured for actual area of work done.

b) When glass is supplied by the Owner, the cutting of glass shall be measured for actual length of cut edges.

1.6.0.0 I. S. CODES

Following are some of the important I.S.Codes relevant to this Section;

I.S. : 3548 - Code of practice for glazing in building.

IS : 1083 - Code of practice for fixing and glazing metal doors, windows and ventilators.

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12.0 TECHNICAL SPECIFICATION

FOR

ROOF WATER PROOFING, INSULATION AND ALLIED

WORKS

1.0.0 SCOPE

This specification covers furnishing, installation, repairing, finishing, curing, testing,, protection, maintenace till handing over of roof water-proofing, insulation and allied works for buildings and at locations covered under the scope of the Contract.

2.0.0 INSTALLATION

2.1.0 Grading Underbed

The suface to receive the under bed shall be roughened and thoroughly cleaned with wire brush and water. Oil patches if any shall be removed with detergent. The surface shall be soaked with water and all excess water removed just before laying of the underbed.

The underbed shall not be laid under direct hot sun and shall be kept in shade immediately after laying so as to avoid quick loss of water from the mix and separation from the roof surface. The underbed shall be cured under water for at least 7 days.

The underbed shall be laid to provide an ultimate run off gradient not less than 1 in 120 and as directed by the Engineer. Upto an average thickness of 25 mm the underbed shall usually be composed of cement and sand plaster. For higher thickness the underbed shall be made with cement concrete.

The underbed shall be finished to receive the waterproofing treatment direct or insulation as the case may be.

2.1.1 The grading plaster shall be average 25mm thick maximum. It shall consist of cement and coarse sand in the ratio 1:4 nominal by volume. The same and cement shall be throughly mixed dry and them water added. Each batch of mix shall be consumed before the initial set starts.

The plaster shall be fully compacted to the desired grade in continuous operation. The surface shall be even and reasonably smooth.

2.1.2 Concrete

The concrete shall be used where the subgrade is more than average 25mm thick. It shall consist of cement concrete 1:2:4 nominal mix by volume with 12mm down stone chips and coarse sand. The aggregate shall be mixed dry and minimum quantity of water shall be added to make the mix workable.

The mix shall be laid to proper grade, fully consolidated and surface shall be smooth and even.

2.2.0 Insulation

The Tenderer shall along with the tender send specification of insulating materials he proposes to use and the proposed method of laying. Before bulk supply, the contractor shall send samples of insulating material to the Engineer, and after approval of the samples, the Contractor shall procure and transport the bulk material to the site. Whenever asked by the Engineer, the Contractor shall

furnish test certificates from testing laboratory on the insulating and other properties of the materials.

After laying the insulation the surface shall be made ready as required to receive the waterproofing treatment. If any plastering is used it shall be not leaner than 1:4 cement sand by volume and not thiner than 12mm and it shall be cured for seven days.

2.2.1 Foam Concrete

This shall be of light weight foam concrete of average 50 mm thickness or as specified or as shown on drawings. This may be laid in situ in suitable panels or in precast blocks. The insulating properties shall be such that the thermal conductivity shall not exceed 0.125 Kcl m/mdegree C. The weight of the insulating material shall be from 0.3 to 0.5 gm/cm.

Before starting the laying of foam concrete samples shall be prepared at site and got tested for approval of the Engineer.

The foam concrete laid shall be sufficiently strong to make the usual work load and standard loads expected on the roof. Any damaged portion shall be removed and replaced forthwith. Approval of the Engineer shall be taken before laying the waterproofing over the insulation.

While laying the foam concrete, samples from each batch of the mix shall be kept for test if so desired by the Engineer.

2.2.2 Expanded Polystyrene Blocks

The expanded polystyrene block insulation shall be fire retardant quality and shall have a maximum thermal conductivity of 0.026 KCl m/mdegree C. It must be strong enough to withstand without deformation the workload and standard loads expected on the roof.

The Contractor shall lay the expanded polystyrene block as per manufacturer's approved specification. Only specifically experienced workers shall be used for this work. If the Engineer is not satisfied about the efficiency of the workers the Contractor shall secure manufacturers' supervision at no extra cost to the Owner.

2.3.0 Fillets

Fillets at junction of roofs and vertical walls shall be provided with the same insulating material as provided for the main roof insulation. The fillets shall be 150 mm x 150 mm in size unless otherwise shown on drawings or instructed by the Engineer.

Where there is no insulation over roof slab, fillets shall be cast-in-situ cement concrete (1:2:4) nominal mix by volume.

2.4.0 Waterproofing

Waterproofing treatment shall be laid by a specialist firm with long experience in the particular trade.

The waterproofing treatment for roofs with Bitumen Felts shall be done following relevant IS:1346. Bitumen felt shall conform to IS:137 and Bitumen primer to IS:3384.

The bonding materials shall consist of blown type conforming to IS:702 or residual bitumen to IS:73 or a mixture of the two to withstand local conditions or prevailing temperature or gradient of roof surface. The Contractor shall convince the Engineer that the bonding material proposed to be used is suitable for the particular job.

The Contractor shall state the source from where he proposed to procure the materials. Samples of the self finished felt shall be submitted in advance to the Engineer along with test certificates for his review. Test certificates for the bonding materials shall also be submitted and samples, if desired by the Engineer, shall be provided for confirmatory tests. Samples of pea sized gravel shall be submitted if instructed by the Engineer.

Minimum overlaps of 100 and 75 mm shall be given at the end and sides of strips of felt and properly bonded with bitumen. Joints in successive layers of felt shall be staggered.

Normal treatment with one layer of felt, heavy treatment with two layers of felt or Extra Heavy treatment with three layers of felt shall be indicated in the Schedule of Items. Brief details of the various treatments shall be as follows :

a) Normal Treatment : Four courses :

1) Hot applied bitumen at the rate of 1.2 kg/m

2) Hessian base self finished felt, type 3, grade 1

3) Hot applied bitumen at the rate of 1.2 kg/m

4) Pea sized gravel at the rate of 0.006 mU2

b) Heavy Treatment : Six Courses :

With Hessian base felt

1) Hot applied bitumen at the rate of 1.2 kg/m

2) Hessian base self-finished felt, type 3, grade 1

3) Hot applied bitumen at the rate of 1.2 kg/m

4) Hessian base self-finished felt, type 3, grade 1.

5) Hot applied bitumen at the rate of 1.2 kg/m

6) Pea sized gravel at the rate of 0.006 mU2

Or

With fibre base felt

1) Hot applied bitumen at the rate of 1.2 kg/m

2) Fibre base self-finished felt, type 2, grade 2

3) Hot applied bitumen at the rate of 1.2 kg/m

4) Fibre base self-finished felt, type 2, grade 2

5) Hot applied bitumen at the rate of 2.5 kg/m and

6) Pea sized gravel at the rate of 0.008 mU2

c) Extra Heavy Treatment : Eight courses :

With fibre based felt

1) Hot applied bitumen at the rate of 1.2 kg/m

2) Fibre-base self-finished felt type 2, grade 1

3) Hot applied bitumen at the rate of 1.2 kg/m

4) Fibre base self-finished felt type 2, grade 1

5) Hot applied bitumen at the rate of 1.2 kg/m

6) Fibre base self-finished felt type 2, grade 1

7) Hot applied bitumen at the rate of 2.5 kg/m and

8) Pea sized gravel at the rate of 0.008 mU2.

Or

With Hessian base felt

1) Hot applied bitumen at the rate of 1.2 kg/m

2) Hessian base self-finished felt, type 3, grade 1.

3) Hot applied bitumen at the rate of 1.2 kg/m

4) Hessian base self-finished felt, type 3, grade 1

5) Hot applied bitumen at the rate of 1.2 kg/m

6) Hessian base self-finished felt, type 3, grade 1

7) Hot applied bitumen at the rate of 1.2 kg/m

8) Pea sized gravel at the rate of 0.006 mU2

However, in special cases, more courses or a combination of fibre base and hessian base felts may be asked for.

The suface to receive the waterproofing treatment must be cleaned and dried satisfactorily and the Engineer's approval taken before starting the work. If any existing waterproofing treatment is being augmented the pea sized gravel or any other existing top course shall be completely removed and all damaged felts or other defects required.

The Engineer may instruct the Contractor to lay part of the stipulated courses at the first instant to be followed later on with the balance courses. This interim finish shall be done with a course of hot applied bitumen. While doing the balance again hot bitumen shall be applied to start with after repair of all damages to the already laid course.

After completion the surface shall be cleaned taking care that loose gravels, felt cuttings etc. do not find their way into rain water down comers.

2.4.1 Waterproofing by epoxy resin based application

Exposed surfaces of cement concrete, lime concrete or brickwork to be treated for waterproofing by the resin based application shall be throughly cleaned and the epoxy resin based material to be applied as directed by the manufacturer. The material shall not have any adverse effect on the surface on which it is applied and must stick to it uniformly to make a strong durable bond. It shall not be affected by short duration from fire, sun, light traffic. The application shall be resistant to growth of fungus and proof against saltpetre action. If desired by the Engineer, a sample shall be prepared in advance and tested for waterproofness for 48 hours under 300 mm depth of standing water. The Contractor shall arrange the demonstration by providing free the materials and labours for the application. This item shall carry a guarantee as specified under the relevant item in the Schedule.

2.4.2 WATER PROOFING TREATMENT WITH APP (ATACTIC POLYPROPYLENE POLYMERIC) MEMBRANE

Water proofing treatment of roofs with APP modified polymeric membrane shall be either five course, seven course as specified in the item. In selecting the combinations of layers of APP membrane, consideration shall be given to the type and construction of buildings, climate and atmospheric conditions and the degree of permanence required. Five course treatment is a normal treatment suitable to moderate rainfall conditions (less than 50 cm.) and seven course treatment is suitable for heavy rainfall (50 cm and above). Seven course treatment with APP modified polymeric membrane 2.00 mm thick and weight 3.00 kg./sqm. to suitable for very heavy conditions of rainfall (more than 150 cm.).

2.4.2.1 Materials

2.4.2.2 The bitumen primer shall conform to the requirements laid down in IS 3384.

2.4.2.3 APP Modified Membrane:

It is a polymeric water proofing membrane manufactured to high standards. It is five layered APP modified polymeric membrane with centre core as 20 micron HMHDPE/100 micron HMHDPE High Molecular High Density Polythylene Film, is the heart of the membrane and protects against water and moisture. The centre core is sandwiched on

both sides by high quality polymeric mix with properties of high softening point, high heat resistance and cold
resistively to make it ideal for all water proofing treatment. The polymeric mix is protected on both sides with 20 micron HMHDPE film. The membrane is available in variable thickness and weights. Usual width is 1.0 m. Important physical and chemical parameter of the membrane shall be as given in Table 7.1 for guidance.

TABLE 2.4.2.3.A

Centre Core	*Film*	*Thickness*	*Weight*
20 micron HMHPDE	20 micron HMHPDE	1.50 mm	2.25 kg/ sqm.
100 micron HMHPDE	20 micron HMHPDE	2.00 mm	3.00 kg./ sqm.

Where proprietary brands Atactic Polyproplene modified polymeric membrane is proposed to be used by the contractor, they shall conform in all respect to the specification in the preceding paras and manufactured by a company of repute.

2.4.2.4 Bonding Material:

This shall consist of blown type bitumen conforming to IS 702 or residual bitumen 85/25 conforming to IS 73 heated to the correct working temperature of 180°C. The penetration of the bitumen shall not be more than 40 when tested in accordance with IS 1203, unless otherwise specified each coat of bonding material shall be of blown type bitumen of grade 85/25 heated to a working temperature of 180 degree C and applied @ 1.20 kg. per square metre of the surface area.

2.4.2.5 Surface Finish:

Surface finish shall be with brick tiles of class designation 100 grouted with cement mortar 1:3 (1 cement : 3 fine sand) with 2% integral water proofing compound by weight of cement over a 12 mm thick layer of cement mortar 1:3 (1 cement: 3 fine sand) and finished neat. Surface finish shall be measured and paid for separately.

2.4.2.6 Preparation of Surface:

The surface to be treated shall have a minimum slope of 1 to 120. This grading shall be carried out with cement concrete or cement plaster with coarse sand, as desired, to the average thickness required and finished smooth. Such grading shall be paid for separately.
Junctions between the roof and vertical faces of parapet walls, chimneys etc. shall be chased by running triangular fillets 7.5 x 7.5 cm. size, cement concrete. At the drain mouths, the fillets shall be suitably cut back and rounded off for easy application of water proofing treatment and easy flow of water. Cement concrete where shall be 1:2:4 mix (1 Cement: 2 Coarse sand: 4 Graded stone aggregate 20 mm. Nominal size). The provision of fillets shall be deemed to be covered by the item of water proofing and shall not be measured or paid for separately. In existing roof where gola and drip course are provided at the junction of roof and vertical face of parapet wall, chimney stacks, etc. These shall be dressed suitably and finished smooth so as to ensure an easy and gradual turning of the flashing. Any dismantlement or forming and finishing smooth the junction for forming the base of the flashing shall not be measured or paid for separately and shall be deemed to form part of the preparation of the surface. While the grading of roof surface is being done, it shall be ensured that the outlet drain pipe have been fixed and mouth at the entrance have been eased and rounded off properly for easy flow of water. When

any pipe passes through the roof to be treated, angular fillet of shape shall be built around it for the water proofing treatment to be taken over it. These fillets shall not be measured or paid for separately. For carrying over and tucking in the water proofing felts into the parapet walls, chimneys stacks etc. a horizontal groove 6.5 cm. deep, 7.5 cm. wide section with its lower edge at not less than 15 cm. above the graded roof surface shall be left on the inner face of the same; during construction if possible. When such groove has not been left, the same shall be cut out neatly and the base at rear of the groove shall be finished smooth with cement plaster 1:4 (1 cement: 4 coarse sand). Such cutting of the groove and its finishing smooth shall be part of the water proofing or paid for separately. No deduction shall be made either for not making the groove or when the latter has already been left in the masonry by the construction agency. Tucking in the water proofing felt will be required where the parapet wall exceeds 45 cm. in the height from the graded surface. Where the height is 45 cm. or less, no groove will be required as the water proofing treatment will be carried over the top of the parapet wall to its full thickness. In the case of low dividing walls of height 30 cm. or less, outlets therein shall be cut open for full height and the bottom and sides shall be rendered smooth and corners rounded and such treatment shall not be measured and paid for separately. Where expansion joints are left in the slab the provision of dwarf walls and/or RCC slabs for covering them and finishing the surface smooth shall be the responsibility of the construction agency, which had laid the roof slab and will not be included in the operation of water proofing. The graded surface of the roof and concrete fillets and the faces of walls shall be thoroughly cleaned with wire brushed and all loose scales etc. removed. The surface shall then be dusted off. Any crack in the roof shall be cut to V section, cleaned and filled up flush with cement mortar slurry 1:4 (1 cement : 4 coarse sand) or blown type petroleum bitumen of IS grade 85/25, or approved quality conforming to IS 702. Such cleaning of the surface or treating the cracks shall not be paid for separately.

2.4.2.7 Treatment:

The water treatment shall be of five or seven course as specified. In seven course treatment, the first four courses shall be the same as for five course treatment. The fifth course shall be a layer of APP modified polymeric membrane. The sixth course shall be a coat of bonding material and the top most seventh course shall be of specified surface finish.

2.4.2.8 Laying

(a) First course shall be a coat of bitumen primer @ 0.40 kg per sqmt followed by subsequent course as per treatment required.

(b) Drain outlets shall be given a four or six course treatment as specified for the roof in the description of the item in the manner specified for the flat roof surface. Water proofing treatment shall be carried into the drain pipe or outlets by at least 10 cm. The water proofing treatment laid on the roof surface shall overlap the upper edge of the water proofing treatment in the drain outlets by at least 10 cm.

(c) The APP modified polymeric membrane shall be cut to the required length, brushed clean of dusting material and laid out flat on the roof to eliminate curls and subsequent stretching. The membrane shall normally be laid in length in the direction of the slope and laying shall be commenced at the lowest level and worked up to crest. The membrane shall not be laid in single piece of very long lengths as they are likely to shrink; 6 to 8 m are suitable lengths. The roof surface shall be cleaned and dry before starting the membrane treatment. Each length of membrane shall be laid in position and rolled up for a distance of half its length. The hot bonding material shall be poured on the roof across the full width of the rolled membrane as the latter is steadily rolled out and

pressed down. The pouring shall be so regulated that the correct weight of bonding material per unit area is spread uniformly over the surface. Excess bonding material that gets squeezed out at the ends shall be levelled up as laying proceeds. When the first half of the strip of felt has been bonded to the roof, the other half shall be rolled up and then unrolled on the hot bonding material in the same way. Subsequent strips shall also be laid in the same manner. Each strip shall overlap the preceding one by at least 7.5 cm. at the longitudinal edges and 10 cm. at the ends. All overlaps shall be firmly bonded with a blow lamp and levelling down unevenness. The fourth layer of bonding material in the five course treatment shall be carried out in a similar manner after the flashing has been completed.

(d) In a seven course treatment the fifth layers of membrane shall be laid in the manner already described, taking care that laps in the membrane are staggered from those in the earlier layer. The sixth layer of bonding material shall be carried out after the flashing is done.

(e) High Parapet Walls, Chimney Stacks etc.*:* Membrane shall be laid as flashing wherever junctions of vertical and horizontal surfaces occur. Longitudinal laps shall be 10 cm. The lower layer of flashing membrane in a six course treatment shall overlap the roof water proofing by not less than 20 cm. while the upper layer shall overlap the roofing felt by 10 cm. The minimum overlap of the flashing membrane in five course treatment over the roofing membrane shall be 10 cm. The flashing shall consist of the same five or seven course treatment as for the roof except that the final course shall be replaced by an application of 12 mm thick cement plaster 1:3 on the vertical and sloping faces only, of the flashing. The overlap along the length of flashing shall stagger with those in the second layer of flashing membrane (in a seven course treatment and with the joints in the roof membrane).

The upper edge of the finishing membrane shall be well tucked into the flashing grooves in the parapet, chimney stacks etc. to a depth of not less than 6.5 cm. Corresponding applications of bonding material shall also be made. The flashing treatment shall be firmly held in place in the grooves with wood edges at intervals and the grooves shall be filled up with cement mortar 1:4 (1 cement: 4 coarse sand) or cement concrete 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate 6 mm nominal size) and surface finished smooth with the rest of the wall. The cement work shall be cured for 7 days. When dry, the exposed plaster joints of grooves shall be painted with bitumen and two coats of bituminous solution shall be applied on the vertical and sloping surface of flashing. After the top flashing membrane layer has been fixed, the penultimate layer of bonding material shall be applied over the roofing membrane and the horizontal overlaps and vertical and sloping surfaces of the flashing at the specified rate.

(f) Low Parapet Walls*:* Where parapet walls are of height 45 cm. or less, membrane flashings shall be provided in the same manner as for flashings in the case of high parapet walls except that the upper edge shall be carried upto the full height of the wall and taken right across the top of the parapet and down on the external vertical faces to a minimum distance of 5 cm.

(g) Low Dividing Walls: Where low dividing walls or inverted beams are met with, the same shall be covered with a four or six layer treatment as for the main roof, the latter bearing carried down both sides of the wall and overlapping the roofing treatment as in the case of flashing of high parapet walls. Drain outlets where formed in the low dividing walls, shall be given water proofing treatment of the same number of courses as specified for the flat roof surface. The bottom and sides shall be so treated that all overlaps are in the direction of flow of drainage.

(h) Expansion Joints*:* Where the expansion joints are provided in the slabs, the joints and their cover slabs shall be suitably treated with water proofing. A typical sketch of an expansion joint with the RCC slabs on either side of the joint turned vertically up and dwarf walls by not less than 7.5 cm. and are provided with throatings on their underside along their length. The water proofing treatment shall be taken up the sloping junction fillets and the vertical faces of the walls to the underside of the cover slabs. The cover slabs are given the water proofing treatment like the roofs slabs, after the cross joints between adjacent cover slabs are first sealed with 15 cm width of roofing felt struck to them with bitumen. The water proofing treatment shall be carried down the sides of the cover slabs to their full thickness. Care shall be taken to see that overlaps if any in the roofing over the cover slabs stagger with the joints between cover slabs. The formation of the expansion joints and provision of the cover slabs shall be the responsibility of the construction agency. The formation of the junction fillets and the water proofing treatment of the joint and cover slabs shall be carried out by the water proofing agency. Nothing agency extra shall be paid for the sealing of the cross joints in the cover slab with 15 cm. width of bitumen strips.

(i) Pipes*:* Where vertical pipe outlets are met with, 7.5 x 7.5 cm fillets of lime or cement concrete of the type and section shall be provided and flashing of four or six course treatment, same as for the roofing treatment shall be laid. The upper edge of the flashing shall be laid sloping down forward and butted against the pipe and annular depression so formed shall be filled with hot bitumen. A circular metal collar in the shape of an inverted truncated cone shall be fixed on the pipe to throw off the rain water clear of the flashing and this shall be paid for separately.

2.4.2.9 Measurement:

Length and breadth shall be measured correct to a cm. The area shall be calculated in square metres correct to two places of decimal. Measurements shall be taken over the entire exposed area of roofing and flashing treatment including flashing over low parapet walls, low dividing walls and expansion joints and at pipe projections etc. Overlaps and tucking into flashing grooves shall not be measured. Vertical and sloping surfaces of water proofing treatment shall also be measured under the five or seven course treatment as the case may be, irrespective of the fact that the final course is replaced by bitumen primer. No deduction in measurements shall be made for either openings or recesses for chimney stacks, roof lights and the like, for areas upto 0.4 sqm nor anything shall be paid for forming such openings. For areas exceeding 0.40 sqm deduction will be made in measurements for full opening and nothing extra shall be paid for forming such openings.

2.4.2.10 *:*

The rate shall include the cost of all labour and materials involved in all the operations described above. The top most layer shall be paid for separately.

2.4.2.11 Flashing

Unless otherwise stated flashing shall be done in the same way as the waterproofing except that the last layer, instead of being finished with pea-sized gravel, shall be finished with two coats of bituminous primer. The flashing shall be extended up the vertical surfaces as shown on drawing. The flashing shall end in grooves in vertical walls. The grooves shall be at least 65 mm deep and caulked with waterproof mastic cement. The minimum overlap with horizontal roofing felt shall be 100 mm.

Where specified on drawings or directed by the Engineer, metal flashing shall be provided. The metal flashing shall be done as shown on the drawings. The materials shall be 18g or 7g G.I. sheets, as specified on the drawings and/or as directed by the Engineer.

3.0.0 ACCEPTANCE CRITERIA

The surface level shall be such as to allow quick draining of rains without leaving any pool anywhere. The finishing course shall be fully secured and shall have an even density. There shall not be any bubble formation or crushed or squeezed insulation or underbed.

The Contractor shall give a guarantee in writing for all works executed under this specification supplemented by a separate and unilateral guarantee from the specified agency for the roof water-proofing treatment work. The guarantee shall be for materials and workmanship for 5 years in case of normal treatment. The mode of execution of the guarantee shall be accpetable to the Owner.

4.0.0 RATES

Rates shall be for complete work as detailed in the specification unless any particular portion is specifically excluded in the Schedule of Items.

5.0.0 METHOD OF MEASUREMENT

The method of measurement for various items of works shall be in general as per IS:1200 and in particular, as specified below :

13.0 TECHNICAL SPECIFICATION
FOR
WATER SUPPLY

1.00.00 SCOPE

This section includes supply of all materials, labour and incidentals for water supply for residential, business and industrial and other types of buildings. The water supply system of a building or premises covers service pipes and the necessary connecting pipes, fittings, control valves and all appurtenances in or adjacent to the building or premises.

1.01.00 Materials

All materials, fittings, fixtures and appliances shall be of the best quality conforming to relevant Indian Standard and shall be procured from approved manufacturers. Unless specifically allowed by the Engineer, the Contractor shall submit samples of fittings and fixtures which will be retained by him for comparison when bulk supplies are received at the site. Ultimate choice of type, model and manufacturer lies completely with the Engineer.

It shall be the responsibility of the Contractor to procure the materials selected by the Engineer. Hence order are to be placed with the manufacturers in time, so that the materials are available at the site well ahead of their requirement.

The materials brought to the site, shall be stored in a separate secured enclosure away from the building materials. Pipe threads, sockets and similar items shall be specially protected till final installation. Brass and other expensive items shall be kept under lock and key. Fragile items shall be checked thoroughly when received at the site and items found damaged shall not be retained at the site.

1.02.00 Pipes and Pipe Fittings

Under scope of this specification, pipes and pipe fittings may be any or a combination of the following types :

a) Polypropylene Random Co-polymer (PP-RC) pipes
b) High density polyethylene (HDPE)pipe
c) Ductile Iron (CMDI) pipes

1.03.00 Water Reservoirs

Water reservoirs like pressed steel tanks and G.I. tanks shall come under scope of this specification. Reservoirs made of concrete masonry or fabricated steel shall be covered by respective work specifications.

1.04.00 Related Works

All works, like earthwork, masonry, concrete, steelwork, cutting holes, chases, repairs and rectification associated directly with installation of water supply systems shall come under scope of the Contractor unless specifically excluded. These works are not detailed out in this Specification.

1.05.00 Regulation

The work which is required to be carried out under the scope of this section, shall be executed by a licensed plumber only (engaged by the Contractor) and he shall obtain all necessary sanctions, permissions, certificates etc. from Municipal and/or other Local Authorities and shall abide by all the rules of such Authorities. The fee paid to the Authorities shall be reimbursed by the Owner.

2.00.00 INSTALLATION

While basic layouts may be available in the drawings provided by the Owner, the details might have to be supplemented by the Contractor for approval of the Engineer.

Special attention shall be given by the Contractor to economy. Symmetry of layout is very important. Fittings meant for operation shall be located and oriented to allow easy reach and operation. Maintenance, repairs and replacements of pipes, fittings and fixtures must be conveniently possible.

2.01.00 Pipe Lines

2.01.01 Laying

In addition to fulfilling the functional requirements all pipelines shall be laid true to line, plumb and level. Any deviation shall need approval of the Engineer. Meticulous care shall be taken to avoid chances of airlock and water hammer.

Pipes shall be laid on continuous unyielding surface or on reliable supports at least one near each joint and spacings as directed by the Engineer. The support must be strong, neat and shall have provisions for securing the pipes in every direction and easy maintenance. Pipes shall be encased or concealed in masonry or concrete if shown on drawing or directed by the Engineer.

2.01.02 Back Flow

The layout of pipe work shall be such that there is no possibility of back flow towards the source of supply from any cistern or appliances, whether by siphonage or otherwise. All pipe works shall be so laid or fixed and maintained as to be and to remain completely water-tight, thereby avoiding waste of water, damage of property and the risk of contamination of the water conveyed.

2.01.03 Contamination

There shall be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting for containing impure water or water liable to contamination or of uncertain quality of water which has been used for any purpose.

No piping shall be laid or fixed so as to pass into or through any sewer, scour outlet or drain or any manhole connected therewith.

2.01.04 Underground Pipings

Underground piping shall be laid at such a depth that it is not likely to be damaged by traffic and other loads and frost, where applicable.

The size and depth of the trench shall be as approved by the Engineer. Back-filling shall be done with selected fine earth, unless otherwise permitted in 150 mm layers and carefully consolidated. Special care shall be taken while filling in the vicinity of the pipe to avoid damage. Before backfilling the laid pipe shall be fully tested and approved.

Where the pipe rests on rock it may be bedded on a layer of fine selected material or concrete to avoid local point support.

The trench shall be so treated by gradient and filling in the area that it does not act as a drainage channel.

2.01.05 Concealed Piping

Where desired by the Engineer or shown on the drawings the pipes shall be concealed in masonry or concrete of the structure. The Contractor may co-ordinate with the building Contractor for leaving the chases, openings, conduits as necessary. However, the Contractor will rectify if required the chases, openings and conduits, supplement and make good after laying and testing of the concealed pipelines.

2.01.06 Jointing of Pipes

Jointing of pipes shall be completely leakproof and durable. Instruction of the manufacturer shall be followed unless desired otherwise by the Engineer. However, usually recommended practices are stated below for guidance :

a) Polypropylene Random Co-polymer (PP-RC) pipes
b) High density polyethylene (HDPE)pipe
c) Ductile Iron (CMDI) pipes

Socket joint : The PPR pipes and fittings are quick and easy to join with socket welding. The samples process involves cutting the pipe to the correct length ,heating the pipe and fitting,connecting the components and applying pressure for a few seconds .The socket welding can be carried out by hand for diameters upto 50 mm and by machine for larger sizes.

Spigot and Socket Joints

i) Lead joint : The joint is made by first caulking in clean spun yarn upto half depth and filling the reminder by running in molten lead taking care that no dross enters the joint and then thoroughly caulking the lead. The lead need not extend into the joint further than the back of the groove formed in the socket. After completing the joint it shall not be allowed to move. For rectification the joint shall be completely redone.

ii) Flanged Joints : Flanged joints shall be made by jointing rings of good quality, smooth and hard compressed fibre board

of thickness not less than 1.5 mm and of such width as to fit inside the circle of bolt. Diagonally opposite bolts shall be tightened in pairs and in stages so that degree of all bolts in a joint are similar. Damaged gaskets shall be replaced.

2.03.00 Valve, Cocks, Taps

All valves, stop cocks, taps etc. shall conform to relevant Indian Standard Specification and shall be of best quality from approved manufacturers. These shall be suitable for working pressures mentioned in the Schedule. Nominal size and material shall be as per schedule.

2.04.00 Protection

Open end of each pipe shall be protected during installation by suitable covers or plugs so that the ends, threads, sockets or spigot are not damaged and no foreign material can find its way into the pipe line.

Fittings and fixtures liable to be misused or stolen during the construction phase shall be fitted only before testing and handing over.

3.00.00 TESTING AND ACCEPTANCE

3.01.00 Inspection Before Installation

All pipes, fittings and appliance shall be inspected, before delivery at the site to see whether they conform to accepted standards. The pipes and fittings shall be inspected on site before laying and shall be sounded to disclose cracks. Any defective items shall be clearly marked as rejected and forthwith removed from the site.

3.02.00 Testing of Mains After Laying

After laying and jointing, the main shall be slowly and carefully charged with water, so that all air is expelled from the main by providing a 25 mm inlet with a stop cock, allowed to stand full of water for a few days if time permits, and then tested under pressure. The test pressure shall be 5 Kg/CM or double the maximum working pressure, whichever is greater. The pressure shall be applied by means of a manually operated test pump, or in the case of long mains or mains of a large diameter, by a power driven test pump, provided that the pump is not left unattached. In either case due precaution shall be taken to ensure that the required test pressure is not exceeded. Pressure gauges shall be accurate and shall preferably have been recalibrated before the test. The pump having been stopped, the test pressure shall maintain itself without measurable less for at least five minutes. The end of the main shall be closed by fitting a water-tight expanding plug and the plug shall be secured by struts to resist the end thrust of the water pressure in the mains.

3.03.00 Testing of Service Pipes and Fittings

The service pipes shall be slowly and carefully charged with water allowing all air to escape avoiding all shock or water hammer. The service pipe shall then be inspected under working conditions of pressure and flow. When all draw-off taps are closed, the service pipes shall be absolutely water-tight. All

pipings, fittings and appliances shall be checked for satisfactory support and protection from damage, corrosion and frost.

4.00.00 RATES

Rates shall be unit rates for the complete work as mentioned in the specification unless any particular portion is specifically excluded in the Schedule of Items.

If any material, fittings or fixtures are provided by the Owner f ree, the Contractor shall have to take delivery, keep in safe custody and be responsible till fitted and handed over.

5.00.00 MEASUREMENT

For method of measurement regarding works under scope of the specification IS:1200 (Part-XVI) latest edition shall be followed unless contrary to the following :

5.01.00 Trenches

Unless particular items are included in the schedule, no separate measurement shall be made to lead, lift, dewatering, dressing, storing, backfilling, consolidation etc. that may be required in this connection.

5.02.00 Concrete Masonry

The measurement shall be on gross area or volume basis as mentioned under the relevant items.

5.03.00 Soling

No separate measurement should be made for dressing and ramming the surface. The soling shall be measured on gross area of the work under the item.

5.04.00 Pipe Works

No separate measurement shall be made for specials, supports and fixtures, cutting chases, holes and rectification unless specially indicated in the Schedule of Items. If the specials are separately indicated in the Schedule, the measurement for these shall be over and above the measurement of the pipe work as mentioned below :

The pipes of different nominal bores shall be measured separately.

The pipe work shall be measured in length inclusive of sockets, specials, fittings etc. in position.

5.05.00 Fittings and Fixtures

Measurement for fittings and fixtures where applicable shall be in number. No separate measurement shall be made for anchors unless they form a separate item in the Schedule.

5.06.00 Chases, Holes

If items for cutting and remaking of chases, holes and similar works are included in the Schedule the measurement shall be on gross length, area or volume as appropriate.

6.00.00 I.S.CODES

Important relevant IS Codes for this Specification are listed below :

Latest editions shall always be consulted.

IS 14333	:	High density polyethylene pipe for sewerage
IS 4984	:	High density polyethylene pipes for potable water supplies
IS:2065	:	Code for Practice for water supply in buildings
IS:172	:	Code of basic requirements for water supply, drainage and sanitation
IS : 8329	:	Centrifugally cast (spun) ductile iron pipes.
IS:1200	:	Laying of water and sewer lines including (Pt.XVI) appcurtnant items.
ISO 3213	:	PP pipes –Effect of time and temperature on the expected strength

14.0 TECHNICAL SPECIFICATION
FOR
DRAINAGE AND SANITATION

1.00.00 SCOPE

1.01.00 This section covers the layout and construction of drains for roof water, surface water and sewage together with all fittings and fixtures and inclusive of ancillary works, such as connections, manholes and inspection chambers used within the building and from the building to the connection to a public sewer or to treatment work, septic tank and soak pit dispersion trenches.

2.00.00 INSTALLATION

2.00.01 General

All pipe lines, locations of fittings and fixtures, etc. shall be as per drawings or as directed by the Engineer. Correctness of lines, plumb, orientation, symmetry and levels shall be strictly ensured. All items shall be fully secured against movement in any direction and so located as to allow easy maintenance.

All pipe lines, fittings and fixtures shall be installed leakproof. When the works under scope of this specification linked up with works executed by others, the connections shall be such as to prevent any splashing or spilling or emission of foul odour and gases.

2.01.00 Rainwater Downcomers & Soil and Drainage Pipes

Rainwater downcomers shall be standard Cast Iron or Asbestos Cement Pipes. In case where specifically desired, M.S. pipes may also be used. M.S. pipes shall be painted outside with two coats of anticorrosive paints under a coat of primer.

Rainwater downcomers shall run along and be secured to walls, columns etc. Where desired by the Engineer these may have to be installed in chases cut in the structure.

All pipes shall be well secured and supported by adequately strong brackets. The brackets may be wrought iron clevis type, split ring type or perforated strap iron type as approved by the Engineer. For vertical runs each pipe shall hang freely on its brackets fixed just below the socket. Suitable spacer blocks shall be provided against the vertical surface to which the pipe is fixed.
All bends and junctions shall be supplied with watertight cleanouts.

Roof and floor drains and yard gullies shall be installed, if required, by cutting into the structure and grouted with 1:2:4 cement concrete. All gutters shall be provided with removable gratings.

All horizontal pipes shall have a minimum fall of 1 in 100.

2.01.01 Unplasticized Polyvinyl Chloride (UPVC) Pipes

The specification covers requirements for plain and socket end unplasticized polyvinyl chloride (upvc) pipes with nominal outside diameters 40 mm to 160 mm for use for soil and waste discharge system inside buildings including ventilating and rain water applications. In this

specification nominal outside diameter DN of pipes are 40,50, 63,75,90,10,125,140 and 160 mm.

Surface colour of the pipes shall be dark shed of grey. For other details and specifications refer code IS : 13592-1992 (amended to 1995)

Above quality of pipes are divided into two types. Type –A meant for rain water pipes & Type- B meant for soil pipes.

2.01.02 Cement concrete pipes

The pipes shall be with reinforcement as required and shall be of the specified class. These shall conform to IS:458. The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process while reinforced cement concrete pipes by spun or pressure process. All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding.

Concrete used for the manufacture of reinforced concrete pipes and collars shall not be leaner than 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate). The maximum size of aggregate should not exceed one third of the thickness of the pipe or 20 mm whichever is smaller. The reinforcement in the reinforced concrete pipes shall extend throughout the length of the pipe. The circumferential and longitudinal reinforcements shall be adequate to withstand the specified hydrostatic pressure and further bending stresses due to the weight of water when running full across a span equal to the length of pipe plus three times its own weight.

2.02.00 Gutters

The gutters shall be made of G.I. or A.C. All gutters shall be supplied by reputable specialised firms. Each section shall be sufficiently rigid, edges and corners straight and the slopes perfectly uniform. G.I. gutters shall have the edges strengthened by suitable means.

Unless noted otherwise the gutters shall have a minimum fall of 1 in 120. Adequate number of string supports shall be provided so that there is no reflection even when the gutter is full. Each joint must have a support. Unless otherwise specified the supports shall be fabricated M.S. brackets. All junctions shall be thoroughly watertight. The joints may be made by rivetting, bolting or soldering. All joints between successive lengths of gutters shall have on overlap of at least 5 cm. The drop in the overlap shall always be in the direction of the fall of the gutter. Ends of gutters shall be closed watertight. Junction with rainwater down comers shall be made fully watertight and secured.

2.03.01 Gradients

If not specified the minimum gradients of soil and drainage pipe line shall be as follows :

100 mm nominal dia : 1 in 35
150 mm nominal dia : 1 in 65
230 mm nominal dia : 1 in 120
300 mm nominal dia : 1 in 200

2.03.02 Relation with water supply pipe lines

Unless specifically cleared by the Engineer, under no circumstances shall special drainage and soil pipes be allowed to come close to water supply pipelines.

2.03.03 Laying

Each separate pipe shall be individually set for line and for level. Where lengths of sewer or drain pipes are laid in trench, properly painted sight rails shall be fixed across the trench at a height, equal to length of the boning rod to be used, above the required invert level of the drain or sewer at the point where the sight is fixed. More sight rails shall be required at manholes, change of gradient and intermediate positions if the distance for sighting is more than 50 ft. apart. The excavation shall be boned in at least once in every 6 ft. The foot of the boning rod shall be set on a block of wood of the exact, thickness of the wall of the pipe. Each pipe shall be separately and accurately boned between sight rails.

2.03.04 Support and Protection on Pipelines

All pipes shall be laid with sockets leading uphill. Preferably the pipe shall rest on solid and even foundations for the full length of the barrel. However, the pipe manufacturer's instruction as approved by the Engineer shall be followed in the matter of support and jointing.

To achieve full and continuous support, concrete for bedding and packing is the best. Where pipes are not bedded on concrete, the floor shall be left slightly high and carefully placed so that the pipe barrels rest on undisturbed ground. If anywhere the excavation has been carried too low packing shall be done in concrete. Where laid on rock or very hard ground which cannot be easily excavated to a smooh surface, the pipes shall be laid on a cradle of fine concrete floor of gravel and crushed stone over laid with concrete or on a well consolidated gravel and crushed stone bed as desired by the Engineer. PVC or similar pipes shall be laid directly on stable soil and packed with selected soil.

The minimum support and protection for glazed stoneware pipes shall be as follows :

a) When cover is less than 2 metre below ground level and where pipes are unavoidably exposed above ground surface, the pipes shall be completely encased or surrounded with concrete.

b) Where pipes are laid on soft soil with the maximum water table laying at the invert of the pipe, the sewer shall be bedded on concrete.

c) Where the pipes have to be laid on soft soil with the maximum water table rising above the invert of the pipe, but below the top of the barrel, the pipe sewer shall be haunched.

d) Where maximum water table is likely to rise above the top of the barrel or wherever the pipe is laid on soft soil the pipe sewers shall be completely encased or surrounded with concrete.

Vitrified clay pipes shall be laid on a bed of 150 mm thick cement concrete (1:3:6) nominal mix by volume.

Cast iron pipes and concrete pipes may be supported on suitable concrete or brick support, where specified. The supports shall be unyielding and strong enough. At least one support shall be located close to ends. Spacing of intermediate supports shall be as decided by the Engineer. Pipes shall be secured to the supports by approved means.

Anchoring of pipes where necessary shall be achieved by suitable concrete encasing designed for the expected thrust.

Laying Of Cement Concrete Pipes : Loading, transporting and unloading of concrete pipes shall be done with care. Handling shall be such as to avoid impact. Gradual unloading by inclined plane or by chain pulley block is recommended. All pipe sections and connections shall be inspected carefully before being laid. Broken or defective pipes or connections shall not be used. Pipes shall be lowered into the trenches carefully. Mechanical appliances may be used. Pipes shall be laid true to line and grade as specified. Laying of pipes shall proceed upgrade of a slope.

If the pipes have spigot and socket joints, the socket ends shall face upstream. In the case of pipes with joints to be made with loose collars, the collars shall be slipped on before the next pipe is laid. Adequate and proper expansion joints shall be provided where directed.

In case where foundation conditions are unusual such as in the proximity of trees or holes, under existing or proposed tracks manholes etc. the pipe shall be encased all-around in 15 cm thick cement concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size) or compacted sand or gravel.

In cases where the natural foundation is inadequate the pipes shall be laid either in concrete cradle supported on proper foundations or on any other suitably designed structure. If a concrete cradle bedding is used the depth of concrete below the bottom of the pipe shall be at least $1/4^{th}$ of the internal dia of the pipe subject to the min. of 10 cm and a maximum of 30 cm. The concrete shall extend up to the sides of the pipe at least to a distance of $1/4^{th}$ of the outside diameter of pipes 300 mm and over a dia. The pipe shall be laid in this concrete bedding before the concrete has set.

2.03.05 Entry into structures

For entry of the pipe lines into any building of structure suitable conduits under the structure or sleeves shall be used. The conduits and sleeves shall be such as to allow easy repairs and replacement of the pipes. When openings or chases are required to be made in the structure for entry of pipe lines, locations and sizes shall be marked

and checked by the Engineer. After laying of the pipeline the openings and chases shall be mended.

2.03.06 Ducts

Where solid, waste and ventilating pipes are accommodated in ducts, access to cleaning areas shall be provided. Connection to drain shall be through a gully with sealed cover to guard against ingress of sewer gas, vermin or backflow.

2.03.07 Traps and Ventilating Pipes

Pipes are carrying off the waste from water closets and waste water and overflow water from baths, wash basins, sinks to drains shall be trapped immediately beneath such fixtures. Traps shall have minimum water seal of 50 mm and shall be ventilated whenever such ventilation is necessary to maintain water seal of the trap.

Ventilating pipes shall be carried up vertically from the drain to a height of at least 600 mm above the outer covering of the roof of the building or as shown on drawings. All vertical ventilating, anti-syphonage and similar pipe shall be covered on top with a cowl. The cowl shall be made of C.I. unless desired otherwise by the Engineer.

