



नेशनल ऑटोमोटिव टेस्ट ट्रैक्स

NATIONAL AUTOMOTIVE TEST TRACKS

Limited Tender Document

For

NATRAX टी-5 टेस्ट ट्रैक के पास पंप हाउस के लिए नाली और पेडस्टल का कार्य/

Drain & Pedestal for Pump House near T-5 Test Track

at

NATRAX

PITHAMPUR, DIST. DHAR (Madhya Pradesh)

Tender No. - NATRAX/PROC/C&I/24-25/77

National Automotive Test Tracks (NATRAX)/ नेशनल ऑटोमोटिव टेस्ट ट्रैक्स
(NATRAX)

A unit of National Automotive Board (NAB)/ राष्ट्रीय मोटर वाहन बोर्ड (एनएबी) की
एक इकाई

NH-52, Old Agra- Mumbai Highway/ NH-52, पुराना आगरा-मुंबई राजमार्ग,

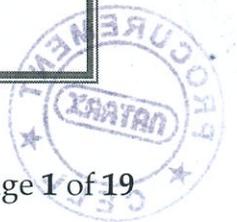
Next to Pithampur Flyover/ पीथमपुर फ्लाईओवर के बगल में,

Post Khandwa (Near Pithampur)/ पोस्ट खंडवा (पीथमपुर के पास)

Dhar District, Madhya Pradesh-454774/ धार जिला, मध्य प्रदेश -454774

Phone: +919893892310, Fax - 07292-256101

Email: a.prabhakar@natrip.in, anuj.kumar@natrip.in



General Instructions:

<p>नेशनल ऑटोमोटिव टेस्ट ट्रैक्स (NATRAX) नेशनल ऑटोमोटिव बोर्ड (NAB) के तहत एक ऑटोमोटिव टेस्टिंग एंड सर्टिफिकेशन सेंटर है, जो भारी उद्योग मंत्रालय, भारत सरकार द्वारा गठित एक स्वायत्त निकाय है। NATRAX को लगभग 3000 एकड़ भूमि पर पीथमपुर, जिला धार, (मध्य प्रदेश, भारत) के पास, सभी प्रकार के ऑटोमोबाइल के व्यापक परीक्षण और मूल्यांकन के लिए स्थापित किया गया है।</p>	<p>National Automotive Test Tracks (NATRAX) is an Automotive Testing & Certification Centre under National Automotive Board (NAB) which is an autonomous body constituted by Ministry of Heavy Industries, Government of India. NATRAX has been set up on approx. 3000 acres of land for comprehensive testing and evaluation of all types of automobiles, near Pithampur, Dist. Dhar, (Madhya Pradesh, India).</p>
<p>नेशनल ऑटोमोटिव टेस्ट ट्रैक्स (NATRAX), ऐसे योग्य और अनुभवी बोलीदाताओं से पासवर्ड संरक्षित या सीलबंद कोटेशन / बोलियां आमंत्रित करता है, जो काम करने, निष्पादित करने और कार्यान्वित करने के लिए इस दस्तावेज़ में निर्दिष्ट पात्रता मानदंड को पूरा करते हैं। तथा निर्धारित शर्तों पर कार्य करने के इच्छुक हैं। कार्यों का संक्षिप्त विवरण और एनआईक्यू/निविदा की समय-सीमा नीचे दी गई तालिका में संक्षेप में दी गई है:</p>	<p>The National Automotive Test Tracks (NATRAX), invites Password Protected OR Sealed Quotations/Bids from the qualified and experience Bidder(s) who meets the specified eligibility criteria in this document in the prescribed Proforma for performing, executing and implementing the works on the terms and conditions contained in this Bid document. Brief description of works and the timelines for NIQ/tender are summarised in the table below:</p>

कार्य का वर्णन / Description of Work	अनुबंध की अवधि / Period of Contract	निविदा के फ्लोटिंग की शुरुआत की तिथि / Date of start of floating of tender	बोली जमा करने की अंतिम तिथि / Last date for submission of Bid	बोली खोलने की तिथि और समय / Date & Time of Bid opening	अनुमानित लागत / Estimated Cost
NATRAX टी-5 टेस्ट ट्रैक के पास पंप हाउस के लिए नाली और पेडस्टल का कार्य / Drain & Pedestal for Pump House near T-5 Test Track at NATRAX Pithampur, Dhar (MP)	45 Days from the date of Issue of NTP.	11th July 2024	25th July 2024	25th July 2024 at 1530 Hrs	Rs. 7.48 Lakh

PRE BID MEETING- 18th July 2024 at 1100 hrs at NATRAX Office.

1. कोटेशन/बोली प्रस्तुत करने का विवरण/ Quotations/Bid Submission details:

<p>पासवर्ड से सुरक्षित बोली/कोटेशन बोलीदाता द्वारा</p>	<p>Password-protected Bids (Technical Bid &</p>
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<p>निम्नलिखित ईमेल आईडी पर उपरोक्त समय और तारीख के बाद या पूर्व सूचना पर अगली सुविधाजनक तारीख और समय के रूप में प्रस्तुत किया जाना है।</p>	<p>Financial Bid) are to be submitted by the Bidder at the following email ID's not later than the aforesaid time & date or as next convenient date & time on pre-intimation</p>
<p>mail to: a.prabhakar@natrip.in, anuj.kumar@natrip.in,</p>	
<p>OR</p>	
<p>मोहरबंद बोलियां/कोटेशन भी पूर्वोक्त तिथि और समय पर NATRAX हब कार्यालय में सीलबंद लिफाफों में हार्ड कॉपी में जमा किए जा सकते हैं।</p>	<p>Sealed Bids (Technical Bid & Financial Bid in two different sealed envelope) may also be submitted in the hard copy in <u>sealed envelopes at NATRAX Hub office</u> in the aforesaid date and time.</p>
<p>उक्त तिथि एवं समय के बाद कोई बोली स्वीकार नहीं की जायेगी। हालाँकि, असाधारण मामलों में, NATRAX के पास बोली खोलने से पहले बोली जमा करने के समय/अंतिम तिथि को अगली सुविधाजनक तिथि/समय तक बढ़ाने का अधिकार सुरक्षित है।</p>	<p>No Bids will be accepted after the aforesaid date and time. However, on exceptional cases, NATRAX reserves the right to extend the time/last date of submission of Bid to a next convenient date/time before opening of the Bids.</p>
<p>टेलीग्राफिक रूप से या ट्रांसमिशन के अन्य माध्यमों (टेलीफैक्स, आदि) के माध्यम से भेजी गई बोलियां जो पासवर्ड से सुरक्षित नहीं हैं, उन्हें दोषपूर्ण, अमान्य माना जाएगा और खारिज कर दिया जाएगा।/</p>	<p>Bids sent telegraphically or through other means of transmission (telefax, etc.) which are not Password Protected shall be treated as defective, invalid and shall stands rejected.</p>
<p>NATRAX गैर-प्राप्ति/गैर-वितरण/या किसी तकनीकी त्रुटि या गलत प्राप्तकर्ता के कारण किसी भी देरी के लिए जिम्मेदार नहीं होगा। बोलीकर्ता NATRAX से अपनी बोली प्रस्तुत करने की प्राप्ति की पुष्टि कर सकते हैं</p>	<p>NATRAX shall not be responsible for any delays for non-receipt /non-delivery/ or any technical errors or due to the wrong addressee. Bidders may confirm the receipt of their Bids submission from NATRAX</p>
<p>Disclaimer/ अस्वीकरण:</p>	
<p>NATRAX बिना कोई कारण बताए किसी या सभी प्रस्तावों को स्वीकार/अस्वीकार/संशोधित/विभाजित करने के सभी अधिकार सुरक्षित रखता है। NATRAX के किसी भी निर्णय के लिए बोलीदाताओं के पास कार्रवाई का कोई कारण या दावा नहीं होगा।</p>	<p>NATRAX reserves all rights to accept/ reject/modify/split any or all proposals without assigning any reasons. Bidders shall not have any cause of action or claim against NATRAX for any of its decisions.</p>
<p style="text-align: right;">For NATRAX</p> <p style="text-align: center;">Head Procurement & Stores</p>	



<p>इस निविदा में आगे चार अनुबंध शामिल हैं/</p> <ul style="list-style-type: none">• अनुबंध-I (ए)-बोलीदाताओं के लिए निर्देश (आईटीबी)/• अनुबंध- I (बी) - अनुबंध की विशेष शर्तें/• अनुबंध-II- अनुबंध/विनिर्देश/ड्राइंग और डिजाइन की तकनीकी शर्तें/• अनुबंध-III- वित्तीय प्रस्ताव/• अनुबंध - IV- प्रस्तुत करने की विधि (ऑनलाइन माध्यम से)/	<p>This tender further contain four Annexures:</p> <ul style="list-style-type: none">• Annexure-I (A)-Instructions to Bidders (ITB).• Annexure-I (B)- Special conditions of contract.• Annexure-II- Technical Conditions of contract/Specification/Drawings & Design.• Annexure-III- Financial Proposal.• Annexure-IV- Method of submission (in case of Bid submission through online mode).
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A. ANNEXURE I (A)- INSTRUCTION TO BIDDERS (ITB)**1. INSTRUCTION TO BIDDERS (ITB)**

Bidders are required to submit their Bids in TWO Different Password Protected PDF files, named as "Technical Bid for Tender No. NATRAX/PROC/C&I/24-25/77" & "Financial Bid for Tender No. NATRAX/PROC/C&I/24-25/77" on the subject of the email, containing Password Protected PDF documents, as given below. The Password Protected bids shall be submitted at the mentioned email ID's before the closure of bid submission date/time.

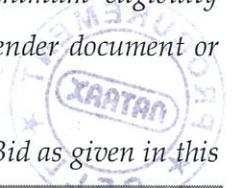
OR

Sealed Bid/Quotation may also be submitted in the hard copy in two different sealed envelopes in the main envelope containing and namely "Technical Bid" and Financial Bid" and main envelope should name/marked as "Bid document for NATRAX/PROC/C&I/24-25/77" at NATRAX office, within the aforesaid date and time.

In-case of online Bid submission through email, the passwords of the technical bid and Financial Bid should be different and shall be disclosed/submitted by the bidder at the time of the opening of Bid.

Technical Bid- The details, documents, information pertaining to the Minimum eligibility criteria, technical competency, company/firm profile, signed copy of complete tender document or any other information should submitted in this portion.

Financial Bid: The details of Rates in the BOQ format and Letter of Financial Bid as given in this



document should be submitted in this portion.

2. Bid Opening:

- a) The technical bid shall be opened NATRAX HUB HUB in the presence of bidder (if available) on the above time and date.

3. Technical bid evaluation:

- a) NATRAX shall perform bid scrutiny, evaluation.
- b) During the technical bid evaluation process, NATRAX may ask for clarifications from the bidder through E-mail or in writing for confirming and consolidating their technical bid.
- c) All such clarifications are required to be answered by the bidder by E-mail, within the time specified by NATRAX.

4. The Contract shall be governed by the terms and conditions specified in this tender document including amendments thereof, work order etc.

5. All Bidders are hereby explicitly informed that "CONDITIONAL OFFERS" or "OFFERS WITH DEVIATIONS" from the conditions of Contract, the quotation not meeting the minimum eligibility criteria, technical specifications, or any other requirements as stipulated in the Tender documents are liable to be "REJECTED".

6. Bidder should give details of their technical soundness and provide list of customers/client of previous works of similar nature in Government Departments/ Undertakings/ Public / Private sectors/Autonomous etc.,

7. **Minimum Eligibility Criteria:** - The bidder should fulfil either of the following two:

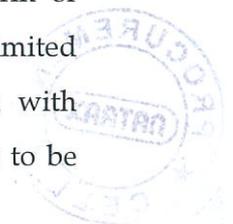
The bidder should have valid registration with NATRAX under vendor registration; the copy of registration letter should be submitted in technical bid.

Or

The bidder should meet the following criteria:

- i. **MEC-I (Legal valid entity):** - Bidder shall be valid legal entity in form of Proprietor/partnership/LLP/Pvt. Ltd company/Govt. entity/Limited Company/autonomous body etc, and should have valid registration with appropriate governing authority. To supporting this, proof should have to be submitted along with quotation.

- ii. **MEC-II (Turnover):** it should have minimum turnover of Rs. 25 Lakh during



last 3 FY (2021-22, 2022-23 & 2023-24), to supporting this, bidder have to submit a copy of balance sheet/CA Certificate clearly indication the turnover and UDIN should also mandatorily mentioned on the same, along with quotation.

iii. MEC-III (Experience): Bidder should have minimum 7 years' experience in similar work*

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

- i. Three similar completed works costing not less than the amount equal to 40% of the estimated cost.
Or
- ii. Two similar completed works costing not less than the amount equal to 50% of the estimated cost.
Or
- iii. One similar completed work costing not less than the amount equal to 80% of the estimated cost.

Similar works*-successfully completed works pertaining to "Supply & Laying of RCC Pipes/Chambers OR RCC Drainages works OR building construction works etc" for any Govt Dept./Reputed firm Private Institution/Academic Institutions, copy of valid LOA/Agreement/work order & completion certificate should be submitted with quotation. In case, work order & completion certificate issued by other than Govt. entity, NATRAX reserve the rights to seeking the 26AS or TDS certificate for the relevant period for authenticity of said order & certificates.

Relaxation for startup firm :

- a. Exempt from paying EMD mentioned in the tender document
- b. Relaxation in the requisite prior experience criteria &
- c. Relaxation under the Prior Turnover

The above shall be considered subject to submission of valid registration certificate and supporting documents for technical competency and if required power point presentation shall be sought.

8. **Opening & Evaluation of Quotations:** the Technical bids shall be opened by the committee of NATRAX officials and shall be evaluated in following mannar:

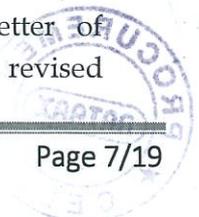


- 7.1. If the bidder is registered vendor of NATRAX, the bids of such bidder shall be accepted & marked "Qualified" for further process.
- 7.2. If bidder is not registered vender of NATRAX, than the evaluation shall be done as per the MEC as mentioned in this document and the bidder meeting the mentioned criteria shall be accepted and Marked as "Qualified" for further process.

9. **Financial Bid opening & evaluation-**

- 8.1. The bids shall be opened by committee at NATRAX. Bidder or Bidder Authorized Representative are advised to attend the bid opening on the given date and time.
- 8.2. The L-1 bidder in the quoted rates shall be deemed as successful Bidder) to determine the successful Bidder.
- 8.3. For the evaluation of the Bids, the eventual Bid prices shall be ascertained after considering all the terms and conditions associated with the Bid price specified in the Bid document and after detailed scrutiny of the quotations/bids.
- 8.4. No Bidder shall be allowed to propose/carry out any revision / correction / modification in his Price Bid offer.
- 8.5. If there is a discrepancy between the sub total/s and the total price that is obtained by multiplying the unit price and quantity/adding the sub total/s, the sub total/s shall prevail and the total price shall be corrected, unless in the opinion of the Employer that there is an obvious misplacement of the decimal point in the sub total price, in which case the total price as quoted shall govern and the sub total/s shall be corrected;
- 8.6. If there is an error in a total, corresponding to the addition or subtraction of sub totals, the subtotal/s shall prevail and the total shall be corrected; and
- 8.7. The Bidder needs to fill the rates against each item in word as well as in figures as mentioned in BOQ (Financial Bid). In case of any discrepancy, the rate provided in word shall prevail and correct the amount against the item. **All the prices should be inclusive of all taxes and GST.**
- 8.8. The amount stated in the Letter to Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, shall be considered as binding upon the bidder. If the Bidder does not accept the corrected amount of Bid, the bid will be rejected.

8.9. Contract negotiations, if any, will be held before the issuance of Letter of Acceptance/ Notification of Award. The negotiation shall conclude with a revised



offer letter from the successful bidder, affecting the discounts if any and accepted by NATRAX.

9. Award of Work:

Prior to the expiry of the period of Bid validity prescribed, NATRAX will issue to the Successful Bidder, the Work Order. The Successful Bidder shall return one copy of the Work Order to NATRAX duly acknowledged and signed by the authorized signatory, within two [2] days of receipt of the same by him.

Notice to proceed (NIT) shall be issued to successful Bidder by EIC within 5 days from the date of acceptance of work order.

10. Validity of bids:

The rate quoted should be valid for a **minimum period of 90 days** from the last date of Submission of Quotation. No claim for escalation of rate will be considered at any point of time.

11. Prospective bidders requiring any clarification of the Tender may write to a.prabhakar@natrip.in; anuj.kumar@natrip.in,

12. The Bids / related correspondences shall be made in English language.

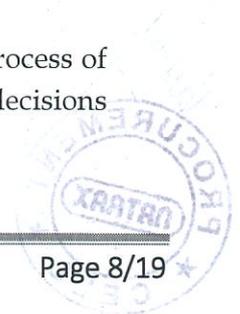
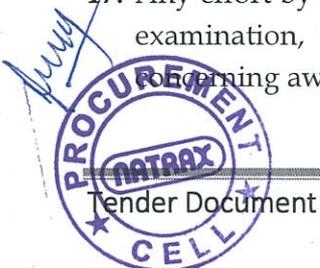
13. While all efforts have been made to avoid errors in drafting of the Tender documents, the Bidder is advised to check the same carefully. No claim on account of any errors detected in the Tender documents shall be entertained.

14. The Bidder shall carry out all the work strictly in accordance with Specification, Standard Practices and instructions of NATRAX or NATRAX's representative and deviation on any account will not be permitted. If in the opinion of NATRAX, changes have to be made and it desires the Bidder to carry out the same. The decision of NATRAX in such cases shall be final and shall not be open to arbitration.

15. The successful Bidder is bound to carry out associated work necessary for the completion of the job even though such items are not included in the quantities to achieve end results and deemed to be priced in the other items. No claim on this account shall be entertained.

16. Addendum / Corrigendum (if required) to the Tender may be issued prior to the date of opening of the Bid to clarify or to intimate any changes/modifications etc. All such addendum / corrigendum shall be treated as an integral part of the Tender.

17. Any effort by a Bidder to influence NATRAX or any of its functionaries in the process of examination, clarification, evaluation and comparison of tenders and in decisions concerning award of contract, may result in rejection of the Bid.



18. In order to afford prospective bidders, reasonable time for preparing their Quotes after taking into account such amendments, NATRAX may, at its discretion, extend the deadline for submission of Bids.
19. Information relating to the examination, clarification, evaluation and comparison of Bids and recommendations concerning the award of Contract shall not be disclosed to Bidders or other persons not officially concerned with such process.
20. NATRAX reserves the right to accept / reject or modify any Bids, and to annul the Tender process and reject all Bid(s)/quotation(s), at any time prior to award of Contract, or to divide the Contract between/amongst Bidders without thereby incurring any liability to the affected Bidder or Bidders or any obligations to inform the affected Bidder or Bidders of the grounds for NATRAX's action. Any Bidder not following ITB stands rejected.