2.03.08 Manhole and Inspection Chambers

The maximum distance between manholes shall be 30 meter unless specially permitted otherwise. In addition, at every change of alignment gradient or diameter there shall be a manhole or inspection chamber. The distance between manhole or inspection chamber and gully chamber shall not exceed 6 metres unless desired otherwise.

Manhole shall be constructed so as to be watertight under test. The bending at the sides shall be carried out in such a manner as to provide no lodgement for any splashings in case of accidental flashing of the chamber. The channel or drain at the bottom of chamber shall be plastered with 1:2 cement, sand mortar and finished smooth to the grade. The channels and drains shall be shaped and laid to provide smooth flow.

Connecting to existing sewer lines shall be through a manhole.

Manholes shall be provided with standard C.I. covers. The covers shall be close fittings so as to prevent gases from coming out. Suitable heavy duty covers shall be used where necessary as decided by the Engineer.

2.03.09 Cutting of Pipes

Manufacturer's instructions shall be followed for cutting of pipes where necessary. Suitable and approved tools shall be used for the cutting so as to leave surface clean and square to the axis of the pipe.

2.03.10 Jointing

Jointing of laid pipes shall be so planned as to avoid completely any movement or strain to the joints already made. If any joint is suspected to be damaged it shall be opened out and redone.

All joints between pipes, pipes and fittings and manholes shall be gas-tight when above ground and water-tight when underground. Method of jointing shall be as per instructions of the pipe and fittings manufacturer and as approved by the Engineer. However, in the absence of any instruction available from the manufacturer the methods as detailed hereunder shall be used.

a) Cast Iron Pipes :

Socket and spigot pipes shall be jointed by the cast lead joints. The spigot shall be centered in the socket of the next pipe by tightly caulking in sufficient turns of tarred gasket or hemp yarn to have unfilled half the depth of socket. When the gasket or hemp yarn has been caulked tightly a jointing shall be placed round the barrel and tightened against the face of the socket to prevent airlock. Molten lead shall then be poured in to fill the remainder of the socket and caulked with suitable tools right round the joint to make up for shrinkage of the molten metal on cooling and shall be finished 3 mm behind the socket face.

Joints in cast iron pipes with special jointing arrangements like 'Tyton' joints etc. shall follow the instructions of the manufactures.

In special cases if flanged joints are accepted by the Engineer the joints shall be made leakproof by inserting approved type of rubber gaskets. The bolts shall be secured in stages to avoid uneven strain.

b) Concrete Pipes

Care shall be taken to place the collar centrally over the joint.

c) Glazed Stoneware Pipes

Tarred gasket or hemp yarn soaked in thick cement slurry shall first be placed round the spigot of each pipe and the spigot shall then be placed into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and the gasket caulked tightly so as not to fill more than 1/4 of the total depth of the socket. The remainder of the Socket shall be filled with a stiff mixture of cement mortar of 1:1 proportion. Then the socket is filled, a fillet shall be formed round the joint with a trowel, forming an angle of 45 deg. with the barrel of the pipe. The newly made joints shall be protected, until Set and shall be covered with damp cloth or other suitable materials.

d) Vitrified clay pipes

These shall be made from refractory clay mixed with crushed pottery and stone and burnt at a high temperature. These shall

be hard, compact and glazed to make them acid resistant and impervious, and shall be obtained from approved manufacturer.

Special care shall be taken in handling these pipes. The pipes shall not be jointed until the earth has been partly refilled over the portion of the pipe between the joint holes. Before laying the second pipe, the socket of the first pipe laid shall be thinly painted all round on the inside with cement slurry (1 part of cement and 2 parts of clean, sharp sand). A ring of rope yarn (closely twisted hemp or jute) dipped in neat cement paste or tar or bitumen, shall be inserted in the socket of pipe and driven home with caulking tools. The rope shall fully encircle the spigot with a slight overlap and shall not occupy more than one-fourth of the total depth of the socket. Where the spigot end of the pipe is made for receiving the gasket, Specification for Building it shall be wrapped with two or three turns of tarred spun, as close to the end as possible, before inserting into the socket. The joint shall then be completely filled with cement mortar (1:1) which shall have very little water and levelled to form a splayed fillet at an angle of 45 degrees with the outside pipe. Special care shall be taken so that any excess mortar etc. left inside the pipe joints is neatly cleaned off immediately after each joint is made. A semi-circular wooden scrapper or a rubber disc to which a long handle is fixed could be used for this purpose.

e) Lead Pipes

The joints in lead pipes shall be made as wiped solder joint. The minimum and the maximum length of the wiped solder joints shall be 8 cm. and 9 cm. respectively. The solders shall generally consist of two parts of lead and one part of tin.

f) Polythylene Pipes

The joints shall be thermo-welded or bolted as per manufacturer's instructions.

g) Jointing Cast Iron Pipes with Stoneware Pipes

Where any cast iron soil pipe, ventilating pipe or trap is connected with a stoneware or semi-vitrified waste pipe or drain communicating with a sewer, the beaded spigot end of such cast iron soil pipe, waste or ventilating pipe or trap shall be inserted into a socket of such stoneware pipe or drain and the joint made with mortar consisting of one part of cement and one part of clean sharp sand after placing a ratted gasket or hemp yarn soaked in neat cement slurry round the joint and inserted in it by means of a caulking tool.

h) Jointing Stoneware with Cast Iron Pipes

Where any water closet pan or earthware trap connected to such a pan is to be jointed with a cast iron soil pipe, the joint between the stoneware spigot and the cast iron socket shall

always be of a flexible nature. Such joint shall be made with a mixture of bitumen and chopped asbestos fibre.

2.04.00 Trenches and other excavations

Width of the trench at the bottom shall be such as to provide 200 mm clearance on either side of the pipe for facility of laying and jointing.

Excavated material shall be stacked sufficiently away from the edge of the trench and the side of the spoil bank shall not be allowed to endanger the stability of the excavation. Spoil may be carted away and used for filling the trench behind the work.

Turf, top soil or other surface material shall be set aside, turf being carefully rolled and stacked for use in reinstatement.

All excavation shall be properly timbered, where necessary.

Efficient arrangements for dewatering during excavation and keeping it dry till backfilling shall be made to the satisfaction of the Engineer. Sumps for dewatering shall be located away from the pipe layout.

Where the excavation proceeds through roads necessary permissions shall be secured by the Contractors from the appropriate authorities.

Special care shall be taken not to damage underground services, cables etc. These when exposed shall be kept adequately supported till the trench is backfilled.

The backfilling shall be done only after the pipeline has been tested and approved by the Engineer. Special care shall be taken under and sides of the pipe during handpacking with selected material. At least 300 mm over the pipe shall also be filled with soft earth or sand. Consolidation shall be done in 150 mm layers. The surface water shall be prevented from getting into the filled up trench. Traffic shall not be inconvenienced by heaping up unduly the backfilling material to compensate future settlement. All future settlements shall be made good regularly to minimise inconvenience of traffic where applicable.

2.05.00 Fixtures

The Tenderer shall mention in his bid the type and make of the fixtures he intends to use enclosing manufacturer's current catalogues. In the absence of any such agreement, the Engineer shall be at liberty to choose any type and make.

All fixtures and fittings shall be of approved quality and type manufactured by well known manufacturers. All items brought to the site must bear indentification marks of the type of the manufacturer. Procurements shall be made well in advance and inspected and approved immediately by the Engineer. All fixtures shall be adequately protected, covered and plugged till handed over.

All fittings, gratings, fasteners, unless specified otherwise, shall be chromium plated. The connecting lead pipes and bends shall weigh at least 3 kg. per 25 mm dia per meter length. Where PVC or similar pipes

are allowed the Contractor shall produce the test reports and convince the Engineer about their durability.

Unless specified in the contract the fixtures shall be as specified hereinafter.

2.05.01 Water closet

a) Raised type

It shall include glazed vitreous china basin with siphon, open front solid plastic seat and plastic cover, low level glazed stoneware flushing cistern with valveless fittings, supply connections and necessary fittings. All fittings shall be chromium plated. Colour of basin, cistern, seat and cover shall be as desired by the Engineer.

b) Squatting type

It shall include glazed vitreous china pan with foot rests and high level cast iron flushing cistern with valveless fittings, supply connections and necessary fittings. All ittings shall be chromium plated. The foot rests shall be made of white glazed vitreous china with chequered surface. The flushing cistern shall be painted as desired by the Engineer.

2.05.02 Urinals

It shall consist of wall type glazed vitreous china urinals, cast iron automatic flushing cistern complete with supply connections, flush pipe, lead pipes, gratings, traps and all other necessary fittings. Automatic flushing shall be approximately once every five minutes. For a number of urinals located together may be served by one cistern of adequate capacity. All fittings shall be chrome plated.

2.05.03 Wash basin

It shall be made of glazed vitreous china. The basin shall be flat back, wall hung by painted cast iron brackets and complete with pattern with hot and cold brass faucets with nylon washers, waste chain, waste washers, lead waste pipes with traps, perforated waste complete with necessary fittings. All fittings including faucets shall be chromium plated.

2.05.04 Sink

It shall be made of glazed stoneware. It shall be wall hung by painted cast iron brackets and complete with one brass faucet with nylon washers, waste chain, waste washers, lead waste pipes with traps, perforated waste with necessary fittings. All fittings includng faucets shall be chromium plated.

2.05.05 Bathroom mirror

It shall be made of the best quality 6 mm thick glass and produced by a reputed mirror manufacturer. It shall be wall mounted with adjustable revolving brackets. The brackets, screws and other fittings shall be chromium plated.

2.05.06 Glass shelves

Glass shelves shall consist of 6 mm thick clear glass with guard rails and shall be wall mounted with brackets. All brackets, guard rails and screws shall be chromium plated.

2.05.07 Towel rail

Towel rails shall be 20 mm dia chromium plated MS pipes wall mounted with steel brackets. The brackets, screws etc. shall also be chromium plated.

2.05.08 Soap holder

It shall be made of chromium plated strong members. The holders shall be wall mounted with chromium plated screws.

2.05.09 Liquid soap dispenser

It shall be round and easily revolving with removable threaded nozzle. The body, bracket for wall mounting and screws shall be chromium plated.

2.05.10 Toilet roll holder

It shall be made of glazed vitreous china with suitable cover cum cutter. Wall mounting screws shall be chromium plated.

2.05.1 Installation

All plumbing fittings and fixtures shall be installed in most workmanlike manner by skilled workers. These shall be perfect in level, plumb, plane, location and symmetry. All items shall be securely anchored to walls and floors. All cuttings in walls and floors shall be made good by the Contractor.

2.06.00 Septic tank & effluent disposal

2.06.01 Septic tank

Septic tank shall consist of the tank itself with inlet and outlets therefrom complete with all necessary earthwork and backfilling. The details of septic tank shall be as shown on drawings. This item shall also include ventilating pipe of at least 100 mm dia. whose top shall be provided with a suitable mosquito proof wiremesh and cowl. Ventilating pipe shall extend to a height of about 2 meter when the septic tank is at least 15 meter away from the nearest building and to a height of 2 meter above the top of building when it is located closer than 15 meter. Ventilating pipes can be connected to the normal soil ventilating system of the building where allowed.

2.06.02 Effluent Disposal

The effluent from the septic tank shall be disposed by allowing it into an open channel or a body of water if the concerned authority approves or into a soak pit for absorption by soil or shall be allowed to be absorbed by soil through open jointed SW pipes laid in a trench filled with broken bricks.

2.06.03 Soak pit

The soak pit shall be complete as shown on drawing. It shall consist of a 900 mm dia. pit 1000 mm in depth below the invert level of the inlet pipe. The pit shall be lined with stone, brick or concrete blocks set in cement mortar (1:6) and filled with brick bats. Inlet pipe shall be taken down to a depth of 900 mm from the top as an anti-mosquito measure.

2.06.04 Open joined SW Pipe / dispersion trenches

Minimum dia. of the SW pipes shall be 150 mm nominal. The trench for laying the pipes shall be minimum 600 x 600 mm pipes. The joints of the pipes shall be left unsealed. The entire length of the pipe within the trench shall be buried in a 250 mm layer gravel or crushed stone of uniform size. On top of gravel/crushed stone layer is a 150 mm bed of well graded coarse aggregate. Ordinary soil is used for filling the top of trench.

2.06.05 Commissioning septic tank

After the septic tank has been proved watertight and the sewage system is checked the tank shall be filled with water to its outlet level before the sewage is let into the tank. It shall be seeded with well digested sludge obtained from septic tank or sludge digestion tank. In the absence of digested sludge a small quantity of decaying organic matter such as digested cow-dung may be introduced.

3.00.00 TESTING AND ACCEPTANCE

3.01.00 Inspection before installation

All pipes, fittings and fixtures shall be inspected, before delivery at the site to see whether they conform to accepted standards. The pipes shall again be inspected on site before laying by sounding to disclose cracks. All defective items shall be clearly marked and forthwith removed from the site.

3.02.00 Testing of Pipelines

Comprehensive tests of all pipe lines shall be made by simulating conditions of use. The method of actual tests shall be decided by the Engineer. All test data shall be recorded and submitted to the Engineer for review and instruction. The Engineer's discretion regarding tolerance shall be final.

General guidance for the tests are given below :

a) Smoke test

All soil pipes, waste pipes and vent pipes and all other pipes when above ground shall be approved gastight by a smoke test conducted under a pressure of 25 mm of water and maintained for 15 minutes after all trap seals have been filled with water. The smoke is produced by burning oily waste or tar paper or similar material in the combustion chamber of a smoke machine. Chemical smokes are not satisfactory.

b) Water test

For pipes other than Cast Iron

Glazed ware and concrete pipes shall be subjected to a test pressure of at least 1.5 m head of water at the highest point of the section under tests. The tolerance figure of two litres per centimeter of diameter per kilometer may be allowed during a period of 10 (ten) minutes. The test shall be carried out by suitably plugging the low end of the drain and the ends of connections, if any, and filling the system with water. A knuckle bend shall be temporarily jointed in at the top end and a sufficient length of the vertical pipe jointed to it so as to provide the required test head or the top end may be plugged with a connection to a hose ending in a funnel which could be raised or lowered till the required head is obtained and fixed suitably for observation.

Subsidence of test water may due to one or more of the following cases:

a) Absorption by pipes and joints
b) Sweating of pipes or joints
c) Leakage at joints or from defective pipes
d) Trapped air.

Allowance shall be made for (a) by adding water until absorption has ceased and after which the test proper should commence. Any leakage and the defective part of the work shall be cut out and made good.

For cast iron pipes

Cast iron sewers and drains shall be tested as for glazedware and concrete pipes. The drain plug shall be suitably strutted to prevent their being forced out of the pipe during the test.

c) For straightness

i) By inserting at the high end of the sewer or drain a smooth ball of a diameter 13 mm less than the pipe bore. In the absence of obstruction, such as yarn or mortar projecting through the joints, the ball with roll down the invert of the pipe end emerge at the lower end; and

ii) By means of a mirror at one end of the line and lamp at the other. If the pipe line is straight, the full circle of light may be observed. The mirror will also indicate obstruction in the barrel if the pipe line is not straight.

3.03.00 Testing Septic Tank

The septic tank shall be tested for water tightness. It shall be filled up with water and allowed to soak for 24 hours. Then, it shall be topped up and allowed to stand again for 24 hours and loss of level recorded. The fall shall not be more than 15 mm.

3.04.00 Fixtures etc.

All fixtures and fittings shall be connected by watertight joints. No dripping shall be accepted.

4.00.00 RATES

Rates shall be unit rates for the complete work as detailed out in the Specification unless any particular portion is specifically excluded in the Schedule of Items.

If any material fittings or fixtures are provided by the Owner free, the Contractor shall have to take delivery, keep in safe custody and be responsible till fitted and handed over.

5.00.00 MEASUREMENT

For method of measurement regarding work under scope of this Specification IS:1200 (Part-XVI) shall be followed unless contrary to the following :

5.01.00 Trenches

Unless particular items are included in the Schedule, no separate measurement shall be made for lead, lift, dewatering, dressing, storing, backfilling consolidation etc. that may be required in this connection.

5.02.00 Concrete, masonry

Unless lumped with other items in the Schedule the measurement shall be on gross area or volume basis as mentioned under relevant items.

5.03.00 Pipe work

No separate measurement shall be made for special supports and fixtures, cutting chases, holes and rectification unless specially indicated in the Schedule of Items. If the specials are separately indicated in the Schedule, the measurement for these shall be over and above the measurement, of the pipe work as mentioned below :

The pipes of different nominal bores shall be measured separately. The pipework shall be measured in length inclusive of sockets specials, fittings etc. in position.

5.04.00 Fittings and fixtures

Measurement for fittings and fixtures where applicable shall be in number for the complete item inclusive of anchors, brackets and fasteners required. However, in special cases anchors, brackets and similar items may be measured separately if included as such in the Schedule of Items.

5.05.00 Chases and holes

No measurement shall be made for cutting chases, holes etc. and making good for any work within the scope of this specification and shall be inclusive.

5.06.00 Painting

All items likely to rust shall be painted with one coat of primer which shall not be measured separately. Where finishing coat of paints are supplied that shall be measured as indicated in the Schedule of Items. Usually, painting of pipes shall be measured in length for each different nominal diameters without giving any extra allowance for specials sockets, etc.

5.07.00 Septic tank, Soak pit

Usually it shall be measured in number for the complete septic tank or soak pit as per drawing. All earthwork, backfilling masonry, concrete, manhole, pipes and fittings included. In case, it is intended to pay for individual items the same shall be indicated in the Schedule and measured in number, length, area or volume as appropriate.

6.00.00 CODES AND STANDARDS

Some of the important Codes and Standards relevant to this specification shall be followed : Latest editions shall always be consulted.

IS:172 - Code of basic requirements for water supply drainage and sanitation.

IS:1200 - Laying of water and sewer lines including appurtenant (Pt. XVI) items.

IS:1239 - Mild Steel Tubes and Mild Steel Tubulars and other (Pt.I & II) wrought steel pipe fittings.

IS:1536 - Centrifugally cast (Spun) iron pressure pipes for water gas and sewage.

IS:1537 - Vertically cast iron pressure pipe for water, gas & sewage.

IS:3486 - Cast Iron spigot & socket drain pipes.

IS:1742 - Code of Practice for building drainage.

IS:5329 - Code of Practice for sanitary pipe work above ground for buildings.

IS:2470 - Code of Practice for designs and construction of septic tank for small and large installations.

IS:3076 - Low density polythelene pipes for potable water supplies.

IS:4984 - High density polythelene pipes for potable water supplies.

IS:1537 - Vertically cast iron pressure pipes for water, gas and sewage.

IS:1538 - Cast Iron fittings for pressure pipes for water, gas & sewage.

IS:1230 - Cast Iron rain water pipes and fittings.

IS:3889 - Centrifugally cast (spun) iron spigot & socket soil waste and ventilating pipes, fittings and accessories.

IS:1729 - Sand cast iron spigot & socket soil, waste and ventilating pipes and accessories.

IS:1626 - Asbestos cement building pipes, gutters and fittings (spigot & socket types).

IS:458 - Concrete pipes (with and without reinforcement)

IS:783 - Code of Practice for laying of concrete pipes.

IS:784 - Prestressed concrete pipes.

IS:651 - Salt glazed stoneware pipes & fittings.

IS:4127 - Code of practice for laying of glazed stoneware pipes.

IS:1726 - Cast Iron manhole covers and frames intended for use in drainage works.

IS:5961 - Cast Iron gratings for drainage purposes.

IS:5219 (Part 1) - 'P' & 'S' traps.

IS:771 - Glazed earthen-ware sanitary appliance.

IS:772 - General requirements of enamelled cast iron sanitary appliances.

IS:774 - Flushing cistern for water closets & urinals (valveless siphonic type).

IS:775 - Cast Iron brackets & supports for wash basins and sinks.

IS:2548 - Plastic water closet seats & covers.

IS:2527 - Code of Practice for fixing rain water gutters and down-pipes for roof drainage.

15.0 TECHNICAL SPECIFICATION
FOR
ALUMINIUM COMPOSITE PANEL

1.00.00 ACP CLADDING

General
The aluminium composite panel shall be stove lacquered cover sheet on the front side and Mill finish or stove lacquered coversheet on the reverse side produced in a continuous finishing process as per technical data sheets of Alpolic/ Alucobond/ Eurobond. It should be a prefabricated anodized material and surface of the standard panel shall either anodized with a self adhesive foil. The complete panel shall be lightweight with excellent product properties for outdoor
applications.

1.01.01 Fixing Arrangement

Frame Work
Mild steel hop dipped, galvanized C barackets of size 75 mm x 1.6 mm with slot of 8 mm x 35 mm are fixed to the existing RCC columns walls or any other backing surface. Aluminium hollow section of size 50 mm x 25 mm of 1.6 mm of 1.6 mm thick are fixed to these brackets both vertically and horizontally by using M6 x 75 mm stainless steel bolts and nuts. The framework can easily be aligned for plumb and straightness panel fixing.

1.01.02 Panel Fixing

Composite panels are cut to size, routed, corners notched and bend as per the dimensions specified. After the panels are bend aluminium cleats of size 16 mm x 16mm by 25 mm length are fixed to the edge of the panels by using aluminium pop rivets. The panels are fixed to the framework by using stainless steel screws. The gap of 12 mm or 16 mm between the panels (both vertical and horizontal) are filled with backer rod of size 12 mm x 20 mm or 16 mm x 20 mm, weather proof silicon sealant of Wackler, Dow corning or equivalent make is used to fill the grooves.

1.01.03 Technical Date

The composite panel shall be of Alpolic/Alucobond/Eurobond with following technical data.
Panel thickness (mm) 4
Cover sheet thickness (mm) 0.5
Weight (Kg/sqm) 5.5 Kg
Core
Polythylene, type LDPE (g/cm2) 0.92
Surface
Lacquering Modified Polyster Lacquer System
Brillance (initial value) 30-30% accord. To Gardner
Hardness (Pencil hardness) H
Temperature resistance Form – 50 + 80□C
UV Stability Very Good
Technical Specifications of Composite Panel as per ASTM Standards :33
Panel Thickness (mm) 4
Technical properties Moment of
Inertia 1 (cm4/m)
0.123
Section modulus W (cm3/m) 0.81
Rigidity E-J (kNcm2/m 865

Alloy / condition of the cover sheets En AW-5005A (AlMg.1),H44
Modulus of elasticity (N/mm2) 70000
Tensile strength of the cover sheets
(N/mm2)
0.2% proof stress (N/mm2) Rp 0/2 : 110-175
Elongation A 50 □□□□3%
Linear thermal expansion 2.4 mm/m at 100□C temperature difference

1.01.04 Acoustical Properties

Sound absorption factor as 0.05
Airbome sound insulation index RW
(dB)
24
Loss factor d 0.0057

1.01.05 Thermal Properties

Thermal resistance 1/A (m2k/W) 0.2280
Heat transition Coefficient k (W/m2k) 5.61
Water absorption DIN 53495 0.01
Static charge No antistatic treatment necessary
Linear thermal expansion 2.4 mm/m at 100□C temperature difference
Static Charge No antistatic treatment necessary
Thermal resistance 1/A (m2k/W) 0.0080
Heat transition coefficient k(W/m2k) 5.61
Temperature resistance From 50 to 80□C
Acoustical absorption as 0.05
Airbome sound insulation index Rw
(accord to ISO 717-1 (dB)
24
Loss factor d 0.0057

1.01.06 Weather Sealant :

Weather Sealant should have minimum tearing strength 4.0 N/mm, sore hardness 20 (ISO
868), joint movement capability + 15% (As per ASTM C-920), one part natural core equivalent to Sika Elastosil 305. Dow Corning 791P or equivalent.

1.01.07 Epdm Gasket

EPDM Gasket should not loose its properties of elasticity and it shuld not become brittle or plastic before 10 years at least.

Measurement
The measurement of the composite panel cladding shall be taken in square meter correct to two places of decimal. (The measurement will be as per the in visible vertical plane of the external façade)

Rate :
The rate shall include providing and fixing of pallets, frame work, fittings and fixtures, wastage, scaffoldings, tools, pallets, frame work, fittings and fixtures, wastage, scaffolding, tools, plants, all cost of composite panel and labour involved in all the operations described above including cartage, lifts and all taxes like Sales Tax / VAT, Excise duty, Octroi etc. as applicable.

SCIENCE CITY. KOLKATA. WESTBENGAL

Summary Sheet of Cost

S. No.		Item		Amount
1	Tender Package I	Cost of Civil, Architecture & Sanitary & Plumbing work of Food Court & Canopy of dynamotion Building.	Rs.	48,381,006.21
2		Cost of Civil & Architecture work of Under-ground Reservoir with Pump House	Rs.	9,709,503.12
		Total :	**Rs.**	**58,090,509.33**
		R/0	**Rs.**	**58,090,509.00**

SPECIAL NOTES :

1 Tenderers should visit the site before quoting the rate to understand the nature of work and condition of the site.

2 Rates shall be quoted inclusive of all materials, wastage, labour, shifting charges,all taxes including **GST,Cess & duties** etc. required for this job. No additional payment shall be made by the Science City for this purpose. Rates indicated shall be firm & fixed for entire period of execution of the order and no escalation of the rate on any ground whatsoever shall be applicable.

3 The works shall be required to be carried out without obstructing the visitors' movement and may also be carried out beyond office hours in order to completre the work **in time**, for which no additional payment shall be made.

4 Time is the essence of this order. The work shall be carried out strictly as per enclosed drawing and specifications within the stipulated time as mentioned in the letter of intent.

5 Bad workmanship will not be accepted and if carried out is liable to be rejected and should be rectified by the successful tenderer at his own cost.

6 All materials must be approved by the Engineer-in- Charge before supplying at site.

7 Rates shall be quoted inclusive of all minor civil repairing / mending of the surface good.

8 Dimensions given in the drawing are only indicative. The actual dimensions for fabrication may vary depending on the site condition.

9 The contractor/ sucessful tenderer may submit final computerized measurement book duly bound,with its pages machine numbered after duly checked by Engineer-in-charge or his authorized representative.The contractor/ sucessful tenderer may also submit to the department separately his computerized Abstract of Cost and the bill based on these final measurements, duly bound, and its pages machine numbered along with two spare copies of the "bill".

10 Regarding the work the directives of the Engineer-in-Charge shall be final and binding.

SCIENCE CITY, KOLKATA, WESTBENGAL

BILL OF QUANTITY FOR CIVIL, ARCHITECTURE AND SANITARY & PLUMBING

CONSTRUCTION OF FOOD COURT & CANOPY OF DYNAMOTION BLDG

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
1	Boring, providing and installation bored cast-in-situ reinforced cement concrete piles of grade M-25 of specified diameter and length below the pile cap, to carry a safe working load not less than specified, excluding the cost of steel reinforcement but including the cost of boring with bentonite solution and temporary casing of appropriate length for setting out and removal of same and the length of the pile to be embedded in the pile cap etc. by percussion drilling using Direct mud circulation (DMC) or Bailer and chisel technique by tripod and mechanical Winch Machine all complete, including removal of excavated earth with all its lifts and leads (length of				
	Note: Truck Mounted rotary/TMR/Tubewell boring mchine shall not be used .				
	500 mm dia. Piles	Mtr.	1757.85	3600.00	6328260.00
	(Cost of the empty boring is included in this item)				
2	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level.				
	For Bored Piling work.				
	Thermomechanicaly treated bar of grade Fe-500D or more	Kg	56.60	60000.00	3396000.00
3	Vertical load testing of piles in accordance with IS 2911 (Part IV) including installation 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 & the direction of Engineer in-				
	Note: 1. Initial and Routine Load Test shall not be carried out by Dynamic method of testing.				
	Note: 2. Testing agency shall submitt the design of loading platform for the approval of Engineer-				
	Single pile upto 50 tonne Safe capacity				
	Initial test (Test Load 2.5 times the Safe capacity)	Per test	38561.8	1.00	38561.80
	Routine test (Test Load 1.5 times the Safe capacity)	Per test	17422.5	2.00	34845.00
4	Lateral load testing of single pile in accordance with IS Code of practice IS : 2911 (Part IV) for determining safe allowable lateral load on pile :				
	Upto 50 tonne capacity pile	Per test	17422.5	2.00	34845.00
5	Integrity testing of Pile using Low Strain/ Sonic Integrity Test/ Sonic Echo Test method in accordance with IS 14893 including surface preparation of pile top by removing soil, mud, dust & chipping lean concrete lumps etc. and use of computerised equipment and high skill trained personal for conducting the test & submission of results, all complete as per direction of	Per test	750.95	3.00	2252.85
6	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means over areas (exceeding 30cm in depth. 1.5m in width as wel as 10 sqm on plan) including disposal of excavated earth, lead upto 50m and lift upto 1.5m, disposed earth to be level ed and neatly dressed.				
	All kinds of soil	Cum	125.95	2150.00	270792.50

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
	(Including bailing out of water if needed)				
7	Extra for every additional lift of 1.5 m or part thereof in excavation / banking excavated or				
	All kinds of soil	Cum	51.75	315.00	16301.25
	(Including bailing out of water if needed)				
8	Filling with available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.	Cum	125.75	2208.00	277656.00
9	Filling in foundation or plinth by silver sand in layers not exceeding 150 mm as directed and consolidating the same by thorough saturation with water, ramming complete including the cost of supply of sand. (payment to be made on measurement of finished quantity)	Cum	1,114.09	349.00	388817.38
10	Removal of rubbish,earth etc. from the working site and disposal of the same beyond the compound, in conformity with the Municipal / Corporation Rules for such disposal, loading into truck and cleaning the site in all respect as per direction of Engineer in charge	Cum	197.54	27.00	5333.58
11	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level :				
	1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size).	Cum	4,927.00	150.00	739050.00
12	Providing and laying damp-proof course 40mm thick with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5mm nominal size).	Sqm	263.10	50.00	13155.00
13	Making plinth protection 50mm thick of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand including finishing the top smooth	Sqm	450.35	100.00	45035.00
14	Centering and shuttering including strutting, propping etc. and removal of form for :				
a.	Foundations, footings, bases of columns, etc. for mass concrete.	Sqm	193.95	1000.00	193950.00
b.	Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	Sqm	378.60	380.00	143868.00
c.	Suspended floors, roofs, landings, balconies and access platform.	Sqm	422.30	1600.00	675680.00
d.	Lintels, beams, plinth beams, girders, bressumers and cantilevers.	Sqm	342.90	1000.00	342900.00
e.	Columns, Pillars, Piers, Abutments, Posts and Struts.	Sqm	467.85	1000.00	467850.00
f.	Stairs, (excluding landings) except spiral stair-cases	Sqm	419.35	50.00	20967.50
g.	Extra for shuttering in circular work (20% of respective centering and shuttering items) - Column	Sqm	93.57	500.00	46785.00
h.	Extra for shuttering in circular work (20% of respective centering and shuttering items) - Beam	Sqm	68.58	600.00	41148.00
i.	Weather shade, chajjas, corbels, etc., including edges.	Sqm	521.75	20.00	10435.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
15	Extra for additional height in centering, shuttering where ever required with adequate bracing, propping etc. including cost of de-shuttering and decentering at all levels, over a height of 3.5 m, for every additional height of 1 metre or part thereof (Plan area to be measured)				
	Suspended floors, roofs, landing, beams and balconies (Plan area to be measured)	Sqm	171.50	2220.00	380730.00
16	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level.				
	Thermomechanicaly treated bar of grade Fe-500D or more	Kg	56.60	80000.00	4528000.00
17	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete above plinth level.				
	Thermomechanicaly treated bar of grade Fe-500D or more	Kg	56.60	86000.00	4867600.00
18	Providing and laying in position ready mixed M-25 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully atutomatic batching plant and transported to site of work in transit mixer for all leads having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of RMC from transit mixer to site of laying, excluding the cost of centering, shuttering, finishing and reinforcement including cost of admixers in recommended proportions as per IS:9103 to accelerate / retard setting of concrete, improve				
	(Note :- Cement content considered in this item is @ 330 kg/cum.Excess/less cement used as per design mix is payable/recoverable separately).				
a.	All works upto plinth level	Cum	6,713.60	570.00	3826752.00
b.	All works above plinth level up to floor V level	Cum	7,517.20	540.00	4059288.00
19	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundation and plinth in:				
	Cement mortar 1:4 (1 cement : 4 coarse sand)	Cum	4,970.30	70.00	347921.00
20	Providing and laying autoclaved aerated cement blocks masonry with 150mm/230mm/300 mm thick AAC blocks in super structure above plinth level up to floor V level with RCC band at sill level and lintel level with approved block laying polymer modified adhesive mortar all complete as per direction of Engineerin-Charge. (The payment of RCC band and reinforcement shall be made for seperately).	cum	5,687.10	286.00	1626510.60
21	Half brick masonry with non modular fly ash bricks of class designation 10, conformingio IS :12894, in super structure above plinth and upto floor V level.				
	Cement mortar 1:4 (1 cement :4 coarse sand)	Sqm	769.50	310.00	238545.00
22	Brick work 7 cm thick with common burnt clay F.P.S. (non modular) brick of class designation 7.5 in cement mortar 1:3 (1 cement : 3 coarse sand) in superstructure above plinth level and	Sqm	535.50	100.00	53550.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
23	Providing and fixing 18mm thick gang saw cut mirror polished premoulded and prepolished machine cut for Kitchen platforms, vanity counters, window sills, facia and similar locations of required size of approved shade, colour and texture laid over 20mm thick base cement mortar 1:4(1 cement:4 coarse sand) with joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing,curing, moulding and polishing to edges to give high gloss finish etc. complete at all levels.				
	Granite of any colour and shade				
	Area of slab over 0.50sqm	Sqm	3,113.30	3.00	9339.90
24	Providing edge moulding to 18mm thick marble/granite stone counters, Vanities etc. including machine polishing to edge to give high gloss finish etc. complete as per design approved by Engineer-in-charge				
	Granite work	Metre	245.70	20.00	4914.00
25	Providing and fixing expansion hold fasteners on C.C. /R.C.C./Brick masonry surface backing including drilling necessary holes and the cost of bolt etc complete.				
	Fastener with threaded dia 10 mm.	Each	25.55	30.00	766.50
26	Stone tile (polished) work for wall lining over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and cement slurry @ 3.3 kg/sqm including pointing in white cement complete.				
	8mm thick				
	Raj nagar plain white marble/ Udaipur green marble/ Zebra black marble	Sqm	1,634.65	10.00	16346.50
	Granite of any colour and shade	Sqm	2,018.00	50.00	100900.00
27	Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought framed and fixed in position with hold fast lugs or with dash fasteners of required dia & length (hold fast lugs or dash fastener shall be paid for separately).				
	Sal wood	Cum	85,386.95	0.70	59770.86
28	Providing and fixing ISI marked flush door shutters conforming to IS: 2202 (Part I) decorative type, core of block board construction with frame of 1st class hard wood and well matched teak 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters.				
	35 mm thick including ISI marked Stainless Steel butt hinges (125x64x2mm) with necessary screws.	Sqm	2,488.95	7.20	17920.44
29	Providing and fixing ISI marked flush door shutters conforming to IS : 2202 (Part I) non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters :				
	35 mm thick including ISI marked Stainless Steel butt hinges (125x64x2mm) with necessary screws	Sqm	1,559.75	40.00	62390.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
30	Providing and fixing M.S. grills of required pattern in frames of windows etc. with M.S. flates, square or round bars etc. including priming coat with Zinc Chromate primer all complete.				
	Fixed to openings/wooden frames with rawl plugs screws etc.	Kg	112.45	1000.00	112450.00
31	Providing 40x5 mm flat iron hold fast approx 30 cm long including fixing to frame with 10 mm diameter bolts, nuts and wooden plugs and embedding in cement concrete block 30x10x15cm 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stone aggregate 20mm nominal size)	Each	118.60	90.00	10674.00
32	Providing and fixing bright finished brass butt hinges with necessary screws etc. complete				
	100x85x5.5 mm (heavy type)	Each	162.45	120.00	19494.00
33	Providing and fixing bright finished brass tower bolts (barrel type) with necessary screws				
a.	200x10mm	Each	251.50	15.00	3772.50
34	Providing and fixing bright finished brass door latch with necessary screws etc. complete :				
a.	250x16x5mm	Each	215.40	15.00	3231.00
35	Providing and fixing bright finished brass handles with screws etc. complete :				
a.	125mm	Each	171.20	30.00	5136.00
36	Providing and fixing bright finished brass hanging type floor door stopper with necessary screws, etc. complete.	Each	85.85	15.00	1287.75
37	Supplying Aluminium casted body hydraulic door closer as per I.S.I.	Each	635.00	15.00	9525.00
38	Providing and fixing Fiber Glass Reinforced plastic (FRP) Door Frames of cross-section 90 mm x 45 mm having single rebate of 32 mm x 15 mm to receive shutter of 30 mm thickness .The laminate shall be moulded with fire resistant grade unsaturated polyester resin and chopped mat. Door frame laminate shall be 2 mm thick and shall be filled with suitable wooden block in all the three legs. The frame shall be covered with fiber glass from all sides. M.S. stay shall be provided at the bottom to steady] the frame.	Mtr	415.50	105.00	43627.50
39	Providing and fixing to existing door frames.				
	30 mm thick Fiberglass Reinforced Plastic (F.R.P.) flush door shutter in different plain and wood finish made with fire retardant grade unsaturated polyester resin, moulded to 3 mm thick FRP laminate all around, with suitable wooden blocks inside at required places for fixing of fittings and polyurethane foam (PUF)/ Polystyrene foam to be used as filler material throughout the hollow panel, casted monolithically with testing parameters of F.R.P. laminate conforming to table - 3 of IS: 14856, complete as per direction of Engineer-in-charge.	Sqm	2,535.80	37.00	93824.60
40	Steel work welded in built up sections/ framed work, including cutting, hoisting, fixing in position and applying a priming coat of Zinc Chromate primer using structural steel etc. as required.				

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
	In gratings, frames, guard bar, ladder, railings, brackets, gates and similar works	Kg	85.95	500.00	42975.00
41	Steel work in built up tubular (round, square or rectangular hollow tubes etc.) trusses etc., including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete.				
	Hot finished seamless type tubes	Kg	93.90	1500.00	140850.00
42	Providing, supplying and fixing of stainless steel railing of brush polished (mat finish) AISI 316 grade quality, avoiding any welding work with 50 mm dia 16 gauge thick stainless steel pipe handrail, 75 mm x 12 mm stainless steel flat post balusters as immediate supports fixed to concrete or masonry surface with two nos 75 mm x 6 mm stainless steel toe angles with stainless steel bolts, 2 nos 40 mm dia 16 gauge thick stainless steel pipes as horozontal members inserted through suitable sized holes in the balusters / vertical post etc. all complete as per approved drawings and including all necessary stainless steel fittings, fixures and	Kg	600.00	300.00	180000.00
43	52 mm thick cement concrete flooring with concrete hardener topping, under layer 40 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) and top layer 12mm thick screed concrete consisting of mix 1:2 (1 cement : 2 graded stone aggregate 6 mm nominal size) by volume, hardening compound Sika Chapdur or equivalent to be applied on the top @ 5 Kg per Sq.m or as per manufacturer's specifications. This includes cost of cement slurry, but excluding the cost of nosing of steps etc. complete.	Sqm	555.25	100.00	55525.00
44	Cement plaster skirting (up to 30 cm height) with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement.				
	18mm thick	Sqm	350.05	20.00	7001.00
45	Providing and fixing glass strips in joints of terrazo/ cement concrete floors.				
	40 mm wide and 4 mm thick.	Metre	52.50	400.00	21000.00
46	Precast terrazo tiles 22 mm thick with graded marble chips of size upto 12 mm, laid in floors, and landings, jointed with neat cement slurry mixed with pigment to match the shade of the tiles, including rubbing and polishing complete, on 20 mm thick bed of cement mortar 1:4 (1 cement:4 coarse sand) :				
	Medium shade pigment using 50% white cement and 50% ordinary cement	Sqm	912.75	220.00	200805.00
47	Marble stone flooring with 18mm thick marble stone(sample of marble shall be approved by Engineer-in charge) over 20mm (average) thick base of cement morter 1:4(1 cement:4 coarse sand) laid and jointed with grey cement slurry including rubbing and polishing complete with:				
	Udaipur green marble	Sqm	1,589.40	14.00	22251.60

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
48	Kota stone slab flooring over 20mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab including rubbing and polishing complete with base of cement mortar 1:4(1 cement: 4 coarse sand):				
	25mm thick	Sqm	1,158.10	340.00	393754.00
49	Kota stone slab flooring over 20mm thick in risers of steps, skirting, dado and pillars laid on 12mm (average) thick cement mortar 1:3(1 cement:3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs, including rubbing and polishing complete.	Sqm	1,238.20	75.00	92865.00
50	Extra for pre finished nosing in treads of steps of Kota stone/ sand stone slab.	Metre	84.85	80.00	6788.00
51	Providing and laying vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS: 15622, of approved make, in all colours and shades, laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand), jointing with grey cement slurry @ 3.3kg/ sqm including grouting the joints with white				
	Size of Tile 600x600 mm	Sqm	1,119.40	120.00	134328.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
52	Supplying and laying true to line and level Double Charge Vitrified Tiles of approved brand conforming to IS 15622: 2006 (Group B I a) and tested as per IS 13630:2006 (relevant parts) [Non-modular sizes for tiles with Water Absorption (av.) ≤ 0.08 %] in floor, skirting etc. using polymerised adhesive of 6mm thick layer applied directly over finished artificial stone floor/Mosaic etc without any backing course and joints grouted with admixture of white epoxy grout materials of approved brand including spacer -2mm as directed and removal of wax coating of top surface of tiles with warm water and polishing the tiles using soft and dry cloth upto mirror finish complete including the cost of materials,labour and all other incidental charges complete as per direction of Engineerin- Charge.				
	Size not less than 600mmX 600 mm X 9.5 mm thick	Sqm	1,863.54	10.00	18635.40
53	Providing and laying Vitrified tiles in different sizes (thickness to be specified by manufacturer), with water absorption less than 0.08 % and conforming to I.S. 15622, of approved make, in all colours & shade, in skirting, riser of steps, over 12 mm thick bed of cement mortar 1:3 (1 cement: 3 coarse sand), jointing with grey cement slurry @ 3.3kg/sqm including grouting the joint with white cement & matching pigments etc. complete.				
	Size of Tile 600x600 mm	Sqm	1,135.20	20.00	22704.00
54	Providing and fixing Ist quality ceramic glazed wall tiles conforming to IS : 15622 (thickness to be specified by the manufacture) of approved make in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge in skirting, risers of steps and dados over 12 mm thick bed of cement Mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm including pointing in white cement	Sqm	744.80	300.00	223440.00
55	Providing and laying rectified Glazed Ceramic floor tiles 300x300 mm or more (thickness to be specified by the manufacturer) of 1st quality conforming to IS : 15622 of approved make in colours White, Ivory, Grey, Fume Red Brown, laid on 20mm thick cement mortar 1:4 (1 Cement : 4 Coarse sand) including grouting the joints with white cement and matching pigments etc., complete.	Sqm	822.45	100.00	82245.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
56	Providing and laying Polished Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building, all complete as per the architectural drawings, with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand), laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade, including rubbing, curing and polishing etc. all complete as				
	Polished Granite stone slab jet Black, Cherry Red, Elite Brown, Cat Eye or equivalent.	Sqm	2,937.70	1012.00	2972952.40
	(The rate is inclusive of skirting)				
57	Providing and laying 60mm thick faciory made cement concrete interlocking paver block of M - 30 grade made by block making machine with strong vibratory compaction, of approved s;ze, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with line sand etc. all complete as per the direction of Engineer-in-charge.	Sqm	615.70	350.00	215495.00
58	Providing and fixing on wall face unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion, (i) Single socketed pipes.				
	110 mm diameter	Mtr	236.35	35.00	8272.25
59	Providing and fixing on wall face unplasticised - PVC moulded fittings/ accessories for unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion.				
	Plain Bend 87.5°				
	110 mm bend	Each	113.10	10.00	1131.00
	Shoe (Plain)				
	110 mm Shoe	Each	98.00	10.00	980.00
60	Supply of UPVC pipes (B Type) & fittings conforming to IS-13592-1992				
	Door Bend (T.S.)				
	110 mm	Each	174.93	10.00	1749.30
61	Providing and fixing to the inlet mouth of rain water pipe PTMT (an Engineering Thermoplastic) grating square (Slit) 150 mm square with a height of 8 mm and weighing not less than 100 gms.	Each	66.45	5.00	332.25
62	Providing & fixing UV stabilised fiberglass reinforced plastic sheet roofing up to any pitch, including fixing with polymer coated 'J' or 'L' hooks, bolts & nuts 8mm dia. G.I plain/bitumen washers complete but excluding the cost of purlins, rafters, trusses etc. The sheets shall be manufactured out of 2400 TEX panel rovigs incorporating minimum 0.3% ultra-violet stabiliser in resin system under approximately 2400 psi and hot cured. They shall be of uniform pigmentation and thickness without air pockets and shall conform to IS 10192 and IS 12866.The				
	2 mm thick corrugated (2.5" or 4.2" or 6") or step-down (2" or 3" or 6") as specified	Sq.m	989.5	10.00	9895.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
63	Supplying, fitting & fixing polycarbonate sheet of approved make & brand conforming to IS: 14443-1997 and having 50 micron UV protection layer under co-extrusion technology, Fire rating being B-s1 as per EN13501-1 certification, fitted and fixed with 60mm wide aluminium channel section top and bottom member in dry-glaze sandwitch system, (unit wt. of top and bottom members: 0.375 kg/m & 0.69 kg/m) of approved brand and profile, EPDM quality rubber gaskets, anti dust tape, end closer "C" channel and 75 mm long Self tapping screw being drilled through the centre leg of the bottom section with nuts placed at 300 mm apart without anyway puncturing the polycarbonate sheet, EPDM Washer 16 mm dia & 3 mm thick washer etc complete strictly as per manufacturers specification and direction of Engineer-in-Charge. (Payment to be made on area of finished work) . In Roof:- Natural/ Blue/Green/Bronze/Opal/Metallic grey colour				
	With 2 wall 8 mm overall thickness (wt.1.50kg/sqm,Ugvalue being 3.3 W/m2K, Min. cold bending radius of 1200 mm)	Sq.m	1577.94	400.00	631176.00
64	Providing corrugated G.S. sheet roofing including vertical / curved surface fixed with polymer coated J or L hooks, bolts and nuts 8 mm diameter with bitumen and G.I. limpet washers or with G.I. limpet washers filled with white lead, including a coat of approved steel primer and two coats of approved paint on overlapping of sheets complete (up to any pitch in horizontal/ vertical or curved surfaces), excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required.				
	1.00 mm thick with zinc coating not less than 275 gm/m²	Sq.m	975.95	30.00	29278.50
65	Providing and fixing false ceiling at all height including providing and fixing of frame work made of special sections, power pressed from M.S. sheets and galvanized with zinc coating of 120 gms/sqm (both side inclusive) as per IS : 277 and consisting of angle cleats of size 25 mm wide x 1.6 mm thick with flanges of 27 mm and 37mm, at 1200 mm centre to centre, one flange fixed to the ceiling with dash fastener 12.5 mm dia x 50mm long with 6mm dia bolts, other flange of cleat fixed to the angle hangers of 25x10x0.50 mm of required length with nuts & bolts of required size and other end of angle hanger fixed with intermediate G.I. channels 45x15x0.9 mm running at the spacing of 1200 mm centre to centre, to which the ceiling section 0.5 mm thick bottom wedge of 80 mm with tapered flanges of 26 mm each having lips of 10.5 mm, at 450 mm centre to centre, shall be fixed in a direction perpendicular to G.I. intermediate channel with connecting clips made out of 2.64 mm dia x 230 mm long G.I. wire at every junction, including fixing perimeter channels 0.5 mm thick 27 mm high having flanges of 20 mm and 30 mm long, the perimeter of ceiling fixed to wall/partition with the help of rawl plugs at 450 mm centre, with 25mm long dry wall screws @ 230 mm interval, including fixing of gypsum board to ceiling section and perimeter channel with the help of dry wall screws of size 3.5 x 25 mm at 230 mm c/c, including jointing and finishing to a flush finish of tapered and square edges of the board with recommended jointing compound , jointing tapes , finishing with jointing compound in 3 layers covering upto 150 mm on both sides of joint and two coats of primer suitable for board, all as per manufacturer's specification and also including the cost of making openings for light				
	12.5 mm thick tapered edge gypsum moisture resistant board	Sq.m	958.65	100.00	95865.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
66	Providing and fixing tiled false ceiling of specified materials of size 595x595 mm in true horizontal level, suspended on inter locking metal grid of hot dipped galvanized steel sections (galvanized @ 120 grams/ sqm, both side inclusive) consisting of main "T" runner with suitably spaced joints to get required length and of size 24x38 mm made from 0.30 mm thick (minimum) sheet, spaced at 1200 mm center to center and cross "T" of size 24x25 mm made of 0.30 mm thick (minimum) sheet, 1200 mm long spaced between main "T" at 600 mm center to center to form a grid of 1200x600 mm and secondary cross "T" of length 600 mm and size 24x25 mm made of 0.30 mm thick (minimum) sheet to be interlocked at middle of the 1200x600 mm panel to form grids of 600x600 mm and wall angle of size 24x24x0.3 mm and laying false ceiling tiles of approved texture in the grid including, required cutting/making, opening for services like diffusers, grills, light fittings, fixtures, smoke detectors etc. Main "T" runners to be suspended from ceiling using GI slotted cleats of size 27 x 37 x 25 x1.6 mm fixed to ceiling with 12.5 mm dia and 50 mm long dash fasteners, 4 mm GI adjustable rods with galvanised butterfly level clips of size 85 x 30 x 0.8 mm spaced at 1200 mm center to center along main T, bottom				
	12.5 mm thick square edge PVC Laminated Gypsum Tile of size 595x595 mm, made of Gypsum plasterboard, manufactured from natural gypsum as per IS 2095 part I and laminated with white 0.16mm thick fire retardant PVC film on the face side and 12micron metalized polyester on the back side with all edges sealed with the face side PVC film which goes around and wraps the edges and is bonded to the edges and the back side metalized polyester film so as to make the tile a completely sealed unit.	Sq.m	993.15	750.00	744862.50
67	12mm th.(Inside on concrete surface) Cement plaster of mix				
	1:4 (1 cement:4 coarse sand)	Sqm	180.85	200.00	36170.00
68	15 mm cement plaster on rough side of single or half brick wall of mix :				
	1:6 (1 cement: 6 coarse sand)	Sqm	194.60	2100.00	408660.00
69	20 mm cement plaster of mix :				
	1:6 (1 cement: 6 coarse sand)	Sqm	232.85	1700.00	395845.00
70	6 mm cement plaster of mix :				
	1:3 (1 cement: 3 fine sand)	Sqm	143.80	2800.00	402640.00
71	Finishing walls with exterior paint of required shade of ICI-Weathershild Max, Asian Paints-Apex Ultima or equivalent approved brand.				
	New work (Two or more coats applied over and including priming coat of approved primer)	Sqm	140.00	1400.00	196000.00
72	Providing and applying white cement based putty of average thickness 1mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete.	Sqm	87.35	4000.00	349400.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
73	Wall painting with premium acrylic emulsion paint of interior grade, having VOC (Volatile Organic Compound) content less than 50 grams/litre. Of approved brand and manufacture, including applying additional coats wherever required to achieve even shade colour.				
	Two coats	Sqm	71.00	2000.00	142000.00
74	Painting with synthetic enamel paint, having VOC (Volatile Organic Compound) content less than 150 grams /litre, of approved brand and manufacture, including applying additional coats wherever required to achieve even shade and colour.				
	Two coats	Sqm	75.00	600.00	45000.00
75	Applying priming coats with primer of approved brand and manufacture, having low VOC (Volatile Organic Compound) content.				
	With ready mixed pink or grey primer on wood work (hard and soft wood) having VOC content less than 50grams/litre.	Sqm	38.45	2600.00	99970.00
76	Labour for Chipping of concrete surface before taking up Plastering work.	Sqm	24.99	3000.00	74970.00
77	White washing with lime to give an even shade :				
	White washing with lime to give an even shade :	Sqm	17.25	2090.00	36052.50
78	Demolishing R.C.C. work manually/ by mechanical means including stacking of steel bars and disposal of unserviceable material within 50 metres lead as per direction of Engineer - in-charge.	Cum	1,454.55	27.00	39272.85
	(For breaking of pile head)				
79	Providing and fixing white vitreous china extended wall mounting water closet of size 780x370x690 mm of approved shape including providing & fixing white vitreous china cistern with dual flush fitting, of flushing capacity 3 litre/ 6 litre (adjustable to 4 litre/ 8 litres), including seat cover, and cistern fittings, nuts, bolts and gasket etc complete.	Each	9,685.70	13.00	125914.10
80	Providing and fixing stone slab with table rubbed, edges rounded and polished, of size 75x50 cm deep and 1.8 cm thick, fixed in urinal partitions by cutting a chase of appropriate width with chase cutter and embedding the stone in the chase with epoxy grout or with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 6 mm nominal size) as per direction				
	Granite Stone of approved shade	Sqm	2,831.95	5.00	14159.75
81	Supplying, fitting & Fixing EWC (Size- 710x370x810 mm)in white glazed vitreous chinaware of approved make supplying, fitting and fixing in position complete with necessary nut and bolts. (Model Code No. S10221114-P Trap (CRUSE SET) of CERA or equivalent.)	Each	5,446.00	2.00	10892.00
82	Supplying, fitting and fixing 10 litre white glazed vitreous chinaware of approve low-down cistern of approved make with either side or bottom inlet, side overflow, brackets complete with all internal fittings. (Model Code No. S1060106 of CERA or equivalent.)				
	White	Each	2,406.00	2.00	4812.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
83	Soft Close seat cover of approved make with lid and C.P. hinges, rubber buffer and brass screws suppling, fitting and fixing complete. E W C (Model Code No. B1520118 of CERA or equivalent.)				
	White	Each	1,299.00	2.00	2598.00
84	Supplying, fitting and fixing Stainless steel Wall Mounted Grab Bar. Load bearing capacity 150 kg, covered by Nylon surface with contour finish (for better grip) with Anti-bacterial surface complete. (Model Code No. B2210106 of CERA or equivalent.)				
	600 mm long	Each	1,825.00	2.00	3650.00
85	Providing and fixing white vitreous china flat back or wall corner type lipped front urinal basin of 430x260x350 mm and 340x410x265 mm sizes respectively with automatic flushing cistern with standard flush pipe and C.P. brass spreaders with brass unions and G.I clamps complete, including painting of fittings and brackets, cutting and making good the walls and floors wherever required :				
	One urinal basin with 5 litre white P.V.C. automatic flushing cistern	Each	3,494.15	6.00	20964.90
86	Supplying, fitting and fixing white vitreous china best quality approved make wash basin with C.I. brackets on 75 mm X 75 mm wooden blocks, C.P. waste fittings of 32 mm dia., one approved quality brass C.P. pillar cock of 15 mm dia., C.P. chain with rubber plug of 30 mm dia., approved quality P.V.C. waste pipe with C.P. nut 32 mm dia., 900 mm long approved quality P.V.C. connection pipe with heavy brass C.P. nut including mending good all damages and painting the brackets with two coats of approved paint.				
	630 mm X 450 mm size	Each	3,260.00	10.00	32600.00
87	Providing and fixing mirror of superior glass (of approved quality) and of required shape and size with plastic moulded frame of approved make and shade with 6 mm thick hard board				
	Rectangular shape 1500x450 mm	Each	1,323.10	5.00	6615.50
88	Providing and fixing toilet paper holder :				
	C.P. brass	Each	385.35	13.00	5009.55

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
89	Providing and fixing P.V.C. waste pipe for sink or wash basin including P.V.C. waste fittings complete.				
	Flexible pipe				
	40 mm dia	Each	75.60	10.00	756.00
90	Providing and fixing PTMT Bottle Trap for Wash basin and sink.				
	Bottle trap 31mm single piece moulded with height of 270 mm, effective length of tail pipe 260 mm from the centre of the waste coupling, 77 mm breadth with 25 mm minimum water seal, weighing not less than 260 gms	Each	293.95	20.00	5879.00
91	Supplying, fitting and fixing liquid soap container.				
	Cromium plated.	Each	393.00	10.00	3930.00
92	Providing and fixing PTMT towel rail complete with brackets fixed to wooden cleats with CP brass screws with concesled fitting arrangement of approved quality and colour				
	600mm long rail with total length of 645mm, width 78mm and effective height of 88mm, weighing not less than 190gms	Each	422.70	19.00	8031.30
93	Providing and placing on terrace (at all floor levels) polyethylene water storage tank ISI : 12701 marked with cover and suitable locking arrangement and making necessary holes for inlet, outlet and overflow pipes but without fittings and the base support for tank	Per litre	7.25	28000.00	203000.00
94	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings This includes jointing of pipes & fittings with one step CPVC solvent cement, trenching, refilling & testing of joints				
	External work				
	50 mm nominal outer dia Pipes	Mtr	484.25	30.00	14527.50
	62.50 mm nominal inner dia Pipes	Mtr	1,081.75	10.00	10817.50
95	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of				
	Concealed work including cutting chases and making good the walls etc.,				
a.	15 mm nominal outer dia Pipes	Mtr	246.20	50.00	12310.00
b.	20 mm nominal outer dia Pipes	Mtr	284.85	30.00	8545.50
c.	25 mm nominal outer dia Pipes	Mtr	333.60	20.00	6672.00
d.	32 mm nominal outer dia Pipes	Mtr	412.90	50.00	20645.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
96	Providing and fixing gunmetal gate valve with C.I. wheel of approved quality (screwed end)				
a.	25 mm dia. nominal bore	Each	428.20	5.00	2141.00
c.	40 mm dia. nominal bore	Each	584.70	3.00	1754.10
d.	50 mm dia. nominal bore	Each	749.90	5.00	3749.50
97	Providing and fixing c.p. brass bib cock of approved quality conforming to IS:8931				
	15 mm nominal bore	Each	371.70	13.00	4832.10
98	Providing and fixing c.p. brass stop cock (concealed) of standard design and of approved make conforming to IS:8931				
	15 mm nominal bore	Each	545.95	6.00	3275.70
99	Providing and fixing C.P. brass angle valve for basin mixer and geyser points of approved quality conforming to IS:8931				
	15 mm nominal bore	Each	475.70	23.00	10941.10
100	Providing and fixing aluminium work for doors, windows, ventilators ,louvers and partitions with extruded built up standard tubular sections/ appropriate Z sections and other sections of approved make conforming to IS: 733 and IS: 1285, fixing with dash fasteners of required dia and size, including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with required EPDM rubber/ neoprene gasket etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle, Aluminium snap beading for glazing / paneling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing, paneling and dash fasteners to be paid for separately) :				
	For fixed portion				
	Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15)	Kg	355.20	550.00	195360.00
	For shutters of doors, windows & ventilators including providing and fixing hinges/ pivots and making provision for fixing of fittings wherever required including the cost of EPDM rubber / neoprene gasket required (Fittings shall be paid for separately).				
	Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15)	Kg	415.05	600.00	249030.00
101	Providing and fixing glazing in aluminium door, window, ventilator,louver shutters and partitions etc. with EPDM rubber / neoprene gasket etc. complete as per the architectural drawings and the directions of engineer-in-charge . (Cost of aluminium snap beading shall be paid in basic item):				
	With float glass panes of 8 mm thickness	Sqm	1,153.90	23.00	26539.70
	With float glass panes of 4.0 mm thickness	Sqm	741.50	70.00	51905.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
102	Providing and fixing double action hydraulic floor spring of approved brand and manufacture conforming to IS : 6315, having brand logo embossed on the body / plate with double spring mechanism and door weight upto 125 kg., for doors, including cost of cutting floors, embedding in floors as required and making good the same matching to the existing floor finishing and cover plates with brass pivot and single piece M.S. sheet outer box with slide plate etc. complete as per the direction of Engineer-in-charge.				
	With stainless steel cover plate minimum 1.25 mm thickness.	Each	2,054.40	4.00	8217.60
103	Providing and fixing stainless steel (SS 304 grade) adjustable friction windows stays of approved quality with necessary stainless steel screws etc. to the side hung windows as per direction of Engineerin-charge complete.	Each	211.60	50.00	10580.00
	205 X 19 mm				
104	Filling the gap in between aluminium frame & adjacent RCC/ Brick/ Stone work by providing weather silicon sealant over backer rod of approved quality as per architectural drawings and direction of Engineer-in-charge complete.				
	Upto 5mm depth and 5 mm width	Metre	62.45	300.00	18735.00
105	Providing and fixing 100mm 6 levers brass mortice locks (make Godrej or equivalent) for aluminium doors including necessary cutting and making good etc. complete.	Each	1,500.00	4.00	6000.00
106	Supplying, fitting & fixing Stainless Steel 'D' or 'H' type of size 300 mm x 19 mm tubular Handle with Grade AISI 316, CE certified, marked & conforming to EN -1154, of approved quality of reputed brand as per direction of Eingineer-in-Charge fitted and fixed complete including all incidental charges.	Each	1,571.00	8.00	12568.00
107	Providing and laying in situ five course water proofing treatment with APP (Atactic Polypropylene) modified Polymeric memberane over roof consisting of first coat of bitumen primer @ 0.40Kg per sqm, 2nd & 4th courses of bonding material @ 1.20 kg/sqm, which shall consist of blown type bitumen of grade 85/25 conforming to IS : 702, 3rd layer of roofing membrane APP modified Polymeric membrane 2.0 mm thick of 3.00 Kg/ sqm weight consisting of five layers prefabricated with centre core as 100 micron HMHDPE film sandwiched on both sides with polymeric mix and the polymeric mix is protected on both side with 20 micron HMHDPE film. 5th, the top most layer shall be finished with brick tiles of class designation 10 grouted with cement mortar 1:3 (1 cement : 3 fine sand) mixed with 2% integral water proofing compound by weight of cement over a 12 mm layer of cement mortar 1:3 (1 cement : 3 fine sand) and finished neat (item of laying brick tiles shall be paid for separately).	Sqm	321.50	560.00	180040.00
108	Grading roof for water proofing treatment with				
	Cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)	Cum	5,583.80	32.50	181473.50

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
109	Providing and supplying aluminium extruded tubular and other aluminium sections as per the architectural drawings and approved shop drawings, the aluminium quality as per grade 6063 T5 or T6 as per BS 1474,including super durable powder coating of 60-80 microns conforming to AAMA 2604 of required colour and shade as approved by the Engineer-in-Charge. (The item includes cost of material such as cleats, sleeves, screws etc. necessary for fabrication of extruded aluminium frame work. Nothing extra shall be paid on this account).	kg	338.25	2700.00	913275.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
110	Designing, fabricating, testing, protection, installing and fixing in position semi (grid) unitized system of structural glazing (with open joints) for linear as well as curvilinear portions of the building for all heights and all levels including:				
	(a) Structural analysis, design and preparation of shop drawings for the specified design loads conforming to IS 875 part III (the system must passed the proof test at 1.5 times design wind pressure without any failure), including functional design of the aluminum sections for fixing glazing panels of various thicknesses, aluminium cleats, sleeves and splice plates etc. gaskets, screws, toggles, nuts, bolts, clamps etc., structural and weather silicone sealants, flashings, fire stop (barrier)-cum-smoke seals, microwave cured EPDM gaskets for water tightness, pressure				
	(b) Fabricating and supplying serrated M.S. hot dip galvanised / Aluminium alloy of 6005 T5 brackets of required sizes, sections and profiles etc. to accommodate 3 Dimentional movement for achieving perfect verticality and proper fixing of structural glazing system with the RCC/ masonry/structural steel framework of building structure, using stainless steel anchor fasteners/ bolts, nylon seperator to prevent bimetallic contacts with nuts and washers etc. of stainless steel				
	(c) Providing and filling, two part pump filled, structural silicone sealant and one part weather silicone sealant compatible with the structural silicone sealant of required bite size in a clean and controlled factory / work shop environment , including double sided spacer tape, setting blocks and backer rod, all of approved grade, brand and manufacturer, as per the approved sealant design, within and all around the perimeter for holding glass.				
	(d) Providing and fixing in position flashings of solid aluminium sheet 1 mm thick and of sizes, shapes and profiles, as required as per the site conditions, to seal the gap between the building structure and all its interfaces with curtain glazing to make it watertight.				
	(e) Making provision for drainage of moisture/ water that enters the curtain glazing system to make it watertight, by incorporating principles of pressure equalization, providing suitable gutter profiles at bottom (if required), making necessary holes of required sizes and of required numbers etc. complete.				
	This item includes cost of all inputs of designing, labour for fabricating and installation of aluminium grid, installation of glazed units, T&P, scaffolding and other incidental charges including wastages etc., enabling temporary structures and services, cranes or cradles etc. as described above and as specified. The item includes the cost of getting all the structural and functional design checked and all the shop drawings vetted by the Principals of the structural glazing system.				
	The item also includes the cost of all mock ups at site, cost of all samples of the individual components for testing in an approved laboratory, field tests on the assembled working structural glazing as specified, cleaning and protection till the handing over of the building for occupation. In the end, the Contractor shall provide a water tight structural glazing having all the performance characteristics etc. all complete as required, as per the Architectural drawings, as per item description, as specified, as per the approved shop drawings and as directed by the Engineer-in-Charge.				

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
	"Note:- 1 The cost of providing extruded aluminium frames, shadow boxes, fire stop (barrier)- cum-smoke seals, extruded aluminium section capping for fixing in the grooves of the curtain glazing and vermin proof stainless steel wire mesh shall be paid for separately under relevant items under this sub-head. However, for the purpose of payment, only the actual area of structural glazing (including width of grooves) on the external face shall be measured in sqm. up to two decimal places.				

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
	Note-2 : The following performance test are to be conducted on structural glazing system if area of structural glazing exceeds 2500 Sqm from the certified laboratories accreditated by NABL (National Accreditation Board for Testing and Calibration Laboratories), Department of Science & Technologies, India. The NIT approving authority will decide the necessity of testing on the basis of cost of the work, cost of the test and importance of the work.				
	Performance Testing of structural glazing system				
	Tests to be conducted in the NABL certified laboratories				
	1. Performance Laboratory Test for Air Leakage Test (-50pa to - 300pa) & (+50pa to +300pa) as per ASTM E-283-04 testing method for a range of testing limit 1 to 200 mVhr“				
	2. Static Water Penetration Test. (50pato 1500pa) as per ASTME- 331-09 testing method for a range upto 2000 ml.“				
	3. Dynamic Water Penetration (50pato 1500pa) as per AAMA 501.01-05 testing method for a range upto 2000 ml“				
	4. Structural Performance Deflection and deformation by static air pressure test (1.5 times design wind pressure without any failure) as per ASTME-330-10 testing method for a range upto 50 mm“				
	5. Seismic Movement Test (Upto 30 mm) as per AAMA 501.4-09 testing method for Qualitative test“				
	Tests to be conducted on site				
	6. Onsite Test for Water Leakage for a pressure range 50 kpa to 240 kpa (35 psi) upto 2000 ml"	Sqm	2,409.90	360.00	867564.00
111	Providing, assembling and supplying vision glass panels (IGUs) comprising of hermetically-sealed 6-12- 6 mm insulated glass (double glazed) vision panel units of size and shape as required and specified, comprising of an outer heat strengthened float glass 6mm thick, of approved colour and shade with reflective soft coating on surface # 2 of approved colour and shade, an inner Heat strengthned clear float glass 6mm thick, spacer tube				
	12mm wide, dessicants, including primary seal and secondary seal (structural silicone sealant) etc. all complete for the required performances, as per the Architectural drawings, as per the approved shop drawings, as specified and as directed by the Engineer-in-Charge. The IGUs shall be assembled in the factory/ workshop of the glass processor. (Payment for fixing of IGU Panels in the curtain glazing is included in cost of item No.26.2) For payment, only the actual area of glass on face # 1 of the glass panels (excluding the areas of the grooves and weather silicone sealant) provided and fixed in position, shall be measured in sqm.				
	(i) Coloured tinted float glass 6mm thick substrate with reflective soft coating on face # 2, + 12mm Airgap + 6mm Heat Strengthened clear Glass of approved make having properties as visible Light transmittance (VLT) of 25 to 35 %, Light reflection internal 10 to 15%, light reflection external 10 to 20 %, shading coefficient (0.25- 0.28) and U value of 3.0 to 3.3 W/m2 degree K etc. The properties of performance glass shall be decided by technical sanctioning authority as per the site requirement.	Sqm	3,730.70	288.00	1074441.60

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
112	Extra for openable side / top hung vision glass panels (IGUs) including providing and supplying at site all accessories and hardwares for the openable panels as specified and of the approved make such as heavy duty stainless steel friction hinges, min 4 -point cremone locking sets with stainless steel plates, handles, buffers etc. including necessary stainless steel screws/ fasteners, nuts, bolts, washers etc. all complete as per the Architectural drawings, as per the approved shop drawings, as specified and as directed by the Engineerin- Charge.	Sqm	2,941.60	86.40	254154.24
113	Providing, fabricating and supplying shadow box of required size and shape, for fixing in the spandrel portion of the structural glazing, in linear as well as curvilinear portions of the building by providing semi -rigid, inorganic, non-combustible fibre glass wool insulation 50 mm thick, conforming to IS: 8183 and BS: 3958 Part 5. The insulation layer shall have facing (factory bonded on surface # 1of the fibre glass insulation layer), of black nonwoven fibre glass tissue of nominal thickness 0.5 mm and nominal mass not less than 60 gm / sqm, made of randomly oriented glass fibres distributed in a binder by a wet-lay process including fixing 1.5 mm thick solid aluminum sheet backing using, 6 mm thick cement board including SS rivets, nuts, bolts, washers etc complete.	sqm	1,542.60	72.00	111067.20
114	Providing and supplying Spandrel Glass Panels comprising of 6 mm thick heat strengthened monolithic float glass of approved colour and shade with reflective soft coating on surface # 2 of approved colour and shade so as to match the colour and shade of the lGUs in the vision panels etc., all complete for the required performances as specified, as per the Architectural drawings, as per the approved shop drawings, as specified, and as directed by the Engineer- in-Charge. For payment, only the actual area of glass on face # 1 of the glass panels (but excluding the area of grooves and weather silicone sealant) provided and fixed in position, shall be measured in sqm.(Payment for fixing of Spandrel Glass Panels in the curtain glazing is included in cost of relevent Item*).				
	(i) Coloured tinted float glass 6mm thick substrate with reflective soft coating on face # 2, having properties as visible Light transmittance (VLT) of 25 to 35%, Light reflection internal 10 to 15%, light reflection external 10 to20%, shading coefficient (0.25- 0.28) and U value of 3.0 to 3.3 W/m2 degree K etc. The properties of performance glass shall be decided by technical	Sqm	2,798.70	72.00	201506.40
115	Providing and fixing fire resistant door frame of section 143 x 57 mm having built in rebate made out of 16 SWG G.I. sheet (zinc coating not less than 120 gm/sqm) duly filled with vermuculite based concrete mix, suitable for mounting 60 minutes fire rated door shutters. The frame is fitted with intumuscent fire seal strip of size 10x4 mm (minimum) alround the frame and fixing with dash fastener of approved size and make, including applying a coat of approved brand fire resistant primer etc. complete as per direction of Engineer-in-charge (Dash fastener to be paid for separately).	Mtr	1,249.20	6.00	7495.20

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
116	Providing and fixing 50 mm thick glazed fire resistant door shutters of 60 minutes fire rating conforming to IS:3614 (Part-II), tested and certified as per laboratory approved by Engineer-in-charge, with suitable mounting on door frame, consisting of vertical styles, lock rail, top rail 100 mm wide, bottom rail 200 mm wide, made out of 16 SWG G.I.sheet (zinc coating not less than 120 gm/m2) duly filled FR insulation material and fixing with necessary stainless steel ball bearing hinges of approved make, including applying a coat of approved fire resistant primer etc. all complete as per direction of Engineer-in-charge (panneling to be paid for separately).	sqm	5,335.85	1.00	5335.85
117	Providing and fixing glazing in fire resistant door shutters, fixed panels, ventilators and partitions etc., with G.I. beading of appropriate size, made out of 20 SWG G.I.sheet (zinc coating not less than 120 gm/m2), fire resistant sealant, including applying a coat of approved fire resistant primer on G.I. beading etc., complete all as per direction of Engineer-incharge.				
	With clear fire resistant glass panes 6mm thick of approved brand, having minimum 60 minutes fire resistance	Sqm	27,399.45	1.50	41099.18

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
118	Providing and fixing panic bar / latch (Double point) fitted with a single body, Trim Latch & Lock on back side of the Panic Latch of reputed brand and manufacture to be approved by the Engineer- in- charge, all complete.	Each	6,143.30	1.00	6143.30
119	Supply of UPVC pipes (B Type) & fittings conforming to IS-13592-1992				
	(i) Double Socketed 3 Meter Length				
	110 mm	Metre	374.85	30.00	11245.50
	Single Socketed 1.8 Meter Length				
	110 mm	metre	348.67	20.00	6973.40
	Coupler				
	110 mm	Each	101.15	10.00	1011.50
	Plain Tee				
	110 mm	Each	101.15	10.00	1011.50
	Door Tee				
	110 mm	Each	232.05	5.00	1160.25
	Vent cowl				
	160 mm	Each	39.27	5.00	196.35
	Pipe Clip				
	110 mm	Each	24.99	25.00	624.75
	110 x 110 P Trap	Each	334.39	5.00	1671.95
	110 x 110 S Trap	Each	516.46	5.00	2582.30
	Branch Saddle 110 x 75 mm	Each	95.20	5.00	476.00
	Plain Floor Trap with top tile & Stainer				
	75 mm	Each	171.36	10.00	1713.60
120	Labour for fitting and fixing U.P.V.C. pipes for above ground work including cost of jointing materials etc. fitting and fixing all necessary specials, cutting pipes, cutting holes in walls or R.C. floor where necessary and mending good all damages excluding the cost of masonry or concrete work, if necessary, but including the cost and fitting and fixing holder bat clamps (any floor) or for underground work including cutting trenches upto 1.5 metre and refilling the same complete as per direction of the Engineer-in-charge. (Payment will be made on centre line measurement of the total pipeline including specials).				
	110 mm dia.	metre	67.83	50.00	3391.50
121	Providing and fixing angular/bent grab bars fabricated from 32 mm dia seamless stainless steel tubes with peened non-slip gripping surface, polished flanges firmly fixed, to be fully safe, with heavy duty anchor fastner having finish/capping similar to the grab bar, complete, including				
	For EWC of Handicaped toilet	Each	1050	2.00	2100.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
122	Anti termite treatment to the top surface of the consolidated earth within plinth walls with chemical emulsion by admixing chloropyrofos emulsifiable concentrates (1% concentration) with water by weight at the rate of 5 Litres per sq. m. of the surface before sand bed or sub-grade is laid. Holes upto 50 mm. to 75 mm. deep at 150 mm. centre to centre both ways shall be made with 12 mm, diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion. The work shall be carried out as per specification described in para 6.4 of code IS-6313 (part -II) 1981. (Mode of measurment will be per Sq.m of plan area of plinth treated.)	Sq.m.	130.90	1200.00	157080.00
123	Anti-termite treatment to the junction of wood work and masonry walls with chemical emulsion by admixing chloropyrofos emulsifiable concentrates (1% concentration) with water by weight including spraying at the points of contact with the adjoining masonry by drilling 6mm. dia holes at a downward angle of about 45 degree at the junction of woodwork and masonry and squirting chemical emulsion into these holes at the rate of half litre per hole. The entire work is to be carried out as per specification of Code I.S.-6313 (Part-III)-1981. The shutters are to be sprayed with emulsion. on both sides. All wooden fixtures like almirahs, racks etc. are also to be throughly sprayed with chemical emulsion. (Payment will be made on the basis of outside measurements of doors and windows)	Sq.m.	72.59	50.00	3629.50
124	Construction of septic tank of different capacities as per approved drawing with 1st class brick work in cement mortar (1:4) including two 560 mm dia. R.C.C. manhole cover(heavy type)of approved make supplied, fitted and fixed in the 100mm thick R.C.C (1:1.5:3) top slab with necessary fittings, 20mm thick cement plaster (4 : 1) with neat cement finish to the internal surfaces and 15 mm thick cement plaster (4 : 1) to outside wall upto 200 mm below G.L floor finished with 25 mm thick grey artificial stone over 100 mm thick R.C.C(1:1.5:3) bottom slab including supplying, fitting and fixing all necessry specials, fittings, S.W. tees, C.I. foot rest etc. including excavation earth in all sorts of soil, shoring, bailing out and pumping out water as necessary, ramming, dressing the bed and fefilling the sides of the tanks with earth, removing spoils, filling up the chamber with clear water, removing foreign materials from the chamber and including constructing attached inspection pit as per approved drawing and connecting all necessary pipes, joints etc. with internal plaster work and artificial stone flooring is to be done with admixture of water proofing compound @ 0.5% by weight of cement with all costs of labour and materials.				
	(iv) For 50 users A) With Pakur variety.	Each	106,716.82	1.00	106716.82
125	Constructing brick masonry chamber for underground C.I. inspection chamber and bends with bricks in cement mortar 1:4 (1 cement : 4 coarse sand) C.I. cover with frame (light duty) 455x610 mm internal dimensions, total weight of cover with frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg), R.C.C. top slab with 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size), foundation concrete 1:5:10 (1 cement : 5 coarse sand (Zone III) : 10 graded stone aggregate 40 mm nominal size), inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand), finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete as per standard design:				

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
	Inside dimensions 500x700 mm and 45 cm deep for pipe line with one or two inlets :				
	With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	Each	5,466.70	8.00	43733.60
126	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement :				
	1:1½:3 (1 cement : 1½ coarse sand (zone-III) : 3 graded stone aggregate 20 mm nominal size).	Cu.m	7,145.80	5.00	35729.00
127	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level :				
	1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size).	Cu.m	5,772.60	5.00	28863.00
128	Supplying and laying Polythene Sheet (150gm / sq.m.) over damp proof course or below flooring or roof terracing or in foundation or in foundation trenches.	Sq.m	28.56	1100.00	31416.00
129	Brick soling with picked jhama bricks including preparation of bed as necessary with brick joints properly filled in and packed with powdered earth and including necessary cushion of similar material below the soling (and in between layers when more than one layer is used) completes as per direction.				
	Single brick flat soling (thickness 75 mm.)	Sq.m	403.41	100.00	40341.00
130	Drilling and fixing of 12 mm dia. Holding Down bolts by Hilti or equivalent as per drawing and direction of Engineer in charge.	Each	350.00	36.00	12600.00
131	Making soak pit 2.5 m diameter 3.0 metre deep with 45 x 45 cm dry brick honey comb shaft with bricks and S.W. drain pipe 100 mm diameter, 1.8 m long complete as per standard design.				
	With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	Each	20,681.55	1.00	20681.55
132	Supplying and fixing of following sizes of steel conduit along with accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required.				
a)	25 mm	Mtr	147.00	100.00	14700.00
b)	32 mm	Mtr	198.00	100.00	19800.00
c)	40 mm	Mtr	293.00	100.00	29300.00
133	Supplying and fixing of following sizes of medium class PVC conduit along with accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required.				
a)	25 mm	Mtr	69.00	1000.00	69000.00
b)	32 mm	Mtr	89.00	300.00	26700.00
c)	40 mm	Mtr	114.00	200.00	22800.00

ITEM NO.	DESCRIPTION OF ITEMS	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
134	Supply of UPVC pipes (B Type) & fittings conforming to IS-13592-1992				
	Single Socketed 3 Meter Length				
	75 mm	Mtr	233.24	24.00	5597.76
	Single Socketed 1.8 Meter Length				
	75 mm	Mtr	242.76	20.00	4855.20
	Coupler				
	75 mm	Each	54.74	15.00	821.10
	Plain Tee				
	75 mm	Each	54.74	5.00	273.70
	Bend 87.5º				
	75 mm	Each	72.59	5.00	362.95
135	Profile cutting for making the opening on the wall by modern profile cutting / core cutting machine with dimond cutter or equivalent all complete as per the drawing and direction of the Engineer in charge.				
	(a) 150 mm dia core cutting.	Each	800.00	8.00	6400.00
	(b) 200 mm dia core cutting.	Each	1,000.00	8.00	8000.00
	Profile cutting	Mtr	2,000.00	30.00	60000.00
136	Supplying, fitting & fixing SS domical grating.				
	125 mm.	Each	200.00	20.00	4000.00
	TOTAL =				**48381006.21**

SCIENCE CITY, KOLKATA, WEST BENGAL

BILL OF QUANTITY FOR UNDERGROUND WATER RESERVOIR & PUMP HOUSE

Sl. No.	Item	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
1	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means over areas (exceeding 30cm in depth. 1.5m in width as wel as 10 sqm on plan) including disposal of excavated earth, lead upto 50m and lift upto 1.5m, disposed earth to be level ed and neatly dressed.				
	All kinds of soil	Cum	125.95	2150.00	270,792.50
	(Including bailing out of water if needed)				
2	Removal of rubbish,earth etc. from the working site and disposal of the same beyond the compound, in conformity with the Municipal / Corporation Rules for such disposal, loading into truck and cleaning the site in all respect as per direction of Engineer in charge	Cum	197.54	1450.00	286,433.00
3	Extra for every additional lift of 1.5 m or part thereof in excavation /banking excavated or stacked materials.				
	All kinds of soil (1.5 to 3.0 m)	cum	51.75	850.00	43,987.50
	All kinds of soil (Below 3.0 m)	cum	103.50	250.00	25,875.00
	(Including bailing out of water if needed)				
4	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.	Cu.m	125.75	700.00	88025.00
5	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level :				
	1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 40mm nominal size)	Cu.m.	4814.55	30.00	144,436.50

Sl. No.	Item	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
6	Providing and laying in position ready mixed M-25 grade concrete for reinforced cement concrete work, using cement content as per approved design mix, manufactured in fully atutomatic batching plant and transported to site of work in transit mixer for all leads having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of RMC from transit mixer to site of laying, excluding the cost of centering, shuttering, finishing and reinforcement including cost of admixers in recommended proportions as per IS:9103 to accelerate / retard setting of concrete, improve workability without impairing strength & durability as per direction of the Engineer-in-charge				
	(Note :- Cement content considered in this item is @ 330 kg/cum.Excess/less cement used as per design mix is payable/recoverable separately).				
	All works upto plinth level	Cum	6713.6	360.00	2,416,896.00
	All works above plinth level up to floor V level	Cum	7517.2	30.00	225,516.00
7	Centering and shuttering including strutting, propping etc. and removal of form for :				
a.	Foundations, footings, bases of columns, etc. for mass concrete.	Sqm	193.95	85.00	16,485.75
b.	Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	Sqm	378.60	1000.00	378,600.00
c.	Suspended floors, roofs, landings, balconies and access platform.	Sqm	422.30	600.00	253,380.00
d.	Lintels, beams, plinth beams, girders, bressumers and cantilevers.	Sqm	342.90	190.00	65,151.00
e.	Columns, Pillars, Piers, Abutments, Posts and Struts.	Sqm	467.85	140.00	65,499.00
8	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete upto plinth level.				
	Thermomechanicaly treated bar of grade Fe-500D or more	Kg	56.60	49000.00	2,773,400.00
9	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete above plinth level.				
	Thermomechanicaly treated bar of grade Fe-500D or more	Kg	56.60	6000.00	339,600.00
10	Providing M.S. foot rests including fixing in manholes with 20x20x10 cm cement concrete blocks 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) as per standard design :				
	With 20x20 mm square bar	Each	267.95	80.00	21,436.00

Sl. No.	Item	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
11	Providing and Placing in position suitable PVC water stops conforming to IS:12200 for construction/ expansion joints between two RCC members and fixed to the reinforcement with binding wire before pouring concrete etc. complete :				
	Serrated with central bulb (225 mm wide, 8-11 mm thick)	Mtr	254.15	400.00	101,660.00
12	Supplying and applying waterproofing treatment to the inside & outside the R.C. Water-body with 2 coats of ready to use waterproofing chemical similar to "Sikatop seal 109 HI" or approved equivalent, applied by brush and complete in all respect strictly as per manufacturer's specification and instruction of Engineer. The work has to be done by manufacturer's authorised applicator.	Sq.m.	470	1260.00	592,200.00
13	Supplying and fixing C.I. cover without frame for manholes :				
	560 mm diameter C.I. cover (heavy duty) the weight of the cover to be not less than 108 kg	Each	5891.2	8.00	47,129.60
14	Brick work with clay flyash F.P.S. (non modular) brick of class designation 7.5 in superstructure above plinth level up to floor five level in :				
	Cement mortar 1:6 (1 Cement : 6 Coarse sand)	Cum	5,269.05	35.00	184,416.75
15	Labour for Chipping of concrete surface before taking up Plastering work.	Sq.m.	24.99	1200.00	29988.00
16	12mm Cement plaster of mix				
	1:4 (1 cement:4 coarse sand)	Sqm	180.85	190.00	34,361.50
17	18 mm cement plaster in two coats under layer 12 mm thick cement plaster 1:5 (1 cement: 5 coarse sand) finished with a top layer 6mm thick cement plaster 1:6 (1 cement: 6 fine sand).	Sqm	255.55	190.00	48,554.50
18	6 mm cement plaster of mix :				
	1:3 (1 cement: 3 fine sand)	Sqm	143.80	1200.00	172,560.00
19	Providing and applying white cement based putty of average thickness 1mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete.	Sqm	87.35	500.00	43,675.00