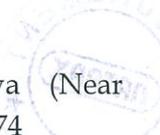
Annexure-I (B)

B. Special Conditions of contract:

a.	Scope of work	Drain & Pedestal for Pump House near T-5 Test Track at NATRAX Pithampur, Dhar
b.	Contract Period	45 Days from the date of Issue of Notice to Proceed (NTP).
c.	Engineer In-charge (EIC)	Shall be notified to successful bidder.
d.	Rate Firmness	The charges/rate quoted by supplier must be firm throughout the Contract period and no escalation of any kind is permissible. The "final contract value" shall be derived on the completion of work at actual.
e.	Defect Liability Period	Six months from the date of completion of work.
	Payment, Mode and Retention	<ul style="list-style-type: none"> i. 95% Payment shall be made IPC Based on the submission of bills along with supporting document and certified by EIC. ii. 05% retention same shall be paid after successful completion of warrantee period of 6 months from the date of completion of work. iii. Payment shall be made after statutory deduction as applicable. iv. Advance payment: maximum 10% of contract value may be paid after receiving request from contractor and submission of bank guarantee of 110% of the requisite amount. An interest 10% per annum shall be charged on the outstanding advance payment. The said advance payment shall be released in minimum two instalments. Contractor has to submit a utilization certificate for the said advance payment. v. The GST/Taxes & duties of Govt. will be reimbursed on actual basis upon the submission of original receipt /



		<p>documentary evidence. All the payments shall be made through RTGS only.</p>
	<p>Quantity Variations / Revision Rates of</p>	<p>NATRAX shall, having regard to the Scope of Works and the approved Contract Price, shall have power to order variations within the Scope of the Works as considers necessary or avoidable during the progress of the Works. Such variations shall form part of the Contract and the Contractor shall carry them out and include them in updated Programmes produced by the Contractor. Oral orders for Variations, unless followed by written confirmation, shall not be taken into account. There will not be any revision in rates for all the items provided in BOQ for any extent of variations, during the entire currency of the contract.</p> <p>New Rate or Price for NON BOQ items shall be finalized by the NATRAX representative based latest Applicable DSR or MPSoR.</p> <p align="center">or</p> <p>New rate or price shall be derived from any relevant rate or price in the contract BOQ.</p> <p align="center">or</p> <p>New rate or price shall be derived from market rate.</p> <p>During repairing, if anything other than the above is found, its payment will be made at the market rate as per the quantity required.</p>
h.	Liquidated Damages	0.1% of the Contract Price per day to a maximum of 10% of the Contract Price.
i.	Performance Bank Guarantee/Performance security	5% of contract piece should be submitted as Performance Security by the Successful Bidder on award of Contract. Performance Security may be furnished in the form of an A/C Payee Demand Draft/Fixed Deposit Receipt/Bank Guarantee from a Scheduled Commercial Bank favoring "National Automotive Test Tracks" & payable at Pithampur and should remain valid for at least 8 months from the date of submission to NATRAX. The performance security shall be returned after successfully completion of contract period/defect rectification period and recommendations of NATRAX officials. In case of any failure of the contractor/denied to do the work as per requirement, NATRAX reserve the right to forfeit the performance security and also can claim the losses from the contractor.
	Project Facility / Place of Installation/delivery	NATRAX Site NH-52, Old Agra- Mumbai Highway, Near to Pithampur Flyover, Post Khandwa (Near Pithampur), Dhar District, Madhya Pradesh-454774



k.	Other Terms and conditions	i. The bidder should submit list of the equipment's/machines with them. In case machines/equipment's are planned to hire from others the rent agreement for hiring the same should be submitted. ii. No extra charge is payable for to and fro, boarding and lodging for the service personnel coming to NATRAX.
l.	Water supply & Electricity Charges	i. Electricity - at one point shall be provided on chargeable basis. ii. Water supply: Free of Cost at the available point.
m.	Termination of Contract	If the work/service is found to be not satisfactory or not found as per the specification indicated in this document, the Contract will be terminated with short notice of 14 days in writing. In case of termination the balance work shall be completed by NATRAX through any other party on the risk & cost of contractor.

C. The bidder should give the following, duly signed and sealed, failing to which the bids will be summarily rejected:

D. DECLARATION:

(To be executed on Bidder's letter head)

I/We having acquainted with the content & requirement of this Tender No. NATRAX/-----, dated _____ and do hereby accept to furnish the same in compliance with all terms & conditions. I/we have not tampered/modified the tender in any manner and breach of any such, will result in rejection of Tender and / or prosecuted.

I / We hereby declare that the firm/company has not been blacklisted or debarred in the past by any other Government organization from taking part in Government tenders.

In case the above information found false or in case of breach of any of terms and conditions at any stage of Tender or Contract, I/We are fully aware that the Tender/ Contract will be rejected / cancelled by NATRAX and Payments (for completed/partially completed), Retention, Bid Security (EMD), Performance Security, etc., shall be forfeited.

Signature of the Bidder: _____

Name and Designation: _____

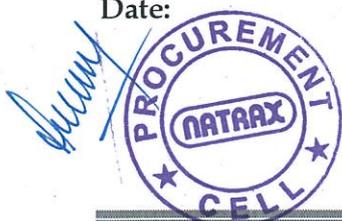
Address: _____

Contact details: _____

Place:

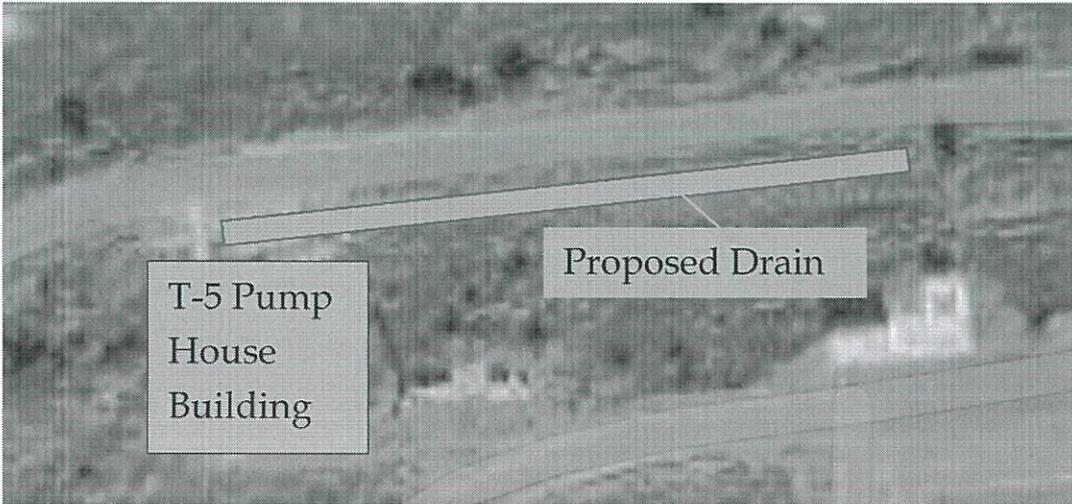
Date:

Seal of the Bidder's Firm



TECHNICAL CONDITIONS OF CONTRACT/ SCOPE OF WORK

The scope of work and technical specifications shall be as per attached Appendix- A, BOQ and prevailing MPSOR/SOR clauses.





Tender No. - NATRAX/PROC/C&I/24-25/77

Form for the submission of Financial Bid

Financial Proposal Submission Form
(To be Executed on Letterhead of the Bidder)

[Location, Date]

To:
The Head Procurement
NH-52, Old Agra- Mumbai Highway,
Near to Pithampur Flyover,
Post Khandwa (Near Pithampur)
Dhar District, Madhya Pradesh-454774

Dear Sir,

We, the undersigned, offer to provide the equipment & services in accordance with your Tender No. _____, dated _____ and our Technical Bid. Our attached Financial Bid includes the price in the format for financial bid provide as part of tender documents. The total price of our offer is _____ (in figures and words) and includes all the deliverables under this tender as per our Technical Bid.

We hereby declare that all the information and statements made in this Bid is true and complete in all respects and is as per the guidelines and terms & conditions laid down in the tender document. We further understand that any information which is found false or is not as per the guidelines and terms & conditions of the tender document may lead to our disqualification.

Our Financial Bid shall be binding upon us subject to the modifications resulting from Contract negotiations, up to expiration of the validity period of the Bid.

We understand NATRAX has right to accept or reject our Bid as per its discretion.

Yours sincerely,

Authorized Signature [In full]: _____

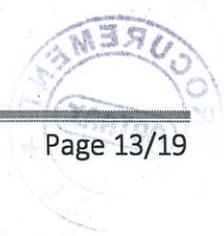
Authorized Signature [In initials]: _____

Name and Title of Signatory: _____

Name of Firm: _____

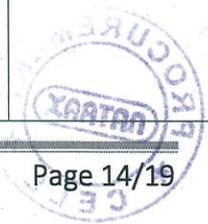
Address: _____

Note: To be signed in blue ink



ANNEXURE-III
Bill of Quantities (BOQ)/Financial Bid

Item No	Item Description	Unit	Qty	Rates (in Rs) including all	Amount in Rs
1	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means over areas (exceeding 30cm in depth. 1.5m in width as well as 10 sqm on plan) including dressing of sides and ramming of bottom disposal of excavated earth, lead up to 50m and lift up to 1.5m, disposed earth to be levelled and neatly dressed. (No extra lift is payable if work is done by mechanical means) All kinds of soil	Cum	10		
2	Earth work in excavation/ by mechanical means (Hydraulic Excavator)/ manual means over areas (exceeding 30 cm in depth, 1.5m in width as well as 10 sqm on plan) including dressing of sides and ramming of bottom disposal of excavated earth, lead up to 50 m and liftup to 1.5 m, disposed earth to be levelled and neatly dressed. Ordinary rock	Cum	30		
3	Filling available excavated earth (excluding hard rock/Ordinary 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	30		
4	Excavating trenches of required width for pipes, cables, etc. including excavation for sockets, and dressing of sides, ramming of bottoms, depth up to 1.5 m including getting out the excavated soil, and then returning the soil as required, in layers not exceeding 20 cm in depth including consolidating each deposited layer by ramming, watering, etc. and disposing of surplus excavated soil as directed, within a lead of 50 m : (No extra lift is payable if work is done by mechanical means) in all kinds of soil				
	Pipes, cables etc. exceeding 80 mm dia. but not exceeding 300 mm dia.	RM	10.00		
5	Providing and laying non- pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 sand) including testing of joints etc. complete :				
	300 mm dia. R.C.C. pipe	RM	10.00		
6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work upto plinth level :With 20mm nominal size graded stone aggregate. M-25 - Grade concrete	Cum	41.25		





Tender No. - NATRAX/PROC/C&I/24-25/77

Item No	Item Description	Unit	Qty	Rates (in Rs) including all	Amount in Rs
7	M-10 Nominal (Mix-1 Cement : 3 sand : 6 graded stone aggregate)	Cum	15.00		
8	Centering and shuttering including strutting, propping etc. and removal of form work for : Upto plinth: Foundations, footings, bases for columns, plinth beams, curtain walls, columns below plinth.	Sqm	380.00		
9	Constructing brick masonry manhole in cement mortar 1:4 (1 cement : 4 sand) R.C.C. top slab with Cement Concrete 1:2:4 mix (1 cement : 2 sand :4 graded stone aggregate 20 mm nominal size), foundation concrete 1:2:4 mix (1 cement :2 sand : 4 graded stoneaggregate 20mm nominal size) inside plastering 12mm thick with cement mortar 1:3 (1 cement : 3 sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement : 2 sand : 4 graded stone aggregate 20mm nominal size) finished with a floating coat of neat cement complete as per standard design.				
10	Inside size 90x80 cm and 45 cm deep including C.I/MS grill cover with frame (light duty) 455x610 mm internal dimensions total weight of cover and frame to be notless than 38 kg (weight of cover23 kg and weight of frame 15 kg) : With well burnt bricks size-90X80 cm	Each	2.00		
11	Brick work with well burnt chimney bricks in bulls pattern trench kiln manufactured by ghol process, crushing strength not less than 40kg /cm ² and water absorptionnot more than 15% in foundation and plinth i/c curing etc. complete.				
12	Cement mortar 1:4 (1 cement : 4 sand)	Cum	1.15		
13	15 mm cement plaster on the rough side of single or half brick wall of mix 1:4 (1 cement : 4 sand)	Sqm	30.00		
14	Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding including cost of binding wire all wastages and overlaps, couplers (overlaps shall be provided as per requirement of IS 13920 for ductile detalingIS 456 RCC Design & SP 34 Reinforcement detailing) etc. complete . Thermo-Mechanically Treated bars.FE 500 D	Kg	3500.00		
	Total Amount				

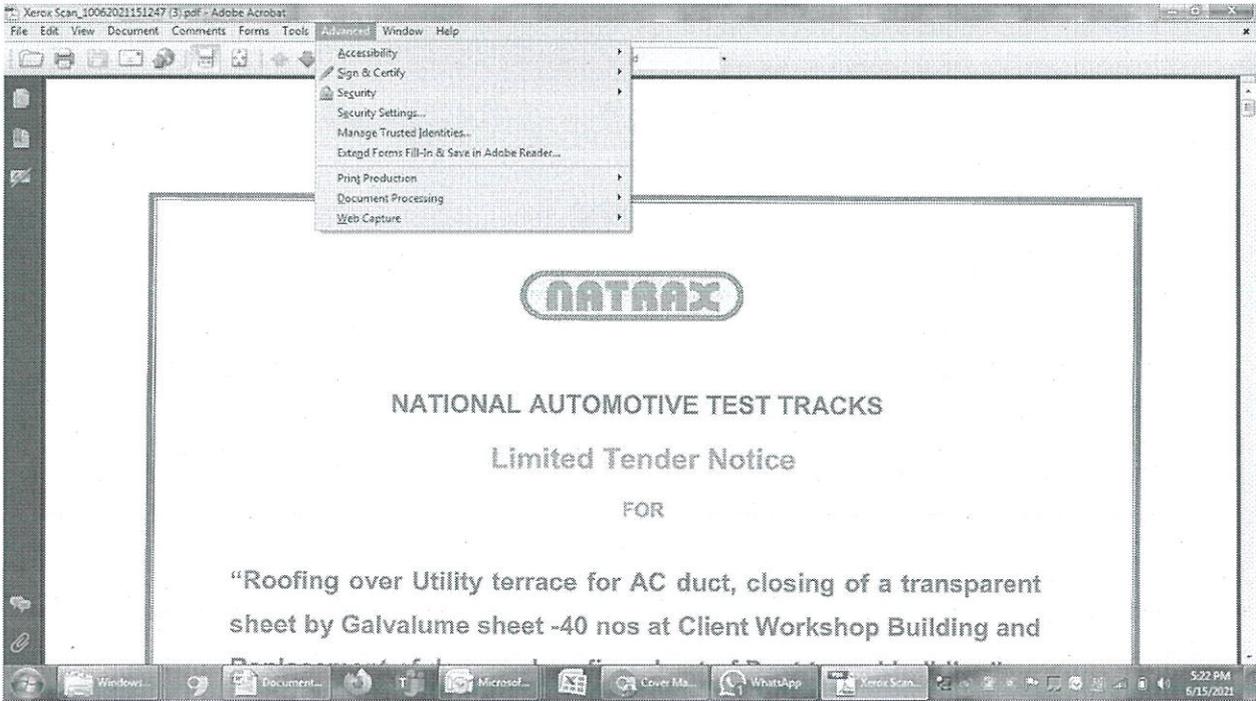
Note: the quoted rates should be inclusive of GST, Transportation, Labour charges etc all.

SEAL & SIGNATURE OF BIDDER'S

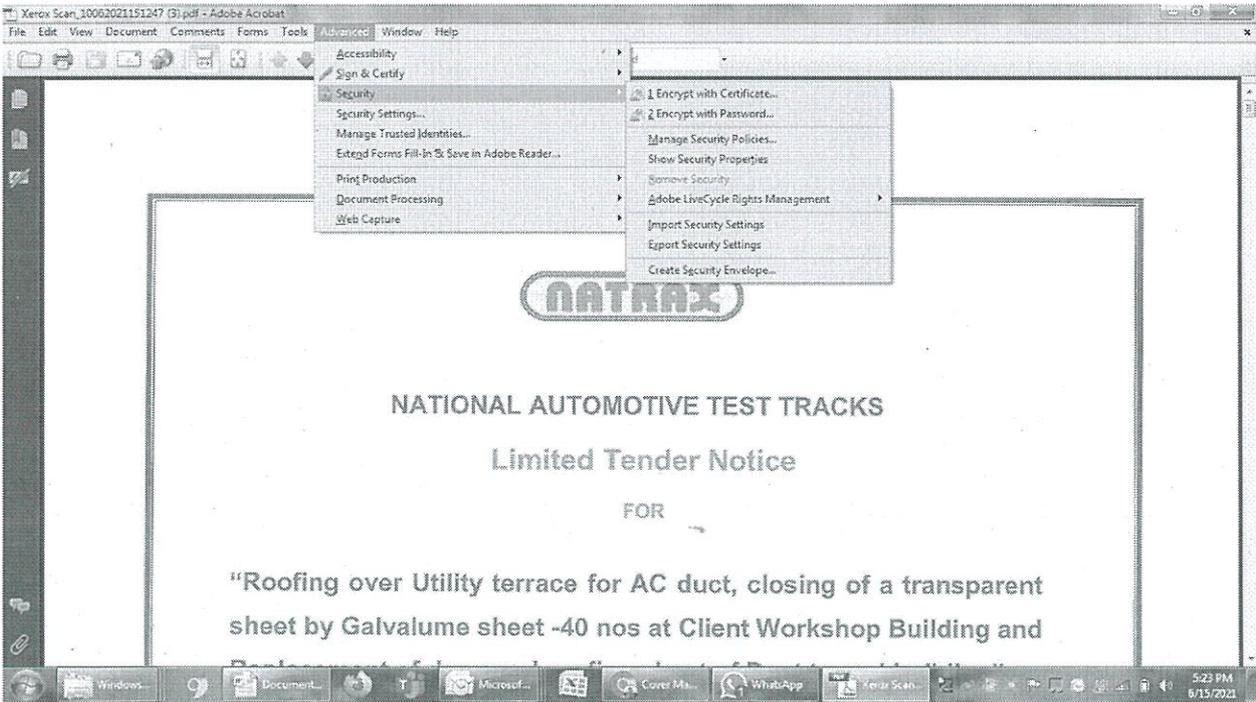


Steps for loading passwords in PDF Files-Method I

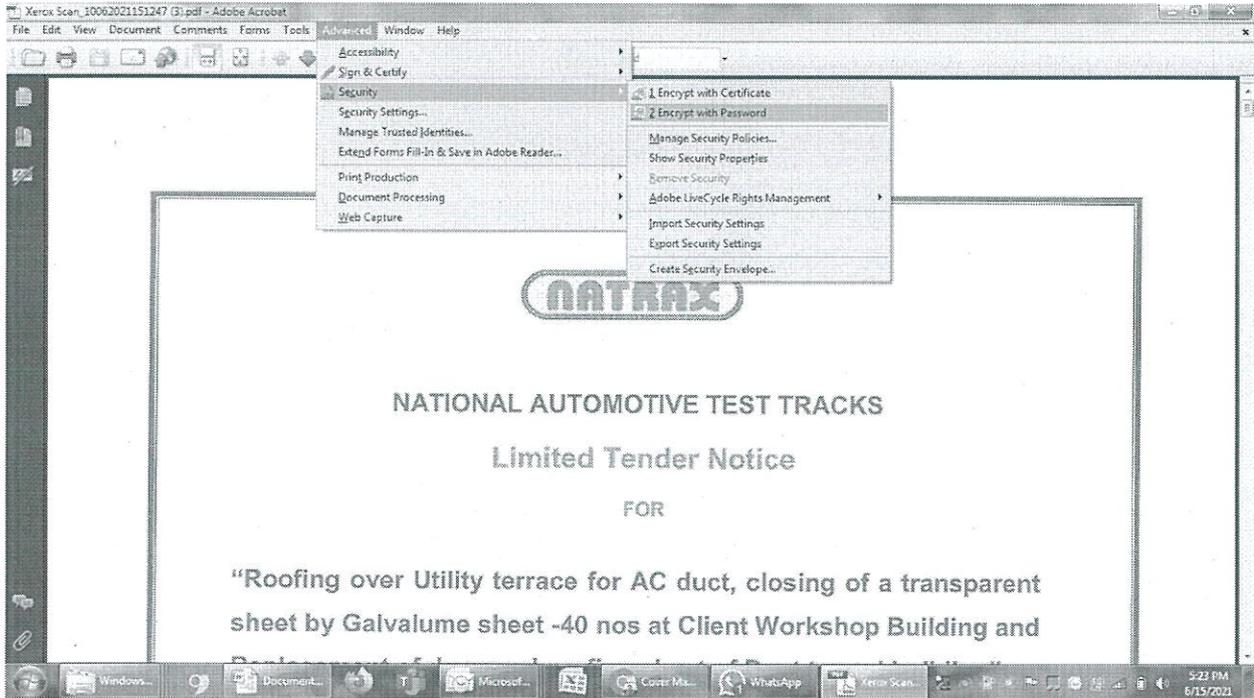
Step 1- please open PDF file and click on "Advance" tab.