Sl. No.	Item	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
20	Steel work welded in built up sections/ framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required.				
	In gratings, frames, guard bar, ladder, railings, brackets, gates and similar works	Kg	85.95	160.00	13,752.00
21	Half brick masonry with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundations and plinth in :				
	cement mortar 1:4 (1 cement : 4 coarse sand)	Sqm	593.5	250.00	148,375.00
22	Applying one coat of water thinnable cement primer of approved brand and manufacture on wall surface :				
	Water thinnable cement primer	Sqm	36.95	450.00	16,627.50
23	Distempering with 1st quality acrylic distemper (ready mixed) of approved manufacturer, of required shade and colour complete, as per manufacturer's specification.				
	Two or more coats on new work	Sqm	53.15	450.00	23,917.50
24	Finishing walls with water proofing cement paint of required shade :				
	New work (Two or more coats applied @ 3.84 kg/10 sqm)	Sqm	58.80	200.00	11,760.00
25	Providing and laying in situ five course water proofing treatment with APP (Atactic Polypropylene) modified Polymeric memberane over roof consisting of first coat of bitumen primer @ 0.40Kg per sqm, 2nd & 4th courses of bonding material @ 1.20 kg/sqm, which shall consist of blown type bitumen of grade 85/25 conforming to IS : 702, 3rd layer of roofing membrane APP modified Polymeric membrane 2.0 mm thick of 3.00 Kg/ sqm weight consisting of five layers prefabricated with centre core as 100 micron HMHDPE film sandwiched on both sides with polymeric mix and the polymeric mix is protected on both side with 20 micron HMHDPE film. 5th, the top most layer shall be finished with brick tiles of class designation 10 grouted with cement mortar 1:3 (1 cement : 3 fine sand) mixed with 2% integral water proofing compound by weight of cement over a 12 mm layer of cement mortar 1:3 (1 cement : 3 fine sand) and finished neat (item of laying brick tiles shall be paid for separately)	Sqm	321.5	130.00	41,795.00

Sl. No.	Item	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
26	Providing and fixing on wall face unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion, (i) Single socketed pipes.				
	110 mm diameter	Mtr	236.35	12.00	2,836.20
27	62 mm thick cement concrete flooring with concrete hardener topping, under layer 40 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) and top layer 12mm thick screed concrete consisting of mix 1:2 (1 cement : 2 graded stone aggregate 6 mm nominal size) by volume, hardening compound Sika Chapdur or equivalent to be applied on the top @ 5 Kg per Sq.m or as per manufacturer's specifications. This includes cost of cement slurry, but excluding the cost of nosing of steps etc. complete.	Sqm	609.05	160.00	97,448.00
28	Neat cement punning.	Sqm	42.60	1200.00	51,120.00
29	Providing and fixing aluminium work for doors, windows, ventilators ,louvers and partitions with extruded built up standard tubular sections/ appropriate Z sections and other sections of approved make conforming to IS: 733 and IS: 1285, fixing with dash fasteners of required dia and size, including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with required EPDM rubber/ neoprene gasket etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle, Aluminium snap beading for glazing / paneling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing, paneling and dash fasteners to be paid for separately) :				
	For fixed portion				
	Anodised aluminium (anodised transparent or dyed to required shade according to IS:1868, Minimum anodic coating of grade AC 15)	Kg	355.20	60.00	21312.00
	For shutters of doors, windows & ventilators including providing and fixing hinges/ pivots and making provision for fixing of fittings wherever required including the cost of EPDM rubber / neoprene gasket required (Fittings shall be paid for separately).				
	Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15)	Kg	415.05	50.00	20752.50

Sl. No.	Item	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
30	Providing and fixing glazing in aluminium door, window, ventilator,louver shutters and partitions etc. with EPDM rubber / neoprene gasket etc. complete as per the architectural drawings and the directions of engineer-in-charge . (Cost of aluminium snap beading shall be paid in basic item):				
	With float glass panes of 4.0 mm thickness	Sqm	741.50	4.50	3,336.75
31	Providing and fixing 1mm thick M.S. sheet door with frame of 40x40x6 mm angle iron and 3 mm M.S. gusset plates at the junctions and corners, all necessary fittings complete, including applying a priming coat of approved steel primer.				
	Using M.S. angles 40x40x6 mm for diagonal braces	Sqm	2,870.25	12.00	34,443.00
32	Applying priming coat:				
	With ready mixed red oxide zinc chromate primer of approved brand and manufacture on steel galvanised iron/ steel works	Sqm	29.10	8.00	232.80
33	Painting with synthetic enamel paint of approved brand and manufacture to give an even shade :				
	Two or more coats on new work	Sqm	78.40	8.00	627.20
34	Providing and fixing mild steel round holding down bolts with nuts and washer plates complete.	Kg	68	120.00	8160.00
35	Providing, fabricating, transport and installing in conc/ masonry miscellaneous fixtures e.g. anchorbolts, anchors, sleeves, inserts, pipes hangers, monorail, conduits and any other misc. fixtures of M.S.,GI, WI, CI steel or other metal items including necessary templates.The outer faces of inserts to be made clean to the satisfaction of the engineer (materials to be arranged by the contractor).	Kg	85	800.00	68000.00
36	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings This includes jointing of pipes & fittings with one step CPVC solvent cement, trenching, refilling & testing of joints complete as per direction of Engineer in Charge.				
	50 mm nominal outer dia Pipes	Mtr	484.25	30.00	14527.50

Sl. No.	Item	Unit	Rate (Rs.)	Quantity	Amount (Rs.)
37	Providing and laying S&S Centrifugally Cast (Spun) / Ductile Iron Pipes conforming to IS : 8329 :				
	100 mm dia Ductile Iron Class K-9 pipes	Mtr	958.95	30.00	28768.50
	150 mm dia Ductile Iron Class K-9 pipes	Mtr	1438.35	20.00	28767.00
38	Filling in foundation or plinth by silver sand in layers not exceeding 150 mm as directed and consolidating the same by thorough saturation with water, ramming complete including the cost of supply of sand. (payment to be made on measurement of finished quantity)	Cu.m	1114.0899	290.00	323086.07
39	Supplying and fixing of following sizes of steel conduit along with accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required.				
	25 mm	Mtr	147.00	50.00	7,350.00
	32 mm	Mtr	198.00	50.00	9,900.00
	40 mm	Mtr	293.00	50.00	14,650.00
40	Supplying and fixing of following sizes of medium class PVC conduit along with accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required.				
	25 mm	Mtr	69.00	400.00	27,600.00
	32 mm	Mtr	89.00	100.00	8,900.00
	40 mm	Mtr	114.00	100.00	11,400.00
	Total:				**9,709,503.12**

APPROVED MAKE OF MATERIALS : CIVIL-ARCHITECTURAL-S&P ITEMS

MATERIALS	APPROVED MAKE
POLY-SULPHIDE SEALENTS	PIDILITE ,BASF, SIKA, FOSROC, CHRYSO
STRUCTURAL STEEL SECTIONS	TATA, SAIL, RINL, JINDAL
ADMIXTURE	FOSROC, MC, SIKA, PIDILITE, DR. FIXIT, BASF, CHRYSO
WHITE CEMENT	J.K. WHITE, BIRLA WHITE
WATER PROOFING COMPOUND	BASF, SIKA, FOSROC, ZYPEX, CHRYSO, DR FIXIT, LAGREEN, STP
INJECTION GROUTING	PIDILITE(DR. FIXIT), SIKA, FOSROC, BASF, CHRYSO
NONMETALIC SURFACE HARDNER	SIKA, FOSROC , PIDILITE, BASF
LOCKS/LATCH	GODREJ, HARRISON, ARCHIS OR EQUIVALENT ISI MARKED
LAMINATES	MERINO, ROYAL TOUCHE, CENTURY, EURO MICA, ARCHIDLAM, GREENLAM
WIRE MESH	STERLING ENTERPRISES, TRIMURTY WELDED MESH OR EUIVALENT ISI MARKED
PRELAMINATED PARTICLE BOARD	CENTURY, NOVOPAN, GREEN PLY OR EQUIVALENT
ADHESIVE	PIDILITE, SIKA, FOSROC, BASF, CHRYSO
EPOXY MORTAR	FOSROC, SIKA, PIDILITE, BASF, CHRYSO, BERGER
DASH FASTNERS	HILTI, FISHER, CANON, BOSCH, DORMA OR EUIVALENT ISI MARKED
BOARD & PLYWOOD	DURO, KITPLY, CENTURY, MAYUR, GREEN PLY
HYDRAULIC DOOR CLOSER / DOOR FLOOR SPRING / DOOR FITTINGS	GODREJ, HAFELE, DORMA, GARNISH OR EQUIVALENT ISI MARKED
S.S. RAILING	JINDAL STAINLESS STEEL LTD, STEEL JUNCTION OR EQUIVALENT
FIRE CHECK DOORS & RADIOACTIVE DOOR	SHAKTIMET HORMANN, NAVAIR, PROMAT, METAFLEX, TUFWUD, KHEMKA, SEHGAL
FIRE DOOR FITTINGS & ACCESSORIES, PANIC DEVICE, SMOKE SEAL STRIP	DORMA, IMPORTED PROMAT, ASTRO FLAME, INGERBOLL RAND, MONARCH OR EQUIVALENT ISI MARKED
ALUMINIUM SECTIONS & ANODISED ALUMINIUM HARDWARE	JINDAL, HINDALCO, INDAL, HARDIMA, EVERITE, SIGMA OR EQUIVALENT ISI MARKED
GLASS	MODIGUARD, SAINT GOBAIN, PILKINTON, ASAHI
ALUMINIUM SECTIONS	JINDAL, HINDALCO, INDAL
FRICTION STAY HINGES	EARL-BIHARI OR EQUIVALENT ISI MARKED
NUTS, BOLTS AND SCREWS, STEEL	KUNDAN, PRIYA, ATUL OR EQUIVALENT ISI MARKED
EPDM GASKET	HANU, ANAND, MODI OR EQUIVALENT ISI MARKED
SILICON SEALANTS	DOW CORNING, GE, PIDILITE, SIKA
ADHESIVE TAPE	3M, MCCOY, FOSROC, PIDILITE, SIKA, 3R
CERAMIC TILES	JOHNSON, SOMANY, ASIAN, KAJARIA, BELL CERAMICS, NITCO, ORIENT
CEMENT CONCRETE TILES, PAVER BLOCKS, CHEQUERED TILES, TERRAZO TILES, ROOF CLAY TILES	PAVIT, JOHNSON, NITCO, NTC, HINDUSTAN, PODDAR, BHARAT, REGENCY, MULTIWIN, ULTRA TILE, GK CONCRETE, UNISTONE, KENJAI
VITRIFIED TILES	JOHNSON, ASIAN GRANITO, NAVIN DIAMOND, KAJARIA, NITCO, SOMANY, MARBITO, EURO, BELL, PAVIT
TILE ADHESIVE	PIDILITE, FERROUS, SIKA, FOSROC, LATICRETE, BASF, CHRYSO, ARALDITE, LA GREEN, KERAKOLL
ACRYLIC EMULSION PAINT, SYNTHETIC ENAMEL PAINT, DISTEMPER	ASIAN, BERGER, NEROLAC, DULUX
STAINLESS STEEL SINKS	JINDAL, NILKANTH, AMC, CORBA, JAYNA, NIRALI OR EQUIVALENT ISI MARKED
C.P.BRASS FITTINGS	JAQUAR, PARKO, MARC, NOVA, GROHE, ESSCO
SOIL, WASTE & VENT PIPES & FITTINGS (A) CENTRIFUGAL CAST IRON TYPE	RIF, NECO OR EQUIVALENT ISI MARKED
G.I. PIPES & FITTINGS	TATA, SAIL, JINDAL, HISSAR, JP, UNIK, ICS OR EQUIVALENT ISI MARKED
GUNMETAL VALVES	LEADER, SANT, ZOLOTO OR EQUIVALENT ISI MARKED

APPROVED MAKE OF MATERIALS : CIVIL-ARCHITECTURAL-S&P ITEMS

STONEWARE PIPE & GULLY TRAPS	PERFECT, PARRY OR EQUIVALENT ISI MARKED
MS PIPES	KESORAM, ELECTRO STEEL OR EQUIVALENT ISI MARKED
BALL VALVES	ZOLOTO, IBP, ARCO, DANFOS, IBP OR EQUIVALENT ISI MARKED
BUTTERFLY VALVES	AUDCO, ZOLOTO OR EQIVALENT
SPIDER FITTINGS	DORMA, HAFELE, OZONE
FALSE CEILING	HUNTER DOUGLAS LUXALON, LAGYP, INDIA GYPSUM, ANUTONE, ARMSTRONG, HILUX
CEMENT	ACC, LAFARGE, AMBUJA ULTRATECH, BIRLA, JP
AAC BRICK	INSPIRA, BILLTECH, KONCRETE
REINFORCEMENT STEEL (TMT)	SAIL,TATA, RINL, VIZAG
ALUMINIUM LOUVER	HUNTER DOUGLAS OR EQUIVALENT ISI MARKED
TOILET PARTITIONS HDF	MERINO, HAFELE, DEBO, SOLAS
FLUSH DOORS	MERINO, DURO, CENTURY, ALISHAN, KUTTY, KHEMKA, TUFWUD
POLYCARBONATE SHEET	DANPALON, BAYER MATERIAL SC., MAKROLON, SUNPAL
EXPANSION JOINTS	SIKA, PIDILITE DR FIXIT, 3M, BASF, 3R
WOODEN FLOORING	MIKASA, WURZE OR EQUIVALENT ISI
BRICK	LOCALLY AVAILABLE BEST QUALITY CLAY BRICK CONFORMING TO IS CODE
STONE CHIPS	PAKUR, RAMPURHAT OR SIMILAR APPROVED VARIETY
WALL PUTTY	BIRLA WHITE WALL CARE, J K PUTTY OR EQUIVALENT ISI MARKED
SAND	APPROVED SOURCE CONFORMING TO IS CODE
PVC, UPVC, FRP DOORS	DUROPLAST, SUPREME, POLYLINE, RAJSHRI, FENESTA, RAVALSON, NYFLEX, AMCON
NON ASBESTOS FIBRE CEMENT BOARD	EVEREST, SHERA, HILUX OR EQUIVALENT ISI MARKED
ANTITERMITE COMPOUND	BIFLEX, BAYER OR EQUIVALENT ISI MARKED
R C JALI	B R PRECAST, G K PRECAST
GLASS MOSAIC TILES	MRIDUL, OPIO, PALLADIO, PIXEL, ITALIA, ACCURA, MACRANA MARBLE OR EQUIVALENT ISI MARKED
VITREOUS CHINA SANITARY WARE	PARRYWARE, HINDWARE, CERA, KOHLER
SANITARY FITTINGS & ACCESSORIES	PARRY WARE, HIND WARE, CERA, COMMANDER, JAQUAR, ESSCO
CPVC, UPVC, PVC, HDPE, PPR PIPES FITTINGS & ACCESSORIES	SUPREME, ASHIRBAD, ORIPLAST, FINOLEX, PRINCE, ALOM POLY, SFMC
S.S HINGED GRATING	GMGR, CHILLY, JYANA OR EQUIVALENT ISI MARKED
RCC PIPES	PRANALI, PRAGATI, USHA OR EQUIVALENT ISI MARKED
METAL VALVES & FITTINGS, LEVEL INDICATORS, WATER METERS	KIRLOSKAR, SHIVA-DURGA, IVC, ZOLOTO, SANT, HYDINT, LEADER, ADVANCE, DANFOSS, KAYCEE, KENTE, DEMESHE, KALPANA, ITAL, TECHNIKA, MINILEC, TBS, IBP OR EQUIVALENT ISI MARKED
MANHOLES FRAME & COVER & G.I. GRATING	NECO, RIFCO, SRIF, KK OR EQUIVALENT ISI MARKED
PUMPS & MOTORS	KIRLOSKAR, SAM TURBO, BP, ITT, GRUNDFOS, CG, XYLEM, WILO, KSB, SIEMENS, ABB OR EQUIVALENT ISI MARKED
Cable trays	Legrand, OBO, Industrial Perforation(I) Pvt. Ltd.
Steel Conduit (GI)	AKG, Tata Steel, Jindal
Switch MS Box Front Plates	ABB, Legrand, C&S
PVC Conduits & Polythene pipe	Supreme, Harsh Electric, Juvas, Senco, Sun, Utkarsh, AKG For polythene pipe reputed ISI Marked/ PWD enlisted if any, make can be used.
Floor Raceway/Wall Dado	Legrand, OBO

DWG. NO. 17T01-000-DWG-A-T001 REV. 3

RESERVOIR

DRINKING WATER LINE
UNFILTER WATER LINE
SOFT WATER LINE

COOLING TOWER
D.T-1
D.T-3
300 m.m wide open drain
WATER TREATMENT & PUMP HOUSE
CESC ELECTRICITY SUB-STATION
DEEP TUBEWELL-2
GATE
7M
3000 R.C.C PIPE
GATE
ROAD
600 wide drain
Ø300 r.c.c pipe
COMMECTER
CIRCUS CONNECTER ROAD
CIRCUS SERVICE ROAD
BUS SHED LOADING/UNLOADING

SEMINAR HALLS
CONVENTION CENTRE
RAMP UP
MAIN AUDITORIUM
MINI AUDITORIUM
3000 swg pipe laid in 1 in 250
Ø230 swg pipe laid in 1 in 250
150 Ør.c.c pipe
CAR PARKING SPACE
49
52
18
50
51
TICKET COUNTER
300 wide open drain
GATE (UNDER CONSTRUCTION)
158.6 W
15 S
GATE No-2
120 W
150 N

Ø150 r.c.c pipe
ROPEWAY STATION
Ø300 r.c.c pipe
Ø150 r.c.c pipe
CANARA BANK AND CAFETERIA
TAXI LANE
4.9M FLANK
PARK
2.4M MEDIAN
47.4 W
12 N
00 E
00 N

MAIN ENTRY
11 EARTH EXPLORATION HALL
GREEN AREA
SERVICE ENTRY
7.5M WIDE ROAD
6M WIDE ROAD
Ø300 m.m r.c.c lines with Ø150 branches (slope 1:250)
SERVICE GATE
ROAD
HVAC PLANT
SCIENCE EXPLORATION HALL
SCIENCE PARK
MUSICAL FOUNTAIN
Ø230 swg pipe laid in slope 1 in 250
GATE COMPLEX AND TICKET COUNTERS
PEDESTRIAN ROAD
3000 r.c.c pipe laid 1 in 250
3
PUBLIC TOILET
WATER BODY
DYNAMOTION HALL
SPACE ODYSSEY
MONO RAIL CYCLE
Ø150 r.c.c pipe
STORAGE TANK
U.G WATER RESERVOIR
D.M PLANT
COOLING TOWER
ROAD
PUBLIC TOILET
SNACK BAR
GATE NO-1
REAR CAR PARKING SPACE
ROAD
ASSEMBLY STATION
FOOD COURT
TOILET
GRAVITY COASTER
ROAD TOY TRAIN ROUTE
OPEN FOOD STALL AREA
MARITIME CENTRE
LO 20
EXISTING WATER BODY
CANAL
SCIENCE CITY
300 m.m wide open drain
106 E
27.5 N
15 Mtr
4.9M
2.4M
600 m.m wide open drain
E.M BYPASS
TO SALTLAKE

6.1M PLANTATION
4.9M EMBANKMENT
3.0M FOOTPATH
7.0M SERVICE ROAD
4.9M FLANK
11.0M CARRIAGE WAY
2.4M MEDIAN
11.0M CARRIAGE WAY
4.9M EMBANKMENT
7.0M SERVICE ROAD
3.0M FOOTPATH
4.9M EMBANKMENT
6.1M PLANTATION
TO BRIDGE
SCIENCE CITY BUS
GATE No-3
SERVICE ROAD
E.M BYPASS
SERVICE ROAD
PEDESTARIAN SUBWAY
LOADING/UNLOADING BUS SHED
BUS SHED
LOADING/UNLOADING

I.T.C
SONAR BANGLA

REFER. DWG. NO.-
17T01-001-DWG-A-T001
17T01-001-DWG-A-T002
17T01-001-DWG-A-T003

TENDER PURPOSE ONLY

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.
REVIEWED					

NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
REVISED STAIR WIDTH & FIRE STAIRCASE INCORPORATED	SL	SMK	1	22.03.18

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY		
FOR CONSTRUCTION	22.03.2018	S.L
REVIEWED: ARCHITECTURAL		
REVIEWED: CIVIL & STRUCTURAL		
REVIEWED: ELECTRICAL		
REVIEWED: INSTRUMENTATION		
REVIEWED: MECHANICAL		

MASTER PLAN
SHOWING LOCATION OF FOOD COURT

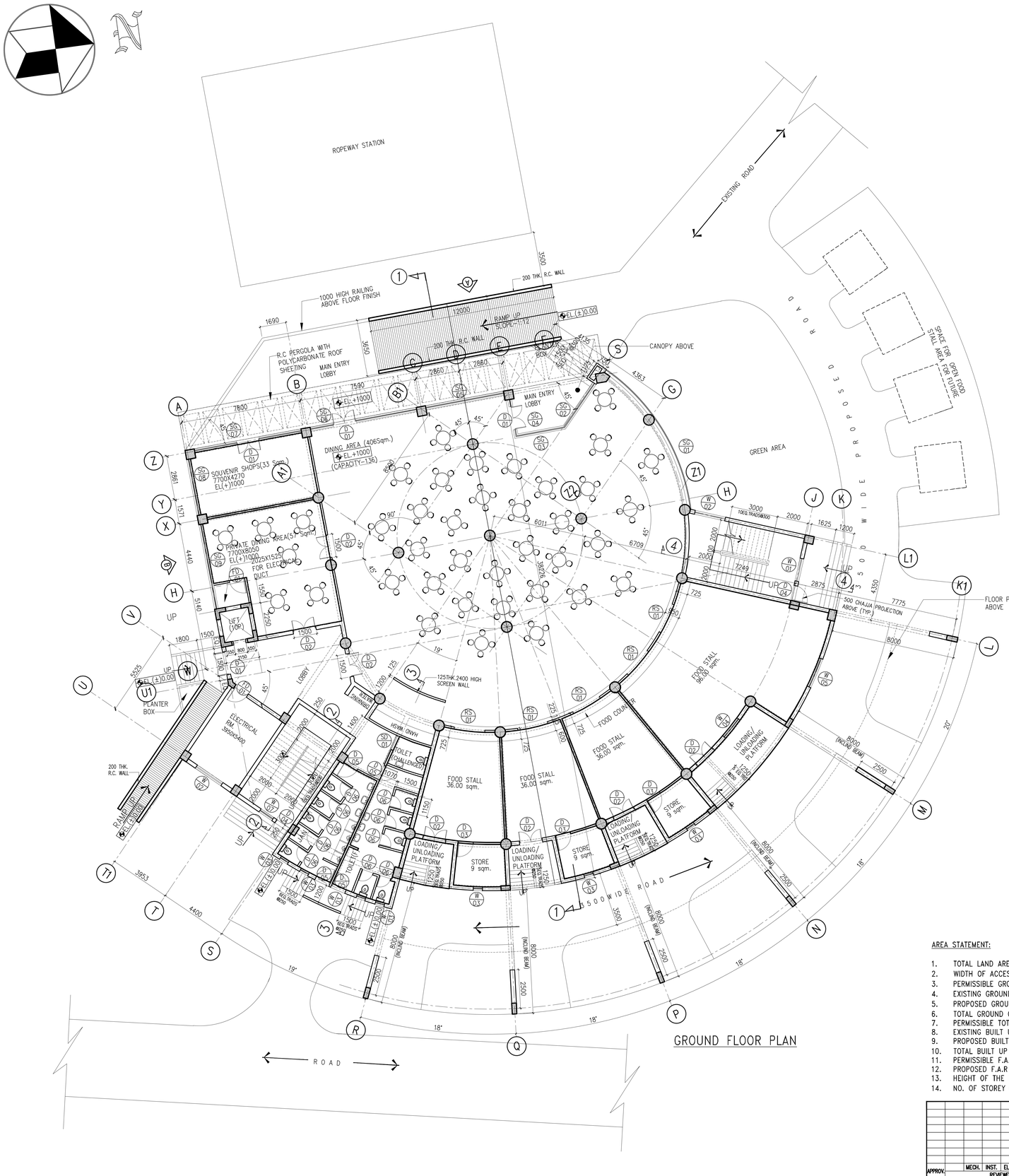
SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

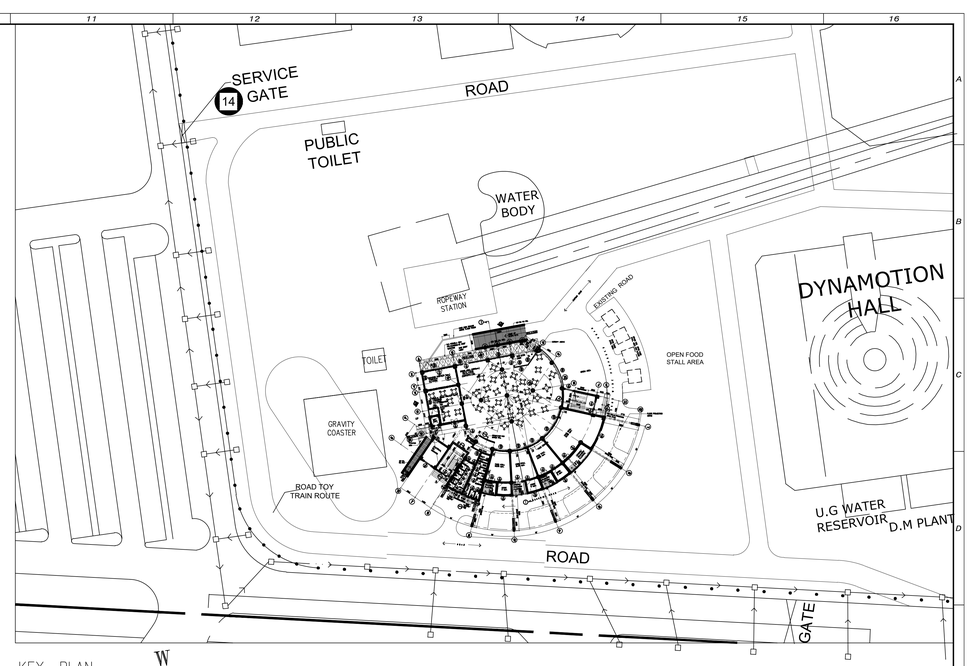
DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
CHENNAI MUMBAI KOLKATA NEW DELHI

DRAWN : SML	CHECKED : S.L	SCALE	1:750
REVIEWED : S.L		DATE	28.08.2017
APPROVED : S.L		JOB NO.	17T01
DWG. NO. 17T01-000-DWG-A-T001		REV.	3

DWG. NO. 17T01-001-DWG-A-T001 REV. 3



GROUND FLOOR PLAN



KEY PLAN
SCALE-1:500

W S N E

SCHEDULE OF STRUCTURAL GLAZING

STRUCTURAL GLAZING MKD.	GLAZING NOS. GROUND FL.	FIRST FL.	ROOF	OPENING SIZE WIDTH	HEIGHT	DESCRIPTION	REMARKS
SG/01	1	–	–	15325	4350	AL. STRUCTURAL GLAZING	
SG/02	1	–	–	15550	4350	–DO–	
SG/03	1	–	–	2975	4350	–DO–	
SG/04	1	–	–	2300	4350	–DO–	
SG/05	1	–	–	5120	4350	–DO–	
SG/06	1	–	–	6990	4350	–DO–	
SG/07	1	–	–	7025	4350	–DO–	
SG/08	1	–	–	3685	4350	–DO–	
SG/09	1	–	–	5820	4350	–DO–	
SG/10	1	–	–	2000	2475	–DO–	
SG/11	–	2	–	8980	2900	–DO–	
SG/12	–	1	–	2000	2650	–DO–	
SG/13	–	–	1	2000	3550	–DO–	

WINDOW SCHEDULE

SL. NO.	WINDOW MARKED	NUMBER OF WINDOW GROUND	FIRST	ROOF	DESCRIPTION	WINDOW SIZE	REMARKS
1.	W/01	1	5		FULL GLAZED ALUMINIUM WINDOW SIDE HUNG OUTSIDE OPENABLE	1500 X 1500	
2.	W/02	7	–		FULL GLAZED ALUMINIUM WINDOW SIDE HUNG OUTSIDE OPENABLE	2000 X 1500	
3.	W/03	7	–		FULLY GLAZED CENTRAL HUNG WINDOW OUTSIDE OPENABLE	600 X 600	
4.	W/04	1	–		FULLY GLAZED SIDE HUNG WINDOW OUTSIDE OPENABLE	1500 X 1000	
5.	W/05	4	–		FULLY GLAZED SIDE HUNG WINDOW OUTSIDE OPENABLE	2000 X 1000	
6.	W/06	–	10		FULL GLAZED ALUMINIUM FIXED WINDOW	1500 X 1500	
7.	W/07	1	–		FULLY GLAZED SIDE HUNG WINDOW OUTSIDE OPENABLE	1000 X 1500	

DOOR SCHEDULE

SL. NO.	DOOR MARKED	NUMBER OF DOORS GROUND	FIRST	ROOF	DESCRIPTION	DOOR SIZE	REMARKS
1.	D/01	4	–		DOUBLE LEAF ALUMINIUM GLAZED DOOR	1500 X 2400	
2.	D/02	7	–		DOUBLE LEAF WOODEN FLUSH DOOR	1500 X 2400	
3.	D/03	3	–	1	SINGLE LEAF WOODEN FLUSH DOOR	1000 X 2100	
4.	D/04	2	–		SINGLE LEAF WOODEN FLUSH DOOR	1000 X 2400	
5.	D/05	4	2		SINGLE LEAF F.R.P. DOOR	1000 X 2100	
6.	D/06	10	2		SINGLE LEAF F.R.P. DOOR	750 X 2100	
7.	FD/01	2	3		SINGLE LEAF METAL FIRE DOOR	1000 X 2400	
8.	D/08	–	2		DOUBLE LEAF ALUMINIUM GLAZED DOOR	1500 X 2400	
9.	SD/01	1	1		F.R.P. SLIDING DOOR	1000 X 2400	
10.	RS/01	5	–		ROLLING SHUTTER	2000 X 1500	

AREA STATEMENT:

1.	TOTAL LAND AREA (44.6 ACRES)	=	180490 SQM.
2.	WIDTH OF ACCESS ROAD (E.M BYEPASS)	=	36 M.
3.	PERMISSIBLE GROUND COVERAGE (35%)	=	63171.50 SQM.
4.	EXISTING GROUND COVERAGE	=	27178 SQM.(15.05%)
5.	PROPOSED GROUND COVERAGE	=	990SQM. (0.55%)
6.	TOTAL GROUND COVERAGE (EXISTING + PROPOSED)	=	28168 SQM.(15.60%)
7.	PERMISSIBLE TOTAL BUILT UP AREA	=	496347.5 SQM.
8.	EXISTING BUILT UP AREA	=	39250 SQM.
9.	PROPOSED BUILT UP AREA	=	1891 SQM.
10.	TOTAL BUILT UP (EXISTING + PROPOSED)	=	41141 SQM.
11.	PERMISSIBLE F.A.R	=	2.475
12.	PROPOSED F.A.R	=	0.23
13.	HEIGHT OF THE PROPOSED BUILDING	=	11.7 M.
14.	NO. OF STOREY OF THE PROPOSED BUILDING	=	2(TWO)

TENDER PURPOSE ONLY

FLOOR WISE BUILT UP AREA
GROUND FLOOR PLAN =1057 Sqm.
FIRST FLOOR PLAN = 834 Sqm.
TOTAL BUILT UP AREA =1891 Sqm.

REFER. DWG. NO.–
17T01-000-DWG-A-T001
17T01-001-DWG-A-T002
17T01-001-DWG-A-T003

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.
	REVIEWED				

NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
REVISED STAIR WIDTH & FIRE STAIRCASE INCORPORATED	SL	SMK	3	22.03.18

RELEASE STATUS		DATE	SIGNATURE
PRELIMINARY			
FOR TENDER ONLY		22.03.2018	S.L
FOR CONSTRUCTION			
REVIEWED	ARCHITECTURAL		
	CIVIL & STRUCTURAL		
	ELECTRICAL		
	INSTRUMENTATION		
	MECHANICAL		

FOOD COURT
GROUND FLOOR PLAN & KEY PLAN & DOOR WINDOW & STRUCTURAL GLAZING SCHEDULE

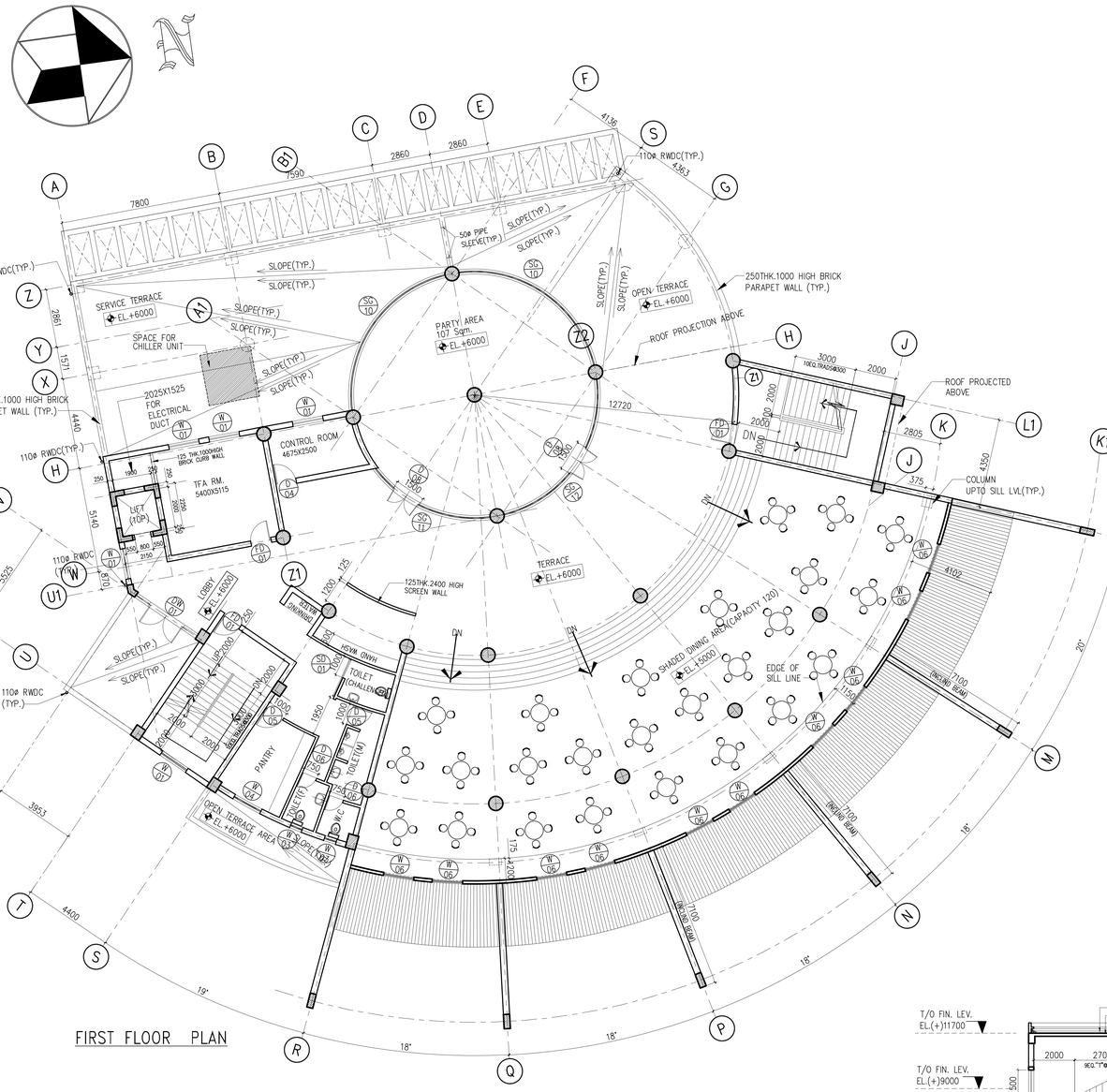
SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA–700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR-V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA – 700091

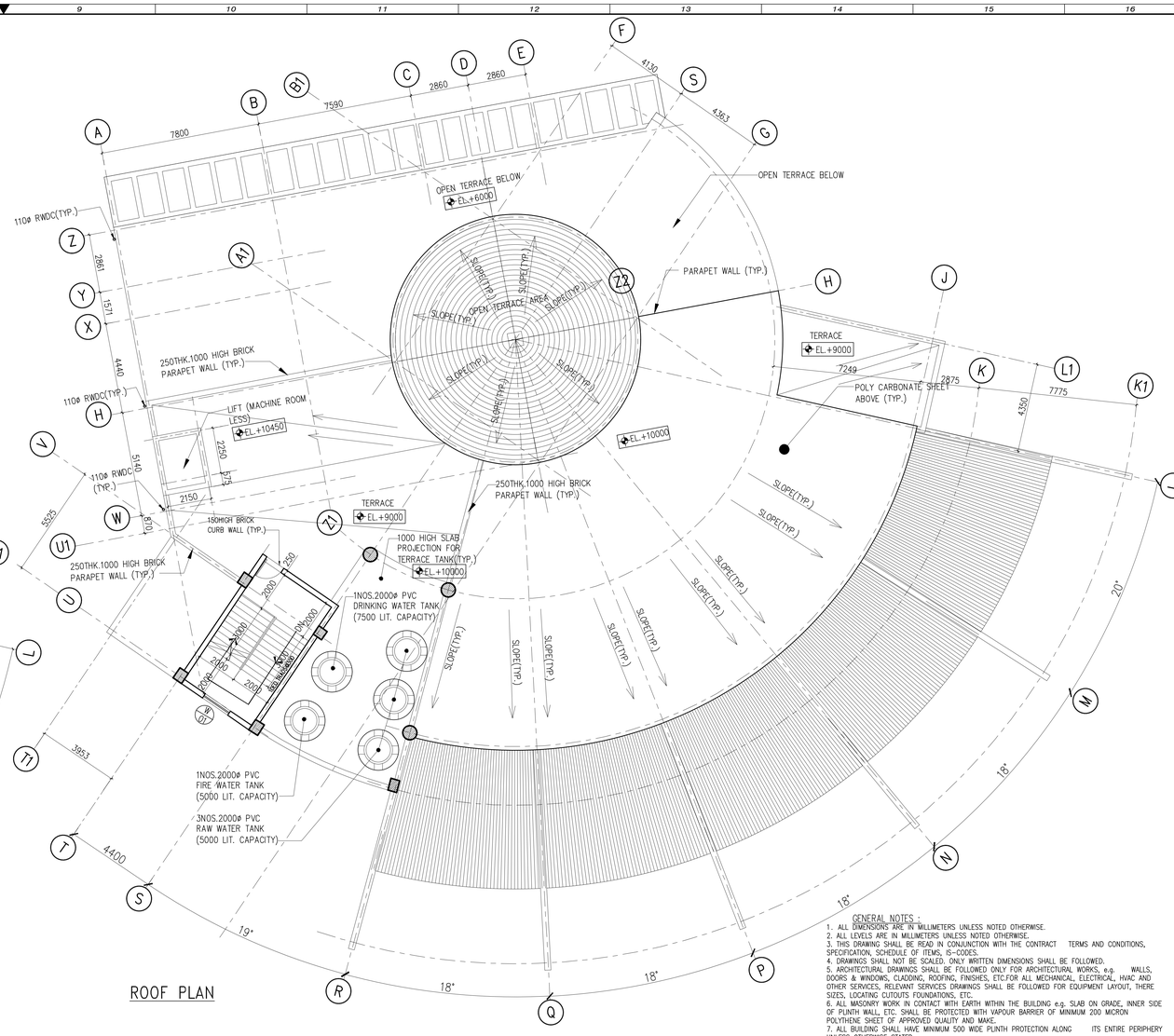
DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
CHENNAI· MUMBAI KOLKATA NEW DELHI

DRAWN :	SMK	CHECKED :	S.L	SCALE	1:100
REVIEWED :	S.L			DATE	28.08.2017
APPROVED :	S.L			JOB NO.	17T01

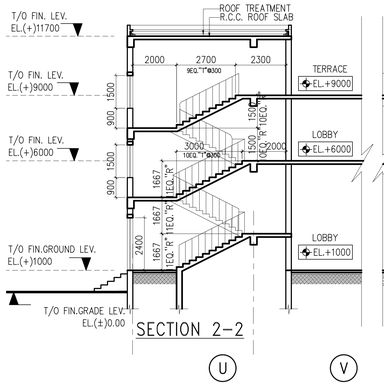
DWG. NO. 17T01–001–DWG–A–T001 REV. 3



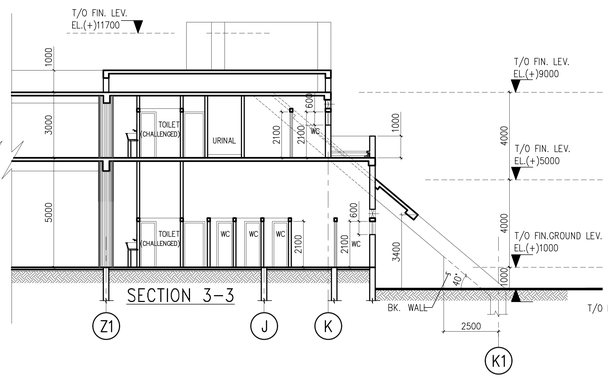
FIRST FLOOR PLAN



ROOF PLAN



SECTION 2-2



SECTION 3-3

FINISH SCHEDULE

GENERAL SPACE DESIGNATION	FLOORING										SKIRTING/DADO										WALLS				CEILING				REMARKS
	L.P.S. WITH NON METALIC HARDNER	KOTA STONE WITH MARBLE STRIPS COMBINATION	KOTA STONE	VITRIFIED TILES	UNGLAZED CERAMIC TILES	GLAZED CERAMIC TILES	WHITE MARBLE AND UDAIPUR GREEN MARBLE	NON-SKID EXTERIOR QUALITY VITRIFIED TILES	EXTERIOR QUALITY PAVER TILES	PRECAST TERRAZO TILES	GRANITE	L.P.S. WITH NON METALIC HARDNER	MARBLE	KOTA STONE	VITRIFIED TILES	UNGLAZED CERAMIC TILES	GLAZED CERAMIC TILES	WHITE MARBLE AND UDAIPUR GREEN MARBLE	NON-SKID EXTERIOR QUALITY VITRIFIED TILES	EXTERIOR QUALITY PAVER TILES	PRECAST TERRAZO TILES	GRANITE	ACRYLIC EMULSION PAINT OVER WALL PUTTY	EPOXY PAINT OVER CEMENT PLASTER & PUTTY	WHITE WASH OVER CEMENT PLASTER	CHEMICAL RESISTANT PAINT OVER CEMENT PLASTER & PUTTY	WHITE WASH OVER CEMENT PLASTER	FALSE CEILING (GYPSUM BOARD)	CEMENT PLASTER	SYNTHETIC DISTEMPER	
DINING AREA											●				●							●				●				
SOUVENIR SHOPS											●				●							●				●				
STAIR		●											●									●								
TOILETS					●												●					●				●				ABOVE DADO 2100mm.HIGH
LOBBY							●											●				●				●				
FOOD STALL			●											●								●				●				
STORE			●											●								●		●		●				
LOADING/ UNLOADING PLATFORM	●											●										●								
PARTY AREA											●				●							●				●				
SHADED DINING AREA								●											●			●								
PANTRY			●										●									●				●				
MAIN ENTRY LOBBY									●											●		●								
OPEN TERRACE										●											●									
PANTRY COUNTER											●											●				●				