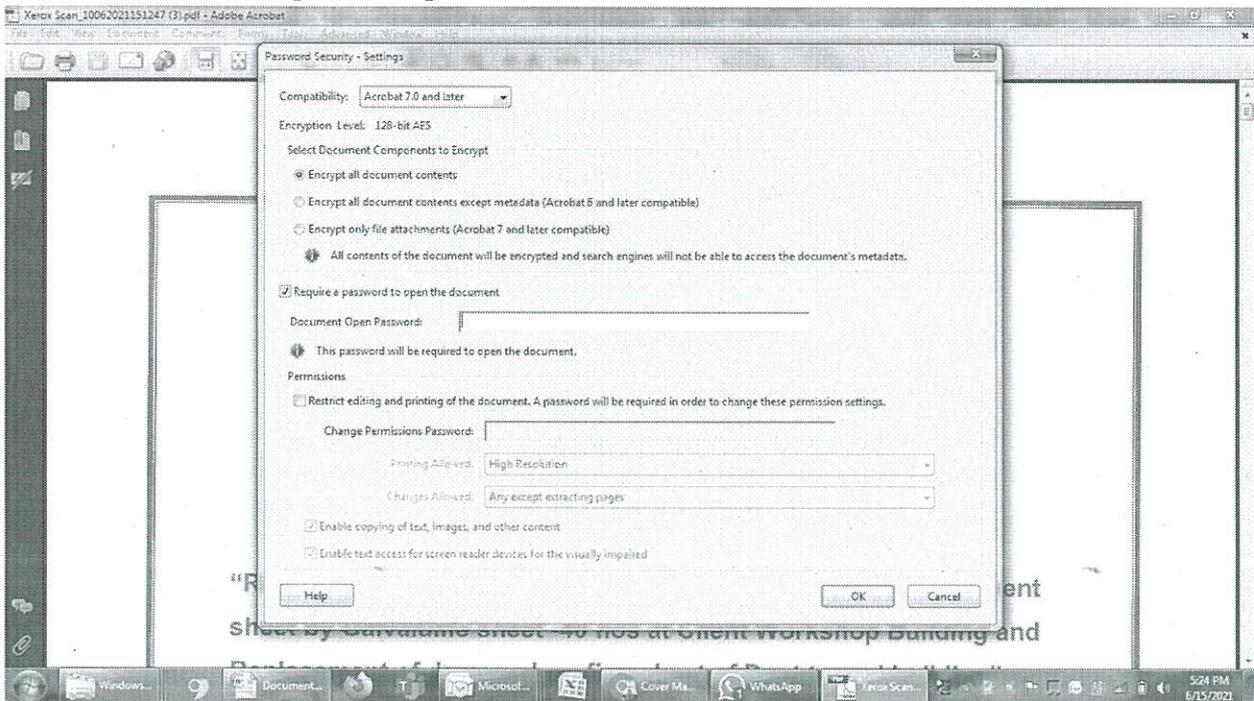
Step 2- in advance tab, please click on "Security" tab.



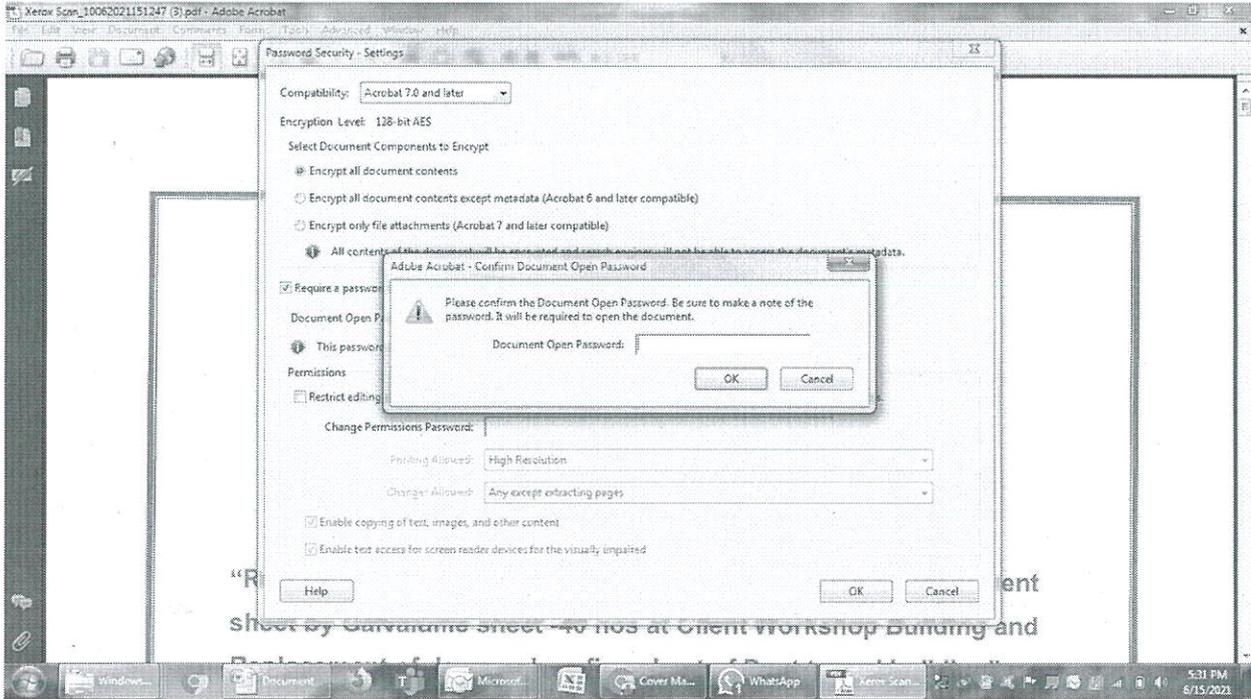
Step 3- in security tab, please click on "2 Encrypt with Password".



Step 4- after that below window will open, please check in option "Required a password to open the document". Then please fill password and click "ok".



Step 5- after that below window will be open, please fill same password again, and click "ok".





TECHNICAL SPECIFICATION

For

“Execution of Drain & Pedestal for Pump House Near T-5 at NATRAX, Pithampur, Distt. Dhar (MP)”

Preamble

1. The Technical Specifications shall be read in conjunction with the other Sections of the bid documents as specified in Instruction to Bidders and other related documents
2. In case of any conflict on unit of measurement and payment in this specification and that in the BOQ, the unit in BOQ shall prevail.
3. The quantity provided in BoQ derived from the scheme drawings provided with tender Document, the work shall be executed as per approved GFCD'S only which will be submitted by contractor based on input provided in the tender documents.
4. The work in general shall be carried out as per Specifications for CPWD specifications and its latest amendments for which specification are not included in the specification, all such works in general shall be carried out as per latest CPWD Specifications as describe below: -

I) The work in general shall be carried out as per latest CPWD Specifications (updated with correction slips issued Up to last date of submission of tender) unless otherwise specified in the nomenclature of the individual item or in the specifications for civil works and CPWD specification, and latest or 1994 for electrical work updated with correction slips issued Upto last date of submission of tender.

II) For items not covered under “CPWD Specifications (Civil Works)/ latest CPWD specification (Electrical works)”, the work shall be done as per latest relevant IS Codes of Practice. In any particular matter if CPWD specifications and IS specifications both are silent than any other relevant codes of practice like ASTM/AASTHO /DIN may be referred.

- III) All electrical installation shall comply with the requirements of Indian Electricity Rules, 1956 and Indian Electricity Act - 1910 as amended Upto date, and byelaw of Pithampur & MPEB and any other concerned Department
5. In the absence of any definite provisions on any particular issue in the aforesaid Specifications, reference may be made to the latest BIS codes and specifications of BIS, BS, ASTM or AASHTO in that order. Where even these are silent, the construction and completion of the works shall conform to sound engineering practice as approved by the Engineer in charge and in case of any dispute arising out of the interpretation of the above, the decision of the Engineer-in-charge shall be final and binding on the Contractor.
 6. Whenever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be accepted subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer's at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

TECHNICAL SPECIFICATIONS FOR CIVIL WORKS

S. N.	CONTENT
1	EARTH WORK
2	CONCRETE WORKS
3	REINFORCEMENT
4	FORMWORK
5	STRUCTURAL STEEL
6	MASONRY
7	CEMENT PLASTERING AND POINTING

DETAILED TECHNICAL SPECIFICATION**1.EARTH WORKS****SITE PREPARATION****1.1 Site Investigation**

The contractor shall carefully examine the site and make all inspections necessary in order to determine the full extent of the work required making the completed work conform to the drawings and specifications. The contractor shall satisfy himself as to the nature and location of the work, conditions, the conformation and condition of the existing ground surface, and the character of the existing ground surface, and the character of equipment and facilities needed prior to and during the execution of the work. The contractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles or utilities to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the drawings, or between the drawings and specifications shall be brought to the Engineer's attention immediately in order to obtain necessary clarifications on the exact nature of the work to be performed.

1.2 Site Clearance

The site shall be cleared of rubbish / debris of all kinds, loose rocks, small trees, not exceeding 30 cm in girth (measured at one meter above ground level), shrubs, stumps, grass, brush wood, undergrowth and any other vegetation, superficial earth etc.as directed by the Engineer-in-Charge. The site clearance shall be done twenty meters around the periphery of the proposed construction. Such site clearance shall be done in advance of the earth work and excavation operations and shall not be paid for. All materials arising from site clearance shall be the property of the Corporation and shall be disposed off by the Contractor at his own cost, as herein provided. All serviceable materials shall be temporarily stacked in separate lots at the site, at places as directed by the Engineer-in-Charge. These materials shall be transported to any place within Air India premises and stacked properly as and where directed by the Engineer-in charge. All products of site clearance which, in the opinion of the

EIC are not useable, shall be carted away by the Contractor to disposal areas designated by the EIC, spread and levelled evenly in layers or the Contractor shall cart away the same as directed by the Engineer-in-Charge. The site clearance shall cover all the operations required in full for clearing the site and its surroundings, including providing labour, materials, tools, equipment's and incidentals necessary to complete the work. It will also include handling, salvaging, piling or stacking or collecting and disposing off cleared materials

1.3 Site Grading

The levels and measurement of the existing site, as shown on the drawings are believed to be correct but the contractor shall verify them and also examine the nature of the ground as no claim or allowance whatever will be entertained thereafter on account of any errors or omissions in the levels of the description of the ground turning out different from that expected or shown on the drawings. Existing surface, after removal of all unwanted and unsuitable material shall be graded to the levels and slopes indicated in the contract drawings. Such grades and levels shall facilitate the intent of design

1.4 Existing utilities

Where existing utilities are encountered and found to interfere with the construction activity in this contract, they shall be removed if not required to be maintained or relocated to avoid interference or protected, supported and maintained during the construction phase, the exact dependent on the instruction of the Engineer.

1.5 Disposal

All rubbish and unwanted materials including unusable soil as they accumulate from time to time during the progress of the works and at completion including that of subcontractors shall be cleared and carted away and all materials condemned by the Engineer are to be removed from the works, within forty-eight hours.

1.6 Classification of soils

All materials encountered in excavation will be classified in the following groups irrespective of mode of excavating the materials and the decisions of the Engineer-in-Charge in this regard shall be final and binding to the contractor.

Classification of Soils

1.6.1 Ordinary Soil - Generally any material which yields to the ordinary application of shovel like turf, sand, loam, soft shale, mixture of sand & clay or any mixture of these soils.

1.6.2 Hard Soil - Material requiring the application of pick such as stiff clays mixed with moorum etc. Soil Mixed with Boulders - This shall consist of moorum, gravel or hard clay intercepted with boulders not larger than 30 cm cube which in the opinion of Engineer-in-charge do not require blasting and which shall be removed by iron, bars and shovel.

1.6.3 Disintegrated Rock - Slates, shale's, laterite and other materials which do not require blasting and can be removed with crow picks and shovel.

1.6.4 Ordinary Rock - Lime stone, sand stone and such other compact rocks which can be quarried or split with crowbars or wedge.

1.6.5 Hard Rock - Requiring blasting and comprise of

(1) Rocks like granite, gneiss, quartzite or trap for the excavation of which the use of mechanical plant or blasting is required.

(2) But where blasting is prohibited for any reason and excavation has to be carried out by chiselling or any other agreed method. Design Consideration Detailed design is not required for spread foundation for light structure as normal requirements, such as the minimum width of footing as given below shall generally be sufficient to bring the bearing pressure within safe limits. However, in case of soils having very low bearing strengths, such as very soft clay, if may be necessary to design the width of footing, in short, the pressure coming on soil due to building and foundation shall not be more than the safe bearing capacity of soil. Foundations on partly made up ground and partly natural grounds on the fill comprising of

mixed material which has been compacted unevenly shall be avoided as they are likely to give variable support from place to place. Where it is not possible to avoid such site, raft foundation may be adopted. Where the foundation can be separated in to two independent units, a slip joint may be introduced to take care of unequal settlement. Wherever Localized pockets of soft soil occurs, such soft soil shall be dug out to sufficient depth and the pockets filled with sand.

1.6.6 Sulphate Bearing Soil- In areas where considerable quantities of soluble salts and sulphates is expected, special precautions shall be taken by any of the following methods.

- (i) Dense cement concrete, M-15 or richer mix may be used to reduce permeability and increase resistance to attack from sulphates.
- (ii) Portland puzzolana cement may be used to control and reduce the activity of the sulphates.
- (iii) Special cements like aluminium cement, super sulphated cement, which are sulphate - resistant may be used.
- (IV) A third layer of cement concrete (with sulphate resistant cement) and coated with bitumen be laid before laying of foundation concrete to prevent infiltrations of pore water in sulphate soils.

1.6.7 Black Cotton Soil- Black Cotton Soil is dangerous for buildings on accounts of its volumetric changes with the change of atmospheric conditions. It swells excessively when wet and shrinks excessively when dry. This soil has a great affinity for water. The differential settlement of the structure, caused by the moment of ground on account of alternate swelling and shrinkage, results in formation of cracks. The cracks thus formed are sometimes 15 to 20 cm. wide and 2.5 to 4 m deep. Therefore, following precautions should be taken. With the bearing capacity 5.5 tons/m², the loading should be restricted to 4.9 tons/m², if water is liable to find an access to the foundation. To take foundation to such depths, where the cracks cease to extend. The minimum depth of foundation should be at at least 1.5 m. To

provide R.C.C ties or band 10 cm. to 15 cm. deep, all round the main walls of the building at plinth level, lintel level and eaves level. If the depth of black cotton strip above given ground is only 1 to 1.5 m, the entire soil above the hard bed Black cotton soil be prevented by direct contact of masonry work below ground level. This can be done by making wider trenches for foundation and filling spaces on either side of foundation masonry with sand or moorum. This extra width may be 20 cm. on either side. The foundation trench should be made firm or hard by ramming it well. A 30 cm. thick layer (in two layers of 15 cm. each) of moorum should be spread and rammed. On the layer either a stone or sand bed should be raised to desired height to rest the foundation concrete. In ordinary buildings, the foundation should be taken at least 30 cm. deeper than the depth where cracks stop, in case of compound wall this depth may be taken as 15 cm. Construction in black cotton soil should be undertaken during dry season. Approximate safe bearing capacity of soil is shown in Table I. d may be completely removed and foundation-laid on the hard bed below

Note: It is suggested that actual bearing capacity shall be calculated on the basis of soil test and same shall be adopted for actual design of foundation.

1.6.8 Soils & Hard Murrum-Soil of all sorts, silt, sand, gravel, murrum (soft or hard), stiff clay, kankar and other soft excavation not covered in the items mentioned hereunder and hard murrum comprising of all kinds of disintegrated rock or shale or indurated conglomerate interspersed with boulders of size between 0.03 cum. and 0.76 cum. weathered and decomposed rock which could be removed with pick, bar, shovel, wedges, hammers, though not without some difficulties

1.6.9 Soft-Rock-This shall include all materials which is rock but which does not need blasting and can be removed with a pick, bar, wedges, pavement breakers, pneumatic tools, etc.

1.6.10 Stripping Surface Materials

Before the surface of any part of the Site is disturbed or the works thereon are begun, the contractor shall take and record levels of such part, in the manner specified or as agreed with the Engineer. Two working days' notice is to be given to the Engineer so that the recording of levels can be performed in the presence of the Engineer. Before any excavations are commenced the surface, materials shall be carefully stripped and set aside for re-use as directed by the Engineer.