GENERAL NOTES :
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE CONTRACT TERMS AND CONDITIONS, SPECIFICATION, SCHEDULE OF ITEMS, IS-CODES.
4. DRAWINGS SHALL NOT BE SCALED. ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
5. ARCHITECTURAL DRAWINGS SHALL BE FOLLOWED ONLY FOR ARCHITECTURAL WORKS, e.g. WALLS, DOORS & WINDOWS, CLADDING, ROOFING, FINISHES, ETC.FOR ALL MECHANICAL, ELECTRICAL, HVAC AND OTHER SERVICES, RELEVANT SERVICES DRAWINGS SHALL BE FOLLOWED FOR EQUIPMENT LAYOUT, THERE SIZES, LOCATING CUTOUTS FOUNDATIONS, ETC.
6. ALL MASONRY WORK IN CONTACT WITH EARTH WITHIN THE BUILDING e.g. SLAB ON GRADE, INNER SIDE OF PLINTH WALL, ETC. SHALL BE PROTECTED WITH VAPOUR BARRIER OF MINIMUM 200 MICRON POLYTHENE SHEET OF APPROVED QUALITY AND MAKE.
7. ALL BUILDING SHALL HAVE MINIMUM 500 WIDE PLINTH PROTECTION ALONG ITS ENTIRE PERIPHERY UNLESS OTHERWISE STATED.
8. PLASTICIZER CUM WATER PROOFING COMPOUND AS PER SPECIFICATION SHALL BE ADDED TO UNDER GROUND WATER/EARTH RETAINING STRUCTURES OR AS INDICATED IN THE DRAWINGS.
9. NO PART OF ANY STRUCTURE SHALL BE USED FOR ERECTION OF EQUIPMENT OR SIMILAR PURPOSE UNLESS OTHERWISE MENTIONED ON DESIGN DRAWING OR AUTHORIZED BY THE ENGINEER.
10. PAINTING (IF ALREADY DONE) SHALL BE REMOVED FROM STEEL SURFACE IN CONTACT WITH CONCRETE PRIOR TO CONCRETING.
11. EMBEDDED MISC. STEEL ITEMS SHALL BE SECURED IN POSITION PRIOR TO CONCRETING.
12. MINIMUM 40MM THK. DAMP PROOF COURSE SHALL BE LAID FLUSH WITH FLOOR FINISH WITH 2%ADMIXTURE AS PER SPECIFICATION AND INSTRUCTION OF ENGINEER-IN-CHARGE.
13. ALL INTERNAL MASONRY WALL SURFACES SHALL HAVE 12/15 mm THICK 1:6 (CEMENT:SAND) PLASTER AS PER SCHEDULE OF ITEMS.
14. UNLESS OTHERWISE MENTIONED ALL EXTERNAL MASONRY WALL SURFACES SHALL HAVE 18/20 mm THICK PLASTER IN 2 COATS AS PER SCHEDULE OF ITEMS.
15. ALL EXPOSED R.C.C. WORK CEILING IN PARTICULAR SHALL HAVE 6 mm THICK 1:4 (CEMENT:SAND) PLASTER UNLESS OTHERWISE NOTED OR AS MENTIONED IN BOQ.
16. ALL FULL BRICK THICK, BRICK MASONRY SHALL HAVE 1:6 (CEMENT:SAND) MORTAR OR AS PER SCHEDULE OF ITEMS.
17. ALL HALF BRICK THICK, BRICK MASONRY SHALL HAVE 1:4 (CEMENT:SAND) MORTAR OR AS PER BOQ.
18. ALL HALF BRICK THICK, BRICK WALL SHALL HAVE 2 NOS. OF 6mm DIA BARS AS PER INSTRUCTION.
19. ALL DIMENSIONS RELATED TO MASONRY WORK ARE EXCLUSIVE OF FINISH.
20. ALL FINISH MATERIAL SHALL BE OF APPROVED MAKE, QUALITY, COLOUR, TEXTURE, ETC.
21. UNLESS OTHERWISE NOTED THE OVERALL THICKNESS OF FLOOR FINISHES SHALL BE 40MM. & SHALL COMMENCE ONLY AFTER ALL MISC. ITEMS LOCATED ON FLOOR ARE CONSTRUCTED / ERECTED.
22. ALL SKIRTING SHALL BE 150 mm HIGH FROM FINISHED FLOOR LEVEL UNLESS INDICATED OTHERWISE.
23. ALL HEIGHTS RELATED TO ARCHITECTURAL DRAWINGS ARE FROM FINISHED FLOOR LEVEL.
24. ALL DOOR HEIGHTS AS INDICATED IN SCHEDULE SHALL BE MEASURED FROM FINISHED FLOOR. HOWEVER DOOR FRAME HEIGHT SHALL BE INCREASED BY THE THICKNESS OF FLOOR FINISH SO THAT THE FRAME RESTS ON CONC. FLOOR SALB.
25. ALL STEEL WINDOWS SHALL CONFORM TO IS:1361/IS:1038, ALL ALUMINIUM WINDOWS TO IS:1948,1949.ALL FIRE CHECK DOORS TO IS:3614 AND ALL WOODEN FLUSH DOOR TO IS:2202 AS PER SPECIFICATIONS.
26. ALL DOORS, WINDOWS, LOUVERS & METAL WORK SHALL HAVE TWO COATS OF SYNTHETIC ENAMEL PAINT OVER A COAT OF PRIMER. TOTAL DFT SHALL NOT BE LESS THAN 120 MICRON.
27. ALL DOORS WINDOWS LOUVERS OPENINGS ETC EXPOSED TO WEATHER SHALL BE SEALED WITH SILICON/POLYSULPHIDE SEALANT AS PER SPECIFICATION & SCHEDULE OF ITEMS TO MAKE THEM COMPLETELY WATERTIGHT.
28. ALL EXTERNAL DOORS SHALL BE FULLY WEATHER TIGHT BY PROVIDING GASKET, WEATHER STRIP, RAIN-DROP,THRESHOLD, ETC AS PER SPECIFICATION AND SCHEDULE OF ITEMS.
29. ALL STEEL WORK EXPOSED TO WEATHER SHALL BE PAINTED WITH ANTI-CORROSIVE PAINT OVER ZINC CHROMATE PRIMER.
30. ALL WET AREAS INCLUDING TOILET FLOORS SHALL HAVE MINIMUM 1:100 SLOPE TOWARDS DRAIN UNLESS INDICATED OTHERWISE.
32. WHERE SCREED IS REQUIRED ON ROOF FOR MAKING SLOPE, IT SHALL BE MADE WITH AVERAGE 25MM THK.SCREED PLASTER AND WITH SCREED CONC. WHERE MORE THICKNESS IS NECESSARY OR AS PER INSTRUCTION.
33. ALL RAINWATER DOWNCOMER & SANITARY PIPES SHALL BE LEAD JOINTED.

TENDER PURPOSE ONLY

REFER. DWG. NO.–
17T01-000-DWG-A-T001
17T01-001-DWG-A-T001
17T01-001-DWG-A-T003

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.	REVIEWED	NATURE OF REVISON & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
							REVISED STAIR WIDTH & FIRE STAIRCASE INCORPORATED	SL	SMK	3	22.03.18

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY	22.03.2018	S.L
FOR CONSTRUCTION		
ARCHITECTURAL		
CIVIL & STRUCTURAL		
ELECTRICAL		
INSTRUMENTATION		
MECHANICAL		

FOOD COURT
FIRST FLOOR PLAN,ROOF PLAN & FINISH SCHEDULE & SECTIONS

SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR-V, BLOCK-GN,
BIDHAN NAGAR, CALCUTTA - 700091

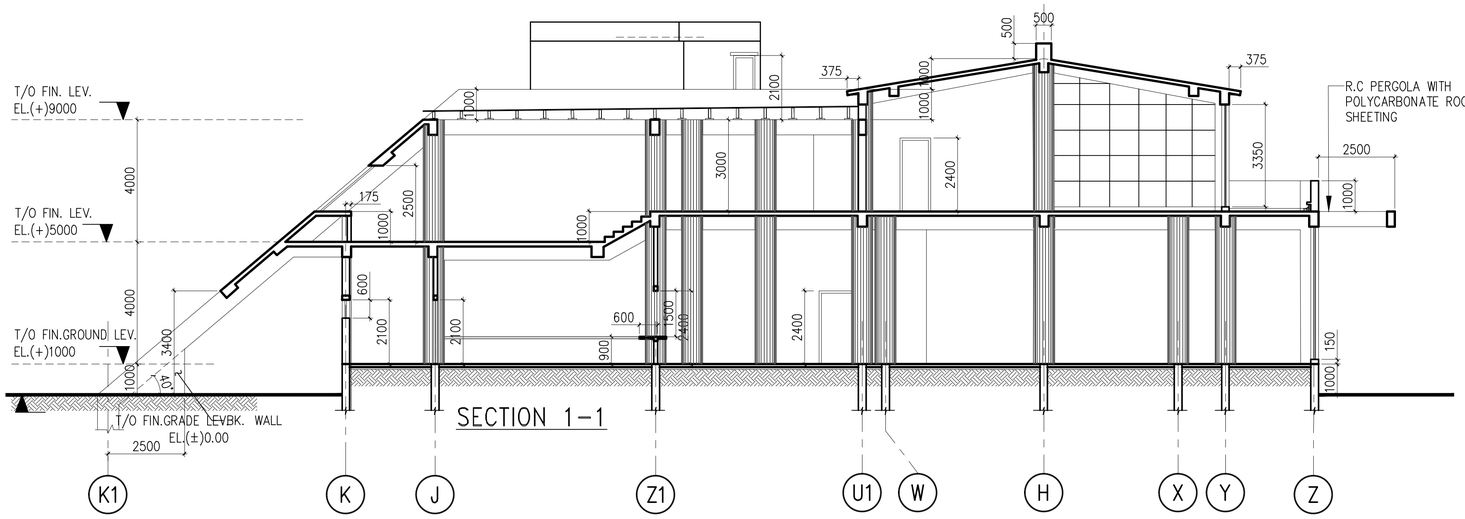
DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
CHENNAI• MUMBAI KOLKATA NEW DELHI

DRAWN : SMK	CHECKED : S.L	SCALE 1:100
REVIEWED : S.L		DATE 28.07.2017
APPROVED : S.L		JOB NO. 17T01

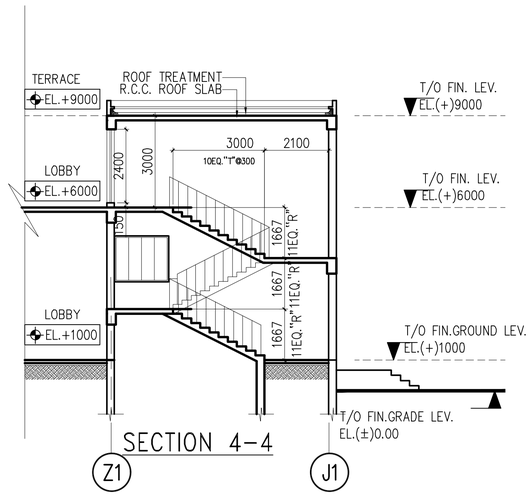
DWG. NO. 17T01-001-DWG-A-T002 REV. 3

08.11.2017 AD_ARCH

DWG. NO. 17T01-001-DWG-A-T003 REV. 3



SECTION 1-1



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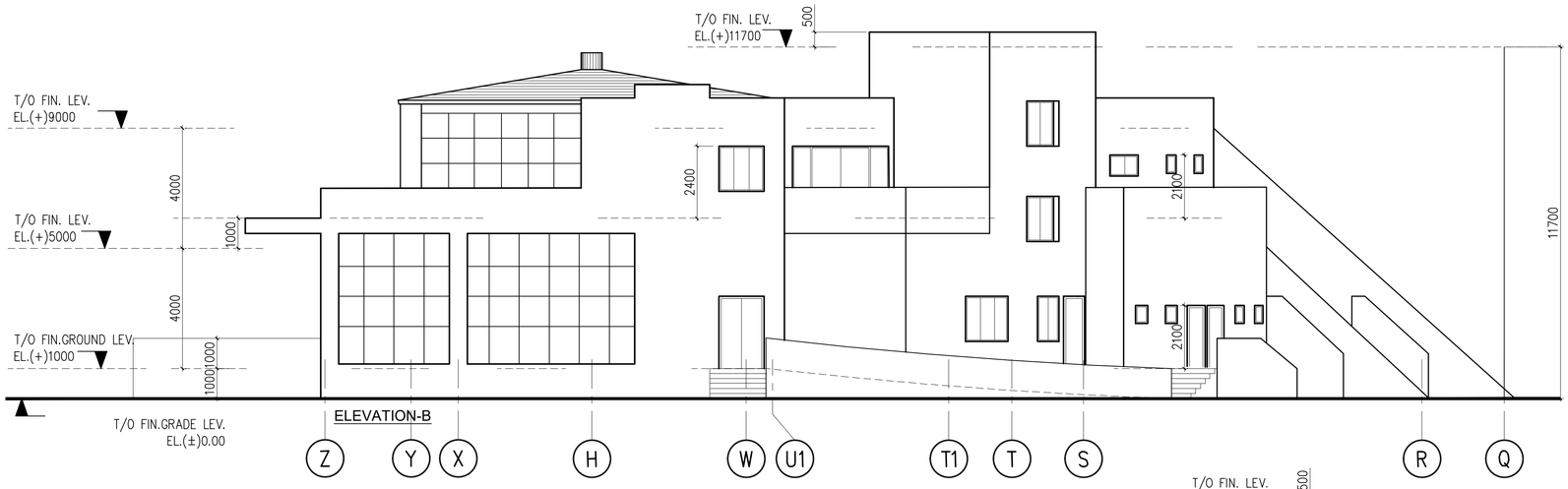
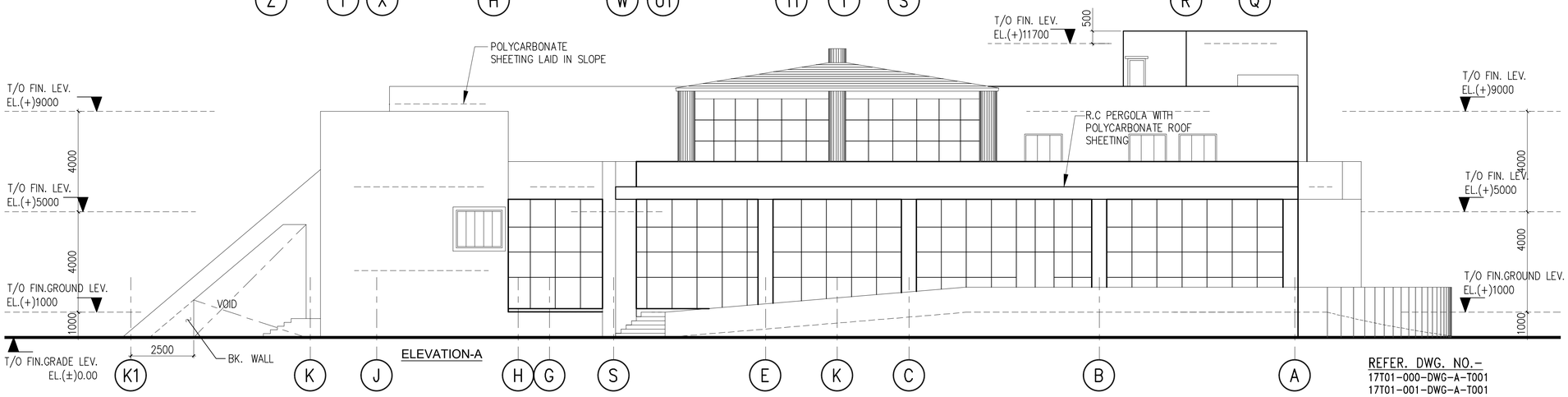


ELEVATION-B



ELEVATION-A

REFER. DWG. NO.-
17T01-000-DWG-A-T001
17T01-001-DWG-A-T001
17T01-001-DWG-A-T002

TENDER PURPOSE ONLY

FOOD COURT
ELEVATIONS & SECTIONS

SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
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RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY	22.03.2018	S.L
FOR CONSTRUCTION		
REVIEWED: ARCHITECTURAL		
REVIEWED: CIVIL & STRUCTURAL		
REVIEWED: ELECTRICAL		
REVIEWED: INSTRUMENTATION		
REVIEWED: MECHANICAL		

NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
REVISED STAIR WIDTH & FIRE STAIRCASE INCORPORATED	SL	SMK	3	22.03.18

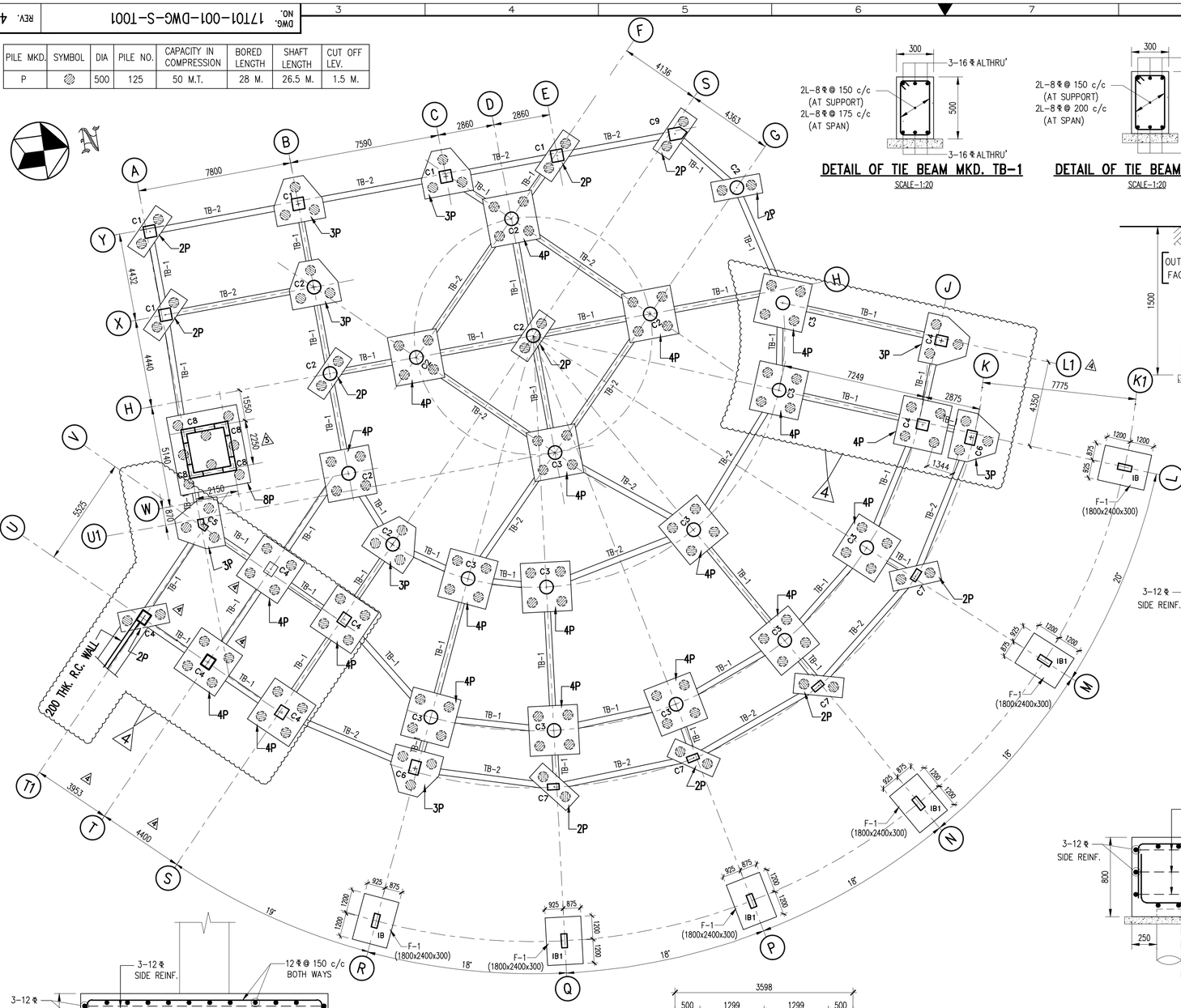
APPROV. | MECH. | INSTR. | ELEC. | STRL. | ARCH. REVIEWED

DRAWN : SMK | CHECKED : S.L | SCALE 1:100
REVIEWED : S.L | DATE 28.07.2017
APPROVED : S.L | JOB NO. 17T01

DWG. NO. 17T01-001-DWG-A-T003 REV. 3

DWG. NO. 17T01-001-DWG-S-T001 REV. 4

PILE MKD.	SYMBOL	DIA	PILE NO.	CAPACITY IN COMPRESSION	BORED LENGTH	SHAFT LENGTH	CUT OFF LEV.
P	⊘	500	125	50 M.T.	28 M.	26.5 M.	1.5 M.



FOUNDATION PLAN

ALL TIE BEAMS ARE 300x500

SCALE-1:125

DETAIL OF TIE BEAM MKD. TB-1

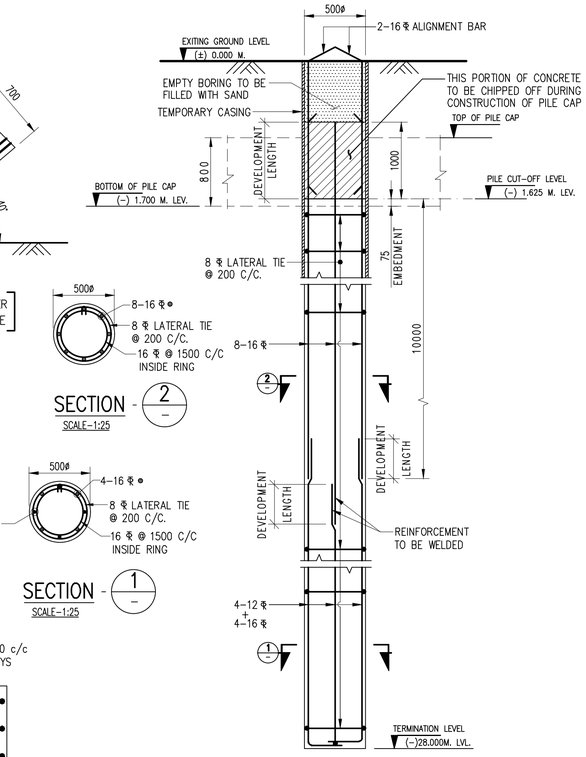
SCALE-1:20

DETAIL OF TIE BEAM MKD. TB-2

SCALE-1:20

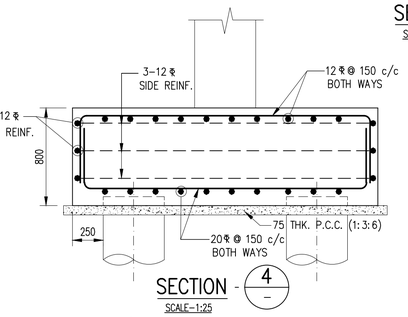
DETAIL OF FOOTING F-1

SCALE-1:25



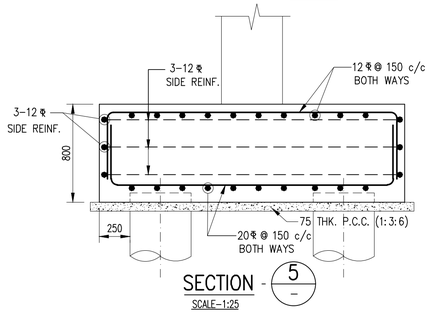
LONG SECTION OF BORED CAST-IN-SITU PILE(500ø)

SCALE-1:25



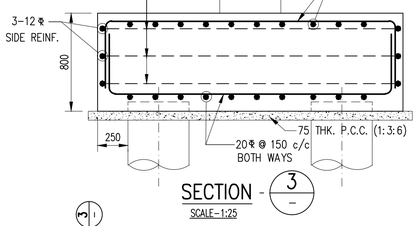
SECTION - 4

SCALE-1:25



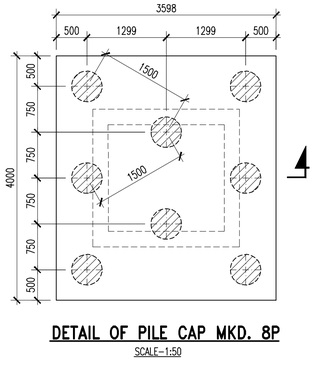
SECTION - 5

SCALE-1:25



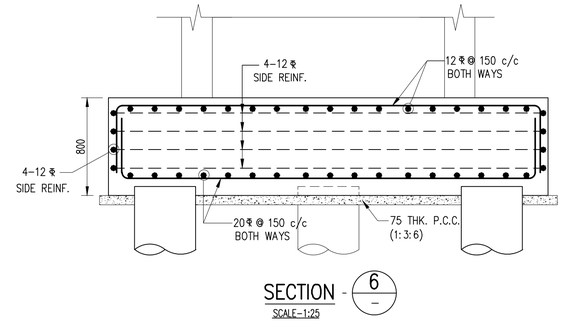
SECTION - 3

SCALE-1:25



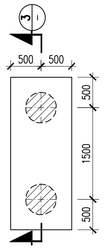
DETAIL OF PILE CAP MKD. 8P

SCALE-1:50



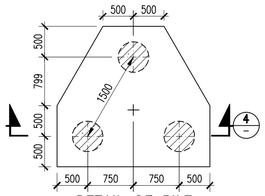
SECTION - 6

SCALE-1:25



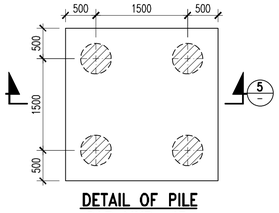
DETAIL OF PILE CAP MKD. 2P

SCALE-1:50



DETAIL OF PILE CAP MKD. 3P

SCALE-1:50



DETAIL OF PILE CAP MKD. 4P

SCALE-1:50

NOTE

1. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METER UNLESS NOTED OTHERWISE.
2. DRAWINGS SHALL NOT BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
3. FOR FINISHED GROUND LEVEL SEE RELEVANT ARCH. DRAWING.
4. FOR PILING DRG. EXISTING GROUND LEVEL HAS BEEN ASSUMED AS (±)0.000 AS SHOWN. PILE CUT OFF LEVEL ARE FIXED ACCORDINGLY.
5. FOR THE LOCATION OF THE DOME REFER ARCHITECTURAL DRG.
6. THE PILING WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE LATEST REVISION OF IS: 2911 (PART-1, SEC.-2) UNLESS NOTED OTHERWISE.
7. CUT OFF LEVELS OF ALL LOAD BEARING PILES SHALL BE 75MM ABOVE THE BOTTOM OF CORRESPONDING PILE CAP.
8. CEMENT CONC. WORK SHALL CONFORM TO LATEST REV. OF IS: 456.
9. GRADE OF CONCRETE SHALL BE OF GRADE M-25 AND GRADE OF STEEL TO BE Fe 500 UNLESS NOTED OTHERWISE.
10. ALL PILES SHALL BE BORED CAST-IN-SITU LOAD BEARING PILES.
11. DOWELS BARS PROJECTING FROM PILES SHALL BE MINIMUM FIFTY TIMES BAR DIAMETER BEYOND PILE CUT-OFF LEVEL.
12. UNLESS SPECIFIED OTHERWISE, BENDING OF BARS SHALL CONFORM TO THE LATEST REV. OF IS: 2502 & IS: 456.
13. CLEAR COVER TO REINF. AS FOLLOWS : PILE = 50mm, PILE CAP = 75mm, FOOTING = 50mm, TIE BEAM = 30mm
14. THE CAPACITIES OF A PILE ARE TO BE CHECKED AND FINALIZED ON THE BASIS OF FIELD TESTS PRIOR TO EXECUTION OF THE PILE.
15. FOR LAYOUT OF PILES REFER RELEVANT STRUCTURAL /ARCHITECTURAL DRAWING
16. NET SAFE BEARING CAPACITY FOR ISOLATED FOOTING HAS BEEN CONSIDERED AS 8T/Sqm.

FOR TENDER ONLY

FOOD COURT
FOUNDATION LAYOUT PLAN AND DETAILS

SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.
REVIEWED					

NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
REVISED AS MARKED 4	K.M.	U.B.	4	19.03.2018
REVISED AS MARKED 3	K.M.	U.B.	3	24.10.2017
GENERAL REVISION	K.M.	P.D.	2	21.09.17
GENERAL REVISION	A.R.	P.D.	1	08.09.16

REVIEWED	RELEASE STATUS	DATE	SIGNATURE
	PRELIMINARY		
✓	FOR TENDER ONLY		
	FOR CONSTRUCTION	19.03.2018	K.M
	ARCHITECTURAL		
	CIVIL & STRUCTURAL	19.03.2018	K.M.
	ELECTRICAL		
	INSTRUMENTATION		
	MECHANICAL		

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DRAWN : P.D./U.B.	CHECKED : S.B.	SCALE	AS NOTED
REVIEWED : K.M.		DATE	11/11/15
APPROVED : K.M.		JOB NO.	17T01

DWG. NO. 17T01-001-DWG-S-T001 REV. 4

DWG. NO. 17T01-001-DWG-S-T002 REV. 4

SCHEDULE OF COLUMNS FROM FOUNDATION TO ROOF AND ABOVE

	C1	C2	C3	C4	C5	C6	C7	C8	C9
COLUMN SIZE & REINFORCEMENT	600 x 600: ● 12–25ϕ	700ϕ: ● 12–25ϕ	700ϕ: • 14–25ϕ	500 x 600: ● 8–25ϕ ○ 4–20ϕ	300 x 600: • 6–25ϕ • 4–20ϕ	500 x 700: ● 12–25ϕ	300 x 600: ● 6–20ϕ ○ 6–16ϕ	250 x 700: ● 16–20ϕ	600 x 600: ● 13–25ϕ
COLUMN MKD.	C1	C2	C3	C4	C5	C6	C7	C8	C9
LINKS	8ϕ @ 100/150 C/C. (3 Nos./SET)	8ϕ @ 100/150 C/C. (1 No./SET)	8ϕ @ 100/150 C/C. (1 No./SET)	8ϕ @ 100/150 C/C. (3 Nos./SET)	8ϕ @ 100/150 C/C. (2 Nos./SET)	8ϕ @ 100/150 C/C. (3 Nos./SET)	8ϕ @ 100/150 C/C. (4 Nos./SET)	8ϕ @ 100/150 C/C. (6 Nos./SET)	8ϕ @ 100/150 C/C. (4 Nos./SET)

COLUMN LAYOUT PLAN

SCALE–1:100

SPACING OF COLUMN LINKS AT TIE LEVEL

SCALE–N.T.S.

DETAIL OF INCLINED BEAM (IB1)

SCALE–1:100

SECTION - 1

SCALE–1:25

TYPICAL CROSS SECTION OF RAMP

SCALE–1:100

NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METRE UNLESS NOTED OTHERWISE.
2. DRAWINGS SHALL NOT BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
3. CEMENT CONC. WORK SHALL CONFORM TO LATEST REV. OF IS: 456. TO BE Fe 500 UNLESS NOTED OTHERWISE.
4. GRADE OF CONCRETE SHALL BE OF GRADE M–25 AND GRADE OF STEEL
5. UNLESS SPECIFIED OTHERWISE, BENDING OF BARS SHALL CONFORM TO THE LATEST REV. OF IS: 2502 & IS: 456.
6. CLEAR COVER TO REINF. AS FOLLOWS : COLUMN = 40mm, SLAB = 20mm, BEAM = 25mm
7. DEVELOPMENT LENGTH, Ld = 50 ϕ, WHERE ϕ= DIAMETER OF BAR.

FOR TENDER ONLY

FOOD COURT:
LAYOUT & R. C. DETAILS OF COLUMNS

SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA–700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA – 700091

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.	NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
	REVIEWED					REVISED AS MARKED 4	K.R.	U.B.	4	19.03.2018
						REVISED AS MARKED 3	K.R.	U.B.	3	24.10.2017
						GENERAL REVISION	K.R.	U.B.	2	21.09.17
						GENERAL REVISION	A.R.	P.D.	1	08.09.16

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY		
FOR CONSTRUCTION	19.03.2018	K.M.
ARCHITECTURAL		
CIVIL & STRUCTURAL	19.03.2018	K.M.
ELECTRICAL		
INSTRUMENTATION		
MECHANICAL		

DEVELOPMENT CONSULTANTS PVT. LTD.
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DRAWN : U.B.	CHECKED : K.R.	SCALE	AS NOTED
REVIEWED : K.M.		DATE	23.08.2017
APPROVED : K.M.		JOB NO.	17T01

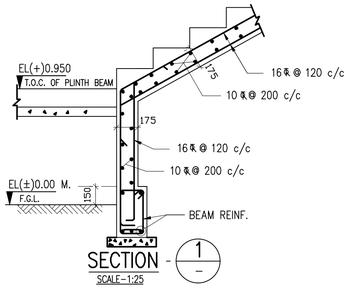
DWG. NO. 17T01–001–DWG–S–T002 REV. 4

DWG. NO. 17T01-001-DWG-S-T003 REV. 4

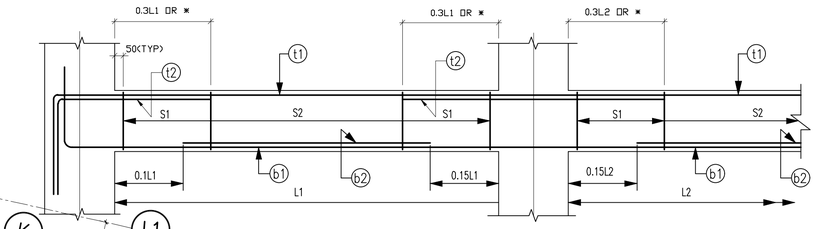
SCHEDULE OF PLINTH BEAMS

BEAM MKD.	SIZE		REINFORCEMENT					
	WIDTH	DEPTH	TOP REINF.		BOTTOM REINF.		STIRRUPS	
			t1	t2	b1	b2	SUPPORT (S1)	SPAN (S2)
PB-1	300	600	3-16ϕ	3-16ϕ	3-16ϕ	2-16ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
PB-2	300	500	3-16ϕ	2-16ϕ	3-16ϕ	2-16ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
PB-3	300	600	3-16ϕ	2-20ϕ	3-16ϕ	2-12ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
PB-4	250	500	3-20ϕ	2-16ϕ	3-20ϕ	–	2L-8ϕ@ 100c/c	2L-8ϕ@ 100c/c
PB-5	300	500	3-20ϕ	2-16ϕ	3-20ϕ	2-16ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 100c/c
PB-6	250	400	2-16ϕ	–	3-16ϕ	–	2L-8ϕ@ 100c/c	2L-8ϕ@ 100c/c
PB-7	300	500	3-20ϕ	2-20ϕ	3-20ϕ	–	4L-8ϕ@ 100c/c	4L-8ϕ@ 125c/c

● HIGHER OF THE REINFORCEMENT TO BE PROVIDED AT CONTINUOUS SUPPORT (TOP) FOR DISSIMILAR MKD. BEAMS

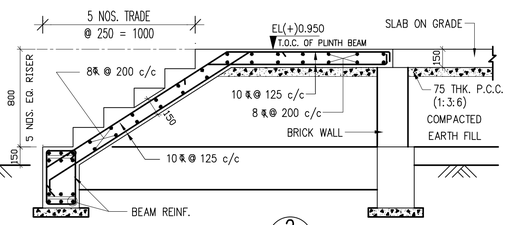


SECTION - 1/– SCALE-1:25

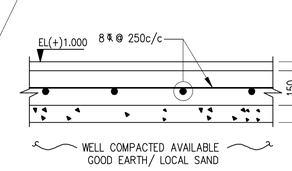


TYPICAL CURTAILMENT RULES FOR FLOOR BEAMS (MULTIPLE-SPAN BEAM)

SCALE-N.T.S.

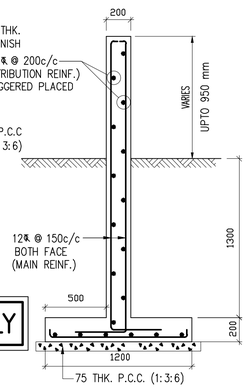


SECTION - 2/– SCALE-1:25



DETAILS OF SLAB ON GRADE

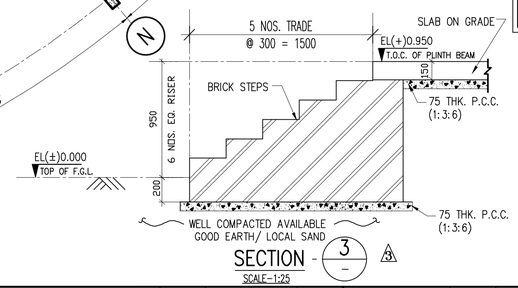
SCALE-N.T.S



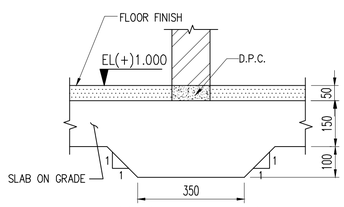
DETAILS OF R.C.C. WALL

SCALE-1:25

FOR TENDER ONLY



SECTION - 3/– SCALE-1:25



TYPICAL FOUNDING DETAIL FOR 1/2 BRICK THICK INTERIOR BRICK WALL

SCALE-1:10

LAYOUT OF PLINTH BEAMS

SCALE-1:100

T.O.C OF PLINTH BEAMS ARE AT EL(+)0.150 M UNLESS NOTED OTHERWISE

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.	NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
	REVIEWED					REVISED AS MARKED 4	K.R.	U.B.	4	19.03.18
						REVISED AS MARKED 3	K.R.	U.B.	3	24.10.17
						GENERAL REVISION	K.M.	U.B.	2	21.09.17
						GENERAL REVISION	A.R.	P.D.	1	08.09.16

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY	19.03.18	K.M
FOR CONSTRUCTION		
ARCHITECTURAL		
CIVIL & STRUCTURAL	19.03.18	K.M.
ELECTRICAL		
INSTRUMENTATION		
MECHANICAL		

REVIEWED

FOOD COURT
LAYOUT AND R. C. DETAILS OF PLINTH BEAMS

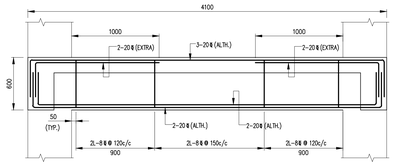
SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
CHENNAI· MUMBAI KOLKATA NEW DELHI

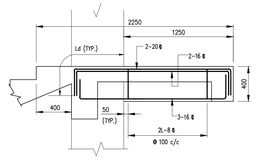
DRAWN : U.B.	CHECKED : K.R.	SCALE	AS NOTED
REVIEWED : K.M.		DATE	28.08.2017
APPROVED : K.M.		JOB NO.	17T01

DWG. NO. 17T01-001-DWG-S-T003 REV. 4



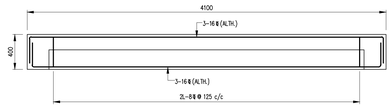
DETAIL OF LANDING BEAM MKD. LB-1 & LB-5 (300x600)

SCALE - 1:25



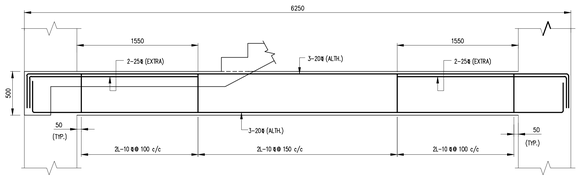
DETAIL OF LANDING BEAM MKD. LB-2 (250x400)

SCALE - 1:25



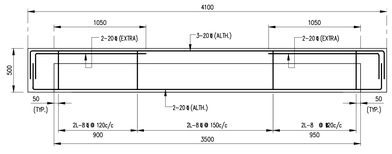
DETAIL OF LANDING BEAM MKD. LB-3 (250x400)

SCALE - 1:25



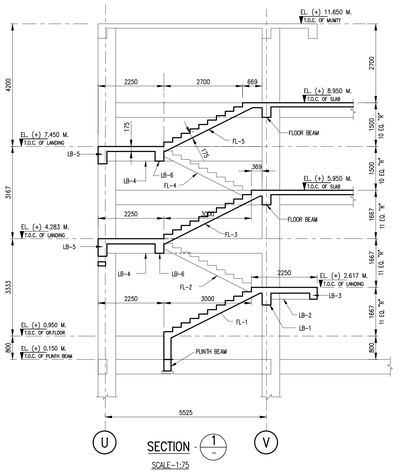
DETAIL OF LANDING BEAM MKD. LB-4 (300x500)

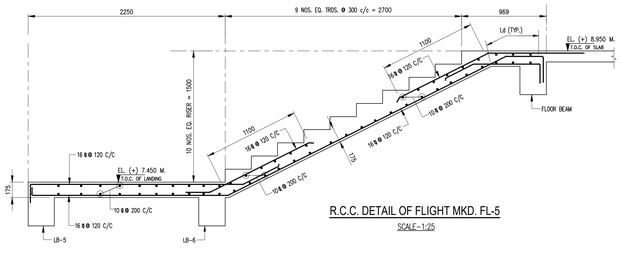
SCALE - 1:25



DETAIL OF LANDING BEAM MKD. LB-6 (300x500)

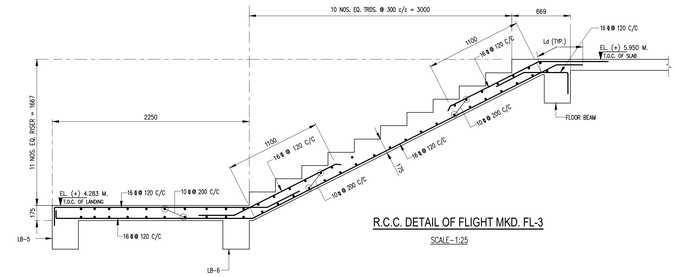
SCALE - 1:25





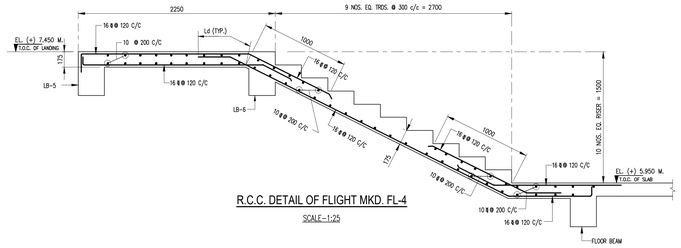
R.C.C. DETAIL OF FLIGHT MKD. FL-5

SCALE - 1:25



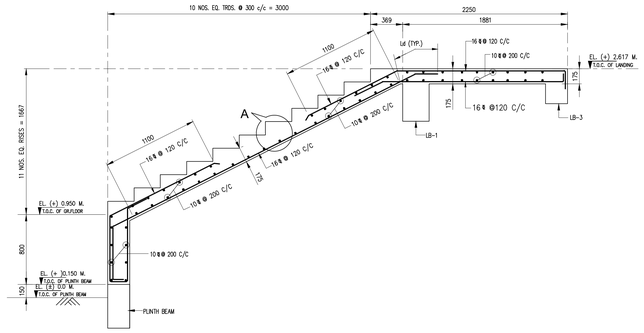
R.C.C. DETAIL OF FLIGHT MKD. FL-3

SCALE - 1:25



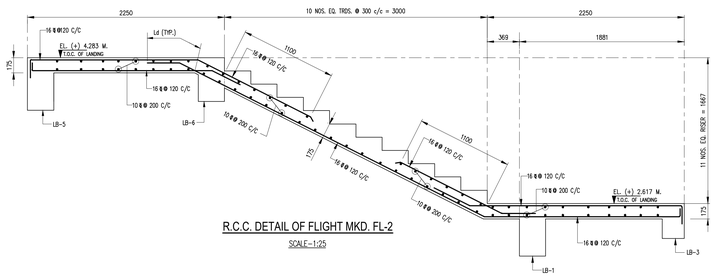
R.C.C. DETAIL OF FLIGHT MKD. FL-4

SCALE - 1:25



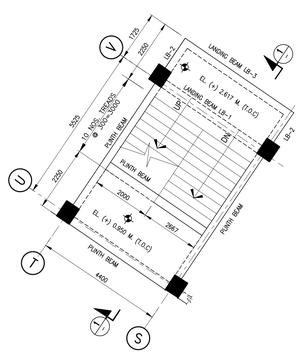
R.C.C. DETAIL OF FLIGHT MKD. FL-1

SCALE - 1:25



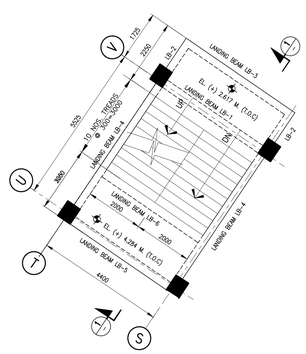
R.C.C. DETAIL OF FLIGHT MKD. FL-2

SCALE - 1:25



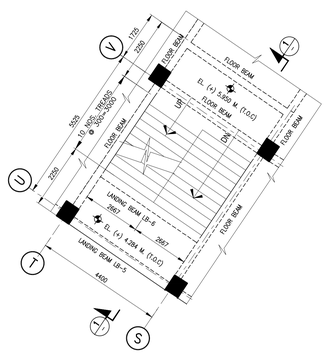
PLAN AT EL. (+) 2.617 M. LEVEL

SCALE - 1:75



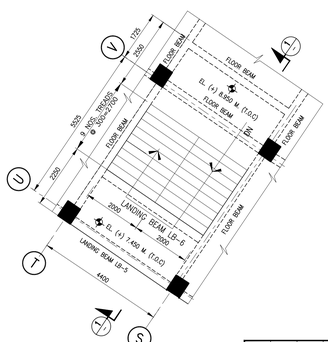
PLAN AT EL. (+) 4.284 M. LEVEL

SCALE - 1:75



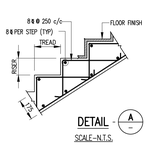
PLAN AT EL. (+) 5.950 M. LEVEL

SCALE - 1:75



PLAN AT EL. (+) 8.950 M. LEVEL

SCALE - 1:75



DETAIL - A/-

SCALE - N.T.S.

FOR TENDER ONLY

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METRE UNLESS NOTED OTHERWISE.
2. DRAWINGS SHALL NOT BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
3. CEMENT CONC. WORK SHALL CONFORM TO LATEST REV. OF IS:456.
4. GRADE OF CONCRETE SHALL BE OF GRADE "M25" AND GRADE OF STEEL TO BE "Fe500" UNLESS NOTED OTHERWISE.
5. UNLESS SPECIFIED OTHERWISE, BENDING OF BARS SHALL CONFORM TO THE LATEST REV. OF IS:2502 & IS:456.
6. CLEAR COVER TO REINF. AS FOLLOWS : SLAB = 20mm, BEAM = 25mm

FOOD COURT
LAYOUT & R.C DETAILS OF STAIRCASE MKD.-ST1

SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR-V, BLOCK-GN,
BIDHAN NAGAR, CALCUTTA - 700091

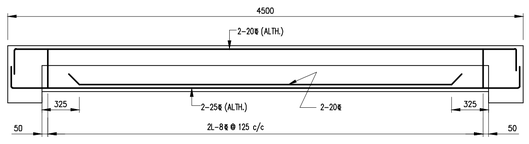
DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
CHENNAI• MUMBAI KOLKATA NEW DELHI

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.	NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
	REVIEWED							U.B.	3	15.03.18
								K.G.	2	24.10.17
								P.D.	1	02.09.16

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY	15.03.2018	K.M.
FOR CONSTRUCTION		
REVIEWED BY: ARCHITECTURAL		
CIVIL & STRUCTURAL	15.03.2018	K.M.
ELECTRICAL		
INSTRUMENTATION		
MECHANICAL		

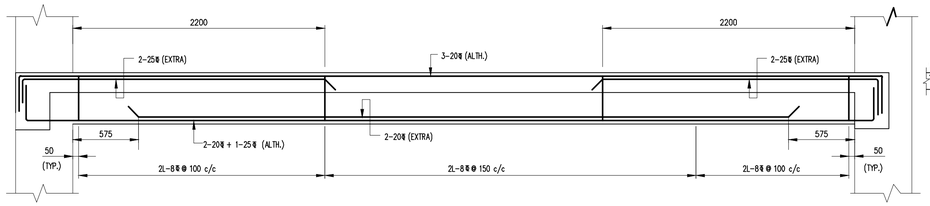
DRAWN : PD	CHECKED : S.B.	SCALE	AS NOTED
REVIEWED : K.M.M.		DATE	28.08.2017
APPROVED : A.M./S.L		JOB NO.	17T01

DWG. NO. 17T01-001-DWG-S-T004 (SH-1) REV. 3



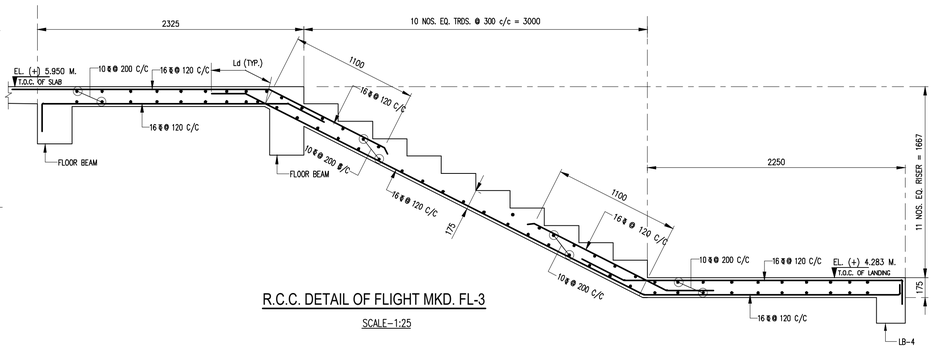
DETAIL OF LANDING BEAM MKD. LB-1 (250x400)

SCALE-1:25



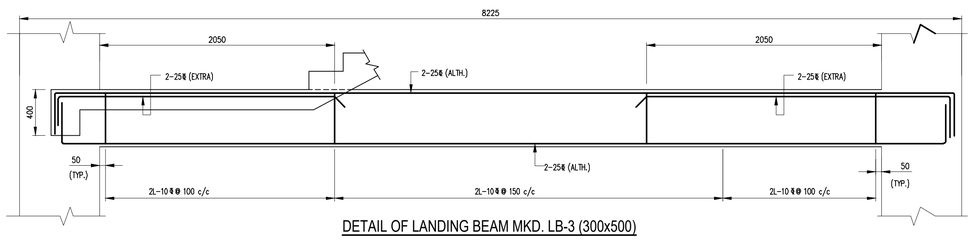
DETAIL OF LANDING BEAM MKD. LB-4 (300x450)

SCALE-1:25



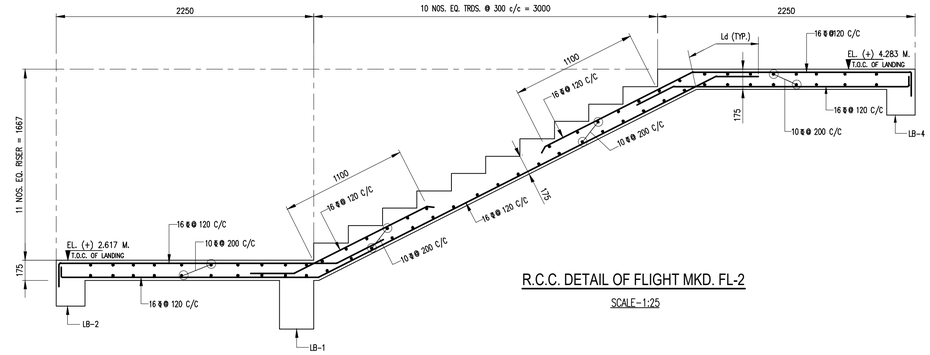
R.C.C. DETAIL OF FLIGHT MKD. FL-3

SCALE-1:25



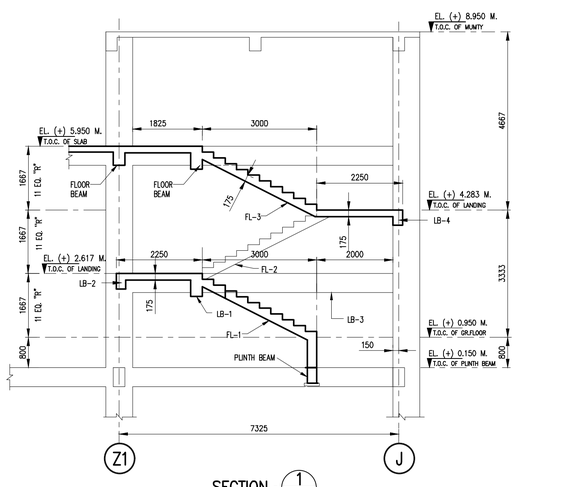
DETAIL OF LANDING BEAM MKD. LB-3 (300x500)

SCALE-1:25



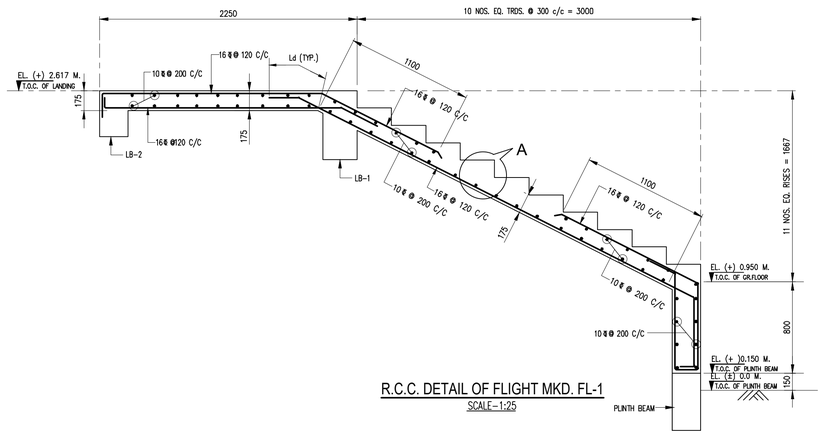
R.C.C. DETAIL OF FLIGHT MKD. FL-2

SCALE-1:25



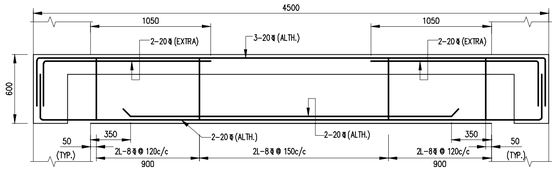
SECTION 1/-

SCALE-1:75



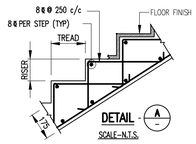
R.C.C. DETAIL OF FLIGHT MKD. FL-1

SCALE-1:25



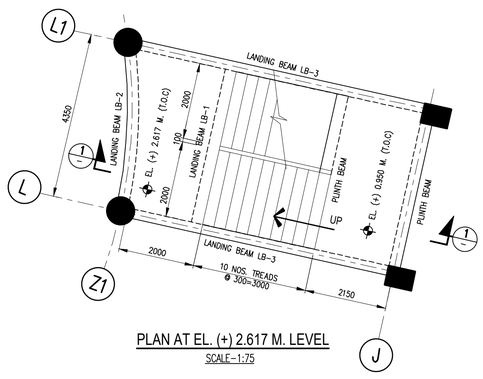
DETAIL OF LANDING BEAM MKD. LB-2 (300x600)

SCALE-1:25



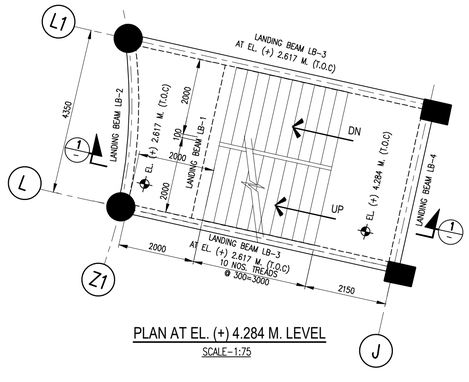
DETAIL A/-

SCALE-N.T.S.



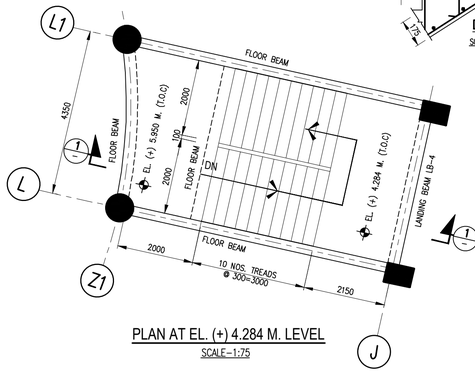
PLAN AT EL. (+) 2.617 M. LEVEL

SCALE-1:75



PLAN AT EL. (+) 4.284 M. LEVEL

SCALE-1:75



PLAN AT EL. (+) 4.284 M. LEVEL

SCALE-1:75

FOR TENDER ONLY

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METRE UNLESS NOTED OTHERWISE.
2. DRAWINGS SHALL NOT BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
3. CEMENT CONC. WORK SHALL CONFORM TO LATEST REV. OF IS:456.
4. GRADE OF CONCRETE SHALL BE OF GRADE "M25" AND GRADE OF STEEL TO BE "Fe500" UNLESS NOTED OTHERWISE.
5. UNLESS SPECIFIED OTHERWISE, BENDING OF BARS SHALL CONFORM TO THE LATEST REV. OF IS:2502 & IS:456.
6. CLEAR COVER TO REINF. AS FOLLOWS : SLAB = 20mm, BEAM = 25mm

FOOD COURT
LAYOUT & R.C DETAILS OF STAIRCASE

SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

APPROV.	FIRE	HVAC	ENVR.	ELEC.	STRL.	ARCH.
	REVIEWED					

NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY	16.03.2018	K.M.
FOR CONSTRUCTION		

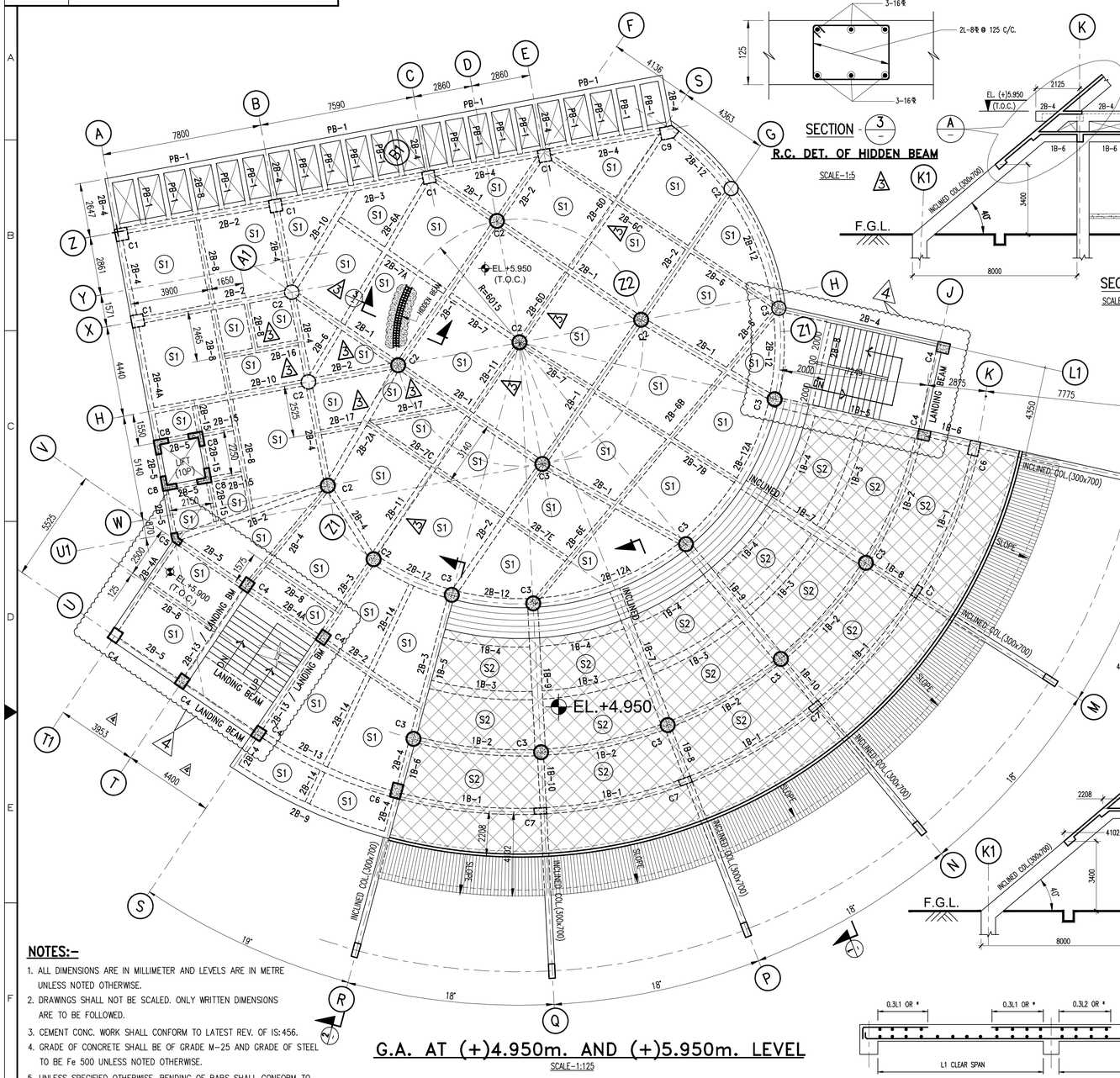
REVIEWED			
ARCHITECTURAL			
CIVIL & STRUCTURAL	16.03.2018	K.M.	
ELECTRICAL			
ENVIRO PROTECTION			
MECH (HVAC)			
MECH (FIRE FIGHT)			

DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
CHENNAI • MUMBAI • KOLKATA • NEW DELHI

DRAWN : U.B.	CHECKED : S.B.	SCALE	AS NOTED
REVIEWED : K.M.		DATE	16.03.2018
APPROVED : K.M.		JOB NO.	17T01

DWG. NO. 17T01-001-DWG-S-T004 (SH-2) REV. 0

DWG. NO. 17T01-001-DWG-S-T005 REV. 4



G.A. AT (+)4.950m. AND (+)5.950m. LEVEL

SCALE-1:125

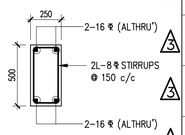
SECTION - (3) / (-)

R.C. DET. OF HIDDEN BEAM

SCALE-1:5

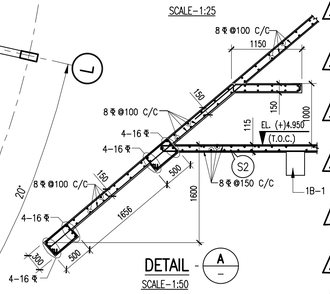
SECTION - (2) / (-)

SCALE-1:125



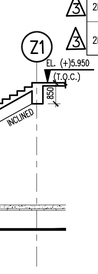
DET. PERGOLA BEAM MKD. PB-1

SCALE-1:25



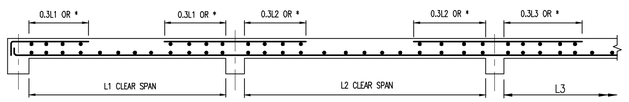
DETAIL - (A) / (-)

SCALE-1:50



SECTION - (1) / (-)

SCALE-1:125



TYPICAL CURTAILMENT RULES FOR FLOOR SLAB

(* DEVELOPMENT LENGTH WHICHEVER IS GREATER)

SCALE-N.T.S.

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METRE UNLESS NOTED OTHERWISE.
2. DRAWINGS SHALL NOT BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
3. CEMENT CONC. WORK SHALL CONFORM TO LATEST REV. OF IS:456.
4. GRADE OF CONCRETE SHALL BE OF GRADE M-25 AND GRADE OF STEEL TO BE Fe 500 UNLESS NOTED OTHERWISE.
5. UNLESS SPECIFIED OTHERWISE, BENDING OF BARS SHALL CONFORM TO THE LATEST REV. OF IS:2502 & IS:456.
6. CLEAR COVER TO REINF. AS FOLLOWS : COLUMN = 40mm, SLAB = 20mm, BEAM = 25mm

SCHEDULE OF FLOOR BEAMS AT EL.(+)5.950 LEV.

REINFORCEMENT

	BEAM MKD.	WIDTH	DEPTH	SUPPORT TOP	SUPPORT BOTTOM	SPAN TOP	SPAN BOTTOM	SUPPORT TOP	SUPPORT BOTTOM	STIRRUPS SUPPORT (S1)	STIRRUPS SPAN (S2)	REMARKS
3	2B-6	250	500	2-20ϕ +1-20ϕ [SUPP. AT COL. C2/C10]	2-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ + 2-20ϕ (2nd)	2-20ϕ [SUPP. AT BEAM B1/B2]	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	
3	2B-6A	250	500	2-20ϕ + 2-20ϕ (2nd) [SUPP. AT BEAM B1]	2-20ϕ +1-16ϕ	2-20ϕ	2-20ϕ +1-16ϕ + 2-16 ϕ (2nd)	2-20ϕ + 2-20ϕ (2nd) [SUPP. AT COL. C1]	2-20ϕ +1-16ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	
3	2B-6B	250	500	3-20ϕ + 2-20ϕ (2nd) [SUPP. AT BEAM B1]	2-20ϕ +1-16ϕ	2-20ϕ	2-20ϕ +1-16ϕ + 2-16 ϕ (2nd)	3-20ϕ + 2-20ϕ (2nd) [SUPP. AT BEAM B1]	2-20ϕ +1-16ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	
3	2B-6C	250	500	2-25ϕ + 2-25ϕ (2nd) [SUPP. AT COL. C1]	2-20ϕ +1-16ϕ	2-25ϕ	2-20ϕ +1-16ϕ + 2-16 ϕ (2nd)	2-25ϕ + 2-25ϕ (2nd) [SUPP. AT BEAM B2]	2-20ϕ +1-16ϕ	4L-8ϕ@ 100 c/c	4L-8ϕ@ 140 c/c	
3	2B-6D	250	450	2-25ϕ + 2-20ϕ (2nd) [SUPP. AT COL. C1]	2-20ϕ +1-16ϕ	2-20ϕ	2-20ϕ +1-16ϕ + 2-16 ϕ (2nd)	2-25ϕ + 2-20ϕ (2nd) [SUPP. AT BEAM B1]	2-20ϕ +1-16ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	
3	2B-6E	250	500	2-20ϕ +1-16ϕ [SUPP. AT COL. C3]	2-20ϕ	2-20ϕ	2-20ϕ	3-20ϕ + 2-20ϕ (2nd) [SUPP. AT BEAM B1]	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	
3	2B-7A	250	450	2-20ϕ [SUPP. AT BEAM B10]	2-20ϕ	2-20ϕ	2-20ϕ + 2-20ϕ (2nd)	2-20ϕ +1-20ϕ [SUPP. AT BEAM B1]	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 150 c/c	
3	2B-7B	250	450	2-20ϕ [SUPP. AT BEAM B12A]	2-20ϕ	2-20ϕ	2-20ϕ + 2-20ϕ (2nd)	2-20ϕ +1-20ϕ [SUPP. AT BEAM B1]	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 150 c/c	
3	2B-7C	250	450	2-20ϕ + 2-20ϕ (2nd) [SUPP. AT BEAM B2]	2-20ϕ	2-20ϕ	2-20ϕ + 2-20ϕ (2nd)	2-20ϕ + 2-20ϕ (2nd) [SUPP. AT BEAM B2]	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 150 c/c	
3	2B-7D	250	400	2-20ϕ +1-16ϕ [SUPP. AT COL. C2]	2-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ + 2-20ϕ (2nd) [SUPP. AT BEAM B2]	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	
3	2B-7E	250	400	2-20ϕ [SUPP. AT BEAM 6E]	2-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ + 2-20ϕ (2nd) [SUPP. AT BEAM B2]	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	
3	2B-10	300	500	2-20ϕ +1-25ϕ + 2-20ϕ (2nd) [SUPP. AT COL. C2]	2-20ϕ	2-20ϕ	2-20ϕ +1-25ϕ	2-20ϕ [SUPP. AT BEAM B4A]	2-20ϕ +1-25ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 175 c/c	
3	2B-11	250	450	2-25ϕ + 3-25ϕ (2nd) [SUPP. AT COL. C2]	2-20ϕ + 2-25ϕ (2nd)	2-25ϕ	2-20ϕ + 2-25ϕ (2nd)	2-25ϕ + 2-25ϕ (2nd) [SUPP. AT BEAM B1]	2-20ϕ + 2-25ϕ (2nd)	4L-10ϕ@ 75 c/c	4L-10ϕ@ 100 c/c	4L-10ϕ (STRUPPS)
3	2B-14	250	400	2-20ϕ +1-16ϕ [SUPP. AT BEAM B2/B13]	2-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ [SUPP. AT BEAM B4/B9]	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	
3	2B-15	250	500	2-25ϕ +1-20ϕ + 3-20ϕ (2nd) [SUPP. AT COL. C12]	2-20ϕ +1-20ϕ	2-25ϕ +1-20ϕ	2-20ϕ	2-25ϕ [SUPP. AT BEAM B2/B10]	2-20ϕ	2L-10ϕ@ 80 c/c	2L-10ϕ@ 80 c/c	
3	2B-16	250	450	2-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ + 2-16 ϕ (2nd)	2-20ϕ	2-20ϕ	2L-10ϕ@ 80 c/c	2L-10ϕ@ 80 c/c	
3	2B-17	250	400	2-25ϕ	2-25ϕ	2-25ϕ +1-20ϕ	2-25ϕ + 2-20ϕ (2nd)	2-25ϕ	2-25ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 125 c/c	

SCHEDULE OF FLOOR BEAMS AT EL.(+)4.950 LEV.

REINFORCEMENT

	BEAM MKD.	WIDTH	DEPTH	END SUPPORT TOP	END SUPPORT BOTTOM	SPAN TOP	SPAN BOTTOM	CONT. SUPPORT TOP	CONT. SUPPORT BOTTOM	STIRRUPS SUPPORT (S1)	STIRRUPS SPAN (S2)	REMARKS
	1B-1	300	500	3-20ϕ + 2-20ϕ	3-20ϕ	3-20ϕ	3-20ϕ	3-20ϕ + 2-20ϕ	3-20ϕ	4L-8ϕ@ 100 c/c	4L-8ϕ@ 150 c/c	4L-STIRRUPS
	1B-2	300	500	3-20ϕ + 2-20ϕ	3-20ϕ	3-20ϕ	3-20ϕ	3-20ϕ + 2-20ϕ	3-20ϕ	4L-8ϕ@ 100 c/c	4L-8ϕ@ 150 c/c	4L-STIRRUPS
3	1B-3	400	500	3-20ϕ	3-20ϕ	3-20ϕ	3-20ϕ	3-20ϕ	3-20ϕ	4L-8ϕ@ 100 c/c	4L-8ϕ@ 175 c/c	4L-STIRRUPS
	1B-4	400	500	4-16ϕ	4-25ϕ	4-16ϕ	4-25ϕ	4-16ϕ	4-25ϕ	4L-8ϕ@ 100 c/c	4L-8ϕ@ 150 c/c	4L-STIRRUPS
3	1B-5	500	650	4-20ϕ + 2-20ϕ	2-20ϕ +2-16ϕ	4-20ϕ	2-20ϕ +2-16ϕ	4-20ϕ	2-20ϕ +2-16ϕ	4L-8ϕ@ 100 c/c	4L-8ϕ@ 150 c/c	4L-STIRRUPS
3	1B-6	300	500	2-20ϕ + 1-20ϕ	2-20ϕ + 1-16 ϕ	2-20ϕ	2-20ϕ + 1-16 ϕ	2-20ϕ + 1-20ϕ	2-20ϕ + 1-16 ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 150 c/c	
3	1B-7	500	650	2-25ϕ +2-20ϕ	4-20ϕ	2-25ϕ +2-20ϕ	4-20ϕ	2-25ϕ +2-20ϕ + 2-25ϕ +2-20ϕ	4-20ϕ	4L-8ϕ@ 100 c/c	4L-8ϕ@ 175 c/c	4L-STIRRUPS
3	1B-8	300	500	2-20ϕ +1-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ +1-20ϕ	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 150 c/c	
3	1B-9	500	650	2-25ϕ +2-20ϕ + 2-25ϕ +2-20ϕ	2-25ϕ +2-20ϕ	2-25ϕ +2-20ϕ	2-25ϕ +2-20ϕ	2-25ϕ +2-20ϕ + 4-20ϕ	2-25ϕ +2-20ϕ	4L-10ϕ@ 80 c/c	4L-10ϕ@ 175 c/c	4L-STIRRUPS
3	1B-10	300	500	2-20ϕ + 1-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ + 1-20ϕ	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 150 c/c	

SCHEDULE OF FLOOR BEAMS AT EL.(+)5.950 LEV.

	BEAM MKD.	SIZE WIDTH	SIZE DEPTH	REINFORCEMENT SUPPORT TOP	SUPPORT BOTTOM	SPAN TOP	SPAN BOTTOM	STIRRUPS SUPPORT	STIRRUPS SPAN	REMARKS
3	2B-1	300	600	3-25ϕ + 2-25ϕ (2nd)	2-25ϕ	2-25ϕ	3-25ϕ + 3-20ϕ (2nd)	4L-10ϕ@ 100 c/c	4L-10ϕ@ 150/c	4L-10ϕ STIRRUPS
3	2B-2	300	500	3-25ϕ + 2-25ϕ (2nd)	2-25ϕ	3-25ϕ	2-25ϕ +1-20ϕ + 2-20ϕ (2nd)	4L-10ϕ@ 100 c/c	4L-10ϕ@ 175 c/c	4L-10ϕ STIRRUPS
3	2B-2A	300	500	3-25ϕ + 2-25ϕ (2nd)	3-25ϕ	3-25ϕ	3-25ϕ + 2-25ϕ (2nd)	4L-10ϕ@ 80 c/c	4L-10 @ 100 c/c	4L-10ϕ STIRRUPS
3	2B-3	300	500	3-25ϕ + 2-20ϕ (2nd)	2-25ϕ	2-25ϕ	2-25ϕ +1-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 175 c/c	
3	2B-4	300	500	2-25ϕ + 1-25ϕ	2-20ϕ + 1-20ϕ	2-25ϕ	2-20ϕ + 1-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 175 c/c	
3	2B-4A	300	500	2-25ϕ + 1-25ϕ	2-20ϕ + 1-16 ϕ	2-25ϕ	2-20ϕ + 1-16 ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 175 c/c	
3	2B-5	250	500	2-25ϕ	2-20ϕ + 1-16 ϕ	2-25ϕ	2-20ϕ + 1-16 ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 165 c/c	
3	2B-7	250	400	2-20ϕ + 1-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	SPANNING BETWN. COL. C10 & BM.B1
3	2B-8	250	400	2-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ + 2-16 ϕ (2nd)	2L-8ϕ@ 100 c/c	2L-8ϕ@ 140 c/c	
3	2B-9	300	500	2-20ϕ	2-20ϕ	2-20ϕ	2-20ϕ	2L-8ϕ@ 100 c/c	2L-8ϕ@ 125 c/c	
	2B-12	450	600	3-25ϕ	3-25ϕ	3-25ϕ	3-25ϕ	4L-8ϕ@ 100 c/c	4L-8ϕ@ 150 c/c	
	2B-12A	450	850	3-25ϕ + 2-25ϕ (2nd)	3-25ϕ + 2-25ϕ (2nd)	3-25ϕ + 2-25ϕ (2nd)	3-25ϕ + 2-25ϕ (2nd)	4L-10ϕ@ 100 c/c	4L-10ϕ@ 150 c/c	2-12ϕ SIDE REINF. (BOTH FACE)
3	2B-13	300	500	3-25ϕ + 2-25ϕ (2nd)	2-25ϕ	2-25ϕ	2-25ϕ + 1-25ϕ	2L-10ϕ@ 100 c/c	2L-10ϕ@ 175 c/c	10ϕ STIRRUPS

SCHEDULE OF SLABS

SLAB MKD.	SLAB THK.	REINFORCEMENT ALONG SHORTER DIRECTION END SUPPORT (TOP)	ALONG SHORTER DIRECTION SPAN (BOTTOM)	ALONG SHORTER DIRECTION CONT. SUPPORT (TOP)	ALONG LONGER DIRECTION END SUPPORT (TOP)	ALONG LONGER DIRECTION SPAN (BOTTOM)	ALONG LONGER DIRECTION CONT. SUPPORT (TOP)
S1	125	8ϕ@100 C/C	8ϕ@100 C/C	8ϕ@100 C/C	8ϕ@100 C/C	8ϕ@100 C/C	8ϕ@100 C/C
S2	115	8ϕ@150 C/C	8ϕ@150 C/C	8ϕ@150 C/C	8ϕ@200 C/C	8ϕ@200 C/C	8ϕ@200 C/C

DISTRIBUTION REINFORCEMENT AT SUPPT. TOP 8 ϕ @ 250 C/C

*** HIGHER OF THE REINFORCEMENT TO BE PROVIDED AT CONTINUOUS SUPPORT (TOP) FOR DISSIMILAR MKD. BEAMS/SLABS

FOR TENDER ONLY

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.	REVIEWED	NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
							REVISED AS MARKED 4	K.R.	U.B.	4	19.03.2018
							REVISED AS MARKED 3	K.R.	U.B.	3	24.10.2017
							GENERAL REVISION	K.M.	P.D.	2	21.09.17
							GENERAL REVISION	A.R.	P.D.	1	08.09.16

REVIEWED	RELEASE STATUS	DATE	SIGNATURE
	PRELIMINARY		
✓	FOR TENDER ONLY	19.03.2018	K.M.
	FOR CONSTRUCTION		
	ARCHITECTURAL		
✓	CIVIL & STRUCTURAL	19.03.2018	K.M.
	ELECTRICAL		
	INSTRUMENTATION		
	MECHANICAL		

FOOD COURT

G.A. & R.C.C. DET. AT 4.950M. & 5.950M. LEV.

SCIENCE CITY AT KOLKATA

J.B.S. HALDANE AVENUE, KOLKATA-700046

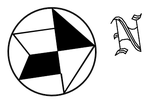
NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

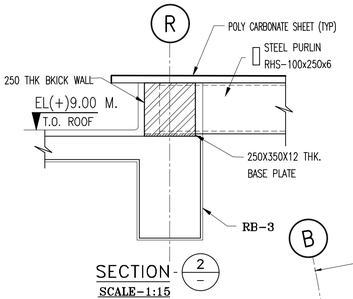
DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
CHENNAI • MUMBAI • KOLKATA • NEW DELHI

DRAWN : P.D.	CHECKED : S.B.	SCALE	AS NOTED
REVIEWED : K.M.		DATE	11/11/15
APPROVED : K.M.		JOB NO.	17T01

DWG. NO. 17T01-001-DWG-S-T005 REV. 4

DWG. NO. 17T01-001-DWG-S-T006 REV. 4





SECTION - 2/–
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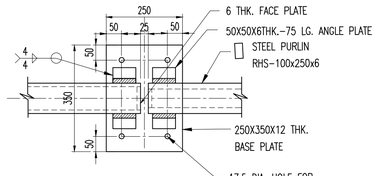
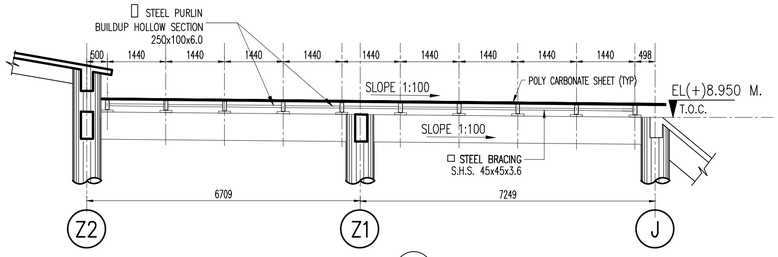
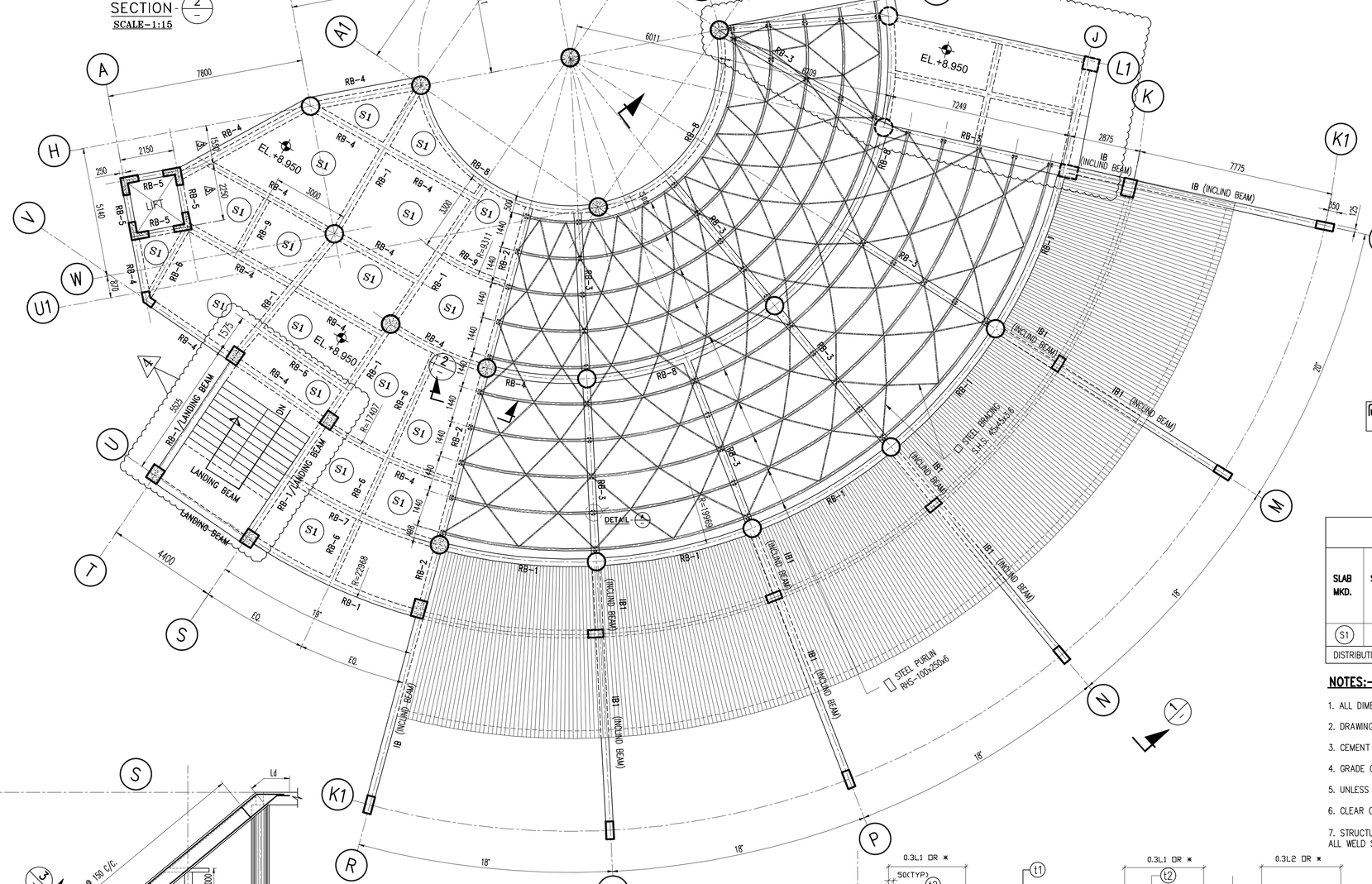


DETAIL OF BASE PLATE
SCALE-1:0



SECTION - 1/–
SCALE-1:75

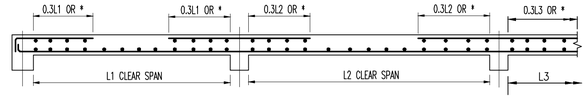


G.A. AT (+) 8.950m. LEVEL
SCALE-1:100

SCHEDULE OF ROOF BEAMS

BEAM MKD.	SIZE		REINFORCEMENT					
	WIDTH	DEPTH	TOP REINF.		BOTTOM REINF.		STIRRUPS	
			t1	t2	b1	b2	SUPPORT (S1)	SPAN (S2)
RB-1	300	500	3-16ϕ	3-20ϕ	3-16ϕ	2-16ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
RB-2	300	500	3-20ϕ	2-25ϕ	3-20ϕ	2-20ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
RB-3	300	500	3-25ϕ	3-20ϕ	3-20ϕ	2-20ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
RB-4	300	500	3-16ϕ	2-16ϕ	3-16ϕ	2-12ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
RB-5	250	500	3-16ϕ	2-16ϕ	3-16ϕ	–	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
RB-6	250	400	3-16ϕ	–	3-16ϕ	–	2L-8ϕ@ 100c/c	2L-8ϕ@ 125c/c
RB-7	300	500	3-16ϕ	3-20ϕ	3-25ϕ	–	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
RB-8	300	500	3-25ϕ	2-25ϕ	3-25ϕ	2-20ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 150c/c
RB-9	250	400	2-16ϕ	–	2-16ϕ	2-12ϕ	2L-8ϕ@ 100c/c	2L-8ϕ@ 125c/c

● HIGHER OF THE REINFORCEMENT TO BE PROVIDED AT CONTINUOUS SUPPORT (TOP) FOR DISSIMILAR MKD. BEAMS



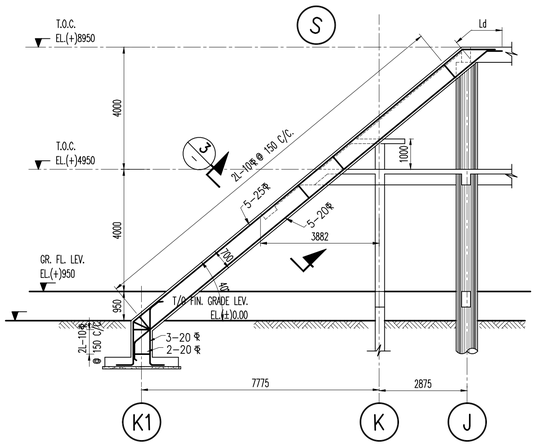
TYPICAL CURTAILMENT RULES FOR FLOOR SLAB
(* DEVELOPMENT LENGTH WHICHEVER IS GREATER)
SCALE-N.T.S.