1.2. EXCAVATION

The contractor shall notify the Engineer-in-charge before starting excavation and before the ground is disturbed, to enable him to take existing level for the purpose of measurements. The ground levels shall be taken at 5 to 15 metres intervals in uniformly sloping ground/Natural Ground and at distance where local mounds, pits, or undulations are met with, as directed by the Engineer-in-charge. The ground levels shall be recorded in field books and plotted on plans, which shall be signed by the Contractor and the Engineer-in-charge, before the earthwork is actually started and a copy of the same shall be submitted to NATIS. The labour required for taking levels, shall be supplied by the Contractor at his own cost. The Contractor shall perform excavation in all types of soils, murrum, soft and hard rock, boulders etc. in foundation, over areas and in trenches to widths, lines, levels, grades and curves as shown in the drawing or lesser widths, lines, levels, grades and levels as directed by the Engineer-in-charge and per items in the schedule of quantities. The item in the schedule of quantities shall specify the excavation in trenches or over areas. For this purpose, the excavation for any depth in trenches for foundation not exceeding 1.5m in width or 10sqm. on plan shall be described as excavation in foundation trenches. Excavation exceeding 1.5m in width as well as 10sqm. on plan (excluding trenches for pipes, cables etc.) and exceeding 30cm in depth shall be described as excavation over areas. Excavation exceeding 1.5m in width as well as 10sqm. on plan but not exceeding 30cm. in depth shall be described as surface Excavation.

Bulk excavations shall be made to such sizes depths and inclinations as the Engineer may direct or as may be necessary to construct the Works. No extra payment shall be made to the contractor for working in a confined space. In the case of concrete roads or concrete foundations to roads the concrete shall be broken up and disposed of as the Engineer shall direct. Any existing reinforcement shall be cut and bent to the sides of the excavation in order that the new reinforcement to be provided in the reinstatement of the surface shall be lapped with the existing reinforcement by at least 300 mm. The top edge of the trench shall be as straight as practicable. Any excavation material stored on site for backfilling or other purposes shall be deposited compactly in such a manner that it will cause no damage and as little inconvenience as possible. The Engineer reserves the right to direct the contractor as to the lengths of trench or portions of bulk excavations which shall remain open at any one time. No pipes or concrete shall be laid or any permanent works commenced until the Engineer has inspected and approved the excavations.

1.2.1 Execution

The excavation for basements, foundations, footings, trenches, paving's, walkways, etc shall be carefully got out to net width and depth as shown on the drawings. "Battering" or "Benching" to the sides of excavation shall have the prior approval of the Engineer. Extra excavation (i.e. excavation beyond the limits required by the drawings), carried out without prior approval of the Engineer will not be measured and such extra excavation will be filled in at the contractor's expenses with concrete (mix specified by the Engineer) well rammed in position and brought upto the required level. Any water that may accumulate in the excavation, due to any cause, is to be bailed or pumped out. Adequate pumping or other facilities shall be employed to keep all the excavations clear of water constantly, glare any damage to buildings or other property or cause inconvenience in the property. The contractor shall take care to avoid damage to water mains or other underground utilities pipes cables, etc. during excavation work; when met with during excavation, they should be properly supported. Any damage done to the above during excavations shall be made good at the contractors' expenses. No foundation shall be put in the excavation before the same is measured and sanctioned by the Engineer-in-Charge. The contractor shall protect the

excavation from the effect of the weather or other damage and make good the damages if any to the satisfaction of the Engineer-in-Charge. Pit and trench bottom shall be smoothed and lightly rammed to a uniform surface and such portion of boulders or rock, as required shall be removed to make the bottom to the required level. The contractor shall at his own expenses and without extra charges, make provision as needed to uphold the sides of excavation and also protect the excavation against the sides of public utilities and service and other structures. The rates for excavation shall include use and waste of timber or steel work, planking and shuttering and open or closed polling boards.

1.2.2 Excavation in all sorts of soils & murram

The item shall include dry or wet excavation and removal of excavated material and its stacking and disposal in a manner hereinafter specified. The water met with if any shall be bailed or pumped out by the contractor as necessary at his own cost. The contractor shall provide all materials and all labour necessary for the excavation and completion of the works in accordance with the drawings and specifications and the intent there of. The contractor shall provide necessary protection to labour, materials equipment etc. to ensure safety against risk and accident. The ISI standard in this regard shall be followed (IS : 3764-1966). The contractor shall be liable to pay compensation for injury to life, and damage to property, if any,

caused due to any operation connected with this item. The contractor shall hand over the site of work in neat and tidy condition after completion of work and shall remove all rubbish of construction work. The contractor shall carry out the work of trial pit of required size and depth and at places as directed by the Engineer to accurately locate and determine the soil strata and water table and shall fill back as required and as ordered.

1.2.3 Shoring

Wherever shoring is found necessary by the Engineer-in-Charge the contractor shall provide the same in the best possible manner with the materials as required and as directed by the Engineer-in-Charge to his complete satisfaction. The contractor shall be responsible for

providing secured shoring and for taking every other precaution which may be necessary or proper for protecting any building or any other structure from getting damaged by the excavation of any trench or otherwise by the execution of works in the vicinity of such buildings or structure. After the work is completed near buildings, the contractor shall remove the shoring if any and make good any damage that might have been done. No part of the shoring shall, any time, be removed by the contractor without obtaining permission of the Engineer-in-Charge. While taking out shoring planks, the hollows, if any, formed shall simultaneously be filled in with soft earth well rammed with rammers after watering.

1.2.4 Excavation to be Kept Free from Water

The contractor shall keep all excavations free from water and sewage whether affected by tides floods storm or otherwise so that the Works shall be constructed in dry conditions. No sub-drainage pipes shall be left in unless they are filled with M - 10 concrete or other approved material. No water shall be discharged into any watercourse or sewer including those sewers laid under the contract.

1.2.5 Pumping out water

The contractor shall provide and work at his own cost of all pumping machinery required to keep foundations, trenches and other excavations, clear of water, whether it will be subsoil water, storm water, leakage from tanks, wells, drains, septic tank, sewers or pipes so that there may be no accumulation of such water. The contractor shall see that no masonry is laid, no concrete is deposited, no joints made and no measurements taken in water. The pumping shall be continued during and after execution of any portion of the work like masonry, curing, etc. under this contract, and repeated so long as the Engineer-in-Charge may consider it necessary. The pumps and power applied must be such as the Engineer-in-Charge may consider the necessary, and no separate payment shall be made for de-watering during any stage of execution of this contract. If proper pumping machinery is not provided, the Engineer-in-Charge may stop the work altogether until the pumping machinery is provided to his satisfaction and requirement. The contractor shall provide and maintain in working

order stand by pumping units to be available and employed in the event of mechanical failure. The contractor must also arrange for night and day manning and operating of the pumps wherever necessary to ensure that at all times and in all weather, the work could proceed.

1.2.6 Breaking Out and Temporary Reinstatement

Holes made for de-watering pipes shall be filled with bentonite as soon as the de-watering equipment is withdrawn. The backfill material shall be suitable to refill the holes completely and the Contractor shall ensure no voids remain.

1.2.7 Sight Rails

Before a trench excavation is commenced for laying sewer lines, sight rails (two uprights), one on each side of the trench to be excavated and a cross rail nailed thereto, shall be erected one each above the manholes and one set in the middle length, or at distances as fixed by the Engineer-in-Charge, uniform height above the proposed invert level of the pipes. The depth of excavation and the level of the pipe invert level shall be checked by boning rods of appropriate length. The sight rails and boning rods shall be provided, fixed and maintained by the contractor at his own cost.

1.2.8 Slips and Falls and Excess Excavation

Every precaution shall be taken by the contractor to prevent slips and falls of earth and other material in the excavations. In the event of slips or falls occurring or in the event of excavation being made in excess of the minimum necessary or practicable for the construction of the Works or in the event of any over excavation whether or not necessary beneath the formation of a structure the voids so formed shall be filled. In all cases where the voids so formed when backfilled would provide support for the permanent works or adjacent structures and services then such voids shall be filled solid with M - 10 concrete at the contractor's expenses. In all other cases the voids shall be filled with selected excavated material thoroughly compacted. In the event of any trench for pipelines exceeding the minimum allowable widths

as specified or shown on the Drawings the Engineer will order the restoration of the trench width or the use of an alternative bedding material or such other remedial action as in his opinion is necessary. The contractor shall then carry out the measures so ordered by the Engineer and shall have no claim against the Employer for any additional costs resulting from such instructions.

1.2.9 Surplus Excavated Material

The Contractor shall be responsible for making all arrangements for the disposal of surplus excavated material arising on any part of the Site to the place as directed by the EIC

1.2.10 Fencing / lighting

The contractor shall make all proper provisions for protecting the work by fencing and by watching and lighting at night, or otherwise as may be directed by the Engineer-in-Charge. In the event of contractor not fully complying with the provisions of fencing, lighting, watching the Engineer may with or without notice to the contractor put up a fence, improve the lighting and adopt such other measures as he may deem necessary for the safety and all costs of such works including penalty to the contractor. The contractor shall also provide and display special boards painted with fluorescent paints indicating the progress of the work.

1.3. BLASTING OPERATIONS

General

The Contractor shall acquaint himself with all the applicable laws and regulations concerning storing, handling and the use of explosives. All such laws, regulations and rules etc. are current from time to time shall be binding upon the Contractor. The provisions detailed in these rules are supplementary to the above laws, rules and regulations etc. and are applicable except where they conflict with the aforementioned laws etc. from time to time. Further, Engineer may issue modifications, alterations or new instructions from time to time, the Contractor shall comply with the same without these being made a cause for any claim.

1.3.1 Materials

All materials such as explosives, detonators, fuse, tamping materials etc. that are proposed to be used in the blasting operations shall have the prior approval of the Engineer in charge. Black powder and safe explosives (as commonly current in India) shall be used wherever possible. Explosives with Nitro glycerine shall only be used under exceptional circumstances, and where the above explosives are not effective. The use of a fuse with only one protective coat is prohibited. The fuse shall be sufficiently water resistant as to be unaffected when immersed in water for thirty minutes. The rate of burning of the fuse shall be uniform and not less than 4 seconds per 2.5 cm of length with 10% tolerance on either side. Before use, the fuse shall be inspected and the moist, damaged or broken one discarded. The rate of burning of all new types of fuses or when they have been in stock for long shall be tested before use. The detonators used shall be capable of giving effective blasting of the explosives, moist or damaged detonators shall be discarded.

1.3.2 Personnel

Excavation by blasting will be permitted only under personal supervision of competent and licensed persons and trained workmen. All supervisors and workmen in charge of makeup, handling, storage and blasting work shall be adequately insured by the Contractor. The storage shall be in charge of a very reliable person, approved by the Engineer, who may, if necessary, cause police enquiries being made as to his reliability, antecedents etc. The Contractor shall have to produce a security for the person in charge of the explosives if and as required by the Engineer, or the Civil authority of the District. The Contractor shall make sure that his supervisors and workmen are fully conversant with all the rules to be observed in storing, handling and use of the explosives. It shall be assured that the Supervisor in charge is thoroughly acquainted with all the details of the handling and blasting operations.

1.3.3 Storage of Explosives

The Contractor shall build a magazine for storing the explosives. The site of the magazine, its capacity and design shall be subject to approval by the Engineer, and the Inspector of Explosives before the construction is taken up. As a result, the explosives should be stored in a clean, dry, well ventilated, bullet proof and fire. Proof building, on an isolated site. The explosive, detonators and fuses shall each be separately stored.

1.3.4 Use of Explosives

For the transport of the explosives and detonators between the store and the site, closed and strong containers made of soft materials such as timber, zinc, copper, leather and the like, shall be used. The explosives and detonators shall be carried in separate boxes and transported separately. For the conveyance of primers, special containers shall be used. The boxes and containers used shall be kept well closed. Explosives shall be stored and used chronologically to ensure the ones received earlier, being used first. A makeup house shall be provided at each working place in which cartridge will be made up by experienced men as required. The makeup house shall be separated from other buildings. Only electric storage battery lamps shall be used in this house. No smoking shall be allowed in makeup house. Disposal of deteriorated explosives: All deteriorated explosives shall be disposed-off in an approved manner. The quantity of the deteriorated explosives to be disposed-off shall be intimated to the Engineer, prior to its disposal. Preparation of primers: The primers shall not be prepared near open flames or fires. The work of preparation of primers shall always be entrusted to the same personnel. Primers shall be used as soon as possible, after they are ready. Changing of holes: The work of charging shall not commence before all the drilling work on site is completed and the supervisor has been satisfied to that effect, by actual inspection. While charging open lamps shall be kept away. For charging with powdered explosives, naked flame shall not be allowed. Only wooden tamping rods without any kind of metal on them shall be allowed to be used. Boreholes must be of such size that the cartridges can easily pass down them. Only one cartridge shall be inserted at a time and

gently pressed with the tamping rod. The sand clay or other tamping materials used for filling the hole completely shall not be tamped too hard.

1.3.5 Blasting

Blasting shall be carried out during fixed hours of the day, which shall have the approved of the Engineer in charge. The hours, once fixed, shall not be altered without prior written approval of the Engineer in charge. The site blasting operations shall be prominently demarcated by red danger flags. The order to fire shall be given only by the Supervisor in charge of the work and this order shall be given only after giving the warning signals three times, so as to enable all the labour, watchmen etc. to reach safe shelter and after having ascertained that nobody is within the danger zone. A bugle or a whistle with a distinctive note shall be used to give the warning signal. This bugle shall not be used for other purposes. All labour shall be made acquainted with the sound of the bugle and shall be strictly warned to leave their work immediately at the first warning signal and make for safe shelters, and not to leave the shelters until the all clear signal has been given. All the roads and foot - paths leading to the blasting area shall be watched. In special cases, suitable extra precautions shall be taken. The Engineer may however permit blasting for underground excavation, without restriction of fixed time, provided that, he is satisfied that proper precautions are taken to give sufficient warning to all concerned and that the work of other agencies on the site is not unduly hampered. For lighting the fuses, a lamp with a strong flame such as a carbide lamp shall be used. The supervisor shall watch the time required to the fixing of the fuses and shall see that all the workmen are under safe shelters in good time.

1.3.6 Electrical Firing

Only the supervisor in charge shall keep key of the firing apparatus and shall keep it always with himself. Special apparatus shall be used as a source of current for the blasting operations. Power lines shall not be tapped for the purpose. All the detonators should be checked before use. For blasts in one series only detonators of the same manufacturers and of the same group of electrical resistance shall be used. Such of the electrical lines as could

constitute danger for work of charging shall be removed from the site. The firing cable shall have a proper insulating cover so as to avoid short circuiting due to contact with water, metallic parts of rock. The use of the earth as a return line shall not be permitted. The firing cable shall be connected to the source of current only after ascertaining that nobody is in the area of blasting. Before firing, the circuit shall be checked by a suitable apparatus. After firing, whether with or without an actual blast, the contact between the firing cable and the source of current shall be cut-off before any persons are allowed to leave the shelters. During storm, charging with electrical detonators shall be suspended. The charges already placed into the holes shall be blasted as quickly as possible, after taking all the safety precautions and giving necessary warning signal. If this is not possible, the site shall be abandoned till the storm has passed.

1.3.7 Precautions after Blasting

After the blast, the supervisor shall carefully inspect the work and satisfy himself that all the charges have exploded. After the blast takes place in underground works the workmen shall not be allowed to go to face till all the toxic gases are evacuated from the face.

1.3.8 Mis-Fires

If it is suspected that part of the blast has failed to fire or is delayed, sufficient time shall be allowed to elapse before entering the danger zone. When the fuse and blasting caps are used, a safe time should be allowed and then the Supervisor alone shall leave the shelter to see that misfire. Drilling near the hole that has misfired shall not be permitted until one of the following operations has been carried out by the Supervisor. The Supervisor should very carefully (when the tamping is of damp clay extract the tamping with a wooden scraper or jet of water or compressed air (using a pipe of soft material) and withdraw fuse with the primer and detonator attached. A fresh primer and detonator with fuse shall then be placed in this hole and fired. The Supervisor shall get one of the tamping cleared off and indicate the direction by placing stick in the hole. Another hole may then be drilled at least 23 cm. away and parallel to it; this hole should then be charged and fired. The balance of the cartridge and

detonators found in the muck shall be removed. Before leaving his work, the Supervisor should inform the Supervisor of the relieving shift of any case of misfire and shall point out the position with a red cross denoting the same and also state what action, if any, he has taken in the matter. The Supervisor shall at once report to the office, all cases of misfire, the steps taken in connection there with. The names of the Supervisor in charge of day and night shifts must be noted daily in the contractor's office. If a misfire has been found to be due to defective detonator, or dynamite, the whole quantity of box from which the defective article was taken, must be returned to the authority as may be directed by the Engineer in charge for inspection to ascertain whether the whole box contains defective materials. Redrilling the holes that have misfired either wholly or partly shall not be permitted.

1.3.9 Accidents

The contractor shall be solely responsible for any accident during the entire procedure of handling explosives and blasting shall pay necessary compensation to the persons affected or for damage to lands property etc. without claims.

1.4 FILLING OPERATIONS

1.4.1 Backfill Material-Excavation Material

Excavated material used for backfilling, shall be free from debris or other contamination, shall be suitably graded to obtain the required compaction and shall not contain stones, rock or concrete fragments larger than 10cm in the largest dimension. Two thirds of the backfill shall consist of well graded material not exceeding 3 cm in the largest dimension.

1.4.2 Importing Material

Where material from excavation is neither adequate in quantity nor satisfactory in quality, backfill material may be imported. Borrow pits for this purpose shall be identified by the contractor in the vicinity of the site approval from the Engineer - in - Charge shall be obtained for the satisfactory quality of the material. Borrow material used for backfilling shall

be sound, clean, uncontaminated granular material free from organic and deleterious material and shall not contain more than 10 percent by weight of clay or silt, individually or in combination.

1.4.3 Execution Deposition of fill

Fill materials shall be deposited in layer of not more than 20 cm in loose thickness for compaction by heavy equipment and not more than 12 cm loose thickness for hand compacted fill, so as to meet suitable extent of compaction. The contractor is responsible for the arrangement and payment for all embankment material and the material selected shall meet the approval of the Engineer - in - Charge.

1.4.4 Backfilling of trenches

No backfilling shall be carried out until all debris and other objectional materials have been removed from the trench and until the Engineer - in - Charge has inspected and approved the pipe installations and bedding. Backfilling shall be carried out in layers as defined below and in such a way that it does not disturb alignments, grades or stability of pipes. Backfilling shall only be carried out with approved materials.

1.4.5 Backfilling around structures and foundations

Backfilling around completed foundation and wall shall be done to the line and level shown on the drawing. This will be done with selected and approved earth from excavation material approved by Engineer-in-Charge. Backfilling around liquid retaining structure shall be done only after testing of structures against leakage and approval by Engineer-in-Charge. No separate payment will be made for backfilling. Rate quoted for excavation should include backfilling also.

1.4.6 Filling in foundations

Subgrades for concrete slabs shall be sand or gravel which have been tamped such that it is well compacted. The finish shall be with a 3cm tolerance when measured with a 3 m straight edge in any direction or location.

1.4.7 Deterioration of Materials

If deterioration of material takes place during the progress of work, the contractor shall at his own expense remove such material and replace it with fresh approved material.