SCHEDULE OF SLABS

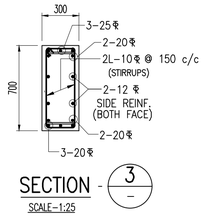
SLAB MKD.	SLAB THK.	REINFORCEMENT					
		ALONG SHORTER DIRECTION			ALONG LONGER DIRECTION		
		END SUPPORT (TOP)	SPAN (BOTTOM)	CONT. SUPPORT (TOP)	END SUPPORT (TOP)	SPAN (BOTTOM)	CONT. SUPPORT (TOP)
(S1)	115	8ϕ @150 C/C	8ϕ @150 C/C	8ϕ @150 C/C	8ϕ @200 C/C	8ϕ @200 C/C	8ϕ @200 C/C
DISTRIBUTION REINFORCEMENT AT SUPPT. TOP 8ϕ @ 250 C/C							

NOTES:-

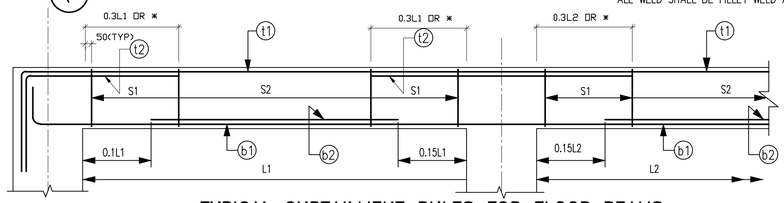
1. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN "METRE" UNLESS NOTED OTHERWISE.
2. DRAWINGS SHALL NOT BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
3. CEMENT CONC. WORK SHALL CONFORM TO LATEST REV. OF IS:456. TO BE Fe 500 UNLESS NOTED OTHERWISE.
4. GRADE OF CONCRETE SHALL BE OF GRADE M-25 AND GRADE OF STEEL
5. UNLESS SPECIFIED OTHERWISE, BENDING OF BARS SHALL CONFORM TO THE LATEST REV. OF IS:2502 & IS:456.
6. CLEAR COVER TO REINF. AS FOLLOWS : COLUMN = 40mm, SLAB = 20mm, BEAM = 25mm
7. STRUCTURAL STEEL HOLLOW SECTIONS (RECTANGULAR & SQUARE) SHALL CONFORM TO IS:4923, Yst.=310 (MINIMUM). 8. ALL WELD SHALL BE FILLET WELD AND MINIMUM WELD SIZE SHALL BE 4 mm. UNLESS NOTED OTHERWISE.



DETAIL OF INCLINED BEAM (IB1)
SCALE-1:100



SECTION - 3/–
SCALE-1:25



TYPICAL CURTAILMENT RULES FOR FLOOR BEAMS
(MULTIPLE-SPAN BEAM)

FOR TENDER ONLY

FOOD COURT:
G.A. AND R.C. DETAILS OF ROOF SLAB & BEAMS

SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
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BIDHAN NAGAR, CALCUTTA - 700091

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CHENNAI• MUMBAI KOLKATA NEW DELHI

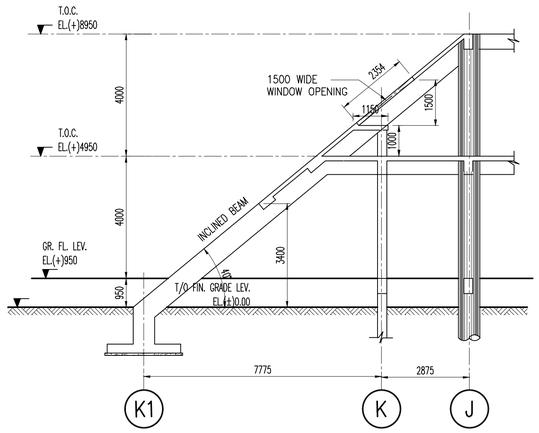
REVIEWED	RELEASE STATUS	DATE	SIGNATURE
APPROV.	PRELIMINARY		
MECH.	FOR TENDER ONLY	19.03.2018	K.M.
INST.	FOR CONSTRUCTION		
ELEC.	ARCHITECTURAL		
STRL.	CIVIL & STRUCTURAL	19.03.2018	K.M.
ARCH.	ELECTRICAL		
	INSTRUMENTATION		
	MECHANICAL		

NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
REVISED AS MARKED 4	K.R.	U.B.	4	19.03.2018
REVISED AS MARKED 3	K.R.	U.B.	3	24.10.2017
GENERAL REVISION	K.R.	U.B.	2	15.09.2017
GENERAL REVISION	A.R.	P.D.	1	08.09.2016

DRAWN : U.B. CHECKED : K.R. SCALE AS NOTED
REVIEWED : K.M. DATE 07.09.2017
APPROVED : K.M. JOB NO. 17T01

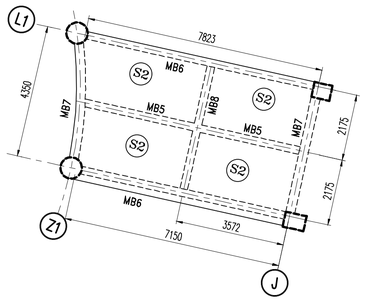
DWG. NO. 17T01-001-DWG-S-T006 REV. 4

DWG. NO. 17T01-001-DWG-S-T007 REV. 3



TYPICAL CROSS SECTION OF INCLINED BEAM (IB1)

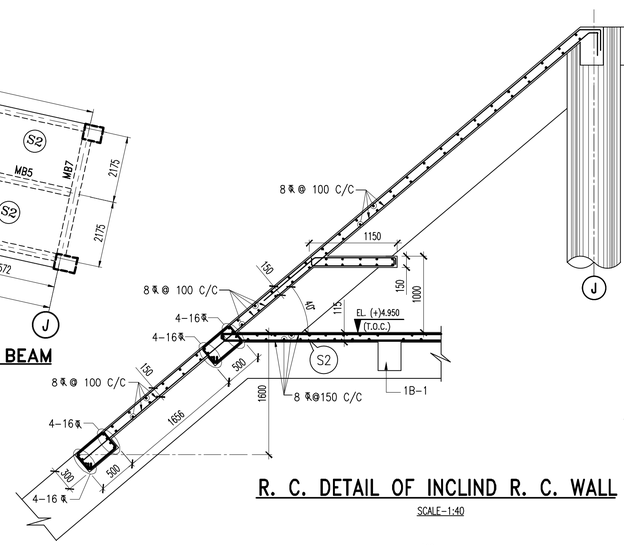
SCALE-1:100



PLAN OF MUMTY SLAB & BEAM AT EL(+)8.950 (T.O.C)

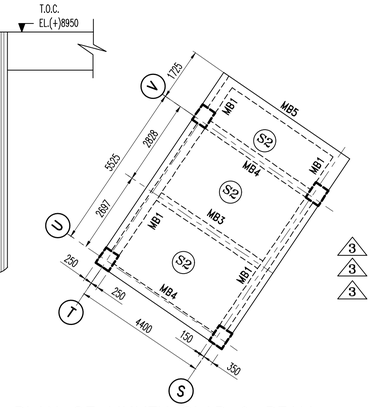
SCALE-1:100

3



R. C. DETAIL OF INCLIND R. C. WALL

SCALE-1:40



PLAN OF MUMTY SLAB & BEAM AT EL(+)11.650 (T.O.C)

SCALE-1:100

3

3

3

SCHEDULE OF MUMTY SLAB BEAMS

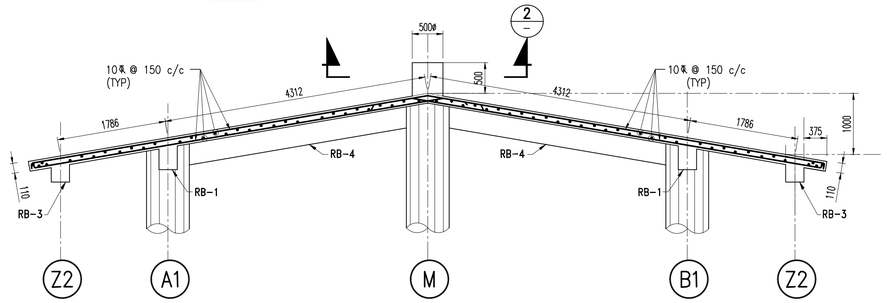
BEAM MKD.	SIZE		REINFORCEMENT					
	WIDTH	DEPTH	TOP REINF.		BOTTOM REINF.		STIRRUPS	
			t1	t2	b1	b2	SUPPORT (S1)	SPAN (S2)
MB-1	300	500	3-20 ϕ	2-16 ϕ	3-16 ϕ	2-16 ϕ	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
MB-2	300	500	3-16 ϕ	–	3-16 ϕ	–	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
MB-3	300	400	3-16 ϕ	–	3-16 ϕ	–	2L-10 ϕ @ 100c/c	2L-10 ϕ @ 150c/c
MB-4	300	500	3-20 ϕ	–	3-16 ϕ	–	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
MB-5	250	400	3-16 ϕ	–	3-16 ϕ	–	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
MB-6	300	500	3-20 ϕ	3-20 ϕ	3-20 ϕ	2-20 ϕ	2L-8 ϕ @ 125c/c	2L-8 ϕ @ 175c/c
MB-7	300	450	2-20 ϕ +1-25 ϕ	–	2-20 ϕ	–	2L-8 ϕ @ 125c/c	2L-8 ϕ @ 165c/c
MB-8	250	450	2-20 ϕ	–	2-20 ϕ +1-20 ϕ	–	2L-8 ϕ @ 150c/c	2L-8 ϕ @ 150c/c

● HIGHER OF THE REINFORCEMENT TO BE PROVIDED AT CONTINUOUS SUPPORT (TOP) FOR DISSIMILAR MKD. BEAMS

SCHEDULE OF ROOF AND WATER TANK SLAB BEAMS

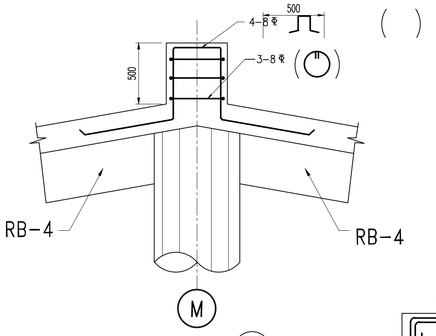
BEAM MKD.	SIZE		REINFORCEMENT					
	WIDTH	DEPTH	TOP REINF.		BOTTOM REINF.		STIRRUPS	
			t1	t2	b1	b2	SUPPORT (S1)	SPAN (S2)
RB-1	300	500	3-20 ϕ	2-20 ϕ	3-16 ϕ	2-16 ϕ	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
RB-2	250	400	2-16 ϕ	–	3-16 ϕ	–	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
RB-3	300	600	3-20 ϕ	–	3-20 ϕ	–	2L-10 ϕ @ 100c/c	2L-10 ϕ @ 150c/c
RB-4	300	500	3-16 ϕ	–	3-16 ϕ	2-16 ϕ	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
WBT-1	300	500	3-16 ϕ	2-16 ϕ	3-16 ϕ	2-16 ϕ	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
WBT-2	300	500	3-20 ϕ	2-20 ϕ	3-20 ϕ	–	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
WBT-3	300	500	3-20 ϕ	2-20 ϕ	3-20 ϕ	2-16 ϕ	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c
WBT-4	250	450	3-16 ϕ	–	3-16 ϕ	–	2L-8 ϕ @ 100c/c	2L-8 ϕ @ 150c/c

● HIGHER OF THE REINFORCEMENT TO BE PROVIDED AT CONTINUOUS SUPPORT (TOP) FOR DISSIMILAR MKD. BEAMS



SECTION - 2/–

SCALE-1:50



SECTION - 3/–

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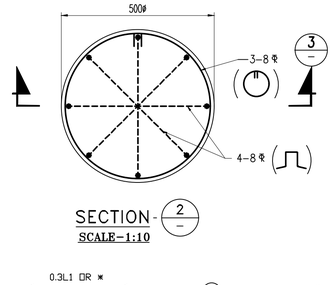
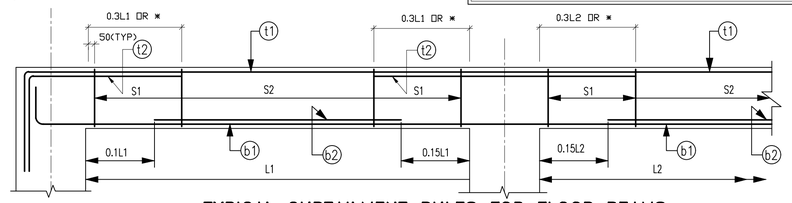
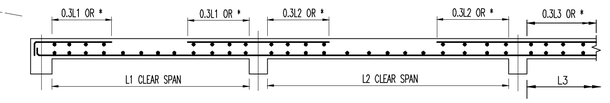


SECTION - 2/–

SCALE-1:10



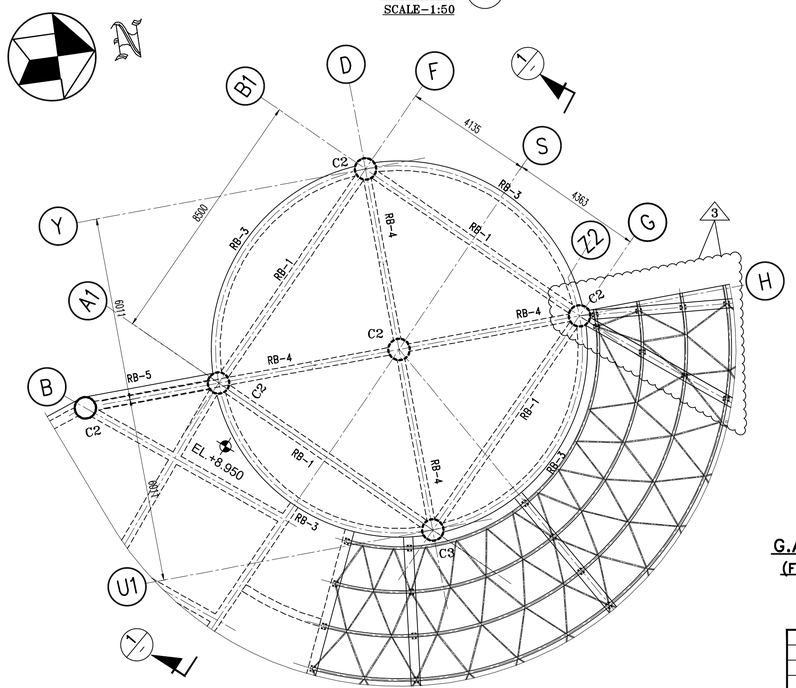
TYPICAL CURTAILMENT RULES FOR FLOOR BEAMS (MULTIPLE-SPAN BEAM)



TYPICAL CURTAILMENT RULES FOR FLOOR SLAB

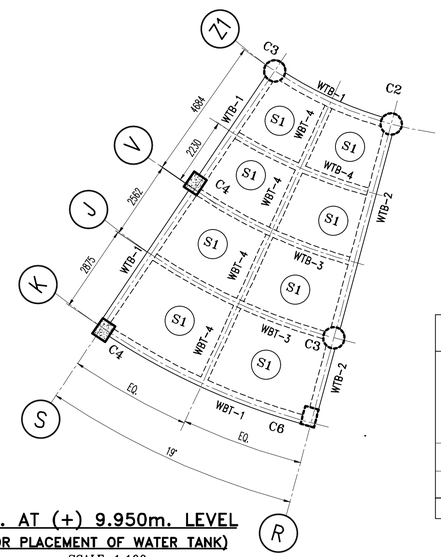
(* DEVELOPMENT LENGTH WHICHEVER IS GREATER)

SCALE-N.T.S.



G.A. AT (+) 11.450m. LEVEL

SCALE-1:100



G.A. AT (+) 9.950m. LEVEL

(FOR PLACEMENT OF WATER TANK)

SCALE-1:100

SCHEDULE OF SLABS

SLAB MKD.	SLAB THK.	REINFORCEMENT					
		ALONG SHORTER DIRECTION			ALONG LONGER DIRECTION		
		END SUPPORT (TOP)	SPAN (BOTTOM)	CONT. SUPPORT (TOP)	END SUPPORT (TOP)	SPAN (BOTTOM)	CONT. SUPPORT (TOP)
S1	125	8 ϕ @150 C/C	8 ϕ @150 C/C	8 ϕ @150 C/C	8 ϕ @150 C/C	8 ϕ @150 C/C	8 ϕ @150 C/C
S2	125	8 ϕ @150 C/C	8 ϕ @150 C/C	8 ϕ @150 C/C	8 ϕ @150 C/C	8 ϕ @150 C/C	8 ϕ @150 C/C
DISTRIBUTION REINFORCEMENT AT SUPPT. TOP 8 ϕ @ 250 C/C							

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METRE UNLESS NOTED OTHERWISE.
2. DRAWINGS SHALL NOT BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.
3. CEMENT CONC. WORK SHALL CONFORM TO LATEST REV. OF IS:456.
4. GRADE OF CONCRETE SHALL BE OF GRADE M-25 AND GRADE OF STEEL TO BE Fe 500 UNLESS NOTED OTHERWISE.
5. UNLESS SPECIFIED OTHERWISE, BENDING OF BARS SHALL CONFORM TO THE LATEST REV. OF IS:2502 & IS:456.
6. CLEAR COVER TO REINF. AS FOLLOWS : COLUMN = 40mm, SLAB = 20mm, BEAM = 25mm

FOR TENDER ONLY

FOOD COURT
G.A. AND R.C.C. DETAILS OF ROOF AT EL.(+)9.950M. & EL.(+)11.650M. (T.O.C)

SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

REVISION	DESCRIPTION	CHECKED	DRAWN	REV.	DATE
	REVISED AS MARKED 3	K.M.	U.B.	3	19.03.18
	GENERAL REVISION	K.M.	U.B.	2	24.10.17
	GENERAL REVISION	A.R.	P.D.	1	08.09.16

APPROV. | MECH. | INST. | ELEC. | STRL. | ARCH. — REVIEWED

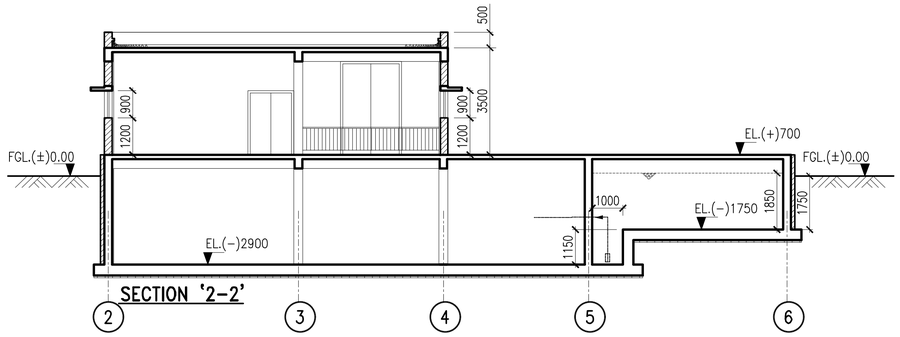
RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY	19.03.18	K.M
FOR CONSTRUCTION		
ARCHITECTURAL		
CIVIL & STRUCTURAL	19.03.18	K.M
ELECTRICAL		
INSTRUMENTATION		
MECHANICAL		

REVIEWED

DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
CHENNAI· MUMBAI KOLKATA NEW DELHI

DRAWN : U.B.	CHECKED : K.R.	SCALE	AS NOTED
REVIEWED : K.M.		DATE	12.09.2017
APPROVED : K.M.		JOB NO.	17T01

DWG. NO. 17T01-001-DWG-S-T007 REV. 3



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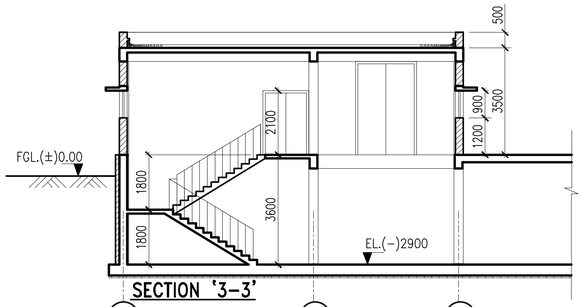

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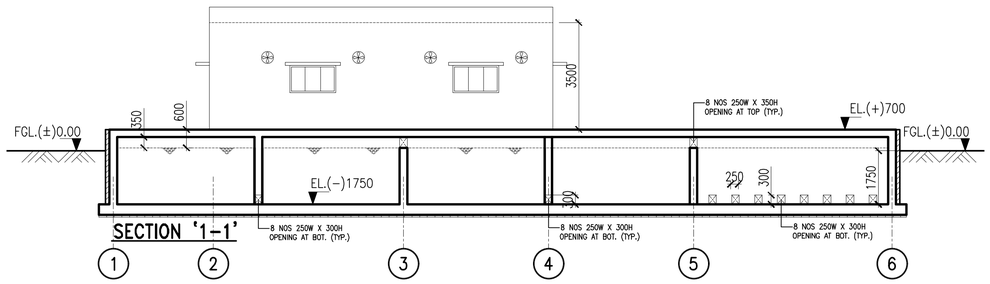

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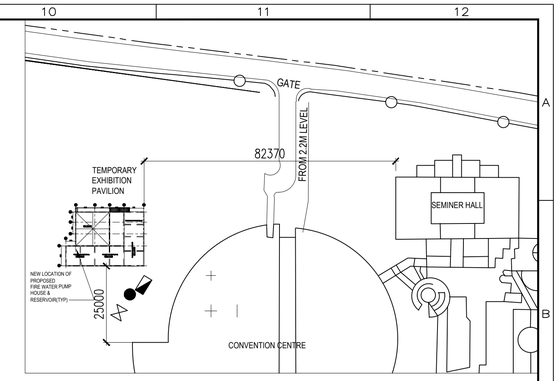
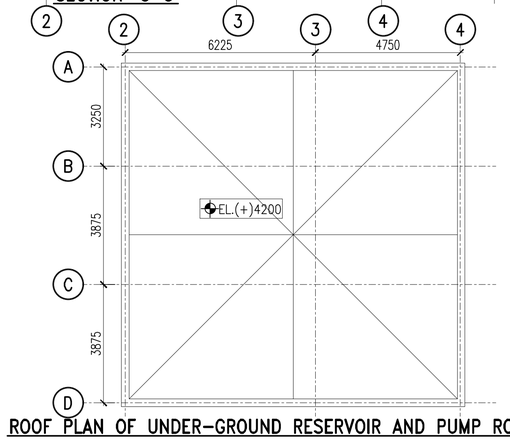
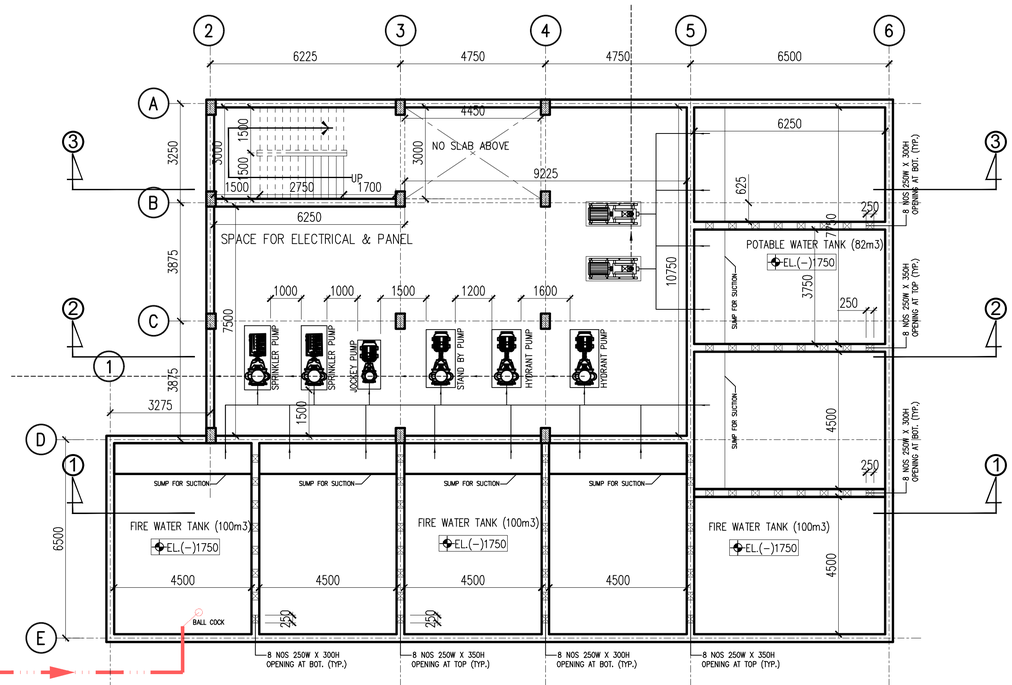


LOCATION PLAN

SCALE-1:1000

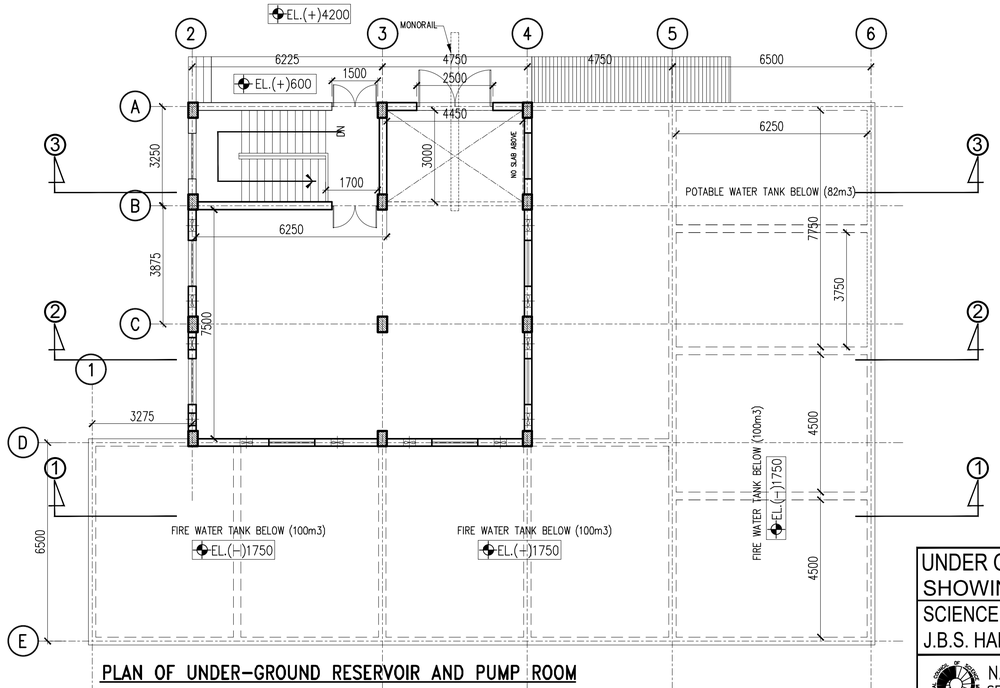


ROOF PLAN OF UNDER-GROUND RESERVOIR AND PUMP ROOM



PLAN OF UNDER-GROUND RESERVOIR AND PUMP ROOM

EL.(−)1750



PLAN OF UNDER-GROUND RESERVOIR AND PUMP ROOM

EL.(+)700

TENDER PURPOSE ONLY

UNDER GROUND RESERVOIR WITH PUMP ROOM SHOWING PLANS & SECTIONS

SCIENCE CITY AT KOLKATA

J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.	NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
	REVIEWED									

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY	27.03.2018	S.L
FOR CONSTRUCTION		

REVIEWED		
ARCHITECTURAL		
CIVIL & STRUCTURAL		
ELECTRICAL		
INSTRUMENTATION		
MECHANICAL		

DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
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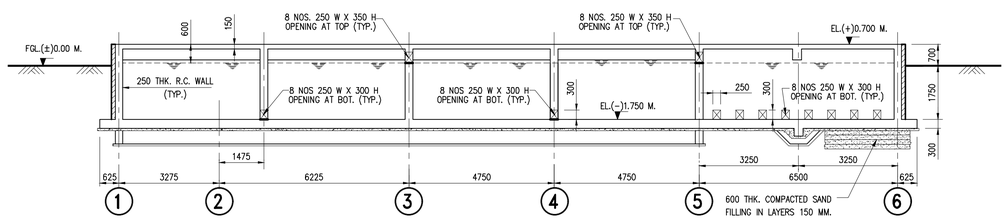
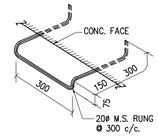
DRAWN : PD	CHECKED : S.L	SCALE	1:100
REVIEWED : S.L		DATE	28.12.2017
APPROVED : S.L		JOB NO.	17T01

DWG. NO. 17T01-801 -DWG-A-T001 REV. 0

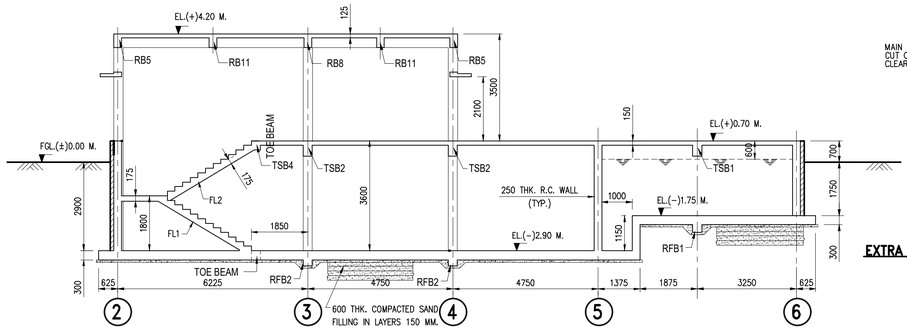


SECTION - (1/—)

SCALE-1:100

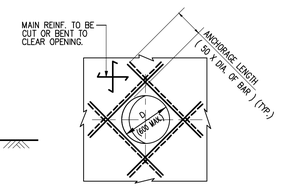


TYP. DETAIL OF M.S. RUNG LADDER

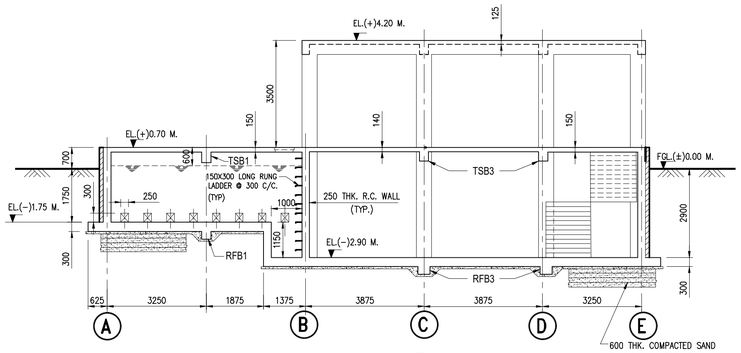


SECTION - (2/—)

SCALE-1:100

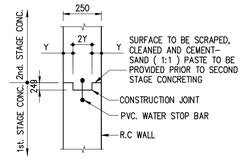


CIRCULAR CUT – OUT
EXTRA REINFORCEMENT AROUND CUT OUTS



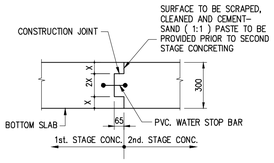
SECTION - (3/—)

SCALE-1:100



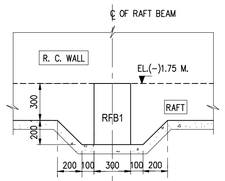
DETAIL OF CONSTRUCTION JOINT FOR 250 THK. R.C WALL

SCALE-1:20



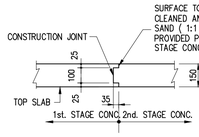
DETAIL OF CONSTRUCTION JOINT FOR 300 THK. BOTTOM SLAB

SCALE-1:20



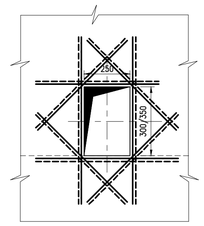
SECTION - (4/—) (TYPICAL)

SCALE-1:25

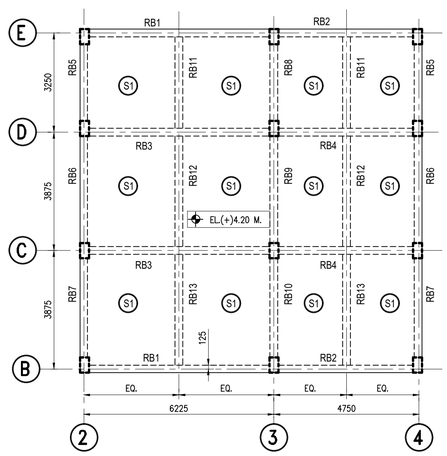


DETAIL OF CONSTRUCTION JOINT FOR 150 THK. TOP SLAB

SCALE-1:20



DETAIL OF OPENING IN PARTITION WALL



PUMP ROOM ROOF LEVEL PLAN

SCALE-1:100

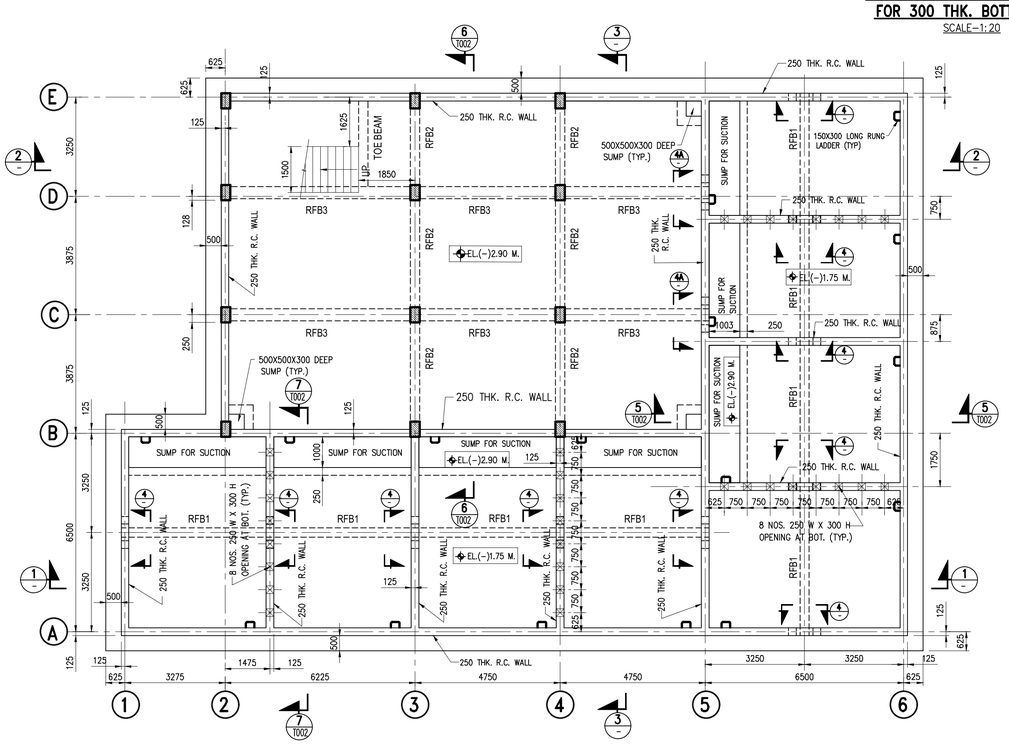
[FOR SCHEDULE OF SLAB REINFORCEMENT, REF. TO DWG. NO. 17T01-801-DWG-S-T002]

SLAB THICKNESS

1. STAIR ROOF SLAB - 125 THK.
2. TANK TOP SLAB - 140/150 THK.
3. TANK RAFT SLAB - 300 THK.

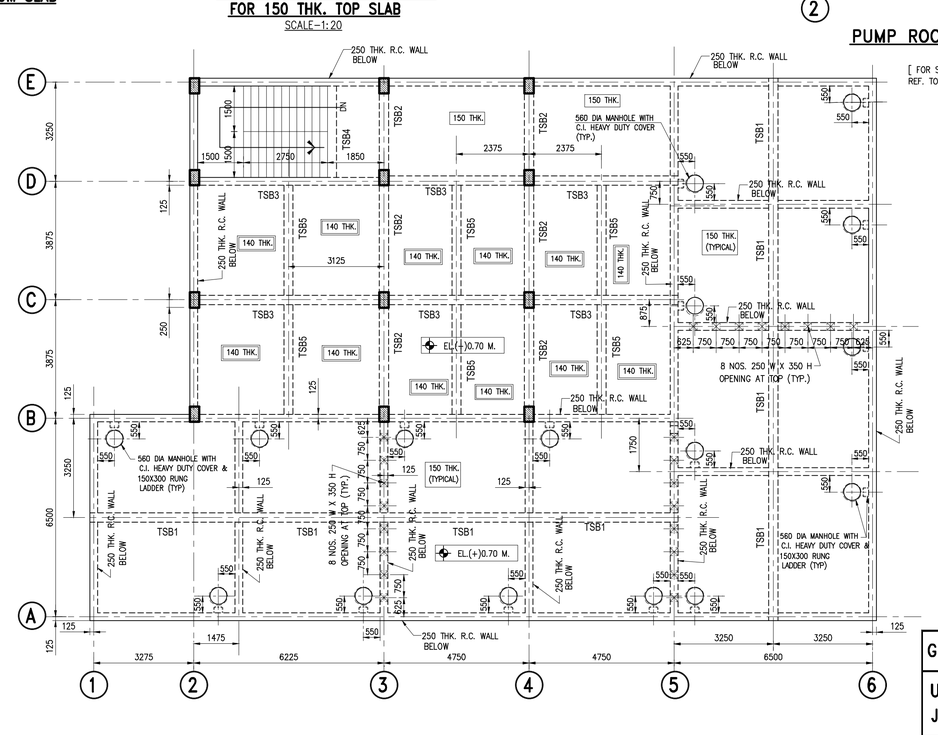
SCHEDULE OF BEAM SIZE

BEAM MKD.	SIZE BREADTH (B) (MM)	SIZE DEPTH (D) (MM)
RFB1	300	450
RFB2	300	400
RFB3	400	600
TOE BEAM	300	300
TSB1	300	450
TSB2	300	400
TSB3	300	450
TSB4	300	300
TSB5	300	350
RB1	250	500
RB2	250	400
RB3	250	500
RB4	250	400
RB5	250	350
RB6	250	350
RB7	250	350
RB8	250	350
RB9	250	350
RB10	250	350
RB11	250	300
RB12	250	300
RB13	250	300



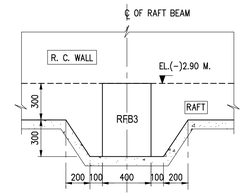
BOTTOM PLAN AT (−) 1.75 M. / (−) 2.90 M. LEV.

SCALE-1:100



TOP PLAN AT (+) 0.700 M. LEV.

SCALE-1:100



SECTION - (4A/—)

SCALE-1:25

NOTES

1. ALL DIMENSIONS ARE IN MM. AND LEVELS ARE IN M. UNLESS MENTIONED OTHERWISE.
2. NO DIMENSIONS ARE TO BE SCALED OUT ONLY FIGURED DIMENSIONS ARE TO BE TAKEN.
3. GRADE OF REINFORCED CONCRETE IS "M30" (MIXED DESIGN).
4. GRADE OF REINFORCEMENT FOR ALL RCC WORK : Fe 500 (H.Y.S.D. BARS) CONFORMING TO IS: 1786–2008.
5. MINIMUM CLEAR COVER TO MAIN REINFORCEMENT SHALL BE AS FOLLOWS: i) RAFT SLAB/BEAM=50 MM. ii) WALL=40 MM. & iii) TOP SLAB/BEAM=30 MM.
6. LAP LENGTH FOR REINFORCEMENT :50 TIMES DIAMETER OF SMALLER BARS.
7. F.G.L. ASSUMED AS (±)0.00 M.
8. ALL UNDERGROUND PIPING SHALL BE WRAPPED AND COATED AS PER IS: 10221
9. UNLESS SPECIFIED OTHERWISE ALL HOOKS, BENDS, LAPS, SPLICES ETC. SHALL BE AS PER LATEST IS:456 AND OTHER RELEVANT INDIAN STANDARDS.
10. UNLESS SPECIFIED OTHERWISE, NOT MORE THAN 50% OF THE BARS SHALL BE LAPPED/SPLICED AT ANY SECTION.
11. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH RELEVENT AND LATEST ARCH. DWG.
12. ANY DISCREPANCY OBSERVED BETWEEN THIS STRUCTURAL DRAWING AND RELEVANT ARCHITECTURAL DRAWING SHALL BE BROUGHT TO THE NOTICE AND GET RECONCILED BEFORE EXECUTION.
13. 'Ld'= DEVELOPMENTS LENGTH OF BARS FOR M30 CONCRETE SHALL BE 46xD (D = DIA OF BAR.)
14. FOR SCHEDULE OF BEAMS REF. TO DWG. NO. 17T01-801-DWG-S-T002.