1.4.8 Compaction Control

- a. Fill backfills under and adjacent to structures shall be compacted to not less than 95 percent of maximum dry density.
- b. Fill materials shall be moistened or dried, to within two (2) percent of optimum moisture content and compacted so as to conform to the following listed values when in accordance with these specifications.
- c. All other fills shown on the plans shall be compacted to not less than ninety (90) percent of maximum dry density.
- d. All working areas shall be protected from damage by water and site drainage shall be maintained at all times. Heavy equipment shall not be operated within 60 cm of any existing structure and vibrating roller not within 150 cm of any structure.

Disposal of surplus material

If the quantity of excavated material to be disposed off in permanent spoil dumps exceed the quantity which can be disposed off in the permanent spoil disposal areas in the site it shall be disposed off from site to a location as directed by the Engineer-in-Charge, including loading, unloading and spreading, etc. Complete surplus material or unsuitable material ordered to be disposed off shall be transported off the site and deposited at such a disposal site. Material so deposited shall be shaped up or spread and leveled as directed by the Engineer-in-Charge.

1.5. ANTITERMITE TREATMENT:

General:

Pre constructional anti-termite treatment is a process in which soil treatment is applied to a building in early stages of its construction. The purpose of anti-termite treatment is to provide the building with a chemical barrier against the sub-terrain termites. Anti-termite treatment being a specialized job, calls for thorough knowledge of the chemicals, soils, termite to be dealt with and the environmental conditions, in order to give effective treatment and lasting protection to the property undergoing treatment. It is therefore imperative that the works of anti-termite treatment should be got executed through specialized agencies only. The specialized agency should be preferably a member of the Indian pest control Association and shall have sufficient experience of carrying out similar works of magnitude envisaged in this tender. The pre constructional soil treatment is required to be applied during the construction stages of the sub-structure up to plinth level. The contractor has to be watchful of the various stages of sub-structure works and arrange to carry out the soil treatment in time after proper coordination with Department and other contractors if any, working at site.

1.5.1 Scope:

The scope of pre constructional anti-termite treatment covers the soil treatment with approved chemicals in water emulsion in foundation trenches for columns, plinth beams, plinth filling, at junction of walls and floor, in expansion joints etc. in stages as detailed in this specifications and drawings. Unless otherwise stipulated, the anti-termite treatment will be carried out as per IS 6313 (part II) 1981 and / or as per direction of the Engineer-in-charge.

1.5.2 Site preparation:

In order to ensure uniform distribution of the chemical emulsion and to assist penetration, the following site preparation shall be carried out:

- a) Remove all trees, stumps, logs or roots from the building site.
- b) Remove all concrete form work if left anywhere, leveling pegs, timber off-cuts and other building debris from the area to be treated.

- c) If the soil to be treated is sandy or porous, preliminary moistening will be required to fill capillary spaces in soil in order to prevent the loss of emulsion through piping or excessive percolations.
- d) In the event of water logging of foundation, the water shall be pumped out before application of chemical emulsion and it should be applied only when the soil is absorbent.
- e) On clays and other heavy soils where penetration is likely to be slow and on sloping sites, where run-off of the treating solution is likely to occur, the surface of the soil should be scarified to a depth of 75mm at least.
- f) All sub-floor leveling and grading should be completed. All cutting trenches and excavations should be completed with backfilling in place, borrowed fill must be free from organic debris and shall be well compacted. If this is not done supplementary treatments should be made to complete the barrier.

1.5.3 Chemical to be used:

The effectiveness of chemical depends upon the choice of the chemical, the dosage adopted and the thoroughness of application. The chemical solutions or emulsions are required to be dispersed uniformly in the soil and to the required strength so as to form an effective chemical barrier which is lethal and repellent to termites and shall comply as per relevant IS codes.

1.5.4 Soil treatment:

One of the following chemicals in water emulsion, after approval from the Engineer-incharge shall be used uniformly over the area to be treated. Chemical % of concentration of Chemical by weight in the Kerosene emulsion

- I. Heptachlor 20 EC emulsified concentrates (I.S.6439 - 19781-R) 0.5
- II. Chlordane 20 EC emulsified concentrates (I.S.2682-1984 II-R) 1.0
- III. THIODAN 35 EC emulsified concentrates (Endosulphan) 0.5
- IV. Chlorpyriphos 20 EC mollifiable concentrates (I.S. 8944-1974) 1.0

The contractor should produce voucher(s) for the chemical purchased and should get verified the sealed container(s) of the specified chemical from the Engineer-in-charge before preparing the emulsion / use for the treatment.

1.5.5 Mode and Rate of Application:

The chemical emulsion as stated above will be applied uniformly by sprayers at the prescribed rates as detailed below in all the stages of the treatment.

1.5.6 Treatment in Foundation Trenches:

In case of normal wall load bearing structures, columns pits, wall trenches and basement, the treatment shall be at 5 liters/sqm. of surface area of the bottom and sides to a height of at least 300mm. After the foundation work, the sides shall be treated at 7.5 liters/sq. of vertical surface of substructure on each side. After the earth filling is done, treatment shall be done by rodding the earth at 150mm centers close to wall surface and spraying the chemical with the above dose i.e. 7.5 liters/sqm. In case of framed structure, the treatment shall start at a depth of 500mm below ground level. From this depth the backfill around the columns, beams and R.C.C. basement walls shall be treated at 7.5 liters / sqm. of the vertical and at 5 liters /sqm. for the horizontal surface at the bottom in the trenches / pits.

1.5.7 Treatment on Top Surfaces on Plinth Filling:

The top surface of the filled earth within plinth walls shall be treated with chemical emulsion at the rate of 5 liters/sqm. of the surface area before sub-base to floor is laid. If filled earth has been well rammed and the surface does not allow the emulsion to seep through, holes up to 50 to 75mm deep at 150 mm centers both ways shall be made with crow bars on the surface to facilitate saturation of the soil with the emulsion.

1.5.8 Treatment at Junction of Walls and floors:

Special care shall be taken to establish continuity of the vertical chemical barrier on the inner wall surfaces from the finished ground level (or from level where the treatment had stopped)

up to the level of the filled earth surface. To achieve this a small channel 30 X 30 mm. shall be made at all the junctions of wall / column with floor (before laying sub-grade) and rod holes made in the channel up to the finished ground level at 150mm apart and the iron rod moved backward and forward to break the earth and chemical emulsion poured along the channel at 7.5 liters (or at recommended quantity per sqm. of the vertical wall / column surfaces so as to soak the soil right up to the bottom. The soil shall be tamped back into place after this operation.

1.5.9 Treatment for Expansion Joints:

The soil beneath the expansion joints shall receive special attention when the treatment under 2.5.1 above is in progress. This treatment shall be supplemented by treating through the expansion joint after sub-grade has been laid at the rate of 2 liters per meter length of expansion joint.

1.5.10 Precautions during Treatment:

1. Utmost care shall be taken to see that the chemical barrier is complete and continuous. Each part of the area shall receive the prescribed dosage of chemical emulsion.
2. The treatment should not be carried out when it is raining or when the soil is wet with rain or sub-soil water.
3. Once formed, the treated soil barrier shall not be disturbed. If by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barrier system.

1.5.11 Precautions for Health Hazards and Safety Measures:

All the chemicals mentioned above are poisonous and hazardous to health. These chemicals can have an adverse effect upon health when absorbed through the skin, inhaled as vapors or spray mist or swallowed. Persons handling or using these chemicals should be warned of these dangers and advised that absorption through the skin is the most likely source of accidental poisoning. They should be cautioned to observe carefully all the safety precautions

particularly when handling these chemicals in the form of concentrates. These chemicals are usually brought to the site in the form of emulsifiable concentrates. The containers should be clearly labelled and should be stored carefully out of the reach of children and pet's animal. They should be kept securely locked. Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water especially before eating. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash into the eyes they shall be flushed with plenty of water and immediate medical attention should be sought. The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing. Care should be taken in the application of chemicals / soil toxicants to see that they are not allowed to contaminate wells or springs and other sources of drinking water.

1.5.12 Guarantee:

The contractor has to furnish the guarantee per EIC from the date of completion of work, starting that in case of reappearance of termites within the building area due to defective materials or workmanship or due to any other reasons, the contractor will carry out the necessary post constructional treatment to keep the entire area free from termite, once again, without any extra cost to the Department during the guarantee period.

1.5.13 Mode of measurement:

The payment will be made on the basis of plinth area measurements at ground floor only for all the stages of treatment in sqm. correct to two places of decimals. Rate includes the cost of materials, labour and all tools, plants, sprayers required for complete operation.

2. CONCRETE WORKS

General

This section covers the requirements for concrete works and placing procedures, finishing and curing procedures for both cast-in-site and pre-cast cement concrete and including reinforced concrete. The Engineer strictly requires that at no time whatsoever will the mixer operator or those supervising or inspecting the works be permitted to alter the quantity of water specified by the Engineer of mixing the concrete. Batching shall be accurate and as specified by the Engineer.

2.1 Water / Cement Ratio: The water/cement ratio will be determined after mix trials by the Contractor in the presence of the Engineer or his Representative. If batching is by volume, the Contractor shall be required to fabricate such volumetric batchers and water containers as the Engineer may determine and require so as to simulate the ideals of the trial mix without recourse to assessments by site staff and workmen.

2.2 Weighing: The Contractor shall make available always a weighing machine if so required by these documents, guaranteed by the Contractor for its accuracy, for weighing cement and batches of aggregate as and when the Engineer or his Representative or his assistant may require. The machine shall be capable of weighting up to 75 Kilograms and shall be accurate to half (+0.5) Kilogram.

2.3 Compaction: All concrete shall be thoroughly compacted and fully worked around the reinforcement by vibration just sufficiently so that the appearance of laitance is kept to a minimum and in such manner as directed by the Engineer's Representative. Under no circumstances shall concrete be compacted by trowels or the like.

2.4 Transport and Placing: Fresh concrete from the mixer shall be transported to formwork where required by the quickest and most efficient means so as to prevent pre-set or segregation or any loss of ingredients and maintaining the required workability. Any laitance from previous mixes shall be removed.

2.5 Testing of Materials

Materials shall be tested as hereinafter specified and unless specified otherwise all sampling and testing shall be performed by Employer-approved Testing Laboratory, at the Contractor's expense.

2.6 Cement: Cement shall comply with the requirements of IS: 269, IS: 8041, IS: 455, IS: 8112, IS: 8043, IS: 6909 IS 1489, IS: 12269. The testing laboratory at the discretion of the Engineer, shall perform such tests as are deemed necessary. Cement bags or bulk silos shall be tagged for identification at location of sampling. Tests will include tensile tests and weighing the cement supply to check for net weight received at site and used in the works.

2.6.1. On arrival at the site, cement shall be stored in weather proof silos designed for the purpose or in dry weather - tight and property ventilated structures with floors raised 15 to 20 cm above ground level, 30 cm away from walls and with adequate provision to prevent absorption of moisture or flooding. All storage facilities shall be subject to approval by the Engineer and shall be such as to permit easy access for inspection and identification. Each consignment of cement shall be kept separately and the Contractor shall use the consignments in the order in which they are received. Any cement in drums or bags which have been opened shall be used immediately. Different types of cement shall be kept in clearly marked separate storage facilities. Not more than 15 bags shall be stacked vertically in one pile. Cement shall be stored in double locking arrangement, so that cement transactions can be with the knowledge of supervisory staff. Daily account of cement shall be maintained by Contractor in the prescribed register and shall be made available to inspecting authorities for store verification.

2.6.2. The Contractor shall provide from each consignment of cement delivered to the site such samples as the Engineer may require for testing. Any cement which is, in the opinion of the Engineer, lumpy or partially set shall be rejected and the contractor shall promptly remove such cement from the site.

2.6.3. Cement which has been stored on the site for more than ninety (90) days and cement which in the opinion of the Engineer is of doubtful quality shall not be used in the works

until it has been retested and test sheets showing that it complies in all respects with the relevant standard have been delivered to the Engineer.

2.7 Water for Concrete Mixing & Curing: Water shall be clean, reasonably clear and free from injurious quantities of salt, traces of oil, acids, alkalis, organic matter and other deleterious materials. The sources of water shall be approved by the Engineer and the containers for conveyance, storage and handling shall be clean. If necessary, standard cement tests shall be conducted using the water intended to be used, in comparison with those adding distilled water to check quality of water. Water shall meet the requirement of 4.3 of IS 456 - 78. Generally potable water is fit for mixing and curing.

2.8 Aggregate

The fine and coarse aggregates shall be measured separately either by volume in gauge boxes made as hereinafter specified or by weight using machines with weigh batching attachments. For high grade concrete the fine aggregate shall be measured singly or cumulatively by weight. The Engineer will rule on this requirement.

a) **Aggregates for Concrete-**Aggregates shall comply with the requirements of IS : 383 : 1970

b) **Fine Aggregate:** Sand for concrete work shall be clean, well graded and shall consist of strong, dense, durable gritty particles, free from veins injurious amounts of disintegrated pieces, alkali, vegetable matters and other deleterious substances and shall be approved by the Engineer. Maximum size of particle shall be restricted to 5 mm minimum being 0.15 mm.

c) Coarse Aggregates

The coarse aggregate shall generally be cubical in shape broken generally from best trap granite / quartzite / gneiss stones as available and generally used in the region. It shall be hard, strong, dense, durable, clean and of proper gradation, veins, free from skin and coatings and weathered aggregates shall not be permitted for use. The maximum size of coarse aggregate shall be as large as possible but not greater than 1/4 of the minimum

thickness of concrete member provided that in case of R.C.C. the size presents no difficulty to surround the reinforcement thoroughly and fill up the corners properly. In plain cement concrete, the maximum size may be 80mm subject to above limitations in absence of any special provisions. For heavily reinforced beams the maximum size shall be restricted to 5 mm less than minimum lateral distance between the bars. Generally, for R.C.C. works 20 mm nominal size of aggregate shall be satisfactory. Aggregates will be tested before and after concrete mix is established and whenever character or source of material is changed. Tests will include a sieve analysis to determine conformity with limits of gradation.

Samples of aggregates 50g. in weight will be taken by the Contractor at source of supply and submitted to the Engineer before placing orders. These samples if approved shall remain preserved in the Engineer's care for reference and the type of aggregate used in the works may not be altered without the Engineer's prior approval.

Aggregates shall be obtained from an approved source and shall conform to the requirements of IS: 383. For fine aggregate grading in table of IS: 383: 1970 shall be applicable. Aggregates shall not be flaky scorable or elongated particles, defined as particles having a maximum dimension greater than five times the minimum dimension. Aggregate shall have a water absorption not exceeding two percent when tested in accordance with IS.

The Contractor shall sample and carry out analysis in the presence of the Engineer's representative, of the fine aggregate and each nominal size of coarse aggregate in use employing the methods described in IS : 383 and 2386 at least once in each week when concreting is in progress and at such more frequent intervals as the Engineer may require. The grading of all aggregates shall be within the respective limits specified in the codes, aggregate vary more than IS from the approved fineness moulds, the Engineer may instruct the Contractor to alter the relative proportions of the aggregates in the mix to allow for such difference, or may require further trial mixes.

Storage of aggregates shall be provided at each point where concrete is made such that each nominal size of coarse aggregate and the fine aggregate shall be kept separated at all times. Contamination of the aggregates by the ground or other foreign matter shall be effectively prevented at all times, and each heap of aggregate shall be capable of draining freely. The Contractor shall ensure that graded coarse aggregates are dumped, stored and removed from store in a manner that does not cause segregation.

Wet fine aggregate shall not be used until, in the opinion of the Engineer, it has drained to a constant and uniform moisture content, unless the Contractor with the knowledge of the Engineer measure the moisture content of fine aggregate and adds water in each batch of concrete mixed to allow for the water contained in the fine aggregate.

2.9 Classes of concrete

All cement concrete whether used in R.C.C. work or plain cement concrete work shall be designed in grades (by strength at the age of 28 days). M10, M15, M20 and M25 Where M refers to the mix and the number 10, 15 20 and 25 represent the specified 28 days works cube compressive strength of the mix under reference, expressed in N/mm³. The proportions of cement, aggregate water for ordinary cement concrete shall be as per relevant standard. The cement concrete shall be tested for compressive strength at the age of 28 days of 15 cm. cubes in accordance with the latest IS: 516.

2.10 Strength requirement of Concrete

Grade of concrete in all RCC work shall not be less than M20 with a minimum cement content of 432 Kg/Cu.m and with a maximum water cement ratio of 0.45. For quick result the contractors shall carry out compression tests on representative 15 cm cubes cast in accordance with relevant IS 516 at 7 days in addition to the normal 28 days compressive strength. However, the 28 days compressive strength alone shall be the criteria for acceptance or rejection of the concrete. Suitable water cement ratio for the different mixes an use shall be

determined in consultation with the Engineer and shall generally not be exceeding 0.45 (i.e 4 percent by weight). The exact value being fixed after taking into account all relevant factors such a strength required, weather condition, water absorbed material, workability and slump required consistent with the work requirements, methods of compaction, etc.

2.11 Admixtures: Admixtures shall mean material added to concrete materials during mixing for the propose of altering properties of normal concrete mixes. If NATIS recommends to use admixtures the contractor shall first obtain the written permission of the Engineer in-charge. The methods of use and the quantities of use shall be subject to the approval of the Engineer in Charge. The methods of use and the quantities of admixture used shall subject to the Engineer's approval, which approval or other shall in no way limit the Contractor's obligations under the contract to produce concrete with the specified strength and workability. Concrete of any class containing an admixture shall be separate designed and have separate preliminary tests and trial mixes and tested for approval by the Engineer as if it were a separate class of concrete.

2.12 Concrete Mix Design

Procedure for designing concrete mixes shall be as per IS: 10262 - 82. Recommended guidelines for concrete mix design.

2.13 Mix Design

Mix design is normally a prerequisite to any concreting job and will be required on all major works. If required by the Documents, an approved testing laboratory shall, at the contractor's expense, design a mix for each class of concrete and shall submit full details of the mix designs to the Engineer for his approval. The Engineer's representative and the Contractor shall clearly code each approved mix with a number and date, and file all details for identifying and reproducing exactly the same mix.

Each mix design shall be such that the aggregate shall comprise fine aggregate and coarse aggregate of the size specified and the combined aggregate grading shall be continuous.

Aggregate shall be calculated by weight, and batching procedures shall be established. The cement content by weight shall not be outside the minimum and maximum limits calculated from the minimum and maximum dry aggregate to cement ratios. The mixes shall be designed to produce an average concrete strength at twenty-eight days after manufacture not less than trial mix test strength specified. The water/cement ratio shall be in the region of 0.45 to 0.55 and shall never exceed 0.60.

The proportions of cement, aggregate and water determined by the Contractor in his mix design shall be preliminary mix of concrete made and tested for strength and workability under laboratory conditions observing the appropriate requirements. These preliminary mixes shall be repeated at adjusted proportions as necessary until concrete mixes meeting requirements of the preliminary and trial mix tests specified with the workability defined herein have been produced. If at any time during construction of the works, the source of cement or aggregates is changed, or the grading of the aggregate alters, further preliminary mixes shall be undertaken.