GENERAL ARRANGEMENT DRAWING OF U.G. RESERVOIR

UPGRADATION JOB, SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA–700046

TENDER PORPOSE ONLY

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

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RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY	22.08.2018	S.B.
FOR CONSTRUCTION		

REVIEWED: ARCHITECTURAL; CIVIL & STRUCTURAL; ELECTRICAL; ENVIRO PROTECTION; MECH (HVAC); MECH (FIRE FIGHT)

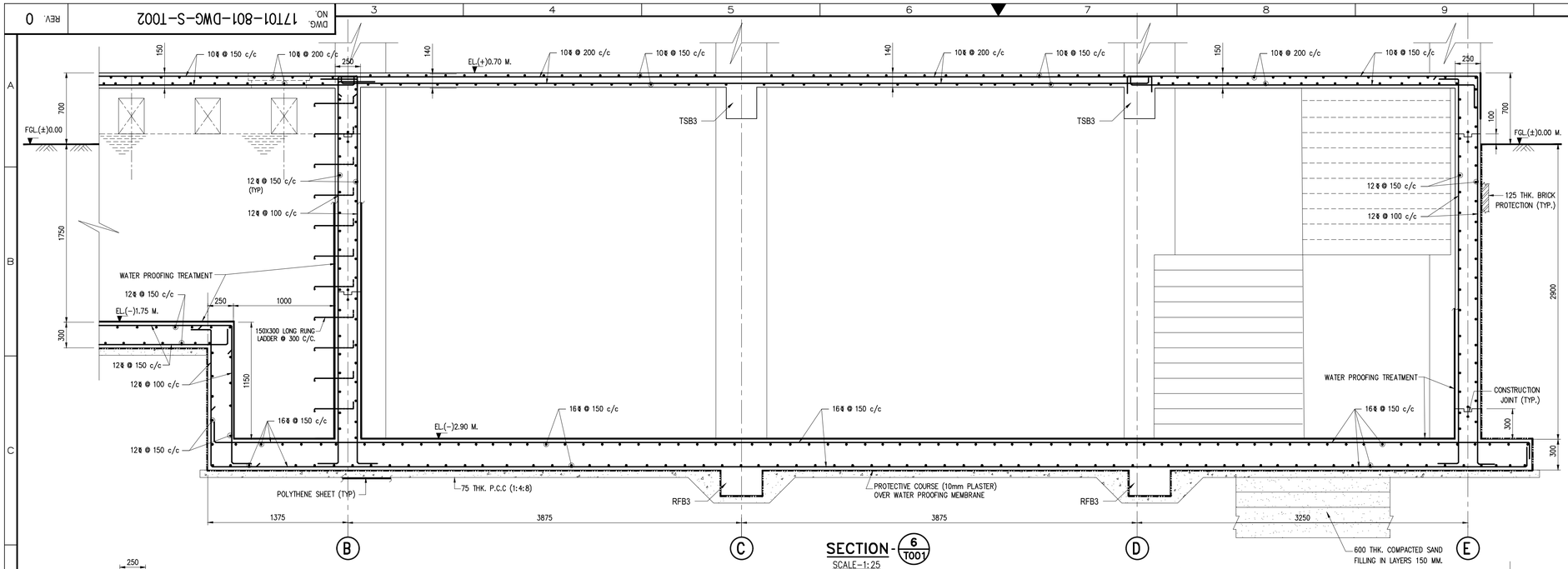
APPROV. | FIRE | HVAC | ENVR. | ELEC. | STRL. | ARCH. — REVIEWED

NATURE OF REVISION & DESCRIPTION | CHECKED | DRAWN | REV. | DATE

DRAWN : U.B/K.G | CHECKED : S.B. | SCALE : AS NOTED
REVIEWED : K.M. | DATE : 26.02.2018
APPROVED : AM/SL | JOB NO. : 17T01

DWG. NO. 17T01-801-DWG-S-T001 | REV. 0

DWG. NO. 17T01-801-DWG-S-T002 | REV. 0



SECTION - 6/T001

SCALE−1:25

SCHEDULE OF BEAMS

BEAM MKD.	SIZE		REINFORCEMENT								REMARKS
	BREATH (B) (MM)	DEPTH (D) (MM)	END SUPPORT		SPAN		CONT. SUPPORT		STIRRUPS		
			TOP	BOTT.	TOP	BOTT.	TOP	BOTT.	SUPPORT	SPAN	
RFB1	300	450	3−25 ϕ	3−25 ϕ	3−25 ϕ + 2−25 ϕ (2nd.)	3−25 ϕ	3−25 ϕ	3−25 ϕ + 2−25 ϕ (2nd.)	2L−8ϕ @ 100 C/C	2L−8ϕ @ 175 C/C	
RFB2	300	400	3−25 ϕ	3−25 ϕ + 2−25 ϕ (2nd.)	3−25 ϕ + 2−25 ϕ (2nd.)	3−25 ϕ	3−25 ϕ	3−25 ϕ + 3−25 ϕ (2nd.)	2L−10ϕ @ 90 C/C	2L−10ϕ @ 175 C/C	
RFB3	*400*	600	4−32 ϕ	4−32 ϕ + 4−32 ϕ (2nd.)	4−32 ϕ + 4−25 ϕ (2nd.)	4−32 ϕ	4−32 ϕ	4−32 ϕ + 4−32 ϕ (2nd.)	4L−10ϕ @ 125 C/C	4L−10ϕ @ 200 C/C	*
TSB1	300	450	3−20 ϕ	3−20 ϕ	3−20 ϕ	3−20 ϕ	3−20 ϕ	3−20 ϕ	2L−8ϕ @ 150 C/C	2L−8ϕ @ 200 C/C	
TSB2	300	400	2−20 ϕ	2−20 ϕ	2−20 ϕ	2−20 ϕ	2−20 ϕ	2−20 ϕ	2L−8ϕ @ 150 C/C	2L−8ϕ @ 200 C/C	
TSB3	300	450	2−25 ϕ + 1−25 ϕ	2−25 ϕ	2−25 ϕ	2−25 ϕ + 1−25 ϕ	2−25 ϕ + 1−25 ϕ	2−25 ϕ	2L−8ϕ @ 125 C/C	2L−8ϕ @ 175 C/C	
TSB4	300	300	2−20 ϕ	2−20 ϕ + 1−25 ϕ	2−20 ϕ	2−20 ϕ + 1−25 ϕ	2−20 ϕ	2−20 ϕ + 1−25 ϕ	2L−8ϕ @ 100 C/C	2L−8ϕ @ 125 C/C	
RB1	250	500	2−20ϕ + 1−16 ϕ	2−16 ϕ	2−20 ϕ	2−16 ϕ + 1−16 ϕ	2−20ϕ + 1−20ϕ	2−16 ϕ	2L−8ϕ @ *110* C/C	2L−8ϕ @ 175 C/C	
RB2	250	400	2−20ϕ + 1−16ϕ	2−16 ϕ	2−20 ϕ	2−16ϕ + 1−16 ϕ	2−20ϕ + 1−20ϕ	2−16 ϕ	2L−8ϕ @ *100* C/C	2L−8ϕ @ 175 C/C	
RB3	250	500	2−20ϕ + 1−20ϕ	2−20 ϕ	2−20 ϕ	2−20ϕ + 1−16 ϕ	2−20ϕ + 1−20ϕ + 2−16ϕ (2nd.)	2−20 ϕ	2L−8ϕ @ *110* C/C	2L−8ϕ @ 150 C/C	
RB4	250	400	2−20ϕ + 1−16ϕ	2−20 ϕ	2−20 ϕ	2−20 ϕ	2−20ϕ + 1−20ϕ + 2−16ϕ (2nd.)	2−20 ϕ	2L−8ϕ @ *100* C/C	2L−8ϕ @ 150 C/C	
RB5, RB7, RB8, RB10	250	350	2−16 ϕ	2−16 ϕ	2−16 ϕ	2−16 ϕ	2−16ϕ + 1−12 ϕ	2−16 ϕ	2L−8ϕ @ *100* C/C	2L−8ϕ @ 150 C/C	
RB6, RB9	250	350	–	–	2−16 ϕ	2−16 ϕ	2−16ϕ + 1−12 ϕ	2−16 ϕ	2L−8ϕ @ *100* C/C	2L−8ϕ @ 150 C/C	
RB11	250	300	2−12 ϕ	2−12 ϕ	2−12 ϕ	2−12ϕ + 1−12 ϕ	2−12ϕ + 1−16 ϕ	2−12 ϕ	2L−8ϕ @ 125 C/C	2L−8ϕ @ 175 C/C	
RB12	250	300	–	–	2−12 ϕ	2−12ϕ + 1−16 ϕ	2−12ϕ + 1−16 ϕ	2−12 ϕ	2L−8ϕ @ 125 C/C	2L−8ϕ @ 175 C/C	
RB13	250	300	2−12 ϕ	2−12 ϕ	2−12 ϕ	2−12ϕ + 1−12 ϕ	2−12ϕ + 1−16 ϕ	2−12 ϕ	2L−8ϕ @ 125 C/C	2L−8ϕ @ 175 C/C	

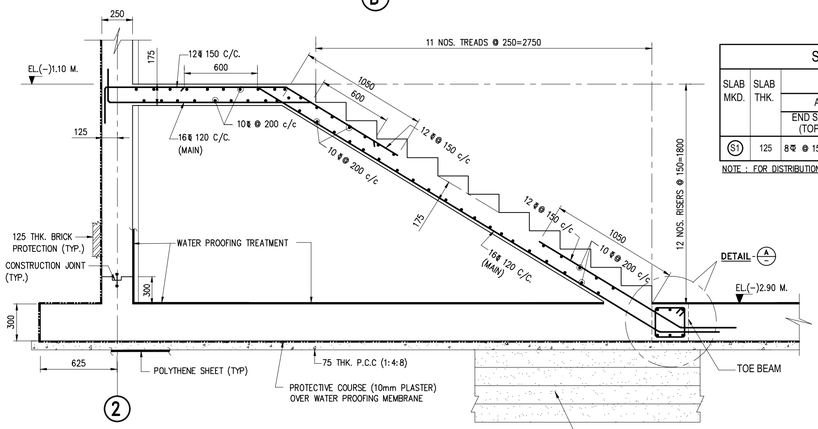
NOTE:
FOR LAYOUT OF BEAMS REF. TO DWG. NO. 17T01−801−S−T001.

* AT WALL CONNECTION/ AT SIMPLY SUPPORTED BEAM END
TOP=4−32ϕ
BOTTOM=4−32ϕ

SCHEDULE OF PUMP ROOM ROOF SLAB

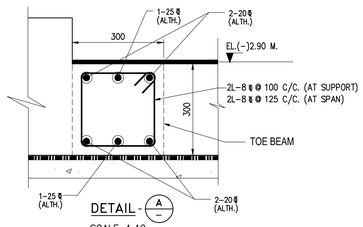
SLAB MKD.	SLAB THK.	REINFORCEMENT						REMARKS
		ALONG SHORTER DIRECTION			ALONG LONGER DIRECTION			
		END SUP. (TOP)	SPAN (BOT.)	CONT. SUP. (TOP)	END SUP. (TOP)	SPAN (BOT.)	CONT. SUP. (TOP)	FOR SLAB MARKING REF. DWG. NO. 17T01−801−DWG −S−T001
S1	125	8ϕ @ 150 C/C	8ϕ @ 150 C/C	8ϕ @ 150 C/C	8ϕ @ 150 C/C	8ϕ @ 150 C/C	8ϕ @ 150 C/C	

NOTE : FOR DISTRIBUTION REINF. AT TOP, PROVIDE 8ϕ @ 200 C/C

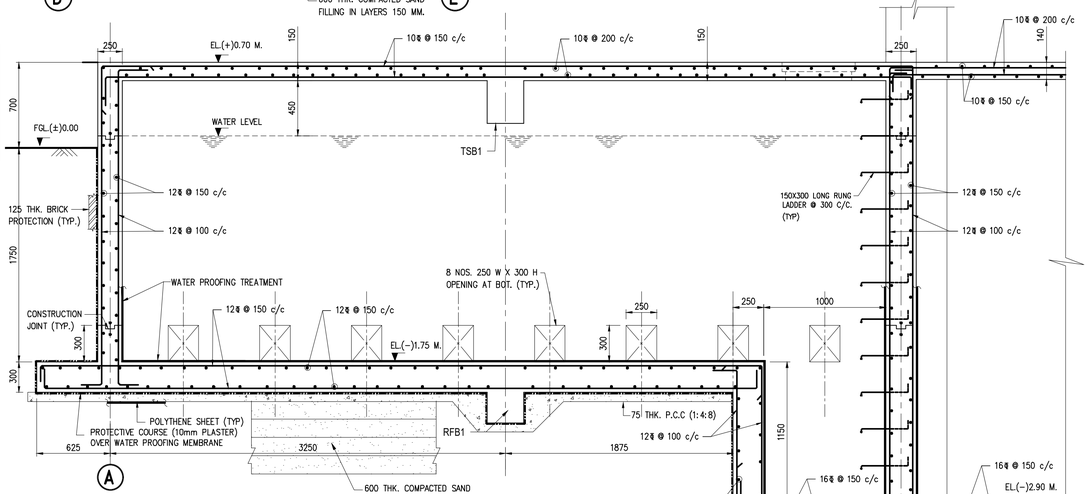


DETAIL OF STAIR FLIGHT MKD.−FL1

SCALE−1:25

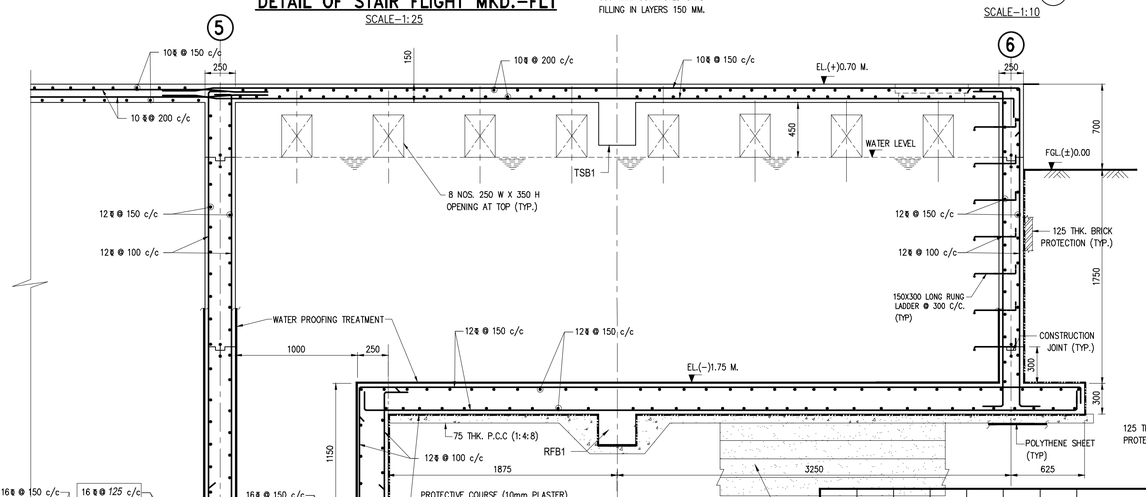


SCALE−1:10



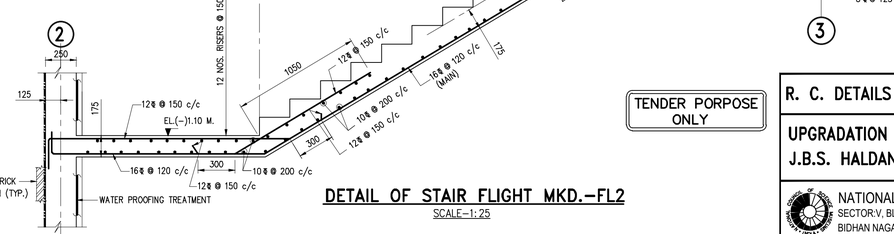
SECTION - 7/T001

SCALE−1:25



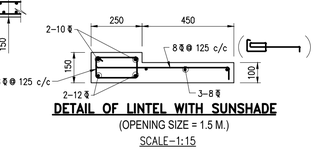
SECTION - 5/T001

SCALE−1:25



DETAIL OF STAIR FLIGHT MKD.−FL2

SCALE−1:25



DETAIL OF LINTEL WITH SUNSHADE

(OPENING SIZE = 1.5 M.)

SCALE−1:15

TENDER PORPOSE ONLY

R. C. DETAILS OF U. G. RESERVOIR

UPGRADATION JOB, SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA−700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

APPROV.	FIRE	HVAC	ENVR.	ELEC.	STRL.	ARCH.
REVIEWED						

NATURE OF REVISION & DESCRIPTION | CHECKED | DRAWN | REV. | DATE

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY		S.B.
FOR CONSTRUCTION		
REVIEWED: ARCHITECTURAL		
REVIEWED: CIVIL & STRUCTURAL		
REVIEWED: ELECTRICAL		
REVIEWED: ENVIRO PROTECTION		
REVIEWED: MECH (HVAC)		
REVIEWED: MECH (FIRE FIGHT)		

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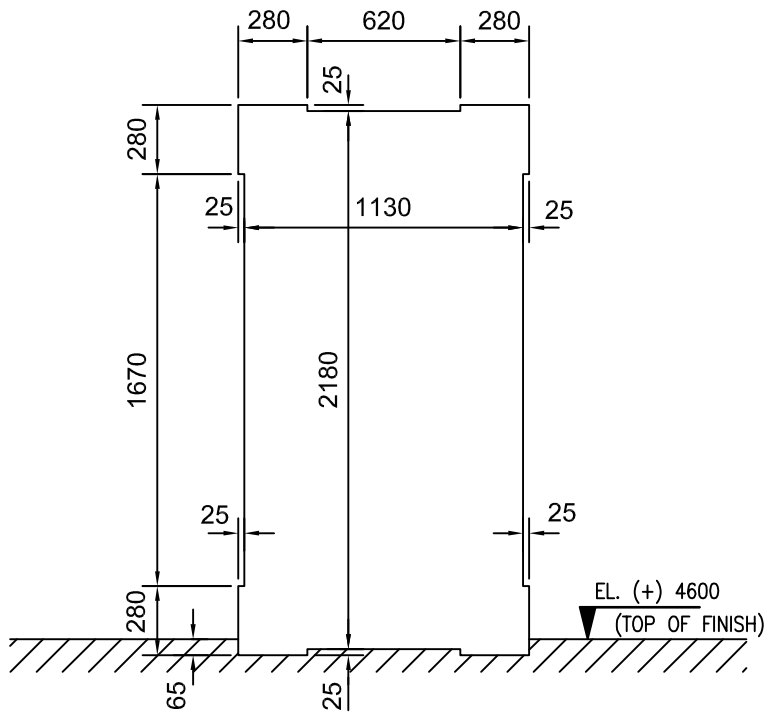
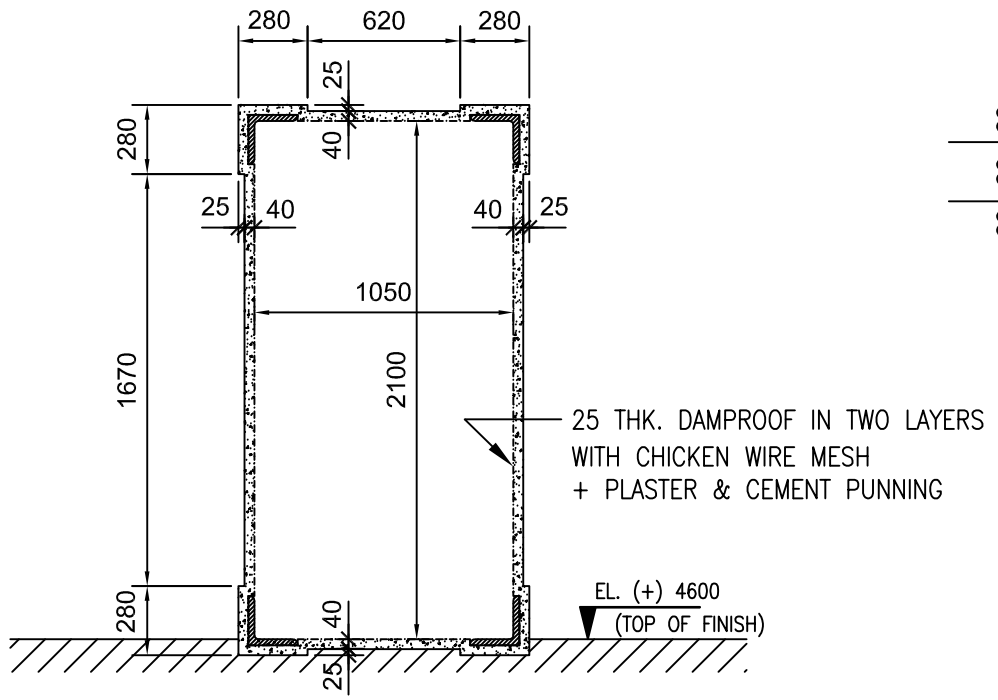
DRAWN :	U.B/K.G	CHECKED :	S.B.
REVIEWED :	K.M.	SCALE	AS NOTED
APPROVED :	AM/SL	DATE	26.02.2018
		JOB NO.	17T01

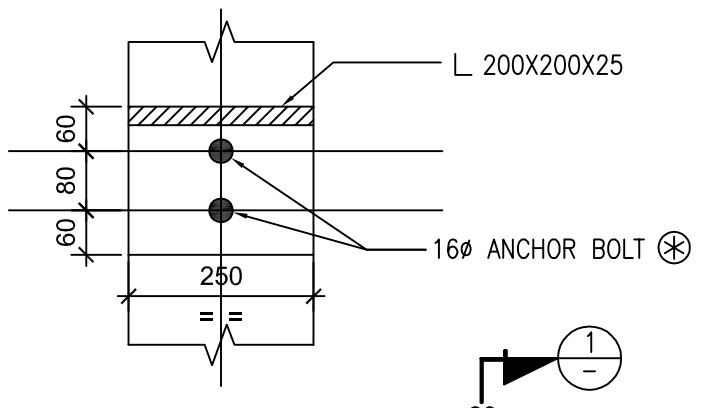
DWG. NO. 17T01−801−DWG−S−T002 REV. 0



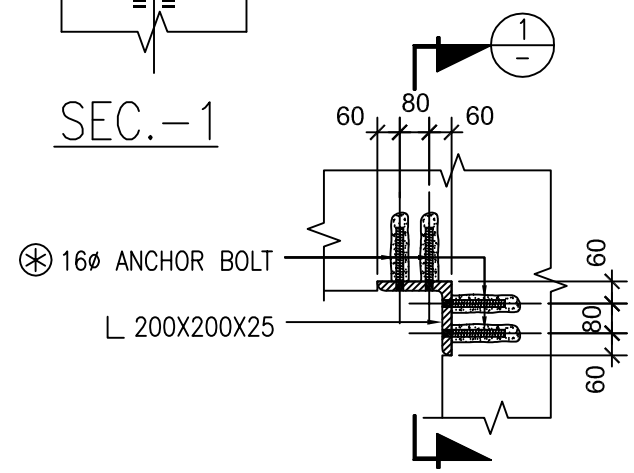
PROPOSED CUTTING ELEVATION



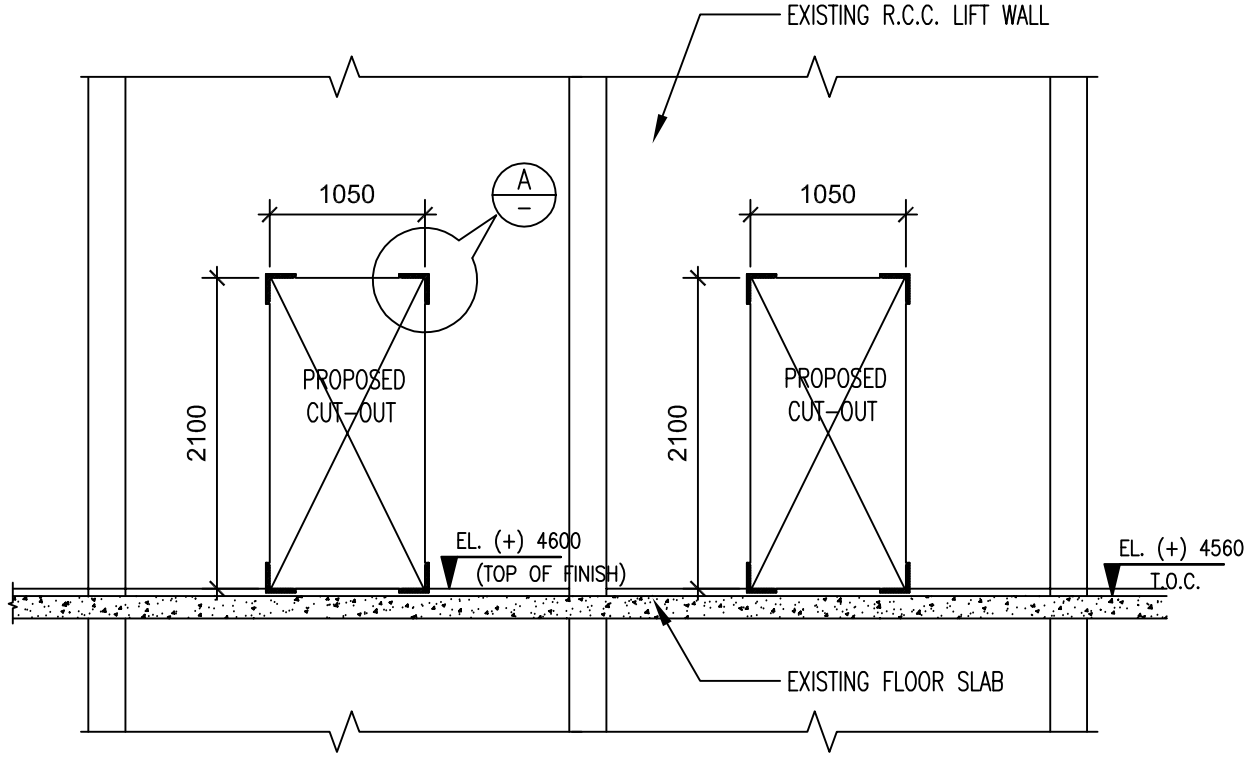
PROPOSED FINISHING ELEVATION



SEC.–1



DETAIL–A



PART FRONT ELEVATION OF LIFT SHAFT

⊛ 16ø BOLT ARE TO BE ANCHORED BY CHEMICAL GROUTING, DEPTH OF INSERTION SHALL BE AS PER MANUFACTURER'S (HILTI OR APPROVED MAKE) RECOMMENDATION

TENDER PURPOSE ONLY

SPECIAL NOTES

1. CUTTING OF WALL SHALL BE DONE BY MECHANICAL MEANS USING CONCRETE CUTTING MACHINE. NO HAMMERING AND CHISELING IS ALLOWED.
2. PROPER SCAFFOLDING ARRANGEMENT SHALL BE MADE INSIDE THE LIFT CORE TO PREVENT THE FALLING OF PIECES OF AGGREGATES, STEEL INSIDE.
3. AFTER CUTTING THE WALL THE EXPOSED SURFACE SHALL BE PAINTED WITH AN ANTICORROSIVE PAINT OVER EXPOSED STEEL. THEN REPAIR THE EXPOSED SURFACES BY RICH DAMPROOF COURSE BY MIXING WATER PROOFING COMPOUND OF SIKA OR EQUIVALENT MAKE . THEN DO PLASTER & CEMENT PUNNING.
4. AFTER 28DAYS OF FINISHING WORK FIX THE CORNER STITCHING MS ANGLE "L200x200x25 BY CHEMICAL ANCHORING BOLT AS PER DRAWING.

REVIEWED										
			SL/AM	KM	KM	PD/KG		TENDER PURPOSE	0	22.06.18
			APPROVED	REVIEWED	CHECKED	DRAWN	DESCRIPTION	RELEASE STATUS	REV.	DATE

DYNAMOTION HALL
STRUCTURAL DETAILS
SCIENCE CITY AT KOLKATA
NATIONAL COUNCIL OF SCIENCE MUSEUMS

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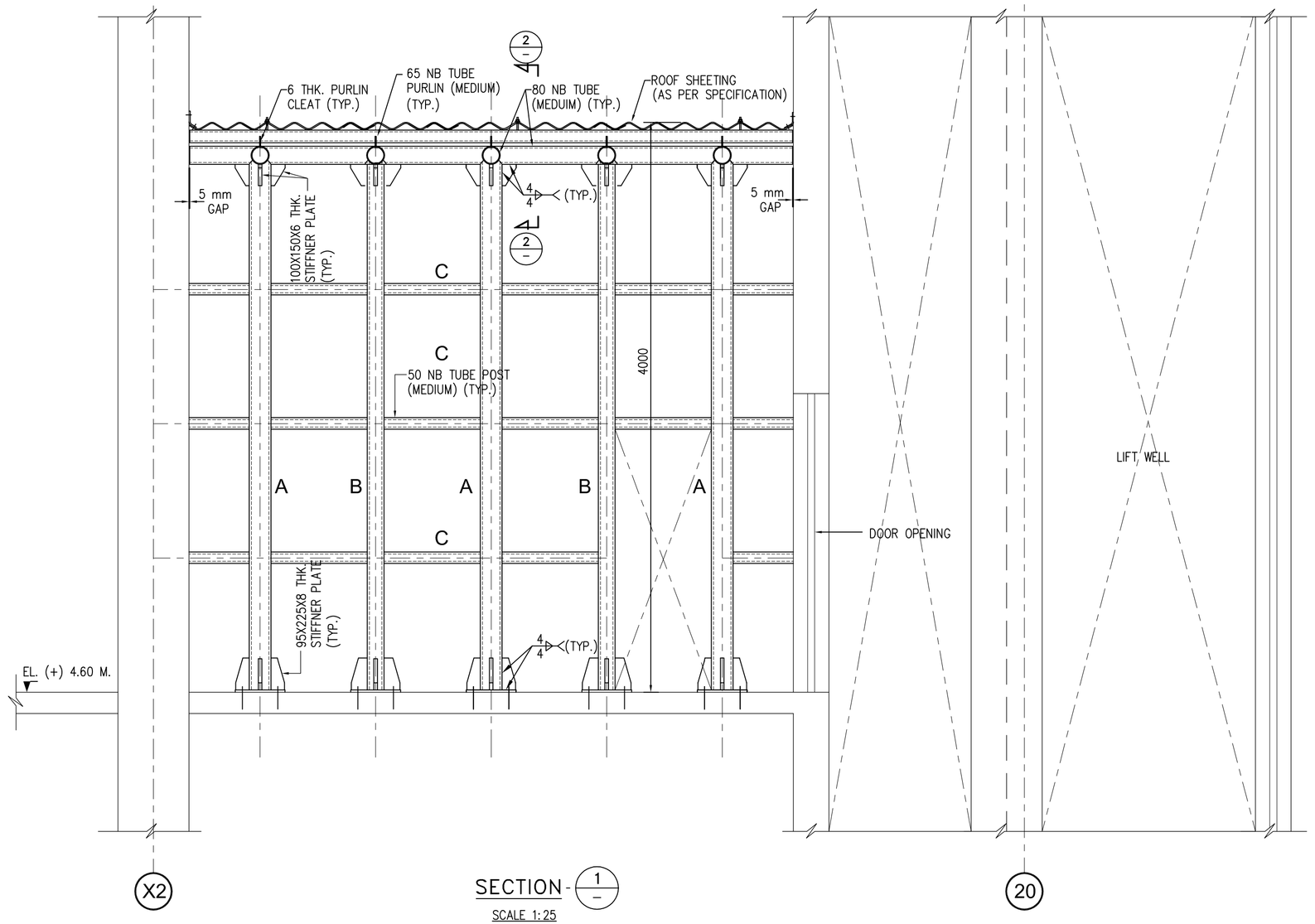
JOB NO. 17T01 | SCALE : N.T.S.
DWG. NO. 17T01–401–DWG–S–T002 | REV. 0

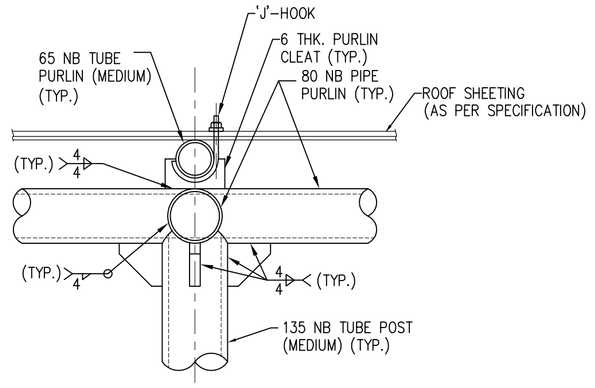
A3 (9–96) [420x297]

DWG. NO. 17T01-401-DWG-S-T001 REV. 0



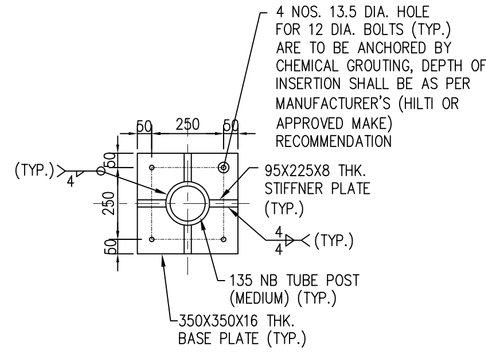
SECTION - 1/–

SCALE 1:25



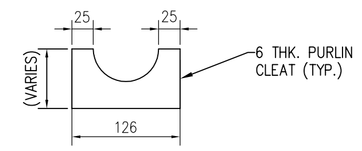
SECTION - 2/–

SCALE 1:10



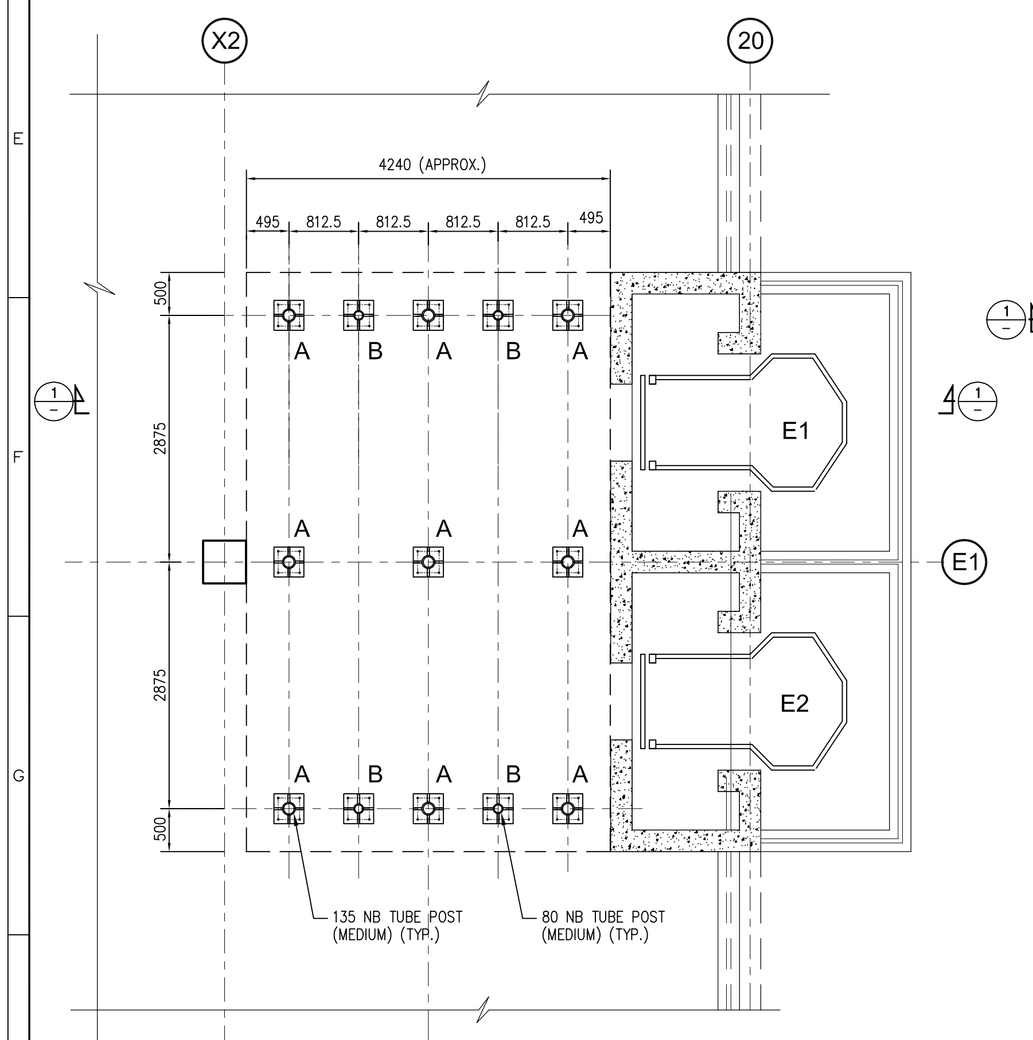
DETAIL OF BAST PLATE

SCALE 1:15



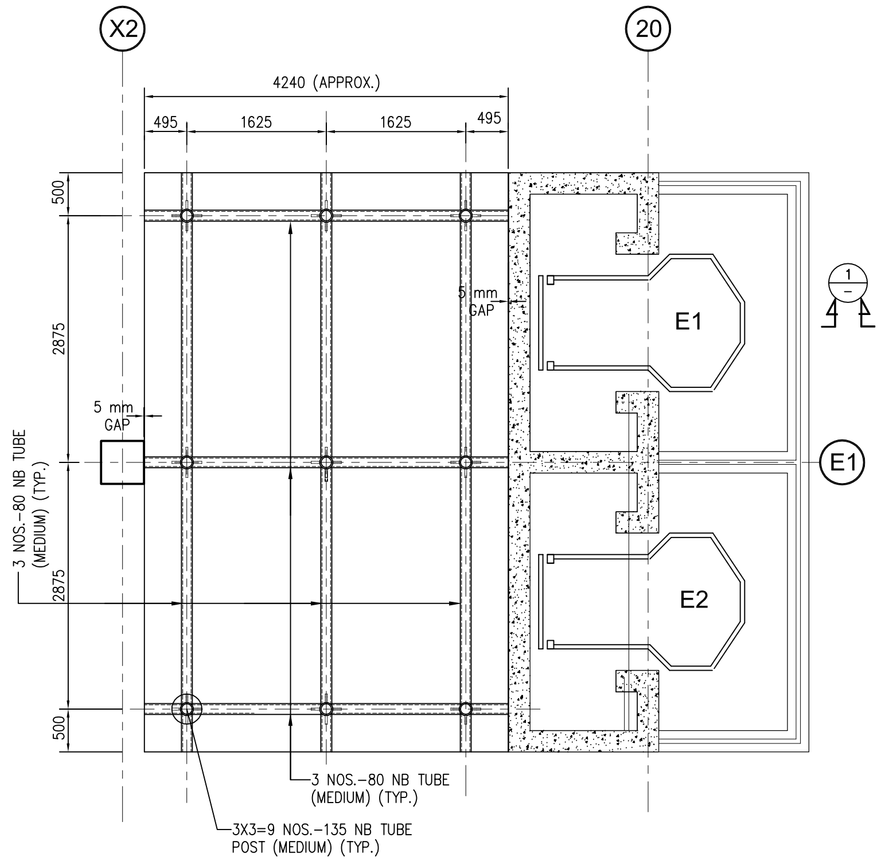
DETAIL OF PURLIN CLEAT

SCALE 1:5



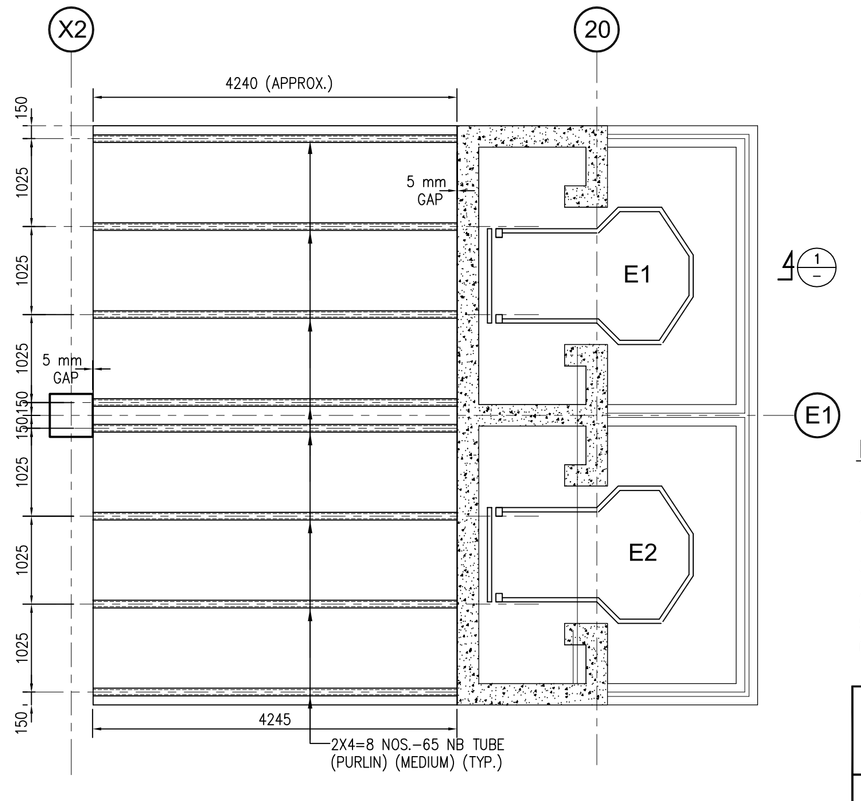
PART PLAN AT EL. (+) 4.600 M. LEVEL

SCALE 1:50



PLAN AT RAFTER LEVEL

SCALE 1:50



PLAN AT PURLIN LEVEL

SCALE 1:50

TENDER PURPOSE ONLY

NOTES:

1. ALL DIMENSIONS ARE IN MM AND ALL LEVELS ARE IN M UNLESS OTHERWISE STATED.
2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH RELEVANT ARCHITECTURAL AND CIVIL DRAWINGS AND SPECIFICATIONS.
3. ALL TUBE SECTIONS SHALL BE OF GRADE YST 310 CONFORMING TO IS-1161
4. ALL WELDS SHALL BE FILLET WELDS, UNLESS OTHERWISE SPECIFIED.
5. ALL TUBES SHALL BE COATED AS PER SPECIFICATION.
6. FOR TUBE CONNECTION ALL WELD SIZE SHALL NOT BE LESS THEN 4 mm.

Signature Not Verified
Digitally signed by SATYANARAYANA POLE
Date: 2018.08.31 12:22:34 IST
Location: eProcure

DYNAMOTION BUILDING

PRO[POSED CANOPY STRUCTURE

UPGRADATION JOB, SCIENCE CITY AT KOLKATA
J.B.S. HALDANE AVENUE, KOLKATA-700046

NATIONAL COUNCIL OF SCIENCE MUSEUMS
SECTOR:V, BLOCK:GN,
BIDHAN NAGAR, CALCUTTA - 700091

APPROV.	MECH.	INST.	ELEC.	STRL.	ARCH.	NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
REVIEWED										

RELEASE STATUS		DATE	SIGNATURE
PRELIMINARY			
FOR TENDER ONLY		15.06.2018	S.B.
FOR CONSTRUCTION			
REVIEWED	ARCHITECTURAL		
	CIVIL & STRUCTURAL	15.06.2018	S.B.
	ELECTRICAL		
	INSTRUMENTATION		
	MECHANICAL		

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DRAWN :	U.B./K.G.	CHECKED : S.B.	SCALE AS NOTED
REVIEWED :	K.M.		DATE 14.06.2018
APPROVED :	A.M./S.L.		JOB NO. 17T01

DWG. NO. 17T01-401-DWG-S-T001 REV. 0

A1 (09-96) [841 x 594]