After the Engineer's approval of the preliminary concrete design for each class of concrete and during or following carrying out of the preliminary tests the Contractor shall prepare a trial mix of each class in the presence of the Engineer. The mixes shall be mixed for the same time and handled by means of same plant that the Contractor proposes to use in the works. The proportion of cement, aggregates and water shall be carefully determined by weight in accordance with the approved mix (or modified mix design after preliminary tests) and sieve analysis shall be made, by approved methods of the fine aggregate and nominal size of coarse aggregate used.

2.14 Waiver of Mix Design and Weigh Batching

On certain works the Engineer may waive the requirement of designing mixes and may allow the use of established nominal mix proportion, provided always that preliminary trials are made to establish the volumetric batching procedure and mix strengths. The Contractor will ensure that any established procedure approved by the Engineer is strictly adhered to, so as to achieve consistent strength, durability and economy of the concrete while ensuring

approved workability of the mix. Any waiver of mix design or weigh batching will not relieve the Contractor of his obligations to consistently produce concrete of the specified and approved strength and durability as determined by works tests defined hereafter. However, in any particular work/part of work the Engineer may decide to adopt mix design (mix) concrete.

2.15 Water: Water for mixing concrete, mortar or grout shall sat the recommendations of IS: 456. If required to do so by Engineer, the Contractor shall take samples of the water and them for quality.

2.16 Workability

The workability of each class of concrete shall be such that satisfactory compaction can be obtained when the concrete is placed and vibrated in the works. There shall be no tendency to segregate when it i handled, transported and compacted by the methods which the Contractor proposes to use when handling, transporting and compacting that class of concrete in the works.

2.17 Batching Cement

All cement used in making concrete shall be measured by weight either with an approved weighing machine or by making the size of each batch of concrete such as to require an integral number of complete bags of cement of weight consistent with the requirements of C1.9 of IS: 269. In case of ordinary mixes, the cement bag shall be taken to be 50 Kg. (35 litres).

2.18 Gauge Boxes

Gauge boxes shall be soundly constructed by the Contractor, with the approval of the Engineer and shall be of timber or of steel to contain exactly the volume of the various aggregates required for one batch of each mix. Each gauge shall be clearly marked with the mix code and the aggregate for which it is intended. When calculating the size of the gauge

box for fine aggregate an allowance shall be made for the bulking of the fine aggregate due to the average amount of moisture contained in the stockpiles on the site. Before the Contractor shall put any gauge box into use on the site, he shall obtain the approval of the Engineer of the size and construction of such gauge box.

2.19 Water Containers

Containers for measuring water shall be soundly constructed of metal to contain the exact quantity of water required for a batch of mix, due allowance having been made for the moisture content of the aggregates, as hereinafter specified, or such fractions of the quantity as are approved by the Engineer. Containers shall have spouts, the spill levels of which have an outlet valve and hose fixed to the bottom of the container. Before any container is put into use, the approval of the Engineer shall be obtained.

2.20 Weigh-Batching

Weigh-batching machines shall provide facilities for the accurate control and measurement of the materials either singly or cumulatively and shall be capable of immediate adjustment of operators in order to permit variations if ordered by the Engineer. All weight dials shall be easily visible from the place at which filling and emptying of the hoppers is controlled.

2.21 Uniformity of Mix: Concrete shall be mixed in batches in plant capable of mixing the aggregates, cement and water (including admixtures, if any) into a mixture uniform in colour and consistency and of discharging the mixture without segregation.

2.22 Contractor's Returns: The Contractor shall render to the Engineer, not more than twenty-four hours in arrears, a daily return for each class of concrete of the number of batches mixed, and total volume of concrete placed, the number of batches wasted or rejected and the weight of cement used. In case of ordinary mixes, where permitted the cement bags consumed for quantities of various classes of concrete shall be furnished. In addition daily details of time of starting concrete, closure, No. of batches through mixer, W.C. ratio, slump,

date of striking form works etc. shall be maintained. These day-to-day records shall be authenticated by responsible supervisory staff.

2.23 Plant and Equipment Generally

All mixing and batching plants boxes, containers and other equipment shall be maintained free of defects or of set concrete or cement and shall be cleaned before commencing mixing. At such intervals as may be directed by the Engineer the Contractor shall provide weights, containers and equipment necessary for testing the accuracy of the weighing plant, water measuring plant and admixture dispenser.

2.24 Laitance : Where laitance on a life of concrete is evident or if a substantial bond between this lift or bay of concrete and the next is required, in the opinion of the Engineer's Representative, the Contractor shall have the surface wire brushed after initial (one day) set of the concrete or have it bush-hammered at no extra cost to the Owner. Any reinforcing bars covered in laitance shall be wire brushed to clean the surface of the metal.

2.25 Binding: As ordered by the Engineer, or as shown on the drawings the formation surfaces on which concrete is to be placed shall be covered with either blinding concrete not less than 75 mm thick, or waterproof building paper, or polythene sheeting immediately after completion of the final trimming of the excavation.

2.26 Inspection

Concrete shall not be placed until the Engineer has inspected the formwork and the reinforcing steel, and taken necessary measurements of the latter, and has approved the surfaces upon which the concrete is to be placed.

2.27 Transporting: Fresh concrete shall be transported from the mixer to its place in the works as quickly and as efficiently as possible by methods which will prevent pre-set or

segregation. If segregation has nevertheless occurred in any instance the materials shall be remixed or discarded at the option of the Engineer.

2.28 Placing: Fresh concrete shall be placed and compacted before initial set has occurred and, in any event, not later than thirty minutes from the time of mixing. Concrete shall be carefully placed in horizontal layers which shall not be allowed to slide or flow down sloping surfaces but shall be placed in its final position form skips, or similar devices. If this is impracticable, it shall be shovelled into position care being taken to avoid segregation. No concrete shall be dropped more than 1.5 m. If greater drops are necessary approved chutes may be used. If the concrete abuts against earth or any other material liable to become loose or to slip, care shall be taken to avoid falls of materials on to the surface of the wet concrete. As far as possible concrete for any particular portion shall be done in one continuous operation leaving construction joints, if specified by drawing. Before commencing subsequent concrete on the one left incomplete all the loose particles, laitance etc. shall be removed and surface shall be covered with thick cement slurry. The concrete compacted manually shall be laid in layers not more than 15 to 20 cm. The successive layer shall follow within 30 minutes or earlier.

2.29 Compaction

All concrete placed in-situ shall be compacted with power drive or pneumatic internal type vibrators unless otherwise approved by the Engineer in writing, and shall be supplemented by hand spading and tamping where required. Vibrating screen type vibrators may be used for thin slabs. There shall be sufficient and spare vibrators of adequate capacity to compact the work in hand.

2.30 Vibration: Vibrators shall be inserted into the uncompacted concrete vertically and at regular intervals. Where the uncompacted concrete is in a layer above freshly compacted concrete the vibrator shall be allowed to penetrate vertically for about 75 mm into the previous freshly compacted layer. The vibrators shall not be allowed to come into contact with the reinforcement or formwork nor shall they be withdrawn weekly from the mass of

concrete but shall be drawn back slowly while in motion so as to leave no voids. Internal type vibrators shall not be placed in the concrete in any arbitrary manner nor shall concrete be moved from one part of the work to another by means of the vibrators. The vibrators shall have minimum 3600 (and preferably 5000) impulses per minute.

2.31 Duration: The duration of vibration shall be limited to that required to produce satisfactory compaction of the concrete without causing segregation. Vibration shall on no account be continued after the appearance of water or grout on the surface.

2.32 Hand Compaction: This shall be permitted exceptionally for small jobs by the Engineer. In such cases, compaction shall be attained by means of rodding, tamping, ramming and slicing with suitable tools. The thickness of concrete layers will also be suitably reduced when hand compaction is resorted to.

2.33 Underwater concreting

No concrete shall be placed in water without the Engineer's written permission, which may only be granted if in his opinion it is not practicable to place the concrete in the dry. Concrete shall not be placed in running water nor shall concrete be allowed to fall through water. Any water entering the area where concrete is being placed shall, at the Contractor's expenses, be kept clear of the concreting works. If under water concreting is permitted, the specified mix of concrete shall be strengthened by increasing the cement content by at least 10.0% and reducing the water/cement ratio not to be more than 0.45, and the placing shall be only through a tremmie approved by the Engineer. The volume or mass of the coarse aggregate shall not be less than 1_ times nor more than twice that of the fine aggregate. The materials shall so proportion as to produce a concrete having a slump of not less than 100 mm & not more than 180 mm.

2.34 Curing

All concrete shall be protected from the effects of sunshine, rain, running water or mechanical damage and cured by covering with jute, hessian or similar absorbent material kept constantly wet or a layer of sand kept covered with water is also permissible for a continuous period of fourteen days at least from the date of placement. Should the Contractor fail to water concrete continuously, the Engineer may provide labour, materials required for watering and recover the cost from the Contractor.

2.35 Finishing

Immediately after removal of forms any undulations, depressions, cavities, honey combing, broken edges or corners high spots and defects shall be made good and finished with cement mortar 1:2 but the necessity of such finishing must be exceptional and total surface requiring finishing shall not exceed 1%. Where concrete surface is to receive plaster, the surface shall be roughened immediately after removal of forms and within a day thereof to secure a hold for the plaster. The rate of concrete is inclusive of this roughening and finishing. Concrete after finishing shall be cured for the full period. The concrete surfaces, where plastering is not required shall be finished to smooth surface with a carbarndum stone rubbing as required by the engineer.

2.36 Joints

Construction joints are defined as joints in the concrete introduced for convenience in construction at which special measures are taken to achieve subsequent continuity without provision for further relative movement.

2.37 Submittal: No concreting shall be started until the Engineer has approved the method of placing, the positions and form of the construction joints and the size of lifts.

2.38 Jointing: The face of a construction joint shall have all laitance removed and the aggregate exposed prior to the placing of fresh concrete. The laitance shall wherever practicable be removed by spraying the concrete surface with water under pressure and

brushing whilst the concrete is still green. Where the laitance cannot be removed whilst the concrete is green, the whole of the concrete surface forming part of the joint shall be hacked to expose the aggregate. Where aggregate is damaged during hacking, it shall be removed from the concrete face by further hacking. All loose matter shall be removed and the exposed surface thoroughly cleaned by wire brushing, and washing down, and the surface to which fresh concrete is applied shall be lean and damp.

2.39 Expansion Joints

Expansion joints are defined as joints intended to accommodate relative movement between adjoining parts of a structure special provision being made where necessary for maintaining the water tightness of the joint.

A. The joint location and type will be as indicated in the drawing.

1. The Contractor shall comply with the instructions of manufacturers of proprietary jointing materials and shall, if required by the Engineer, demonstrate that the jointing materials can be applied satisfactorily and will last the life of the structure.
2. Flexible water stops shall be fully supported in the formwork, free of nails and clear of reinforcement and other fixtures. Damaged water stopper shall be replaced and during concreting care shall be taken to place the concrete so that water stops do not bend or distort.

B. Jointing: The surface of set concrete shall not be disturbed and concrete shall be placed against the dry finished surface.

1. If ingress of water or corrosive agents in the joint is possible, the steel, where such steel is continued, shall be cleaned and coated with two coats of an approved bituminous paint to a distance not exceeding 10 mm.
2. Where specified, the surface of the set concrete shall be painted with two coats of an approved bituminous paint which shall be allowed to dry before placing new concrete against it. Care shall be taken
3. Expansion joints shall be formed by a separating strip of pre-formed compressible unperishable joint filler, to be approved by the Engineer.

2. 40 Hydraulic Test

Structures designed as water retaining shall be hydraulically tested. Hydraulic test shall be as per relevant standards or as directed by the Engineer in charge. Water required for such tests shall be arranged by the contractor at his own cost.

2.41 Protection of Concrete

Concrete placed below ground level shall be protected from falling earth during and after placing. Concrete placed in ground containing deleterious substances, shall be kept free from contact with such ground and with water draining there during placing for a period of three days or as otherwise instructed thereafter. No load of any kind, however light, shall be allowed on concrete which has not adequately set,

and unless it has been pronounced fit by the Engineer. Immediately after the compaction of the concrete has been completed contractor shall ensure that it is adequately protected from the weather. Protective materials shall be kept continuously damp and in position for a minimum period of fourteen days or such other time as the Engineer may direct. Where large sections of concrete are poured special precautions as approved by the Engineer shall be taken to reduce and dissipate the heat generated by the setting and hardening of the concrete.

The contractor shall set up a mini lab for conducting cube strength etc. The contractor shall provide such details along with the tender.

3. REINFORCEMENT

Reinforcement shall be FE 500 as per the requirement as indicated and specified. Supply and delivery of reinforcing bars and mesh, bending, wire brushing and cleaning, steel fixing and the attendance of the fitter during concreting, to inspect fixed reinforcing bars and maintain bars in correct position at each location. Whenever mention of I.S. codes is made, the latest editions thereof shall be applicable. All continuous inspections shall be performed by the

Engineer's representative or his authorised assistant or a specialist called by the Owner or the Engineer. Reports as required by code or authorities concerned shall be prepared and submitted to the owner and such authorities.

3.1 Cleanliness of Reinforcement: The Contractor shall ensure that all reinforcing bars are thoroughly wire brushed and cleaned free of loose mill scale loose rust, coats of paints oil mud or other coating.

3.2 Concreting Operations: During concrete placing, a fitter shall be in attendance to inspect fixed reinforcing bars and maintain bars in correct positions at each pour locations.

Drawings: The Engineer will supply detailed drawings of reinforced concrete works. Working drawings and bar bending schedules shall be prepared by the Contractor from drawings supplied to him by the Engineer.

3.3 Samples: At least one month in advance of placing an order by him the Contractor shall submit four samples of reinforcing bars which he intends ordering in case the steel is to be supplied by the Contractor. The samples shall confirm to IS: 10790 Part 2 - 1984. The Engineer may carry out any test he may require, to satisfy that the steel to be brought by the Contractor complies with the test specifications. The Engineers reserves the right to shortlist the vendors and the contractor shall procure only from such sources.

3.4 Reinforcing Bars

Reinforcing Bars shall either be supplied by the Owner or shall have to be brought by the Contractor as laid down in the tender conditions.

3.5 Laps:

Laps and splices for reinforcement shall be shown in the drawings. Splices, in adjacent bars shall be staggered and the locations of all splices, except those specified on the drawing shall be

approved by the Engineer-in-charge. The bars shall not be lapped unless the length required exceeds the maximum available length of bars at site.

3.6 Bending:

All bars shall be accurately bent according to the sizes and shapes shown on the detailed working drawings/ bar bending schedules. They shall be bent gradually by machine or other approved means. Reinforcing bars shall not be straightened and rebent in a manner that will injure the materials. Bars containing cracks or splits shall be rejected. They shall be bent cold, except bars of over 25mm in diameter which may be bent hot if specifically approved by the Engineer-in charge. Bars bent hot shall not be heated beyond cherry red colour (not exceeding 645oC) and after bending shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only of ht means used for straightening and rebinding be such as shall not, in the opinion of the Engineer-in-charge injure the material. NO reinforcement bar shall be bent when in position in the work without approval, whether or not it is partially embedded in hardened concrete. Bars having links or bends other than those required by design shall not be used.

Unless otherwise indicated or specified, bars shall be bent and fixed in accordance with the provisions of IS: 2502. All bending shall be done cold with the use of an approved bending machine. Incorrectly bent bars shall not be permitted to be used by re-bending.

3.7 Bending at Construction Joints:

Where reinforcement bars are bent aide at construction joints and afterwards bent back into their original position, care should be taken to ensure that no time the radius of the bend is less than 4 bar diameters for plain mild steel or 6 bar diameters for deformed bars. Care shall also be taken when bending back bars to ensure that the concrete around the bar is not damaged.

3.8 Fixing / Placing ad Tolerance on Placing:

Reinforcement shall be accurately fixed by ay approved means maintain din the correct position as shown in the drawings by the use of blocks, spacer and chairs as per IS 2502 to

prevent displacement during placing and compaction of concrete. Bar intended to be in contact at crossing point shall be securely bound together at all such points with number 16 gauge annealed soft iron wire. The vertical distances required between successive layers of bars in beams or similar members shall be maintained by the provision of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars

3.9 Welded Wire Mesh

Mesh reinforcement, where specified shall conform to IS: 1566 - 1982.

3.10 Binding Wire

Binding wire shall be 0-90 mm (20 SWG) diameter annealed wire conforming to IS 280.

3.11 Supports and Accessories

Spacers for reinforcement shall be provided as per 7.80 of IS: 2502. The cover blocks as per 73 of IS: 2502 shall be made so as to provide the exact specified cover to reinforcement. Stays, blocks, ties spacers or other supports as approved by Engineer shall be provided at appropriate intervals to avoid sagging of bars between supports. Broken stones, brick pieces, wooden blocks shall not be allowed for the purpose under any circumstances.

3.12 Dowels

Where and as designated on the drawings, steel bar dowels shall be provided for anchorage to previously cast concrete. For anchorage where shown or required to existing construction, an approved non shrink epoxy type grout or approved deferred bolting devices shall be used.

3.13 Cleaning:

Before placing reinforcement and again before concrete is placed, reinforcement shall be wire brushed and cleaned of loose mill scale, oil, or other coating that might destroy or reduce bond.

3.14 Concrete Cover:

Cover over reinforcing bars shall be as indicated. Correct concrete cover to reinforcement shall be maintained with the aid of approved cover blocks. Top reinforcement in slabs shall be maintained in position by means of chairs made out of mild steel, the diameter and quantity being sufficient to ensure security of the reinforcement in shape and position.

3.15 Securing Place:

All reinforcement shall be securely and accurately fixed in positions shown on the drawings, care being taken to prevent contact with coated shuttering's and forms, by using approved support or spacer blocks, or chairs where necessary. All intersections of bars shall be secured with approved clips or with wire, the ends being turned into the body of the concrete. The Contractor shall ensure that all reinforcement is maintained in position at all times, particular care being taken during placing of the concrete.

3.16 Splices:

Shall be wired contact lap splices unless otherwise indicated or approved. Splices at points of maximum tensile stress shall be avoided and shall be staggered elsewhere. The lap length and other provisions shall conform to 25.2.5 IS: 450-78.

3.18 1. Vertical Bars: Splicing of vertical bars in concrete shall be at approved positions.

3.18.2. Horizontal Bars: Unless otherwise shown, lap splices shall be made with at least one continuous bar between adjacent splices. Where double mats of bars occur in walls, lap splices in opposite mats shall be offset at least 1.5 m.

3.17 Welding:

Welding of reinforcing bars is not permitted unless indicated or approved by the Engineer in writing in each case. Where permitted in writing, reinforcement which is specified to be welded shall be welded by any process after which the Contractor can demonstrate by bend and tensile tests that the strength of the parent metal is not reduced and that the weld

possesses a strength not less than that of the parent metal. The welding procedure established by successful test welds shall be maintained and no departure from this procedure shall be permitted. Welds in positions other than those shown on the drawings shall not be permitted. Welding shall be carried out only by qualified welders with experience of similar works. The standard for welding will be those required by IS : 2751 - 79 code of practice for welding of mild steel bars used in reinforced concrete construction and IS : 9417-1989 Recommendations for welding cold worked steel bars for reinforced concrete construction.

3.18 Misuse: No part of the reinforcement shall be used to support access ways, working platforms, or placing equipment or for the conducting of an electric current.

3.19 Additional Reinforcement: Additional reinforcing bars shall be provided at sleeves and openings as indicated or required. Where additional bars are not shown for such locations, Engineer's instructions shall be obtained and additional bars provided as directed.

3.20 Welded Wire Mesh: All necessary supports and chairs shall be provided to hold in place during concrete pours. Care shall be taken to prevent contact between the mesh and coated shutters. Mesh shall be straightened to lay in flat plane before placing it and mesh shall be bent as shown or required to fit the work. Laps shall be as per 25.5.1 IS: 456.

3.21 Access: Where reinforcing mats have been fixed, access for concreting purposes shall, where necessary, be provided by timber benches or similar approved devices supported by the falsework. Under no circumstances shall such access ways be supported by reinforcement bars or mats.

3.22 Substitution : In case sizes of bars other than specified ones are permitted to be used, the C/S area of steel shall have an area not less than designed area provided further that bond

stress is not exceeded and criteria for minimum and maximum spacing of bars as per IS : 456 is not violated.

4.FORMWORK

4.1 All formwork shall be constructed of timber, sheet metal or other approved material. It shall be firmly supported, adequately strutted, braced and tied to withstand the placing and vibrating of concrete and the effects of weather. Design of structures shown on the Engineer's drawings does not include any allowance or consideration for imposed construction loads. One copy of the contractor's shoring and form work drawings shall be submitted to the Employer for record purpose only and not for review or approval. Forms, shoring and false work shall be adequate for imposed live and dead loads including equipment and men, height of concrete drop, concrete and foundation pressures and stresses, wind pressures, lateral stability, and other safety factors during construction. The Contractor shall be responsible for the calculations and designs for the formwork. The Contractor shall be held solely responsible for any failure and for the safety of work and workmen. He shall pay necessary compensation, if need be, for damages to work, property and injuries to persons. The scaffolding, hoisting arrangements and ladders shall have easy approach to work spot and afford easy inspection.

Standards and Tolerances: All formwork shall be fabricated in compliance with the best modern practice, so that the finished surface is even, unblemished free of fins and true to line, level and shape as shown by the drawings. The forms shall comply with the requirements of IS: 456.

i. Faces of formwork in contact with concrete shall be free from adhering foreign matter, projecting nails and the like, splits or other defects, and all form work shall be clean and free from standing water, dirt, shavings, chippings or other foreign matter. Joints shall be watertight to prevent the escape of mortar and cement slurry or the formation of fins or other blemishes on the face of the concrete.

ii. Openings for inspection of the inside of the formwork and for the removal of water used for washing down shall be provided and so formed as to be easily closed before placing concrete. Before placing concrete all bolts, pipes or any other fixtures which are to be built in shall be fixed in their correct positions and cores and other devices for forming holes shall be held fast by fixing to the form work or otherwise. Holes shall not be cut in any concrete without the approval of the Engineer.

4.2 Formwork Coating

The coating on all formwork shall be of a non-grain raising and non-staining resin or polymer type or mould oil that will not leave residual matter on surface of concrete or adversely affect bonding to concrete of any subsequent paint, plaster, mortar or other applied materials. Coatings containing mineral oils, paraffins, waxes, or other non-drying ingredients are not permitted. For concrete surfaces contacting potable stored water, the coatings and form-release agents shall be completely non-toxic. Care shall be taken to prevent the coating from coming into contact with reinforcement or with concrete at construction joints.

4.3 Timber

Timber shuttering shall be fabricated from well-seasoned timber which shall not warp under the effects of the ambient temperature and humidity. Boards shall be strong enough to support the stresses imposed on the shuttering without flexing.

4.4 Joints

Timber board joints shall be to rqued and grooved. All joints shall be bonded to prevent loss of grout during concreting.

4.5 Plywood

Plywood shall conform to IS: 4990 and shall be braced as necessary.

4.6 Metal form ties

Ties for climbing shuttering shall be of the prefabricated threaded internal disconnecting type of tensile strength to resist all imposed loads. Ties shall leave no metal within 40 mm of concrete surfaces after removal. The Engineer's approval shall be sought before ties are used on any concrete work.

4.7 Metal Forms

Metal Forms shall be true to detail, in good condition, clean, free from dents, bents, rust and mineral oils.

4.8 Round Column Forms

Round Forms shall be of structural quality fibreboard, metal tubes as specified for metal forms, or fibre glass reinforced plastic, or formed to shape in plywood and braced as necessary.

4.9 Form Joint Sealers

Sealers for joints between form panels shall be of resilient foam rubber strips, or non-hardening plastic type caulking compound free of oil, or waterproof pressure-sensitive plastic tape or a suitable adhesive. Form tie holes shall be sealed with rubber plugs, plastic caulking compound or equal. All joints shall be watertight to totally prevent the loss or leaching of grout during concreting.

4.10 Moulds

For grooves, drips, rebates, profiles, chamfers, and similar items, smooth finished timber coated with specified form coating shall be used. Standard products such as extruded polymer plastic units of the indicated or required shapes may also be used.

4.11 Form types and finishes

Finishes to formed surface of concrete shall be classified as Class A, Class B and Class C or such other special finish as may be particularly specified. Where the class of finish is not specified the concrete shall be finished to Class C.

4.12 Various Classes of finishes

4.12.1 Class A - High Quality Finish

Formwork for Class A finish shall be lined with as large panels as possible of non-staining material with a smooth unblemished surface true to required form such as sanded plywood or hard compressed fibre board, arranged in a uniform approved pattern and fixed back formwork by oval nails. Unfaced wrought boarding or standard steel panels shall not be permitted.

4.12.2 Class B General Finish

Formwork for Class B finish shall be faced with wrought tongued and grooved boards or plywood or metal panels true to required form arranged in a uniform approved pattern free from defects likely to detract from the appearance of the surface.

4.12.3. Class C Unexposed Finish

Formwork for Class C finish shall be constructed of timber, sheet metal or any suitable materials which will prevent loss of cement slurry. The loads shall be properly distributed over base area on which shoring is erected, either concrete slabs or ground; if on ground, it shall be protected against undermining or settlement, particularly against wetting of soils, and near excavations. The forms shall be constructed to produce in finished structure all lines, grades and camber as required. jacks, wedges, or similar means shall be used and firmly anchored to take any settlement in formwork which may occur before placing of concrete. Camber for beams and slabs shall be as indicated.

4.13 Form construction

Forms shall be build to exact shapes, sizes, lines, and dimensions as required to obtain accurate alignment, location and grades. Provision shall be made for openings, offsets, keyways, recesses, mouldings, reglets, chamfers, blocking, joint screens, bulkheads,

anchorages, and other required features. Forms shall be made for easy removal without hammering or prying against concrete. Metal spreaders may be used to provide accurate spreading of forms. Construction of forms shall be such that there will be no sagging, leakage or displacement occurring during and after pouring of concrete. Forms shall be coated with specified coating material; and coating material shall not come into contact with reinforcing bars.

4.13.1. Slopes

Formwork shall be provided for the top surfaces of sloping work where the slope exceeds fifteen degrees from the horizontal (except where such top surface is specified as spaded finish) and shall be anchored to enable the concrete to be properly compacted and to prevent flotation, care being taken to prevent flotation, care being trapped.

4.13.2 Chamfers

All exterior horizontal angles on the finished concrete of 90 degrees or less along the tops of walls shall be given 20 mm chamfers ; columns are required to have chamfers on vertical angles, which run out 125 mm from the bottom and top of the column ; other exterior angles shall be left sharp unless otherwise ordered by the Engineer.

4.13.3 Ties

No ties or bolts or other device shall be built into the concrete for the purpose of supporting formwork without the prior approval of the Engineer. The whole or part of any such supports shall be capable of removal so that no part remaining embedded in the concrete shall be nearer than 50 mm from the surface in the case of reinforced concrete and 150 mm in the case of unreinforced concrete. Holes left after removal of such supports shall be neatly filled with 1:3 drypack mortar which shall contain just sufficient water to make it plastic. It shall be well rammed into the hole and finished flush.

4.13.4 Form Windows

Windows shall be provided in the formwork wherever directed or necessary for access for concrete placement and vibration. Windows shall be of size adequate for tremies and vibrators, spaced at maximum 1.8 m centres horizontally, and shall be tightly closed and sealed before placing higher concrete.

4.13.5 Cleanouts and Cleaning

Temporary openings shall be provided in wall, column and slab formwork for cleaning and inspection. Prior to pouring, all forms and surfaces shall be cleaned and coated to receive concrete.

4.13.6 Re-use

Form material shall be cleaned and reconditioned before re-use.

4.14 Embedded piping, conduits and anchors

All trades which require openings for the passage of pipes, electrical conduits, and other inserts shall be consulted and the necessary pipe sleeves, anchors, or other required inserts shall be properly and accurately installed. Openings required by other trades shall be reinforced as indicated and required. Conduits or pipes shall be located so as not to reduce the strength of the construction, and in no case shall pipes other than conduits be placed in a slab 4 1/2" (11.4 cm) or less in thickness. Conduit buried in a concrete slab shall not have an outside diameter greater than 1/3 of the thickness of the slab not be placed below bottom reinforcing steel or over top reinforcing steel. Conduits may be embedded in walls provided they are not larger in outside diameter than 1/3 the thickness of the wall, are not spaced closer than three diameters on the centre, and do not impair the strength of the structure. Electrical conduits shall be placed with due regard to allowable bend radii continuity in its length from outlet to outlet, and shall be equipped with a pull cord. The outlets shall be temporarily plugged to totally avoid ingress of concrete or grout.

4.15 Field Quality Control

4.15.1 Control during concrete placement

Devices of the tell-tale type shall be installed on supported forms and elsewhere as required to detect formwork movements and deflection during concrete placement. Required slab and beam cambers shall be checked and correctly maintained as concrete loads are applied on forms. Workmen shall be assigned to check forms during concrete placement and to promptly seal any mortar leaks.

4.15.2 Defects in formed surfaces

Workmanship in formwork and concreting shall be such that concrete shall normally require no making good, surfaces being perfectly compacted and smooth. If any blemishes are revealed after removal of formwork, the Engineer's decisions concerning remedial measures shall be obtained immediately. These measures may include but shall be limited to the following:

1. Fins, pinhole bubbles, surface discolouration and minor defects may be rubbed down with hacking immediately the formwork is removed.
2. Abrupt and gradual irregularities may be rubbed down with carborundum and water after the concrete has been fully cured. These and any other defects shall be remedied by methods approved by the Engineer which may include using a suitable epoxy resin or, where necessary cutting out to a regular dovetailed shape at least 75mm deep and refilling with concrete over steel mesh reinforcement sprung into the dovetail.

4.15.3. Removal of Forms and Shoring

Formwork shall be so designed as to permit easy removal without resorting to hammering or levering against the surface of the concrete. The periods of time elapsing between the placing of the concrete and the striking of the formwork shall be as approved by the Engineer after consideration of the loads likely to be imposed on the concrete and shall in any case but not less than the periods shown below, depending on the ambient temperature. Location of Form Time for striking using ordinary Portland cement (days) Seem sides, walls and columns 3

Slab Soffits 7 to 14 Beam Soffits 14 to 21 Notwithstanding the foregoing the Contractor shall be held responsible for any damage arising from removal of formwork before the structure is capable of carrying its own weight and any incidental loading. The contractor shall be wholly responsible for repairing or reconstruction as directed by the Engineer the section of the Works so affected.

4.15.4 Sharing and Falsework Removal

In retaining wall construction Sharing and falsework shall not be removed until 21 days after concrete placement or until concrete has attained at least 90 percent of the 28-day design compressive strength as demonstrated by control test cylinders, whichever is the earlier.

4.15.5 Restriction

Construction equipment, or permanent loads shall not be imposed on columns, supported slabs, or supported beams until concrete has attained the 28-day design compressive strength as demonstrated by control test Cylinders.

4.15.6. Concrete curing during removals

Concrete shall be thoroughly wetted as soon as forms are first loosened and shall be kept wet during the removal operations and until curing media or sacking is applied. Potable water supply with hoses or buckets shall be ready at each removal location before removal operations are commenced.

5. STRUCTURAL STEEL

This specification are for the supplying, fabricating and erecting in position mild steel structures such as beams, monorail, platform, M.S. ladders, stairs and M.S. grating etc. from angles channels, flats, plates etc. including cost of steel, cutting to required size, riveting, bolting or welding, fixing in the line and level, painting with two coats, of red oxide primer and two coats of approved enamel paint. Requirements specified in this section will form a

part of detailed specifications for item of works falling under this category. Indian standards shall apply as if included herein. Design of structure shall be compliance with Indian Standards (IS) viz. for rivets IS:1148-1954 for bolts IS:1148- 1964 and IS:1962 for structural fabrication IS:800-1962, and its latest edition.

Structural steel members, steel joints, plates and connections, steel chair assemblies, pipe supports for piping in all locations, ladders and stairs and miscellaneous metal work for water supply and sewerage and disposal installations. Unless otherwise specified all work specified herein and shown on the drawing shall conform to the applicable requirements of the following specifications and codes. Fabrication and erection of structural steel shall be in accordance with IS:800-962 and amendments issued.

This work shall include the furnishing and installation of all structural steel and miscellaneous metal work and related supports, tanks, manhole steps, equipment guards, anchors and other appurtenances and any other work shown on the drawings or herein specified. All materials shall be new, sound and of the best quality available.

i) Structural

Built-up sections are made from hot rolled plates conforming to ASTM A-572 Gr50 (345 MPa) steel. The plates are joined together on one side of the web by a continuous automatic submerged arc welding process to produce the section required. Hot rolled sections except beams are mill sections complying with IS:2062 (240 MPa) steel.

ERW pipes, sections and crane beams are mill formed sections conforming IS 2062 for 240 MPa yield. Black (non coated) cold formed sections of thickness 1.6 mm, 2.0 mm and 2.5 mm are made of hot rolled sheet to ASTM A607 Gr50(345 Mpa) steel.

Bracing rods and sag rods are made of steel bars conforming to IS:2062 with a minimum yield strength of 240MPa. Alum/Zinc coated (Galvalume) alloy sheets are 0.47 mm nominal thickness, cold roll formed from a cold rolled coil conforming to ASTM A-792 M, Grade-80 with a minimum

yield strength of 550 MPa. These sheets are hot dip coated with a 55% Aluminium and 45% Zinc alloy.

Pre-painted sheets are 0.5 mm nominal thickness, coated with a baked silicon polyester finish on top of an Alum/Zinc alloy finished steel sheet (as per the specification above). The paint finish film thickness is 20 microns of silicon polyester on the exterior face and 10 microns of polyester on the interior face.

ii)Fasteners

Primary structural connection are made with electro galvanized (silver) high strength bolts Gr. 8.8 steel conforming to IS 3757 Purlins and girts are connected to their supporting members by machine bolts Gr. 4.6 steel conforming to IS 1363 electro-galvanized (yellow). Anchor bolts are made of rods conforming to ASTM F1554 with a minimum yield strength of 250 MPa. Roof and wall panels are fastened by No. 12 carbon steel self-drilling screws hot-dip galvanized with polymer coated finish with an integral washer head to which an EPDM elastomer layer is bonded.

iii)Non-Metals

Sky and wall lights are made of translucent white acrylic modified, Ultra Violet stabilized, fiber glass panels. Panels shall be of 3.9 Kg/m² nominal weight and provide same coverage as panel width with a maximum length of 3250 mm. Profile of light panels matches that of the roof / wall panel.

Closure strips shall match the sheeting profile, and be made of XLPE or similar material.

Adhesive sealing tapes are made of an elastomeric butyl rubber based extruded sealant on silicon release paper. End lap sealant is neutralized silicon sealant.

Fiberglass insulation is as per IS 8183, 50 / 100 mm thick, with a vapor barrier (foil scrim Kraft/ reinforced white vinyl/ reinforced white metalized film scrim kraft facing). Density shall be no less than 16 Kg/m³. No wire mesh is required under the insulation.

iv)Paint

a.Shop Primer

Primary steel shall be cleaned to Specification St2. One shop primer coat of Red Oxide Zinc Chromate shall be applied with an average dry film thickness of 25 microns on all red steel. Shop primer provides protection for elements while in transit and construction, and is not intended to be for permanent protection.

V) Wall and Roof Panel

Exterior and interior finishes on the roof panel and walls shall be Tracdek Aluminium/Zinc alloy with modified silicon polyester (SMP) paint with color selected from the standard Color Guide. Interior finish coat of wall panels shall be polyester paint, Light-Greycolor.

The coil manufacturer shall apply colour coating after proper hot dipped metallic coating and priming has been applied. Finish coats of paints shall be applied and baked on the surface as per the coil manufacturer's standards.

vi)Standard Accessories**a.Louvers**

S-type fixed louvers shall be manufactured out of 0.5mm silicon polyester coated Galvalume sheet in white colour with insect screen and is supplied in standard modules of 1500 mm wide x 1000 mm high. Special sizes can be manufactured on request.

b.Vents

Gravity flow Ridge Vents shall be 300 mm, 500 mm or 600 mm throat, in 3000 mm long units manufactured out of 0.5mm silicon polyester coated Galvalume sheet in white colour.

c.Roof Extensions

Sidewalk Roof Extensions shall be 900 mm cantilevered roof members located at the eave and sloped at the same pitch as the main structure roof slope. End wall Roof Extension shall be 900 mm cantilevered "C" and "Z" sections which are continuous span extensions of the main building end bay purlins and eave struts. Roof Extensions structural members (except rafters) shall be completely concealed when optional soffit panel is specified.

d.Structural Canopy

Side wall Canopies shall be 1500 mm cantilevered rafters attached at the eave, or at any point below the eave, supporting 200/250 mm deep "Z" purlins. Optional soffit panel shall conceal only canopy purlins, leaving rafters exposed, unless otherwise specified.

e.Fascias and Parapets

Vertical and Curveline fascias shall be of the bracket mounted type.

f.Vertical fascias shall consist of hot rolled "I" section or cold formed "C" section fascia posts supported by a hot rolled section bracket that is cantilevered from the rigid frames columns at side walls and from the Endwell posts at end walls, with cold formed 200/250 mm deep "Z" and "C" sections as top and bottom girts respectively. An intermediate "C" grit oriented vertically shall be supplied to support valley gutters when required. Vertical fascia's shall project 600 mm from the steel line. The height of the fascia shall vary depending on actual requirements.

Fascia cladding shall be of 0.5 mm thick (nominal) pre-painted Hi-Rib panels. Soffit panels and back side panels are provided only when specified.

g. Curveline Fascias shall consist of the same type of construction as vertical fascias but shall be supplied with curved steel panels having the same corrugation profile as the Hi- Rib panel and shall be available in three types:

Type-I shall have a circular panel at the bottom of the fascia only.

Type-II shall have a circular panel at the top and bottom of the fascia.

Type-III shall be single panel profile curved at the mid height of the fascia.

h.A parapet shall be made from the same construction as the vertical fascia but without the cantilever. The building's wall sheeting shall continue to the top of the parapet.

i.Trims and Liner Panels

Trims shall be made of pre-painted Al-Zn steel, 0.5 mm minimum thickness. All trims shall be White except for corner trims and fascia trims which shall match the panel colors.

Gutters shall be nominal channel made of 0.5 mm Al-Zn steel, pre-painted White.

Downspouts shall be in 100mm square in 0.5mm alum/ zinc steel pre-painted in white.

Liner panel shall be 0.5 mm galvanized steel pre-painted with White finish Hi-Rib panels.

All liner trims shall match the liner panel color.

j.Foundation and Anchorage

Foundation and horizontal ties and concrete floor slabs shall be designed by NATIS/Its representatives. Design shall be based on job site soil conditions. Anchor bolts shall be set in strict accordance with IS Standards and best practices.

k.Colour Shade

The colour shade for the roof and wall cladding sheets shall be selected from the standard Colour Shade Card depending upon availability subject to prior sale.

- Doors shall be of 35mm thick and flush
- Single leaf doors shall be 915mm x 2135mm
- All doors shall be prepared for cylindrical locks/ mortise locks/ aldrops
- Glass, when supplied shall be 5mm thick clear tampered, factory installed
- Each door leaf shall have 4(four) 100mm long hinges
- Rolling shutters shall be manually or electrically chain operated as per the requirement in accordance to relevant standards.

5.2 Material Steel rolled sections, plates and bars shall conform to the latest editions of IS:226, 808, 1730, 1732 & 3954. Pipes used for columns or other structural purposes shall conform to IS:1161-1968. Iron for castings shall conform to IS:210.

5.3 Steel Chequered Plate

Plates shall be of regular quality carbon steel of the thickness shown on the drawings. The raised legs shall be diamond shaped and have an angle and opposed pattern.

The chequered plate (size, location and type) shall be as shown in the drawing. Steel chequered plate and frame shall be galvanised after fabrication unless noted otherwise. All assemblies shall be reinforced on concealed faces as necessary to support the service loads required. Aluminium shall be isolated from dissimilar metals, concrete, masonry and plaster to prevent electrolytic deterioration.

5.4 Common Bolts

Bolts and nuts shall conform to IS:1363-1967. The bolts exposed to liquid surfaces shall be of Stainless Steel or Brass.

5.5 Welding Electrodes

The electrodes shall conform to the requirements of IS:814 latest edition.

5.6 Shop Painting

Structural steel not designated to be galvanised shall be stop-coated using priming coat of red lead as specified in painting section of these specifications. The portion of steel to be embedded in concrete shall not be painted.

5.7 Miscellaneous Structural Works

Steel fabricated components, unit and assemblies for various equipment for waste water treatment plant to be installed shall be fabricated as per drawings and conforming to various standards codes of manufacture as specified and applicable.

5.8 Execution

Erection shall include the installation and erection of all structural steel as called for the section. The contractor shall verify correctness before starting erection. As erection progress, the work shall be securely bolted up to take care of all dead-load, wind and erection stresses. No final bolting or welding shall be done until each portion of the structure has been

properly aligned and plumbed. Bolts shall be drawn up tight and threads set so that nuts cannot become loose.

5.9 Damaged Members

During erection, members which are bent, twisted or damaged shall be straightened or replaced as directed. If heating is required in straightening, a heat method shall be used which will ensure uniform temperature throughout the entire member. Members, which in the opinion of the Engineer are damaged to an extent impairing their appearance, strength or serviceability, shall be removed and replaced with new members.

5.10 Bearing Plates

Bearing plates shall be provided under beams and columns resting on walls or footings. Bearing plates may be attached or loose and aligned on steel wedges or shims. After the supported members have been plumbed and properly positioned and the anchor nuts tightened, the entire bearing area under the plate shall be dry packed solidly with bedding mortar. Wedges and shims shall be cut off flush with edge of bearing plate, and shall be left in place.

5.11 Substitutions

Unless otherwise directed, the exact sections, shapes, thickness, sizes, weights and the details of construction shown for the structural steel work shall be furnished. However, the Contractor, because of his stock or shop practices, may suggest changes if the net area of section is not thereby reduced, if the section properties are at least equivalent and if the overall dimensions are not exceeded. All substitutions or other deviations from drawings and/or specifications shall be specifically noted or "clouded" on the shop drawing submittals.

5.12 Flame Cutting

Flame cutting by the use of a gas cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. The use of flame-

cutting torch will be permitted only on minor members, when the member is not under stress, and only after the approval of the Employer has been obtained.

5.13 Storage of Materials

Structural material, either plain or fabricated, shall be stored above ground upon platforms, skids, or other supports. Material shall be kept free from dirt, grease and other foreign matter and shall be protected from corrosion.

5.14 Steel Stairs

To be fabricated true to size and details and provided complete with all attachments, steel pipe rails and handrails, checker plate-nosed grating type treads and landings. Shop and setting drawings shall be submitted beforehand for approval of the Engineer.

5.15 Anchors Bolts and Anchors

Anchors bolts and anchors shall be properly located and built into concrete to work. Bolts and anchors shall be present by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately. Embedded anchor bolts that are submerged in process water or pump room floors, or are in enclosed tanks or spaces exposed to process gas or moisture, shall be of stainless-steel bolts, a non-oxidising lubricant greases will be applied before bolting.

5.16 Ladders

- i. Contingent upon designated requirements for different locations, galvanised steel unit will be fabricated conforming to requirements. Rails where indicated will be provided.
- ii. M.S. Ladders with stringers as specified and the steps of M.S. bars of specified dia shall be provided. The handholds shall be curved. The size and dimensions shall be as specified or as shown in the drawings.

5.17 Stair Abrasive Safety Nosings

Extended nosings to within 150mm of wall or stringer and equip each with embedded anchorage of secure attachment. Finish flush with concrete at all cast in plate concrete stairs, except or otherwise designated.

5.18 GI Piping Railing

Hand railing shall be with 40 mm of GI pipe in double row with 40mm of GI pipe uprights at a spacing not more than 1.5 m and of one metre clear height. Hand railing shall be painted with two coats of enamel paints over a coat of red oxide primer. Hand railing shall be provided all around sumps/tanks, platforms, ladders and walkways.

5.19 C.I. Steps

C.I. Steps for wet well shall be as per IS:5455. The steps shall be clean, well-cast and shall be free from oil and sand holes, wrappings etc. The C.I. steps shall be PVC consulted heavy duty type having size 300 x 150 x 25 mm. The portion of the step which projects from the wall of the wet well shall have a raised chequered design to provide an adequate non-slip grip. Minimum weight of each step shall be as per IS. The step shall be coated with approved bituminous paint.

5.20 Welding Electrodes

Finishing with Enamel paint (two or more coats) at all locations prepared and applied as per manufacturer's specifications including appropriate priming coat, etc. complete on steel work.

5.21 Galvanising

All metal work shown or specified to be galvanised shall be zinc coated as per IS: 2629. The zinc coating should be free from defects and shall have uniform thickness of coating.

a. Galvanised coatings marred or damaged during erection or fabrication shall be repaired by any approved process as directed by the Engineer.

5.22 Test Reports

Certified physical and chemical mill test reports shall be furnished by the Contractor for material used for major structural members.

5.23 Shop Drawings

Five sets of shop drawings shall be submitted to the Engineer for approval before fabrication of any of the work. In approving shop drawings, the Engineer does not assume responsibility for accuracy of the work or work relative to other plant components as constructed.

5.24 Anchor Bolts

Shall be galvanised and shall be fabricated as shown, or specified by the equipment manufacturer. Suitable expansion bolts may be used in lieu of anchor bolts at certain locations. It shall be the responsibility of the Contractor to request the substitution and obtain the Engineer's approval regarding type and location of expansion bolts proposed to be used prior to pouring concrete.

5.25 Steel Grating

Seat angles and anchors shall be of steel. Grating and support shall be galvanised. Gratings to be supplied and installed as detailed in the drawings.

5.26 Miscellaneous Structural Works

Gravity Ventilator-Throat 600mm & 3.00 mts length shall be executed as per NATIS/standard practice. Header pipes of different diameters shall be executed as per NATIS standards.

Steel fabricated components, units and assemblies for various equipment for water supply and sewage treatment installation shall be fabricated as per drawings and conforming to various standard codes of manufacture as specified and applicable.

6. MASONRY

Brick Masonry

6.1 Manufacture

Common burnt clay building bricks shall conform to the requirements of IS : 1077 and shall be of quality not less than class 50 with moisture absorption rate not exceeding 15 percent as defined in IS : 1077. The bricks shall be chamber burnt and shall not be damaged in any manner and sizes shall conform to the works sizes specified with tolerates as given in 6.2 of IS: 1077.

6.2 Samples

The Contractor shall deliver samples of each type of brick to the Engineer, and no orders shall be placed without the written approval of the Engineer. All the bricks used in the works shall be of the same standard as the approved samples. The samples shall be preserved on site, and subsequent deliveries shall be checked for uniformity of shape, colour and texture against the samples. If in the opinion of the Engineer any deliveries vary from the standard of the samples, such bricks shall be rejected and removed from the site.

6.3 Uniformity

The bricks selected for exposed pointed brickwork walls shall be of uniform colour, deep cherry red or copper colour and uniform texture. Only such bricks as are permitted by the Engineer shall be used.

6.4 Testing

Samples of the bricks shall be tested in accordance with IS : 3495 by the Contractor for compliance with the aforesaid, before any order is placed, and soon after receipt of a consignment. Tests shall be carried out as and when required by the Engineer on samples selected by the Engineer's representative.

6.5 Brick Work

All exposed brickwork shall be constructed in accordance with the provisions of IS: 2212

6.6 Laying

Brickwork shall be uniformly bedded, bricks being laid upwards. Each brick shall be floated and rubbed in upon such sufficient quantity of mortar that the mortar is squeezed up into the joints, but if such joints are not filled with mortar by this process they shall be flushed up with the mortar from the next succeeding bed. The courses shall be laid truly and strictly to line and horizontal level.

6.7 Bond

Brickwork courses shall be alternatively laid in stretcher bond and header bond. Damaged bricks shall not be used. The greatest care shall be taken to prevent mortar dropping on to or in any other way disfiguring or discoloring the bricks, and all edges and sides shall be kept strictly plumb and square, in-line, and flush with the required finished face. As the work proceeds, it shall be continuously checked with a 2 m long straight edge and spirit level.

6.8 Construction

Walls shall be carried up in a uniform manner and no one portion raised more than 1 m above another at any one time, the open end being racked out. Over-hang work shall in no case be permitted. Brickwork shall be cleaned down after each day's work and newly laid brickwork shall be protected by suitable means.

6.9 Dry Weather

In dry weather the suction rate of clay bricks shall be adjusted by wetting as necessary before use. Bricks shall be stored in a free draining area and protected from rain.

6.10 Lintels

Where brickwork rests upon lintels or supporting ribs of concrete, the bricks shall be cut as necessary and carefully bedded so that proper support to the outer leaf of brickwork is obtained.

6.11 Pointing

At the time of laying, all joints of exposed brickwork shall normally be raked out neatly and pointed to 15 mm depth.

6.12 Approval

All workmanship shall be strictly in accordance with the foregoing. The Engineer or the Engineer's representative reserves the right to reject any of the work on grounds of shabby workmanship. Such rejected work shall be removed and rebuilt to the Engineer's satisfaction.

7. CEMENT PLASTERING AND POINTING

8.1 Plastering

Specifications here under shall cover plastering concrete, stone or brick masonry surfaces in cement mortar of specified proportion and specified thickness including scaffolding, curing etc. complete as directed.

8.2 Materials

Cement Mortar: Cement mortar shall have the proportion of cement to sand as mentioned in the wording of the item or in the special provisions and shall comply with the following for:

8.3 Cement: Cement shall conform to IS : 269 Ordinary Portland cement shall be used. The weight of ordinary Portland cement shall be taken as 50 kg per bag. The Contractor shall ensure that the cement is of sound and requiring quality before using it. Any cement which has deteriorated, caked or which has been damaged shall not be used. The specifications covered under the section 'Concrete' shall be applicable in addition.

8.4 Water: Water for mixing cement mortar or concrete shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil, acid and injurious alkali, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause aforescence. Sea water shall not be used. Water fit for drinking shall generally be found suitable for mixing cement mortar. Water fit curing mortar

or concrete shall not be too acidic or alkaline. It shall have pH value above 6. Sea water shall not be used for curing purpose.

8.5 Fine Aggregate

All fine aggregate shall conform to IS: 383 - 1963 and relevant portion of IS: 515-1959. Sand shall be clean, well graded, hard, strong, durable and gritty particles free from injurious amounts of dust, clay, kankar nodules, silt or flaky particles, shale, alkali, salts, organic matter loam mica or other deleterious substances and shall be approved by the Engineer. The maximum size of particles shall be limited to 5 mm (about 3/16"). If the fine aggregate contains more than 4 per cent of clay, dust or silt, it shall be washed. The fine aggregate for cement mortar for masonry and first coat of plaster should generally satisfy as per IS standards.

IS: 2116 - 1980 shall generally apply for sand for plaster. The fine aggregate should be stacked carefully on a clean, hard surface so that it will not get mixed up with deleterious foreign materials.

8.6 Proportion

Cement and sand shall be mixed in specified proportions, sand being measured in measuring boxes. The proportions will be by volume. The mortar may be hand mixed or machine mixed.

8.7 Preparation

In hand mixed mortar, cement and sand in the special proportions shall be thoroughly mixed dry on a clean impervious platform. Fresh and clean water as specified above shall be added gradually and thoroughly mixed to form a stiff plastic mass of uniform colour so that, each particle of sand shall be completely covered with a film of wet cement. The water cement ratio may be as under or as directed by the Engineer.

Machine mixed mortar shall be prepared in an approved mixer. Water cement ratio shall be as per hand mixed mortar. The mortar so prepared shall be within 30 minutes of adding

water should be used in the work. The mortar remaining unused after that period mortar which has partially hardened or is otherwise damaged shall not be retempered or remixed. It shall be destroyed or thrown away.

8.8 Scaffolding

Scaffolding required for facility of construction shall be provided by the contractor at his expense. Scaffolding shall be erected with steel sections or pipes, ballies or bamboos of adequate strength so as to be safe for all construction operations. The Contractor shall take all measure to ensure the safety of the work and working people. The Contractor shall be entirely responsible for any damage to property or injury to persons resulting from ill erected scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Put log holes shall be made good by stones bricks to match the facework when scaffolding is being removed after ensuring that all holes behind are solidly filled in with M-10 cement concrete.

8.9 Preparatory Work

All joints in the facework that is to be plastered shall be raked out to a depth equal to not less than the width of the joints. In case of new works, the raking shall be done when the joint mortar is still green. Smooth surfaces of concrete, old plaster etc must be suitably roughened to provide necessary bond for the plaster. In case of stone masonry, bushing on the walls to receive the plaster shall not be more than 12 mm. The surface to be plastered shall be cleared and scrubbed with fresh water and kept wet for 6 hour prior to plastering.

8.10 Gauges

Patches of plaster 15 cm x 15 cm shall be put on about 3m apart as gauges to ensure even plastering in one plane.

8.11 Plastering

In all plaster work the mortar shall be firmly applied with somewhat more than the required thickness and well pressed into the joints and on the surface and rubbed and levelled with a flat wooden rule to give required thickness. All corners must be finished to their true angles or rounded as directed by the Engineer to give neat appearance. The mortar shall adhere to the masonry surface intimately when set, and there should be no hollow sound when struck. The plastering shall be proceeded from top downwards.

8.12 Watering & Curing

All plaster work shall be kept damp continuously for a period of 14 days. To prevent excessive evaporation on the sunny or windward side of the building in hot dry weather, matting or gunny bags may be hung over on the outside of the plaster in the beginning and kept moist. Should the Contractor fail to water the work to the satisfaction of the Engineer, the latter may engage requisite labour, materials and equipment to water the work properly at the cost of the Contractor. If the plastering work is not done as specified above, the plaster shall be removed and redone at the Contractor's expense.

8.13 Cement Plaster in Two Coats

The first coat for Brick Masonry and rubble masonry shall be of 10 mm and 20 mm thickness respectively. In case more thickness is specified, the work shall be carried out in two coats necessarily. The first coat shall be applied as above, but the surface is not floated or polished but roughened to give a key to the second coat of plaster. For this, before the first coat hardens, it shall be combed in wavy lines, 12 mm apart and 3 mm deep. This coat shall be kept damp for 2 days thereafter and then allowed to dry. Before starting to apply the second coat, the surface of the first coat shall be damped evenly and 2nd coat applied. The final surface (either of the 1st 2nd coat) shall be rubbed smooth after floating it with thick coat of pure cement slurry while base coat is still fresh. If neeru finish is specified, floating with neat cement will not be required. The finished surface shall be true and even and present a uniform texture throughout and all joining marks shall be eliminated.

8.14 Plaster in Single Coat.

After coat of plaster is done, the surface shall be rubbed smooth after floating it with thick coat of cement slurry or the neeru finish as the case may be. The finished surface shall be true and even and present a uniform texture throughout and all jointing marks shall be eliminated.

8.15 Cement Pointing

Specifications hereunder shall cover, cement pointing with mortar of specified proportion to stone masonry or brick work including raking out joints, scaffolding, curing, watering etc complete. Materials Cement mortar for pointing shall be of the specified mix.

8.16 Construction Details

Unless other type of pointing are specified in the item or the special provisions, pointing shall be of the grooved type. The joints in the masonry shall be raked out to a depth not less than the width of the joint when the mortar is green. The joints are to be brushed clean of dust and loose particles with a stiff brush. The area shall be washed and the joints thoroughly wetted before pointing is commenced. The raked-out joints shall be filled with mortar of the specified mix and required consistency and well pressed and rubbed smooth. A semi-circular depression 3 mm dia shall be made in the joint by pressing a clean string with trowel keeping the string exactly horizontal and on the centre line of the joint. The vertical joints shall be similarly marked. These depressed lines will then be immediately rubbed till they become uniformly 6 mm deep 6 mm wide and assume fairly blackish colour. Where joints are not horizontal and vertical as in the case of uncoursed rubble masonry, the pointing shall be made along the centre line of actual joints and the functions of pointing made neatly. The pointing mortar shall not spread over the adjoining stones. Mortar pointing shall be restricted to the width of the joints, and all superfluous mortar shall be removed with a trowel.

8.17 Watering

The pointed face shall be kept continuously wet for 14 days after initial set. Should the mortar perish or deteriorate through neglect of watering or any other default and if the work is not done neatly as specified above, the pointing shall be removed and redone, at the expense of the Contractor.